Schizophrenia Research: Cognition 19 (2020) 100139

Contents lists available at ScienceDirect

Schizophrenia Research: Cognition

journal homepage: www.elsevier.com/locate/scog

Emotion-specific performance across empathy tasks in schizophrenia: Influence of metacognitive capacity

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ARTICLE INFO

Keywords:
Social cognition
Psychosis
Emotion recognition
Self-reflectivity

ABSTRACT

People with schizophrenia exhibit deficits in emotion recognition that are associated with community and social functioning. Emotion-specific performance within emotion recognition tasks has been investigated, suggesting differential patterns of recognition for positive and negative emotions. However, no study has yet examined emotion-specific performance for a higher-order social cognitive construct such as empathy. This study aimed to: 1) examine emotion-specific performance on an empathy task, and 2) elucidate associations with four metacognitive domains: self-reflectivity, understanding of others' minds, decentration, and mastery. Fifty-seven people with schizophrenia or schizoaffective disorder participated. All were administered a computerized, performance-based measure of empathy and an interview-based measure of metacognitive capacity. Results revealed that, consistent with research on facial affect recognition, participants performed significantly better when recognizing happiness in empathic stimuli than all other emotions. Results also revealed positive associations between empathic performance and metacognitive self-reflectivity, across types of emotions. Other metacognitive domains were also associated with performance, but in a less consistent manner. Together, results indicate that not all emotions are created equal – happiness is easier to recognize for those with schizophrenia, suggesting that social cognitive interventions may be more helpful if focused on recognizing negative emotions. Results also emphasize the importance of metacognitive capacity for basic and higher-order social cognitive skills.

1. Introduction

It is well-established in the literature that people with schizophrenia have deficits in emotion recognition (Kohler et al., 2010), particularly in recognizing facial affect, and that these deficits are related to difficulties in social and community functioning (Fett et al., 2011; Irani et al., 2012). Additional research indicates that these deficits extend to affective prosody recognition (i.e., recognizing emotion from voice intonation; Hoekert et al., 2007). Research on facial affect recognition, specifically, has accumulated to such a level that we are now able to comment on emotion-specific performance within and across tasks, such that people with schizophrenia most easily recognize positive emotions, like happiness and surprise, and experience greater difficulty in recognizing negative emotions, like fear (see reviews by Edwards et al., 2002; Pomarol-Clotet et al., 2010). The prosody literature has begun to investigate this area as well, revealing less consistent patterns of emotion-specific performance (Amminger et al., 2012; Bell et al., 1997; Bonfils et al., Under review; Edwards et al., 2001; Herniman et al., 2017). Thus far, research has been limited to examining basic recognition of emotions (through facial affect or prosody), a relatively lower-level social cognitive skill. To our knowledge, no study has yet examined ability to detect specific emotions in more complex social cognitive tasks in people with schizophrenia.

One area of particular interest in recent years is empathy, or the ability to comprehend and share the emotions of others (Decety and Jackson, 2004). People with schizophrenia perceive themselves to have less of both cognitive and affective aspects of empathy than healthy people (Bonfils et al., 2017), which is borne out in numerous performance-based studies (see meta-analyses Bonfils et al., 2016; Savla et al., 2013). Empathy is important in establishing large and supportive social networks (Salovey and Mayer, 1990). In healthy people, those with higher empathy are more aware of emotional and socially relevant

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https://doi.org/10.1016/j.scog.2019.100139
Received 4 December 2018; Received in revised form 6 February 2019; Accepted 17 March 2019
Available online 17 April 2019

information in social interactions (Hofelich and Preston, 2012; van den Brink et al., 2012), and people who more often share the emotions of others have better forgiveness and relationship maintenance behaviors (McCullough et al., 1998, 1997). Indeed, empathy plays a role in our relationships extremely early on – research suggests we can detect high or low levels of empathy in a person within just a few seconds of interpersonal exposure (Wu et al., 2016).

While deficits in empathy have been established in people with schizophrenia, no study to date has examined differential performance across emotion conditions in empathy tasks. Empathy as a construct presents a unique opportunity for deeper understanding of emotion-specific performance, as the construct is complex and multifaceted, thus presenting multiple levels at which performance can be analyzed. Though there is some debate in the field regarding empathic components, one conceptualization that has gained traction describes three core components: emotion recognition (i.e., the ability to recognize the emotion expressed by another), emotional perspective-taking (i.e., the ability to take another's perspective), and affective responsiveness (i.e., the ability to share the emotional states of others while recognizing the distinction between self and other; Derntl et al., 2009). Within this conceptual framework, we can analyze emotion-specific performance for both cognitive (emotional perspective-taking) and affective (affective responsiveness) components of empathy – considered to be higher-order processes – while also examining the more basic skill of recognizing facial emotions.

