**The relationship between metacognitive ability, cognitive insight & mood in healthy participants**

*Sally Bramley*

Supervisor: *Professor Anthony David*

March 2013

Word count: 5,990

**ABSTRACT**

**INTRODUCTION** Cognitive insight is the ability to monitor, interpret and modify beliefs and is thought to rely on higher-level metacognitive processes. The Beck Cognitive Insight Scale (BCIS) assesses two dimensions of insight: self-certainty and self-reflectiveness. Despite widening use of this questionnaire there is limited understanding of the factors which account for variation of cognitive insight among the general population. We therefore sought to determine how the BCIS dimensions relate to measures of metacognitive ability, mood and depressive symptoms.

**METHOD** The sample consisted of 43 participants recruited from the general population. Metacognitive ability was assessed by asking participants to make a visual perceptual judgement and subsequently rate their confidence in their choice. Cognitive Insight, explicit mood and depression were measured using standardised self-report scales (BCIS and BDI-II).

**RESULTS** Metacognitive ability was positively correlated with self-certainty but was not significantly associated with self-reflectiveness. Self-certainty had a negative relationship with mean confidence on this task and with self-reflectiveness. Multiple regression analysis revealed BDI-II scores to be a significant predictor of self-reflectiveness.

**CONCLUSION** Results suggest that the relationship between metacognitive ability and cognitive insight is not as straightforward as the theoretical framework would suggest. They also support an association between depressive symptoms and self-reflectiveness.

**TABLE OF CONTENTS**

**Abstract…………………………………………………………...…………… 2**

**1. Introduction………………………………………………………………… 4**

**2. Methods……………………………………………………………………... 10**

2.1. Participants……………….…….………………………..……………. 10

2.2. Design…………………….…….……………………..………………. 11

2.3. Instruments……………………………………………………………. 12

2.4. Quantification of metacognitive ability………………………..……… 15

2.5. Statistical Analyses……………………………………………………. 16

**3. Results…………….………………………………….………...…...……..… 17**

**4. Discussion……………………………………………….………………...… 23**

**References…………………………………………….………………….….…. 32**

**Appendix………………………………………………………….……………. 37**

1. **INTRODUCTION**

Lack of insight is one of the most characteristic features of psychosis (Amador *et al,* 1993), with studies estimating that between 30 and 50% of patients with schizophrenia are unaware they have a mental disorder (Baier, 2010). One possible explanation for the variation in this estimate is the inconsistency of definitions used to define insight (Shwartz, 1998). Traditional definitions of insight have primarily focused on the patient’s awareness of having a mental illness and the need for treatment. However, there is now a general agreement that insight is a multidimensional concept occurring in a continuum, rather than a unimodal characteristic (Surguladze & David, 1990). Consequently, the patient’s ability to re-label particular signs and symptoms as pathological and their understanding of the social consequences of the disorder are important considerations (Amador & David, 1998).

Although clinical insight scales are useful in the treatment of psychotic illness and in formulating its prognosis (David *et al,* 1995), they do not consider the underlying cognitive impairments which may account for poor insight. To address this, in 2004 Beck introduced the concept of cognitive insight. This refers to a person’s ability to understand, evaluate and amend his or her own reasoning processes and beliefs. Consequently, greater cognitive insight is thought to be protective against psychotic delusions as it allows correction of misinterpretations (Warman *et al*, 2007). In contrast, those who are overconfident in their judgements have been found to be more prone to delusions (Huq *et al,* 1988; Warman & Martin, 2006).

In order to address these theoretical propositions, the Beck Cognitive Insight Scale (Beck *et al*, 2004) was developed as a 15-item self-report measure of cognitive insight (Appendix A) which evaluates the aspects of cognitive flexibility that are thought to lead to poor insight. Whilst clinical insight is multidimensional, cognitive insight is considered to have two main dimensions, namely self-certainty (SC) and self-reflectiveness (SR). The six SC items assess overconfidence in one’s own convictions and unwillingness to modify them, whilst the nine SR items assess one’s ability to reflect and openness to feedback.

Overconfidence in one’s beliefs, indicated by a high SC score, is thought to impair the ability to reflect on them. A composite cognitive insight index score (CI), which taps into this broader construct, is therefore calculated by subtracting the SC score from the SR score. The validity of this structure has been confirmed using principle components analyses (PCA) in a number of studies, as well as the reliability of the measure, test-retest stability and the internal consistency of each factor (Uchida *et al,* 2009; Riggs *et al*, 2012). This has been shown by groups using the BCIS is both psychiatric and non-psychiatric subjects (Warman *et al,* 2004; Martin *et al,* 2010).

The majority of studies using the BCIS have been on psychosis, usually in comparison with controls (Riggs *et al*, 2012). As control groups have been found to have higher CI scores than patients, such scores are thought to reflect a greater ability to interpret and modify beliefs and to characterize less impaired patients. This is reflected in the finding that CI is positively correlated with clinical insight in psychosis, although this has not been found on all occasions (Lepage *et* al, 2008; Donohoe *et al,* 2009; Greenberger *et al,* 2010).

 Clinical insight and CI both require self-reflection, hence why they may be co-related. However, whilst clinical insight is a useful diagnostic tool, it is unlikely that a cut-off score of CI to differentiate between patients and controls will be obtainable (Martin *et al*, 2010). The advantages of the BCIS over clinical insight measures are its ability to assess the cognitive abilities underlying self-reflection, evaluation of experiences and erroneous convictions, making it a more appropriate measure for the current study.

The associations between CI and both positive and negative symptoms in psychosis has also produced mixed findings. For example, a number of groups have demonstrated a positive correlation between severity of delusions and SC, whilst its association with SR has been more inconsistent (David *et al*, 2012). In sum, there is substantial individual variation in scores on these measures, to some extent within certain clinical conditions, and so further research is needed to resolve the sources of this variation.

It is thought that deficits in metacognition, often defined as ‘thinking about thinking’, may account for the poor cognitive insight observed in psychosis (Koren *et al*, 2004). Metacognition is the process by which we monitor and control our own cognitive processes, and form complex representations of others or ourselves; it can also include the constructs “Mentalisation” and “Theory of Mind” (Semerari *et al*, 2003). Insight can also be grouped under the larger umbrella term of metacognition and since, like metacognition, it requires self-appraisal, it is likely to be based on similar “higher-level” cognitive processes. Metacognition may be one source of the individual variation described earlier.

Although there is an expanding literature on metacognition and CI in disorders associated with insight deficits, such as schizophrenia (Lysaker *et al*, 2011; Tastet, 2012) and Alzheimer’s disease (Degermenci *et al,* 2013), much less is known about their typical levels in the general population. Studying cognitive insight in healthy participants contributes to a fuller understanding of the factors which either impair of improve it, including how it relates to demographic characteristics such as age and education. Consequently, this was our group of interest for the present study. CI is thought to be dependent on metacognitive processes, but how the dimensions of SC and SR relate to metacognitive ability is uncertain.

