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## Metacognition in psychotic disorders

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# CHAPTER 3

## Metacognitive deficits as a risk factor for violence in psychosis: a discriminant function analysis

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## ABSTRACT

**Background:** Although most patients with a psychotic disorder are not violent, recent meta-analyses acknowledge a small, but significant relationship between psychosis and violence. Investigations of social cognition as a risk factor for violence in psychosis have turned up mixed results, with authors suggesting this may be due to different processes being measured, ranging from more basic processes such as facial affect recognition to more synthetic processes such as mentalizing or metacognition. The current study sought to investigate which measures of social cognition and metacognition are related to a violent history over and above the deficits commonly associated with psychotic disorders.

**Methods:** Data were gathered from control participants, patients with a psychotic disorder and no violent history, and patients with a psychotic disorder in treatment at a forensic clinic due to a violent crime. Discriminant analysis is utilized.

**Results:** Across all three groups, metacognition and associative learning as measured by the Digit Symbol Test emerge as significant factors. In a follow-up analysis between only the patient groups, self-reflectivity and empathic accuracy emerged as significant factors. The control group presented with a higher level of metacognitive capacity than the patient groups, and the forensic patient group had lower levels than the non-forensic patient group.

**Conclusions:** Our findings support previous research findings implying impaired metacognitive Self-Reflectivity in particular as a risk factor for violence. Interpretations and limitations of these findings are discussed in light of the current literature.

## INTRODUCTION

There is considerable debate whether psychotic disorders are a risk factor for violent behavior, and if so, which specific processes contribute to this risk. Based on meta-analyses, there is a “small, but significant relationship between psychosis and aggressive behavior” (Douglas *et al.* 2009; Volavka 2013; van Dongen *et al.* 2016). The relationship between psychosis and violence may be mediated by impaired ‘social cognition’ (Green *et al.* 2008). Social cognition refers to mental operations underlying social interactions (National Institute of Mental Health (NIMH), 2017).

Investigations of social cognition as a risk factor for violence in schizophrenia by comparing violent and non-violent patients are relatively sparse, with methodological difficulties hampering the interpretation of mixed results (Bragado-Jimenez & Taylor 2012; Malone *et al.* 2012). In recent years, it has been suggested that these mixed findings may be due to the variety of processes being examined, ranging from basic processes, such as facial affect recognition, to higher order processes that facilitate the integration of such information into a representation of mental states, with some support in fMRI evidence for such a distinction (Beauchamp & Anderson 2010; van der Meer *et al.* 2010; Dimaggio *et al.* 2013; van Veluw & Chance 2014; O’Reilly *et al.* 2015). For instance, relatively preserved social-perceptive abilities have been found in high functioning patients when compared to low functioning patients, but deficits in such higher-order processes (here called mentalizing) are similarly impaired in both groups (Karpouzian *et al.* 2016). Different theoretical frameworks led to a variety of terms for these higher order processes, such as Theory of Mind (Baron-Cohen *et al.* 2001; Majorek *et al.* 2009), mentalizing (Levinson & Fonagy

2004) and metacognition (Mitchell *et al.* 2012). There is currently no consensus on which theoretical framework is superior to others, leading to authors using the terms interchangeably (Brüne 2005).

To avoid confusion, we therefore specify that in this paper, the term ‘social cognition’ refers to scores on instruments such as those recommended by the NIMH Research Domain Criteria (RDoC) Matrix (National Institute of Mental Health (NIMH) 2017). In these tasks, participants are prompted to perform socio-cognitive activities such as self-report questionnaires (e.g. the Interpersonal Reactivity Index; Davis, 1983), short tests of understanding social ‘hints’ in stories (Hinting Task; Corcoran, Mercer, & Frith, 1995) or emotion recognition (Reading the Mind in the Eyes; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001).

