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Incongruent Emotion Experience in Schizophrenia: The Role of Negative Affect and Response Inhibition

By

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Abstract

Incongruent emotion experience in schizophrenia: The role of negative affect and response inhibition

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We investigated the relationship between incongruent emotion experience (negative emotion reported in response to positive and neutral stimuli), state negative affect, and response inhibition (a facet of cognitive control) in people with and without schizophrenia. We also tested whether a positive mood induction (the Broad-Minded Affective Coping, or BMAC, procedure) would decrease state negative affect and subsequently decrease incongruent emotion experience in people with schizophrenia. People with schizophrenia or schizoaffective disorder (n=29) reported significantly more state and trait negative affect and more incongruent emotion experience in response to positive and neutral film clips compared to people without schizophrenia (n=26). The BMAC procedure increased positive affect but did not decrease negative affect in all participants nor did it influence reports of incongruent emotion experience in people with schizophrenia. State negative affect, but not response inhibition, predicted incongruent emotion experience in people with schizophrenia. These results indicate that incongruent emotion experience may reflect heightened state negative affect in people with schizophrenia that does not readily diminish in the face of positive experiences.

Incongruent emotion experience in schizophrenia: The role of negative affect and response inhibition

One of the most well-replicated findings on emotion experience in schizophrenia (SZ) is that people with SZ report equivalent amounts of positive emotion in response to positive stimuli and negative emotion in response to negative stimuli when compared to people without SZ (for reviews and meta analyses, see Cohen & Minor, 2010; Kring & Elis, 2013; Strauss & Gold, 2012; Strauss, Waltz, & Gold, 2014). In other words, people with SZ report emotion experiences that are *congruent* with what would be expected to be experienced in response to these stimuli. However, across laboratory studies that assess positive and negative emotion independently, people with SZ report more negative emotion in response to putatively positive and neutral stimuli compared to people without SZ, in what is known as *incongruent* emotion experience (for a meta-analysis, see Cohen & Minor, 2010). Incongruent emotion experience has also been found in daily life, with Sanchez and colleagues finding that people with SZ reported more negative emotion in response to putatively positive situations in their daily lives compared to people without SZ (Sanchez, Lavaysse, Starr, & Gard, 2014).

Incongruent emotion experience — specifically, reporting more negative emotion in response to positive and neutral stimuli — has been associated with symptoms and functioning in SZ. For example, heightened negative emotion in response to emotionally evocative stimuli in people with SZ is positively correlated with anhedonia (Horan, Green, Kring, & Nuechterlein, 2006; Trémeau et al., 2009), which is associated with poorer outcomes (e.g., Foussias & Remington, 2010). Incongruent emotion experience is also related to symptom severity and poorer daily life skills in people with SZ (Trémeau et al., 2009). Further, people with SZ who exhibit poorer neurocognitive performance report more negative emotion to positive situations in daily life compared to those who perform better on such tasks, suggesting a relationship between neurocognitive ability and incongruent emotion experience in people with SZ (Sanchez et al., 2014).

More broadly, incongruent emotion experience may be a sign that people with SZ experience positive events differently than people without SZ, which in turn may have other consequences. If people with SZ experience negative emotions that do not diminish in the face of putatively positive experiences, they may have difficulty reaping the benefits that these experiences bring. Indeed, the experience of positive emotion has many benefits, including resiliency to stress, improved cognitive and interpersonal resources, and faster cardiovascular recovery after a negative emotional experience (Folkman & Moskowitz, 2000; Fredrickson, 2001; Garland et al., 2010). However, it may be more difficult for people with SZ to successfully capitalize on these benefits if they feel heightened negative emotions in response to positive experiences.

Why do people with SZ report incongruent emotion experience? In the present study, we examined two possible, interrelated explanations: The experience and persistence of heightened negative affect[1] and deficits in response inhibition, one facet of cognitive control.

[1] Throughout this paper, "affect" refers to a feeling state that reflects either valence (positive or negative) or activation/arousal (high or low) that may or may not be elicited by a specific evocative stimulus. Further, affect may refer to a variety of emotion labels (anger, sadness, boredom) that all represent the same valence (negative affect) (Kuppens, Tuerlinckx, Russell, & Barrett, 2013; Russell & Barrett, 1999).

Heightened negative affect

The experience of negative emotions in response to positive and neutral stimuli may reflect the fact that people with SZ experience heightened negative affect (NA) more generally. Others have argued (e.g., Cohen, Minor, & Najolia, 2010) that people with SZ report incongruent emotion experience because they have difficulty overcoming heightened NA in the presence of emotionally evocative stimuli. Cohen and colleagues (2010) use the term "ambivalence" to reference the idea that people with SZ may experience both positive and negative emotions in response to positive stimuli, and that this "ambivalence" is driven by the persistence of NA even in the presence of positive stimuli. In other words, people with SZ feel and report pleasure in response to positive (or neutral) stimuli to the same extent as people without SZ, but have difficulty in overcoming heightened NA and thus continue to experience and report more negative emotion in response to these stimuli compared to people without SZ.

Evidence for heightened NA in people with SZ comes from several studies. First, people with SZ report more trait NA compared to people without SZ (e.g., Berenbaum & Fujita, 1994; Horan & Blanchard, 2003; Horan, Blanchard, Clark, & Green, 2008). Second, laboratory studies show that people with SZ report more negative emotions in response to all (positive, negative, neutral) emotionally evocative stimuli compared to people without SZ (e.g., Earnst & Kring, 1999; Habel, Krasenbrink, Bowi, Ott, & Schneider, 2006; Kring & Earnst, 1999; Salem & Kring, 1999; Strauss & Herbener, 2011). While meta-analyses show that people with SZ do not differ from people without SZ in their reports of congruent emotion experiences (Cohen & Minor, 2010; Yan et al., 2012), when individual studies *do* find differences in emotion experience reports, people with SZ report more negative emotions in response to *all* evocative stimuli compared to people without SZ. Third, experience sampling studies show that regardless of the situation, people with SZ report more negative emotion (Myin-Germeys, Delespaul, & deVries, 2000; Oorschot et al., 2012; Sanchez et al., 2014) or higher intensity in their negative emotions in their daily lives (Kimhy et al., 2014) compared to people without SZ. Finally, Horan and colleagues (2006) found that people with SZ not only reported more baseline state NA prior to the presentation of evocative stimuli, but people with SZ also reported more incongruent emotion experience in response to positive and neutral stimuli compared to people without SZ. Moreover, baseline state NA was positively correlated with incongruent emotion experience in people with SZ. When state NA was included as a covariate in the analyses, people with SZ no longer differed from people without SZ in their reports of incongruent emotion experience (Horan et al., 2006). In sum, evidence from trait measures, laboratory tasks, and experience sampling studies show that people with SZ may, regardless of the context, experience heightened NA compared to people without SZ, and this heightened NA may directly contribute to reports of incongruent emotion experience in response to evocative stimuli.