Examination of emotion-specific performance on empathy tasks represents a significant expansion to our knowledge of social cognitive deficits in schizophrenia; however, further research is needed to understand factors that may influence performance on specific emotions. Some work has theorized that deficits in recognition of negative emotions in facial emotion recognition studies of schizophrenia may be linked to dysfunction in the amygdala (Amminger et al., 2012), which has a particular role in recognition of fear and sadness (Adolphs et al., 1995; Adolphs and Tranel, 2004). Other work has focused on abnormal visual scan paths in people with delusional symptoms, which are hypothesized to impair recognition of threat-related expressions (Green et al., 2003). In the psychological realm, others have posited that deficits in emotion recognition may serve as a defense mechanism, protecting the person with schizophrenia from excessive negative expressions they may encounter related to stigma (Hasson-Ohayon et al., 2017).

This study aims to continue this research in emotion recognition and extend to higher order empathy tasks, by examining associations with metacognition, or, broadly, “thinking about thinking” (Moritz and Lysaker, 2018). Taking a more nuanced view of metacognition, four domains can be described: self-reflectivity (i.e., understanding one's own thoughts and feelings); understanding of others' minds (i.e., understanding others' thoughts and feelings); decentration (i.e., interpreting the world and actions of others as independent from the self); and mastery (i.e., use of skills from other domains to solve psychological and social problems; Lysaker et al., 2014; Lysaker et al., 2005). To our knowledge, three studies have examined associations between metacognition and empathy. The first found a positive association between total metacognitive capacity and self-reported empathic tendencies in a Chinese sample (WeiMing et al., 2015). The second found that metacognitive self-reflectivity was positively, moderately correlated with observer-rated empathic capacity in a Veteran sample (Bonfils et al., 2018). The third and most recent study found positive, moderate correlations between metacognition and both emotional perspective-taking and affective responsiveness on performance-based empathy tasks in a community-based sample (Bonfils et al., 2019). Together, these results suggest that better metacognition is associated with better empathy across methods of measurement. However, no study has yet examined the influence of metacognitive abilities on emotion-specific empathic performance. It stands to reason that if emotion-specific performance varies within an empathy task, metacognitive domains may have unique relationships with individual emotions, and that the influence of metacognition on recognition of specific emotions should be considered in treatment.

Thus, the purpose of this study was to examine emotion-specific performance and associations with metacognition for a performance-based empathy assessment with three tasks: emotion recognition, emotional perspective-taking, and affective responsiveness. We hypothesized that 1) emotion-specific performance would vary significantly within each task, showing better performance for some emotions and poorer performance for others. While we expected better performance for happiness on the facial affect recognition task, based on inconsistent patterns of emotion performance in other modalities (i.e., prosody), we did not make hypotheses regarding which emotions would show better or worse performance for emotional perspective-taking or affective responsiveness. We further hypothesized that 2) metacognitive abilities (across domains) would be positively associated with better emotion-specific performance on all three empathy tasks. We expected that understanding of others' minds, a component of metacognition, would be most consistently associated with empathy (i.e., positive, moderate correlations with all emotion-specific scores) due to the nature of this construct, which, by definition, aligns with the task demands (ability to recognize and interpret emotions in others). Regarding other metacognitive domains (self-reflectivity, decentration, and mastery), we did not make specific hypotheses; however, where present, we expected associations to be positive, such that better metacognitive capacities would be associated with better emotion-specific performance.

2. Method

2.1. Participants

Fifty-seven people with schizophrenia ($N = 35$) or schizoaffective disorder ($N = 22$), confirmed with a brief version of the Structured Clinical Interview for the DSM–5 ([SCID-5]; First et al., 2015), were recruited from participating community mental health centers to complete measures for this study. Participants were required to be 18 years of age, fluent in English, and able to provide informed consent.