Measured in this way, patients with psychotic disorders display marked deficiencies in performance (Vohs *et al.* 2014; Weijers *et al.* 2016) on scores of emotion recognition tasks (Kohler *et al.* 2010), understanding social ‘hints’, including patients in remission (Bora *et al.* 2009) and measurements of self-reported empathy (Montag *et al.* 2007) which appear stable over time (Haker *et al.* 2012). Literature reviews on risk of violence in patients with a psychotic disorder indicate social cognition as a fruitful avenue for further exploration, but a paucity of (large) studies and mixed evidence preclude firm conclusions (Bo *et al.* 2011; Bragado-Jimenez & Taylor 2012; Malone *et al.* 2012).

Though various definitions of the concept of metacognition exist (Wells 2009; Moritz *et al.* 2011; de Jong *et al.* 2016b), the current paper utilizes a conceptualization of metacognition as the way people make sense of their own, and other people’s thoughts and emotions. Metacognition is seen as a range of semi-independent mental activities to ‘think about thinking and feeling’ along four domains: Self-Reflectivity, Understanding the Other’s Mind, Decentration, or the

ability to abandon one's own personal perspective and Mastery, which refers to the ability to use representations of oneself, others and the social world to address psychological distress (Semerari *et al.* 2003; Lysaker *et al.* 2014). Metacognition from this perspective refers to the dynamic processes that synthesize information into complex representations, measured by scoring speech samples in which no socio-cognitive prompts are introduced. In so doing, it is important to acknowledge that the presented Metacognition Assessment Scale – A scores may be interpreted as measuring a similar phenomenon as mentalizing (Fonagy *et al.* 2011).

Metacognition has consistently been found to be impaired in persons with psychotic disorders (Lysaker *et al.* 2008; Vohs *et al.* 2014; Bo *et al.* 2015; Dimaggio & Lysaker 2015; Weijers *et al.* 2016). Associations were found between impaired metacognition and violent behavior (Abu-akel *et al.* 2015), though not in all studies (Mitchell *et al.* 2012). In a review on violence and psychotic disorders, it was noted that research into the association between metacognition and violence is sparse and that further research on paradigms involving both cognitive and affective aspects is warranted (Bo *et al.* 2011).

The current study was constructed to investigate which measures of social cognition and metacognition are related to a violent history over and above the deficits commonly associated with psychotic disorders. Scores on measures of social cognition and metacognition were collected and compared from a group of persons with a psychotic disorder in care at a forensic clinic for a violent crime (forensic and psychotic: F-P), a group of persons with a psychotic disorder without a forensic history (psychotic: P) and a control group with no known diagnosis of a mental disorder (control: C).

Based on previous research (Abu-Akel & Abushua'leh 2004; Majorek *et al.* 2009; Abu-akel *et al.* 2015), we hypothesized that both patients

groups would perform worse than controls on measures of social cognition and metacognition, but that metacognition would be a better predictor of a violent history. Secondly, if differences in metacognition between F-P and P would prove significant, we were interested in which of the four specific domains of metacognition are particularly indicative of a violent history. Due to limited research and theory on the topic, this relationship was examined in an explorative way.

## **METHODS**

### **PARTICIPANTS**

For this study we compared male outpatients diagnosed with a psychotic disorder without a forensic history (psychosis group,  $n = 27$ ), male patients diagnosed with a psychotic disorder in treatment at a forensic clinic for highly violent crime (forensic psychosis group,  $n = 23$ ), and male participants without a known history of mental disorder or violent crime (control group,  $n = 33$ ). Inclusion criteria for the patient groups were: 1) a primary diagnosis of schizophrenia or schizoaffective disorder (DSM-IV-TR), 2) age  $> 18$  and 3) not having had a significant change in medication in the 30 days prior to assessment. Exclusion criteria were: 1) a florid psychosis (PANSS positive avg.  $\geq 4$ ) at the time of assessment, 2) comorbid neurological disorder, 3) an inability to read / write or 4) an estimated IQ lower than 70. All three groups were similar with regard to age, mean level of education, ratio of diagnoses of schizophrenia vs. schizoaffective disorder and the median number of admissions into a mental healthcare institute.

