ABSTRACT

Title of Thesis: SOCIAL EMOTIONAL MEMORY AND NEGATIVE SYMPTOMS IN INDIVIDUALS WITH SCHIZOPHRENIA

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The current study investigated social and nonsocial emotional memory in schizophrenia, the relation of impairments in the recall of positive stimuli to increased negative symptoms, and the mediating role of defeatist performance beliefs. Twenty-three individuals with schizophrenia and twenty-four healthy controls completed clinical symptom interviews, social and nonsocial laboratory emotional memory tasks, and a measure of dysfunctional attitudes. Results indicated that on a social affective learning task, in comparison to controls, the schizophrenia participants were impaired in their ability to exhibit minimal affective learning of positive pairings. Defeatist performance beliefs did not mediate the relation between recall of positive stimuli and experiential negative symptoms. These findings suggest that it is primarily in the social domain that we see deficits in emotional memory in schizophrenia, and that this impairment in the ability to learn positive social associations may be linked to decreased motivation to engage in social, vocational, and recreational activities.

SOCIAL EMOTIONAL MEMORY AND NEGATIVE SYMPTOMS IN INDIVIDUALS WITH SCHIZOPHRENIA

by

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Chapter 1: Introduction

Thought to be one of the most disabling and emotionally devastating illnesses, schizophrenia affects about 1 percent of the population (Messias, Chen, & Eaton, 2007; National Institute of Mental Health [NIMH], 2013). Though the symptoms most often associated with schizophrenia are positive symptoms, which include hallucinations, delusions, and thought disorder (Pogue-Geile & Harrow, 1984), negative symptoms are a crushing feature of the illness that tend to be lifelong and affect roughly twenty-five percent of this population (Buchanan, 2007). Negative symptoms are a diminution of normal functioning and consist of social anhedonia (a lack of pleasure from social interactions), alogia (reduced verbal expression), asociality (reduced social engagement), avolition (diminished motivation and goal directed behavior), and blunted affect (decreased emotional expression) (Kirkpatrick, Fenton, Carpenter, & Marder, 2006). Research has suggested that negative symptom severity is established early on in the illness and remains a traitlike characteristic in patients with schizophrenia (Lindenmayer, Kay, & Friedman, 1986; Carpenter and Strauss, 1991).

Negative symptoms often lead to functional impairments, and these include impaired independent living skills and difficulty in maintaining employment, attending school, making and keeping friends, and having romantic relationships (Harvey, Velligan, & Bellack, 2007). Although there are current psychosocial treatments available to ameliorate these functional impairments, they are only marginally successful in treating negative symptoms (Klingberg et al., 2012). Furthermore, medications are minimally effective for reducing negative symptoms, and thus these symptoms remain an unmet treatment need (Mojtabai, Lavelle, Gibson, & Bromet, 2003). A better understanding of the social and emotional components underlying negative symptoms may inform the development of new treatment approaches (Kirkpatrick et al., 2006; Miyamoto, Miyake, Jarskog, Fleischhacker, & Lieberman, 2012).

Perhaps one of the reasons it is difficult to treat negative symptoms is that we do not know why some people with schizophrenia develop negative symptoms and others do not (Avery, Startup, & Calabria, 2009). A recent promising avenue in the search for the cause of negative symptoms is Beck's cognitive model, which postulates that cognitive impairments result in functional difficulties, leading to dysfunctional attitudes and ultimately negative symptoms (Grant & Beck, 2009). The following sections will review defeatist performance beliefs (a subset of dysfunctional attitudes) and their relation to negative symptoms, cognitive deficits that may give rise to these beliefs, and the current literature on emotional memory research in schizophrenia. This will be followed by a background on affective learning in a social context, and negative symptom assessments.

Beck's Cognitive Model

Defeatist performance beliefs are overly generalized negative conclusions about one's ability to successfully perform tasks, such as "if you cannot do something well, there is little point in doing it at all" (Rector, Beck, & Stolar, 2005). These attitudes stem from real world failures caused by cognitive deficits, and in turn contribute to the decreased motivation, interest, and involvement in pleasurable activities that manifest clinically as negative symptoms. Though healthy individuals can experience defeatist performance beliefs, they are more strongly endorsed in people with schizophrenia and have been shown to correlate with negative, but not positive, symptoms even after controlling for depression (Couture, Blanchard, & Bennett, 2011; Grant & Beck, 2009;

Horan et al., 2010). Current literature suggests that these defeatist, negativistic beliefs contribute to the avoidance of pleasurable activities, which leads to negative symptoms such as social anhedonia (Rector et al., 2005).

In testing the model that defeatist performance beliefs provide a link between cognitive impairment and negative symptoms, Beck and Grant (2009) conducted a small cross-sectional study of individuals with schizophrenia. They found that defeatist performance beliefs were correlated with both negative symptoms (r = .49) and neurocognitive performance (r = -.37), as measured by an aggregate score of verbal memory, processing speed, and attention. More recently, researchers investigating the relation between defeatist performance beliefs and negative symptoms have found that it is only in the experiential (e.g. avolition and social anhedonia), but not expressive (e.g. blunted affect and alogia) domain of negative symptoms that this relation is found to exist with correlations in the moderate range (Green, Hellemann, Horan, Lee, & Wynn, 2012; Couture et al., 2011). This is not surprising, because if an individual has low efficacy beliefs about their ability to perform at work or in social situations, they will be less motivated to engage in these types of activities. Preliminary data has also supported Beck's model even in the prodromal phase of illness as defeatist performance beliefs are associated with negative symptom levels in individuals at high risk for developing psychosis (Perivoliotis, Morrison, Grant, French, & Beck, 2008).

In his cognitive model of negative symptoms, Beck has hypothesized that broad cognitive impairments (a collective deficit in information processing, memory, and attention) may give rise dysfunctional attitudes that contribute to negative symptoms (Rector et al., 2005). While the support for an association between defeatist performance beliefs and negative symptoms is fairly well established, the literature on a link between broad cognitive deficits and negative symptoms is mixed. Although this model specifically invokes the role of cognitive impairments in negative symptoms, research has shown that broad cognitive functioning is only modestly correlated (approximate *r's* = .20) with negative symptoms in schizophrenia (Harvey, Koren, Reichenberg, & Bowie, 2006). In a recent study of cognitive impairments, positive and negative symptoms, and everyday living skills, Leifker and colleagues (2009) administered an exhaustive cognitive battery of attention, motor skill, verbal learning, memory, verbal fluency, and executive functioning assessments and the Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein, & Opler, 1987) to 194 outpatients with schizophrenia. The researchers found that while significant, the relation between general cognitive performance and negative symptoms remained small at $r = -.21$ (Leifker, Bowie, & Harvey, 2009). Additionally, in longitudinal studies, general cognitive impairment does not predict the severity of negative symptoms over time (Harvey et al., 1996). Some have even critiqued the demonstrated correlation between cognitive impairments and negative symptoms in studies that have used the PANSS and the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983) because they blur the conceptual boundary between the two constructs as they include items that are clearly cognitive in nature (e.g. "deficits in abstract thinking" on the PANSS and the attention section on the SANS) (Harvey et al., 2006).

Moving forward, it will be important to refine what domain of cognition we look at in understanding what may give rise to negative symptoms. Investigating memory may prove to be fruitful, as research has shown that individuals with schizophrenia exhibit abnormalities in the way that valenced information is encoded and retrieved (Herbener, 2008). Emotional memory biases are evident in other disorders like depression, in which a preferential recall of negative material is a robust finding in the field (Mathews & MacLeod, 2005). As anhedonia and a combination of high negative affect and low positive affect are often seen across both schizophrenia and depression (Horan & Blanchard, 2003; Watson, Clark, & Tellegen, 1988), it will be useful to investigate the role that emotional memory biases play in negative symptoms of schizophrenia. To date, some researchers have found support for a relation between emotional memory biases and negative symptoms (Koh, Grinker, Marusarz, & Foreman, 1981; Mathews & Barch, 2004), whereas others have not (Mathews & Barch, 2006; Harvey, Bodnar, Sergerie, Armony, & Lepage, 2009). One potential reason for this discrepancy in the literature may be that researchers have not considered the mediating role of defeatist performance beliefs, as suggested by Beck's cognitive model. In the service of testing this model, researchers have confirmed that defeatist performance beliefs mediate the relation between different facets of cognitive impairments and negative symptoms. For example, Green and colleagues (2012) have found that greater social cognitive deficits lead to increased experiential negative symptoms indirectly through their relation on defeatist performance beliefs (Green et al., 2012). Additionally, others investigators have found that decreased functional capacity leads to increased experiential negative symptoms indirectly through its relation on defeatist performance beliefs (Horan et al., 2010). To this end, the current study will examine the role defeatist performance beliefs may have in mediating the relation between emotional memory biases and negative symptoms.

Emotional Memory in Schizophrenia

As previously noted, emotional memory biases may be a viable explanation for the expression of negative symptoms in some patients. Individuals with schizophrenia tend to be impaired in memory of emotional experiences, which may play a role in the diminution of goal-related behavior and symptoms of anhedonia and amotivation (Herbener, 2008). Emotional memory is defined as the recall or recognition of stimuli, that are characterized by valence (pleasantness versus unpleasantness) and arousal level (calmness versus excitement) (Lang, Bradley, & Cuthbert, 2005). Simply put, this means that memory is most often enhanced by positive and negative, rather than neutral, experiences (Wirtz, Kruger, Napa, Scollon, & Diener, 2003). Emotional memory biases arise when an individual is inclined towards recalling positive memories or negative memories. In nonclinical samples, there is most often a bias towards positive stimuli, which is referred to as the Pollyanna effect (Silvera, Krull, & Sassler, 2002). However, in schizophrenia, this is not the case. Consistent with Beck's cognitive model that people with schizophrenia are attending to and anticipating negative outcomes that may facilitate the retrieval of negative information, some researchers have found the presence of a negativistic bias towards increased recall of negative stimuli (Calev & Edelist, 1993). Another possible hypothesis comes from a reduced hedonic capacity perspective, in that people may anticipate less pleasure due to a memory impairment of positively valenced experiences (Koh et al., 1981). Both of these theories have implications for negative symptoms as the preferential recall of negative events or the diminished recall of positive events could contribute to a lack of motivation to engage in previously enjoyable activities, which would manifest clinically as anhedonia.