The relationship between metacognition and CI has previously been investigated in a study using a metacognitive version of the Wisconsin Card Sorting test (meta-WCST; Bruno *et al,* 2012). In contrast to the conventional WCST, a ‘free-choice’ aspect was introduced whereby subjects could choose whether they wanted their response to count towards their overall score. The meta-WCST is thought to capture metacognitive processes because it requires participants to control and monitor their performance. A negative correlation was reported between SC and two of the indices of metacognitive ability, free-choice improvement and global monitoring. As this trend was observed in a group of psychiatric patients it has limited ability to predict how SC and SR relate to metacognitive accuracy in healthy participants. Nevertheless, since metacognition and cognitive insight are thought to be partially overlapping constructs, we hypothesised that metacognitive accuracy would be associated with higher CI scores.

The present study assessed metacognition by asking participants to make a perceptual judgement and then rate their confidence in their decision after each test item. Individuals have been shown to have varying ability to accurately predict performance on such tasks, reflecting individual differences in metacognitive ability (Fleming & Dolan, 2012). This has been found to remain stable across different perceptual tasks (Song *et al,* 2011). Metacognitive ability can be dissociated from objective task performance, and subjective confidence, to produce a quantitative measure. To obtain this measure, type 2 receiver-operating characteristic (ROC) curves are constructed based on the participant’s task performance; the area under the curve (AROC) is then taken to reflect metacognitive ability (see 2.4. in methods for further explanation).

Using AROC as a measure of metacognitive ability was first used by Fleming *et al* (2010) to investigate the neuroanatomical basis of metacognition. They found that inter-individual differences in AROC were related to grey matter volume in the rostrolateral prefrontal cortex. Nevertheless, it remains uncertain whether these findings will be translatable to non-perceptual measures of metacognition. For example, a recent study by McCurdy *et al* (2013) found that meta-memory ability, a component of metacognition linking to ‘knowledge about memory’, was associated with a different area of the cortex, the precuneus. Consequently, any conclusions drawn from this study will only be applicable to perceptual metacognitive accuracy.

A further remaining question is whether cognitive insight, SR and SC are affected by mood. Mood may be another potential source of individual differences in scores as it is relatively normally distributed in the population and may therefore better quantify within-group variation. Studies of psychotic patients have found that lower mood is associated with better clinical insight, except in cases of psychotic depression (Moore *et al,* 1999). Furthermore, a number of studies have reported a positive relationship between depressive symptoms, measured by the Beck Depression Inventory-II (BDI-II), and CI and SR scores in psychiatric patients (Warman *et al*, 2007; Colis *et al*, 2008; Uchida *et al*, 2009). Some researchers have interpreted this to suggest that depression may be a consequence of realising one is mentally ill, or alternatively, lack of insight may be a defensive coping strategy to prevent feelings of depression (Mintz *et al,* 2003). By examining cognitive insight and mood in healthy participants we hoped to elucidate the cognitive processes which may underlie this relationship.

The majority of studies examining BCIS scores in the healthy, general population have not included a measure of depression (Warman *et al*, 2006; Martin *et al*, 2010; Orfei *et al*, 2011) therefore it was uncertain how depressive symptoms may affect CI. One of the few studies to date that did administer the BCIS and BDI-II to a group of controls reported no relationship (Kao *et al,* 2011). However, since these findings were unexpected, we aimed to reinvestigate whether symptoms of depression can affect cognitive insight. Furthermore, it is unknown how depression may impair metacognitive efficiency, therefore this was also addressed.

In summary, the research aims of the present study were to determine the following in a group of healthy participants: (1) whether cognitive insight is related to metacognitive ability; (2) how depressive symptoms, as measured by the BDI-II, are related to cognitive insight and metacognitive ability; (3) whether explicit and implicit mood measures have a relationship with these outcomes; (4) whether these outcomes are affected by the socio-demographic factors of age, education and gender; and finally (5) an indication of the normative levels of cognitive insight. Based on previous research in both psychiatric and non-psychiatric populations, it was predicted that there would be a positive relationship between cognitive insight and metacognitive ability, and that lower mood or greater depressive symptoms would be associated with higher scores of CI and SR.

1. **METHOD**
	1. Participants

Participants (*n* = 43) were recruited from a group of healthy subjects who had taken part in a previous study and had agreed to be re-contacted, and by sending approach letters via post to residential addresses in the London boroughs of Lambeth and Southwark. The sample was composed of 26 women and 17 men, aged 19–88 (M= 43.4 ± 20.56). The demographics of the sample are presented in table 1. Participants less than 18 years of age or with a history of psychosis, Alzheimer’s disease or mild cognitive impairment were excluded (*n* = 0).

Participants were tested individually and remunerated for their time. They provided written informed consent after a detailed explanation of the study and could withdraw at any time. All data collected was confidential and identified by code number only. The study was approved by the Psychiatry, Nursing and Midwifery Research Ethics Committee (study ref: PNM/11/12-94).

 **Table 1:** Participant demographics (*n* = 43)

|  |  |  |
| --- | --- | --- |
|  | N | % |
| Race Asian African-American White Other | 15343 | 2.311.679.06.9 |
| Education 11+ GCSEs or equivalent A-levels or equivalent University undergraduate degree University postgraduate degree  |  1 5131311 | 2.311.630.230.225.6 |
| Employment Status Full time employment Part time employment Unemployed Self-employed Student Retired | 17513710 | 23.211.62.36.916.223.2 |

* 1. Design

The present study was a cross-sectional observational design using a modest community-based sample. There was also a correlational component to the design, namely to quantify the relationship between metacognition and cognitive insight, and to investigate how these are related to mood and depressive symptoms. This was part of a larger study investigating metacognition and cognitive insight in psychiatric patients.

* 1. Instruments

**BCIS**

Cognitive insight was assessed using the BCIS, a self-report measure consisting of 14 statements rated on a 4-point Likert scale (0 = do not agree at all to 3 = agree completely). Based on factor analysis the scale has been divided into 2 dimensions: SR (9-items) and SC (6-items). A Composite Index (CI) score is obtained by subtracting SC from SR. There was no time limit for completing the questionnaire.

Participants were informed that the questionnaire was originally designed to be used on patients with psychosis and that the examiner would explain any questions they did not understand. Some participants asked questions regarding the statements referring to ‘unusual experiences’ and were subsequently informed “this may refer to experiences such as an unusual dream, an unlikely coincidence or a spiritual feeling”.

**BDI-II**

To assess the relationship between depression and cognitive insight we administered the Beck Depression Inventory II (BDI-II; Beck *et al,* 1996), a standardised clinical assessment scale to measure severity of self-reported depression in adults and adolescents. It consists of a 21-items which address all nine of the diagnostic criteria for a major depressive disorder as listed in the DSM-IV. Each item consists of four statements which each reflect an increasing severity of a particular depressive symptom. For each item, participants were asked to select the statement which best described the way they had been feeling during the previous two weeks, including the present day. These statements were rated from 0 to 3 and the scores from all 21 items are summed to obtain a total score of depression. Total scores range between 0 (no depression) to 63 (very severe depression).

**Mood**

A self-reported indication of participant’s mood was obtained by asking participants to draw a mark on a horizontal black line to show “how happy [they] were feeling at the present moment”. The line was 10 cm long and labelled with “1 - Very Sad” at the left and “10 - Very Happy” on the right. A measurement (cm) of how far along the line the participant had drawn their mark was taken to represent mood. In addition, to obtain an implicit measure of low mood, speech rate was measured. The time taken for participants to count from 1 to 10 at a normal speech rate was timed (s). Both the self-reported and implicit mood tests were taken directly before (t1) and after (t2) the metacognitive task.

