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Metacognition within narratives of schizophrenia: Associations with multiple domains of neurocognition

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Abstract

Research has suggested many with schizophrenia experience impairments in metacognition, or difficulties apprehending their own thoughts and the thoughts of others, and that those deficits are not reducible to a single symptom or cognitive impairment. While links between metacognition and more severe levels of symptoms have emerged, less clear is whether there are consistent associations between metacognition and other neurocognitive capacities. Accordingly the current study sought to examine whether different patterns of metacognition deficits have different neurocognitive correlates. Narratives were gathered from 69 adults with schizophrenia spectrum disorder using the Indiana Psychiatric Illness Interview along with a symptom interview and neurocognitive battery including subtests of the Wechsler Adult Intelligence Scale III, Wechsler Memory Scale III and the Wisconsin Card Sorting Test. Metacognitive capacity within the narrative interview was assessed using the Metacognition Assessment Scale and participants were divided based on those scores into three groups: minimal self-reflectivity/not decentered ($n=25$); basic self-reflectivity/not decentered ($n=33$); and basic self-reflectivity/decentered ($n=11$). Basic self-reflectivity refers to the ability to distinguish one's own thoughts and feelings while decentered refers to the ability to see others as having independent perspectives and relationships with one another. MANOVA and ANOVA comparing groups revealed that the participants lacking basic self-reflectivity had significantly poorer working memory and more symptoms of disorganization, while participants able to see others as having independent perspectives and relationships demonstrated better visual memory. Results suggest different deficits in metacognition may be linked to different neurocognitive capacities.

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Terms such as “Metacognition,” “Theory of Mind,” and “Mentalizing” refer to a person's general capacity to think about thinking, both their own thinking and the thinking of others. These terms, while often used interchangeably to refer to a general aptitude, involve a wide range of semi independent faculties which allow

persons to represent their own mental states and the mental states of others, to form, revise and reform ideas of what is believed, felt, dreamt of, feared, feigned or pretended (Frith, 1992). These capacities consequently allow humans to make meaning of their dilemmas, to understand one another's intentions, and to ultimately adapt to a changing environment. In this paper we have selected to use the term metacognition to refer to this general set of phenomenon because of its potential to

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43 describe a wide range of internal and socially driven
44 cognitive acts which contain primarily reflexive qualities
45 (e.g. Semerari et al., 2003). Admittedly there is much in
46 common between this term and theory of mind, which
47 has been defined, for instance, as the “capacity to
48 represent one’s own and other persons’ mental states”
49 (Brune, 2005, p 21).

50 Over the last 15 years, research has explored whether
51 schizophrenia fundamentally involves deficits in meta-
52 cognition. A link between schizophrenia and metacogni-
53 tion seems likely as many symptoms of schizophrenia
54 involve a failure to draw plausible conclusions about the
55 motives of others and the origins of one’s internal states
56 (Frith, 1992). As noted in recent reviews by Brune
57 (2005) and Harrington et al. (2005), multiple studies
58 have confirmed that many with schizophrenia experi-
59 ence difficulties apprehending their own thoughts and
60 the thoughts of others and that those deficits are not
61 reducible to a single symptom or cognitive impairment.
62 These studies have also suggested that more severe
63 levels of psychopathology, particularly symptoms such
64 as paranoia, negative symptoms and thought disorder,
65 predict poorer performance on tests requiring partici-
66 pants to discern the intentions of others.

67 One issue awaiting clarification is whether there are
68 consistent patterns of association between metacognition
69 and other neurocognitive “capacities such as attention,
70 memory and general intelligence” (Brune, 2003, p.62).
71 Performance on tests of neurocognition do not fully
72 explain the impact of deficits in metacognition on func-
73 tion (Roncone et al., 2002), and intact neurocognitive
74 function is not necessarily sufficient for full metacogni-
75 tive function. Yet metacognitive and neurocognitive
76 abilities may be related. Evidence of this includes find-
77 ings that better metacognitive skills are associated with
78 better performance on tests of verbal and visual memory
79 (Greig et al., 2004), visual memory span (Langdon et al.,
80 2001), intelligence (Brune, 2003), executive function
81 (Greig et al., 2004; Langdon et al., 2002) and learning
82 ability (Doody et al., 1998).

