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# Overconfidence in Social Cognitive Decision Making: Correlations with Social Cognitive and Neurocognitive Performance in Participants with Schizophrenia and Healthy Individuals

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## Abstract

It has been reported that people with schizophrenia are frequently overconfident relative to their performance, a trait observed in healthy individuals as well. In schizophrenia, impaired self-assessments have been found to be associated with functional impairments in various domains. Previous studies examining the correlation of overconfidence and task performance within domains (e.g., social cognition) had found overconfidence was associated with particularly poor performance. This study examines how overconfidence on a social cognitive emotion recognition task is correlated with performance on other social cognitive tests, measures of neurocognition, and intelligence. The sample includes 154 healthy controls and 218 outpatient individuals

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Author contributions

Drs. Harvey, Penn, and Pinkham designed the study. Ms. Perez and Ms. Tercero created and managed a merged database, ran the statistical analyses, and drafted the manuscript, editing several drafts.

All authors have reviewed and edited the paper and approve the final version.



Conflict of interest statement

In the last year, Dr. Harvey has received consulting fees or travel reimbursements from Alkermes, Bio Excel, Boehringer Ingelheim, Intra-Cellular Therapies, Minerva Pharma, Otsuka America, Regeneron, Roche Pharma, and Sunovion Pharma. He receives royalties from the Brief Assessment of Cognition in Schizophrenia and the MATRICS Consensus Battery. He has a research grant from Takeda and from the Stanley Medical Research Foundation. Dr. Pinkham has served as a consultant for Roche Pharma. The other authors have no potential Biomedical Conflicts of Interest.

diagnosed with schizophrenia. For the healthy controls, overconfidence was a significant predictor of poorer performance on social cognitive, but not neurocognitive tasks. For the participants with schizophrenia, overconfidence was a predictor of poorer performance on every performance-based task. In addition, overconfidence in healthy controls was more strongly correlated with intelligence than it was in participants with schizophrenia. The data suggest that a bias towards overestimation of performance aligns with poorer performance social cognitive domains, as well as neurocognitive domains in participants with schizophrenia. In healthy individuals, consistent with previous results, lower general intelligence seems to be a substantial predictor of overconfidence. These data suggest that attention to the accuracy of self-assessment is an area for future clinical interventions in people with schizophrenia.

**Keywords**

Schizophrenia; Neurocognition; Social Cognition; Confidence; Intelligence; Self-assessment

## 1. Introduction

Awareness of illness and associated self-assessment abilities are challenged in many ways in participants with schizophrenia, including domains of clinical symptoms (Amador et al., 1993), functional abilities (Durand et al., 2015), cognitive abilities (Gould et al., 2015), and, more recently, social cognitive abilities (Silberstein et al., 2018). It appears that reduced awareness of illness can be associated with certain cognitive deficits (David and Kemp, 1997) or with lower levels of intellectual functioning. Specifically, previous studies have connected greater unawareness of illness to a lack of flexibility in abstract thinking (Lysaker et al., 2006) or other elements of executive functioning (Nair et al., 2014).

One conceptualization of the wide-ranging challenges with self-assessment is that they are defined by two constructs: introspective accuracy (IA) and introspective bias (IB). IA encompasses self-evaluations of actual achievements to date and potential for future achievement in everyday functioning, cognitive performance, and social cognition (Harvey and Pinkham, 2015). IB refers to the direction of overestimation or underestimation of one’s abilities (Silberstein and Harvey, 2019a). Thus, this conceptualization parses accuracy of self-assessment from the direction of self-assessments errors when they are made. Although overlapping, IA is not interchangeable with other domains of the self-monitoring construct of metacognition. While metacognitive skills such as self-reflection and theory of mind focus on one’s thought content and the ability to infer other’s beliefs, respectively, IA is exclusively self-focused (Silberstein and Harvey, 2019a). The concepts of IA and IB are separable in that it is possible to mis-estimate your functioning or ability (IA) in a direction toward either overestimation or underestimation (IB). For example, we have shown that in participants with schizophrenia, mis-estimation of ability can reflect either overestimating or underestimating, in approximately equal proportions (Gould et al., 2015; Silberstein et al., 2018), across neurocognitive and social cognitive domains.