Response inhibition

Broadly, cognitive control refers to the recruitment of various aspects of cognition (e.g., working memory, attention, response inhibition, etc.) in support of goal-directed behavior (Miller & Cohen, 2001; Ridderinkhof, van den Wildenberg, Segalowitz, & Carter, 2004). Emotional states influence engagement in cognitive control processes (and vice versa), and cognitive control can shape responses based on emotional contexts, including attending to specific situations and regulating one's emotional responses to those situations (Dolcos, Iordan, & Dolcos, 2011; Ochsner & Gross, 2005). Given that emotion experience and cognitive control

are so intertwined, facets of cognitive control may play a role in incongruent emotion experience in people with SZ.

Response inhibition, or the ability to inhibit a prepotent response, is one facet of cognitive control. Within the context of goal-directed behavior, response inhibition refers to inhibiting a prepotent response to make a contextually appropriate response given the demands of a situation (e.g., Levy & Anderson, 2002; MacLeod, 2007). For example, if your local grocery store closes, you may need to inhibit both the memory of the location of that grocery store as well as the behavior of driving your car to the old location (the prepotent response) in order to drive to a different grocery store (the contextually appropriate response).

Evidence from studies with healthy people indicate that response inhibition and NA are related. For example, trait and state NA (manipulated through emotion induction paradigms) have been associated with poorer performance on response inhibition tasks (Hur et al., 2015; Patterson et al., 2016; but see Chepenik, Cornew, & Farah, 2006). Further, in the studies that assessed brain activation, induced NA was associated with less activation in the inferior frontal gyrus, a brain region associated with response inhibition (e.g., Hampshire, Chamberlain, Monti, Duncan, & Owen, 2010; Swick, Ashley, & Turken, 2008). Thus, in healthy people, heightened NA may impair response inhibition.

Within the context of incongruent emotion experience, response inhibition may contribute to the difficulty that people with SZ have in "overcoming" heightened state NA when reporting their emotion experience in response to positive and neutral stimuli (Cohen et al., 2010). Several studies have found that people with SZ perform more poorly than people without SZ on response inhibition tasks (Henik & Salo, 2004; Westerhausen, Kompus, & Hugdahl, 2011) and show less activation in brain regions associated with response inhibition, such as the inferior frontal gyrus and dorsolateral prefrontal cortex (Duncan & Owen, 2000; Levy & Anderson, 2002; Minzenberg, Laird, Thelen, Carter, & Glahn, 2009). Other evidence suggests a relationship between dorsolateral prefrontal cortex (DLPFC) activation, a brain region associated with response inhibition, and incongruent emotion experience in SZ. Ursu and colleagues (2011) found that DLPFC activation following the offset of evocative stimuli (i.e., during an emotion "maintenance" period) was negatively correlated with incongruent emotion experience, but only in people with SZ. This suggests that decreased recruitment of a brain region associated with response inhibition is related to increased reports of incongruent emotion experience in people with SZ.

If NA is related to impaired response inhibition in healthy people, heightened state NA in people with SZ may also be related to response inhibition. Further, response inhibition may be necessary for people with SZ to make emotion responses to evocative stimuli. The experience of heightened NA prior to viewing any evocative stimuli may be considered task-irrelevant information (a prepotent emotional response) that needs to be inhibited in order for people with SZ to make contextually appropriate responses to positive and neutral stimuli. Thus, incongruent emotion experience may reflect both heightened NA and impairments in response inhibition in people with SZ.

Taken together, response inhibition appears to be related to the experience of NA in healthy people and possibly in people with SZ. People with SZ show impairments in response inhibition and report heightened NA. If incongruent emotion experience reflects heightened state (or trait) NA in people with SZ, it may also reflect deficits in response inhibition. Through understanding the relationship between state NA, response inhibition, and incongruent emotion

experience in people with SZ, we may illuminate possible explanations for incongruent emotion experience in SZ.

The present study

We sought to assess the relationship between state NA, response inhibition, and incongruent emotion experience in people with and without SZ. In addition to assessing baseline NA and emotion experienced in response to evocative stimuli, we also included a manipulation of NA to assess whether this might decrease both state NA and incongruent emotion experience in SZ. In other words, we reasoned that through decreasing state NA in people with SZ, we could also decrease reports of incongruent emotion experience.

To reduce state NA, we chose the Broad-Minded Affective Coping (BMAC) procedure, a procedure that was developed as a cognitive-behavioral tool to increase positive affect (PA) in a variety of clinical populations (Tarrier, 2010). Although increasing PA does not necessarily lead to a reduction in NA, prior studies using the BMAC procedure have found that it does both. Briefly, the BMAC procedure involves asking participants to imagine and attempt to re-experience emotions from a past positive event. In one study, the BMAC procedure increased positive emotions and decreased negative emotions in people with post-traumatic stress disorder (Panagioti, Gooding, & Tarrier, 2012). Within the same study, the BMAC procedure was more effective at increasing positive emotions and decreasing negative emotions when compared to a different mood induction procedure (writing about a personal positive memory; Panagioti et al., 2012). Johnson and colleagues found that the BMAC procedure increased specific positive emotions (happiness and hope) in people with SZ (Johnson, Gooding, Wood, Fair, & Tarrier 2013).

To assess incongruent emotion experience, we chose putatively positive and neutral film clips as our emotionally evocative stimuli. In order to assess whether the BMAC procedure reduced state NA and thus decreased reports of incongruent emotion experience in response to the film clips, we included two conditions. Specifically, people were randomly assigned to receive the BMAC procedure either prior to viewing film clips or in between two periods of film clip viewing. Based on prior evidence that people with SZ show difficulty in maintaining emotion experience over an extended period of time (Gard et al., 2011; Kring, Germans Gard, & Gard, 2011; Ursu et al., 2011), we reasoned that the mood induction effects of the BMAC procedure might only persist for two film clips immediately following BMAC procedure administration. Further, we wanted to understand whether the BMAC procedure on its own could effectively reduce state NA prior to the presentation of any other positive stimuli (such as the positive film). These two conditions allowed us to assess these possibilities.

We tested several hypotheses regarding heightened NA and response inhibition:
With respect to **heightened NA**, we predicted:

1. People with SZ will report heightened baseline state NA and trait NA compared to people without SZ.
2. To the extent that the BMAC procedure is successful in decreasing state NA, people with SZ will not differ from people without SZ in reports of incongruent emotion experience in response to film clips shown *directly following* the BMAC procedure.
3. People with SZ will report more incongruent emotion experience than people without SZ in response to film clips *not* shown directly after the BMAC procedure.
4. Baseline state NA and trait NA will be positively correlated with and significantly predict incongruent emotion experience in people with SZ.

With respect to **response inhibition**, we predicted that:

1. Response inhibition performance will be negatively correlated with reports of state NA and incongruent emotion experience in people with SZ.
2. Response inhibition will significantly predict incongruent emotion experience in people with SZ.