**Metacognition**

A contrast discrimination task developed by Fleming *et al* (2010) was used to assess metacognition*.* Participants were asked to make a perceptual judgement about a temporal two-alternative force-choice task and then make an estimate of their relative confidence in their decision. These retrospective confidence ratings were based on a scale of one-to-six (1 being least confident) using the numerical keys on the keyboard.

A laptop was used to administer the perceptual task on a uniform grey screen. Participants were shown two successive images, each consisting of six identical Gabor gratings arranged in a circle around a fixation point (Fig. 1). In one of the images a single Gabor gratings would be of a higher contrast that the other five causing it to ‘pop-out’. The participant was required to select whether the ‘pop-out’ occurred on either the first or second image, selecting their choice using either numerical key 1 or 2, respectively.



**Figure 1.** Six Gabor gratings (circles of varying light and dark bars) were arranged around a central fixation point. ‘Baseline’ Gabors were set at a contrast of 20% of maximum and the ‘pop-out’ Gabors varied between 23 and 80% of maximum between trials.

The contrast of the ‘pop-out’ was adjusted throughout the task, using a 2-up-1-down staircase procedure, to maintain performance of approximately 71% correct. In both the perceptual and confidence judgements the participants used their non-dominant hand to select their judgement and a red square would subsequently indicate their selection. The contrast and spatial position of the ‘pop-out’ was varied randomly throughout the task. After carrying out 5 practice trials, which not scored, each participant completed a total of 600 trials separated into 6 blocks. Scores from the first block were excluded to allow for adaptation of the task. The experiment was carried out in the same testing room, with moderate light levels and no distractions. Stimulus display was programmed using MATLAB (Mathworks Inc., Natick, MA, USA) and was kept constant throughout.

* 1. Quantification of metacognitive ability

**Table 2.** Signal detection theory applied to the metacognitive task

|  |  |
| --- | --- |
|  | **Type 2 task** |
| **Low Confidence**  | **High Confidence**  |
| **Type 1 task** | **Correct Judgement** | Miss | Hit |
| **Incorrect Judgement** | Correct Rejection | False Alarm |

The analyses of metacognitive accuracy were based on signal detection theory. Better metacognitive efficacy is associated with a greater ratio of “hits” and “correct rejections” to “misses” and “false alarms” (table 2). A confidence rating of 1-3 was taken as low confidence and a rating of 4-6 was taken as high confidence. Type 2 ROC curves were constructed for each participant (Fig. 2); these characterise the probability of a subject making an accurate perceptual judgement for any given confidence rating, high or low. The greater the upward bow of the curve, the greater the relationship between confidence and accuracy. The area underlying this curve (AROC) therefore reflects metacognitive ability, in that a greater area means the subject is more able to make accurate confidence judgements.



**p (confidence I correct)**

**p (confidence I incorrect)**

**Figure 2.** Confidence ratings were used to construct a Type II ROC curve as shown in this example. ROC curves were anchored at [0, 0] and [1, 1]. The area between the curve and the major diagonal (red line) is taken as a quantitative measure of metacognitive ability, AROC.

* 1. Statistical analyses

The present statistical analyses were performed using the SPSS 20.0 for Windows, with the significance level set at *P* < 0.05 (two-tailed test). Correlation analyses were conducted using Pearson’s Correlation Test to determine the relationship between scores of the BCIS, metacognitive task, mood and BDI-II, and their relationship with socio-demographic factors. Hierarchical multiple regression was used to determine the effects of age, education and depressive symptoms on SR scores. Student’s *t*-tests were conducted to explore the effects of gender. Highest level of education was converted to a categorical variable and scored as follows: 11+, GCSEs or equivalent (1), A-levels or equivalent (2), undergraduate degree (3), Postgraduate degree (4).

1. **RESULTS**

One participant withdrew from the study and their data was excluded from the analyses. Due to practical constraints of administering the metacognitive task, 12 additional participants did not complete it. In addition, one participant was excluded from the analyses as their Type 1 task performance on the metacognitive task fell below 3 standard deviations of the group mean. This left 42 participants for analysis on the BCIS and BDI-II measures, and 30 participants for analysis of the metacognitive measure.

Mean scores of the BCIS, metacognitive task, BDI-II and mood are presented in table 3. Analysis of the distribution of these scores using Kolmogorov-Smirnov tests showed that they were all normally distributed, *p*>.05. The assumption of homogeneity of variance was also met; scatterplots of ZRESID vs. ZPRED showed a random pattern around 0. The only measure producing outliers was the BDI-II, with two participants scoring 20, which were included in the analyses since depression didn’t warrant exclusion.

 **Table 3:** Mean participant scores

|  |  |  |  |
| --- | --- | --- | --- |
|  | N | Mean ± S.D. | Range |
| BCIS SR | 42 | 19.95 ±3.65 | 19.0 |
| BCIS SC | 42 | 13.00 ± 3.33 | 15.0 |
| BCIS CI | 42 | 7.00 ± 5.74 | 27.0 |
| AROC | 30 | 0.69 ± 0.06 | 0.3 |
| BDI-II | 42 | 5.00 ± 4.65 | 20.0 |
| Mood Scale t1 | 42 | 7.19 ± 1.67 | 9.6 |
| Mood Scale t2 | 42 | 6.37 ± 1.79 | 9.4 |
| Average Mood | 42 | 6.78 ± 1.39 | 6.7 |
| Speech Rate t1 | 42 | 6.56 ± 2.72 | 11.0 |
| Speech Rate t2 | 42 | 6.48 ± 2.82 | 11.9 |

BCIS, Beck Cognitive Insight Scale; SR, Self-reflectiveness; SC, Self-certainty; CI, Composite Index; AROC, metacognitive ability; BDI-II, Beck Depression Inventory-II.

The difficulty of the perceptual judgement on the metacognitive task was varied over time to keep Type 1 task performance constant (71% correct); nevertheless, there was some variation in this outcome (M= 70.60 ± 2.27, range = 62.5 – 73.21, *n=* 30). A number of participants said they found the task to be difficult and one participant appeared frustrated, rating their mood as ‘0’ after a previously reported mood of 8.5. The mean confidence rating on the metacognitive task was 3.8 ± 0.8, ranging between 2 and 5.25.

No significant correlation was found between SR or CI and metacognitive ability (AROC), *r*= .10, *p*= .62 and *r*= -.16, *p*= .44, respectively. However, an unexpected positive correlation was found between SC and AROC, *r*(28)= .37, *p*< .05. Furthermore, SC was also found to be correlated with mean confidence on this task, *r*= -.364, *p*< .05. To remove the effects of mean confidence on AROC scores, we conducted partial correlation analysis and found the relationship between AROC and SC remained significant, *r*= .38, *p* < .05.

**Figure 3** – Scores of self-certainty and self-reflectiveness, as measured by the BCIS, were negatively correlated (*n* = 42).

