Reality monitoring and its association with social functioning in schizophrenia

Marielle Divilbiss [a,*], Amanda McCleery [a], Jennifer M. Aakre [b], James P. Seghers [a],
Emily Bell Schumann [a], Nancy M. Docherty [a]

[a] Department of Psychology, Kent State University, P.O. Box 5190, Kent, OH 44240-0001, United States
[b] VA Capitol Healthcare Network Mental Illness Research, Education, and Clinical Center (MIRECC) at Baltimore VA Medical Center, 10 North Greene Street,
Baltimore MD, 21201, United States

ARTICLE INFO

ABSTRACT

Reality monitoring, or the ability to discriminate internal from external information present in short-term memory, is relevant in the study of schizophrenia. Previous research has linked monitoring impairments with psychotic symptoms and certain forms of communication disturbance. The focus of the present study was to test the hypothesis that there would be specific relationships between reality monitoring in patients with schizophrenia and current and pre-morbid social functioning, beyond the effects of general verbal ability. Fifty outpatients with schizophrenia or schizoaffective disorder were assessed for internal/external reality monitoring deficits, general verbal intelligence, and both current and pre-morbid social functioning. Associations between these variables were assessed. Exploratory analyses also were conducted to determine whether specific types of reality monitoring errors were related to social functioning. Results showed that (a) overall accuracy in reality monitoring was related to pre-morbid social functioning beyond the effects of verbal ability, (b) sensitivity to old versus new information in reality monitoring was related to current social functioning, and (c) a say–report–think reality monitoring error was significantly associated with pre-morbid social functioning. The results support the hypothesis of an association between reality monitoring sensitivity and social functioning.

© 2010 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Source monitoring has been widely studied in the context of schizophrenia. In the simplest terms, source monitoring is the ability to identify the origins of information in memory, that is, to discern the sources of one's memories, knowledge, and beliefs (Johnson et al., 1993). Many studies have demonstrated that people with schizophrenia perform more poorly on tasks of source monitoring when compared to non-schizophrenic controls (Brebion et al., 2002; Moritz et al., 2003; Henquet et al., 2005). Further, some studies have demonstrated that unaffected first-degree relatives of people with schizophrenia and people with schizotypal traits perform more poorly on source monitoring tasks than healthy controls, indicating a possible vulnerability factor (Brunelin et al., 2007; Peters et al., 2007).

One type of source monitoring of interest in schizophrenia is internal/external source monitoring, which involves the ability to differentiate between internally generated material and material generated from an external source. Investigators have theorized that internal/external source monitoring impairment may underlie psychotic symptoms and certain forms of communication disturbance associated with schizophrenia. Johnson et al. (1993) theorized about the relationship of hallucinations to source monitoring, and the relationship between delusions and source monitoring. Auditory hallucinations involve the misperception that internally generated material is coming from an external source. Similarly, delusions involve confusion between internally generated fantasy and external reality. Research has found evidence, albeit somewhat mixed, to support associations between source monitoring impairment and these core psychotic symptoms (Bentall et al., 1991; Keefe et al., 1999; Brunelin et al., 2006).

A related construct, reality monitoring, is the ability to discriminate the sources of information present in short-term memory, such as emitted speech versus planned speech (Harvey, 1985). In "say/think" tasks measuring this construct, subjects are shown a series of words, and asked to read some of them aloud, others silently. Subjects are then required to distinguish which words they said aloud and which they only thought in their heads. As with other types of source monitoring tasks, individuals with schizophrenia have a difficult time making this differentiation (Brunelin et al., 2006, 2007; Moritz and Woodward, 2006). Nienow and Docherty (2005) have theorized, and demonstrated empirically, that certain schizophrenic communication disturbances are associated with verbal reality monitoring deficits. Specifically, the inability to remember what one has said versus what one has only thought is associated with a high frequency of "missing information" references in speech, i.e. references for which there is no referent. Confusion of spoken words with thoughts presumably disrupts effective communication.

* Corresponding author. Tel.: +1 330 672 7671; fax: +1 330 672 3786.
E-mail address: mdivilbiss@gmail.com (M. Divilbiss).