Although there have been many studies analyzing the recall and recognition of positive, negative, and neutral stimuli (pictures, words, food, and video clips) in schizophrenia, the overall findings have been mixed. Some studies have found that individuals with schizophrenia, in comparison to healthy controls, display equivalent recall and recognition of emotional material (Horan, Green, Kring, and Nuechterlein, 2006; Koh et al, 1981; Koh, Kayton, & Peterson, 1976), while others have found that schizophrenia patients recall either fewer positive or negative emotional stimuli (Herbener, Rosen, Khine, & Sweeney, 2007; Hall, Harris, McKirdy, Johnstone, and Lawrie, 2007; Neumann, Blairy, Lecompte, & Philippot, 2007). Possible explanations for the equivocal results in the current literature are that the studies employ different types of emotional stimuli and varying delays for recall and recognition. Studies looking at visual versus auditory stimuli have consistently found greater deficits in processing of visual stimuli in schizophrenia (Herbener, 2008; Neumann, Blairy, Lecompte, & Philippot, 2007). This population also tends to exhibit deficits in emotional memory when testing is conducted over longer delay periods, typically at least twenty-four hours, which could implicate problems in encoding or retrieval of long-term memories (Herbener, 2008). This may lead to the recalling of previously enjoyable activities as less pleasurable than they actually were (Horan, Green, Kring, & Nuechterlein, 2006). Indeed, it is primarily in memory paradigms with longer delays and visual stimuli that a difference in memory between schizophrenia patients and healthy controls is observed (Hall et al., 2007; Neumann et al., 2007). In the studies that have explicitly looked at emotional memory biases in schizophrenia, it has also been found that it is most often in delay periods of twenty-four hours or greater that there is an emotional enhancement of negative and decrement of positive stimuli in long-term memory (Herbener et al., 2007; Calev & Edelist, 1993; Dieleman & Roder, 2012).

In schizophrenia research, the most common method for assessing emotional memory has been to show participants either positive, negative, and neutral images from International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005) or words from the Affective Norms for English Words (ANEW; Bradley & Lang, 1999) varying on different levels of arousal. Participants usually engage in an incidental-encoding task during which they must rate the pictures or words on arousal level (Hall et al., 2007; Herbener et al., 2007), valence level (Neumann et al., 2007), or both (Mathews & Barch, 2004). Alternatively, some investigators have the participants identify the sex of facial IAPS pictures (Harvey, Bodnar, Sergerie, Armony, & Lepage, 2009). A benefit of the incidental-encoding task is that it can allow researchers to assess participants' perception of emotion, so that one can be more certain that if memory biases occur, it is not due to an emotion perception deficit. A recall trial, recognition trial, or both follow this initial task. Past studies have used varying lengths of delay from immediate recall and recognition trials (Koh et al., 1981; Mathews & Barch, 2004) up to as long as a 3-week delay (Hall et al., 2007). The current study will employ similar methodology for assessing emotional memory that has previously been used in both a nonclinical population with high levels of social anhedonia (Mathews & Barch, 2006) as well as in individuals with schizophrenia (Mathews & Barch, 2004).

Social Emotional Memory

Whereas many studies of memory in schizophrenia have used valenced stimuli, none to date have looked at the role of social emotional memory. Horan and colleagues

(2006) found that patients did not significantly differ from controls in either immediate or delayed recall of emotional video clips and from their null findings, the authors suggested the use of socially affiliative stimuli in future studies (Horan et al., 2006). This social aspect is a critical component because negative symptoms are comprised of deficits that relate to social relationships (social anhedonia, asociality) and have a pronounced connection to social functioning impairments (Bell, Corbera, Johannesen, Fiszdon, & Wexler, 2013), such that people with negative symptoms are more socially withdrawn (Kirkpatrick et al., 2006). This suggests that their emotional deficits may be more pronounced in the social domain. Studies on emotional memory biases most often use facial pictures or words varying on valence and arousal ratings from the IAPS (Lang et al., 2005) and the ANEW (Bradley & Lang, 1999). Though these methods are valid and reliable ways of assessing emotional memory, they are not the optimal approach when considering the effect of emotional memory biases on negative symptoms, as they do not include social stimuli. Whereas some may argue that faces are inherently social, this is largely dependent upon the definition of social. If social is described as involving interactions between people, then static singular pictures of faces on the IAPS are not social. Looking at such nonsocial stimuli may not tap into these core affiliative deficits in schizophrenia, and thus future research should incorporate social stimuli. However, it is still useful to include a memory measure of valenced nonsocial stimuli in order to definitively confirm that it is in the social emotional realm that these biases arise for individuals with schizophrenia and greater negative symptoms.

In our world we often encounter social facial stimuli that we need to associate with emotional experiences. This ability to learn valenced social information is fundamental to our success as social beings, because when we navigate our social environment, we are trying to learn how people are associated with their behavioral acts. Essentially, we want learn if a novel person behaves in a friendly, positive way, or in a mean, negative way to guide our future interactions with this individual. Given the need to improve measurement of affiliative memory, and in the service of testing affective learning, Bliss-Moreau and colleagues (2008) developed a task that incorporates a social aspect in a learning paradigm, which would be a unique assessment of emotional memory biases in schizophrenia. The affective learning task (Bliss-Moreau, Feldman Barrett, & Wright, 2008) pulls from the idea that people rely on minimal exposure to mildly affective behavioral cues when learning about the positive and negative value of people. Previous research has indeed shown that individuals are able to rapidly learn about other people regardless of the cognitive load (Todorov & Uleman, 2003). In the affective learning task, neutral face pictures are paired with sentences describing positive, neutral, or negative social behaviors of the individual in the photo (e.g. “helped an elderly woman with her groceries”). In Bliss-Moreau and colleagues’ study (2008) it was shown that healthy people are in fact able to learn these associations, quickly categorizing neutral faces as positive, negative, or neutral based on the prior pairings. This finding has also held true in cognitively impaired populations, as previous research has shown that patients with Alzheimer’s disease who are shown neutral faces and read pleasant or unpleasant fictional biographies are able to correctly pair the face with the valence of the biography after a three hour delay (Blessing, Keil, Linden, Heim, & Ray, 2006).

Interested in elucidating the individual differences in affective learning, Bliss-Moreau and colleagues also examined the role of extraversion (indicating sensitivity to reward and positive/ pleasant cues) and neuroticism (indicating sensitivity to punishment or negative cues) in affective learning. They hypothesized that individuals who are more sensitive to stimuli that will produce a pleasurable affective state may be more predisposed to recalling positive associations, whereas individuals who are more sensitive to stimuli that will produce an unpleasant affective state may be more predisposed to learn negative associations. Results indicated that participants high in extraversion exhibited a greater propensity to recall positive associations, and those high in neuroticism showed impaired learning of positive associations. Previous research has revealed similar findings as other studies have indicated that individuals high in negative affect overestimate the recall of intensity of their negative emotion and underestimate the recall of positive emotions (Cutler, Larsen, & Bunce, 1996; Feldman Barrett, 1997; Safer & Keuler, 2002; Safer, Levine, & Drapalski, 2002). In light of the low extraversion (Berenbaum & Fujita, 1994), low positive affectivity and high negative affectivity (Horan, Blanchard, Green, & Clark, 2008) that characterize schizophrenia, underestimates in recall for pleasant emotions and overestimates in recall of unpleasant emotions might also be expected in this disorder. Furthermore, as extraverts have been shown to be differentially sensitive to social information (Ashton, Lee, & Paunomem, 2002), especially when that information is positively valenced, one can speculate that individuals high in negative symptoms who experience social and motivational deficits would be less sensitive to positive social cues and thus may not encode positive experiences properly.

Negative Symptoms

With the role that emotional memory biases may play in motivation and pleasure deficits of negative symptoms, it is surprising that most of the current emotion memory literature in schizophrenia does not include negative symptoms in analyses. Although many studies have not specifically explored the role of negative symptoms in emotional deficits, the few that have note a relation between emotional memory deficits and negative symptoms, such that higher negative symptoms correlate with greater emotional memory deficits (Horan et al., 2006; Hall et al., 2007; Mathews & Barch, 2004). In emotional memory bias and negative symptom research however, there have been more equivocal results obtained thus far (Lepage et al., 2007). Some research has found that whereas healthy controls recalled more positive than negative words and faces, schizophrenia participants high in anhedonia do not exhibit this differential recall, indicating a decrement in recall of positive stimuli (Koh et al., 1981). The results of a more recent study on nonclinical participants with high levels of physical and social anhedonia indicated no effect of valence on memory (Mathews & Barch, 2006). There has been a lack of replication in terms of emotional memory biases' relation to negative symptoms due to two contributing factors. One is the nature of the memory paradigms used, whereas the other involves measurement issues regarding clinical symptomatology.

The use of older negative symptom interview assessments, such as the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983), the Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein, & Opler, 1987), and the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962) may explain the null findings in some emotional memory bias studies (Calev & Edelist, 1993). A limitation of using the

BPRS is that it fails to assess the full range of negative symptoms as it lacks ratings of anhedonia and asociality (Blanchard & Cohen, 2006). Both the PANSS and the SANS include ratings that assess cognitive functioning and these items have been shown through factor analytic studies to not cohere well with other negative symptom ratings (Sayers, Curran, & Mueser, 1996; White, Harvey, Opley, & Lindenmayer, 1997; van der Gaag et al., 2006). Yet another critique of these older assessments is that they are heavily tilted toward behavioral success. Prior studies largely rely on instruments that have been criticized for their behavioral elements, and these assessments could be more measures of functional outcomes than of the core internal deficits characteristic of negative symptoms, like anhedonia and amotivation.

