METACOGNITION ASSESSMENT INTERVIEW: INSTRUMENT DESCRIPTION AND FACTOR STRUCTURE

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Abstract

Objective: Metacognition is a multi-component psychological construct, characterised by the ability to identify and describe one's own mental states and those of others. Evidence has been found for an association between deficits in metacognitive abilities and poor social functioning, low quality of life, psychopathology, and symptoms in Personality Disorders (PDs). However, to date, there are few psychometrically validated instruments available for assessing the different components of metacognition. A semi-structured interview, the Metacognition Assessment Interview (MAI), has been developed to evaluate different domains of metacognition. In the present study, we investigated the psychometric properties of the MAI in an outpatient clinical sample.

Method: The MAI was administered to a clinical population of 306 outpatients attending a private clinical centre. Exploratory factor analysis, confirmatory factor analysis and correlation with instruments assessing alexithymia and interpersonal problems were carried out to examine the dimensionality and validity of the MAI.

Result: Explorative and confirmatory factor analyses revealed a good fit for both a two-factor model and a four-factor model of metacognition. The two-factor model yielded two main dimensions, which we named: Self domain, defined as self-reflection, and Other domain, defined as critical distancing from one's own mental state and that of others. The four-factor solution is composed of four sub-domains: monitoring, integration, differentiation and decentration. Moreover, the MAI showed good convergent validity, with significant correlations with both alexithymia and interpersonal problems.

Conclusions: These results confirm that the MAI is a reliable instrument for measuring metacognition and its different sub-domains. In particular, the MAI represents a useful and flexible instrument for the assessment of metacognition impairments in different psychopathologies and it can provide useful indications for the focus of psychotherapy treatment.

Key words: metacognition, psychotherapy, personality disorders, mind-reading, assessment

Declaration of interest: The authors have nothing to disclose. This manuscript contains no actual or potential conflict of interest on the part of any of its authors

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Introduction

Metacognition has been defined as 'a set of skills which allow people to identify mental states, reasoning about them, and ascribing them to themselves and others, in order to regulate own mental state and interpersonal relationship' (Semerari et al. 2012). This definition highlights how metacognition is a multi-component ability that enables us to comprehend our own mental states, as well as that of others. Conversely, Wells (2000) used the same term to refer to a set of beliefs about one's own mental state that regulates attention processes and may be a contributing factor in the maintenance of dysfunctional processes, such as rumination.

According to Semerari and colleagues (2007), metacognition refers to the ability to understand mental states and it partially overlaps the concept of mentalisation Bateman and Fonagy (2004) introduced. The principal difference between these two models is that mentalisation is viewed as a unidimensional function (Fonagy et al. 1998), while Semerari and colleagues (2007, 2012) considered metacognition as a multi-component function, in which single components can be selectively impaired. Currently, metacognition is considered crucial in several areas of psychopathology (Dimaggio and Lysaker 2010, Gumley 2011).

An impaired understanding of one's own and other's mental contents and processes seem to interfere with the development of an integrated and stable self-

Submitted Semptember 2015, Accepted December 2015

representation and with the creation of positive and long lasting relationships (Dimaggio et al. 2007a, Jørgensen 2010). In persons with schizophrenia, metacognitive deterioration is strongly associated with diminished social skills and with neuropsychological and executive functions deficits (Lysaker et al. 2008, 2011a, 2011b). Emotional awareness, which is a basic component of metacognitive abilities, has been found to be poor in many personality disorders (Nicolò et al. 2011), and is significantly related to a wide number of clinical variables, such as poor engagement in psychotherapy (Ogrodniczuk et al. 2005, 2011), higher frequency of somatic complaints in depression (Vanheule et al. 2007) and somatoform disorders (Pedrosa Gil et al. 2008).

Overall, metacognitive impairments have been described in patients with personality disorders (PDs) (Semerari et al. 2005, Dimaggio et al. 2009, Carcione et al. 2011), and they have been hypothesised to play a crucial role in the genesis and maintenance of PDs (Bateman and Fonagy 2004, Dimaggio et al. 2007b, Dimaggio and Lysaker 2010). Poor metacognition has been globally linked with the severity of the PDs (Semerari et al. 2014) and with a cold, distant and non-assertive personality style (Spitzer et al. 2005, Inslegers et al. 2012).