As noted above, research has demonstrated relationships between source/reality monitoring impairments, positive symptoms and communication disturbance. It seems likely that other functions would also be affected, particularly in the area of social functioning. Effective social relating is based on a socially-shared reality. A person who has difficulty discriminating between internal and external information will likely have comprehension and communication impairments that will impede social relating. Indeed, difficulty in reality monitoring, or problems in recognizing what one knows (i.e. metacognition), would inhibit real-world functioning (Koren et al., 2006; Lysaker et al., 2009). Awareness of both knowledge, and the limitations of one's knowledge, are necessary for interacting with others socially, so that communication is clear. This awareness is also required for working, so that one can perform tasks appropriately or ask for assistance when needed. Therefore, awareness of one's knowledge, including differentiating internal and external experiences, is necessary for daily functioning.

It is also possible that internal/external reality monitoring impairments affect the pre-morbid functioning of those who go on to develop schizophrenia. Social functioning impairments have already been documented during the pre-morbid phase (Crow et al., 1995; Davidson et al., 1999). Blurring of reality with fantasy, such as unusual experiences or magical ideation, has also been documented as related to psychosis proneness (Chapman et al., 1994; Kwapil et al., 1997). Given the presence of other deficits in pre-morbid functioning, it is plausible that internal/external reality monitoring might also be impaired, and might provide a valuable measure for those considered to be in a prodromal phase of the disease.

The present study looked at the associations between performance on an internal/external reality monitoring task and both current and pre-morbid social functioning. We hypothesized that there would be a specific association between reality monitoring accuracy and current social functioning, such that patients who provided fewer correct answers on a reality monitoring task would show worse social functioning, beyond the effects of general verbal ability. We hypothesized that there would be a specific association between reality monitoring sensitivity and current social functioning, such that patients who performed more poorly on a reality monitoring task, taking into account both correct responses and false alarms, would show worse social functioning, beyond the effects of general verbal ability. Based on the findings of reality monitoring impairment in relatives of patients and in people with schizotypal traits (Docherty et al., 1999; Brunelin et al., 2007), we also expected to find an association between reality monitoring accuracy and sensitivity and pre-morbid social functioning. Exploratory analyses were also conducted to assess whether specific types of reality monitoring errors (say–report–think and think–report–say) were associated with current or pre-morbid social functioning. In addition, because findings of associations of source monitoring with delusions and hallucinations have been mixed, we tested for those associations in the present study as well.

2. Method

2.1. Participants

Participants consisted of 50 outpatients (Table 1), ages 18–55, receiving treatment at a community mental health clinic. All patients met *Diagnostic and Statistical Manual of Mental Disorders: Fourth Edition* (DSM-IV; American Psychiatric Association, 1994) criteria for schizophrenia or schizoaffective disorder. Patients were excluded from the study if they had histories suggestive of organic complications (alcohol dependence, inhalant abuse, head injury, and seizure disorder), met criteria for current substance abuse, or were not native English speakers. All patients in the sample were considered clinically stable as determined by their outpatient clinicians, and all except for one patient were receiving antipsychotic medications.

2.2. Procedures

2.2.1. Diagnosis

A semi-structured diagnostic interview, the Schedule for Affective Disorders and Schizophrenia–Lifetime Version (SADS–L; Spitzer and Endicott, 1977), adapted to be

Table 1
Descriptive information for participants and scale mean scores (standard deviations).

	Mean (standard deviation)
Number of participants	50
Men (%)	28 (56%)
Age	36 (9)
Education	12 (2)
Shipley Verbal IQ	98.9 (11.6)
Global Assessment of Functioning	50.8 (11.4)
Pre-morbid social functioning	23 (6.2)
BPRS Hallucinations	3.3 (2.0)
BPRS Delusions	2.8 (1.8)
Reality monitoring accuracy	15.30 (2.93)
Reality monitoring hits — say	4.62 (1.85)
Reality monitoring hits — think	4.92 (2.07)
Reality monitoring false alarms — say	2.54 (1.66)
Reality monitoring false alarms — think	1.36 (1.70)
Say–report–think errors	0.34 (0.22)
Think–report–say errors	0.22 (0.27)
Reality monitoring sensitivity (d')	0 (1.19)
Reality monitoring response bias (β)	0.28 (1.80)

BPRS (Brief Psychiatric Rating Scale).
Maximum possible scores for Global Assessment of Functioning = 100, Pre-morbid Adjustment Scale = 35, BPRS Hallucinations = 7, BPRS Delusions = 7.

used with DSM-IV criteria, was administered to each participant. Diagnoses were determined by a clinical psychologist with extensive research diagnostic experience, based on information from the SADS interview and chart review.