Assessing impairments in IA requires the use of self-reports of perceived competence, which are then related to external indicators of competence and performance. These external indicators can include either performance-based assessments or judgments rendered by people who know the participant well. Previous work on IA has included comparisons between participants' self-reports of their neurocognitive, social cognitive, and everyday functional abilities and these other informant sources, as well as performance on objective social cognitive tests. For instance, in the domain of social cognition, discrepancies were indexed by the differences between self-ratings of social cognitive abilities on the Observable Social Cognition Rating Scale (OSCARS; Healey et al., 2015) and those of high contact informants (Silberstein and Harvey, 2019b) as well comparing self and informant ratings to the results of social cognitive tests. Silberstein et al. (2018) demonstrated that overestimation of social cognitive abilities in participants with schizophrenia was a better predictor of impairments in everyday social outcomes than social cognitive test performance. In the domain of neurocognition, Gould et al. (2015) similarly found that deficits in vocational and everyday functioning were better predicted by overestimation of neurocognitive abilities than by performance on tests of neurocognitive abilities and functional capacity.

In previous literature on overconfidence in schizophrenia, participants are reported to be overconfident in the accuracy of their interpersonal judgments (Kother et al., 2012). Overconfidence in social abilities can affect relationships because of discrepancies between how a patient with schizophrenia sees themselves and how outsiders perceive them (Lysaker et al., 1998). This discrepancy can influence attempts at social interactions and can lead to interpersonal challenges. Moritz et al. (2014) found that schizophrenia participants were overconfident, even when making mistakes, and overconfidence was correlated with paranoia. Similarly, this correlation with overconfidence has also been seen with delusions (Moritz et al., 2006a). We have recently shown that although participants with schizophrenia show both lower confidence and lower performance on average on a social cognitive test than healthy individuals, they overestimated their performance at every level of actual accuracy in this test (Jones et al., 2019). In fact, there was a subgroup of participants with schizophrenia who stated that they believed that they were 100% accurate on every item in a challenging social cognition task; this 18% of the sample of participants with schizophrenia were actually the poorest performers.

Challenges in self-assessment of performance also extend to healthy individuals. Pennycook et al. (2017) reported that healthy individuals overestimated their performance on a test of analytical thinking. Kruger and Dunning (1999) found that the healthy participants who performed worse on tests for humor, grammar and logic overestimated their performance. Moreover, in our previous study of participants with schizophrenia (Jones et al., 2019), we found that in healthy people, higher confidence in ability was correlated with more rapid responding, regardless of accuracy. However, in that study, healthy people adjusted their effort in response to task difficulty, although the more confident participants still responded more rapidly. In contrast, participants with schizophrenia have been shown to be less likely to adjust both level of effort and confidence judgments in response to the difficulty of test items (Cornacchio et al., 2017).

In this paper, we present additional analyses of data from the final validation phase of the Social Cognition Psychometric Evaluation (SCOPE; Pinkham et al., 2018) study. The

SCOPE study compared multiple performance-based measures of social cognitive abilities, with the best of those measures based on convergent validity and psychometric properties included in this study. Further, in the SCOPE study we examined the convergence with neurocognitive performance, with the tests used also included in this paper. Our goals in this paper are to examine the association of overconfidence in social cognitive ability with performance on the full array of suitable social cognitive, neurocognitive, and intelligence measures from SCOPE. Our previous analyses were limited to the examination of the impact of overconfidence in ability on a single social cognitive test, the Bell Lysaker Emotion Recognition Test (BLERT; Bryson et al., 1997), to performance on that specific test. Here we expand our analysis of IA and IB to the broader prediction of performance on a collection of social cognitive and neurocognitive tests, as well as vocabulary scores. By performing this analysis across these separable but correlated performance domains, we are better poised to make statements about the generality of the association of overconfidence with multiple functionally relevant performance domains.

We hypothesized that overconfidence in social cognitive abilities, reflecting the concurrent presence of impairments in IA and a positively valanced IB, would be associated with poorer performance in social cognition tests in both healthy controls and participants with schizophrenia. We also hypothesized that neurocognitive test performance would also be poorer in participants with schizophrenia with evidence of overconfidence in their social cognitive abilities. Finally, we tested the idea that estimated crystallized intelligence, inferred from a vocabulary test, would also be found to be associated with overconfidence in their social cognitive abilities. We also compared HC and participants with schizophrenia on the relative associations of overconfidence and performance, as previous studies have suggested that poorer performers on measures of abilities among healthy controls also over-estimate their performance.