83 One possibility is that certain elements of metacogni-
84 tion require minimal levels of neurocognitive function.
85 In other words, certain levels of neurocognitive capacity
86 may be necessary but not sufficient for basic acts of
87 metacognition. There are at least several reasons to ex-
88 pect that a combination of impairments in various do-
89 mains of neurocognition might represent a barrier to
90 successful metacognitive function. For one, deficits in
91 flexibility of abstract thought have been suggested to
92 underlie deficits in a variety of phenomena which would
93 seem to require some metacognitive function, including
94 awareness of illness (Drake and Lewis, 2003; Lysaker

et al., 2003; Smith et al., 2000), social cognition 95
(Lancaster et al., 2003), and the development of social 96
skills (Lysaker et al., 1995). The possibility that cog- 97
nitive decline in schizophrenia could underpin some 98
deficits in metacognition is also supported by studies of 99
head injury and related conditions. Research has sug- 100
gested persons experience familiar social situations as 101
increasingly difficult to understand following the loss of 102
cognitive abilities (Frank et al., 2006; Newton and 103
Johnson, 1985) and that with the loss of neurocognitive 104
abilities there follows a reduced ability to shift mentally 105
between different self-representations (Heller et al., 2006) 106
and to perform basic self monitoring tasks (Ownsworth 107
and Fleming, 2005). In the case of Asperger’s syndrome, 108
an inability to appreciate the thoughts and feelings of 109
others, a deficit also seen in schizophrenia, has been 110
linked to difficulties both integrating contextual informa- 111
tion, and to impairments in executive function which 112
compromise persons’ abilities to smoothly shift back and 113
forth from two viewpoints (Frith and Vignemont, 2005). 114

115 We would suggest that one of the reasons why research
116 has been slow to explore the association of neuro-
117 cognition and metacognition is that most studies have
118 assessed metacognition along a singular continuum from
119 “intact” to “impaired” by observing performance after a
120 participant is cued to make a judgment about someone’s
121 thinking in a fictional story (Brune, 2005; Harrington
122 et al., 2005). An initial problem here is that performance
123 on these tests may not speak to persons’ abilities to engage
124 in metacognitive acts when personal issues are involved
125 or when there are no specific cues that call for specific
126 metacognitive acts (Lysaker et al., 2005). A larger
127 problem though is that many have argued that metacogni-
128 tion, like other abilities (e.g. memory), is composed of
129 multiple semi independent capacities which can be acti-
130 vated independently of one another (Casacchia et al.,
131 2004; Nichols and Stich, 2001; Semerari et al., 2003;
132 Semerari et al., in press). Stressed by this view is that
133 different metacognitive functions, such as awareness of
134 one’s own thoughts and awareness of other’s thoughts
135 may involve activity in different cortical regions of the
136 brain (Frith and Frith, 1999; Ruby and Decety, 2003; Saxe
137 et al., 2004; Vogeley et al., 2004). Thus some functions
138 may be impaired while others are not. Research sup-
139 porting this includes findings that fundamentally different
140 patterns of metacognitive deficits exist in persons with
141 different forms of personality disorders and that in each
142 personality disorder some aspects of metacognition func-
143 tion well while others are impaired (Dimaggio et al., in
144 press; Semerari et al., 2005; Prunetti et al., in press).
145 Additionally some persons with schizophrenia experience
146 greater deficits in self awareness as opposed to awareness

of others, while the opposite may be true in Asperger's syndrome (Marruffa and Meini, 2004). Studying metacognition as varying along one axis thus risks missing the possibility that different patterns of metacognition deficits have different correlates, that is, that combinations of different deficits may have unique links to neurocognition.

To address these concerns we have developed a means of measuring metacognition as it has emerged naturally in narratives of self and illness among participants with schizophrenia using an adaptation of the Metacognition Assessment Scale (MAS; Semerari et al., 2003), a scale allowing for multiple domains of metacognition to be assessed. In an initial study using this method, we found that assessment of awareness of one's own mind was positively correlated with performance on neurocognitive tests involving verbal memory, spatial memory, verbal intelligence and processing speed (Lysaker et al., 2005). In the current study we have sought to expand our work by studying whether performance on neurocognitive tests was linked to whether or not participants could perform alone or in combination two specific metacognitive tasks, which are widely recognized as key impairments in schizophrenia.

Specifically we have asked whether neurocognition was first linked to the ability to recognize and distinguish one's own thoughts and feelings. As widely described in the literature, people with schizophrenia concurrently experience grave confusion about their internal states as well as profound confusion about how they fit into the world taking place around them (Bleuler, 1911/1950; Laing, 1978; Parnas and Handest, 2003; Searles, 1965). We have secondly asked whether neurocognition is linked to the ability to see the world in a non-egocentric or decentered manner. Here we refer to the ability to see that others' actions in the world stem from their own goals and reasons, and that others see the world from their own unique perspective. The ability to see the world in a decentered manner has been conceptualized as a semi independent metacognitive capacity, relative to the ability to know one's own thoughts by several phenomenological researchers (Sass and Parnas, 2003; Stanghellini, 2004). In particular, these researchers have described a group of persons with schizophrenia who are fully aware, if not hyperaware, of their own thoughts and feelings, but who simultaneously find the actions of others in the world incomprehensible.