The Clinical Assessment Interview for Negative Symptoms (CAINS; Kring, Gur, Blanchard, Horan, & Reise, 2013) is a novel negative symptom assessment that was created as a response to the 2006 NIMH consensus statement on negative symptoms in order to address the limitations of existing negative symptoms assessments. The CAINS is implemented as a two-scale measure, one assessing expression and the other tapping into motivation and pleasure (MAP) deficits. The MAP subscale goes beyond the existing measures as it assesses behavioral engagement in social, recreational, and vocational activities as well as reported emotion, pleasure, and motivation the participant expects to experience over the following week. With this addition of motivation and pleasure items in this new measure, it will be more feasible to understand the relation between emotional memory biases and the internal deficits of negative symptoms.

Purpose and Hypotheses

The primary aim of the current study is to understand the relation between social emotional memory biases and negative symptoms in schizophrenia. The current study provides a unique contribution to the literature by adding a social component to an emotional memory paradigm and using the most current assessment of negative symptoms. The study will also be the first to assess whether defeatist performance beliefs play a role in the relation between emotional memory biases and experiential negative symptoms. We will be looking at memory in two different contexts: 1) associative learning of valenced social acts, and 2) valenced verbal encoding and retrieval in a nonsocial context.

The study will examine the following hypotheses:

Between group hypotheses:

1) In comparison to healthy controls, participants with schizophrenia will exhibit poorer memory of positive words on the incidental encoding, recall, and recognition task. Specifically, individuals with schizophrenia will recall less positive words than healthy controls.

2) In comparison to healthy controls, participants with schizophrenia will exhibit poorer affective learning of positive material on the affective learning task. Specifically, individuals with schizophrenia will have a lower mean proportion response rate for faces correctly judged as being paired with a positive behavioral act.

Within group hypotheses:

3) Experiential negative symptoms will be negatively associated with recall of positive stimuli on (a) the incidental encoding, recall, and recognition task and (b) the affective learning task, and positively associated with defeatist performance beliefs, even after controlling for depression

4) Defeatist performance beliefs will mediate the relation between the diminished recall of positive stimuli (on the incidental encoding, recall, and recognition task and the affective learning task) and experiential negative symptoms.

Chapter 2: Method

Participants

Participants were twenty-three outpatients with schizophrenia or schizoaffective disorder and twenty-four demographically matched healthy controls between the age of 18 and 65. Individuals with schizophrenia were recruited from outpatient mental health clinics in Baltimore, MD. Schizophrenia participants were identified via medical record review or mental health clinician (MHC) referral, with MHC approval sought before approaching any potential participants. Healthy controls were recruited through flyers placed around the UMD- Baltimore campus, email bulletins, and participant referral. Schizophrenia and schizoaffective individuals were excluded from the study if they 1) met DSM-IV criteria for alcohol dependence or drug dependence in the last six months, 2) met DSM-IV criteria for alcohol abuse or drug abuse in the last month, 3) had mental retardation, 4) had history of significant head injury or trauma, 5) had significant neurological disease, 6) were unable to provide informed consent, 7) were not proficient in English, and 8) were unable to effectively participate due to intoxication or psychiatric symptoms as determined by MHC or the study interviewer. Healthy controls were excluded from the study if they 1) had experienced a major depressive episode within the past month, 2) met DSM-IV criteria for current bipolar disorder, 3) had ever experienced psychotic symptoms, 4) met DSM-IV criteria for alcohol abuse or drug abuse in the last six months, and 5) met DSM-IV criteria for social anxiety.

Measures

After MHC approval was obtained, the study recruiter or study interviewer scheduled a time to meet with the identified patient to explain the study, verify that the individual has met all inclusion and exclusion criteria, and obtain informed consent. Following this, the participant was scheduled for an assessment. All measures were administered in a fixed order for all participants: survey of demographic information, SCID-I (if not completed in the last five years), BPRS, CAINS, CDSS, DPBS, B-CATS, affective learning task, and the incidental encoding, recall, and recognition task. Participants returned 1 day later to complete the affective learning task delayed judgment phase and the delayed recall trial for the incidental encoding, recall, and recognition task. All assessment interviews were videotaped.

Structured Clinical Interview for DSM-IV (SCID). The SCID-I (First et al., 1995) is a semi-structured interview used to confirm a schizophrenia spectrum diagnosis and exclusionary diagnoses. Various sources of information were used to confirm diagnoses (e.g., patient record, medical records, and treatment providers). The SCID-I was developed for use in research by trained clinicians and includes obligatory questions, operation criteria from the DSM-IV, a categorical system for rating symptoms, and an algorithm for arriving at a final diagnosis.

Clinical Assessment Interview for Negative Symptoms (CAINS). The CAINS (Kring et al., 2013) is a 13-item semi-structured interview that evaluates negative symptoms in schizophrenia. The assessment consists of two factors: Expression (EXP; 4 items) and Motivation and Pleasure (MAP; 9 items). The scales have demonstrated good internal consistency (α = .88 for EXP, .74 for MAP), test-retest reliability (r = .69 for both scales), and inter-rater reliability (average ICC = .77 for EXP, .93 for MAP) (Kring et al., 2013). The CAINS also demonstrates good convergent and discriminant validity (Kring et al., 2013). All study interviewers were trained and supervised by one of the developers of the CAINS (JJB).

Brief Psychiatric Rating Scale (BPRS). The BPRS (Overall & Gorham, 1962; Ventura et al., 1993) is a 24-item clinician-rated measure that assesses clinical psychiatric symptoms (e.g., somatic concern, suicidality, unusual thought content, suspiciousness) experienced over the previous week. Items are rated on a 7-point Likert scale, ranging from 1 (*not present*) to 7 (*extremely severe*). Following the factor structure supported by Kopelowicz and colleagues (2008), four subscale scores (Positive Symptoms, Agitation/Mania, Negative Symptoms, Depression/Anxiety) were utilized to assess current level of psychopathology and psychotic symptoms. The BPRS is used extensively in psychiatric research and has well-established psychometric properties (Anderson et al., 1989; Morlan & Tan, 1998; Overall & Gorham, 1962).

Calgary Depression Scale for Schizophrenia (CDSS). The CDSS (Addington, Addington, & Schissel, 1990) is a 9-item semi-structured interview that assesses depressive symptoms in individuals with schizophrenia, including depression, hopelessness, and pathological guilt. Items are rated on a 4-point scale, ranging from 0 (*absent*) to 3 (*severe*), providing a total score. The CDSS has been used extensively in both inpatient and outpatient samples, and studies have shown that this measure assesses depressive symptoms distinct from positive, negative, and extrapyramidal symptoms in individuals with schizophrenia (Addington, Addington, Maticka-Tyndale, & Joyce, 1992; Addington, Addington, & Atkinson, 1996; Collins, Remington, Coulter, & Birkett, 1996). The CDSS has also demonstrated good inter-rater agreement and good convergent and discriminant validity (Addington et al., 1990; Addington et al., 1992; Kim et al., 2006).

Defeatist Performance Belief Scale (DPBS). The DPBS is a 15-item self-report measure of overgeneralized conclusions about one's ability to perform tasks and is a subscale of the 40-item Dysfunctional Attitudes Scale (Weissman, 1978). The scale consists of 15 statements that must be rated on a 7-point Likert scale ranging from 1 (*agree completely*) to 7 (*disagree completely*). Sample items include "If you cannot do something well, there is little point in doing it at all" and "People should have a reasonable likelihood of success before undertaking anything." Some items are reverse-scored and then all 15 items are summed to obtain a final DPBS score, with higher scores indicating greater defeatist performance beliefs. Research has indicated that the DPBS exhibits good internal consistency and reliability with $\alpha = .85$ (Couture, Blanchard, & Bennett, 2011; Horan, Rassovsky, Kern, Lee, Wynn, & Green, 2010).

Affective Learning Task. The affective learning task (Bliss-Moreau, Barrett, & Wright, 2008) is used to assess rapid learning of valenced social stimuli. The task consists of three phases: a learning phase, a post-learning judgment phase, and a delayed judgment phase. During the learning phase, participants view face-sentence pairs and are told to remember the pairings by imagining each person performing the behavior described in by the corresponding sentence. The faces include both male and female sexes, as well as Caucasian and African American races. The 60 target faces are each paired with a unique descriptive sentence that is positive, negative, or neutral in affective tone. All of the sentences are social in nature, meaning that they explicitly or implicitly reference another person. The face-sentence pairs are displayed on the computer screen for 5 seconds with a 1-second intertrial interval. Each face-sentence pair is presented four times in random order. During the post-learning judgment phase, participants are shown the 60 target faces, plus 20 novel faces, and are instructed to make quick, "snap judgments" of the faces, rating the valence of each face (positive, negative, or neutral) using marked keys on a computer keyboard. The participants indicate their ratings by button-press on the keyboard. During the delayed judgment phase, participants are recalled for a second laboratory session 1 day after the initial session. In this second session, participants again rate the faces from the posttest of the learning task. The affective learning task has only been assessed in nonclinical populations but it provides preliminary validity as an objective measure of rapid learning.