## 2. Methods

### 2.1 Participants

Data were collected at three sites in the Social Cognition Psychometric Evaluation study, phase 5 (SCOPE-5; Pinkham et al., 2018): The University of Texas at Dallas (UTD), The University of Miami Miller School of Medicine (UM), and The University of North Carolina at Chapel Hill (UNC). All participants were stable outpatients with diagnoses of schizophrenia or schizoaffective disorder ($n$=218) and healthy controls ($n$=154). UTD participants were recruited from Metrocare Services, a non-profit mental health services provider organization in Dallas County, TX, and other area clinics. UM participants were recruited from the Miami VA Medical Center and the Jackson Memorial Hospital-University of Miami Medical Center. UNC participants were recruited from the Schizophrenia Treatment and Evaluation Program (STEP) in Carrboro, NC and the Clinical Research Unit (CRU) in Raleigh, NC.

Methods for diagnosis, assessment, recruitment, and exclusion were previously published (Pinkham, et al., 2018). Participants were required to have a DSM-IV diagnosis of schizophrenia or schizoaffective disorder confirmed by clinical interview using the SCID Psychosis Module (First, et al., 2002) and the MINI International Neuropsychiatric

Inventory (Sheehan et al., 1998). We never planned to compare these two subsamples because of our concerns about the validity of the diagnoses of schizoaffective disorder. In addition, participants had to be on a regular medication schedule for at least six weeks with no dose changes in the last two weeks. In healthy controls, the same assessments were used to ensure the absence of psychopathology.

## 2.2 Exclusion criteria

Participants were excluded if they presented with: 1) current or past history of pervasive developmental disorder or intellectual disability by DSM-IV criteria (defined as IQ<70), 2) current or past history of medical or neurological disorders that may affect brain function (e.g. seizures, CNS tumors, or loss of consciousness for 15 or more minutes), 3) sensory limitations including visual (e.g. blindness, glaucoma, vision uncorrectable to 20/40) or hearing impairments that would interfere with assessment, 4) lack of English proficiency, 5) history of substance abuse within the past month, excluding nicotine or caffeine, and 6) presence of substance dependence that has not been in remission over the past six months. Furthermore, participants were excluded if they had been hospitalized in the past two months. We did not exclude patients for the presence of current depressive symptoms or for a lifetime history of major depression, as long as their primary diagnosis was schizophrenia and not mood disorders.

## 2.3 Measures

### 2.3.1 Social cognition measures

**Bell Lysaker Emotion Recognition Task (BLERT; Bryson et al., 1997).:** The BLERT measures the ability to correctly identify seven emotional states: happiness, sadness, fear, disgust, surprise, anger, or no emotion. Stimuli are presented on a monitor and consist of videos depicting these different emotions. First, participants were instructed to respond as rapidly as possible without sacrificing accuracy, which would allow a response prior to the end of the video clip.

For comparison of scores, we converted the number of items correct out of 21 into a percentage. This percentage of correct responses was the performance dependent variable. Second, after responding by identifying the expressed emotion in the video clip, participants then rated how confident they were that their response was correct on a scale from 0 (not at all confident) to 100 (extremely confident). This 0–100 score was used as the confidence dependent variable. In order to generate a direct comparison of the two indices, we calculated the difference of the two scores, subtracting performance (0–100%) from confidence (0–100 confident), such that higher scores reflected levels of confidence that were greater than levels of performance (referred to in the future as “overconfidence).

**Penn Emotion Recognition Task (ER-40; Kohler et al., 2003).:** The ER-40 measures the ability to accurately identify both high-intensity and low intensity emotions conveyed in static photographs of faces presented on a computer monitor in a PowerPoint format. Facial expressions include happiness, sadness, anger, fear, and no emotion. The dependent variable is the total correct out of a possible score of 40.

**Reading the Mind in the Eyes Test (Eyes; Baron-Cohen et al., 2001).:** The Eyes Test measures the participant's capacity to determine the mental state of others by viewing 36 photos of the eye region of different faces and choosing the mental state term that best describes the expression. The dependent variable is the total number correct.

