Confusing thoughts and speech: source monitoring and psychosis

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Abstract

To explore the idea that deficits in source monitoring may underlie positive symptoms of schizophrenia, the current study compared schizophrenic patients’ performance (n=15) on an internal source-monitoring task with that of normal controls (n=15). On the basis of a source-monitoring task in which participants had to recall whether they had verbalized answers or merely thought about these answers, overall source monitoring performance, discrimination index, and response bias were calculated. In addition, participants completed cognitive tests and symptomatology questionnaires. Relative to controls, patients had significantly more difficulties with monitoring their own actions and showed a tendency towards misclassifying imagined thoughts as verbalized thoughts. Source-monitoring performance was related to selective attention, but not to other cognitive domains. No relationship was found between source monitoring and symptomatology. Failures in internal source monitoring are a prominent feature of schizophrenia, and our results suggest that they form a more enduring characteristic of this disorder than has previously been assumed.

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1. Introduction

Source monitoring refers to cognitive processes involved in determining the source of memory information (Johnson et al., 1993). The following three source-monitoring situations can be distinguished: (a) discriminating between internally generated information (e.g., fantasies) and memories of externally derived information, a process that is usually termed reality monitoring (Johnson and Raye, 1981); (b) discriminating between two or more external sources (e.g., television versus a good friend); and (c) discriminating between two internal sources (e.g., fantasies versus dreams), a process that is often referred to as self-monitoring (Johnson et al., 1993).
Transient source-monitoring errors are common in everyday social situations. However, psychotic experiences have been hypothesized to originate from a fundamentally disturbed source monitoring. Thus, several authors have argued that a specific source-monitoring impairment may underlie certain positive psychotic symptoms (Heilbrun, 1980; Hoffman, 1986; Bentall, 1990). For example, according to Frith’s model of psychosis (Frith and Done, 1989; Frith, 1992), symptoms of alien control and certain hallucinations arise from difficulties with monitoring one’s own willed intentions, actions, and thoughts, whereas other symptoms (e.g., paranoid delusions) are due to difficulties in monitoring the intentions of others. A number of source-monitoring studies have shown that during the acute phase of schizophrenia, patients find it difficult to discriminate between self-generated items and items generated by the researcher (Keefe et al., 1999; Brébion et al., 2000). The majority of these studies suggest that an external attribution bias underlies reality-monitoring failures exhibited by schizophrenic patients (Harvey, 1985; Keefe et al., 1999; see also Franck et al., 2000). In this line of reasoning, positive symptoms (e.g., hallucinations and certain delusions) originate from a tendency to attribute self-generated information to an external source (Slade and Bentall, 1988).

Many previous studies on schizophrenic patients’ source-monitoring abilities relied on tasks that were highly artificial, in the sense of being far removed from everyday situations. A typical approach involves presenting the patient with examples of a certain category and asking him/her to generate other examples. Subsequently, the patient has to differentiate between self-generated items and items generated by the researcher (Keefe et al., 1999; Brébion et al., 2000). Although this type of design has provided important insights, a potential limitation is that its results may be difficult to generalize to real-life source-monitoring tasks (Parks, 1997). With this in mind, the present study relied on a source-monitoring task involving the common situation in which one tries to remember whether one has actually said or only thought something (Parks, 1997). Thus, we investigated whether schizophrenic patients make more mistakes on such an everyday source-monitoring task than matched normal controls, and if so, whether these mistakes specifically take the form of falsely identifying internal thoughts as verbalized thoughts.

There is still controversy regarding the precise relationship between source-monitoring performance and other cognitive functions (Brébion et al., 1996; Seal et al., 1997; Stirling et al., 1998). Seal et al. (1997) opined that performance on self-monitoring tasks is confounded by factors such as verbal intelligence, whereas the study by Stirling and colleagues indicated that self-monitoring performance is unrelated to general cognitive functioning (Stirling et al., 1998). Interestingly, Brébion et al. (1996) found schizophrenic patients’ source-monitoring performance to be related to selective attention, but not to memory capacity. We addressed this issue by examining the links between source-monitoring scores and performance in other cognitive domains, notably general intelligence, attention, and memory.