Incidental Encoding, Recall, and Recognition Task. The incidental encoding, recall, and recognition task (Mathews & Barch, 2004; Mathews & Barch, 2006) is a paper and pencil behavioral memory task for both valenced and neutral word stimuli. Ten neutral words, 10 positive high arousal words, 10 positive low arousal words, 10 negative high arousal words, and 10 negative low arousal words were selected as stimuli and were matched on word frequency and length. The words were obtained from previously published studies on memory and emotion. Participants are told that they will be rating words on how they make them feel. Using the Self-Assessment Manikin (SAM; Lang, 1980), participants rate each word on valance and arousal through a 5-point Likert scale, with 1 being the most negative or calm and 5 being the most positive or aroused. In Mathews' original study (Mathews & Barch, 2004), they found that there were no differences in arousal and valence ratings between controls and individuals with schizophrenia, indicating intact emotion processing. This allows us to be more certain that any observed group differences will be due to emotional memory biases rather than processing deficits. After completion of this incidental-encoding phase, there is a surprise recall trial, during which each participant has three minutes to write down every word he or she remembers from the 50-word list. This is immediately followed by a recognition phase in which participants are read a series of 100 words one a time, with 50 words being form the incidental-encoding task and 50 new words randomly intermixed. The 50 new words are of the same valence and arousal proportion as the original 50 words. Although Mathews and Barch (2004) did not find any group differences in the recognition phase, and we have no a priori hypotheses in regard to recognition of emotional stimuli, this portion of the task will be left in the battery for potential additional analyses. The original published task has been extended to now include a delayed recall phase. Participants must return 24-hours after the first assessment session to again write down as many words as they can remember in three minutes.

Brief Cognitive Assessment Tool for Schizophrenia (B-CATS). The B-CATS (Hurford, Marder, Keefe, Reise, & Bilder, 2011) is a standardized method by which to measure cognition. The B-CATS is comprised of three tests: trail making test part B (Reitan, 1958), category fluency, and digit symbol (Kreiner & Ryan, 2001). The B-CATS correlates well with more extensive cognitive batteries (*r*'s ranging from .73 to .86; Hurford et al., 2011).

Data-Analytic Plan

SPSS was used to conduct the analyses. Before conducting a priori hypotheses, we examined the psychometric properties of the two emotional memory tasks. Specifically, we assessed the internal consistency of the affective learning task and the test-retest reliability of the incidental encoding, recall, and recognition task. A 2 x 3 repeated measures ANOVA with group (schizophrenia vs. control) as a between-subjects factor and word type (negative, neutral, or positive) as a within-subjects factor was used to assess recall of words. A 2 x 3 repeated measures ANOVA with group (schizophrenia vs. control) as a between-subjects factor and sentence valence (negative, neutral, or positive) as a within-subjects factor was conducted on the mean proportion of correctly rated trials (i.e., categorizing faces with the valence of the sentence with which they were paired) on the affective learning task. Correlations were run to determine the associations between defeatist performance beliefs, recall of positive stimuli on the two emotional memory tasks, and negative symptoms. Finally, a path analysis was conducted following Shrout and Bolger's (2002) procedure to determine if the following 3-variable model is consistent with mediation of an indirect effect: impaired recall of positive stimuli (X), defeatist performance beliefs (M), and experiential negative symptoms (Y). Nonparametric bootstrapping (Preacher & Hayes, 2004) was employed to estimate standard errors of the direct and indirect effects for significance testing.

Chapter 3: Results

Demographic and Clinical Characteristics

Information on demographics for each group is shown in Table 1. Twenty-three individuals with schizophrenia (n = 16) or schizoaffective (n = 7) disorder and twenty-four healthy controls participated in the present study. The schizophrenia sample was comprised of primarily chronically ill, unemployed middle-aged males who were high school educated and identified as African American. The control sample was comprised of primarily unemployed middle-aged males who were also high school educated and exclusively identified as African American. Planned comparisons indicated that controls and individuals with schizophrenia did not differ on age, $F(1,45) = 2.86$, $p > .05$, gender, $\chi^2(1) = 0.04$, $p > .10$, race, $\chi^2(1) = 1.06$, $p > .10$, education, $F(1,45) = 0.80$, $p > .10$, or employment, $\chi^2(1) = 1.08$, $p > .10$.

Clinical characteristics are presented in Table 2. As expected, individuals with schizophrenia exhibited significantly higher scores than controls on all clinical interviews (all p's < .01) and on the defeatist performance beliefs scale, $F(1,45) = 11.03$, $p = .002$. Additionally, they evidenced more severe cognitive impairment than controls (all p's < .01). Both the schizophrenia sample and the healthy controls overall reported low levels of depression on the CDSS. Two participants from the schizophrenia group scored 6 or higher on the CDSS, indicating that they met the cut-off for clinically significant depression (Addington et al., 1990). The schizophrenia sample reported low levels of psychiatric symptoms on the BPRS, mild to moderate levels of experiential negative symptoms on the CAINS MAP, mild levels of expressive negative symptoms on the

CAINS EXP, and moderate levels of defeatist performance beliefs on the DPBS.

Incidental Encoding, Recall, and Recognition Task

The incidental encoding, recall, and recognition task exhibited poor test-retest reliability for the recall condition for the total sample of words (r = .40) and for each valence: positive (r = .45), negative (r = .35), and neutral (r = .30). Cronbach's alpha for the recognition condition was .91, indicating excellent internal consistency. To examine our hypothesis that the schizophrenia group would recall less positive words compared to controls, we conducted a 2 x 3 repeated measures ANOVA, with group (schizophrenia, control) as a between-subjects factor and word type (positive, negative, or neutral) as a within-subjects factor for both day one and day two assessments. The mean proportion of words recalled in each condition for each group and standard errors is shown in Figure 1 for day one and Figure 2 for day two. The means and standard deviations for both days are shown in Table 3. The day one ANOVA indicated a main effect of group, $F(1, 41) = 7.69$, $p < .01$, $\eta^2 = .14$, with schizophrenia participants recalling fewer words than controls. The ANOVA also indicated a main effect of word type, $F(2,90) = 36.92$, $p < .001$, $\eta^2 = .45$. Within-subjects contrasts revealed that negative, $F(1,45) = 57.37$, $p < .001$, $\eta^2 = .56$, and positive words, $F(1,45) = 57.53$, $p < .001$, $\eta^2 = .56$, were recalled more often than neutral words. A significant group by word type interaction, $F(2,90) = 10.68$, $p < .001$, $\eta^2 = .19$, indicated that individuals with schizophrenia recalled less negative words than controls.

The day two ANOVA indicated a main effect of word type, $F(2, 90) = 15.81$, $p < .001$, $\eta^2 = .26$, but no main effect of group, $F(2,90) = 1.36$, $p = .24$, $\eta^2 = .02$, or group by word type interaction, $F(2,90) = 1.18$, $p = .31$, $\eta^2 = .02$. Within-subjects contrasts revealed that negative, $F(1,45) = 24.94$, $p < .001$, $\eta^2 = .35$, and positive words, $F(1,45) = 19.05$, $p < .001$, $\eta^2 = .29$, were recalled more often than neutral words. These results indicate that on both days valenced words were recalled more often than neutral words. Additionally, during the immediate recall trial individuals with schizophrenia exhibited poorer memory than controls, and this is particularly true for negatively valenced words. However, after a delay of one day, both groups performed similarly across all word types on this memory assessment.

Affective Learning

Psychometric Properties and Data Plan. The affective learning task exhibited acceptable internal consistency on day one ($\alpha = .66$), but poor internal consistency on day two ($\alpha = .20$). Examination of the internal consistency on day two when broken down by valence yielded good internal consistency for the positive ($\alpha = .77$), negative ($\alpha = .70$), and neutral ($\alpha = .83$) items. To assess for minimal affective learning, we first examined whether participants in each group were able to correctly categorize the faces more likely than chance (33%) using one-sample t-tests. To examine our hypothesis that the schizophrenia group would exhibit poorer learning of positive associations compared to controls, we conducted a 2 x 3 repeated measures ANOVA on the mean proportion of correctly rated trials (i.e., categorizing faces with the valence of the sentence with which they were paired), with group (schizophrenia, control) as a between-subjects factor and sentence valence (positive, negative, or neutral) as a within-subjects factor for both day one and day two assessments. The mean proportion of valence judgments in each condition for each group and standard errors are shown in Figure 3 for day one and

Figure 4 for day two. The means and standard deviations are shown in Table 4 for both days.

Day One Chance Comparisons. On day one, faces paired with negative sentences were not significantly more likely than chance to be categorized as negative, neutral, or positive in either group. This indicates that neither controls nor individuals with schizophrenia exhibited minimal affective learning of the negative associations.

In the control group, faces paired with neutral sentences were not significantly more likely than chance to be categorized as neutral, but were more likely than chance to be categorized as positive and less likely than chance to be categorized as negative in the control group. In the schizophrenia group, faces paired with neutral sentences were not more likely than chance to be categorized as neutral, negative, or positive.

In the control group, faces paired with positive sentences were significantly more likely than chance to be categorized as positive and significantly less likely than chance to be categorized as negative or neutral in the control group. In the schizophrenia group, faces paired with positive sentences were not significantly more likely than chance to be categorized as positive or neutral, but were less likely than chance to be categorized as negative.

Novel faces were more likely than chance to be categorized as neutral and significantly less likely than chance to be categorized as negative or positive in both groups. This result indicates that both controls and individuals with schizophrenia did not view novel faces positively or negatively. Taken together, the day one minimal affective learning results indicate that the schizophrenia group was unable to correctly associate faces with the valenced behaviors with which they were previously paired; however, the control group came to see faces as positive when those faces were previously paired with positive and neutral behavioral acts.

Day Two Chance Comparisons. In the control group, faces paired with negative sentences were not significantly more likely than chance to be categorized as negative or neutral, but were more likely than chance to be categorized as positive. In the schizophrenia group, faces paired with negative sentences were not more likely than chance to be categorized as negative, neutral, or positive.

In the control group faces paired with neutral sentences were significantly more likely than chance to be categorized as positive, and were less likely than chance to be categorized as neutral or negative. In the schizophrenia group, faces paired with neutral sentences were not significantly more likely than chance to be categorized as negative, neutral, or positive.

In the control group, faces paired with positive sentences more likely than chance to be categorized as positive, and less likely than chance to be categorized as neutral or negative. In the schizophrenia group faces paired with positive sentences were more likely than chance to be categorized as positive, less likely than chance to be categorized as negative, and were categorized as neutral at chance levels.