**The Awareness of Social Inferences Test, Part III (TASIT; McDonald et al., 2003).:** The TASIT assesses detection of lies and sarcasm using 16 videos of various social interactions. After viewing each video, participants respond to four questions about the intentions of the characters in a yes/no format for a total of 64 possible correct responses.

**Hinting Task (Corcoran et al., 1995).:** The Hinting Task examines the ability of individuals to infer the true intent of indirect speech by using ten short verbal passages that present an interaction between two characters. Each passage ends with one of the characters dropping a hint, and participants must state what the character wanted. The dependent variable is the total score, out of a possible score of 20.

#### 2.3.2 Abbreviated version of the MATRICS Consensus Cognitive Battery (MCCB; Nuechterlein et al. 2008).—

Participants completed a subset of the tests from MATRICS Consensus Cognitive Battery including Trail Making Test-Part A, BACS-Symbol Coding, Category Fluency-Animal Naming, Letter-Number Span, and the Hopkins Verbal Learning Test-Revised.

**Wechsler Abbreviated Scale of Intelligence - Vocabulary (WASI; Wechsler, D., 1999).:** The WASI is a general intelligence, or IQ test created to assess specific and overall cognitive capabilities. The Vocabulary subtest assesses overall understanding of words, and we used the age-corrected scale score as our proxy for general intelligence.

### 2.4 Procedures

All participants provided signed informed consent and the project was approved at each site by the local IRB. Data from the baseline visit are used in this analysis as the neurocognitive and intelligence was not repeated at the second assessment. During this baseline visit, participants completed neurocognitive, social cognitive, and functional outcome evaluations. All diagnostic and symptom raters were trained using established procedures at each site to guarantee reliability.

### 2.5 Statistical analyses

Our statistical analyses were performed with SPSS edition 26 (IBM corporation, 2020). We examined group means and standard deviation on BLERT performance, confidence, and overconfidence. Thus, differences between performance and confidence reflect IA and the higher the difference score, the more positive (i.e., overconfident) the IB (Jones et al., 2020). Furthermore, we calculated Pearson correlations between performance, confidence, and overconfidence on the BLERT with scores on other performance-based variables. In addition, we conducted regression analyses predicting performance-based tasks with overconfidence on BLERT entered first and BLERT performance entered second to see if overconfidence was a significant predictor of performance on other measures. Lastly, we used stepwise regression in healthy controls and in participants, separately, to examine what performance-based measures predicted overconfidence. Statistical analyses were performed using IBM SPSS version 26.

The stepwise regression was selected because we knew from our previous research that the other measures were intercorrelated. Thus, relating overconfidence to these correlated items required identifying what the independent associations were. We also performed a systematic assessment of potential multicollinearity in the predictor sets in each sample. We did not identify and a priori p value for statistical significance, because we know that with these large samples highly significant p values could be expected.

## 3. Results

Supplementary Table 1 presents the demographic information on the sample as well as means and standard deviations for task performance, which was published previously. Table 1 presents the scores on the BLERT for the two participant samples, and Table 2 presents the correlations between performance, confidence, and overconfidence on the BLERT and all of the other performance-based variables. As seen in Table 1, although the participants with schizophrenia had lower performance and lower confidence than the healthy controls, they were significantly more overconfident compared to their performance. As can be seen in Table 2, confidence alone on the BLERT was not related to any of the performance-based assessments in the participants with schizophrenia and was minimally, but negatively, correlated with performance on the ER-40 and WASI in the healthy controls. Other than for the ER-40 and the hinting task in the healthy controls, better performance on the BLERT was associated with better performance on all of the performance-based measures.

Consistent with our hypotheses, being overconfident compared to actual BLERT performance was associated negatively with performance on all other measures (other than the hinting task and the ER-40 in the healthy controls) in both participant samples. When we used Fisher's r-to-z transformation to compare the significance of the difference between correlation coefficients, we found that the correlation between overconfidence on the BLERT and poorer performance on the other performance-based measures was significantly larger in participants with schizophrenia, compared to the healthy controls, on the ER-40, hinting task, eyes task, Letter-Number span and HVLT total score. There were no variables where the correlation of the healthy control sample was larger than in the patient sample (all $p > .05$).