Simple correlations between the BCIS measures and the other variables are presented in table 4. SC and SR were found to be negatively correlated, *r*= -.35, *p*< .05, as shown in figure 3. In addition, there was a tendency for males to have higher SC scores (M= 13.41) and SR scores (M= 20.29) than females (SC M= 12.80; SR M= 19.72), although independent samples *t-*tests revealed this effect was not statistically significant, *t*(40) = -.66, *p*= .64 and *t*(40) = -.66, *p*= .64, respectively.

**Table 4**: Pearson’s correlates of the BCIS indexes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | N |  SR*r p-*value |  SC*r p-*value |  CI*r p-*value |
| Metacognition (AROC) | 30 | .10 .62 | .37 .04\* | -.16 .44 |
| BDI-II | 42 | .34 .03\* | -.09 .56 | .27 .09 |
| Average Mood | 42 | -.12 .48 | .20 .21 | -.19 .24 |
| Average Speech Rate | 42 | .25 .12 | -.05 .74 | .18 .23 |
| Age | 42 | -.26 .10 | -.06 .57 | -.13 .40 |
| Gender | 42 | .08 .62 | .10 .52 | -.01 .94 |
| Education | 42 | -.35 .02\* | -.10 .53 | .30 .05  |

\* Significant at the 0.005 level

BDI-II scores were significantly correlated with SR, but not with CI or SC (table 4). This relationship is presented in figure 4. BDI-II scores also correlated with gender, *r*= .37, *p*< .05, with females reporting higher average depression scores (M = 6.38) than males (M= 2.88). Gender and age had no significant effect on SR scores, however, SR was found to be positively correlated with highest level of education, *r*= .41, *p*< .05. No noticeable difference was found when using partial correlation analysis to control for age, *r*= .32 *p*< .05. Self-reported mood and speech rate were not correlated, *r*= -.16, *p*= .41.

**Figure 4** – The BCIS measure of self-reflectiveness was positively correlated with depressive symptoms, as measured by the BDI-II (*n* = 42).

Hierarchical multiple regression was used to assess the contribution of these variables to the variation in scores of SR (table 5). SC and CI scores were not included in the regression analysis as they are part of the same scale as SR and are conceptually related. We aimed to determine whether depressive symptoms added any predictive value towards SR scores, over and above age and education. These latter two variables were therefore entered into the regression model first and were found to account for 16% (R square change = .16, *p*= .03) of the variation in SR scores, with BDI-II accounting for an additional 13.6% (R square change = .13, *p*= .01) of the variance.

 **Table 5.** Results of Multiple Linear Regression with SR as the dependent variable

|  |  |  |  |
| --- | --- | --- | --- |
|  | B | SE B |  β |
| Step 1 |  |  |  |
|  Age | -.02 | 0.03 | -.13 |
|  Education | 1.09 | 0.53 | .33\* |
| Step 2 |  |  |  |
|  Age | -0.01 | 0.03 | -.07 |
|  Education | 1.32 | 0.50 | .40\* |
|  BDI | 0.30 | 0.12 | .38\* |

 Note: *R*2 = .16 for Step 1, △*R*2 = .14 for step 2. \* *p* < .05

1. **DISCUSSION**

The present study aimed to determine whether the BCIS dimensions of SC and SR, as well as cognitive insight index scores, are associated with metacognitive ability as assessed by an established perceptual task. AROC scores, which indicate the participant’s accuracy at judging their performance on a perceptual task, were used as a quantitative measure of metacognitive ability. Cognitive insight is thought to be reliant on higher-level metacognitive processes (Beck *et al,* 2004) which are responsible for forming internal representations of one’s own cognition and allowing reliable inferences to be made about how to apply one’s knowledge to a particular situation. It was therefore predicted that better metacognition would be associated with higher CI scores, which in turn are thought to represent more adaptive cognitive functioning (Kao *et al,* 2011). Establishing any such association would be a first for the field.

CI indicates how well a person is able to objectively interpret their thoughts and experiences, and their ability to modify judgements based on corrective feedback (Riggs *et al*, 2012). For the expected positive relationship between metacognitive ability and CI, AROC would need to be either positively correlated with SR or negatively correlated with SC. However, the present findings showed, unexpectedly, that AROC scores had a positive relationship with SC and were independent from SR. Although SR was not associated with AROC, it was found to have a positive relationship with the number of self-reported depressive symptoms on the BDI-II. In contrast, measurements of current mood had no effect on SC, SR or AROC.

As SC was found to be positively correlated with AROC scores, it is possible that poorer metacognitive ability makes one prone to making misinterpretations about experiences, internal states and judgements, and over time this could result in a reduced certainty about them. These speculations are consistent with the finding that higher SC scores are associated with better performance on executive tasks (Orfei *et al*, 2011). Indeed, metacognition is proposed to be a function of the executive regions of the brain (Riddenikhof *et al,* 2004; Middlebrooks *et al*, 2012).

However, Bruno *et al* (2012) found that, in psychosis patients, higher SC was associated with decreased scores on two indices of metacognitive ability on the meta-WCST. A proposal made by Orfei (2011), that high SC is maladaptive in delusional patients but cognitively functional in healthy participants, may explain the discrepancy in these findings. High SC could reflect a realistic understanding of experiences among healthy participants, whilst in patients it prevents the correction of erroneous convictions.

Although self-certainty is often defined as overconfidence in one’s beliefs, this suggests that SC may be closely tied to certainty than confidence in healthy participants, in that whilst overconfidence is maladaptive, high certainty may be an efficient cognitive approach to making decisions. However, mean confidence on the metacognitive task was found to be correlated with SC, suggesting that these findings could have arisen from the methodological approach used to examine the relationship. Consequently, further research into metacognition and cognitive insight in the general population is required to exclude other possible explanations.

A secondary aim of the study was to examine the relationship between depression and cognitive insight. The majority of previous studies in patients groups have found a positive correlation between depressive symptoms and SR (Warman *et al*, 2007; Colis *et al*, 2008; Uchida *et al*, 2009), but not SC, which is consistent with our findings. It has been proposed that high scores of SR could relate to excessive self-rumination and negative self-appraisal (Takano & Tanno, 2009). Consequently, although it was originally suggested that higher SR scores represent healthier functioning (Beck et al, 2004), it could be that this is only up to a certain point, after which there is an increased risk of depression.

However, one previous study did not find this relationship (Pedrelli *et al,* 2004) and their use of an interview-based measure of depression, the Hamilton Rating Scale, may account for this. An alternative explanation of the observed relationship between SR and depression is therefore that individuals who are more reflective are better able to think of an instance in the past two weeks when the statements were true for them, or they have a greater openness to reporting such instances. As SR appeared to be influenced by depressive symptoms but SC wasn’t, this suggests SR is a more variable dimension of CI, whilst SC has greater stability over time. This is supported by the finding that SR, but not SC, appears to be affected by level of education. As SR and SC can fluctuate as a result of psychosis (Bora *et al*, 2007) it remains unknown whether the BCIS sub-dimensions represent traits or states and this is an area for future investigation.

No correlations were found between mood and the metacognitive task, perhaps because it is an objective task that isn’t affected by emotional components. In contrast, the statements on the BCIS are more likely to elicit a subjective response, which may be influenced by affective states. Nevertheless, it would be useful for future studies to make use of alternative mood measures before firm conclusions can be made. Implicit and explicit moods showed no correlation, suggesting these measures may have poor validity.