In both groups, novel faces were less likely than chance to be categorized as negative, more likely than chance to be categorized as neutral, and were categorized as positive at chance levels. Taken together, the day two results indicate that again, the control group was only able to correctly exhibit minimal affective learning for faces paired with positive sentences. Interestingly, the control group classified all faces that they had seen paired with sentences on the prior day as primarily positive. Results also suggest that after a one-day delay, the schizophrenia sample was able to exhibit minimal affective learning for the faces paired with positive sentences.

Mere Exposure Effect. We examined evidence for a mere exposure effect (Zajonc, 1968) by comparing positive judgments of faces that had never been seen before to positive judgments of the faces that had been previously paired with neutral sentences. Controls exhibited a mere exposure effect both on day one, $t(21) = 7.64$, $p < .001$, and on day two, $t(21) = 6.53$, $p < .001$. Additionally, the schizophrenia sample also exhibited a mere exposure effect on day one, $t(19) = 3.55$, $p < .01$, and on day two, $t(18) = 2.35$, $p < .05$. These results indicate that both groups viewed familiar faces more positively than novel faces.

Day One ANOVA. The day one 2 x 3 repeated measures ANOVA indicated a main effect of group, $F(1,40) = 5.52$, $p < .05$, $\eta^2 = .12$, signifying that the controls were able to learn the affective meaning of faces paired with behavioral acts better than the schizophrenia participants. The ANOVA also indicated a main effect of valence, $F(2,80) = 8.09$, $p < .001$, $\eta^2 = .16$. Within-subjects contrasts revealed that the correct categorization of faces paired with positive sentences occurred more often than correct categorization of faces paired with negative, $F(1,40) = 10.22$, $p < .01$, $\eta^2 = .20$, and neutral sentences, $F(1,40) = 12.98$, $p < .01$, $\eta^2 = .24$. A significant group by valence interaction, $F(2,80) = 3.15$, $p < .05$, $\eta^2 = .07$, indicated that controls exhibited greater minimal positive affective learning than the schizophrenia sample. To better understand where patients were incorrectly allocating their effort for the positive pairings, we performed post-hoc independent samples t-tests, which revealed that the schizophrenia group was more likely than controls to categorize the faces paired with positive sentences as neutral, $t(40) = -2.77$, $p < .01$. The results indicate that as predicted, the schizophrenia sample, in comparison to controls, exhibited impaired minimal affective learning of positive stimuli.

Day Two ANOVA. For the day two ANOVA, Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 6.89$, $p < .05$, therefore a Greenhouse-Geisser correction was used. The ANOVA indicated a main effect of valence, $F(1.71,66.89) = 14.72$, $p < .001$, $\eta^2 = .27$, and a group by valence interaction, $F(1.71,66.89) = 8.28$, $p < .01$, $\eta^2 = .17$, but no main effect of group, $F(1,39) = 0.19$, $p = .65$, $\eta^2 = .01$. Within-subjects contrasts again revealed that the correct categorization of faces paired with positive sentences occurred more often than correct categorization of faces paired with negative, $F(1,39) = 35.33$, $p < .001$, $\eta^2 = .47$, and neutral sentences, $F(1,39) = 18.03$, $p < .001$, $\eta^2 = .31$. The significant interaction indicated that controls exhibited greater minimal positive affective learning than the schizophrenia sample, and that the schizophrenia sample exhibited greater minimal neutral affective learning than the controls. Post-hoc independent samples t-tests revealed that the schizophrenia group was more likely than controls to categorize the faces paired with positive sentences as neutral, $t(28.69) = -2.79$, $p < .01$, and that controls were more likely than the schizophrenia group to categorize the faces paired with neutral sentences as positive, $t(39) = 2.93$, $p < .01$. These results suggest that the schizophrenia group's impairment in positive affective learning, in comparison to controls, persists after a one-day delay; however, they are more adept than controls at correctly categorizing faces paired with neutral sentences after the delay.

Relations Between Negative Symptoms, Emotional Memory, and Defeatist Performance Beliefs

To examine the relation between negative symptoms, emotional memory, and defeatist performance beliefs, we computed correlations between the CAINS, DPBS, and recall of positive stimuli on the emotional memory tasks for the schizophrenia sample on day one and day two (see Table 5). Contrary to our hypothesis, neither recall of positive words nor correct judgment of faces paired with positive sentences on day one or day two were significantly associated with experiential negative symptoms. In examining the relation between expressive negative symptoms and emotional memory, only the relation between CAINS EXP and day two recall of positive words approached significance. Defeatist performance beliefs were not associated with expressive or experiential negative symptoms. Because none of the correlations were significant, we did not conduct partial correlations controlling for depression. These results indicate that although individuals with schizophrenia, in comparison to controls, exhibit a decrement in positive minimal affective learning, this impairment is not related to negative symptoms.

Mediation Models

A path analysis was conducted following Shrout and Bolger's (2002) procedure to determine if the following 3-variable model is consistent with mediation of an indirect effect: impaired recall of positive stimuli (X), defeatist performance beliefs (M), and experiential negative symptoms (Y). Nonparametric bootstrapping with n = 10,000 resamples was employed to estimate standard errors of the direct and indirect effects for significance testing (Preacher & Hayes, 2004). This mediation model was examined for recall of positive words on the day one incidental encoding, recall, and recognition task, and also for correct positive judgments on the day one affective learning task. See Figures 5 and 6 for standardized and unstandardized path estimates for the two models.

The effect of recall of positive words on experiential negative symptoms was nonsignificant. The effect of defeatist performance beliefs on experiential negative symptoms was also nonsignificant. The test of the indirect effect was nonsignificant (indirect effect = 0.03, *SE* = 6.15; [95% CI = -15.35 to 11.01]), indicating that the data are not consistent with the claim that a decrement in the recall of positive words influences experiential negative symptoms indirectly through its relation on defeatist performance beliefs. The effect of correct positive judgments on experiential negative symptoms was nonsignificant. The effect of defeatist performance beliefs on experiential negative symptoms was also nonsignificant. The test of the indirect effect was nonsignificant (indirect effect = 1.26, *SE* = 3.95; [95% CI = -5.07 to 12.01]), indicating that the data are not consistent with the claim that a decreased ability to exhibit affective learning for neutral faces paired with positive sentences influences experiential negative symptoms indirectly through its relation on defeatist performance beliefs.

Chapter 4: Discussion

Main Findings

This study sought to examine whether individuals with schizophrenia, in comparison to healthy controls, would exhibit impairment in the recall of positive stimuli on social and nonsocial emotional memory assessments. An additional aim was to examine the associations of memory performance and defeatist performance beliefs with negative symptoms. The current study extends prior laboratory research involving individuals with schizophrenia through the use of a memory task that is social in nature. Additionally, it is the first study to examine the specific cognitive domain of emotional memory in Beck's cognitive model of negative symptoms.

Our first hypothesis that in comparison to healthy controls, participants with schizophrenia would exhibit poorer memory of positive words was not supported by our results. The two groups recalled a similar number of positive and neutral words on the first day, but in regard to negative words, the schizophrenia sample recalled significantly fewer words than controls. In the original study employing this task the authors found that individuals with schizophrenia and controls exhibited similar patterns of recall, and specifically, that both groups tended to recall negative words more than positive words (Mathews & Barch, 2004). Our control findings are in line with this result, as they exhibited the greatest recall for negative words. When examining symptom correlates of memory performance, Mathews and Barch found that blunted affect was associated with less of an improvement in recall for the highly arousing positive and negative words. Hall and colleagues (2007) also reported an impairment in recall for highly arousing negative stimuli for their participants with schizophrenia in comparison to controls. Although we had no a prior hypotheses about the influence of arousal on memory, it is possible that our participants exhibited an impairment in recall of highly arousal negative words, and that this decrement in performance could be associated with expressive negative symptoms.

During the delayed recall trial, group differences in performance were no longer observed and valence-enhanced recall for both positive and negative words (compared to neutral) was evidenced for both groups. Although this result is consistent with Mathews and Barch's (2004) finding that individuals with schizophrenia and controls exhibit similar patterns of recall, it is inconsistent with the literature that suggests group differences in emotional memory become more pronounced after delays of at least one day (Herbener, 2008). The control participants in studies that found group differences after a delay of at least one day were typically younger and more educated than the healthy controls in this study (Neumann et al., 2007; Horan et al., 2006). Although different emotional memory methodologies were employed in each study, it is possible that these types of participant characteristics influenced memory performance on day two, and that it may be the poor control group performance that contributed to the lack of observed group differences. Though the following were not assessed in this study, research has shown that psychophysiological arousal (i.e., heart rate and skin conductance response; Cunningham, et al., 2014), cortisol levels at encoding, and sleep can all impact emotional memory consolidation (Bennion, Mickley Steinmetz, Kensinger, & Payne, 2014). Thus, future studies examining delayed recall of emotional stimuli would benefit from assessment of these factors.

Our second hypothesis that individuals with schizophrenia would exhibit poorer affective learning for positive social information compared to controls was supported by our findings. Specifically, controls categorized faces paired with positive behavioral acts as positive significantly more often than our schizophrenia sample on both day one and day two. This result is consistent with prior research illustrating that there is a memory impairment of positively valenced stimuli in this population (Koh et al., 1981). Additionally, our finding that the clinical sample exhibited an intact mere exposure effect is in line with previous work, which found that despite impaired explicit memory, individuals with schizophrenia evidence increased liking for previously unfamiliar stimuli after frequent exposures (Marie et al., 2001). However, whereas within group analyses indicated intact operation of the mere exposure effect in the schizophrenia sample, between group analyses that suggested that this was more pronounced in the controls, as they were significantly more likely to categorize faces paired with neutral acts as positive.