In our regression analyses (See Table 3), we examined whether overconfidence remained an important predictor of performance on the tasks by entering overconfidence first and then entering performance on the BLERT second. For the healthy controls, overconfidence was a significant predictor of poorer performance on all of these tasks but the ER-40 and the hinting task. In that sample, BLERT performance was significantly associated with three of the four social cognition tasks, ER-40, eyes, and TASIT, after controlling for overconfidence. However, none of the neurocognitive measures were associated with BLERT performance after controlling for overconfidence. In the patient sample, overconfidence was associated with poorer performance on every performance-based variable, while BLERT performance was also correlated with performance on each task, even after adjusting for overconfidence.

In a final analysis, we examined the relative importance of the other performance-based measures for the prediction of overconfidence on the BLERT in the healthy controls and patient samples separately (See Table 4). We used a stepwise regression model wherein we regressed all 8 of the other performance-based measures on overconfidence scores on the BLERT. Then we examined the association of WASI vocabulary alone on the overconfidence scores and then we added the vocabulary scores to the other 8 variables. In the first analysis, we saw that performance on the eyes test, the ER-40 and animal naming all added variance to the prediction of overconfidence, predicting a total of 39% of the variance. The WASI vocabulary score itself shared 25% of the variance with the BLERT overconfidence score by itself and when the WASI was added to the other equation, the total variance accounted for increased by 3% compared to the prior model. In total, over 40% of the variance in overconfidence was associated with poorer performance on the social cognitive, neurocognitive, and intelligence measures. In the healthy controls, the results were quite different. The performance-based variables accounted for 18% of the variance, which was less than that accounted for by the WASI vocabulary alone (20%). When added to the model, the WASI vocabulary score was the most important predictor and only performance on the Eyes test added any variance at all.

Given that performance-based variables in schizophrenia are highly correlated with each other, we computed collinearity statistics for the performance-based measures neurocognitive predictors with the SPSS (V26) collinearity diagnostics routine. The critical statistics are “condition indices” which are computed as the square roots of the ratios of the largest eigenvalue to each successive eigenvalue. Values greater than 15 indicate a possible problem with collinearity and greater than 30 reflects a serious problem. For the schizophrenia patients, across the 2 regression analyses, there were no identified dimensions that exceeded the threshold of 15, with the highest value detected being 12.94. In the HC sample, one of the dimensions over the threshold of 15, but the highest value was 17.97.

## 4. Discussion

In this further analysis of Introspective accuracy and bias compared to actual performance, we find that participants with schizophrenia who manifest overconfidence on an emotion perception test also show poorer performance on a variety of other performance-based tests of neurocognition and social cognition. Healthy controls were also overconfident on average, and the direction of the correlation between performance on various tests and confidence is in the same direction, but significantly smaller than those relationships seen in participants. Likewise, for the participants with schizophrenia, but less so for the healthy controls, overconfidence predicts poorer performance across the different other domains even when ability, indexed by BLERT accuracy, is considered. Within the two samples, the correlation between overconfidence and performance manifest some limits of domain specificity, in that poorer performance on the ER-40 was the strongest correlate of overconfidence on the BLERT. There appears to be a larger contribution of intelligence, measured with a vocabulary test, in healthy controls than in participants with schizophrenia.

This difference in correlations between intelligence and overconfidence is not due to differences in the range of scores. The healthy controls' raw scores on the WASI ranged from 18.00 to 77.00 (M=55.97, SD=11.10), while the raw scores for the participants with schizophrenia ranged from 6.00 to 77.00 (M=48.28, SD=14.41). These findings suggest a wider range of scores and greater variance in the participants with schizophrenia.

There are several possibilities to explain overconfidence and its impact on performance on other tasks. Failure to adjust effort when faced with tasks of varying degrees of difficulty has also been reported to be associated with poorer performance in participants with schizophrenia. Cornacchio et al. (2017) suggested that the origin of this failure to adjust is that participants with schizophrenia may have a general challenge in normative estimation of the difficulty of tasks. In considering these results it is important to note that confidence in performance on the BLERT was not associated on a zero-order basis with performance on any of the tests in the participants with schizophrenia and only with two (in a negative direction) in the HC sample. Thus, confidence judgments do not appear to be originating from accurate consideration of actual abilities.