The psychosis group was recruited from GGZ Friesland, a Dutch mental health care center, as an extension of a multicenter randomized controlled trial investigating the effects of a new metacognitive psychotherapy (Van Donkersgoed *et al.* 2014). For this clinical trial, inclusion criteria involved difficulties in metacognitive capacity, sixteen

participants met these criteria. To ensure a representative sample, all participants from this institute who were excluded from the randomized controlled trial on these grounds were approached for participation in the current study by a research assistant, and added to the baseline assessment data pool from the randomized controlled trial, adding eleven participants for a final sample of 27.

The forensic psychosis group was recruited from forensic clinics: FPC Dr. S. van Mesdag, FPA Franeker, FPK Assen and FPA Zuidlaren. In addition, for the forensic psychosis group, inclusion was only possible if they were in forensic care for serious violence from criminal court proceeding. The control group was recruited using social media and posters spread in the Netherlands.

## INSTRUMENTS

**Mini International Neuropsychiatric Interview** (M.I.N.I. Plus; Sheehan *et al.*, 1998). This structured interview was used to confirm a diagnosis of schizophrenia or schizoaffective disorder according to the DSM-IV-TR criteria.

**Positive and Negative Syndrome Scale** (PANSS; Kay, Fiszbein, & Opler, 1987). The PANSS is a 30-item interviewer-rating scale, intended to measure symptoms along three domains (positive, negative and general psychopathology). Interviews and scoring were performed by students enrolled in a master's degree program of Psychology, who had completed a 2-day PANSS training.

**Trailmaking Test A&B** (TMT; Reitan & Wolfson, 1985). As a part of the Halstead-Reitan Battery, the TMT provides information on the neurocognitive functioning of participants. During part A of the test, the participant is asked to draw lines sequentially, connecting 25 encircled numbers on a page. During part B, the participant is asked to do the same, though this time alternating between numbers and letters (1-A-2-B etc.). The final score is the time used (seconds) of part B minus the time used (seconds) on Part A.



**Digit Symbol Test** (Wechsler, 1995). This task evaluates neurocognitive function. Participants are presented with a row of boxes, pairing numbers with a symbol followed by several rows of paired boxes, where the symbol is omitted. Participants are asked to fill in the missing symbols. The final score of the test is the amount of symbols the participant has filled in 90 seconds.

**Interpersonal Reactivity Index** (IRI; M. H. Davis, 1983). The IRI is a questionnaire intended to measure self-reported empathy, using 28 items on a 5-point Likert scale, resulting in a total score.

**Questionnaire of Cognitive and Affective Empathy** (QCAE; Reniers, Corcoran, Drake, Shryane, & Völlm, 2011). The QCAE is a self-report questionnaire developed to measure cognitive and affective empathy using 31 items on a 4-point Likert-scale. The questionnaire was developed based on factor analysis of items from other well-known empathy questionnaires (including the IRI, causing some overlap in items). The total score of all items was used for analysis.

**Faux-Pas Task** (Baron-Cohen *et al.*, 1999). This task intends to measure 'Theory of Mind'. During the task, ten stories are read aloud to the participant. In five of these, a character in the story commits a 'faux pas'. Scoring consists of the amount of faux pas the participant correctly identified, and the amount of 'empathy questions' (e.g. 'how does person X in the story feel?') answered correctly.

**Empathic Accuracy Test** (EAT, Zaki, Bolger, & Ochsner, 2008). The Dutch version of this task (aan het Rot & Hogenelst, 2014) was used to measure empathic accuracy. Participants are required to watch four videos in which someone tells a personal story, and provide continuous ratings of valence (happy – sad). Participants are asked to continuously rate 'how the target person in the video is feeling'. Scores are correlated with the speaker's own ratings, leading to an index of empathic accuracy.

**Indiana Psychiatric Illness Interview** (IPII; Lysaker, Clements, Plascak-Hallberg, Knipscheer, & Wright, 2002). This open interview is intended to elicit a spontaneous speech sample, specifically developed for use with the MAS-A (see following instrument). Through five questions, the participant is asked to speak freely about their life story and their illness narrative (in the case of patients) or a significant adverse event in their lives (controls). All interviews were transcribed before receiving ratings on metacognition using the Abbreviated Metacognition Assessment Scale (MAS-A).