In the current study, with a new sample, we have consequently sought to classify participants on the basis of metacognitive assessments of their narratives into three groups: i) minimal self-reflectivity/not decentered; ii) basic self-reflectivity/not decentered; and iii) basic self-reflectivity/decentered. Of note, by basic self-reflectivity

in the latter two groups we refer to the ability to merely recognize and distinguish one's own affective states but not necessarily having higher levels of metacognition, such as those involving the ability to give a complete description of one's own mental state and to distinguish cognitive and emotional elements involved in one's interpersonal processes. While we hypothesized basic levels of self-reflectivity may be related to neurocognition, we did not anticipate that higher levels of reflectivity would be linked to neurocognition given a literature linking more complex aspects of metacognition in a variety of disorders including psychosis and personality disorders, to other factors such as social isolation or developmental history (Bentall et al., in press; Fonagy et al., 2002; Semerari et al., in press). In fact there are of course many factors beyond neurocognition likely to affect metacognition. For instance, it remains possible that history of trauma may also damage the capacity for self-reflectivity in psychosis (Bebbington et al., 2004; Hardy et al., 2005).

We predicted that participants in our study with deficits in both self-reflectivity and decenteration would have poorer neurocognitive function than participants whose basic self-reflectivity was intact but who also suffered from a lack of decenteration. We also predicted that participants without either metacognitive deficit would have the best neurocognitive test performance. We assessed a variety of domains of neurocognition previously linked to function in schizophrenia in order to study in an exploratory manner whether different metacognitive capacities were related to different forms of neurocognition. A further aim of our study was to begin to fill the gap between the study of metacognition regarding one's life and the ability to infer affects in others and, therefore we included in our battery a test of the ability to recognize positive and negative emotions as portrayed by an actor in videotaped segments. We lastly planned exploratory analyses comparing symptom assessments with metacognition.

1. Methods

1.1. Participants

Participants were 61 adult men and 8 women with SCID confirmed DSM-IV diagnoses of schizophrenia ($n=43$) or schizoaffective disorder ($n=26$). The participants comprised the full sample of persons enrolled in a larger study seeking to develop a cognitive behavioral therapy targeting working function in schizophrenia. All were recruited from the outpatient Psychiatry Service of a VA Medical Center ($n=50$) or Community Mental Health Center ($n=19$) and were in a post acute phase of illness as

248 defined by having no hospitalizations or changes in
249 medication or housing in the month prior to entering the
250 study. Excluded from the study were participants with
251 mental retardation or active substance abuse. The mean
252 age and education of the sample was 46.68 (SD=10.11)
253 and 12.68 (SD=2.46) years respectively. Participants had,
254 on average, 5.90 lifetime psychiatric hospitalizations
255 (SD=6.09) with the first occurring on average at the age
256 of 27.08 (SD=9.61). Their parents' average level of
257 education was 12.57 (SD=2.49). Thirty were Caucasian,
258 38 African American, and one Latino.

259 1.2. Instruments

260 *Indiana Psychiatric Illness Interview* (Lysaker et al.,
261 2002) is the semi-structured interview developed to assess
262 illness narratives. A research assistant conducts the
263 interview which typically lasts between 30 and 60 min.
264 Responses are audio taped and later transcribed. The
265 interview is divided conceptually into four sections. First,
266 rapport is established and participants are asked to tell the
267 story of their lives in as much detail as they can. Second,
268 participants are asked if they think they have a mental
269 illness and how they understand it. This is followed with
270 questions about what has and has not been affected by their
271 condition in terms of interpersonal and psychological life.
272 In the third section, participants are asked if their condition
273 "controls" their life and if they "control" their condition.
274 Fourth, participants are asked what they expect to stay the
275 same and what will be different in the future, again in terms
276 of interpersonal and psychological function. For the
277 purposes of the current study we have added an additional
278 group of two questions into the third section which ask
279 how much their illness is affected by others and how much
280 have others been affected by their illness. This was added
281 to offer another opportunity for persons to portray the
282 world in a decentered manner. The IPII procedures differ
283 from other psychiatric interviews in that they do not
284 introduce content. If the participant does not mention
285 hallucinations, the IPII interviewer does not inquire about
286 hallucinations. The interviewer may ask for clarification
287 when confused and may query non-directively. The tone of
288 the interview is directed to be conversational and questions
289 are not posed for participants to solve. The IPII thus results
290 in a narrative of self and psychiatric challenges that can be
291 analyzed in terms of the metacognitive capacities utilized
292 during the telling of the story.

293 *The Metacognition Assessment Scale* (MAS; Semerari
294 et al., 2003) is a rating scale that assesses metacognitive
295 abilities as manifest in an individual's verbalizations. It
296 was originally designed to detect within psychotherapy
297 transcripts changes in the ability of persons with severe

298 personality disorders to think about their own thinking. In
299 consultation with the authors, the MAS has been adapted
300 for the study of IPII transcripts (Lysaker et al., 2005). The
301 MAS focuses on metacognitive functions and not on
302 metacognitive contents and conceptualizes metacognition
303 as the set of abilities that allows persons to understand
304 mental phenomena and to use that understanding to tackle
305 tasks that are sources of distress.