As we found before, participants with schizophrenia with reduced life experience in critical areas, such as employment, overestimated their ability in comparison to information from high contact clinicians (Holshausen et al., 2014). We also found that participants with schizophrenia with elevations on the PANSS Autism Scale (PAUSS; Deste et al., 2018) were both less socially competent and underestimated their impairments compared to participants without those elevations, possibly because of reduced experience in social interactions. It has also been reported that there are cognitive contributions to self-assessment challenges, including lower levels of memory performance correlating associated with impaired cognitive insight, (Engh et al., 2011). Other cognitive abilities implicated in these difficulties are challenges in self-monitoring (Gaweda et al., 2013) or difficulties updating memories and revising their own assessments (Orfei et al., 2017).

Impairments self-assessment likely arise from several combinations of these sources, in experiential and cognitive domains. Individuals must monitor their performance in order develop a momentary impression of their functioning. They must remember these momentary impressions and consolidate them into more global constructs of their ability. Then, they must use these constructs to decide about their likely ability to succeed when attempting a discrete task. This also requires an ability to estimate the level of objective challenges in the tasks themselves. As received above, there is evidence for challenges in all of these processes and previous studies of the accuracy of momentary judgements and the effective utilization of momentary judgments to guide future behavior suggest challenges in both areas (Koren et al.,2005).

If one is uncertain about their ability, why overestimate compared to underestimating, particularly if one is uncertain of what constitutes good versus poor performance? One possibility for the origin of this bias is reliance on momentary mood states to make global and specific judgments. In analyses originating from this sample, Oliveri et al. (2020) found that current severity of depression was a predictor of self-assessment of social global functioning, in that those with lower depressive symptoms reported considerably higher levels of everyday social functioning. Although the mean depression severity in this sample was a Beck Depression Inventory-2 (BDI-2, Beck et al., 1996) score of 15, one third of the participants had scores in the very mild to absent range. This tendency toward low depression and overestimation has been confirmed in samples of participants with schizophrenia with no overlap with the current participants (Harvey et al., 2017; Siu et al., 2015) and bipolar depression (Harvey et al., 2015) as well. In all of those studies the severity of depression was more substantially associated with judgments about functioning than with objectively indexed real-world outcomes. Siu et al. (2015) found that 44% of participants with chronic schizophrenia in the CATIE study reported that they believed that they were mostly satisfied or pleased/delighted with their lives. Those participants had lower depression, greater lack of insight, and poorer executive functioning than participants with a more negative (and unfortunately realistic) view of their lives. Previous studies have suggested that participants with schizophrenia arrive at judgements with less evidence and are more likely to be convinced of the accuracy of their judgments than healthy people. The consequences of misjudgments are exaggerated when conclusions are rapidly reached and firmly held, as previously reported by Moritz et al. (2006b, 2012, 2015). As noted previously, participants who were convinced that they were 100% correct in performing the BLERT were the poorest performers (Jones et al., 2019); here we see that overconfidence is related to reduced performance across multiple different tasks.

There are limitations in the study. A limitation of this data analysis is that we do not have confidence ratings on all of the variables and this analysis only includes the confidence ratings on the BLERT, an emotion processing social cognitive measure. Another limitation is that there was no momentary feedback provided to the participants about their performance and due to this the participants may have been unaware of their performance on a trial by trial basis. Stepwise regression analysis can lead to the impression that a more limited set of variables is associated with the outcomes measures than is actually the case. What this analysis provides is information about which variables have the greatest independent association with the outcomes measure. A final limitation is that we did not choose a priori p values for statistically significant. This issue is obviated by the fact that all 20 of the steps in the forced entry analyses for the schizophrenia participants were significant at $p<.003$ or less; the Bonferroni correction would require a p value of $p<.0025$ for these analyses. In the HC sample, the general tendency for the regression results was either statistical significance at $p<.003$ (9/20) or a complete failure to even achieve nominal ($p<.05$) significance (8/20).

