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Daily life evidence of environment-incongruent emotion in schizophrenia

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ABSTRACT

Researchers have recently hypothesized that negative emotion in positive situations may be one mechanism for understanding emotion dysfunction in schizophrenia. Using ecological momentary assessment, we examined the relationship between emotion experience and environmental context in the daily lives of participants with and without schizophrenia. Participants with ($n=47$) and without schizophrenia ($n=41$) were provided a cellular telephone and called four times a day for one week. During each call participants rated their emotion experiences, described their current activities, and rated enjoyment from those activities. In line with previous research, participants with schizophrenia reported higher negative emotion overall relative to participants without schizophrenia, but equivalent levels of positive emotion and activity enjoyment. In line with the environment-incongruent negative emotion hypothesis, participants with schizophrenia evidenced a weaker relationship between reported enjoyment of current activities and current negative emotion compared to participants without schizophrenia. In addition, lower neurocognition predicted this weak relationship between negative emotion and context in the schizophrenia group. These findings provide ecologically valid support for environment-incongruent negative emotion in schizophrenia, and suggest that people with schizophrenia with more impaired neurocognition may have more difficulties regulating negative emotion.

1. Introduction

There is growing evidence that elevated negative emotion is an important feature of emotion dysfunction in schizophrenia. Self-report and ecological momentary assessment (EMA) studies have found that people with schizophrenia report more negative emotion compared to people without schizophrenia and that higher negative emotion is related to symptom onset, poor functioning, and lower quality of life (Myin-Germeys et al., 2000, 2003, 2005; see Horan et al., 2008). Recently, emotion regulation deficits have attracted attention as potential mechanisms behind elevated negative emotion in schizophrenia (Horan et al., 2013; Kimhy et al., 2012; Strauss et al., 2013). For example, compared to people without schizophrenia, people with schizophrenia have higher stress reactivity (for review see Myin-Germeys and Van Os, 2007). In one study, Myin-Germeys et al. (2001) found that participants with schizophrenia reported a greater increase in negative affect in response to daily life stress. Further, individuals with schizophrenia use cognitive emotion regulation strategies less frequently than those without the disorder (Kimhy et al., 2012; Van der Meer et al., 2009). This may be because cognitive regulation of emotions is less effective in schizophrenia. For example both Horan et al. (2013) and Strauss et al. (2013) found that while people without schizophrenia had attenuated neural responses to negative pictures appraised in a neutral context versus a negative context, participants with schizophrenia exhibited no such attenuation. These findings suggest that people with schizophrenia have more difficulty using cognitive strategies to down-regulate negative emotion in response to aversive stimuli.

1.1. Stimulus-incongruent negative emotion in schizophrenia

Elevated negative emotion in people with schizophrenia may not be limited to negative experiences, but may also "seep" in to positive experiences. While studies with the general population have shown that people typically report feeling positive emotion in positive circumstances and negative emotion in negative circumstances (Larsen et al., 2001), people with schizophrenia may experience *stimulus-incongruent* negative emotion, that is, negative emotions in putatively positive and neutral environments (Park et al., 2009; Cohen et al., 2010, 2011; Strauss and Herbener, 2011; Trémeau et al., 2009; Ursu et al., 2011; for review see Kring and Elis, 2013). For example, a meta-analysis of laboratory mood induction tasks by Cohen and Minor (2010) indicated that when positive and negative emotional responses were measured

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independently (i.e., not on a bipolar unpleasant to pleasant scale, but with a separate measure for pleasantness and unpleasantness), people with schizophrenia reported higher negative emotion during positive and neutral stimuli compared to people without schizophrenia, even while reporting equivalent positive emotion. The authors propose that these findings may reflect higher emotional 'ambivalence' with particular deficits in negative emotion regulation in schizophrenia. That is, people with schizophrenia may experience negative emotion even while *simultaneously* feeling positive emotions during pleasurable experiences. Additional laboratory studies support stimulus-incongruent emotion in schizophrenia (Park et al., 2009; Trémeau et al., 2009; Strauss and Herbener, 2011; Ursu et al., 2011). For instance, across several types of emotionally evocative stimuli (pictures, words, and sounds) Trémeau et al. (2009) found that while participants with and without schizophrenia reported similar stimulus-congruent emotion ratings, schizophrenia participants reported higher stimulus-incongruent emotion to both positive and negative stimuli. These lab findings are supported by self-report studies finding that psychosis may be associated with higher trait ambivalence (Kwapil et al., 2002; Kerns, 2006; Kerns and Becker, 2008).