306 The MAS contains four scales: "Understanding of
307 one's own mind" or the comprehension of one's own
308 mental states; "Understanding of others' minds," or the
309 comprehension of other individuals' mental states,
310 "Decentration" or the ability to see the world as existing
311 with others having independent motives, and "Mastery"
312 or the ability to work through one's representations and
313 mental states to implement effective action strategies
314 in order to accomplish cognitive tasks or cope with
315 problematic mental states. The MAS requires the rater to
316 indicate whether the participant has successfully used or
317 failed to use a function for each task which increases in
318 complexity. For the purposes of this study we were first
319 interested in whether participants achieved a rating of "4"
320 or higher (out of "9") on awareness of one's mind,
321 indicating the participant was at least able to define and
322 distinguish their own emotions and thoughts from one
323 another. We were secondly interested in whether partic-
324 ipants achieved scores of "2" or higher (out of "3") on
325 decentration indicating the participant was at least able to
326 recognize others as perceiving and interpreting events in a
327 different way than themselves. Interrater reliability was
328 assessed in this study with two blind raters for 10 tran-
329 scriptions. Consistent with our earlier use with a different
330 sample, good overall reliability was found with an in-
331 tra-class correlation for the total of .86 ($p < .05$). An overall
332 significant level of internal consistency was also found for
333 all four scales (coefficient alpha = .80, $p < .05$).

334 *The Wechsler Adult Intelligence Scale III* (WIAT III;
335 Wechsler, 1997a,b) is a widely used battery of tests used
336 to assess intellectual function and generates age corrected
337 scaled scores where the expected population mean is a
338 "10". For the purposes of this study four subtests were
339 administered: Vocabulary, Block Design, Arithmetic and
340 Digit Symbol. The Vocabulary subtest assesses partic-
341 ipants' global verbal intellectual function and is believed to
342 tap premorbid intelligence in schizophrenia. The Block
343 Design subtest assesses visual spatial processing and is
344 often used as a non-verbal measure of intelligence. The
345 Arithmetic subtest calls on persons to mentally manipu-
346 late numbers in order to solve mathematical problems and
347 thus is understood to involve working memory. The Digit
348 Symbol subtest assesses participants' visuomotor proces-
349 sing speed.

350 *Wechsler Memory Scale III*: (WMS III, Wechsler,
351 1997a,b) is a widely used battery of tests used to assess
352 memory function. The Visual Reproduction subtest asks
353 participants to reproduce four drawings after a brief
354 period of visual exposure and is thought to be closely
355 associated with visual spatial memory. The Logical
356 Memory subtest is a test of verbal memory in which
357 participants hear stories and are then asked to recall as
358 many different units of meaning from those stories. It is a
359 measure of verbal memory.

360 *Wisconsin Card Sorting Test*: (WCST; Heaton et al.,
361 1993) asks participants to sort cards that vary according to
362 shape, color and number of objects depicted. Subjects are
363 told to match cards to “key” cards but are not told the
364 matching principle which changes after 10 correct re-
365 sponses. This study utilized two scores: the total number
366 of categories correct, a score which can range from “0” to
367 “6” which reflects the participant’s ability to grasp, hold
368 and shift when necessary, and the number of perseverative
369 responses which suggest a tendency to have difficulty
370 shifting sets.

371 *Bell-Lysaker Emotional Recognition Task* (BLERT;
372 Bell et al., 1997; Bryson et al., 1997) is a measure of ability
373 to identify affect cues in videotaped stimuli. Participants
374 are presented with videotaped segments and asked to cor-
375 rectly identify two positive affects (happy and surprised)
376 and four negative affects (fearful, angry, disgusted, sad)
377 presented by an actor in three separate vignettes. Scores are
378 available for the number of correctly identified positive
379 affects, ranging from 0 to 6 and negative affects, ranging
380 from 0 to 12. It has excellent categorical stability of
381 measurement over five months ($Kappa=.93$) and has
382 demonstrated discriminant validity among community,
383 substance abuse, and schizophrenia samples.

384 *Positive and Negative Syndrome Scale*: (PANSS; Kay
385 et al., 1987) is a 30 item rating scale completed by
386 clinically trained research staff at the conclusion of chart
387 review and semi-structured interview. Individual items
388 are rated on a “1” to “7” scale with higher scores re-
389 flecting greater psychopathology. For the purposes of
390 this study, five factors derived from a 10 fold cross vali-
391 dation method were utilized: Positive, Negative, Disor-
392 ganization, Excitement and Emotional Discomfort (Van
393 der Gaag et al., 2006). Good to excellent interrater
394 reliability has been found for raters in this study with
395 intraclass correlations ranging from .80 to .92.