3. Measures

Empathy was assessed using the computerized, performance-based Derntl paradigm (Derntl et al., 2009) adapted for the English language (Smith et al., 2014). The Derntl paradigm assesses emotion recognition, emotional-perspective taking, and affective responsiveness based on three forced-choice, timed tasks. Facial images come from a standardized stimulus set portraying fear, anger, sadness, disgust, happiness, or neutral expressions (Gur et al., 2002). The emotion recognition task contains 30 items and asks participants to choose which of two emotions is portrayed. The emotional perspective-taking task contains 58 items, each presenting a scene with two actors engaged in social interaction, with one actor's face masked to hide the emotional expression. Participants must choose which of two emotional faces is appropriate for the masked actor in the scene. The affective responsiveness task contains 150 items asking participants to choose one of two emotional faces that portrays the emotion they would feel in an emotionally provocative (or neutral) situation, presented as brief sentences. “Correct” answers for this task were determined based on normative response (Smith et al., 2014). Across tasks, internal reliability estimates in this sample were adequate ($\alpha = 0.71–0.88$).

Metacognition was assessed using the Metacognition Assessment Scale-Abbreviated (MAS-A; Lysaker et al., 2005). The Indiana Psychiatric Illness Interview (IPII; Lysaker et al., 2002), a semi-structured personal history interview with focus on narratives of illness and related challenges, was used to produce transcripts for MAS-A ratings. The MAS-A generates ratings on four domains: self-reflectivity,

Table 1
Performance on empathy tasks and specific emotions.

Task/Emotion	Mean	Standard deviation	ANOVA Statistic
Emotion recognition			$F[4.00, 224.22] = 14.68$, $p < .001$
Happiness	95.4	10.7	
Neutral	83.5	19.7	
Anger	75.8	19.9	
Disgust	70.9	20.7	
Sadness	73.0	19.1	
Fear	78.9	22.8	
Emotional perspective-taking			$F[4.29, 240.25] = 17.14$, $p < .001$
Happiness	84.6	18.9	
Neutral	69.6	19.7	
Anger	59.1	17.8	
Disgust	65.1	18.0	
Sadness	68.2	22.0	
Fear	73.9	17.9	
Affective responsiveness			$F[3.68, 206.14] = 24.29$, $p < .001$
Happiness	85.6	13.3	
Neutral	77.7	16.9	
Anger	63.4	16.6	
Disgust	72.6	13.4	
Sadness	66.3	14.1	
Fear	74.9	13.9	

Note. Means and standard deviations are presented here as percent correct for each emotion on each Derntl task to enable comparisons across tasks. ANOVA statistics are provided for the overall F test of each within-subjects ANOVA. Detailed results of pairwise post-hoc comparisons are available upon request from the authors.

understanding of others' minds, decentration, and mastery (Lysaker et al., 2010). MAS-A ratings begin at a very basic level (e.g., recognition that one has thoughts or emotions at all) and advance sequentially to a more integrative level where thoughts and feelings are brought together to represent a more nuanced and complex understanding of oneself and others. MAS-A raters underwent training with the developer of the MAS-A prior to providing ratings for these transcripts, and raters received continued supervision and attended regular consensus meetings. Inter-rater reliability was good in this data (ICCs = 0.70–0.90).

4. Procedure

All procedures were approved by the university institutional review board. Participants were recruited from two community mental health centers in Midwest communities via informational fliers and clinician referral. After providing informed consent, participants were administered a battery of assessments as part of a cross-sectional study (Bonfils et al., 2019). All interviews were conducted by the first author or a trained research assistant.

5. Analyses

To test Hypothesis 1, that participants' performance on the Derntl empathy tasks would vary across emotion conditions within each task, within-subjects analyses of variance (ANOVAs) were conducted comparing performance across six conditions (happiness, fear, anger, sadness, disgust, and neutral), using Bonferroni corrections to adjust for multiple pairwise post-hoc comparisons. To test Hypothesis 2, that metacognitive domains (self-reflectivity, understanding of others' minds, decentration, and mastery) would be associated with performance on specific emotions, we first calculated specific emotion scores by computing an average of scores across tasks (e.g., scores for happiness on the three tasks were averaged to create one total happiness score). This was done to limit the number of analyses and enable more meaningful conclusions. Pearson's correlations were then conducted to examine associations between specific emotion scores with the four metacognitive domains. All analyses were conducted in SPSS Version 25.

6. Results

Participants were mostly female ($N = 34$, 60%) and Black ($N = 40$, 70%). Most were not employed at the time of the study ($N = 42$, 74%) and were single or divorced ($N = 54$, 95%). The average age of participants was 46.0 (SD = 9.5) years.