**Metacognition Assessment Scale – Abbreviated** (Lysaker *et al.*, 2005). The MAS-A relies on trained raters to score transcripts of spontaneous speech samples along the domains of Self-Reflectivity, Understanding the Other's Mind, Decentration and Mastery. Raters completed a training session and participated in three consensus meetings with experienced raters before their ratings were used. All MAS-A ratings were first performed individually before a joint score was constructed in a consensus meeting with a minimum of three raters.

**Dutch Adult reading test** (Schmand *et al.*, 1991). This test, in which participants are asked to pronounce uncommon Dutch words, serves as an indicator of premorbid intellectual functioning.

## PROCEDURES

The protocol for this study was approved by the University Medical Center Groningen (NL47493.042.13) and is registered in the Dutch Trial Register (NTR4501) in 2014. Recruitment procedures for the patient group without a forensic history are described elsewhere (Van Donkersgoed *et al.*, 2014). All clients which fit the in- and exclusion criteria in the participating therapist's caseloads were informed of the study. In the first meeting participants signed informed consent, if applicable the diagnoses were confirmed using the MINI PLUS, and

the PANSS and IPIII interviews were administered. The rest of the test battery was administered during a second sitting or more if there were symptoms of fatigue. All measurements were performed by persons enrolled in a Master's degree program of psychology.

### **ANALYSES**

The analyses were conducted using IBM SPSS Statistics version 24. Groups were compared on demographic variables using *Fisher's Exact-z* (education level, # of admissions), chi-square test (diagnosis) or ANOVA (age).

After verification that groups did not differ significantly on demographic variables, a stepwise Discriminant Function Analysis (Field, 2013) was conducted in order to determine which variables constitute a statistically significant predictor of group membership (control, psychosis, forensic psychosis). Due to an issue with one research assistant, there were some missing values on particularly the neurocognitive measures in the control group (Table 1). To account for this, missing values were replaced by group means as these were highly similar to those obtained in other studies (Joy *et al.*, 2004; Tombaugh 2004; Mahurin *et al.*, 2006).

Follow-up analysis was conducted to determine which specific elements of metacognition (Self-Reflectivity, Understanding the Other's Mind, Decentration and Mastery) predict being in forensic care amongst persons with psychosis. This was tested using a second stepwise Discriminant Function Analysis, omitting the control group, and substituting MAS-total scores for its subscales.

Discriminant Function Analysis (DFA) relies on several assumptions: the data must represent a sample from a multivariate normal distribution, homogeneity of variances/covariances and non-multicollinearity. DFA is known to be relatively robust against violations

of multivariate normality, but has been documented as being sensitive to outliers. As such, multivariate outliers were assessed first by calculating squared Mahalanobis distances for each case, per group and testing these against the chi-square distribution using the number of predictors (9) for degrees of freedom,  $p=.001$  (Tabachnick & Fidell 2007). Second, to ensure the resulting model is reliable, cross-validation (also called leave-one-out or 'jack-knife' classification) was applied in which each case is classified by the functions derived from all cases other than that case, resulting in a more conservative estimate.

## RESULTS

Not all variables are normally distributed in all 3 groups according to Shapiro-Wilk tests (Faux Pas Test, IRI, EAT, Trailmaking and QCAE); transformations of the data could not resolve this in all groups simultaneously. A per-case test of Mahalanobis distances revealed no significant multivariate outliers. Box's M test (Field, 2013) revealed the assumption of homogeneity of variance/covariance was met. To test hypothesis one, a discriminant function analysis was conducted to uncover the dimensions which differentiate control participants, persons diagnosed with a psychotic disorder and persons with a psychotic disorder in forensic care for a violent crime. Variables entered were MAS-Total scores, Trailmaking total scores, Digit Symbol scores, DART scores, Faux Pas # correctly identified, Faux Pas # Empathy questions wrong, QCAE total scores, IRI total scores and EAT scores.