396 1.3. Procedures

397 Following informed written consent, diagnoses were
398 determined using the Structured Clinical Interview for
399 the DSM IV (SCID; First et al., 1997). The SCID was

conducted by a clinical psychologist. Next, participants
were given the neurocognitive battery, PANSS, and IPII
as part of a baseline assessment for a study of Cognitive
Behavior Therapy and work outcome. The IPII and
PANSS interviews were conducted by different person-
nel. The IPII interview was audio taped and later tran-
scribed with identifying information removed. Ratings
of the transcripts were made using the MAS with raters
blind to participant identity, test performance, and
symptom ratings. Raters were not present during the
PANSS, or IPII interviews, nor did they transcribe the
audiotapes of the interviews. Raters had a minimum of
a graduate degree in psychology or nursing and were
trained by the first author. A subset of these IPII
transcripts ($n=34$) were previously rated for narrative
content using different procedures and different raters
and has been published elsewhere (Lysaker et al., 2006).

2. Analyses

Analyses were planned in two phases. First we planned
to correlate MAS Understanding one’s own mind and
Decentration scores with symptoms and neurocognitive
test scores. If significant associations were found we
planned to divide participants into three groups on the
basis of whether or not they: a) demonstrated a self-
reflective capacity and b) among those who had basic self-
reflectivity whether or not they also achieved decentra-
tion. Participants were rated on a priori basis as having
basic self-reflective capacity if they obtained scores of “4”
or higher and as not having basic self-reflectivity if their
score was lower than “4” on the Understanding of one’s
own mind scale of the MAS. They were rated on an a
priori basis as having achieved decentration if they
achieved a score of “2” or higher and as not having
achieved decentration if they achieved scores of less than
“2” on the Decentration scale of the MAS. This resulted
in three groups which were labeled: i) minimal self-
reflectivity/not decentered; ii) basic self-reflectivity/not
decentered; and iii) basic self-reflectivity/decentered.
Groups were then compared on background, symptom
and neurocognitive variables.

3. Results

Examination of MAS, symptom and neurocognitive
variables revealed the majority of these were not nor-
mally distributed. To assess whether the MAS Under-
standing of one’s own mind and Decentration scores
were associated with symptoms and neurocognitive
scores, Spearman Rho correlations were, therefore,
calculated. As revealed in Table 1, these indicated higher

t1.1 Table 1
t1.2 Associations of symptoms and neurocognitive assessments with
t1.3 Understanding one's own mind and Decentration scores

t1.3	Assessments	Understanding one's own mind	Decentration
t1.4	PANSS		
t1.5	Positive	0.02	-0.10
t1.6	Negative	-0.27*	-0.08
t1.7	Disorganization	-0.36**	-0.20
t1.8	Excitement	0.02	-0.20
t1.9	Emotional discomfort	0.32**	0.21
t1.10	WAIS III		
t1.11	Arithmetic	0.45**	0.21
t1.12	Vocabulary	0.34**	0.15
t1.13	Block design	0.27*	0.20
t1.14	Digit symbol	0.24	0.17
t1.15	WMS III		
t1.16	Visual reproduction	0.26*	0.34**
t1.17	Logical memory	0.18	0.16
t1.18	WCST		
t1.19	Correct categories	0.32**	0.12
t1.20	Perseverative responses	-0.29*	-0.20
t1.21	BLERT		
t1.22	Positive emotions	0.14	0.14
t1.23	Negative emotions	0.44**	0.26*

t1.24 Spearman rho correlations* $p < .05$; ** $p < .01$.

448 levels of Understanding of one's own mind were linked
449 to better performance on the WCST, BLERT, Visual
450 Reproduction on the WMS III, and Arithmetic Vocabu-
451 lary, and Block Design subtests of the WAIS III. Greater
452 levels of Understanding one's own mind were also
453 linked to less severe Negative and Disorganization
454 symptoms and higher levels of Emotional Discomfort.

Higher levels of Decentration were linked to better
performance on the BLERT and the Visual reproduction
on the WMS III.

Given the existence of linear relationships partici-
pants were next classified according to our a priori
scheme. This revealed 25 participants did not achieve
basic (labeled as minimal) self-reflectivity or decentra-
tion, 33 achieved basic self-reflectivity but not decentra-
tion and 11 achieved both decentration and basic self-
reflectivity. Chi Square analyses revealed groups did not
differ according to diagnosis, gender or recruitment site
(VA vs. CMHC). As revealed in Table 2, groups did not
differ on age, education, parents' highest level of
education or hospitalization history. The two groups
classified as not decentered did not differ on MAS
decentration score. The basic self-reflectivity/decentered
group had higher scores on the MAS Understanding of
one's own mind subscale relative to the other groups.