Method

Participants

Twenty-nine people with schizophrenia or schizoaffective disorder (SZ) and 26 people without SZ (healthy controls; HCs) participated (see Table 1 for demographic information)[2]. Participants were recruited through other research laboratories in the California Bay Area, community board and care homes, nonprofit agencies for people with mental illness, community flyers, and Craigslist. People with a history of head trauma, stroke, neurological disease, or loss of consciousness for more than five minutes; full scale IQ below 70 (all participants completed the Wechsler Test of Adult Reading (WTAR); Wechsler, 2001); a current mood episode; or substance use disorder within the past six months were not invited to participate. For the HC group, people with a current *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (*DSM-5*; American Psychiatric Association, 2013) diagnosis; previous psychiatric hospitalization; family history of SZ; or who were currently taking psychiatric medications were not invited to participate.

Clinical measures

Diagnoses of participants were confirmed using the *Structured Clinical Interview for DSM-5 Research Version* (*SCID-5-RV*; First, Williams, Karg, & Spitzer, 2015). Symptom ratings for the SZ group were made using the 24-item Brief Psychiatric Rating Scale (BPRS: Lukoff, Nuechterlein, & Ventura, 1986; Overall & Gorham, 1962).

Stimuli

We selected four short film clips (each approximately 3-minutes in duration) based on their use in previous studies (e.g., Kring & Earnst, 1999; Mote, Stuart, & Kring, 2014; Sturm et al., 2015). The two positive film clips included comedy scenes of a husband and wife attempting to repair a house and women working in a chocolate factory. The two neutral film clips included two scenes from a documentary on trains. Participants viewed films in groups of two, with the positive film clip preceding the neutral film clip. The four film clips were divided into two sets of films, and participants were randomly assigned to view the film sets in one of two orders (see Figure 1).

The Broad-Minded Affective Coping (BMAC) procedure

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[2] People with schizophrenia (n=17) had significantly less years of education (M = 13.88, SD = 1.93) compared to people with schizoaffective disorder (n=12; M = 15.75, SD = 2.14), t (27) = 2.45, p = 0.02. People with schizophrenia and schizoaffective disorder did not significantly differ on any other demographic variable and are combined as one group (people with SZ) in our analyses.

The same researcher (JM) completed the BMAC procedure with all participants. First, participants were instructed via standardized questions to think of a recent, specific positive memory where they could recall multiple details about the memory. If a participant did not generate a positive memory (e.g., the participant used multiple negative emotion words to describe the memory) or a recent memory (e.g., it was more than a few years from the date of participation), the researcher prompted the participant to think of a different positive memory. If the participant exhibited difficulty in recalling a positive memory, the participant was given predetermined prompts to help him or her think of a memory (e.g., "What about the last time you spent time with friends?", "What about the last time you ate your favorite food or meal?")[3]. After the interview, the researcher guided the participant through a relaxation exercise to focus on body posture and breathing and then a mental imagery exercise, where the researcher prompted the participant to create a vivid mental image of the positive memory that was discussed during the interview. Participants were instructed to focus on the sensations from the memory (sights, sounds, smells, tastes, touch), re-experience the thoughts and emotions from the memory, and develop positive appraisals related to the memory (why the memory was important, how the memory helped the participant, what the memory meant about the participant's life, and how the memory demonstrated the participant's positive qualities). Finally, the researcher guided participants through the relaxation and mental imagery exercises, focusing on the same memory, for a second time[4]. The entire procedure took approximately 35 minutes. The BMAC procedure was completed either prior to viewing any film clips or after viewing one pair of film clips (see Figure 1).

State and trait affective experience

Participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) at baseline, after each film, and before and after the BMAC procedure. The PANAS includes 10 high arousal, positive emotion words (interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, active) and 10 high arousal, negative emotion words (distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, afraid). Participants were instructed to rate the extent to which they felt each of the emotions at the present moment using a 5-point Likert scale (1 = very slightly or not at all, 5 = extremely). Trait affective experience was assessed using the Positive and Negative Affect Schedule-Version X, which included the same positive and negative words used on the PANAS among additional emotion words, along with the same 5-point Likert scale (PANAS-X; Watson & Clark, 1994).

Response inhibition

To assess response inhibition, participants completed the timed, paper version of the Stroop task (Stroop, 1935). Participants completed three sections: the Word section, where they

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[3] One participant (male HC) could not recall a positive memory, even after he was given all predetermined prompts to aid his recall. We did not include this participant in the analyses since he did not generate a positive memory and thus did not complete the BMAC procedure.

[4] One participant (female SZ) requested to change her original memory after the first round of relaxation and mental imagery exercises. The participant focused on a different memory when she completed the second round of relaxation and mental imagery exercises. Results did not significantly change when we excluded this participant, so we did not exclude her from analyses.

read as many words printed in black ink on a page as they could in 45 seconds; the Color section, where they viewed crosshatches of different colors and named as many colors as they could in 45 seconds; and the Color-Word section, where they named as many colors as they could on a page of unrelated color words (e.g., the word "red" is printed in blue ink, and the participant must name the color of the ink the word is printed in) in 45 seconds.

Procedure

All participants completed informed verbal and written consent. Immediately following consent, participants completed the PANAS to assess baseline state PA and NA. Diagnoses were then confirmed with the *SCID-5-RV*, symptom ratings were made using the BPRS (for the SZ group only), and demographic information was gathered via interview.

Next, participants were randomly assigned to one of two orders for film clip viewing and the BMAC procedure (see Figure 1). In Order 1, participants viewed one positive and one neutral film clip and completed the PANAS after each film clip. Participants then completed the BMAC procedure (completing the PANAS before and after). After the BMAC procedure, participants then watched one positive and one neutral film clip (different film clips from the previous clips). Again, participants completed the PANAS after watching each film clip. In Order 2, participants completed the BMAC procedure prior to viewing any film clips. Then, participants watched four films: positive, neutral, positive, neutral.

The two BMAC procedure orders allowed us to gain a clearer picture of a) whether the BMAC procedure by itself decreased NA in participants and b) whether potential reductions in incongruent emotion experience in people with SZ in response to the film clips only persisted for the first two film clips administered directly following the BMAC procedure. By including Order 2, where the BMAC procedure was administered before any of the film clips, we were able to better understand whether the BMAC procedure by itself decreased NA in participants or whether emotion responses would differ from Order 1, when the BMAC procedure was preceded by two evocative film clips. Further, by including Order 2, we were able to examine potential differences in emotion experience reports comparing the first two film clips immediately following the BMAC procedure to the last two film clips presented. We expected that incongruent emotion experience would only be reduced for the two film clips immediately following the BMAC procedure based on previous evidence that people with SZ exhibit impairments in maintaining emotion experience over time (e.g., Gard et al., 2011).