The final aim of our study was to add to the rapidly expanding pool of data representing the “normal” levels of cognitive insight levels in the healthy, general population. The average SR (19.95) and SC (13.00) scores found in the present study were higher than those reported by previous studies which have used the BCIS on healthy participants (table 6). Since both SR and SC were higher, this meant the mean CI score (6.95) was more consistent with previous findings, albeit slight lower.

**Table 6:** Means (SD, except where indicated) of cognitive insight scores in healthy community samples from previous studies.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Warman et al, 2006 | Engh et al, 2007 | Warman et al, 2007 | Uchida et al, 2009 | Martin et al, 2010 |
| Self-Reflectiveness | 13.74 (3.38) | 13.40 (4.3) | 13.90 (SE = .514) | 11.53 (3.47) | 14.41 (4.36) |
| Self-Certainty | 6.70 (2.71) | 8.00 (2.7) | 6.62 (2.37) | 4.24 (3.00) | 7.02 (3.36) |
| Composite Index | 7.03 (4.58) | 5.40 (3.5) | 7.34 (SE = .624) | 7.30 (4.70) | 7.39 (4.79) |
| Mean Age | 21.11 | 33.7 | 21.35 | 26.73 | 20.31 |

There are a number of reasons why this could have occurred. Firstly, the mean age of participants in these previous studies was considerably lower than the mean age in the present study, which was over 40. Secondly, in all but one of these studies the samples were composed of university students. The one study which used a more heterogeneous cohort (Engh *et al,* 2007) found more varied CI and SR scores, however, since over half of the participants in this study were ‘volunteering professionals’ and had a narrow range of ages, it is likely that this sample was also not representative of the general population. Thirdly, there were methodological differences in the administration of the questionnaires. In the present study, participants were told to ask the examiner if they were confused by any of the questions. This meant that all participants completed the full questionnaire; in previous studies this has not always been the case (Engh *et al,* 2007; Uchida *et al,* 2009).

The BCIS was originally developed for use in patient populations and this may account for the fact it is occasionally left uncompleted by healthy participants. For example, two of the items on the SR subscale ask subjects to reflect on their “unusual experiences”. Responses to such statements may differ depending on what the person interprets this phrase to be referring to, or they may state ‘do not agree at all’ because they’ve never had such an experience (Martin *et al*, 2010). Participants from the general population must take the reference to “unusual experiences” into a non-psychotic context in order to respond to the statement. Since patients are likely to interpret this differently, care should be taken when comparing CI scores between different diagnostic groups and controls.

Due to these methodological difficulties, although an increasing number of studies are using the BCIS in healthy participants the normative scores of SC and SR remain undetermined. Here we used a relatively representative sample, however, this was limited by its small size. Consequently, the regression analysis used to determine the ability of mood to predict SR may have been underpowered statistically; future studies using larger sample sizes are required before firm conclusions can be drawn. In addition, this may have caused important relationships, such as the effects of age and gender, to be overlooked.

A larger sample is also likely to produce a wider range of scores on the BDI-II. Although a floor affect wasn’t observed, as scores ranged between 0 and 20, participants predominantly scored between 0 and 10. Including a group with diagnosed depression would have allowed the full extent of the relationship between SR and depressive symptoms to be explored. Replication using more diverse groups is also required to understand the reasons why education level appears to be linked to SR, with an exploration of the link between CI and IQ, executive functioning and memory.

There are a number of other limitations that should be acknowledged. Firstly, the task we used for this has been newly developed, therefore its validity and reliability is questionable. A recent study by Maniscalco and Lau (2012) argues that the conventional approach of using signal detection theory (SDT) to calculate metacognitive Type 2 sensitivity is confounded by Type 1 sensitivity (stimulus discrimination sensitivity, *d’*) and Type 1 and 2 response bias i.e. a propensity to select either the first or second image (Type 1), or a high or low confidence (Type 2; Galvin *et al*, 2003).

To isolate metacognitive ability (AROC), our design deliberately aimed to minimise variation in *d’* using a staircase procedure. Furthermore, by conducting a partial correlation using mean confidence as a covariate we hoped to eliminate the effects of response bias, finding no difference in the observed relationship between AROC and SC. However, a calculation of meta-*d’*, as recommended by Maniscalco and Lau,may have been a more accurate method of determining metacognitive accuracy. Meta-*d’* represents the *observed* Type 2 sensitivity of the task, whilst *d’* can only provide the SDT-*expected* Type 2 sensitivity. By comparing *d’* to meta-*d’* a measure of relative Type 2 sensitivity can be obtained, factoring out the effects of the subjects performance on the Type 1 task and thereby providing a better measure of metacognitive ability.

Secondly, we only used a single measure of metacognitive ability. Since it is likely that metacognition, like insight, is a multifaceted construct, a range of metacognitive tasks would be required to determine whether the link with SC is due to a specific cognitive process or the result or a more general underlying mechanism. For example, the Metacognitive Assessment Scale (Semerari *et al,* 2003) has been used by a number of previous studies (Raffard *et al,* 2007) and its use here would have allowed comparison with other findings. Furthermore, since the task in the present study was visual, it also remains unknown how metacognitive tasks involving other modalities such as audition and vision will relate to the BCIS measure.

Thirdly, a number of participants stated that they found the metacognitive task difficult and this was reflected in the lower average mood at t2 compared with t1. Since one participant rated their mood as ‘0’ after the task, it is possible that mood at t2 may reflect anger or annoyance rather than sadness. As with all negative findings, future studies should reinvestigate this relationship and make use of different measures of mood. Carrying out the task in a darker room, using a greater contrast for the ‘pop-out’ Gabor, and ensuring all participants had normal or corrected-to-normal vision would have helped to overcome the difficulty of this task.

In summary, having insight into one’s own cognition requires metacognitive functions that act to monitor, interpret and evaluate thoughts and process information. Despite the theoretic framework suggesting that that these two constructs should be tightly linked, measuring them using the BCIS and a perceptual metacognitive task demonstrates an unpredicted and tenuous relationship. This is likely to be due to the inherent difficulty of reliably measuring these abilities (David *et al,* 2012) and the uncertainty as to what “normal” cognitive insight corresponds to. The findings in this paper suggest that metacognition is positively related to SC, but not SR, although it remains uncertain whether this is because these functions share overlapping neural mechanisms. Future studies should consider the use of alternative measures of metacognition and cognitive insight to gain a fuller understanding of how these complex constructs may influence each other.

The cross-sectional nature of this study prevents conclusions being made about the stability of the cognitive insight and metacognitive ability. Findings from other studies suggest that they both show intra-individual variation (Thompson *et al,* 1996; Mass & Lincoln, 2012), which could also account for the difficulty of identifying how they are associated. There is an increasing amount of evidence that SR is related to depressive symptoms, as found in this study, but longitudinal studies are required to establish the causative factor in this relationship. Until then, caution should be taken when developing treatment strategies to increase SR, which has previously been though to reflect healthier levels of cognitive insight (Beck *et al*, 2004; Engh *et al,* 2007).