Participants' performance for specific emotions across tasks are summarized in Table 1. Results of within-subjects ANOVAs revealed that participants' performance significantly differed across emotions for each task. Pairwise post-hoc comparisons indicated that for all three tasks, recognition of happiness was significantly better than recognition of all other emotions. Additionally, for emotion recognition, recognition of neutral faces was significantly better than sad or disgusted faces, but recognition of negative emotions did not differ from one another. For emotional perspective-taking, recognition of anger was significantly worse than recognition of fear, sadness, and neutral. Recognition of disgust did not significantly differ from any negative emotion or neutral faces, and recognition of fear, sadness, and neutral faces did not differ from each other. For affective responsiveness, scores for situations meant to provoke anger and sadness were significantly lower than scores for all other emotions, but did not differ from each other. Responses for neutral situations and situations meant to provoke fear or disgust did not differ from one another.

Regarding associations between the four MAS-A metacognitive domains and emotion-specific performance (see Table 2), only self-reflectivity was positively correlated with recognition of each of the six emotions. Understanding of others' minds was positively correlated with recognition of disgust, sadness, and fear (but not happiness, neutral, or anger). Decentration was positively correlated with recognition of happiness, disgust, and neutral faces, and mastery was positively correlated only with recognition of disgust.

7. Discussion

This study is the first to examine emotion-specific performance for empathy and how performance on specific emotions is associated with metacognitive capacity. As hypothesized, performance significantly differed across emotions for three empathy tasks: emotion recognition,

Table 2
Correlations between emotion-specific performance and metacognitive domains.

	Mean (SD)	Happiness	Neutral	Anger	Disgust	Sadness	Fear
Self-reflectivity	5.07 (1.48)	0.31*	0.45**	0.26*	0.45**	0.33*	0.28*
Understanding of others' minds	2.96 (0.80)	0.15	0.23	0.08	0.29*	0.33*	0.28*
Decentration	0.53 (0.43)	0.29*	0.32*	0.06	0.33*	0.22	0.2
Mastery	4.30 (1.69)	0.17	0.21	0.24	0.33*	0.24	0.19

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). Analyses reported above used composite emotion variables; that is, performance on each emotion was collapsed across tasks. Higher scores on the Derntl paradigm empathy tasks and the MAS-A domains represent better empathic performance and better metacognition, respectively.

emotional perspective-taking, and affective responsiveness. Consistent with past literature, our participants performed best when identifying happiness on the emotion recognition task. Our findings extend this prior work by including two other empathy tasks of emotional perspective-taking and affective responsiveness, both of which also indicated participants performed best on happiness. Further, on these latter two tasks, performance for anger was significantly worse than most other emotions, suggesting that anger may present particular difficulty in the context of higher-order empathic processes for people with schizophrenia. Regarding metacognition, contrary to our hypothesis that the metacognitive domain of understanding of others' minds would be most consistently related to emotion-specific performance, our results showed that self-reflectivity (ability to understand one's own thoughts and emotions) was most consistently associated. Understanding of others' minds, on the other hand, was not associated with emotion-specific performance for happy, neutral, or angry expressions.

While literature has accumulated examining emotion-specific performance on faces (Edwards et al., 2002; Pomarol-Clotet et al., 2010), this is the first study to examine emotion-specific performance for higher-order social cognitive processes involved in empathy. Results of facial emotion recognition tasks have in the past largely suggested that people with schizophrenia are better at recognizing positive emotions than negative – that finding was borne out here, as our participants consistently performed best for happiness, across both basic (emotion recognition) and higher-order (emotional perspective-taking and affective responsiveness) empathy tasks. Our finding coupled with the body of literature suggests that there may be something unique about the happy face lending itself to easier detection. This finding extends to other populations, including those with dementia (Kumfor et al., 2013) and autism (Ashwin et al., 2006), and has been extensively studied in the healthy population. For example, happiness (as opposed to other emotions) can be detected on faces even from great distances (Hager and Ekman, 1979) and is more quickly detected on faces as they change from neutral to emotional than are negative emotions (Becker et al., 2012). Preference for happy faces also emerges as early as infancy (Kuchuk et al., 1986). Evolutionarily, theorists have posited that expressions of happiness grew out of a need to communicate and create social networks; as such, either through internal perceptual mechanisms or external markers unique to happiness (e.g., bared teeth), there is ample evidence to suggest that happiness is “vivid” in ways that other emotions are not (Becker and Srinivasan, 2014). Our findings imply that patients with schizophrenia-spectrum disorders may, in fact, have relatively intact abilities to recognize happiness, especially compared to negative emotions. Further, findings suggest that happiness continues to be more easily recognized even in higher-order empathy tasks (i.e., emotional perspective-taking and affective responsiveness). Though future work is needed on empathy with healthy comparison samples, our findings situated within the larger literature suggest that happiness may need less attention in social cognitive interventions. Indeed, interventions may be able to leverage relatively more intact skill in recognizing happiness while providing instruction on other emotions.