Although our primary hypothesis in regard to the affective learning task was supported, there were some unexpected findings. First, neither the schizophrenia sample nor the control group evidenced affective learning for negative social information on day one and day two. On day one in both groups these faces were not allocated to valenced categories at greater than chance levels. Interestingly, on day two controls assessed faces paired with negative information as being positive more likely than chance.

The reasons for the lack of learning negative associations in the current study are unclear but may relate to sample differences. The assessment of affective learning using social information paired with neutral faces has only been administered to nonclinical undergraduates at Boston College. In their research on this sample, Bliss-Moreau and colleagues (2008) consistently found that these participants exhibited minimal affective learning for the positive, negative, and neutral conditions. Differences in demographic factors, such as education level, age, gender, and race may have contributed to our participants viewing the negative sentences differently than young college students. It is possible that in impoverished urban settings the sentences describing negative behavioral acts are judged differently. Baltimore has recently been rated as the seventh most dangerous city in the United States, with a violent crime rate of 1,417 per 100,000 residents. Research has shown that urban, low-income, African Americans disproportionately reside in neighborhoods that are characterized by poverty, crime, and violence, which increases the likelihood that they will witness community violence (Carlo, Crockett, & Carranza, 2011; Centers for Disease Control and Prevention [CDC], 2010). Perhaps the largely unemployed African Americans participants in our study were exposed to crime and violence more often than undergraduates in Boston, and thus, sentences such as, “cut in line at the bank,” and “yelled at a bus driver” were not viewed as particularly negative. Additionally, sentences such as, “cheated on a spouse,” and “abandoned a partner” may actually be more normative, rather than negative, in older African American samples, given that research has shown that more non-exclusive sexual partnering occurs in African American males than in Caucasian males (Adimora et al., 2001), and that there is greater marital and romantic relationship instability in African American communities (Barr, Culatta, & Simons, 2013). Future research would benefit from having participants rate all the affective learning task sentences on valence to ensure that that the negative behavioral acts are actually perceived as negative by participants.

Second, with the exception of correctly classifying the day two faces paired with positive sentences as positive and categorizing faces paired with positive sentences as negative significantly below chance levels on both days, the schizophrenia sample did not exhibit minimal affective learning. Like controls though, they did classify novel faces as neutral more often than chance on both assessment days. One possible explanation for the first result is that the task may be too difficult for individuals with cognitive impairments. Several of the clinical sample participants had difficulty reading the sentences in the time allotted before the computer program would advance to the next face and sentence pairing. As such, this could indicate that participants with schizophrenia require more time to view the faces and fully read the sentences, which could have diminished effective encoding of the pairings. Further examinations of affective learning in cognitively impaired populations should increase the display time for each pairing, and perhaps even increase the number of times each pairing is viewed. Explanations are less clear for why participants with schizophrenia were able to classify novel faces as neutral at similar rates as controls. Continuing with the difficulty justification, perhaps it is simply less cognitively demanding to notice that a face is novel rather than recalling what kind of sentence was paired with a face. Indeed, research has shown that as cognitive load increases, memory performance decreases in individuals with schizophrenia (Cairo, Woodward, & Ngan, 2005).

Third, it is intriguing that individuals with schizophrenia were more likely than controls to correctly categorize faces paired with neutral faces as neutral, whereas controls more often categorized these faces as positive. Research has shown that healthy individuals often exhibit positive illusions, such that they display unrealistic positive views, while mildly depressed individuals often have more realistic views (Taylor & Brown, 1988). This consistent finding from the social psychology literature may help explain why it is that our controls viewed all faces that they had seen during the learning phase on the prior day as significantly more positive than chance on the second day, even when the faces were not paired with positive behavioral acts. Additionally, it may suggest that like mildly depressed populations, individuals with schizophrenia exhibit more balanced perceptions, such that they do not apply positive affective value to stimuli when there is no viable reason to.

An alternative explanation could be related to the mere exposure effect. As originally postulated by Zajonc (1968), the mere exposure effect reflects the development of an emotional preference, or increased liking, for previously novel material after repeated exposures. Research has typically validated the mere exposure effect through studies showing that increased exposure leads to increased liking, personal attraction, and desire for future interaction (Brockner & Swap, 1976; Saegert, Swap, & Zajonc, 1973). There may also be an evolutionary benefit to exhibiting preference for familiar people, such that individuals who do this could be more likely to increase their social network and the likelihood that they will reproduce and pass on their genes. Furthermore, increased liking of previously unfamiliar individuals or objects can lead to a feeling of security and can signify that your environment is not dangerous (Reis, Maniaci, Caprariello, Eastwick, & Finkel, 2011). Although both patients and controls exhibited a mere exposure effect, compared to controls participants with schizophrenia displayed significantly lower positive ratings of faces that were previously paired with positive (on day one and day two) and neutral (on day two) sentences. Given that the individuals with schizophrenia in our study applied less positive value to previously viewed faces, this could play a role in decreased motivation to engage in social behaviors. This is in line with our results, which suggest that, although nonsignificant, there is a small association between increased experiential negative symptoms and decreased categorization of faces paired with positive sentences as positive. Future research would benefit from examination of how the mere exposure effect may affect real-world social interactions in anhedonic clinical populations.

Our third hypothesis that experiential negative symptoms would be positively associated with defeatist performance beliefs and negatively associated with recall of positive words and positive affective learning was not supported by our data. Given that the literature on dysfunctional attitudes and experiential negative symptoms has consistently found small to moderate correlations between the two, it is surprising that we did not replicate the finding (Couture et al., 2011; Green et al., 2012; Horan et al., 2010; Quinlan, Roesch, & Granholm, 2014). These other studies involved schizophrenia participants of similar age, education, and gender proportions, so it is unlikely that demographic factors contributed to our unusual finding. Furthermore, mean symptom and defeatist performance belief ratings are comparable across studies; therefore, clinical factors are unlikely to have contributed to our findings. A possible explanation for our result is that the participants in this study were recruited from a highly structured community outpatient center in which the mental health consumers spend the majority of each weekday in psychosocial groups and program activities. It may be that individuals in our study endorse defeatist performance beliefs, but because of their involvement in the program these beliefs do not influence their motivation to engage in social, recreational, and vocational activities.

Although the correlation between positive minimal affective learning and experiential negative symptoms was nonsignificant, it was in the predicted direction, such that higher experiential negative symptoms were related to impairment in positive affective learning. It is possible that our study was statistically underpowered to detect a significant association, since we have only recruited half of the proposed schizophrenia sample to date. The nonsocial memory task, in comparison, had a much weaker association with experiential negative symptoms. This finding presents preliminary support for the idea that an association between decreased ability to learn positive associations and experiential negative symptoms is most evident when emotional memory is examined in a social context. It's likely that nonsocial stimuli may not tap into the affiliative deficits that characterize negative symptoms of schizophrenia.

Our fourth hypothesis that defeatist performance beliefs would mediate the relation between a diminished recall of positive stimuli and experiential negative symptoms was not supported by our results. Nonsignificant mediation may have been influenced by the lack of a zero-order correlation between defeatist performance beliefs and negative symptoms in our sample. Additionally, each mediation model only explained three to five percent of the variance in negative symptoms, so it may indeed be that more broad cognitive impairment gives rise to defeatist performance beliefs and negative symptoms, as originally suggested (Grant & Beck, 2009). Moreover, there may be other non-cognitive factors, such as stigma, that have not yet been examined as predictors in Beck's model. To illustrate, individuals may experience stigma after obtaining a mental health diagnosis. After undergoing discrimination, an individual could over time develop defeatist beliefs and then begin to socially withdraw. Although there is no research to date examining the relation between stigma and defeatist beliefs, there has been work showing that stigma can influence social functioning through increased social isolation in an attempt to avoid rejection (Link, Struening, Neese-Todd, Asmussen, & Phelan, 2002).

Limitations

As with all research, this study had several limitations. First, this study used cross-sectional data, which removes the ability to establish any causal relations. Although the use of cross-sectional data has been common in studies examining Beck's cognitive model, this study design is suboptimal when probing mediation. Cross-sectional data can lead to biased estimates of effects because it ignores that it takes time for variables to exert their effects, that variables have effects on themselves, and that the size of effects can depend on the amount of time between variable measurement (MacKinnon, 2008; Maxwell & Cole, 2007). Future research would benefit from longitudinal analysis of the relation between emotional memory, dysfunctional attitudes, and negative symptoms. A second limitation pertains to generalizability, as the study sample was racially homogeneous. As previously mentioned, participant race may have affected negative pairing performance on the affective learning task. Future studies may want to assess affective learning in more ethnically diverse clinical samples to extend the findings to the general population. Relatedly, participants tended to be middle-aged and male. Examining emotional memory, defeatist performance beliefs, negative symptoms, and the relations among these constructs in younger individuals or in women may yield different results. Third, every participant in the schizophrenia sample was prescribed at least one antipsychotic drug, whereas none of the controls reported any current use of psychotropic medication. It is possible that medications may have unknown impact on cognitive performance. Some researchers have noted that antipsychotics cause or exacerbate memory impairments (Stip, 1996), although others have reported that these drugs have no effect on memory (Huron et al., 1995) or that they may even improve certain domains of cognition (i.e., abstract thinking and attention; Spohn & Strauss, 1989). Ultimately, recruiting unmedicated individuals would decrease the generalizability of our findings, and terminating medication use for the study would be unethical. Lastly, analyses were limited in power to due the small sample size. Study recruitment is ongoing and further analyses on the full sample may alter our findings.