Given that some symptoms and neurocognition scores
were not normally distributed, all were transformed into Z
scores with normal distributions. MANOVA and ANOVA
were then conducted comparing groups on the normalized
scores. The raw untransformed scores and the results of
the group comparisons are presented in Tables 2 and 3. As
revealed in Table 2, the minimal self-reflectivity/not de-
centered group had more severe disorganization symp-
toms than either other group and more severe negative
symptoms than the basic self-reflectivity/not decentered
group. The basic self-reflectivity/decentered group had
more symptoms of emotional discomfort than the mini-
mal self-reflectivity/not decentered group. There were no

t2.1 Table 2
t2.2 Background characteristics of groups varying on the presence or absence of basic self-reflectivity and decentration ($n=69$)

t2.3		Group 1	Group 2	Group 3	F	Post hoc comparisons
t2.4		Minimal reflectivity	Basic reflectivity	Basic reflectivity		$p < .05$
t2.5		Not decentered	Not decentered	($n=11$)		
t2.6		($n=25$)	($n=33$)			
t2.7	Age	46.60 (11.35)	46.73 (10.10)	46.73 (7.64)	0.01	
t2.8	Education	11.96 (2.32)	13.21 (2.71)	12.73 (1.55)	1.89	
t2.9	Parents highest level of education	12.20 (2.65)	12.82 (2.37)	12.64 (2.66)	0.44	
t2.10	Lifetime psychiatric hospitalizations	4.76 (4.82)	5.45 (6.22)	9.91 (7.31)	3.06	
t2.11	Age of first hospitalization	24.10 (6.97)	28.87 (10.82)	27.45 (9.59)	1.54	
t2.12	MAS					
t2.13	Understanding one's own mind	2.84 (0.47)	4.18 (0.53)	5.91 (0.83)	116.50**	3 > 2 > 1
t2.14	Decentration	0.08 (0.28)	0.33 (0.53)	2.09 (0.54)	77.67**	3 > 1 > 2
t2.15	PANSS					
t2.16	Positive	12.80 (4.10)	13.91 (4.65)	13.27 (3.82)	0.73	
t2.17	Negative	21.08 (4.62)	17.57 (4.54)	18.91 (3.80)	4.23**	2 < 1
t2.18	Disorganization	13.60 (4.12)	11.45 (3.11)	10.81 (3.68)	3.63*	2, 3 > 1
t2.19	Excitement	6.92 (2.63)	7.61 (2.72)	7.09 (2.98)	0.45	
t2.20	Emotional discomfort	10.64 (3.90)	12.61 (3.65)	14.45 (3.56)	4.25**	3 > 1

t2.21 * $p < .05$; ** $p < .01$.

t3.1 Table 3

t3.2 Comparisons of performance on neurocognition among groups varying on the presence or absence of basic self-reflectivity and decentration ($n=69$)

t3.3 Neurocognitive assessments	Group 1	Group 2	Group 3	F^a	Post hoc comparisons
t3.4	Minimal reflectivity	Basic reflectivity	Basic reflectivity		$p < .05$
t3.5	Not decentered	Not decentered	Decentered		
t3.6	($n=25$)	($n=33$)	($n=11$)		
t3.7	WAIS III				
t3.8	Arithmetic	8.00 (2.92)	8.36 (1.91)	8.61**	3, 2 > 1
t3.9	Vocabulary	6.04 (2.54)	7.33 (3.33)	3.32*	3 > 1
t3.10	Block design	6.92 (2.16)	7.61 (2.72)	3.19*	3 > 1
t3.11	Digit symbol	5.44 (1.83)	6.36 (1.93)	2.47	
t3.12	WMS III				
t3.13	Visual reproduction	5.20 (3.54)	5.45 (3.43)	4.57*	3 > 1, 2
t3.14	Logical memory	5.20 (3.53)	6.48 (3.87)	1.24	
t3.15	WCST				
t3.16	Correct categories	2.44 (2.36)	4.12 (2.04)	6.19**	3, 2 > 1
t3.17	Perseverative responses	52.36 (38.24)	30.82 (20.41)	5.60**	3, 2 > 1
t3.18	BLERT				
t3.19	Positive emotions	4.00 (1.15)	4.33 (1.21)	0.82	
t3.20	Negative emotions	4.80 (2.61)	6.70 (2.30)	5.97**	3, 2 > 1

t3.21 * $p < .05$; ** $p < .01$.t3.22 ^a MANOVA; Wilks Lambda $F=2.08$, $p=.014$; Given not all test scores were normally distributed, scores were converted into normalized scores and then subjected to analyses.

486 differences in overall Positive or Excitement symptoms.
 487 MANOVA and individual ANOVA comparing all three
 488 groups on the normalized scores on a battery of neuro-
 489 cognitive testing are presented in Table 3. These analyses
 490 revealed that the achievement of basic self-reflectivity
 491 was related to better performance on the Wisconsin Card
 492 Sorting Test, better recognition of negative emotions on
 493 the BLERT and better performance on the WAIS III
 494 Arithmetic subtest, while the achievement of decentration
 495 was linked to better performance on the Visual reproduc-
 496 tion subtest of the WMS III. The basic self-reflectivity/
 497 decentered group also had better performance on the
 498 Vocabulary and Block Design Subtest than the minimal
 499 reflectivity group.