After viewing the film clips and the administration of the BMAC procedure, all participants completed the WTAR, the Stroop, and the PANAS-X[5].

Data analytic plan

We computed mean state PA and NA scores for each PANAS administration. Mean trait PA and NA scores were calculated using the same 10 positive and 10 negative emotion words, but from the PANAS-X. Response inhibition was computed as the raw total score (how many words were read aloud in 45 seconds) on the Color-Word subtest of the Stroop. Pearson correlations and linear regressions were calculated separately for the SZ and HC groups. Separate mixed-effects analyses of variances (ANOVAs) including group (SZ, HC) and sex (men, women) as between-subjects variables were used to examine PA and NA separately to

[5] All but one participant (female HC) completed the PANAS-X at the end of the study.

assess: a) state baseline affect, b) changes in affect from before the BMAC procedure compared to after the BMAC procedure, and c) affect experienced in response to the film clips. Effect sizes were calculated for significant main effects and interactions as partial η^2. Independent and paired-samples *t* tests with Bonferroni corrections were used to examine other between- and within-subjects effects.

Results

Preliminary analyses

As shown in Table 1, the SZ and HC groups did not significantly differ in ratio of men to women; mean age, years of education, or WTAR scores; distribution of ethnic backgrounds; or marital status, *p*'s > 0.05.

To examine whether there were any differences in reported PA and NA in response to the different positive and neutral film clips, we calculated paired samples *t* tests within each group. Participants in the HC group reported significantly more PA in response to the positive film of the women in the chocolate factory ($M = 3.14$, $SD = 0.95$) compared to the positive film of the husband and wife repairing a house ($M = 2.58$, $SD = 0.87$), $t\ (25) = 3.99$, $p = 0.001$. All other differences within the SZ and HC groups were not significant. Given the minimal differences between films in eliciting affect, we collapsed across the two positive and two neutral film clips for all subsequent analyses.

To examine BMAC procedure order effects, separate 2 (Order: 1 or 2) X 2 (Group: SZ, HC) X 2 (Film Type: positive, neutral) mixed-effects ANOVAs for PA and NA reported in response to the film clips were calculated. For PA, the order main effect was not significant, $F\ (1, 51) = 0.10$, $p = 0.75$. The Order X Film Type interaction was significant for PA, $F\ (1, 51) = 4.18$, $p = 0.05$, partial $\eta^2 = 0.08$. However, independent samples *t* tests showed that across groups, PA reported in response to neutral film clips and positive film clips did not significantly differ between Orders 1 and 2. For PA, all other interactions with order were not significant (*p*'s > 0.09). For NA, neither the order main effect ($F\ (1, 51) = 0.31$, $p = 0.56$) nor any interaction with order were significant (*p*'s > 0.44). Thus, for subsequent analyses, we collapsed across BMAC procedure orders.

Did people with SZ report greater state and trait NA?

We conducted separate 2 (Group) X 2 (Sex: men, women) ANOVAs to assess baseline state and trait NA. For baseline state NA, the group main effect was significant, $F\ (1, 51) = 10.24$, $p = 0.002$, partial $\eta^2 = 0.17$. Consistent with our hypothesis, people with SZ reported significantly more baseline state NA ($M = 1.47$, $SD = 0.54$) than the HC group ($M = 1.13$, $SD = 0.23$) (see Figure 2). Neither the sex main effect ($F\ (1, 51) = 2.03$, $p = 0.16$) nor the Group X Sex interaction ($F\ (1, 51) = 0.72$, $p = 0.40$) were significant.

For trait NA, we also found a significant group main effect, $F\ (1, 50) = 10.11$, $p = 0.003$, partial $\eta^2 = 0.17$. As we predicted, people with SZ reported significantly more trait NA ($M = 1.77$, $SD = 0.85$) compared to HCs ($M = 1.26$, $SD = 0.34$). We also found a significant sex main effect, $F\ (1, 50) = 4.55$, $p = 0.04$, partial $\eta^2 = 0.08$. Men reported significantly less trait NA ($M = 1.39$, $SD = 0.55$) than women ($M = 1.71$, $SD = 0.82$). The Group X Sex interaction was not significant, $F\ (1, 50) = 0.78$, $p = 0.38$.

Consistent with our predictions, people with SZ reported greater trait and baseline state NA than people without SZ. Men reported less trait NA than women regardless of diagnostic group, but did not differ from women in baseline state NA.

Although not a focus of our predictions, we also assessed group differences in state and trait PA. For baseline state PA, the group main effect was not significant, F (1, 51) = 0.01, p = 0.91. People with SZ (M = 3.11, SD = 1.08) did not significantly differ from the HC group (M = 3.07, SD = 0.64) (see Figure 2). The sex main effect approached significance, F (1, 51) = 3.11, p = 0.08, partial η^2 = 0.06. Across groups, men tended to report higher baseline state PA (M = 3.30, SD = 0.86) than women (M = 2.87, SD = 0.88). The Group X Sex interaction was not significant, F (1, 51) = 0.83, p = 0.37. Paired-samples t tests showed that both people with SZ (t (28) = 7.79) and HCs (t (25) = 13.80) reported significantly more baseline state PA than NA, p's < 0.001.

By contrast, for trait PA, the group main effect was significant, F (1, 50) = 3.53, p = 0.03, partial η^2 = 0.09. People with SZ reported significantly less trait PA (M = 3.40, SD = 0.60) than people without SZ (M = 2.97, SD = 1.13). We also found a significant sex main effect, (F (1, 50) = 5.73, p = 0.02, partial η^2 = 0.10): Men reported significantly more trait PA (M = 3.42, SD = 0.92) than women (M = 2.88, SD = 0.90). The Group X Sex interaction approached significance, F (1, 50) = 3.56, p = 0.07, partial η^2 = 0.07. Paired-samples t tests showed that both people with SZ (t (28) = 4.26) and HCs (t (24) = 18.27) reported significantly more trait PA than NA, p's < 0.001.

In sum, people with SZ reported less trait PA than HCs, but did not differ in baseline state PA. Regardless of diagnostic group, men reported experiencing more trait PA and tended to report more baseline state PA than women. Both people with and without SZ reported more state and trait PA compared to state and trait NA, respectively.

Did the BMAC procedure decrease NA (and increase PA)?

We conducted separate 2 (Time: before BMAC procedure, after BMAC procedure) X 2 (Group) X 2 (Sex) mixed-effects ANOVAs to examine NA and PA reported before and after the BMAC procedure (see Table 2). For NA, the time main effect was not significant, F (1, 51) = 0.57, p = 0.45. Thus, contrary to expectations, the BMAC procedure did not decrease NA in either group. The group main effect was significant, F (1, 51) = 8.58, p = 0.005, partial η^2 = 0.14. Participants with SZ reported more NA overall (M = 1.33, SD = 0.47) compared to the HC group (M = 1.05, SD = 0.08), suggesting that NA was persistently heightened in the SZ group regardless of the BMAC procedure manipulation. The sex main effect was not significant, F (1, 51) = 0.002, p = 0.96. All interactions were nonsignificant, p's > 0.13.