Overconfidence in healthy controls was more strongly associated with intelligence, measured by the WASI, than it was in participants with schizophrenia. This overconfidence is certainly consistent with the finding that people with lower ability tend to overestimate their functioning (Kruger and Dunning, 1999). In addition to making errors and wrong conclusions, those with lower ability scores do not realize their errors. When the skill level of participants on different measures was greater, they were increasingly able to recognize the limitations in their abilities (Kruger and Dunning, 1999). In fact, Ehrlinger et al. (2008) showed that over time better performing students became more accurate in predicting future test scores, while the worst performers were unable to do so, despite being given repeated feedback about their performance.

### Conclusions.

These data suggest that lower levels of ability, across neurocognitive and social cognitive domains, converge with a bias toward overestimation of performance. It is not clear at this time whether the momentary judgement of performance, the forgetting of momentary judgments, challenges in consolidating of momentary judgements, or problems in judging the difficulty of external tasks is the origin of the mismatch between confidence and performance. Treatment interventions aimed at challenges in self-assessment will need to consider several factors, including understanding the level of information requires to make a judgment, the level of certainty in judgments, and the need to use prior information to guide future behavior. Later research addressing momentary accuracy versus ability to correctly aggregate momentary impressions will be important. This research will also need to address the issue of whether a relentlessly positive introspective bias actually suggests the absence of attempts at accurate introspective accuracy. This research will also need to address whether momentary mood states are truly implicated in momentary judgments about performance on challenging tasks or whether the lack of endorsement of any depression is an overt manifestation of challenges in self-assessment.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1.**

Performance on the Bell Lysaker Emotion Recognition Test

| | Healthy Controls (Mean ± SD) | Schizophrenia (Mean ± SD) |
|---|---|---|
| *N* | 154 | 218 |
| Confidence (0–100) | 85.58 ± 10.56 | 81.06 ± 16.66 |
| Task performance (%) | 75.79 ± 12.84 | 66.34 ± 19.15 |
| Difference between confidence and performance (%) | 9.26 ± 16.78 | 17.19 ± 24.91 |

Note. Participants with schizophrenia were significantly more overconfident than healthy controls, $t(369)=3.67$, $p<.001$, correcting for unequal variances.

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## Table 2.

Pearson Correlations Between Confidence, Performance, and Overconfidence on the Bell Lysaker Emotion Recognition Test and Performance-Based and Self-reported variables

| | Healthy Control (HC) | | | Participants with schizophrenia (SCZ) | | |
|---|---|---|---|---|---|---|
| **Performance Based Tasks** | **BLERT confidence in performance (0–100)** | **BLERT performance (%)** | **BLERT Over confidence** | **BLERT confidence in performance (0–100)** | **BLERT performance (%)** | **BLERT Over confidence** |
| ER-40 | −.16* | .34** | −.14! | .01 | .67** | −.50**! |
| Hinting | 0.01 | .08 | −.07! | .03 | .35** | −.30**! |
| Eyes | −.03 | .40** | −.38**! | −.03 | .65** | −.55**! |
| TASIT | 0.06 | .38** | −.35** | −.03 | .53** | −.44** |
| Trails A | −.02 | −.32** | .29** | −.01 | −.31** | .23* |
| Symbol Coding | .00 | .35** | −.34** | .00 | .43** | −.38** |
| HVLT | −.04 | .18* | −.23*! | .00 | .50** | −.37**! |
| Letter number span | −.13 | .19* | −.28**! | −.01 | .49** | −.42**! |
| Animal Fluency | −.03 | .26* | −.27** | −.05 | .44** | −.38** |
| WASI Vocabulary | −.21** | .35** | −.47** | −.03 | .57** | −.50** |

* $p$<.05;

** $p$<.01;

! Correlation is significantly larger in the SCZ sample than HC

## Table 3.

Regression Analyses Predicting Performance Based Tasks with BLERT Overconfidence Entered First and BLERT performance Entered Second