In contrast, high metacognitive capacities have been associated with greater emotional regulation skills and a better capacity to create stable interpersonal relationships (Bender et al. 2011). Due to the clinical relevance of the metacognition construct, there is increasing awareness about the need for reliable metacognition assessment tools. The aim of the present study is to proceed with the psychometric validation of a new instrument named the MAI (Metacognition Assessment Interview), recently developed by Semerari et al. (2012) in order to assess metacognition and its sub-functions. Semerari and colleagues (2012) validated the MAI in a sample of 175 non-clinical adults. The results showed two factors structure of the MAI: Self domain and Other domain.

The Self domain refers to self-reflective mindreading abilities and includes two sub-functions: monitoring and integration. Monitoring is the ability to identify and label the components of one's own mental states in terms of emotions, thoughts, motivations and desires. Since the construct of alexithymia refers to the ability to recognise and label emotions, monitoring impairment partially overlaps with this concept (Bagby et al. 1994). Integration refers to a more complex capacity of reflecting upon different individuals' mental states, identifying internal contradictions, conflicts and the rules typically triggering transitions among different states of mind (Semerari et al. 2105). These abilities allow us to sustain goal-oriented and coherent behaviour and maintain a stable sense of identity. Integration impairments overlaps, in part, with the concept of non-integration of Self and Other representations, described in borderline personality disorder (BPD) (Ryle 1997, Kernberg 1975).

The Other domain refers to the ability to assume a critical distance from one's thoughts and includes two metacognitive components: differentiation and decentration. Differentiation indicates the ability to recognise the representational nature of mental states, clearly distinguishing between internal psychological contents and external reality. Impairments in differentiation correspond to the '*equivalent mode*' in BPD, described by Bateman and Fonagy (2004). This refers to a state in which fantasies are taken as real. This capacity to recognise the subjectivity of mental representations, and therefore, to take critical distance from our own representations, is fundamental for emotional regulation. Decentration refers to the ability of taking on others' perspectives in order to understand their intentions, thoughts and desires, independently from one's own personal point of view. Decentration is thus closely related to the concept of theory of mind (Premack and Woodruff 1978). As we noted in a previous study conducted on a community sample, psychometric properties for the MAI were satisfying. However, replication in a treatment-seeking sample of adults suffering from significant psychopathology is still needed (Semerari et al. 2012). The current study is therefore based on data collected from a treatment-seeking population.

Our specific hypotheses are as follows:

a) Consistent with the previous study, the MAI has a two-factor structure with two separate domains: the Self domain and Other domain of metacognitive abilities.
b) These two higher factors are comprised of two sub-functions, respectively: monitoring, integration in the Self domain, and differentiation and decentration in the Other domain.
c) The Self domain is specifically associated with alexithymia or a lack of emotional awareness.
d) The Other domain is correlated with interpersonal difficulties.

Table 1. *Demographic characteristics and percentage of diagnostic characteristics in the two groups: Axis I diagnosis and Axis II diagnostic comorbidity for PD*

	N	Sex	Age
PD	198	95M/103F	34(10.72) range (18–70)
NPD	108	46M/62F	36(10.29) range (18–72)

	Percentage of Axis I diagnosis				
	Anxiety disorders	Mood disorders	Eating disorders	Dissociative disorders	Other
NPD	46.29	36.11	7.4	–	10.18
PD	43.21	32.66	7.53	7.03	9.54

	Percentage of Axis II diagnostic comorbidity for PD										
	AV	DEP	OC	PA	DE	PAR	ST	SZ	HIS	NAR	BDL
	2.01	1.50	2.51	8.54	15.07	5.52	2.51	1.00	3.01	3.51	6.03

Note. PD = Personality Disorder; NPD = No Personality Disorder; Other = Axis I disorders not included in the Anxiety, Mood, Eating and Dissociative Disorders; AV= Avoidant PD; DEP= Dependent PD; OC= Obsessive-Compulsive PD; PA= Passive-Aggressive PD; DE= Depressive PD; PA= Paranoid PD; ST= Schizotypal PD; SZ= Schizoid PD; HIS= Histrionic PD; NA= Narcissistic PD; BDL= Borderline PD.