For PA, the time main effect was significant, F (1, 51) = 6.05, p = 0.02, partial η^2 = 0.11. Consistent with other studies using the BMAC procedure, all participants reported significantly more PA after compared to before the BMAC procedure, indicating that the BMAC procedure increased PA for both groups. The sex main effect was also significant, F (1, 51) = 5.27, p = 0.03, partial η^2 = 0.09. Men reported more PA overall (M = 3.21, SD = 0.94) compared to women (M = 2.57, SD = 1.00). The group main effect was not significant, F (1, 51) = 0.39, p = 0.53. People with SZ did not differ from the HC group in their reports of PA before or after the BMAC procedure. All interactions were nonsignificant, p's > 0.15.

In sum, contrary to expectations, the BMAC procedure did not decrease NA in either participant group. Further, people with SZ reported significantly more NA than HCs both before and after administration of the BMAC procedure. However, the BMAC procedure also increased PA in both people with and without SZ, partially supporting our hypothesis. Because our

prediction that the BMAC procedure would decrease NA in people with and without SZ was not supported and because we did not observe any order effects, we combined PA and NA in response to all film clips irrespective of when they were shown (before or after BMAC) for subsequent analyses of incongruent emotion experience.

Did people with SZ report incongruent emotion experience?

We conducted separate 2 (Group) X 2 (Sex) X 2 (Film Type) mixed-effects ANOVAs for NA and PA reported in response to the film clips (see Table 3). For NA, the group main effect was significant, F (1, 51) = 7.99, p = 0.007, partial η^2 = 0.14. As predicted, people with SZ reported more NA (i.e., incongruent emotion experience) compared to the HC group, and this was true for both positive and neutral film clips (see Figure 3). Neither the sex main effect (F (1, 51) = 0.01, p = 0.94) nor the film type main effect (F (1, 51) = 3.05, p = 0.09) were significant. All interactions were nonsignificant, p's > 0.34.

For PA, the group main effect was not significant, F (1, 51) = 1.92, p = 0.17. However, the Group X Film Type interaction was significant, F (1, 51) = 5.44, p = 0.02, partial η^2 = 0.10. Independent samples t tests indicated that people with SZ and the HC group did not differ in PA reported in response to the positive film clips, p = 0.39. However, people with SZ reported significantly more PA in response to the neutral film clips compared to the HC group, t (53) = 2.32, p = 0.03. The sex main effect was also significant, F (1, 51) = 6.19, p = 0.02, partial η^2 = 0.04. Men reported significantly more PA in response to all film clips (M = 3.08, SD = 1.00) compared to women (M = 2.38, SD = 0.90). Finally, the film type main effect was significant, F (1, 51) = 22.79, p < 0.001, partial η^2 = 0.40. All participants reported more PA in response to the positive than the neutral film clips. All other interactions were nonsignificant, p's > 0.17.

In sum, people with SZ reported more NA in response to positive and neutral film clips compared to the HC group, confirming our prediction that the SZ group would report incongruent emotion experience. People with SZ and the HC group did not differ in reports of PA in response to the positive film clips. Interestingly, people with SZ reported more PA than HCs in response to the neutral film clips. Both people with and without SZ reported more PA in response to the positive than the neutral film clips, and both groups reported more PA than NA to all film clips.

Is incongruent emotion experience related to state and trait NA?

We computed Pearson correlations between baseline state NA, trait NA, and incongruent emotion experience (mean NA reported in response to all films; see Table 3). In the SZ group, baseline state NA was significantly positively correlated with trait NA (r = 0.59, p = 0.001) and incongruent emotion experience (r = 0.60, p = 0.001). However, trait NA was not significantly correlated with incongruent emotion experience (r = 0.15, p = 0.44).

In the HC group, baseline state NA was marginally significantly positively correlated with trait NA (r = 0.39, p = 0.06), but was not significantly correlated with incongruent emotion experience (r = 0.23, p = 0.25). Trait NA was also not significantly correlated with incongruent emotion experience in the HC group (r = 0.26, p = 0.22).

We calculated linear regressions to examine if baseline state NA significantly predicted incongruent emotion experience in people with SZ. In support of our hypothesis, significant variance in incongruent emotion experience was accounted for by baseline state NA, R^2 = 0.60, F (1, 27) = 14.91, p = 0.001.

Is response inhibition related to NA and incongruent emotion experience?

We conducted a 2 (Group) X 2 (Sex) ANOVA to assess performance on the Color-Word subtest of the Stroop. The group main effect was significant, F (1, 51) = 7.70, p = 0.008, partial η^2 = 0.13, indicating that people with SZ performed significantly worse (M = 33.83, SD = 12.93) on the Color-Word subtest of the Stroop compared to people without SZ (M = 43.23, SD = 10.42). Neither the sex main effect (F (1, 51) = 2.48, p = 0.12) nor the Group X Sex interaction (F (1, 51) = 0.35, p = 0.56) were significant. Consistent with prior studies, people with SZ performed more poorly on a response inhibition task compared to people without SZ.

We computed Pearson correlations between response inhibition (Color-Word subtest score), baseline state NA, trait NA, and incongruent emotion experience in people with SZ and the HC group. Contrary to our predictions, response inhibition was not significantly correlated with incongruent emotion experience in people with SZ (r = -0.16, p = 0.40). Further, linear regression analyses showed that significant variance in incongruent emotion experience was not accounted for by response inhibition performance in people with SZ, R^2 = 0.03, F (1, 27) = 0.73, p = 0.40. Finally, response inhibition was not significantly correlated with baseline state NA (r = -0.14, p = 0.46) or trait NA (r = -0.24, p = 0.21) in people with SZ.

By contrast, in the HC group, response inhibition was significantly positively correlated with baseline state NA (r = 0.40, p = 0.04), but not trait NA (r = 0.06, p = 0.79). Response inhibition was not significantly correlated with incongruent emotion experience (r = -0.27, p = 0.18) in the HC group.

In summary, people with SZ performed worse on the Color-Word subtest of the Stroop compared to people without SZ. Contrary to expectations, response inhibition performance was not significantly correlated with state NA, trait NA, or incongruent emotion experience in people with SZ. Response inhibition was significantly positively correlated with baseline state NA in the HC group.

Discussion

In the current study, we sought to understand the relationship between state and trait NA, response inhibition (a feature of cognitive control), and incongruent emotion experience in people with SZ. Consistent with other studies, we found that people with SZ reported incongruent emotion experience. That is, they reported experiencing more NA than people without SZ in response to putatively positive and neutral stimuli. Moreover, our efforts to decrease NA using the BMAC procedure were unsuccessful and thus did not eliminate reports of incongruent experience in people with SZ.