2.2.2. Symptom ratings

Symptom severities were rated with the Brief Psychiatric Scale (BPRS; Overall and Gorham, 1962; Lukoff et al., 1986). All of the symptom ratings were done by graduate level research assistants previously trained to good levels of interrater reliability on these scales. Co-ratings of 10 patients in the present study indicated good reliability: total BPRS ICC = 0.90; hallucinations ICC = 0.83; delusions ICC = 0.90.

2.2.3. Internal/external reality monitoring

Internal/external reality monitoring was evaluated by a two part performance-based assessment developed for a previous study (see Nienow and Docherty, 2005). For part one, participants were presented with a series of 16 simple incomplete statements (e.g. A one cent coin is called a ___) and then asked to either think of the answer in their head (8 items) or say it out loud (8 items). Say and think statements in part one were presented in a quasi-random order (think, say, say, say, think, say, think, say, think, think, say, think, think, say, think, say) which was kept consistent across participants. However, the instructions were alternated so that the "say" statements for even numbered participants were the "think" statements for odd numbered participants, and vice versa. For part two, participants were handed a word list containing the 16 target words, interspersed with 8 novel words, immediately after presentation of part one. Participants were asked to look at each word and indicate whether it was said out loud, thought in their head, or a new word.

Five indices were produced using this reality monitoring task. First, an accuracy index was created by dividing the number of items correctly identified as say, think or new by the total number of items. Next, signal detection analysis was used to calculate sensitivity (d') and response bias (β) in identifying old (versus new) words. Sensitivity is a measure of accuracy that takes into account both hits and false alarms (Stanislaw and Todorov, 1999). Response bias indicates an overall tendency to give a particular response, in this case to identify words as "old." The two other indices were attribution error frequencies for old words. A say–report–think error occurred when a participant inaccurately classified a word as having been thought when it was actually said aloud. Say–report–think errors were calculated as a proportion: the number of say items misattributed as think items, divided by the number of say items accurately recognized as old. A think–report–say error occurred when a participant inaccurately classified a word as having been said aloud when it was only thought. Think–report–say errors also were calculated as a proportion: the number of think items misattributed as say items, divided by the number of think items accurately recognized as old.

2.2.4. Current social functioning

The Global Assessment of Functioning Scale (GAF; American Psychiatric Association, 1994) is an interviewer-rated measure of current functioning based on psychological, social and occupational functioning variables. Current functioning is rated on a scale from 1 (e.g. persistent danger of severely hurting self or others) to 100 (e.g. superior functioning; no symptoms).

2.2.5. Pre-morbid social functioning

The Pre-morbid Adjustment Scale (Goldstein, 1978) is a self-report measure comprised of questions relating to social functioning during the adolescent years (ages 16 to 20) and prior to onset of the illness. Questions inquire about friendships, dating, participation in

organizations, hobbies, and other activities. The measure is rated on a scale from 5 to 35, with higher scores indicating better pre-morbid social functioning.

2.2.6. Verbal ability

The Shipley Institute of Living Scale, Part I (SILS; Shipley, 1940) was used as a measure of general verbal ability. The measure is comprised of 40 multiple-choice vocabulary words. Because vocabulary ability is believed to remain stable over time, the SILS is a good measure of pre-morbid verbal ability.

2.2.7. Statistical analyses

Pearson correlations were used to examine the associations between internal/external reality monitoring performance and current and pre-morbid social functioning. Pearson correlations were also used to examine the associations of current and pre-morbid social functioning with reality monitoring after general verbal ability was regressed out. Exploratory Pearson correlations were conducted between specific types of reality monitoring errors and current and pre-morbid social functioning. Finally, Pearson correlations were further used to examine the associations between reality monitoring sensitivity and both hallucinations and delusions. All analyses were two-tailed.

3. Results

3.1. Reality monitoring accuracy, sensitivity, and response bias

Distributions of all variables met normal assumptions (see Table 1 for descriptive statistics). Table 2 presents the correlations of reality monitoring accuracy, sensitivity and response bias with current and pre-morbid social functioning, both before and after controlling for general verbal ability. Significant associations were found between pre-morbid social functioning and reality monitoring accuracy before controlling for general verbal ability and after controlling for general verbal ability. Non-significant associations were found between current social functioning and reality monitoring accuracy, both before and after controlling for general verbal ability. Significant associations were found between current social functioning and reality monitoring sensitivity, both before and after controlling for general verbal ability. Non-significant associations were found between pre-morbid social functioning and reality monitoring sensitivity, both before and after controlling for general verbal ability. No significant relationships were found between reality monitoring response bias and either pre-morbid or current social functioning, before or after controlling for general verbal ability.