Methods

Participants

The participants were 306 adult patients requiring treatment or consultation in an Italian private setting from 2009 to 2012. The mean age was 34.72 (*SD* = 10.67), ranging from age 18 to 72 years. One hundred and forty-one (46.07%) were male and 165 (53.92%) were female. Exclusion criteria were the presence of neurological disorders, schizophrenia and active psychotic disorders, and current substance dependence (see **table 1**). Each patient was asked to give written informed consent, both for participation in the study and for data publication. The local institutional ethics committee approved the protocol.

Measures

Metacognition Assessment Interview (MAI)

The MAI is a semi-structured interview evaluating different capacities of understanding mental states, both in the Self and in the Other domains. The Self and Other domains are comprised of two sub-functions, as previously described: monitoring and integration for the Self, and differentiation and decentration for the Other. During the interview, the participant is asked to narrate the most troubling interpersonal experience from the previous six months, a time frame selected in order to facilitate recall and permit test–retest, avoiding recalling biases, in the evaluation of changes during psychotherapy. The reported experience must be autobiographical and involve at least one other person, preferably one close to the interviewed, in order to assess the ability to understand others' mental states.

Once the narrative episode is completed, the interviewer asks a list of questions, divided into four modules, to elicit and evaluate 16 facets, which are supposed to constitute the metacognitive sub-functions (four facets for each sub-function; see **table 2**). The interviewer assigns a score ranging from one to five to each of the 16 basic facets, based on a Likert scale (see **table 2** for score details). An example of interviewer questions designed to stimulate the Self domain are: 'How do you feel?' and 'What do you think?' for monitoring, and 'Do you often feel/think/behave like this?' for integration. Examples of interviewer's questions stimulating the Other domain are: 'Did you take into consideration any alternative interpretations of what was happening?' to elicit differentiation and 'How did you think the other person would react emotionally to what was happening?' or 'What do you think he/she was thinking?' to elicit the decentering ability.

Table 2. *MAI facets and scoring*

Monitoring		
1)	The ability to recognise one's own representations (thoughts and beliefs)	1 2 3 4 5
2)	The ability to recognise and verbalise one's own emotions	1 2 3 4 5
3)	The ability to establish relations among the separate components of a mental state	1 2 3 4 5
4)	The ability to establish relations between the components of mental states and behaviour	1 2 3 4 5
	TOT	
Integrating		
1)	The ability to describe understandable and coherent links among thoughts, events, actions and behaviours	1 2 3 4 5
2)	The ability to describe transitions between different mental states and explain the reasons why	1 2 3 4 5
3)	The ability to form generalised representations of his/her mental functioning, taking into account continuity over time of patterns of thinking and feeling	1 2 3 4 5
4)	The ability to reconstruct and describe to the interviewer one's own mental functioning, providing enough information, without giving irrelevant and out-of-focus details, and giving a sense of order and coherence to the discourse	1 2 3 4 5
	TOT	
Differentiation		
1)	The ability to consider one's own representation of the world as subjective and questionable	1 2 3 4 5
2)	The ability to give plausible interpretations of events	1 2 3 4 5
3)	The ability to reflect on and evaluate events (as opposed to a tendency to act impulsively)	1 2 3 4 5
4)	The ability to distinguish between different modes of thought such as dreaming, fantasising and imagining	1 2 3 4 5
	TOT	
Decentration		
1)	The ability to recognise, define and verbalise other people's emotional inner state	1 2 3 4 5
2)	The ability to recognise, define and verbalise other people's cognitive inner state	1 2 3 4 5
3)	The ability to establish relations among the separate components of others' mental state	1 2 3 4 5
4)	The ability to establish relations between the components of others' mental state and their behaviour	1 2 3 4 5
	TOT	

The Structured Clinical Interview for DSM-IV.