As factors such as education and age appear to influence SC and SR, studies comparing BCIS scores between patient and control groups should ensure the groups are closely matched demographically. It remains to be seen how other factors such as IQ, race and personality traits can affect cognitive insight. Further research will also be necessary to understand the complex interaction between SR and SC. We found they were negatively correlated in healthy participants, but other studies have found no correlation (Engh *et al,* 2007; Uchida *et al*, 2009; Kao *et al,* 2011).

In conclusion, this study provides a useful base for the future exploration of the relationship between CI and metacognition in healthy participants. Nevertheless, the conclusions which can be drawn from these findings are limited by the small sample size and methodological drawbacks that were encountered. Future research should make use of longitudinal designs, additional measures of mood and metacognition, and larger sample sizes to determine the utility of the BCIS and the relationship of SC and SR with metacognitive ability.

**References**

Amador XF, Strauss DH, Yale Sa, Flaum MM, Endicott J, Gorman JM. Assessment of insight in psychosis. Psychiatry; 1993; 150: 873–879.

Amador XF, David AS. Insight and Psychosis: Awareness of Illness in Schizophrenia and Related Disorders (2nd edition), Oxford University Press, New York; 2004: 79–87

# Baier M. Insight in schizophrenia: a review. [Current Psychiatry Reports;](http://www.ncbi.nlm.nih.gov/pubmed/20526897) 2010; 12(4): 356-61.

Beck A, Baruch E, Balter JM, Steer RA, Warman DM. A new instrument for measuring insight: the Beck Cognitive Insight Scale. Schizophrenia Research; 2004; 68: 319–329.

Bora E, Erkan A, Kayahan B, Veznedaroglu B. Cognitive insight and acute psychosis in schizophrenia. Psychiatiatry and Clinical Neuroscience; 2007; 61: 634-639.

Colis MJ, Steer RA, Beck AT. Cognitive insight in inpatients with psychotic, bipolar, and major depressive disorders. J. of Psychopathology and Behavioral Assessment;2008; 28(4): 245-249.

David AS, Bedford N, Wiffen B, Gilleen J. Failures of metacognition and lack of insight in neuropsychiatric disorders. [Philos Trans R Soc Lond B Biol Sci.](http://www.ncbi.nlm.nih.gov/pubmed/22492754) 2012; 19; 367:1379-90

Degirmenci E, Degermenci T, Duguncu Y, Yilmaz G. Cognitive Insight in Alzheimer’s Disease. American Journal od Alzheimers disease and other disorders; 2013: 14 (Epub).

[Donohoe G](http://www.ncbi.nlm.nih.gov/pubmed?term=Donohoe%20G%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Hayden J](http://www.ncbi.nlm.nih.gov/pubmed?term=Hayden%20J%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [McGlade N](http://www.ncbi.nlm.nih.gov/pubmed?term=McGlade%20N%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [O'Gráda C](http://www.ncbi.nlm.nih.gov/pubmed?term=O'Gr%C3%A1da%20C%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Burke T](http://www.ncbi.nlm.nih.gov/pubmed?term=Burke%20T%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Barry S](http://www.ncbi.nlm.nih.gov/pubmed?term=Barry%20S%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Behan C](http://www.ncbi.nlm.nih.gov/pubmed?term=Behan%20C%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Dinan TG](http://www.ncbi.nlm.nih.gov/pubmed?term=Dinan%20TG%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [O'Callaghan E](http://www.ncbi.nlm.nih.gov/pubmed?term=O'Callaghan%20E%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Gill M](http://www.ncbi.nlm.nih.gov/pubmed?term=Gill%20M%5BAuthor%5D&cauthor=true&cauthor_uid=19402933), [Corvin AP](http://www.ncbi.nlm.nih.gov/pubmed?term=Corvin%20AP%5BAuthor%5D&cauthor=true&cauthor_uid=19402933). Is "clinical" insight the same as "cognitive" insight in schizophrenia? [J Int Neuropsychol Soc.](http://www.ncbi.nlm.nih.gov/pubmed/19402933); 2009; 15(3):471-5.

Engh JA, Friss S, Birkenaes AB. Measuring cognitive insight in schizophrenia and bipolar disorder: A comparative study. BMC Psychiatry; 2007; 7:71-77.

Galvin S, Podd JV, DRGA V, Witmore J. Type 2 tasks in the theory of signal detectability: Discrimination between correct and incorrect decisions. Psychometric Bulletin & Review; 2003;10(4): 843-876

Greenberger C, Serper MR. Examination of clinical and cognitive insight in acute schizophrenia patients. Journal of Nervous Mental Disorders; 2012; 198” 465–469

Fleming SM, Weil RS, Nagy Z, Dolan RJ, Rees G. Relating Introspective Accuracy to Individual Differences in Brain Structure. Science; 2010; 329: 1541

[Fleming SM](http://www.ncbi.nlm.nih.gov/pubmed?term=Fleming%20SM%5BAuthor%5D&cauthor=true&cauthor_uid=22492751), [Dolan RJ](http://www.ncbi.nlm.nih.gov/pubmed?term=Dolan%20RJ%5BAuthor%5D&cauthor=true&cauthor_uid=22492751). The neural basis of metacognitive ability.Philosophical Transactions of the Royal Society of London; 2012; 19(367):1338-49.

Huq SF, Garety PA, Hemsley DR. Probabilistic judgments in deluded and non-deluded subjects. Q. Journal of Experimental Psychology; 1988; 40: 801 – 812

Kelemen W, Frost PJ, Weaver CA. Individual differencesin metacognition:Evidence against a generalmetacognitive ability. Memory & Cognition; 2000; 28(1): 92-107

**Kemp R, David A.** Insight and compliance. In Treatment Compliance and the Therapeutic Alliance (ed. B. Blackwell), Amsterdam: Harwood;1997: 61-84.

[Lepage M](http://europepmc.org/search/?page=1&query=AUTH:%22Lepage+M%22), [Buchy L](http://europepmc.org/search/?page=1&query=AUTH:%22Buchy+L%22), [Bodnar M](http://europepmc.org/search/?page=1&query=AUTH:%22Bodnar+M%22), [Bertrand MC](http://europepmc.org/search/?page=1&query=AUTH:%22Bertrand+MC%22), [Joober R](http://europepmc.org/search/?page=1&query=AUTH:%22Joober+R%22), [Malla A](http://europepmc.org/search/?page=1&query=AUTH:%22Malla+A%22). Cognitive insight and verbal memory in first episode of psychosis. The Journal of the Association of European Psychiatrists; 2008; 23(5):368-374.

Kao Y, Wang T, Chien-Wen L, Yia-Ping L. Assessing cognitive insight in nonpsychiatric individuals and outpatients with schizophrenia in Taiwan: an investigation using the Beck Cognitive Insight Scale. MC Psychiatry; 2011; 11:170

[Ko Y](http://www.ncbi.nlm.nih.gov/pubmed?term=Ko%20Y%5BAuthor%5D&cauthor=true&cauthor_uid=22492756), [Lau H](http://www.ncbi.nlm.nih.gov/pubmed?term=Lau%20H%5BAuthor%5D&cauthor=true&cauthor_uid=22492756). A detection theoretic explanation of blindsight suggests a link between conscious perception and metacognition. Philosophical Transactions of the Royal Society of London; 2012; 19: 367.