3.2. Specific reality monitoring errors and social functioning

Table 3 presents the exploratory correlations of current and pre-morbid social functioning with specific types of reality monitoring errors. One statistically significant correlation was found between pre-morbid social functioning and say–report–think errors ($r = -0.405$, $P < 0.01$), indicating that participants with poorer pre-morbid social functioning made more errors indicating belief they had only thought words that they actually had said out loud. The statistically significant correlation between pre-morbid social functioning and say–report–think errors remained after controlling for general verbal ability. There were no other significant correlations with specific types of errors. There were no significant correlations between specific types of errors and either delusions or hallucinations.

3.3. Reality monitoring and symptoms

Based on the recent findings of Keefe and Brunelin (Keefe et al., 2002; Brunelin et al., 2006, 2007), we ran zero-order correlations to assess the associations of positive symptoms with reality monitoring. A significant relationship was found between reality monitoring sensitivity and delusions ($r = -0.307$, $P < 0.05$) and a non-significant trend was found between reality monitoring bias and delusions ($r = 0.238$, $P = 0.096$). A non-significant association was found between reality monitoring sensitivity and hallucinations ($r = -0.212$, $P = 0.140$) and no association was found between reality monitoring bias and hallucinations ($r = -0.012$, $P = 0.933$).

4. Discussion

The results showed that accuracy in reality monitoring was significantly related to pre-morbid social functioning. This significant relationship remained after controlling for general verbal ability. Results also showed a trend between current social functioning and reality monitoring accuracy which remained after controlling for general verbal ability. The significant relationship between pre-morbid social functioning and reality monitoring accuracy supports previous research suggesting that reality monitoring impairment reflects a vulnerability factor for schizophrenia. This impairment further affects functioning even prior to the onset of the illness (Green et al., 1997; Brunelin et al., 2007).

The results showed that sensitivity in reality monitoring was significantly related to current social functioning. This significant relationship remained after controlling for general verbal ability. Results also showed a non-significant trend between pre-morbid social functioning and reality monitoring sensitivity, which remained after controlling for general verbal ability. These findings support the idea that internal/external reality monitoring sensitivity is related to social functioning, and that the relationship is independent of general verbal ability. It is possible, however, that the relationship between internal/external reality monitoring sensitivity and social functioning is due to problems in memory functioning in general. It has been shown that people with schizophrenia have memory difficulties (Aleman et al., 1999), and facets of memory other than reality monitoring were not assessed in the current study. Future research should incorporate a general measure of memory functioning to elucidate these results. However, whether due to general or specific memory impairments, the significant relationship between current social functioning and reality monitoring sensitivity supports previous research suggesting that reality monitoring performance is related to functional outcomes (Koren et al., 2006). The findings of this study are consistent with those of other researchers considering the impact of metacognitive ability on work behavior (Lysaker et al., 2009) and social relating (Brune, 2006), and may help to pin-point the specific metacognitive abilities related to social functioning. In addition, research has shown that focusing on metacognitive abilities in treatment can lead to better functional outcomes (Dimaggio et al., 2008; Silverstein and Bellack, 2008).

Table 2
Correlations of reality monitoring accuracy, sensitivity and response bias with current and pre-morbid social functioning.

		Reality monitoring accuracy	Significance (2-tailed)	Reality monitoring sensitivity (d')	Significance (2-tailed)	Reality monitoring response bias (β)	Significance (2-tailed)
GAF	Without controlling for SILS-I	0.237[†]	0.098	0.388[**]	0.001	0.003	0.986
	Controlling for SILS-I	0.219	0.127	0.369[**]	0.001	−0.003	0.981
PAS	Without controlling for SILS-I	0.358[*]	0.012	0.242[†]	0.093	0.217	0.134
	Controlling for SILS-I	0.351[*]	0.014	0.236	0.103	0.214	0.139

GAF (Global Assessment of Functioning Scale); PAS (Pre-morbid Adjustment Scale).
[†] $P < 0.10$.
[*] $P < 0.05$.
[**] $P < 0.01$.

Table 3
Correlations of specific error types with total pre-morbid and current social functioning.