Conclusions

The current study had many strengths, including the examination of emotional memory through a social affective learning paradigm, and a reconsideration of Beck's cognitive model that invokes the role of impaired memory for positive stimuli in the development of negative symptoms. Though previous studies have examined emotional memory in individuals with schizophrenia (Mathews & Barch, 2004; Horan et al., 2006), the present study aimed to expand our understanding of emotional memory through the addition of a social component and exploring the relation of both social and nonsocial emotional memory to negative symptoms. Our results indicate that memory for positively valenced stimuli is intact for a word recall task, but impaired, in comparison to controls, in a social memory task in which one must learn the affective value of others. However, memory for positively valenced stimuli for both tasks was not correlated with negative symptoms. Taken together, this suggests that individuals with schizophrenia, regardless of negative symptom severity, evidence impairments in the recall of positive social stimuli. With regard to our examination of Beck's cognitive model, we did not replicate previous research reporting the role of defeatist performance beliefs in mediating the relation between cognitive impairments and experiential negative symptoms. This indicates that emotional memory, whether social or nonsocial, may not be a major driver of dysfunctional attitudes and negative symptoms.

Table 1

Demographic Data for Schizophrenia (SZ) and Control (Con) Groups

	SZ (*n* = 23)	**Con** (*n* = 24)
Age, *M (SD)*	50.91 (8.26)	45.91 (11.63)
Gender		
Male (%)	70	67
Female (%)	30	33
Race		
African American (%)	95	100
Caucasian (%)	5	0
Education		
Years, *M (SD)*	11.3 (2.03)	11.9 (2.59)
Employed (%)	13	25
Duration of Illness		
Years, *M (SD)*	31.80 (9.20)	--

Table 2

Descriptive Information for Clinical and Self-Report Measures for Schizophrenia (SZ) and Control (Con) Groups

	SZ (n = 23)	**Con** (n = 24)	
	M (SD)	**M (SD)**	***F***
CAINS			
MAP	15.41 (6.80)	5.51 (6.40)	25.22 ***
EXP	4.52 (4.15)	1.04 (2.09)	13.31 **
BPRS			
Total	41.91 (8.73)	27.66 (3.01)	56.72 ***
Positive	2.06 (0.78)	1.16 (3.01)	30.07 ***
Negative	1.98 (1.11)	1.11 (0.23)	14.19 ***
Agitation-Mania	1.37 (0.43)	1.07 (0.17)	9.73 **
Depression-Anxiety	1.81 (0.69)	1.30 (0.44)	9.18 **
CDSS	1.86 (1.86)	0.41 (0.71)	12.61 **
DPBS	47.60 (17.17)	32.45 (13.99)	11.03 **
B-CATS			
Trails B	191.68 (86.82)	120.54 (77.60)	8.61 **
Category Fluency	32.86 (6.73)	42.00 (10.09)	13.18 **
Digit Symbol	4.47 (1.80)	6.29 (2.36)	8.66 **

Note. Clinical Assessment Interview for Negative Symptoms; MAP = Motivation and Pleasure subscale, EXP = Expression subscale; BPRS = Brief Psychiatric Rating Scale; CDSS = Calgary Depression Scale for Schizophrenia; DPBS = Defeatist Performance Beliefs Scale; B-CATS = Brief Cognitive Assessment Tool for Schizophrenia
** $p < .01$; *** $p < .001$

Table 3

Means and Standard Deviations for Recall of Words on Emotional Memory Task for Schizophrenia (SZ) and Control (Con) Groups

	Day 1				Day 2			
	SZ (*n* = 23)		Con (*n* = 24)		SZ (*n* = 23)		Con (*n* = 24)	
Word Type	# *M (SD)*	Prop *M (SD)*	# *M (SD)*	Prop *M (SD)*	# *M (SD)*	Prop *M (SD)*	# *M (SD)*	Prop *M (SD)*
Neutral	0.21 (0.42)	.02 (0.04)	0.25 (0.44)	.02 (0.04)	0.13 (0.45)	.01 (0.04)	0.37 (0.87)	.03 (0.08)
Negative	1.13 (1.17)	.05 (0.04)	3.25 (1.87)	.16 (0.09)	1.30 (1.32)	.06 (0.06)	2.00 (1.38)	.10 (0.06)
Positive	2.17 (1.61)	.10 (0.08)	2.50 (1.69)	.12 (0.08)	1.73 (1.73)	.08 (0.01)	1.70 (1.60)	.08 (0.01)

Table 4.

Means and Standard Deviations on the Affective Learning Task for Schizophrenia (SZ) and Control (Con) Groups

	Day 1		Day 2	
	SZ (n = 20)	Con (n = 22)	SZ (n = 19)	Con (n = 22)
	M (SD)	M (SD)	M (SD)	M (SD)
Prop. Neg Judged Neg	.36 (.23)	.37 (.22)	.29 (.20)	.31 (.15)
Prop. Neg Judged Neu	.33 (.18)	.28 (.20)	.37 (.23)	.26 (.20)
Prop. Neg Judged Pos	.29 (.20)	.34 (.20)	.32 (.18)	.42 (.21)
Prop. Neu Judged Neg	.26 (.23)	.13 (.10)	.25 (.18)	.26 (.17)
Prop. Neu Judged Neu	.30 (.23)	.29 (.21)	.38 (.24)	.20 (.15)
Prop. Neu Judged Pos	.42 (.25)	.57 (.22)	.35 (.24)	.52 (.18)
Prop. Pos Judged Neg	.22 (.22)	.16 (.14)	.18 (.15)	.17 (.12)
Prop. Pos Judged Neu	.37 (.19)	.21 (.18)	.38 (.25)	.20 (.15)
Prop. Pos Judged Pos	.39 (.21)	.62 (.22)	.42 (.18)	.62 (.25)
Prop. Extra Judged Neg	.23 (.24)	.16 (.18)	.12 (.10)	.19 (.17)
Prop. Extra Judged Neu	.54 (.32)	.63 (.31)	.63 (.31)	.52 (.34)
Prop. Extra Judged Pos	.22 (.17)	.20 (.18)	.24 (.24)	.27 (.24)

Note. *n*'s are smaller than the total sample. Technical difficulties with the affective learning task program caused 5 participants (3 SZ, 2 Con) to have incomplete data files on day one and 1 participant (SZ) to have an incomplete data file on day two.

Table 5

Correlations Between CAINS and DPBS, Correct Positive Judgments on the ALT, and Recall of Positive Words on the IERRT

	Day 1			Day 2	
	DPBS	**ALT**	**IERRT**	**ALT**	**IERRT**
CAINS					
MAP	.05	-.20	-.04	.11	.12
EXP	-.29	.18	-.21	.31	-.36 ^

Note. DPBS = Defeatist Performance Beliefs Scale; ALT = Affective Learning Task; IERRT = Incidental Encoding, Recall, and Recognition Task.
^ $p < .10$

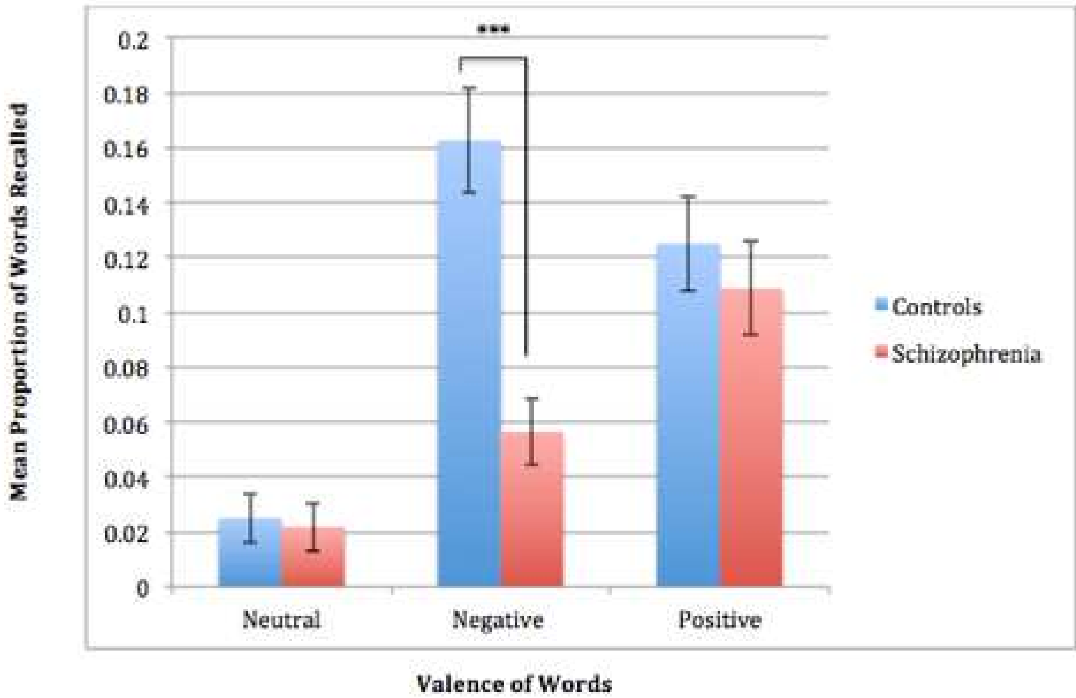

Figure 1. Proportion of words recalled on day one emotional memory task.