Two discriminant functions emerged (Table 3): the first function explained 92.8% of the variance, canonical  $R^2 = .34$ , whereas the second

**TABLE 1** Demographics

	Controls (N=33)	Psychosis (N=27)	Forensic (N=23)	F (df) / z / $\chi^2$	p
Age min – max	22 – 74	20 – 67	21 – 56		
Age mean (SD)	38.61 (11.02)	35.41 (11.27)	37.26 (9.11)	6.75 (2)	.51
Education mean <sup>1</sup>	5.15	4.89	4.65 <sup>2</sup>	2.37	.69
Schizophrenia Schizoaffective disorder Psychotic disorder NOS		19 (70%) 8 (30%) 0	19 (83%) 3 (13%) 1 (4%)	2.83	.24
Age first psychosis, mean (SD)		24.30 (6.89)	24.09 (6.67) <sup>3</sup>	0.11 (1)	.92
Illness duration in years, mean (SD)		11.11 (9.58)	12.81 (5.95) <sup>3</sup>	.53	.47
Mode no. of admissions		2-4 (44%)	2-4 (39%)	3.120	.59

<sup>1</sup> Education classification system of Verhage, 1983  
<sup>2</sup> Data missing (n=6)  
<sup>3</sup> Missing data for 1 participant

**TABLE 2** Average scores, mean (SD)

	Trailmaking	Dig. Symb.	DART	FP- Rec.	FP- Emp.	QCAE	IRI	EAT	MAS-A
Control	94.78 (39.70) <sup>1</sup>	72.44 (16.38) <sup>1</sup>	78.47 (12.57) <sup>2</sup>	4.28 (.80)	2.62 (1.21)	89.48 (8.67)	63.33 (14.38)	1.24 (0.47)	14.53 (2.83)
Psychosis	149.56 (76.77)	56.89 (16.89)	78.96 (8.57)	3.81 (1.18)	2.63 (1.62)	89.56 (12.00)	53.37 (9.68)	1.07 (0.52)	11.44 (3.38)
For. Psychosis	151.56 (57.92) <sup>3</sup>	53.78 (11.58) <sup>3</sup>	71.81 (15.69) <sup>4</sup>	3.22 (1.51)	2.43 (1.31)	88.70 (9.11)	55.57 (14.04)	0.88 (0.64)	9.00 (2.80)

<sup>1</sup> Data is only available for 18 / 33 participants.  
<sup>2</sup> Data available for 17/33 participants  
<sup>3</sup> Data available for 18/23 participants  
<sup>4</sup> Data available for 16/23 participants

<b>Analysis 1: Control – Psychosis – Forensic Psychosis</b>					<b>Analysis 2: Psychosis – Forensic Psychosis</b>		
	<b>Function</b>		<b>SCDFC<sup>1</sup></b>			<b>Function</b>	<b>SDFC</b>
<b>Entered</b>	Fn 1	Fn 2	Fn. 1	Fn 2	<b>Entered</b>	Fn. 1	Fn. 1
MAS-A: Total	.792	-.610	.741	-.677	MAS-A: Self Reflectivity	.743	1.106
Digit Symbol	.675	.738	.612	.795	EAT	.234	.762
<b>Not in the model</b>					<b>Not in the model</b>		
Faux Pas Empathy	-.168	-.163			MAS-A: Understanding Other	.584	
QCAE	-.123	-.077			MAS-A: Mastery	.443	
IRI	-.100	.008			Faux Pas – Empathy	-.295	
Trailmaking	-.215	-.385			Faux Pas Recognized	.254	
EAT	-.086	.315			MAS-A: Decentration	.234	
Faux Pas Recognized	.091	.290			Trailmaking	-.168	
DART	.056	.086			IRI	-.046	
					Digit Symbol	.029	
					DART	-.021	
<sup>1</sup> Standardized Canonical Discriminant Function Coefficient							

<b>Analysis 1: Control – Psychosis – Forensic Psychosis</b>			<b>Analysis 2: P - FP</b>
	<b>Function</b>		<b>Function</b>
<b>Group</b>	<b>Fn.1</b>	<b>Fn.2</b>	<b>Fn. 1</b>
Control (C)	.902	.107	
Psychosis (P)	-.172	-.236	.646
Forensic (F-P)	-.849	.207	-.923