The DSM-IV Axis I and II diagnoses were obtained using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First, Spitzer, Gibbon, & Williams 1997a) and the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID- II; First, Spitzer, Gibbon & Williams 1997b), respectively.

Toronto Alexithymia Scale (TAS)

The TAS (Bagby et al. 1994) is a 20-item questionnaire that assesses alexithymia. It consists of three subscales: difficulty identifying feelings, difficulty describing feelings, and an externally oriented (or concrete) thinking style. The TAS is the most widely used and reliable measure of alexithymia.

Inventory of Interpersonal Problems (IIP)

The Inventory of Interpersonal Problems (Pilkonis et al. 1996, Italian version: Ubbiali et al. 2011) is a 47-item self-report scale that assesses interpersonal problems. It yields five subscales: interpersonal sensitivity, interpersonal ambivalence, aggression, need for social approval, and lack of sociability.

Analysis

In order to evaluate reliability, the MAI three senior interviewers that were blinded to the clinical diagnosis administered, coded and scored the MAI. All raters had a minimum of at least five years (with an average of 12.5) in CBT clinical practice. A preliminary inter-rater reliability evaluation was carried out on 20 subjects' interviews [error margin = 22.36% and coefficient of variation = 66.6% (Gwet 2012)], randomly selected from our database. To estimate the correlation of every single facet rated by the different judges, the Intraclass Correlation Coefficient (ICC) was used. A two-way mixed absolute agreement model was applied to carry out the ICC for each dimension of the MAI. Additionally, the internal consistency of the scales was calculated using Cronbach's alphas. Two explorative factorial analyses (EFA) were conducted in order to assess the MAI's structural validity relative to both hypothesised solutions: one with two factors (Self and Other domains) and one with four factors (monitoring, integration, differentiation and decentration). A Confirmatory Factorial Analysis (CFA) technique was used in order to analyse a priori theoretical models, specifying the numbers of factors and their correspondence with the indicator.

On the basis of the results of the explorative factor analysis, a number of different models were examined that could fit the matrix of the 16 items of the interview and could be considered conceptually and theoretically plausible. In particular, we considered three competitive models: a) a one-factor model with Metacognition as a single, global dimension; b) a first-order factor model with two factors mutually correlated: Self and Other; c) a first-order factor model with four factors mutually correlated: monitoring, integration, differentiation and decentration. Multiple statistical fit indices were used to determine the degree to which the sample variance–covariance data fit the structural equation model: absolute fit indices (Chi Square/d.f. ratio and Goodness of Fit Index [GFI]), incremental fit indices (Comparative Fit Index [CFI] and Normed Fit Index [NFI]), non-centrality based index (Root Mean Square Error of Approximation [RMSEA]) and a comparative index (Akaike Information Criterion [AIC]). Since the tested models differ in the number of latent variables, we used an AIC measure to compare them.

According to statistical criteria reported elsewhere by different authors, a good fitting model produces consistent results on many different indices (Ullman 1996, Netemeyer et al. 2004, Kline 2010). The total sample (N = 306) was randomly divided into two split-half samples (n = 153); in the first group, an EFA was conducted and in the second group, a CFA. Since non-normality of distribution might affect Structural Equation Model statistics, the normality of observed variables was also assessed (Kline 2010). Finally, a correlational analysis was carried out between the MAI (the whole sample) and the TAS and IIP scores in order to investigate convergent validity and construct relationships. SPSS 20 (Mac version) software was used for data entering, coding and EFA; Amos 20 (Windows version) was used for CFA.

Results

Inter-rater reliability

The Intraclass Correlation Coefficients of the different MAI functions ranged from .55 to .72 for monitoring, .50 to .67 for integration,.49 to 78 for differentiation, and.45 to .61 for decentration. All analyses were significant, with $p < .001$, and showed good inter-rater reliability.

Reliability

The reliability of the scales was assessed according to internal consistency using Cronbach's alphas. Cronbach's alpha was .90 for the Self domain (eight items), .91 for the Other domain (eight items), .88 for monitoring (four items), .83 for integration (four items), .79 for differentiation (four items) and .90 for decentration (four items).