# Koren D, Seidman LJ, Poyurovsky M, Goldsmith M, Viksman P, Zichel S, Klein E. The neuropsychological basis of insight in first-episode schizophrenia: a pilot metacognitive study. Schizophr Res; 2012; 70(2-3): 195-202.

Kunimoto C, Miller J, Pashler H. Confidence and accuracy of near-threshold discrimination responses. Consciousness and Cognition; 2001;10:294–340

[Lysaker PH](http://www.ncbi.nlm.nih.gov/pubmed?term=Lysaker%20PH%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Dimaggio G](http://www.ncbi.nlm.nih.gov/pubmed?term=Dimaggio%20G%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Buck KD](http://www.ncbi.nlm.nih.gov/pubmed?term=Buck%20KD%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Callaway SS](http://www.ncbi.nlm.nih.gov/pubmed?term=Callaway%20SS%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Salvatore G](http://www.ncbi.nlm.nih.gov/pubmed?term=Salvatore%20G%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Carcione A](http://www.ncbi.nlm.nih.gov/pubmed?term=Carcione%20A%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Nicolò G](http://www.ncbi.nlm.nih.gov/pubmed?term=Nicol%C3%B2%20G%5BAuthor%5D&cauthor=true&cauthor_uid=21497218), [Stanghellini G](http://www.ncbi.nlm.nih.gov/pubmed?term=Stanghellini%20G%5BAuthor%5D&cauthor=true&cauthor_uid=21497218). Poor insight in schizophrenia: links between different forms of metacognition with awareness of symptoms, treatment need, and consequences of illness. [Compr Psychiatry.](http://www.ncbi.nlm.nih.gov/pubmed/21497218); 2011; 52(3):253-60.

[Lysaker](http://www.sciencedirect.com/science/article/pii/S0165178110004178) PH, [Olesek](http://www.sciencedirect.com/science/article/pii/S0165178110004178)KL, [Warman](http://www.sciencedirect.com/science/article/pii/S0165178110004178)DM, [Martin](http://www.sciencedirect.com/science/article/pii/S0165178110004178) JM, [Salzman](http://www.sciencedirect.com/science/article/pii/S0165178110004178)AK, [Nicolò](http://www.sciencedirect.com/science/article/pii/S0165178110004178) G, [Salvatore](http://www.sciencedirect.com/science/article/pii/S0165178110004178)G, [Dimaggio](http://www.sciencedirect.com/science/article/pii/S0165178110004178) G. Metacognition in schizophrenia: Correlates and stability of deficits in theory of mind and self-reflectivity; 2012; 190(1); 18-22.

Maniscalcoa B, Lau H. A signal detection theoretic approach for estimating metacognitive sensitivity from conﬁdence ratings. Consciousness and Cognition; 2012; 422–430.

Mass R, Wolf K. Associations of the Beck Cognitive Insight Scale (BCIS) with Poor Insight, Subjective Experiences, and Depression. Int. J. of Cognitive Therapy; 2012; 5(2): 197–210.

# McCurdy LY, [Maniscalco B](http://www.ncbi.nlm.nih.gov/pubmed?term=Maniscalco%20B%5BAuthor%5D&cauthor=true&cauthor_uid=23365229), [Metcalfe J](http://www.ncbi.nlm.nih.gov/pubmed?term=Metcalfe%20J%5BAuthor%5D&cauthor=true&cauthor_uid=23365229), [Liu KY](http://www.ncbi.nlm.nih.gov/pubmed?term=Liu%20KY%5BAuthor%5D&cauthor=true&cauthor_uid=23365229), [de Lange FP](http://www.ncbi.nlm.nih.gov/pubmed?term=de%20Lange%20FP%5BAuthor%5D&cauthor=true&cauthor_uid=23365229), [Lau H](http://www.ncbi.nlm.nih.gov/pubmed?term=Lau%20H%5BAuthor%5D&cauthor=true&cauthor_uid=23365229). Anatomical coupling between distinct metacognitive systems for memory and visual perception. [Journal of Neuroscience; 2013;](http://www.ncbi.nlm.nih.gov/pubmed/23365229) 33(5):1897-906.

Middlebrooks PG, Sommer MA. [Neuronal correlates of metacognition in primate frontal cortex.](http://www.ncbi.nlm.nih.gov/pubmed/22884334) Neuron; 2012; 75(3):517-30.

Mintz, AR, Dobson, KS, Romney, DM. Insight in schizophrenia: a meta-analysis. Schizophr. Res. 2003; 61: 75-88.

Moore O, [Cassidy E](http://europepmc.org/search/;jsessionid=rLa4nOQRLLQdmPKwYG6e.16?page=1&query=AUTH:%22Cassidy+E%22), [Carr A](http://europepmc.org/search/;jsessionid=rLa4nOQRLLQdmPKwYG6e.16?page=1&query=AUTH:%22Carr+A%22), [O'Callaghan E](http://europepmc.org/search/;jsessionid=rLa4nOQRLLQdmPKwYG6e.16?page=1&query=AUTH:%22O'Callaghan+E%22). Unawareness of illness and its relationship with depression and self-deception in schizophrenia. European Psychiatry: the Journal of Association of European Psychiatrists; 1999; 14(5):264-269.

Orfei MD, Caltagirone C, Cacciari, C, Assogna F, Spalletta G. The neuropsychological correlates of cognitive insight in healthy participants. Applied Cognitive Psychology; 2011; 25: 927–932.

Pedrelli P, McQuaid JR, Granholm E, Patterson TL, McClure F, Beck AT, Jeste DV. Measuring cognitive insight in middle-aged and older patients with psychotic disorders. Schizophrenia Research; 2004; 71, 297-305.

Perivoliotis D, Grant PM, Peters ER, Ison R, Kuipers E, Beck AT. Cognitive insight predicts favorable outcome in cognitive behavioral therapy for psychosis. Psychosis; 2010; 2:23–33.

[Raffard S](http://www.ncbi.nlm.nih.gov/pubmed?term=Raffard%20S%5BAuthor%5D&cauthor=true&cauthor_uid=19068341), [Bayard S](http://www.ncbi.nlm.nih.gov/pubmed?term=Bayard%20S%5BAuthor%5D&cauthor=true&cauthor_uid=19068341), [Capdevielle D](http://www.ncbi.nlm.nih.gov/pubmed?term=Capdevielle%20D%5BAuthor%5D&cauthor=true&cauthor_uid=19068341), [Garcia F](http://www.ncbi.nlm.nih.gov/pubmed?term=Garcia%20F%5BAuthor%5D&cauthor=true&cauthor_uid=19068341), [Boulenger JP](http://www.ncbi.nlm.nih.gov/pubmed?term=Boulenger%20JP%5BAuthor%5D&cauthor=true&cauthor_uid=19068341), [Gely-Nargeot MC](http://www.ncbi.nlm.nih.gov/pubmed?term=Gely-Nargeot%20MC%5BAuthor%5D&cauthor=true&cauthor_uid=19068341). Lack of insight in schizophrenia: a review**.** [Encephale.](http://www.ncbi.nlm.nih.gov/pubmed); 2012; 34(5):511-6.