Importantly, our findings suggest that patterns of emotion-specific performance for empathy align with findings in the literature for facial emotion recognition (at least in valence), but not affective prosody recognition. This may be due, in part, to method variance, as facial affect recognition is measured using visual prompts only, similar to the tasks used in this study. Furthermore, evidence indicates visual perception of faces is processed differently than non-face objects, suggesting an innate predisposal to face recognition (Farah et al., 1998). Too few studies have examined emotion-specific performance in affective prosody recognition to establish a clear pattern of performance, and published studies report variable results. However, this emerging literature does suggest that happiness may not be as easily detectable in prosody as it is in facial emotional expressions (Amminger et al., 2012; Bonfils et al., Under review). Future studies should examine effects of sensory modality (i.e., visual vs. auditory or a combination) to determine if findings regarding detectability of happiness hold in tasks that go beyond simple visual stimuli.

Regarding metacognitive capacity, self-reflectivity (the ability to reflect on one's own thoughts and feelings) was positively associated with performance on each specific emotion. Against hypotheses, understanding others' minds (i.e., thoughts and feelings of others) was not associated with performance for some specific emotions (happiness, anger, or neutral expressions). This is somewhat surprising, as the construct of ‘empathy’ is inherently other-oriented, so we expected consistent associations (across emotions) with understanding of others' minds, the metacognitive domain most oriented toward others. One potential explanation for this finding may lie in the scores obtained by participants in this study for understanding of others' minds. Both the self-reflectivity and understanding of others' minds subscales of the MAS-A are structured such that the ability to discern cognitive operations is scored prior to discernment of emotional states. The mean score on understanding of others' minds (2.96, Table 2) in this study suggests that participants were generally able to recognize and distinguish the cognitive operations of others, but that many participants were not consistently recognizing and distinguishing emotional states in others nor integrating cognitive and emotional states into a holistic understanding of the other. Our understanding of this scoring on the MAS-A differs from emotion recognition or empathy performance in that participants are rated based on evidence of their tendency to engage in a certain type of thinking about their lives and relationships (as demonstrated in the IPII), as opposed to performance on a lab-based task. This difference in measurement may serve to attenuate the correlation between the two constructs. It may also be that in a sample with greater range or where more participants achieve higher scores, indicating greater understanding of others' emotions, we would see more consistent associations with emotion recognition.

Instead, in this sample, our results suggest that the ability to understand one's *own* thoughts and emotional experiences may be more important in determining empathy performance. This aligns with other work showing that, in the context of reduced ability to tolerate distress, those with relatively higher self-reflectivity are still able to have higher capacity for empathy (Bonfils et al., 2018). While our study is not causal, the clear importance of metacognitive self-reflectivity in our data, coupled with associations across the spectrum of metacognitive capacities, suggests that metacognitively-oriented interventions (such as Metacognitive Reflection and Insight Therapy; Lysaker and Klion, 2017) may be of particular importance in fostering both lower- and higher-order aspects of empathy.

This study has limited generalizability given the smaller sample of majority Black women engaged in community-based treatment. Further, without a healthy comparison sample, results cannot be interpreted as evidence of deficits, but rather only as levels of performance within the schizophrenia sample presented here; thus, future work is needed to replicate results and compare emotion-specific performance with healthy control participants. This work is also limited in that it can only inform empathic domains assessed in this study. Empathy is a broad and multifaceted construct, and measurement of some important components has yet to be perfected – for example, we have yet to adequately measure an emotion regulatory mechanism facilitating both understanding of emotional origin (self vs. other) and appropriate empathic responses (Elliott et al., 2011). Future work could continue to enhance our understanding of the empathy construct, its measurement, and how it interacts with metacognition. Future work is also needed to understand when and how empathic deficits occur, as well as how results might differ in early psychosis or clinical high-risk samples.

Taken together, our results indicate that performance on specific emotions varies within empathy tasks and that metacognitive capacity is associated with emotion-specific performance for people with schizophrenia. Metacognitive self-reflectivity may play a particularly important role in social cognitive processes. Future work is needed to investigate emotion-specific performance in higher-order social cognitive processes using tasks with varying sensory modalities. Clinically, results suggest that social cognitive interventions may be optimized by targeting the relative deficits in recognition and interpretation of negative emotional states, and that metacognitive interventions (especially targeting self-reflectivity) could serve to bolster empathic performance.