2. Method

2.1. Subjects

Participants were 15 patients with schizophrenia and 15 healthy controls. Patients were recruited through clinical and ambulatory facilities of psychiatric hospital Vijverdal, Maastricht, the Netherlands. Diagnoses were made by patients’ psychiatrists based on DSM-IV criteria (American Psychiatric Association, 1994). Mean age of the patient group (14 men; 1 woman) was 26.7 years (S.D.=6.4). Their average level of education measured on an 8-point scale, ranging from primary school to university degree, was 3.7 (S.D.=1.4). Average scores on the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1986) were 9.6 (S.D.=3.1) for the positive scale and 10.0 (S.D.=2.6) for the negative scale, indicating low levels of acute symptoms in the patient group. Eight patients received antipsychotic medication, with four of them using conventional neuroleptics and four receiving atypical neuroleptic drugs.

Control participants were recruited from the general population through random mailings in the local area and through the staff in the same psychiatric hospital. An attempt was made to match
controls with patients on age. Controls were only included if they had an absence of a lifetime history of any psychiatric disorder. None of them used psychotropic medication. The mean age of the control group (11 men; 4 women) was 26.6 years (S.D.=8.4), while the average level of education was 5.3 (S.D.=1.0). Patient and control groups did not differ with regard to age \( t(26)=1.0, P=0.38 \) or gender distribution \( \chi^2(1)=2.16, P=0.14 \). However, patients had a significantly lower level of education than controls \( t(26)=3.79, P<0.01 \).

For both patients and controls, the following exclusion criteria were used: (i) head trauma (with loss of consciousness), (ii) alcohol abuse (more than 5 units per day), and (iii) weekly use of drugs. Participants were paid for their participation, and written informed consent was obtained from all participants.

### 2.2. Materials and procedure

The source-monitoring task was derived from a series of studies by Parks (1997) and addressed participants’ ability to discriminate thoughts from actually verbalized thoughts. More specifically, participants had to indicate whether they had verbalized answers to earlier presented questions or only imagined they did. Materials consisted of 24 non-intrusive questions concerning personal history (e.g., “When were you born?”) and opinion (e.g., “What food do you like?”). Questions were presented on a computer screen, using a computer program specifically developed for this purpose (Dautzenberg and Henquet, 2000).

The source-monitoring task involved 16 trials. On half of the trials, single questions were presented. On the other half, questions were presented in pairs, with one question being located at the top half of the computer screen and the other being located at the bottom half of the screen. Questions were presented, after which a white screen was shown for 3 s. Participants had to prepare an answer to the presented questions. On single question trials, the word “answer” appeared shortly after presentation of the question. On dual question trials, either the words “answer top” or “answer bottom” appeared. Thus, here participants had to prepare an answer to both questions, but they verbalized only one answer. This resulted in verbalizing answers to 16 questions, while 8 answers were covertly prepared but never verbalized. Single questions and pairs were presented in a quasi-random order, and two counterbalanced versions were used. Participants were randomly allocated to one of the two versions. An examiner was present to monitor whether participants actually verbalized the answers. All participants were capable of answering the questions, which makes clear that the questions were simple and direct. Participants were instructed to press a button as soon as they had prepared an answer for the questions. Preparation time varied between participants but never took longer than 7 s. Given this constellation, we have every reason to believe that participants actually did prepare answers during the preparation phase of two-question trials, as opposed to merely remembering the questions. Following the presentation of the questions and a filler task (which took about 5 min), participants were given a surprise recognition task. In this task, participants saw original questions, each paired with a new question of the same content and form. For example, the old item “When were you born?” was presented along with the new item “Where were you born?” Participants were asked to identify for each of the 24 pairs of old and new items the question they had seen before (i.e., the memory aspect of the task). Further, they had to indicate whether they verbalized answers to the “old” items or only thought about an answer (i.e., the source-monitoring aspect of the task).