Factorial analysis

The KMO test and the Bartlett's test of sphericity were conducted to assess whether the data were suitable for factor analysis. Both suggested that factor analysis was appropriate: KMO was greater than .70 (KMO = .92) and Bartlett's test had a significance level (p) less than .01. The visual inspection of the scree plot and the eigenvalue greater than one suggested that up to four factors could be extracted. In particular, the first two factors explained most of the variance (57.39%), compared to the third and fourth factors (12.65%). According to our hypothesis, we first extracted two factors before then extracting four factors. The pattern matrix of the factor loadings, representing the different model solutions, is presented in **tables 3** and **4**.

An oblique rotation was chosen with the intent of allowing factors to correlate freely. To this regard, the correlations between factors ranged from .3 to .67, confirming the substantial relationship between the different factors. In the interpretation and labelling of the factors, items were included as a factor if the item loading was above .30 and the secondary loadings differed by at least .10. In both solutions, all items loaded on the expected factor. In the first solution, the only exceptions were facet 2 of integration ('The ability to

describe transitions between different mental states and to explain the reasons why'), facet 4 of integration ('The ability to reconstruct and describe to the interviewer one's own mental functioning, providing enough information, without giving irrelevant and out-of-focus details, and giving a sense of order and coherence to the discourse') and facet 4 of differentiation ('The ability to distinguish between different modes of thought such as dreaming, fantasising and imagining'). These three items are ambiguous, loading onto both the Self and the Other factors (the first .37 and .38, the second .46 and .32, and the third .32 and .33). In the second solution, facet 4 of differentiation ('The ability to distinguish between different modes of thought such as dreaming, fantasising and imagining') loaded onto the integration factor, whereas item 1 of differentiation ('The ability to consider one's own representation of the world as subjective and questionable') appeared complex, loading onto decentration (.43) and differentiation (.42).

Table 3. *Factor Analysis of the 16 facets: Two-factor solution*

	SELF	OTHER
MON4	.877	–
MON2	.843	–
MON3	.686	–
MON1	.618	–
INT1	.581	–
INT3	.572	–
INT4	.460	.327
DEC3	–	.931
DEC4	–	.853
DEC2	–	.719
DEC1	–	.676
DIF1	–	.656
DIF2	.346	.435
DIF3	–	.383
INT2	.373	.382
DIF4	.320	.333

Note. Extraction: Oblimin Rotation. Factor loadings higher than 0.30 are marked. Self domain includes following facet: MON1 = Monitoring, item 1; MON2 = Monitoring, item 2; MON3 = Monitoring, item 3; MON4 = Monitoring, item 4; INT1 = Integration, item 1; INT2 1= Integration, item 2; INT3 = Integration, item 3; INT4 = Integration, item 4.Other domain includes following facets: DIF1 = Differentiation, item 1; DIF2 = Differentiation, item 2; DIF3 = Differentiation, item 3; DIF4 = Differentiation, item 4; DEC1 = Decentration, item 1; DEC2 = Decentration, item 2; DEC3 = Decentration, item 3; DEC4 = Decentration, item 4.

Table 4. *Factor Analysis of the 16 facets: Four–factor solution*

	INTEGRATION	MONITORING	DECENTRATION	
INT3	.819	–	–	–
INT4	.655	–	–	–
DIF4	.531	–	–	–
INT2	.473	–	–	–
INT1	.427	–	–	–
MON4	–	.854	–	–
MON2	–	.767	–	–
MON1	–	.645	–	–
MON3	.	.450	–	–
DEC3	–	–	.823	–
DEC2	–	–	.789	–
DEC4	–	–	.742	–
DEC1	–	–	.709	–
DIF1	–	–	.433	.426
DIF2	–	–	–	.553
DIF3	–	–	–	.520

Note. Extraction: Oblimin Rotation. Factor loadings higher than 0.30 are marked. INT1 = Integration, item 1; INT2 1= Integration, item 2; INT3 = Integration, item 3; INT4 = Integration, item 4; MON1 = Monitoring, item 1; MON2 = Monitoring, item 2; MON3 = Monitoring, item 3; MON4 = Monitoring, item 4; ; DEC1 = Decentration, item 1; DEC2 = Decentration, item 2; DEC3 = Decentration, item 3; DEC4 = Decentration, item 4 ; DIF1 = Differentiation, item 1; DIF2 = Differentiation, item 2; DIF3 = Differentiation, item 3; DIF4 = Differentiation, item 4.