[Ridderinkhof KR](http://www.ncbi.nlm.nih.gov/pubmed?term=Ridderinkhof%20KR%5BAuthor%5D&cauthor=true&cauthor_uid=15486290), [Ullsperger M](http://www.ncbi.nlm.nih.gov/pubmed?term=Ullsperger%20M%5BAuthor%5D&cauthor=true&cauthor_uid=15486290), [Crone EA](http://www.ncbi.nlm.nih.gov/pubmed?term=Crone%20EA%5BAuthor%5D&cauthor=true&cauthor_uid=15486290), [Nieuwenhuis S](http://www.ncbi.nlm.nih.gov/pubmed?term=Nieuwenhuis%20S%5BAuthor%5D&cauthor=true&cauthor_uid=15486290). The role of the medial frontal cortex in cognitive control.Science[; 2004;](http://www.ncbi.nlm.nih.gov/pubmed/15486290) 306(5695):443-7.

[Riggs SE](http://www.ncbi.nlm.nih.gov/pubmed?term=Riggs%20SE%5BAuthor%5D&cauthor=true&cauthor_uid=20693342), [Grant PM](http://www.ncbi.nlm.nih.gov/pubmed?term=Grant%20PM%5BAuthor%5D&cauthor=true&cauthor_uid=20693342), [Perivoliotis D](http://www.ncbi.nlm.nih.gov/pubmed?term=Perivoliotis%20D%5BAuthor%5D&cauthor=true&cauthor_uid=20693342), [Beck AT](http://www.ncbi.nlm.nih.gov/pubmed?term=Beck%20AT%5BAuthor%5D&cauthor=true&cauthor_uid=20693342). Assessment of cognitive insight: a qualitative review. [Schizophr Bull.](http://www.ncbi.nlm.nih.gov/pubmed/20693342); 2012; 38(2):338-50.

Schwartz, R.C. Insight and illness in chronic schizophrenia. Comp. Psychiatry; 1998; 39, 249-254.

Semerari A, Carcione A, Dimaggio G, Falcone M, Nicolo G, Procaci M, Alleva G. How to evaluate metacognitive function in psychotherapy? The metacognition assessment scale its applications. Clin. Psychol. Psychother; 2003; 10: 238–261.

Song C, [Kanai](http://www.ncbi.nlm.nih.gov/pubmed/?term=Kanai%20R%5Bauth%5D) R, [Fleming](http://www.ncbi.nlm.nih.gov/pubmed/?term=Fleming%20SM%5Bauth%5D) SM, [Weil](http://www.ncbi.nlm.nih.gov/pubmed/?term=Weil%20RS%5Bauth%5D) RS, [Schwarzkopf](http://www.ncbi.nlm.nih.gov/pubmed/?term=Schwarzkopf%20DS%5Bauth%5D) DS, ReesG. Relating inter-individual differences in metacognitive performance on different perceptual tasks Conscious Cogn; 2011; 20(4): 1787–1792.

Surguladze S, David AS. Insight and Major Mental Illness: An Update for Clinicians Advances in Psychiatric Treatment; 1999; 5:163-170.

[Takano K](http://www.ncbi.nlm.nih.gov/pubmed?term=Takano%20K%5BAuthor%5D&cauthor=true&cauthor_uid=19181307), [Tanno Y](http://www.ncbi.nlm.nih.gov/pubmed?term=Tanno%20Y%5BAuthor%5D&cauthor=true&cauthor_uid=19181307). Self-rumination, self-reflection, and depression: self-rumination counteracts the adaptive effect of self-reflection. [Behav Res Ther.](http://www.ncbi.nlm.nih.gov/pubmed/19181307); 2009; 47(3):260-4.

[Tastet H](http://www.ncbi.nlm.nih.gov/pubmed?term=Tastet%20H%5BAuthor%5D&cauthor=true&cauthor_uid=23034576), [Verdoux H](http://www.ncbi.nlm.nih.gov/pubmed?term=Verdoux%20H%5BAuthor%5D&cauthor=true&cauthor_uid=23034576), [Bergua V](http://www.ncbi.nlm.nih.gov/pubmed?term=Bergua%20V%5BAuthor%5D&cauthor=true&cauthor_uid=23034576), [Destaillats JM](http://www.ncbi.nlm.nih.gov/pubmed?term=Destaillats%20JM%5BAuthor%5D&cauthor=true&cauthor_uid=23034576), [Prouteau A](http://www.ncbi.nlm.nih.gov/pubmed?term=Prouteau%20A%5BAuthor%5D&cauthor=true&cauthor_uid=23034576). Cognitive insight in schizophrenia: the missing link between insight and neurocognitive complaint?The Journal of Mental and Nervous Disease; 2012(10):908-10.

Thompson WB, Mason SE. Instability of individual differences in the association between confidence judgments and memory performance.[Mem Cognit.](http://www.ncbi.nlm.nih.gov/pubmed/8881325); 1996; 24(2):226-34.

Tranulis C, Lepage M, Malla A. Insight in first episode psychosis: Who is measuring what? Early Intervention in Psychiatry; 2008; 2, 34-41.

Uchida T, Matsumoto, K, Kikuchi A, Miyakoshi T, Ito F, Takashia U, Matsuoka H. Psychometric properties of the Japanese version of the Beck Cognitive Insight Scale: Relation of cognitive insight to clinical insight. Psychiatry and Clinical Neurosciences 2009; 63: 291–297.84, 297–304.

Warman, DM., Dunahue, S., Martin, J.M., Beck, A.T., 2004. An investigation of the Beck Cognitive Insight Scale in the general population. Poster presented at the 38th annual meeting of the Association for the Advancement of Behavior Therapy, New Orleans, LA. November.

Warman DM, Martin JM. Cognitive insight and delusion proneness: An investigation using the Beck Cognitive Insight Scale. Schizophrenia Research; 2006; 84: 297 – 304.

Warman D, Lysaker P, Martin J. Cognitive insight and psychotic disorder: The impact of active delusions. Schizophrenia Research; 2007; 90: 325–333

**Appendix A:**

BCIS

Response choices: ‘‘do not agree at all’’ ‘‘agree slightly’’ ‘‘agree a lot’’ and ‘‘agree completely’’.

**1. At times, I have misunderstood other people’s attitudes towards me.**

2. My interpretations of my experiences are definitely right.

**3. Other people can understand the cause of my unusual experiences better than I can.**

**4. I have jumped to conclusions too fast.**

**5. Some of my experiences that have seemed very real may have been due to my imagination.**

**6. Some of the ideas I was certain were true turned out to be false.**

7. If something feels right, it means that it is right.

**8. Even though I feel strongly that I am right, I could be wrong.**

9. I know better than anyone else what my problems are.

10. When people disagree with me, they are generally wrong.

11. I cannot trust other people’s opinion about my experiences.

**12. If somebody points out that my beliefs are wrong, I am willing to consider it.**

13. I can trust my own judgment at all times.

**14. There is often more than one possible explanation for why people act the way they do.**

**15. My unusual experiences may be due to my being extremely upset or stressed.**

**Items 1, 3, 4, 5, 6, 8, 12, 14 and 15 assess self-reflectiveness**

Items 2, 7, 9, 10, 11 and 13 assess self-certainty