*** $p < .001$

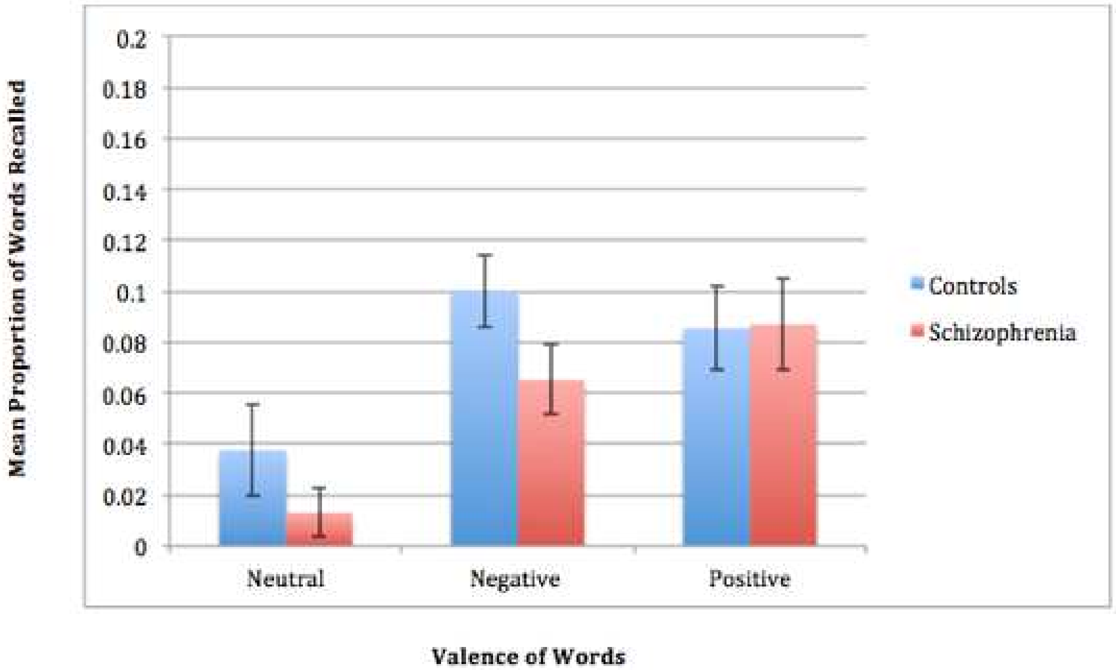

Figure 2. Proportion of words recalled on day two emotional memory task.

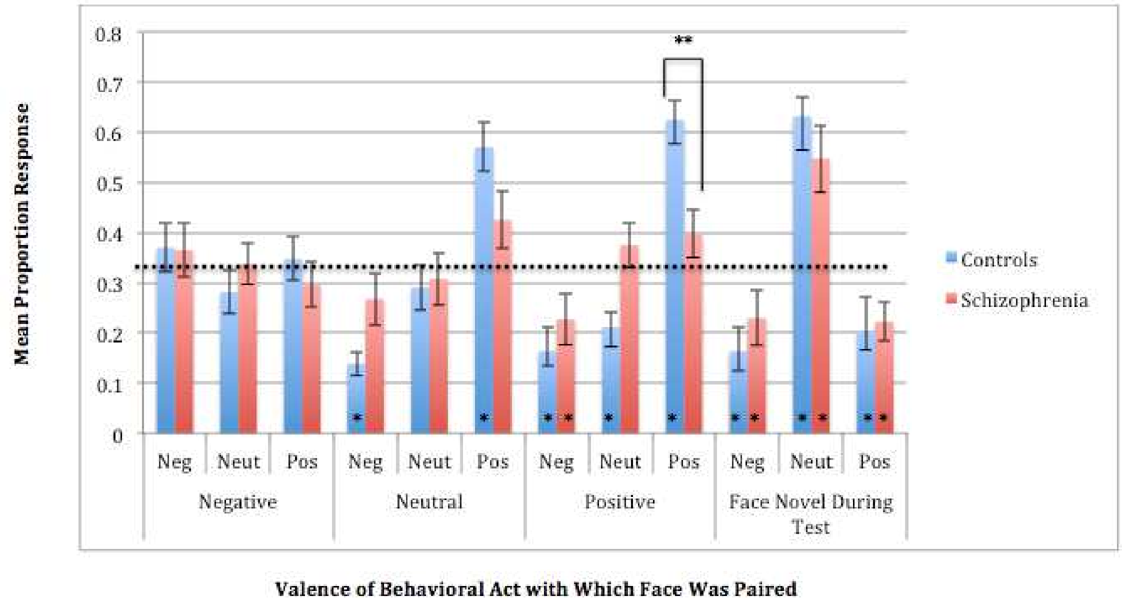

Figure 3. Mean proportion of categorizations on the affective learning task based on valence of behavioral act with which face was paired on day one for schizophrenia and control groups.

Note. The dotted line is chance (.33). Columns with asterisks are different from chance.

** $p < .01$

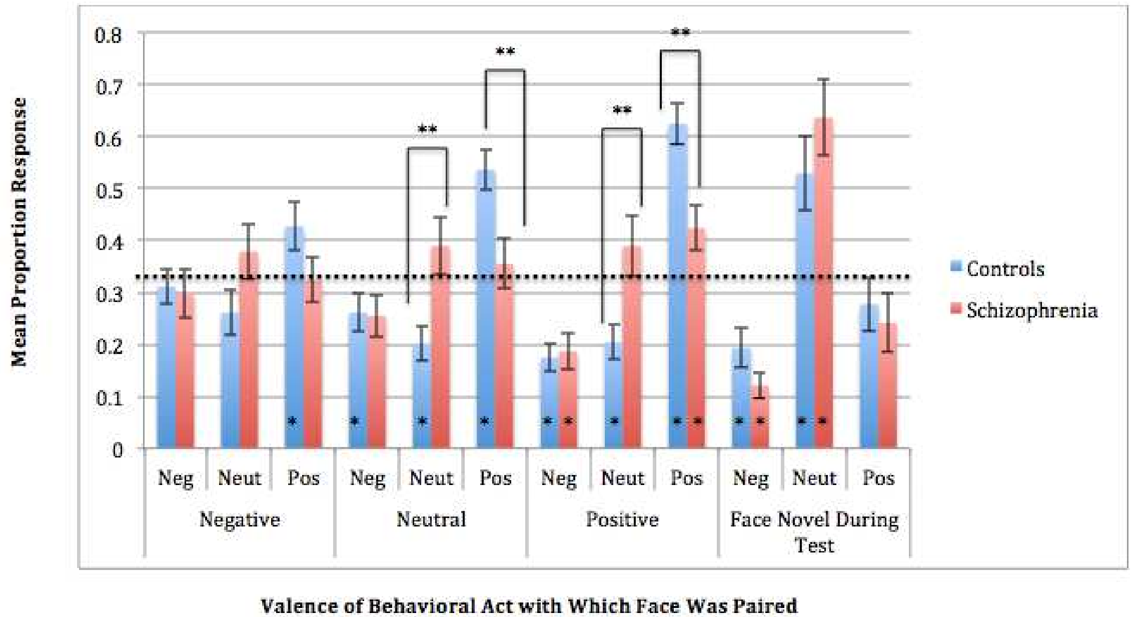

Figure 4. Mean proportion of categorizations on the affective learning task based on valence of behavioral act with which face was paired on day two for schizophrenia and control groups.

Note. The dotted line is chance (.33). Columns with asterisks are different from chance.

** $p < .01$

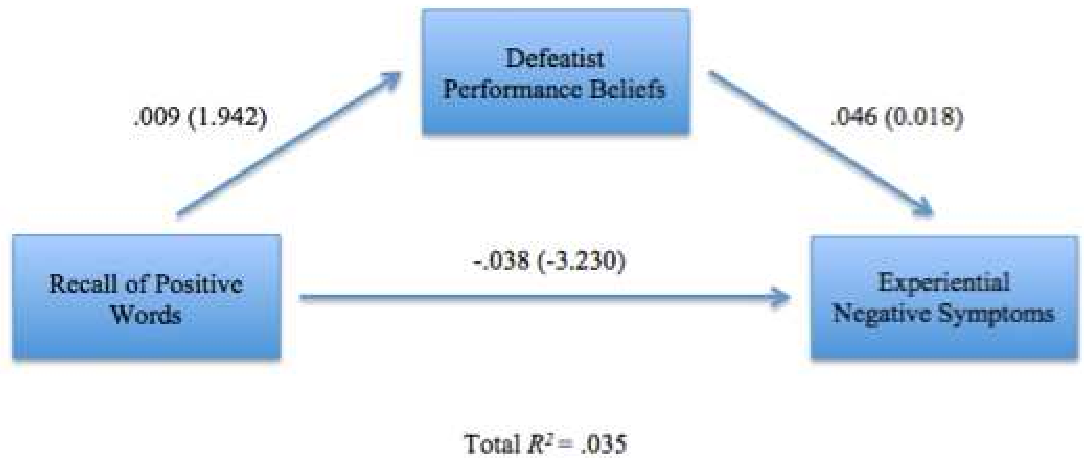

Figure 5. Standardized and (unstandardized) path estimates for the model including recall of positive words.

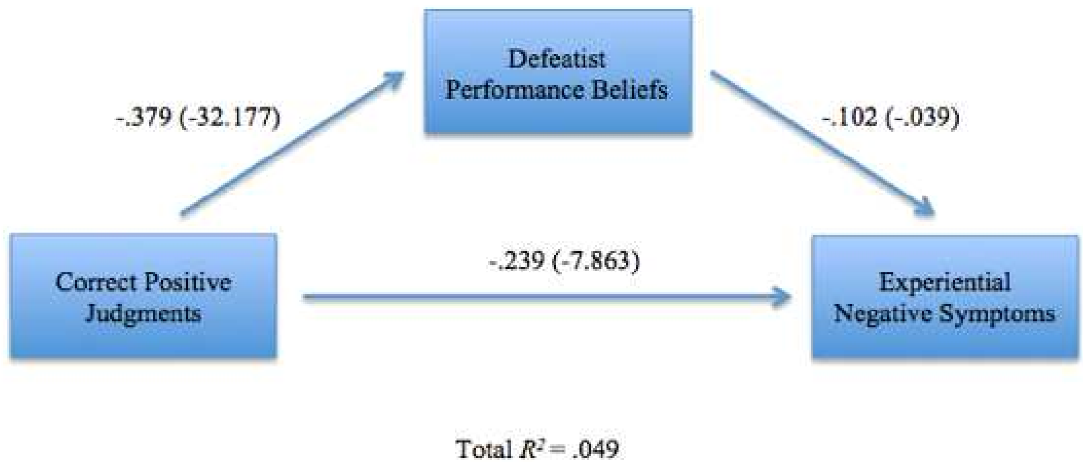

Figure 6. Standardized and (unstandardized) path estimates for the model including judgments of neutral faces paired with positive sentences.

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