500 4. Discussion

501 Results suggest that when metacognition is assessed
 502 within personal narratives gathered using a semi-struct-
 503 ured interview, many with schizophrenia spectrum
 504 disorders experience significant deficits in at least two
 505 semi independent domains of metacognition. Fifty
 506 eight of 68 participants (85%) demonstrated impair-
 507 ments in the ability to see the world in a decentered
 508 manner, that is, as involving others who have their own
 509 unique thoughts, feelings and perspectives. Twenty
 510 five of those 58 (37%) had an additional deficit in the
 511 ability to recognize and distinguish their own feelings.
 512 Only 11 (15%) participants in this sample demonstrat-

ed both an ability to be able to see the world as
 involving others who have their own unique thoughts,
 feelings and perspectives and an ability to recognize
 and distinguish their own feelings. The basic reflectiv-
 ity/decentered participants demonstrated greater over-
 all levels of awareness of their own mind suggesting
 that not only were they able to distinguish their own
 feelings but also to see their constructions of the world
 as subjective and that their expectations, thoughts and
 desires had limited impact on reality.

When compared on symptoms level and neurocog-
 nitive test performance, participants unable to identi-
 fy their feelings performed more poorly on WAIS III
 Arithmetic subtest (a test of working memory), made
 more perseverative responses and achieved fewer cate-
 gories on the WCST. They also demonstrated more
 disorganization symptoms relative to participants able
 to identify their own feelings. One possible interpreta-
 tion is that difficulties distinguishing internal states in
 schizophrenia can emerge when persons have greater
 difficulties holding abstract matters in mind and then
 shifting fluidly from one abstract concept to another.
 When compared on a test of the ability to recognize
 emotions in others, participants unable to identify their
 own feelings had greater difficulties recognizing nega-
 tive but not positive emotions. One possible interpre-
 tation here is that human beings need the ability to
 recognize emotions in themselves in order to be able to
 recognize emotions in the expressions and voices of

542 others. When this ability is compromised in schizohre- 594
543 nia, persons may lose the ability to detect emotions in 595
544 others and manifest negative symptoms (Salvatore 596
545 et al., in press). This finding appears to be theoretically 597
546 consistent with a simulation theory of mindreading 598
547 (Gallese and Goldman, 1998) and studies by Corcoran 599
548 and Frith (2003, 2005) which reported that performance 600
549 on theory of mind tasks predicted impoverished 601
550 autobiographical accounts among persons with schizo- 602
551 phrenia. It is also consistent with an fMRI study which 603
552 suggested activities related to self-reflection were 604
553 necessary to infer the mental states of others for persons 605
554 without neurological illness (Mitchell et al., 2005). 606

555 Beyond this, participants able to both distinguish their 607
556 thoughts and feelings and to see the world in a de- 608
557 centered manner had superior performance on a test of 609
558 visual memory compared with non-decentered partici- 610
559 pants, regardless of whether or not the non-decentered 611
560 participants had achieved basic self-reflectivity. This 612
561 could suggest whereas flexibility in abstract thought aids 613
562 in self awareness, the ability to see that others have their 614
563 unique views requires relatively intact visual memory, 615
564 perhaps to be able to represent social relations in a com- 616
565 plex spatial manner. The lack of a difference in BLERT 617
566 performance between the decentered group and the non- 618
567 decentered groups may also suggest that the failure to 619
568 make sense of others' relationships with one another is 620
569 more than a matter of merely being unable to decipher 621
570 others' emotions. Such assertions are consistent with the 622
571 Frith and Vignemont (2005) observation that the 623
572 egocentrism in Asperger's syndrome may result from 624
573 an inability to form representations of others as having 625
574 a relation to one another which is fully independent of their 626
575 relationship to oneself. 627

576 Thus, study predictions were only partially con- 628
577 firmed. Participants with deficits in both self-reflectiv- 629
578 ity and decenteration generally had the poorest levels 630
579 neurocognitive function, demonstrating lower scores 631
580 on 7 of the 10 tests than the group with neither deficit. 632
581 The group with two deficits though had lower scores on 633
582 only 4 of 10 tests than the group with only a deficit in 634
583 decenteration. The group with no deficits also only 635
584 demonstrated better neurocognitive performance on 636
585 only one test relative to the groups with a deficit in only 637
586 decenteration. 638

587 Of note, the correlational nature of this study pre- 639
588 cludes drawing any firm conclusions and thus all inter- 640
589 pretations of the observed relationships are intended as 641
590 speculative and a possible basis for hypotheses for future 642
591 study. Furthermore, there are alternative hypotheses that 643
592 cannot be ruled out. First, it is possible that different 644
593 neurocognitive deficits in schizophrenia are in part the 645

result of different forms of metacognitive deficits. 594
Perhaps different metacognitive dysfunctions interact 595
with each other to generate neurocognitive dysfunctions 596
or possibly deficits in neurocognition and metacognition 597
magnify one another in the manner of a vicious cycle. It 598
is also possible that relationships observed here were the 599
products of other biological or socio-cultural variables 600
not measured. 601