Conflict of interest statement

The authors declare no conflicts of interest.

Acknowledgement

The authors would like to express our thanks to all the individuals who participated and make our work possible. This work was funded by a Clinical Psychology Dissertation Funding Award of the Psychology Department at Indiana University-Purdue University, Indianapolis, awarded to K. Bonfils. Additional partial support for K. Bonfils was provided by the VISN 4 Mental Illness Research, Education, & Clinical Center (MIRECC; Director: D. Oslin; Associate Director: G. Haas), VA Pittsburgh Healthcare System. The contents of this manuscript do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

References

Adolphs, R., Tranel, D., 2004. Impaired judgments of sadness but not happiness following bilateral amygdala damage. J. Cogn. Neurosci. 16, 453–462. https://doi.org/10.1162/089892904322926782.

Adolphs, R., Tranel, D., Damasio, H., Damasio, A.R., 1995. Fear and the human amygdala. J. Neurosci. 15, 5879–5891. https://doi.org/10.1523/JNEUROSCI.15-09-05879.1995.

Amminger, G.P., Schäfer, M.R., Papageorgiou, K., Klier, C.M., Schlögelhofer, M., Mossaheb, N., Werneck-Rohrer, S., Nelson, B., McGorry, P.D., 2012. Emotion recognition in individuals at clinical high-risk for schizophrenia. Schizophr. Bull. 38, 1030–1039. https://doi.org/10.1093/schbul/sbr015.

Ashwin, C., Chapman, E., Colle, L., Baron-Cohen, S., 2006. Impaired recognition of negative basic emotions in autism: a test of the amygdala theory. Soc. Neurosci. 1, 349–363. https://doi.org/10.1016/0040-6031(88)87422-7.

Becker, D.V., Srinivasan, N., 2014. The vividness of the happy face. Curr. Dir. Psychol. Sci. 23, 189–194. https://doi.org/10.1177/0963721414533702.

Becker, D.V., Neel, R., Srinivasan, N., Neufeld, S., Kumar, D., Fouse, S., 2012. The vividness of happiness in dynamic facial displays of emotion. PLoS One 7, e26551. https://doi.org/10.1371/journal.pone.0026551.

Bell, M., Bryson, G., Lysaker, P., 1997. Positive and negative affect recognition in schizophrenia: a comparison with substance abuse and normal control subjects. Psychiatry Res. 73, 73–82. https://doi.org/10.1016/s0165-1781(97)00111-x.

Bonfils, K.A., Lysaker, P.H., Minor, K.S., Salyers, M.P., 2016. Affective empathy in schizophrenia: a meta-analysis. Schizophr. Res. 175, 109–117. https://doi.org/10.1016/j.schres.2016.03.037.

Bonfils, K.A., Lysaker, P.H., Minor, K.S., Salyers, M.P., 2017. Empathy in schizophrenia: a meta-analysis of the interpersonal reactivity index. Psychiatry Res. 249, 293–303. https://doi.org/10.1016/j.psychres.2016.12.033.

Bonfils, K.A., Minor, K.S., Leonhardt, B.L., Lysaker, P.H., 2018. Metacognitive self-reflectivity moderates the relationship between distress tolerance and empathy in schizophrenia. Psychiatry Res. 265, 1–6. https://doi.org/10.1016/j.psychres.2018.04.042.

Bonfils, K.A., Lysaker, P.H., Minor, K.S., Salyers, M.P., 2019. Metacognition, personal distress, and performance-based empathy in schizophrenia. Schizophr. Bull. 45, 19–26. https://doi.org/10.1093/schbul/sby137.

Bonfils, K.A., Ventura, J., Subotnik, K.L., Nuechterlein, K.H. Under Review. Affective Prosody and Facial Emotion Recognition in First-episode Schizophrenia: Associations With Functioning and Symptoms.

Decety, J., Jackson, P.L., 2004. The functional architecture of human empathy. Behav. Cogn. Neurosci. Rev. 3, 71–100. https://doi.org/10.1177/1534582304267187.

van den Brink, D., Van berkum, J.J.A., Bastiaansen, M.C.M., Tesink, C.M.J.Y., Kos, M., Buitelaar, J.K., Hagoort, P., 2012. Empathy matters: ERP evidence for inter-individual differences in social language processing. Soc. Cogn. Affect. Neurosci. 7, 173–183. https://doi.org/10.1093/scan/nsq094.