**TABLE 5** *Classification tables*

Analysis 1: Control – Psychosis – Forensic Psychosis					Analysis 2: Psychosis – Forensic Psychosis	
		Predicted Group Membership			Predicted Group Membership	
Actual group	<i>n</i>	Control	Psychosis (P)	Forensic (F-P)	Psychosis	Forensic
<b>Control (C)</b>	33	23 (70%)	10 (30%)	0 (0%)		
<b>Psychosis (P)</b>	27	6 (22%)	12 (44.4%)	9 (33%)	23 (85.2%)	4 (14.8%)
<b>Forensic (F-P)</b>	23	2 (9%)	8 (35%)	13 (57%)	6 (26.1%)	17 (73.9%)
Percentage of cases correctly classified: 57.8% Cross-validation correct classification: 54.2%					Percentage of cases correctly classified: 80% Cross-validation correct classification: 78%	

function explained only 7.2%, canonical  $R^2 = .04$ . As such, only the first significantly differentiated between the groups, Wilks'  $\Lambda = .636$ ,  $\chi^2(4) = 21.462$ ,  $p < .001$ . The second function did not reach significance, Wilks'  $\Lambda = .962$ ,  $\chi^2(1) = 1.854$ ,  $p = .17$ . Interpretation of functions at group centroids confirms that a structural hierarchy exists in the order of scores (Table 4), with the forensic group scoring worse than the psychosis group, and both patient groups scoring worse than controls. Correlations between the group membership and the discriminant function (Table 3) revealed that only two variables loaded onto this first function, namely metacognition total scores ( $r = .792$ ), and the Digit Symbol Test ( $r = .675$ ). The combination of functions 1 and 2 correctly classify 57.8% of the cases in their respective groups (Table 5). The more conservative cross-validated model correctly classified 54.2%.

As a second question, we were interested to see whether specific domains of metacognition are particularly indicative of a violent history. A per-case test of Mahalanobis distances revealed no significant

multivariate outliers. As such, another discriminant analysis was performed, omitting the control group and substituting MAS-total scores for scores on its subscales. This resulting model consisted of only one function explaining 100% of the variation, canonical  $R^2 = .38$ . This function significantly differentiated between the groups, Wilks'  $\Lambda = .612$ ,  $\chi^2(2) = 15.206$ ,  $p < .001$ . Once more, two variables loaded onto this function (Table 5): scores on Self-Reflectivity ( $r = .743$ ), and scores on the EAT ( $r = .234$ ). Group centroids revealed the same hierarchy, with lower scores associated with membership to the forensic group (Table 4). This model correctly classified 80% of the cases between the psychosis and forensic psychosis group; the more conservative cross-validated model correctly classified 78% (Table 5).

## DISCUSSION

The current study investigated the relationship between social cognition and metacognition and forensic history in patients with psychotic disorders. As a secondary aim, we sought to investigate which specific domains of metacognition were particularly indicative of a violent history. Our results revealed that metacognitive capacity as measured by the MAS-A, and associative learning scores on the Digit Symbol test, were the only variables that significantly differentiated between all three groups, with controls scoring higher than both patient groups, and patients without a forensic history outperforming those in treatment at a forensic clinic. Additionally, an explorative analysis in which the MAS-A total scores were substituted for its subscales, revealed differences in scores between the forensic and not-forensic patient groups stem mainly from functioning on Self-Reflectivity and scores of empathic accuracy.

This is the first study which includes both measures of social cognition and metacognition in samples with a psychotic disorder, with a



psychotic disorder in forensic care and healthy controls. Thus, results of the current study cannot be directly compared to prior research. Given how well-established the findings are that people with a psychotic disorder underperform on measures of neurocognition, metacognition and social cognition, we shall only discuss our findings in terms of forensic and non-forensic group in-depth.