Confirmatory factor analysis

The data sample was consistent with the assumption of normal distribution, as evidenced by the values of skewness (ranging from -.320 to .435) and kurtosis (ranging from -.943 to .352). Considering the three models, examination of the analysis suggested that not all models appear tenable; specifically models b and c showed better fit indices, but model a did not (see **table 5**). In model a (one-factor model with a global factors: metacognition), the Chi Square/d.f. ratio was consistent with a moderate fit (2.93). The NFI and CFI showed an acceptable fit (.81 and .87 respectively), whereas the RMSEA (.11, ^{p}close-fit H_0 < .05) was inadequate and the GFI (.77) appeared to be just sufficient. The standardised factor loadings revealed moderate-to-good (range = .56–.75) relationships between the latent factors and the MAI items.

In Model b (first-order factor model with two factors mutually correlated: Self and Other), the Chi Square/d.f. ratio was consistent with adequate fit (1.9), as well as were the NFI, CFI (.89 and .94 respectively), RMSEA (.07, ^{p}close-fit H_0 < .05) and GFI (.87). The standardised factor loadings revealed moderate-to-strong (range = .52–.83) relationships between the two latent factors and the MAI items, whereas the pattern of interfactor correlations evidenced a high relationship (.87).

For model c (first-order factor model with four factors mutually correlated: monitoring, integration, differentiation and decentration), all fit indices examined, the Chi Square/d.f. ratio (1.4), NFI (.91), CFI (.97) RMSEA (.06, ^{p}close-fit H_0 > .05) and GFI (.90), were good. The four latent factors and the MAI items were strongly correlated, with standardised factor loadings ranging from .60 to 86; the interfactor correlations values were between .60 and .90. In order to compare the parsimony of the models, we analysed the AIC values of the three models, which were, respectively, 363.07 for model a, 267.83 for model b and 220.52 for model c. Model c, evidencing the lower value, can be considered the better solution.

Table 5. *CFA goodness of fit results for various factor structure models for the 16-item set.*

		Goodness of fit statistics							
Models		χ^2 (d.f.)	χ^2/d.f. ratio	NFI	CFI	RMSEA	^{p}close-fit H_0	GFI	AIC
One-factor model	a	287.37 (98)	2.93	.81	.87	.11	p < .05	.77	363.07
Two-factor models	b	179.83 (92)	1.9	.89	.94	.07	p < .05	.87	267.83
Four-factor models	c	130.85 (91)	1.4	.91	.97	.05	p > .05	.90	220.52

Relationships between the MAI, alexithymia and interpersonal problems

The MAI's Self domain showed significant (p < .01) correlation with the TAS, both with the global score and with its three subscales: difficulties in identifying emotions, describing feelings, and externally oriented thinking. The MAI's Other domain also correlated significantly with the TAS subscales, but to a lesser extent than did the Self domain (see **table 6**). Moreover, the MAI's Self domain showed significant correlation (p <. 01) with the IIP subscales of interpersonal ambivalence and lack of sociability. In contrast, the MAI's Other domain showed significant correlations with all IIP subscales, except for the need for social approval subscales (see **table 6**).