Heightened NA in the presence of PA

Overall, our findings point to the persistence of heightened NA in people with SZ. Indeed, we found that people with SZ reported more NA across multiple time points and in response to multiple stimuli/situations compared to people without SZ: at baseline, on a trait measure, in response to positive and neutral film clips, and in response to the BMAC procedure. Heightened state NA in people with SZ appeared to persist even during situations where PA increased (i.e., after a positive film clip and after the BMAC procedure). This is consistent with others who have argued that people with SZ have difficulty "overcoming" state NA in the face of positive situations (Cohen et al., 2010; Horan et al., 2006).

Additionally, we found that incongruent emotion experience was related to how negative people with SZ felt *in the moment* (state), but not how negative people with SZ felt *in general* (trait). Thus, incongruent emotion experience seems to uniquely reflect heightened state NA in people with SZ. People with SZ may experience even positive situations and stimuli as more negative, in part because they feel more negative "in the moment" compared to people without SZ. It may be that people with SZ experience what many people experience when they have a "bad day," where even putatively positive experiences (seeing friends, watching a funny movie) can be dampened in the presence of NA. Indeed, even on "good days," people with SZ may experience heightened NA that may contribute to the experience of more NA in the face of positive stimuli and situations. This notion is consistent with experience sampling studies that find that people with SZ report more NA to a variety of situations in daily life compared to people without SZ (Kimhy et al., 2014; Myin-Germeys et al., 2000; Oorschot et al., 2012; Sanchez et al., 2014).

The relationship between state NA and incongruent emotion experience suggests that people with SZ may have difficulty disengaging from their heightened state NA across a variety of emotionally evocative situations. Previous research shows that people with SZ have difficulty with maintaining affective states — i.e., "holding in mind" how they felt in response to an evocative stimulus after stimulus offset — over short periods of time (Gard et al., 2011; Kring et al., 2011; Ursu et al., 2011). Initially, these findings appear to contradict the notion that people with SZ have difficulty maintaining emotion: If people with SZ exhibit impairments in the maintenance of both PA and NA in the absence of evocative stimuli, why do they report persistent NA that does not go away in the presence of positive and neutral stimuli? In reconciling these findings, it is important to note that people with SZ in our study reported more state PA than NA, similar to the HC group, and reported less state NA than what would be reported in response to negative stimuli. The experience of heightened NA in the presence of abundant PA may partially account for the putative impairments in maintaining affective states that are observed in people with SZ.

Although speculative, maintaining the experience of more NA than PA (as what is reported in response to negative stimuli) may require more effort for people with SZ even if they are experiencing heightened NA; in other words, even if a person with SZ is experiencing heightened NA on a "good day," it may be still be more difficult for that person to maintain or upregulate even *more* NA in the absence of anything negative in their environment. Further, the experience of heightened state NA by itself, while still less than the experience of state PA, may still interfere with one's ability to maintain PA in the absence of explicitly positive stimuli. While one study has shown that people with SZ report incongruent emotion experience while attempting to maintain affective states (Ursu et al., 2011), no study to date has examined the relationship between baseline affective states and the maintenance of affective state after the offset of evocative stimuli. Future researchers can clarify this relationship to better understand why people with SZ have difficulties maintaining affective states in the presence of persistent state NA.

Despite experiencing heightened NA in response to positive stimuli or situations, people with SZ reported comparable PA as people without SZ, a finding consistent with many other laboratory studies (Cohen & Minor, 2010; Kring & Elis, 2013). People with and without SZ reported more PA than NA across all time points (at baseline, on trait measures, in response to positive and neutral films, and in response to the BMAC procedure). Specifically, the BMAC procedure effectively improved PA in people with SZ, replicating previous findings (Johnson et

al., 2013). As people with SZ report a lower frequency of positive experiences in their lives (Oorschot et al., 2012) and report more anhedonia on trait measures (Strauss & Gold, 2012) compared to people without SZ, it remains important to understand what techniques effectively improve PA in SZ as people with SZ can still benefit greatly from the use of such techniques. People with SZ were not only able to recall a positive memory from their recent past during the BMAC procedure, but effectively increased PA from an exercise that instructed them to essentially re-live the positive memory in their mind. This finding is consistent with other work showing that people with SZ do not exhibit difficulty in recalling positive emotional memories or experiencing PA from those memories when cued with specific and salient prompts (e.g., Johnson et al., 2013; Painter & Kring, 2016). The BMAC procedure is a relatively short technique (35-minute administration on average) that could be effectively taught to people with SZ to practice on a daily basis in order to boost PA.

It may be that people with SZ need to engage in a higher frequency of activities that improve PA, such as the BMAC procedure, in order to most effectively reap the benefits of these experiences, especially if these activities are undertaken in the presence of heightened NA. The experience of NA in response to positive events may create a "cycle" whereby people with SZ associate such events with negative emotions (even as they also experience positive emotions), thus they decide against pursuing potential future positive events. As previously stated, people with SZ report a lower frequency of positive experiences in daily life compared to people without SZ (Oorschot et al., 2012), which could either be a contributing factor to or a consequence of the experience of heightened NA. To disentangle these two possibilities, experience sampling studies can examine whether the experience of heightened NA in SZ in daily life predicts the quantity of future positive emotional experiences, and/or whether the quantity of positive emotional experiences predicts heightened NA. The experience of heightened NA "in the moment" may be related to the impairments in anticipatory pleasure and motivated behavior also seen in people with SZ (Frost & Strauss, 2016; Kring & Elis, 2013). Understanding this relationship, and whether people with SZ also report more NA in anticipation of future experiences, would be an important avenue for future research.

Response inhibition

We also sought to understand the relationship between response inhibition and incongruent emotion experience in people with SZ. While people with SZ performed more poorly on a response inhibition task compared to people without SZ, response inhibition was not associated with incongruent emotion experience, trait NA, or state NA in people with SZ. While we did not explicitly instruct participants to regulate their emotional states, these findings suggest that incongruent emotion experience may not reflect difficulties in inhibiting heightened NA.

Another plausible explanation for why incongruent emotion experience in people with SZ was not related to impairments in response inhibition is because the NA experienced in response to positive and neutral stimuli is lower than the NA experienced in response to negative stimuli. In fact, a floor effect of NA may have constrained our ability to observe this linkage. Prior studies with healthy people have shown that response inhibition performance is impaired following the presentation of negative (but not positive) stimuli (e.g., Patterson et al., 2016). Further, one study showed that it was the combination of both higher trait NA as well as induced state NA in healthy people that was necessary to observe an impairment in response inhibition (Hur et al., 2015). Thus, negative mood inductions that sufficiently increase NA over and above

the experience of PA may be necessary to observe a relationship between response inhibition and NA in people with and without SZ. Indeed, we also did not find significant negative correlations between NA and response inhibition in the HC group, perhaps because HCs experienced very little NA across the study, even at baseline, making it difficult to clarify the one positive correlation we found between baseline state NA and response inhibition performance in this group. Future studies might benefit from also including negative emotional stimuli to assess whether response inhibition is only related to greater experienced NA.