		Say–report–think errors	Significance (2-tailed)	Think–report–say errors	Significance (2-tailed)
GAF	Without controlling for SILS-I	− 0.045	0.756	0.089	0.541
	Controlling for SILS-I	− 0.033	0.822	0.088	0.543
PAS	Without controlling for SILS-I	− 0.405[**]	0.004	0.179	0.218
	Controlling for SILS-I	− 0.399[**]	0.005	0.178	0.220

GAF (Global Assessment of Functioning Scale); PAS (Pre-morbid Adjustment Scale).
 * $P < 0.05$.
 ** $P < 0.01$.

Exploratory analyses showed that patients in this sample who had poorer pre-morbid social functioning made more errors misattributing external material as internal. While we predicted that internal/external reality monitoring would be related to social functioning, it is less clear why there was a bias toward making this specific type of error. It is possible that a bias toward internal misattributions may reflect a deficient ability to recognize and remember external stimuli. Such a confusion could result in an impaired understanding of social situations. For example, if a person attributed external cues to internal sources, he/she might not respond appropriately to external stimuli, such as input from another person. However, it is important to note that these findings are based on exploratory analyses and require further research. A significant relationship also was found between reality monitoring sensitivity and delusions, consistent with theory and similar to findings of Keefe et al. (2002), although it was not significantly related to hallucinations in this sample.

There were some limitations to this study. Although the association between current social functioning and reality monitoring sensitivity was significant, the association between current social functioning and reality monitoring accuracy was not significant. The GAF is not specifically a measure of interpersonal functioning but includes current psychological symptoms and occupational functioning in addition to social functioning. The assessment of pre-morbid social functioning also had limitations in that it was retrospective. Furthermore, the current study was limited in its measures more generally due to use of an archival data set. In future studies, a more specific measure of current social functioning should be used, as well as a more accurate measure of pre-morbid social functioning. Another limitation was the lack of a more comprehensive neurocognitive battery. Although the Shipley is an acceptable measure of general verbal functioning, it is limited in the assessment of non-verbal aspects of general cognitive ability. The current study also lacked a control group for the comparison of results. However, despite these limitations, the findings are promising, and contribute to our understanding of how specific deficits affect the everyday lives of people with schizophrenia. This area of research can inform cognitive remediation intervention programs that might help individuals function better socially.