Table 6. *Correlation between the MAI's Self and Other domains and TAS-20 subscales and IIP subscales*

	MAI Self	MAI Others
Difficulties in identifying feelings (TAS)	-.290**	-.261**
Difficulties in describing feelings (TAS)	-.289**	-.192**
External oriented thinking (TAS)	-.267**	-.184**
TAS total score (TAS)	-.356**	-.276**
Interpersonal Sensitivity (IIP)	-.071	-.198**
Interpersonal Ambivalence (IIP)	-.166**	-.205**
Aggression (IIP)	-.109	-.194**
Need for Social Approval (IIP)	-.082	-.109
Lack of Sociability (IIP)	-.230**	-.293**

**p < .01.

Discussion

In this study, the psychometric properties of a clinical tool, the Metacognition Assessment Interview, which measures different aspects of metacognitive abilities in a natural everyday life setting, was tested in a clinical sample. Overall, the MAI showed good psychometric properties that were characterised by a higher inter-rater reliability, internal consistency and a good factorial structure. According to our first hypothesis, the factorial analysis confirmed the two-factor structure of metacognition previously found in a non-clinical sample (Semerari et al. 2012), with two higher-order factors, named the Self domain and the Other domain. Factor 1 (Self domain) included all items related to the monitoring of inner states, with the exception of items 2 and 4 of integration, which saturated on the first and second domain. One possible explanation for item 4 ('The ability to reconstruct and describe to the interviewer one's own mental functioning, providing enough information, without giving irrelevant and out-of-focus details, and giving a sense of order and coherence to the discourse') is that it describes the ability to both detect simple inner states and to evaluate if one's own narrative is understandable by others. With respect to item 2 of integration ('Describes transitions among different mental states and explains the reasons why'), a possible reason is that the item encompassed a general capacity for inference about processes and transitions between mental states. This inferential process is involved both when we think about our own mental states (Self domain) and when we try to explain the mental states of others (Other domain). Factor 2 (Other domain) encompassed all items related to the ability to distance oneself from one's thoughts and understand that others can have different point of views and beliefs.

There were only two problematic items that were complex, loading on the Self domain and on the Other domain: item 2 ('The ability to give plausible interpretations of events') and item 4 ('The ability to distinguish between different modes of thought such as dreaming, fantasising and imagining') of differentiation. Concerning item 2, a person can provide plausible interpretation of events regarding him/herself, as well as the events of other people. With respect to item 4, it describes a general ability to recognise the quality of different mental states in ourselves, just as in others. Therefore, it could be plausible that this ability belongs to the Self domain, as well as to the Other domain.

According to our second hypothesis, the factorial analysis showed that metacognition could also be described as being comprised of four sub-functions: monitoring, integration, differentiation and decentration. All of the MAI items loaded onto the expected factors, except item 4 of differentiation ('He/she is able to distinguish between different modes of thought, such as dreaming, fantasising and imagining') that, contrary to our predictions, loaded onto Factor 1 (integration), in addition to item 1 of differentiation ('The ability to consider one's own representation of the world as subjective and questionable'), which loaded onto both factors 3 and 4 (respectively decentration and differentiation).

Item 4 of differentiation assessed to what extent the interviewee was able to reflect on the nature of his/her own representations, and to make distinctions between his/her personal representations and the real events. In order to make this distinction, a matching between different mental state representations is needed. Hence, these abilities could also be easily considered as overlapping with the capacity of integration. Therefore, the inclusion of this item in the differentiation function may need to be reconsidered. Considering item 1 of differentiation, this facet described awareness that own beliefs may be false. This capacity is performed both on own thoughts and on those of others. Therefore, this can be a reasonable explanation for the fact that item 1 of differentiation loaded both onto the differentiation and onto the decentration sub-domains.

With regards to the confirmatory factorial analysis, all three examined models showed good values of fit, and therefore, they could be tenable. However, model b (first-order factor model with two factors: Self and Other) and model c (first-order factor model: monitoring, integration, differentiation and decentration) were better compared to model a (one-factor model with a global factors: metacognition). Specifically, in analysing the differences between the three models (a, b and c), the NFI, CFI, RMSEA, GFI and AIC indices suggested that model c was more robust than other models. According to our third prediction that the MAI Self domain was related to alexithymia, the data showed a significant correlation with TAS scores, underlying a good convergent validity.

The results showed that TAS partially correlated with factor 2, which belonged to the Other domain. These findings can be explained in light of studies that argued that understanding the mind of the others depends, to a certain degree, on the awareness of one's own mental states (Bird and Viding 2014, Dimaggio et al. 2008, Gazzola et al. 2007). In particular, these studies showed that awareness of our inner states is crucial when we try to answer questions, such as what is going on in another's mind or what is shared and what is different between our mind and another's mind.