Results may have implications for the study of meta- 602
cognition in general. The findings are consistent with 603
assertions that metacognition is not a unidimensional 604
capacity, but is composed of semi independent functions 605
possibly related to different aspects of brain function. 606
Results also point to the possibility that different types of 607
cortical dysfunction may interact with one another re- 608
sulting in complex metacognitive dysfunction. For ex- 609
ample, as hypothesized above, impairments in visual 610
memory may limit the ability of persons with schizo- 611
phrenia to see the world in a decentered manner and if 612
there are additional deficits in working memory, an 613
inability to distinguish one's own thoughts may also 614
emerge. As only persons with schizophrenia spectrum 615
disorder were studied here, a natural next step is to ex- 616
plore whether similar findings are found in other groups 617
with metacognitive deficits. 618

Of note there were several unexpected findings. 619
Groups did not differ in processing speed or positive 620
symptoms. This may suggest that the influence of these 621
capacities and symptoms on metacognition is more sub- 622
tle or possibly not related to the specific metacognitive 623
tasks measured here. It was also surprising that the 624
minimal self-reflectivity/not decentered group had more 625
severe negative symptoms than the basic self-reflectiv- 626
ity/not decentered group but not the basic self-reflectiv- 627
ity/decentered group. This may suggest there are two 628
different paths to negative symptoms: one with deficits 629
in metacognition and neurocognition leading to lack of 630
interest and withdrawal and another in which persons 631
with greater awareness of themselves and others choose 632
to withdraw as an adaptive response. This is consistent 633
with the results of phenomenological research suggest- 634
ing some persons "positively" withdraw to sustain health 635
because of discomfort with the social order (Corin, 636
1998), an assertion supported by the finding here that 637
the basic self-reflectivity/decentered group had higher 638
levels of emotional discomfort than the minimal self- 639
reflectivity group. The observation is also consistent 640
with emerging models suggesting the independence of 641
these symptom domains (Harvey et al., 2006). The 642
finding that only the basic self-reflectivity/decentered 643
and minimal self-reflectivity groups differed from one 644
another on verbal function and visual spatial reasoning 645

646 may suggest that general deficits or lack of deficits in
 647 general intellectual ability play a role in the extreme
 648 absence or general presence of metacognitive capacities.
 649 Importantly there are several limitations. As noted
 650 above, the correlational nature of this study precludes
 651 drawing any conclusions regarding causality. Generaliza-
 652 tion of findings also is limited by sample composition.
 653 Participants were mostly persons in their 40's, all of
 654 whom were involved in treatment. It may well be that a
 655 different relationship exists between neurocognition and
 656 metacognition among younger persons with schizophre-
 657 nia, or in particular, persons who decline treatment. We
 658 additionally examined only two of many possible com-
 659 binations of metacognitive capacity in schizophrenia and
 660 more study is called for exploring a wide range of other
 661 possible patterns of deficit. Thus, more research is nec-
 662 essary which involves the collection of data at multiple
 663 time points using broader samples which explores other
 664 aspects of neurocognition and metacognition. Further-
 665 more, without studying persons with other disorders, it
 666 also remains unclear whether or not the results observed
 667 here apply to persons with other conditions.

668 With replication these findings may finally have sev-
 669 eral clinical implications. First rehabilitative and psycho-
 670 logical interventions may need to take into account that
 671 persons may experience multiple and unique patterns of
 672 metacognitive deficits which may need to be addressed in
 673 a particular order and call for different techniques. This is
 674 consistent with case reports (Lysaker et al., 2005; Lysaker
 675 and Hermans, 2007) in which patients over the course of
 676 years in psychotherapy first achieved awareness of their
 677 own thoughts and feelings and then later developed a
 678 sense of others as having independent relationships with
 679 one another. Considered in the light of this study, it may be
 680 that persons with schizophrenia who have limited self
 681 awareness and who cannot perceive the independent
 682 relationships others have with one another must first
 683 achieve basic self-reflectivity before achieving a larger
 684 non-egocentric sense of the world. This is also consistent
 685 with recent rehabilitative models of coping which suggest
 686 that the ability to personally make meaning of one's own
 687 illness comes only after persons become more able to
 688 distinguish their own thoughts and feelings from the
 689 symptoms of mental illness and social stereotypes (Roe,
 690 2001; Roe et al., 2006). It is also notable that the greatest
 691 levels of metacognition were linked to the greatest levels
 692 of distress relative to the poorest levels of metacognition.
 693 This may suggest the need for emerging treatments to take
 694 into account that achievement of recovery from schizo-
 695 phrenia for many may be a painful process which requires
 696 the processing of pain that emerges with greater clarity
 697 of thought.

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