Scores on metacognition, in particular self-reflectivity, differentiated between forensic and non-forensic participants. In addition, empathic accuracy differentiated, but scores on social cognition (such as ToM) did not. It has been noted that people with schizophrenia and a forensic history do not appear to differ from their non-forensic counterparts on first-order Theory of Mind tasks (Harris & Picchioni, 2013), and that evidence of more basic processes such as Facial Affect Recognition as a predictor for violence in schizophrenia is limited and mixed (Malone *et al.*, 2012; Harris & Picchioni, 2013). Our data fail to support a link between Theory of Mind and violent behavior in schizophrenia, instead implicating synthetic metacognition, i.e. higher order processes that involve integration of different cognitive functions, as previously proposed by several authors (Abu-Akel & Abushua'leh 2004; Bo *et al.*, 2011; Mitchell *et al.*, 2012).

Abu-Akel and Abushua'leh (2004) compared forensic patients with a psychotic disorder to non-forensic psychosis patients on Theory of Mind tests, and performance on the Faux Pas Test. Their results revealed near-significant differences on Faux Pas recognition and empathic inferences, with nonviolent patients outperforming violent patients. They suggest that lack of statistical significance was due to low statistical power. Entering these variables into a regression model, however, did improve the model fit. Majorek et al (2009), using a slightly different ToM task, did not replicate this finding. Our results are in line with the latter: scores on these measures between our groups do not approach

significance, nor do scores on the Faux Pas test improve discriminant power when entered into a discriminant analysis.

In our samples, metacognitive deficits proved to discriminate best between all three groups (i.e. including controls), but also between the two patient groups, implicating particularly scores on the self-reflectivity subscale as a risk factor for violence. Using a similar instrument (MAS-R), Mitchell *et al.* (2012) did not find a forensic sample (N=18) to differ significantly from a patient group without a forensic history, but included only 11 patients in the group of participants with a psychotic disorder. It is therefore difficult to formulate a definitive conclusion based on our results, when taking extant literature into account. What can be ascertained is that self-report questionnaires of empathic abilities are unlikely to be a viable instrument to determine relative violence risk of patients. Self-reflective capacities in this group may be insufficient to obtain accurate scores, and social desirability may play a significant role. Although somewhat less certain, it also appears that faux pas recognition or empathic inferencing ability as measured via questions about characters in a story do not provide information on a construct related to violence-proneness in patients.

Instrument choice appears to play a significant role: the empathic accuracy task, in which participants continuously rate how a person in a video is feeling (sad – happy) provides a different type of information than tests such as Faux Pas recognition or empathy questions: it is a much more synthetic measure with ecologically valid stimuli in which the participant has to integrate information from multiple media (facial expressions, intonation, content of the personal story). Importantly, these scores can be correlated to a ‘true’ score obtained from the person who told the story. Additionally, the task is much less cognitively/insight oriented and much more affect-driven, and is less susceptible to social desirability, given how difficult it is to discern what would be ‘socially

desirable'. Between forensic and non-forensic patients, this score differentiated, while the MAS-A score of "Understanding the Other's Mind did not differentiate in the same manner. This subscale, however, measures complexity of representations of others, rather than accuracy of social cognition. Our data provides further evidence that these are different (although perhaps related) constructs, as some authors suggest (e.g. Dimaggio *et al.*, 2013).

We see three interpretations of these results as viable: the first is based on fMRI evidence that, neurologically, self-relevance determines the amount of emotional processing that takes place in reflecting about others: the more self-relevance, the more emotional processing takes place in the ventromedial prefrontal cortex (van der Meer *et al.*, 2010). It is possible that persons with a psychotic history and a violent history are equally able to, but less inclined to, form complex representations of others. This would be in part explained by the diminished scores on self-reflectivity: a less complex, less stable representation of oneself may make it more difficult to determine that another person is important to oneself. This would lead to a somewhat solipsistic world-view in which other persons, except for the most intimately known or familiar, are more akin to a 'faceless group' than persons just like oneself with whom experiences can be shared. Such a conception of the world may share similarities with a more 'psychopathic' or a fear-based view of the world.