Even though the correlations between the Self domain and the TAS were significant, they were in the moderate range. The low values observed make sense given that the MAI's Self domain assessed processes that were more complex than merely emotional awareness assessed by TAS. Indeed, the MAI also assessed the ability to identify one's own beliefs and describe one's own thought processes, which are quite distinct from detecting one's own emotions and communicating them to others.

With regards to the fourth hypothesis that metacognitive impairments in the Other domain are a liability to interpersonal problems, correlations between IIP subscales and the MAI's Other domain were consistent with our predictions. These results fit well with previous findings, which showed that difficulties in differentiation and decentration could predispose individuals to maladaptive social interactions and interpersonal conflicts (Dimaggio et al. 2007a, Semerari et al. 2007). Although we did not specifically predict that impairments in the Self domain were related to interpersonal problems, correlations with lack of sociability and interpersonal problems are not surprising. With limited access to one's own wishes, goals, feelings and motives, connecting with others is more difficult (Lysaker et al. 2010). In particular, individuals with monitoring difficulties do not have easy access to their own mental states relative to those of others. Consequently, uncertainty about the course of a relationship or tendencies to disengage is likely.

In conclusion, the present data showed that the MAI is a promising clinical tool with good psychometric properties, and is able to assess different components of metacognitive abilities. Since the interview was based on the narrative of the most recent and troubling patients' interpersonal experiences, this clinical tool

allows for identifying which metacognitive domains are impaired and hampering the management of the problematic state. Therefore, the clinicians can help the patient to improve the specific metacognitive function that he/she is unable to use in order to cope with the problematic states. The MAI interview may provide a quick and reliable appraisal of patients' metacognitive abilities, which may allow for treatment planning. In particular, therapists' interventions may actually be tailored to the patients' ability levels at each specific moment of therapy (Dimaggio et al. 2012).

Limitations

In spite of the promising findings, this study has a number of limitations. All patients were Caucasian, mostly belonging to a medium–high socio-economic status. Social status, together with ethnicity, might prevent generalisability of our findings. Further investigations, which take into account patients with different socio-economic statuses and studies representing different ethnic groups, are needed.

The MAI assesses real-life interpersonal experiences, which likely varied across respondents. Although we believe that selecting the most troubling interpersonal experiences could be representative of metacognitive functioning, it is reasonable that metacognition could vary with the emotional intensity of the narrated interpersonal experiences. In a future study, to solve this problem, an instrument that asks to the interviewee to evaluate a previous episode could be introduced in order to check for effects of the type of experience on metacognitive level of functioning.

The MAI is just one way to assess mentalistic abilities in patients' narratives. Indeed, there are other methodologies that try to tap the same ability. In particular, metacognition has also been evaluated using a narrative of history of personal illness (Lysaker et al. 2005), a semi-structured interview measuring alexithymia (Bagby 2006), and via interviews on reflective functioning in adult attachment history (Fonagy et al. 1998). Convergent validity with similar instruments is needed, as well as with more ecological laboratory tasks, such as the MASC (Dziobek et al. 2006) or the MSCEIT (Meyer 2003). A further limitation concerns the psychometric properties of the MAI. Results from the CFA have to be considered provisional due to the sample size of our study. In general, the literature suggests that a number above 200 provides sufficient statistical power for data analysis (Hoelter 1983). Finally, additional studies will be required in order to define normative cut-off values for metacognition impairments.

Conclusion

The study of metacognition is mainly approached by examining various aspects of mindreading ability, such as recognising emotions, being able to reflect on mental states in general and recognising the mental states of others. In this study, we showed how the MAI could be considered a useful instrument for exploring the complexity of metacognition through the assessment of different domains and functions. From a clinical perspective, the MAI was confirmed to be a flexible instrument for the assessment of specific profiles of metacognitive impairment in different psychopathologies, and thus may contribute, in clinical settings, to the definition of treatment focus.

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