Stimulus-incongruent emotion activation appears to be particularly salient in the case of negative emotion, with elevated stimulus-incongruent negative emotion related to negative symptoms and symptom severity (Park et al., 2009; Trémeau et al., 2009; Strauss and Herbener, 2011). These results are in line with neuroimaging studies that indicate elevated amygdala activation during neutral stimuli in schizophrenia (Anticevic et al., 2012) and reduced activation in frontal regions supporting emotional processing (Taylor et al., 2012). EMA studies support negative emotion dysregulation, finding that that people with schizophrenia report more negative emotion than people without schizophrenia (Myin-Germeys et al., 2000, 2003, 2005; Oorschot et al., 2013), and, intriguingly, a recent EMA study found that people with schizophrenia evidenced less differentiation of positive and negative emotions in daily life (Kimhy et al., 2014). Although individuals typically reciprocally activate positive and negative emotion (Larsen et al., 2001) people with schizophrenia may have more independent or even coactivation of positive and negative emotion. Further, while people with schizophrenia experience elevated negative emotion, they typically rate their daily activities as enjoyable as those without (see Myin-Germeys et al., 2000, 2011; Gard et al., 2007; Oorschot et al., 2013). Thus they may experience elevated negative emotion even while reporting equivalently pleasurable circumstances, although this has not been tested directly. Rather, EMA studies thus far have emphasized either positive and negative emotion or pleasure appraisals of activities. Research thus far on the disconnect between emotional experience and emotion-eliciting stimuli in schizophrenia has been conducted primarily in the laboratory. It remains unclear if stimulus-incongruent negative emotion found in laboratory tasks extends to *environment*-incongruent emotion in daily life, and whether such environment-incongruent emotion experience is related to other areas of impairment, such as positive or negative symptoms or neurocognition.

Importantly, examining emotion dysregulation in daily life provides insight to emotion regulation strategies that laboratory studies have a limited capacity to measure. For example, in the majority of laboratory emotion regulation studies the stimuli presented is largely beyond the participants' control. These tasks measure the participant's *capacity* to manage emotional reactions elicited by the stimuli. However, in daily life people have more freedom to choose and modify environments to which they are exposed. That is, to use the terminology of the process model of emotion regulation (Gross and Thompson, 2007), in daily life people can use situation selection and situation modification to regulate their emotions. Situation selection and situation modification occur early in the emotion generation process and thus may be particularly effective for avoiding undesirable emotional responses. For instance, people with schizophrenia may seek out environments that are more familiar and emotionally predictable. It is possible that while people with schizophrenia may have a more stimulus-incongruent negative emotion in the lab, they may be able to select situations that will elicit a "pure" positive emotional response in daily life. EMA is uniquely suited to study whether or not environment-incongruent emotion is still evidenced in schizophrenia whensituation selection and situation modification emotion regulation strategies are available. More thoroughly understanding the relationship between emotion and enjoyment of activities would be promising, as it would provide implications for psychosocial treatments for both emotion regulation and negative symptoms such as anhedonia.

1.2. Current study

The current study used EMA, a methodology developed to measure experiences in-the-moment (e.g., Csikszentmihalyi and Larson, 1987), to investigate environment-incongruent negative emotion in the daily lives of people with and without schizophrenia,. Research assistants called participants four times a day for a week, and asked them about their current emotional state (including several positive and negative emotions), their current activities, and how much they were enjoying these activities. We also examined the *relationship* of emotion ratings to activity enjoyment ratings. A weak relationship between emotion ratings and activity enjoyment ratings would indicate that emotion experience is disconnected from fluctuations in pleasure appraisals of the environment. For example, for most people positive emotion goes up and negative emotion goes down as they engage in pleasurable activities. However, if negative emotion stays elevated even as one engages in pleasurable activities, this would constitute environment-incongruent negative emotion. This can be compared to measuring incongruent emotion in lab tasks, where emotion experience is not as sensitive to the hedonic quality of the stimulus. However in contrast to most lab tasks, we examined how reports of in-the-moment emotional experience were related to pleasure appraisals of the environment rather than only emotion appraisals of stimuli. We predicted that, in line with past EMA studies, people with schizophrenia would endorse higher negative emotion compared to participants without schizophrenia in their daily life. In addition, consistent with lab findings, we predicted that negative emotion would be more weakly related to participants' ratings of current activity enjoyment in people with schizophrenia than in those individuals without schizophrenia. One possible explanation for such a finding is that people with schizophrenia may be unable to appropriately regulate their negative emotions to conform to their current circumstances (or, put differently, that the current pleasurable experience was not regulating the higher negative emotion). We also investigated whether there is positive emotion congruity (i.e. a connection between the environment and positive emotions) or whether emotion dysregulation is specifically limited to negative emotion. If the problem is limited to negative emotion only we expect to find a weaker relationship between negative emotion and activity enjoyment. However, if the problem is a general emotional disconnect from pleasure in the environment, we expect both positive and negative emotions to have a weaker relationship to pleasure appraisals of the environment. We also examined the relation between positive and negative emotions to determine if positive and negative emotional experiences were more independent in schizophrenia or if participants with schizophrenia