PA in response to neutral stimuli

In our study, people with SZ not only reported more NA in response to positive and neutral film clips, but they also reported more PA in response to neutral stimuli compared to people without SZ. This may be similar to the finding from other studies that show that people with SZ sometimes report more PA in response to negative stimuli (Trémeau et al., 2009; Ursu et al., 2011), which may represent a different kind of incongruent emotion experience that may warrant future investigation. Alternatively, there is evidence that people with SZ report higher arousal (or activation) towards neutral stimuli compared to people without SZ (Llerena, Strauss, & Cohen, 2012). Because the PANAS only includes emotion words that are high arousal negative and high arousal positive emotions, reports of more NA and PA in response to neutral film clips could reflect that people with SZ were reporting higher arousal (and not just valence) in response to neutral stimuli when compared to people without SZ. To better understand the nature of incongruent emotion experiences, future researchers can assess valence and arousal separately to understand whether different types of incongruent emotion experiences exist outside of the experience of more NA in response to positive and neutral stimuli, and the consequences (if any) of these experiences in people with SZ.

Sex differences

We found some interesting sex differences, though these were not a focus of our hypotheses. Compared to women, men reported significantly less trait NA, more trait PA, more PA in response to all film types, and more PA both before and after the BMAC procedure. These differences in emotion experience do not appear to be accounted for by other demographic differences in our sample since men and women across groups did not differ in age, education, or ratio of ethnic backgrounds. It may be that the higher trait PA and lower trait NA in men in our sample contributed to men's' greater reported PA across different tasks. In at least one previous study of people with and without SZ, men reported more PA in response to emotionally evocative images compared to women (Kring et al., 2011), though this study did not include baseline assessments of affect. In general, studies on healthy people have found that men and women do not report differences in emotion experience in response to evocative stimuli (Brody, Hall, & Stokes, 2016; Hyde, 2014). Other studies that administered the BMAC procedure did not examine sex differences (Johnson et al., 2013; Panagioti et al., 2012), so it is unclear whether the sex differences we found would be replicated. Future researchers can continue to investigate sex differences in studies of people with and without SZ to better understand their role, if any, on reports of both trait and state affective experiences.

Future directions and limitations

These results suggest other future research avenues and methodological suggestions. First, assessing PA and NA separately (as well as arousal) in laboratory tasks that assess emotion

experience in people with SZ is an important and straightforward method of assessing incongruent emotion experience. Further, exploring whether people with SZ experience heightened NA in the presence of social interactions would extend these findings to the social domain to discover whether incongruent emotion experience is present in social contexts that are putatively positive or neutral. Additionally, investigating the time course of incongruent emotion experience and whether people with SZ also report more NA in response to anticipating future events would help us understand the relationship between persistent NA and the motivational impairments found in the disorder.

The implementation of interventions that decrease NA in people with SZ over and above improving PA would be important to address the potential consequences of experiencing heightened NA. While techniques like the BMAC procedure may be effective in boosting PA in the short term, it remains unclear if this would translate to daily life. Moreover, other interventions that specifically target decreasing NA would be beneficial. It may be that longer-term interventions that teach a variety of skills related to downregulating NA may be necessary to reduce heightened NA in people with SZ. Caponigro and colleagues (2013) adapted an intervention that improved PA and reduced NA in people recently diagnosed as HIV positive (Moskowitz et al., 2011) for people with SZ. This intervention, Awareness and Coping with Emotion in Schizophrenia (ACES), was a six-week group intervention where people with SZ learned skills relating to improving PA and reducing NA, including: noticing daily positives, savoring, gratitude and altruism, mindfulness, positive reappraisal, identifying personal strengths, and setting attainable goals (Caponigro, Moran, Kring & Moskowitz, 2013). While this study was an open pilot trial with no control group, people with SZ found ACES feasible, helpful, and reported a reduction in NA. Alternatively, Johnson and colleagues (2011) found that a six-week loving kindness meditation intervention — a mindfulness practice where individuals focus on feeling compassion towards oneself and others — for people with SZ increased the frequency of experiencing PA and reduced anhedonia post-treatment and at 3-month follow-up. While these studies are feasibility studies of novel interventions with relatively small sample sizes, they suggest potential for intervention development that may decrease NA in people with SZ.

As with any study, it is important to acknowledge limitations. Our sample sizes were relatively small and this may have hampered our ability to detect group differences. We only used one measure of response inhibition (the Stroop), which may have limited our ability to find a relationship between this aspect of cognitive control and affective experience in people with SZ. Finally, we only assessed reported affective experience. While this was clearly justified given our interest in the phenomenon of incongruent emotion experience, it will be useful in future studies to continue to assess reported emotion experience alongside other methodologies, including behavioral, psychophysiological, and/or neuroimaging techniques (e.g., Kring et al., 2011; Ursu et al., 2011).

Conclusion

To our knowledge, this is the first study to examine the relationship between state NA, response inhibition, and incongruent emotion experience in people with SZ. While we did not decrease state NA, the BMAC procedure proved an effective technique to increase PA in people with SZ. We found that heightened state NA, not response inhibition nor trait NA, was related to incongruent emotion in people with SZ. Thus, incongruent emotion experience appears to reflect persistent state NA even during experiences that increase PA in people with SZ.

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Table 1

Demographic and clinical characteristics

Characteristic	SZ (n=29)	HC (n=26)	*p* value
Mean Age (SD)	51.90 (10.81)	48.08 (14.23)	0.27
Age Range	25-64	25-64	
% Men	59%	46%	0.36
% White (Non-Hispanic)	31%	27%	0.57
% Black	24%	19%	0.57
% Asian	21%	15%	0.57
% Hispanic/Latino	7%	23%	0.57
% Other/Multiple Ethnicities	17%	15%	0.57
% Married/Cohabitating	10%	23%	0.20
Mean Years of Education (SD)	14.67 (2.19)	15.35 (2.08)	0.24
WTAR Total	106.34 (10.94)	106.81 (9.52)	0.87
BPRS Total	41.55 (10.00)		
Mean Age of First Hospitalization (SD)	21.57 (6.76)		
Mean Number of Hospitalizations (SD)	7.32 (6.14)		
% 1st Generation Antipsychotics Only	17%		
% 2nd Generation Antipsychotics Only	59%		
% Multiple Antipsychotics	10%		
% No Antipsychotics	14%		

Notes. BPRS = Brief Psychiatric Rating Scale, HC = healthy controls, SD = standard deviation, SZ = people with SZ, WTAR = Wechsler Test of Adult Reading, an assessment of full scale IQ.

Table 2

Means and standard deviations of PA and NA before and after the BMAC procedure.