Derntl, B., Finkelmeyer, A., Toygar, T.K., Hülsmann, A., Schneider, F., Falkenberg, D.I., Habel, U., 2009. Generalized deficit in all core components of empathy in schizophrenia. Schizophr. Res. 108, 197–206. https://doi.org/10.1016/j.schres.2008.11.009.

Edwards, J., Pattison, P.E., Jackson, H.J., Wales, R.J., 2001. Facial affect and affective prosody recognition in first-episode schizophrenia. Schizophr. Res. 48, 235–253. https://doi.org/10.1016/S0920-9964(00)00099-2.

Edwards, J., Jackson, H.J., Pattison, P.E., 2002. Emotion recognition via facial expression and affective prosody in schizophrenia. A methodological review. Clin. Psychol. Rev. 22, 789–832. https://doi.org/10.1016/s0272-7358(02)00130-7.

Elliott, R., Bohart, A.C., Watson, J.C., Greenberg, L.S., 2011. Empathy. Psychotherapy 48, 43–49. https://doi.org/10.1037/a0022187.

Farah, M., Wilson, K., Drain, M., Tanaka, J., 1998. What is "special" about face perception? Psychol. Rev. 105, 482–498. https://doi.org/10.1037/0033-295x.105.3.482.

Fett, A.K.J., Viechtbauer, W., Dominguez, M. de G., Penn, D.L., van Os, J., Krabbendam, L., 2011. The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: a meta-analysis. Neurosci. Biobehav. Rev. 35, 573–588. https://doi.org/10.1016/j.neubiorev.2010.07.001.

First, M.B., Williams, J.B.W., Karg, R.S., Spitzer, R.L., 2015. Structured Clinical Interview for DSM-5, Research Version (SCID-5 for DSM-5, Research Version; SCID-5-RV). Arlington, VA.

Green, M.J., Williams, L.M., Davidson, D., 2003. Visual scanpaths to threat-related faces in deluded schizophrenia. Psychiatry Res. 119, 271–285. https://doi.org/10.1016/S0165-1781(03)00129-X.

Gur, R.C., Sara, R., Hagendoorn, M., Marom, O., Hughett, P., Macy, L., Turner, T., Bajcsy, R., Posner, A., Gur, R.E., 2002. A method for obtaining 3-dimensional facial expressions and its standardization for use in neurocognitive studies. J. Neurosci. Methods 115, 137–143. https://doi.org/10.1016/S0165-0270(02)00006-7.

Hager, J.C., Ekman, P., 1979. Long-distance of transmission of facial affect signals. Ethol. Sociobiol. 1, 77–82. https://doi.org/10.1016/0162-3095(79)90007-4.

Hasson-Ohayon, I., Mashiach-Eizenberg, M., Arnon-Ribenfeld, N., Kravetz, S., Roe, D., 2017. Neuro-cognition and social cognition elements of social functioning and social quality of life. Psychiatry Res. 258, 538–543. https://doi.org/10.1016/j.psychres.2017.09.004.

Herniman, S.E., Allott, K.A., Killackey, E., Hester, R., Cotton, S.M., 2017. The effect of comorbid depression on facial and prosody emotion recognition in first-episode schizophrenia spectrum. J. Affect. Disord. 208, 223–229. https://doi.org/10.1016/j.jad.2016.08.068.

Hoekert, M., Kahn, R.S., Pijnenborg, M., Aleman, A., 2007. Impaired recognition and expression of emotional prosody in schizophrenia: review and meta-analysis. Schizophr. Res. 96, 135–145. https://doi.org/10.1016/j.schres.2007.07.023.

Hofelich, A.J., Preston, S.D., 2012. The meaning in empathy: distinguishing conceptual encoding from facial mimicry, trait empathy, and attention to emotion. Cogn. Emot. 26, 119–128. https://doi.org/10.1080/02699931.2011.559192.

Irani, F., Seligman, S., Kamath, V., Kohler, C., Gur, R.C., 2012. A meta-analysis of emotion perception and functional outcomes in schizophrenia. Schizophr. Res. 137, 203–211. https://doi.org/10.1016/j.schres.2012.01.023.

Kohler, C.G., Walker, J.B., Martin, E.A., Healey, K.M., Moberg, P.J., 2010. Facial emotion perception in schizophrenia: a meta-analytic review. Schizophr. Bull. 36, 1009–1019. https://doi.org/10.1093/schbul/sbn192.

Kuchuk, A., Vibbert, M., Bornstein, M.H., 1986. The perception of smiling and its experiential correlates in three-month-old infants. Child Dev. 57, 1054–1061. https://doi.org/10.1016/0959-440X(95)80090-5.