The second explanation regards the mode of measurement. The MAS-A, importantly, does not in any way measure accuracy of inferences and has a relatively cognitive character. A person may represent their mother as a person with cognitions and emotions during the IPII interview, and plausibly infer the intentions of her actions. This representation is not tested: the MAS-A raters can only determine plausibility and complexity of representation, not accuracy as they do not know the mother. The empathic accuracy test, however, does

measure accuracy and has a more affective character. At first glance, this may seem similar to Facial Affect Recognition tasks, which have mixed findings in regards their connection to violence. It could be that these mixed findings are best explained in terms of complexity of processing: at the basic level, emotion recognition is impaired in persons with a psychotic disorder but are not in themselves a risk for violence. Understanding others is not, however, limited to only recognition of facial affect but an integration of all this information into an understanding of the other person's mental state. It could be that difficulties in this ability are the risk factor for violence.

Finally, our findings suggest that those with diminished Self-Reflective capacities could find themselves more overwhelmed by emotions, as demonstrated by the average self-reflectivity scores between the groups. In both control condition and the non-forensic group, averages are above S4, with only 9% in the control group scoring below S4, and 33% in the non-forensic group. In the forensic group, however, 74% of the participants score below S4, which is reflected in a group average of S3.2. It is at precisely this level of metacognition (S4) where a person demonstrates the ability to differentiate between emotions and integrate these into their self-representation. The average score of S3 in the forensic group indicates only the ability to differentiate between cognitive operations, but not emotions. However, alternative interpretations cannot be ruled out, including that the commission of violent crime or incarceration diminishes metacognitive capacity or that some factor not measured here accounts for the observed relationship.

The present study has several limitations: while the total sample size is acceptable, the number of participants per group is modest. Furthermore, our study did not include any data on comorbid substance abuse or personality pathology in either the psychosis group, nor the control groups. Additionally, the current set of instruments

pertaining social cognition is only a small sample of the instruments available to measure the construct(s); for instance, the current study did not incorporate the 'Managing Emotions' subtest of the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), which has also demonstrated an association with violence (O'Reilly *et al.*, 2015). Future research should be designed as prospective studies in which risk assessment batteries are conducted in conjunction with measures of social cognition (particularly metacognition) to determine whether metacognitive capacity demonstrates predictive validity over and above information acquired from comprehensive risk assessment. The further development of instruments targeting more synthetic metacognitive abilities may prove highly informative and useful, in this context. In addition, more investigations into metacognitive capacity in those with personality disorders could potentially further disentangle the complex relationship between psychosis and (comorbid) personality pathology as a risk factor for violence.

One final limitation pertains to symptomatology: our forensic sample can be assumed to be under adequate medication management due to the forced character of treatment, which consisted of both in- and outpatients. Such assumptions cannot be made for our patient non-forensic group, which consisted only of outpatients; it is a common finding that medication adherence is rather poor among patients with a psychotic disorder (e.g. Colizzi *et al.*, 2016). Symptom scores at the time of assessment between groups are virtually identical, but are perhaps not the most relevant information to enter into a statistical model. After all, no information could be entered into the model pertaining to medication use or symptom severity at the time of the index crime.

**IN CONCLUSION,** our findings support previous research findings implying impaired metacognitive self-reflectivity and empathic accuracy as risk factors for violence. As evidence is beginning to mount that synthetic metacognitive capacity may add unique information to statistical models of violence risk, there may be some urgency to direct research efforts into more measures of these abilities and, perhaps more importantly, interventions aimed at these abilities for both treatment of violent offenders but also prevention of violence. To date, several such methods have been developed and are under investigation for their efficacy, based on either the mentalization framework, the notion of metacognition as awareness of susceptibility to one's own biases, or synthetic metacognition. (Bateman *et al.*, 2009; Wells, 2009; Moritz *et al.*, 2011; Hamm *et al.*, 2013; Van Donkersgoed *et al.*, 2014; de Jong *et al.*, 2016a), and future research is warranted to determine effectiveness within the field of psychosis, including whether they may prove similarly useful in forensic care. Given the considerable implications for the patient, victim and society at large, further research is needed.

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