		SZ (n=29)	HC (n=26)
Before the BMAC procedure	PA	2.95 (1.28)[a]	2.54 (0.79)[b]
	NA	1.32 (0.49)[c]	1.05 (0.09)[d]
After the BMAC procedure	PA	3.10 (1.23)[a]	3.01 (1.03)[b]
	NA	1.35 (0.50)[c]	1.05 (0.12)[d]

Notes. BMAC procedure = Broad-Minded Affective Coping procedure, HC = healthy controls, NA = negative affect, PA = positive affect, SZ = people with SZ. Within each row, [a] and [b] are not significantly different from one another, $p > 0.52$. Within each row, [c] and [d] are significantly different from one another, $p < 0.006$.

[a] The two means are significantly different from one another, $p < 0.03$.
[b] The two means are significantly different from one another, $p < 0.03$.
[c] The two means are not significantly different from one another, $p > 0.44$.
[d] The two means are not significantly different from one another, $p > 0.05$.

Table 3

Means and standard deviations of PA and NA in response to film clips.

		SZ (n=29)	HC (n=26)
Positive film clips	PA	3.09 (1.14)[a]	2.86 (0.84)[b]
	NA	1.42 (0.66)[c]	1.07 (0.15)[d]
Neutral film clips	PA	2.82 (1.29)[a]	2.17 (0.76)[b]
	NA	1.31 (0.46)[c]	1.03 (0.07)[d]
All film clips	PA	2.96 (1.18)	2.51 (0.73)
	NA	1.37 (0.54)	1.05 (0.09)

Notes. HC = healthy controls, NA = negative affect, PA = positive affect, SZ = people with SZ. For the positive film clips, [a] and [b] are not significantly different from one another, $p > 0.38$. For the neutral film clips, [a] and [b] are significantly different from one another, $p < 0.04$. For both positive and neutral film clips, [c] and [d] are significantly different from one another, $p < 0.008$.

[a] The two means are significantly different from one another, $p < 0.001$.
[b] The two means are significantly different from one another, $p < 0.001$.
[c] The two means are not significantly different from one another, $p > 0.10$.
[d] The two means are not significantly different from one another, $p > 0.10$.

Order 1	Clinical Interviews	Watch positive film	Watch neutral film	BMAC Procedure	Watch positive film	Watch neutral film
Order 2	Clinical Interviews	BMAC Procedure	Watch positive film	Watch neutral film	Watch positive film	Watch neutral film

Figure 1. Orders 1 and 2 of viewing films, administration of the BMAC procedure. BMAC procedure = Broad-Minded Affective Coping procedure,

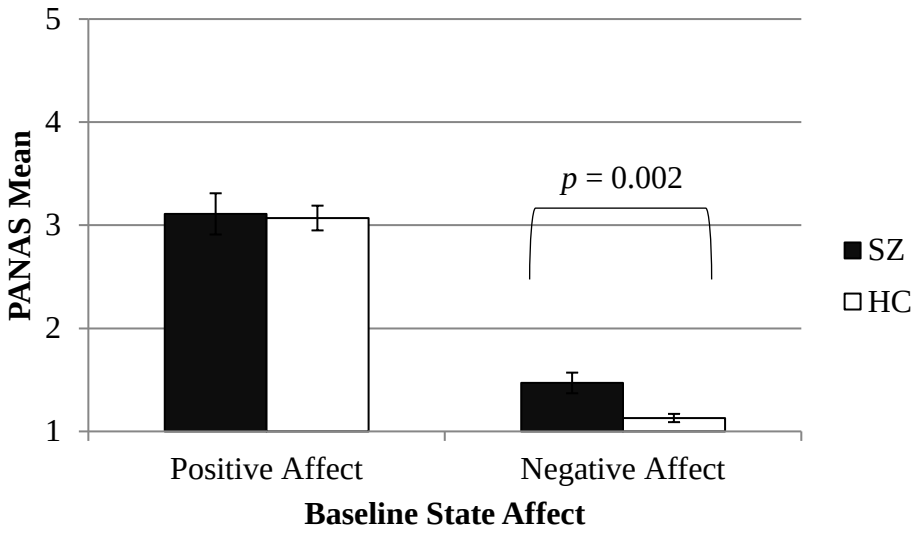

Figure 2. Baseline state positive and negative affect. Error bars represent standard error. HC = healthy controls, PANAS = Positive and Negative Affect Schedule, SZ = people with SZ.

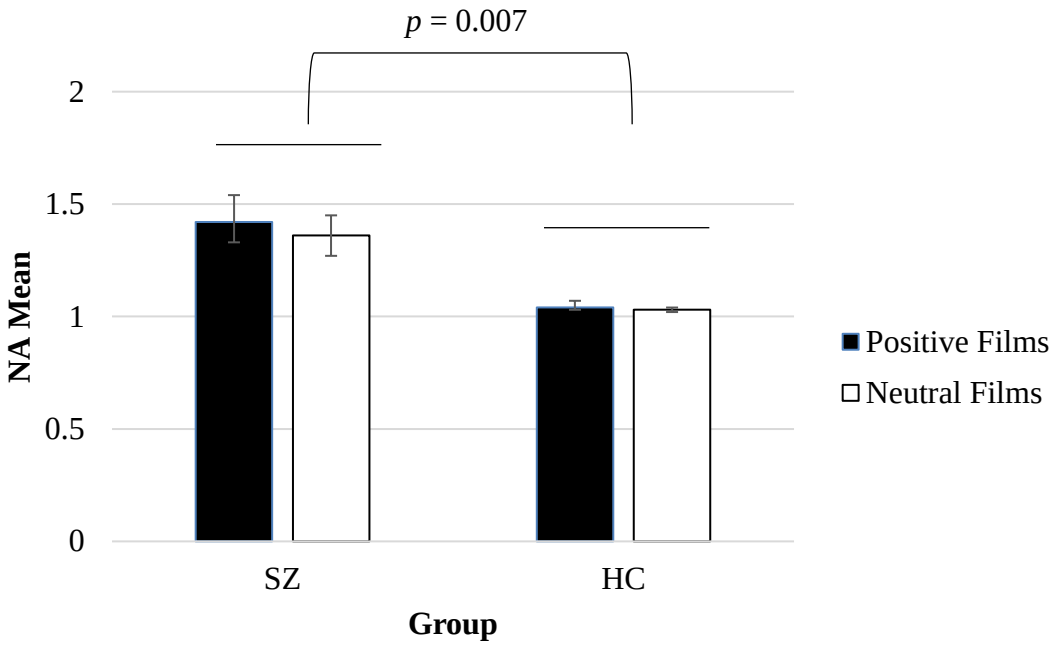

Figure 3. Incongruent emotion experience in response to positive and neutral films. Error bars represent standard error. HC = healthy controls, NA = negative affect, SZ = people with SZ.