References

Aleman, A., Hijman, R., de Haan, E.H.F., Kahn, R.S., 1999. Memory impairment in schizophrenia: a meta-analysis. The American Journal of Psychiatry 156, 1358–1366.
American Psychiatric Association, 1994. Diagnostic and statistical manual of mental disorders, Fourth Edition. Washington, DC, American Psychiatric Association.
Bentall, R.P., Baker, G.A., Havers, S., 1991. Reality monitoring and psychotic hallucinations. The British Journal of Clinical Psychology 30 (3), 213–222.
Brebion, G., Gorman, J.M., Amador, X., Malaspina, D., Sharif, Z., 2002. Source monitoring impairments in schizophrenia: characterization and association with positive and negative symptomatology. Psychiatry Research 112 (1), 27–39.
Brune, M., 2006. Theory of mind and social competence in schizophrenia. Clinical Neuropsychiatry 3 (2), 132–138.
Brunelin, J., Combris, M., Poulet, E., Kallel, L., D'Amato, T., Dalery, J., Saoud, M., 2006. Source monitoring deficits in hallucinating compared to non-hallucinating patients with schizophrenia. European Psychiatry 21 (4), 259–261.
Brunelin, J., D'Amato, T., Brun, P., Bediou, B., Kallel, L., Senn, M., Poulet, E., Saoud, M., 2007. Impaired verbal source monitoring in schizophrenia: an intermediate trait vulnerability marker? Schizophrenia Research 89 (1–3), 287–292.
Chapman, L.J., Chapman, J.P., Kwapil, T.R., Eckblad, M., Zincer, M.C., 1994. Putatively psychosis-prone subjects 10 years later. Journal of Abnormal Psychology 103 (2), 171–183.
Crow, T.J., Done, D.J., Sacker, A., 1995. Childhood precursors of psychosis as clues to its evolutionary origins. European Archives of Psychiatry and Clinical Neuroscience 245 (2), 61–69.
Davidson, M., Reichenberg, A., Rabinowitz, J., Weiser, M., Kaplan, Z., Mark, M., 1999. Behavioral and intellectual markers for schizophrenia in apparently healthy male adolescents. The American Journal of Psychiatry 156 (9), 1328–1335.
Dimaggio, G., Lysaker, P.H., Carcione, A., Nicolo, G., Semerari, A., 2008. Know yourself and you shall know the other…to a certain extent: multiple paths of influence of self-reflection on mindreading. Consciousness and Cognition 17, 778–789.
Docherty, N.M., Gordinier, S.W., Hall, M.J., Cutting, L.P., 1999. Communication disturbances in relatives beyond the age of risk for schizophrenia and their associations with symptoms in patients. Schizophrenia Bulletin 25 (4), 851–862.
Goldstein, M., 1978. Further data concerning the relation between premorbid adjustment and paranoid symptomatology. Schizophrenia Bulletin 4 (2), 236–243.
Green, M.F., Nuecherlein, K.H., Breitmeyer, B., 1997. Backward masking performance in unaffected siblings of schizophrenic patients: evidence for a vulnerability indicator. Archives of General Psychiatry 54 (5), 465–472.
Harvey, P.D., 1985. Reality monitoring in mania and schizophrenia: the association of thought disorder and performance. The Journal of Nervous and Mental Disease 173 (2), 67–73.
Henquet, C., Krabbendam, L., Dautzenberg, J., Jolles, J., Merckelbach, H., 2005. Confusing thoughts and speech: source monitoring and psychosis. Psychiatry Research 133 (1), 57–63.
Johnson, M.K., Hashtroudi, S., Lindsay, D.S., 1993. Source monitoring. Psychological Bulletin 114 (1), 3–28.
Keefe, R.S.E., Arnold, M.C., Bayen, U.J., 1999. Source monitoring deficits in patients with schizophrenia; a multinomial modeling analysis. Psychological Medicine 29 (4), 903–914.
Keefe, R.S.E., Arnold, M.C., Bayen, U.J., McEvoy, J.P., Wilson, W.H., 2002. Source-monitoring deficits for self-generated stimuli in schizophrenia: multinomial modeling of data from three sources. Schizophrenia Research 57, 51–67.
Koren, D., Seidman, L.J., Goldsmith, M., Harvey, P.D., 2006. Real-world cognitive- and metacognitive-dysfunction in schizophrenia: a new approach for measuring (and remediating) more "right stuff". Schizophrenia Bulletin 32 (2), 310–326.
Kwapil, T.R., Miller, M.B., Zincer, M.C., Chapman, J., Chapman, L.J., 1997. Magical ideation and social anhedonia as predictors of psychosis proneness: a partial replication. Journal of Abnormal Psychology 106, 491–495.
Lukoff, D., Liberman, R.P., Nuechterlein, K.H., 1986. Symptom monitoring in the rehabilitation of schizophrenic patients. Schizophrenia Bulletin 12 (4), 578–602.
Lysaker, P.H., Dimaggio, G., Carcione, A., Procacci, M., Bock, K.D., Davis, L.W., Nicolo, G., 2009. Metacognition and schizophrenia: the capacity for self-reflectivity as a predictor for prospective assessments of work performance over six months. Schizophrenia Research. doi:10.1016/j.schres.2009.04.024 electronic publication, May 19, 2009.
Moritz, S., Woodward, T.S., 2006. The contribution of metamemory deficits to schizophrenia. Journal of Abnormal Psychology 115 (1), 15–25.
Moritz, S., Woodward, T.S., Ruff, C.C., 2003. Source monitoring and memory confidence in schizophrenia. Psychological Medicine 33 (1), 131–139.
Nienow, T., Docherty, N., 2005. Internal source monitoring deficits and communication disturbance in patients with schizophrenia. Psychological Medicine 35, 1717–1726.
Overall, J.E., Gorham, D.R., 1962. The brief psychiatric rating scale. Psychological Reports 10, 799–812.
Peters, M.J.V., Smeets, T., Giesbrecht, T., Jelicic, M., Merckelbach, H., 2007. Confusing action and imagination: action source monitoring in individuals with schizotypal traits. The Journal of Nervous and Mental Disease 195 (9), 752–757.
Shipley, W.C., 1940. A self-administering scale for measuring intellectual impairment and deterioration. Journal of Psychology: Interdisciplinary and Applied 9, 371–377.
Silverstein, S.M., Bellack, A.S., 2008. A scientific agenda for the concept of recovery as it applies to schizophrenia. Clinical Psychology Review 28 (7), 1108–1124.
Spitzer, R.L., Endicott, J., 1977. Schedule for Affective Disorders and Schizophrenia — Lifetime Version. New York Psychiatric Institute, New York.
Stanislaw, H., Todorov, N., 1999. Calculation of signal detection theory measures. Behavior Research Methods, Instruments, & Computers 31 (1), 137–149.