Kumfor, F., Irish, M., Hodges, J.R., Piguet, O., 2013. Discrete neural correlates for the recognition of negative emotions: insights from frontotemporal dementia. PLoS One 8. https://doi.org/10.1371/journal.pone.0067457.

Lysaker, P.H., Klion, R., 2017. Recovery, Meaning-making, and Severe Mental Illness: A Comprehensive Guide to Metacognitive Reflection and Insight Therapy. Routledge, New York, NY.

Lysaker, P.H., Clements, C.A., Plascak-Hallberg, C.D., Knipscheer, S.J., Wright, D.E., 2002. Insight and personal narratives of illness in schizophrenia. Psychiatry Interpers. Biol. Process. 65, 197–206. https://doi.org/10.1521/psyc.65.3.197.20174.

Lysaker, P.H., Carcione, A., Dimaggio, G., Johannesen, J.K., Nicolò, G., Procacci, M., Semerari, A., 2005. Metacognition amidst narratives of self and illness in schizophrenia: associations with neurocognition, symptoms, insight and quality of life. Acta Psychiatr. Scand. 112, 64–71. https://doi.org/10.1111/j.1600-0447.2005.00514.x.

Lysaker, P.H., Dimaggio, G., Daroyanni, P., Buck, K.D., LaRocco, V.A., Carcione, A., Nicolò, G., 2010. Assessing metacognition in schizophrenia with the metacognition assessment scale: associations with the social cognition and object relations scale. Psychol. Psychother. Theory Res. Pract. 83, 303–315. https://doi.org/10.1348/147608309X481117.

Lysaker, P.H., Leonhardt, B.L., Pijnenborg, M., van Donkersgoed, R., de Jong, S., Dimaggio, G., 2014. Metacognition in schizophrenia spectrum disorders: methods of assessment and associations with neurocognition, symptoms, cognitive style and function. Isr. J. Psychiatry Relat. Sci. 51, 54–62.

McCullough, M.E., Rachal, K.C., Worthington, E.L., 1997. Interpersonal forgiving in close relationships. J. Pers. Soc. Psychol. 73, 321–336. https://doi.org/10.1037/0022-3514.73.2.321.

McCullough, M.E., Rachal, K.C., Sandage, S.J., Worthington, E.L., Brown, S.W., Hight, T.L., 1998. Interpersonal forgiving in close relationships: II. Theoretical elaboration and measurement. J. Pers. Soc. Psychol. 75, 1586–1603. https://doi.org/10.1037/

0022-3514.75.6.1586.
Moritz, S., Lysaker, P.H., 2018. Metacognition – what did James H. Flavell really say and the implications for the conceptualization and design of metacognitive interventions. Schizophr. Res. 201, 20–26. https://doi.org/10.1016/j.schres.2018.06.001.
Pomarol-Clotet, E., Hynes, F., Ashwin, C., Bullmore, E.T., McKenna, P.J., Laws, K.R., 2010. Facial emotion processing in schizophrenia: a non-specific neuropsychological deficit? Psychol. Med. 40, 911–919. https://doi.org/10.1017/S0033291709991309.
Salovey, P., Mayer, J.D., 1990. Emotional intelligence. Imagin. Cogn. Pers. 9, 185–211. https://doi.org/10.2190/dugg-p24e-52wk-6cdg.
Savla, G.N., Vella, L., Armstrong, C.C., Penn, D.L., Twamley, E.W., 2013. Deficits in domains of social cognition in schizophrenia: a meta-analysis of the empirical evidence. Schizophr. Bull. 39, 979–992. https://doi.org/10.1093/schbul/sbs080.
Smith, M.J., Horan, W.P., Cobia, D.J., Karpouzian, T.M., Fox, J.M., Reilly, J.L., Breiter, H.C., 2014. Performance-based empathy mediates the influence of working memory on social competence in schizophrenia. Schizophr. Bull. 40, 824–834. https://doi.org/10.1093/schbul/sbt084.
WeiMing, W., Yi, D., Lysaker, P.H., Kai, W., 2015. The relationship among metacognition, empathy and psychosis in schizophrenia patients in a post acute phase of illness. Chinese J. Behav. Med. Sci. 2015, 128–131.
Wu, W., Sheppard, E., Mitchell, P., 2016. Being Sherlock Holmes: can we sense empathy from a brief sample of behaviour? Br. J. Psychol. 107, 1–22. https://doi.org/10.1111/bjop.12157.