| | Healthy Control | | | | Participants with schizophrenia | | | |
|---|---|---|---|---|---|---|---|---|
| | ***R*²** | ***R*²** | ***t*** | ***p*** | ***R*²** | ***R*²** | ***t*** | ***p*** |
| | **Change** | **Total** | | | **Change** | **Total** | | |
| ER-40 | | | | | | | | |
| Over Confidence | .04 | .04 | 2.67 | .01 | .24 | .24 | 8.32 | <.001 |
| Performance | .07 | .11 | 3.50 | <.001 | .21 | .46 | 9.18 | <001 |
| Hinting | | | | | | | | |
| Over Confidence | .01 | .01 | 0.35 | .73 | .09 | .09 | 4.62 | <.001 |
| Performance | .01 | .02 | 0.98 | .33 | .04 | .13 | 2.92 | .004 |
| Eyes | | | | | | | | |
| Over Confidence | .17 | .17 | 5.48 | <.001 | .31 | .31 | 9.87 | <.001 |
| Performance | .01 | .18 | 2.37 | .019 | .12 | .43 | 6.62 | <.001 |
| TASIT | | | | | | | | |
| Over Confidence | .15 | .15 | 5.10 | <.001 | .20 | .20 | 7.29 | <.001 |
| Performance | .00 | .15 | 1.16 | .247 | .09 | .29 | 5.11 | <.001 |
| Trails A | | | | | | | | |
| Over Confidence | .08 | .08 | 3.64 | <.001 | .06 | .06 | 3.52 | .001 |
| Performance | .02 | .10 | 1.88 | .062 | .04 | .10 | 3.05 | .003 |
| Symbol Coding | | | | | | | | |
| Over Confidence | .12 | .12 | 4.35 | <.001 | .14 | .14 | 5.86 | <.001 |
| Performance | .02 | .14 | 1.70 | .091 | .05 | .19 | 3.59 | <.001 |
| HVLT | | | | | | | | |
| Over Confidence | .05 | .05 | 2.72 | .007 | .14 | .14 | 5.72 | <.001 |
| Performance | .00 | .05 | 0.20 | .844 | .07 | .21 | 4.30 | <.001 |
| Letter Number | | | | | | | | |
| Over Confidence | .08 | .08 | 3.52 | .001 | .17 | .17 | 6.57 | <.001 |
| Performance | .00 | .08 | 0.51 | .61 | .07 | .24 | 4.45 | <.001 |
| Animal Fluency | | | | | | | | |
| Over Confidence | .07 | .07 | 3,32 | .001 | .14 | .14 | 4.42 | <.001 |
| Performance | .01 | .08 | 1.34 | .17 | .05 | .19 | 3.51 | .001 |
| WASI IQ | | | | | | | | |
| Over Confidence | .22 | .22 | 6.44 | <.001 | .25 | .25 | 8.36 | <.001 |
| Performance | .00 | .22 | 0.28 | .78 | .08 | .33 | 4.83 | <.001 |

Note. t and p values are from the final step

**Table 4.**

Regression Results predicting Overconfidence

| | | | | | |
|---|---|---|---|---|---|
| **Participants with schizophrenia** | | | | | |
| **Model 1** | | | | | |
| **Variable** | **Step** | **$R^2$ Change** | **$R^2$ Total** | ***t*** | ***p*** |
| Eyes Test | 1 | .31 | .31 | 5.00 | .001 |
| ER-40 | 2 | .05 | .36 | 3.95 | .001 |
| Animal Naming | 3 | .03 | .39 | 2.84 | .001 |
| Model 2 | | | | | |
| WASI Vocabulary | 1 | .25 | .25 | 8.33 | .001 |
| Model 3 | | | | | |
| Eyes Test | 1 | .30 | .30 | 3.29 | .001 |
| ER-40 | 2 | .05 | .35 | 3.64 | .001 |
| WASI Vocabulary | 3 | .04 | .39 | 2.43 | .016 |
| Animal Naming | 4 | .03 | .42 | 2.42 | .001 |
| **Healthy Controls** | | | | | |
| **Model 1** | | | | | |
| **Variable** | **Step** | **$R^2$ Change** | **$R^2$ Total** | ***t*** | ***p*** |
| Eyes Test | 1 | .14 | .14 | 4.36 | .001 |
| Symbol Coding | 2 | .04 | .18 | 3.10 | .002 |
| Model 2 | | | | | |
| WASI Vocabulary | 1 | .20 | .20 | 6.02 | .001 |
| Model 3 | | | | | |
| WASI Vocabulary | 1 | .21 | .20 | 4.38 | .001 |
| Eyes Test | 2 | .03 | .24 | 2.52 | .013 |