Neuropsychological assessment focused on intelligence and selective attention. Overall intellectual functioning was measured by three subtests of the Groningen Intelligence Test (GIT; Luteijn and van der Ploeg, 1983). The Stroop Color-Word test (Stroop, 1935) was used to tap selective attention (Houx et al., 1991). This test involves three cards displaying color names, colored patches, and color names printed in inconsistent ink colors (cards I–III, respectively). The time needed to complete card III is largely determined by the ability to ignore irrelevant but salient verbal color names, so as to color name the ink of the words. To obtain a measure of selective attention, Stroop response latencies were transformed into a Stroop interference score. The Schizotypal Personality Scale-A (STA; Claridge and Broks, 1984) was administered to measure schizotypal traits. Hallucinations, delu-
sions, and thought disorders were rated with the PANSS (Kay et al., 1986).

2.3. Data analyses

Data analysis was carried out using SPSS for Windows Version 10.0. Six source-monitoring indices were derived. First, a total score of correct source-monitoring responses was obtained by summing the number of old items that participants correctly classified as verbalized or covertly prepared items. Second, the memory score was calculated by summing the number of correctly identified old items. To correct for misses, source-monitoring responses were transformed into proportions of the total number of the 16 questions minus missed items.

Third, following the Two-High Threshold theory (Corwin, 1994), we calculated false-alarm rates (i.e., erroneous claims of verbalized answers) and missing rates (i.e., failures to identify verbalized answers). In keeping with the work of Brébion et al. (1997), we calculated a discrimination index and a response bias index, as measures of accurate and biased discrimination between internal and external thoughts, respectively. In doing so, we took the number of erroneous answers into account. Thus, the discrimination index was defined as: (number of hits+0.5/number of targets+1)−(number of false alarms+0.5/number of distractors+1). Response bias was defined as: (number of false alarms+0.5/number of distractors+1)/(1−discrimination index). Note that the source-monitoring task consisted of 16 targets (verbalized answers) and 8 distractors (covertly prepared answers). Measures were calculated into group means and compared between groups.

Group differences in source-monitoring performance, memory capacity, IQ, selective attention, and symptomatic measures were evaluated with Student t-tests. In addition, for the combined groups, Pearson correlations were calculated between the source-monitoring discrimination index and cognitive and symptomatic measures. Further, a Pearson correlation was calculated between source-monitoring performance and memory score. Multiple regression analysis was conducted with the discrimination index as the dependent variable and IQ, level of education, Stroop interference, and memory as independent variables.

3. Results

Basic psychometric information about the two groups is summarized in Table 1. As can be seen, patients had a lower educational level, lower IQ, but higher scores on STA than controls. Table 2 shows source-monitoring indices. Patients had fewer correct responses (i.e., correct identifications of verbalized versus internally prepared items) than controls: t(28)=2.84, \( P<0.01 \). Groups also differed with regard to a number of Two-High Threshold theory parameters. Thus, relative to controls, patients were signifi-
cantly worse at discriminating between targets and distractors, taking into account the number of errors they made [i.e., patients scored lower on the discrimination index than controls: $t(28)=2.94$, $P<0.01$]. Furthermore, relative to controls, patients tended to misclassify imagined thoughts as verbalized answers [$t(28)=-1.87$, $P=0.07$]. However, when overall performance accuracy was taken into account, no response bias was evident. There were no group differences with regard to the opposite type of failure (i.e., misclassifying a verbalized response as an imagined response). However, patients performed worse than controls on the memory aspect of the source-monitoring task [$t(28)=2.92$, $P<0.01$].

Table 3 shows correlations between the discrimination index derived from the source-monitoring task, cognitive performance indices, and symptomatology scores for the full sample. The discrimination index correlated significantly with IQ, selective attention, and memory capacity. The correlation between source-monitoring performance and memory score remained non-significant ($r=0.34$, $P=0.07$). Multiple regression analysis in which IQ, selective attention, level of education, and memory scores were entered together showed that only selective attention and IQ contributed significantly to the source-monitoring discrimination index ($R^2=0.45$). Alone, selective attention accounted for only 52% of the variance in the discrimination index. Analyses were repeated to compare medicated versus unmedicated patients. Medicated patients showed better performance on source-monitoring total score [$t(13)=2.22$, $P<0.05$] and had higher scores on the discrimination index [$t(10)=3.33$, $P<0.01$]. However, multiple regression analysis in which IQ, selective attention, and use of medication were entered together showed that use of medication did not contribute significantly to the source-monitoring discrimination index ($R^2=0.44$). No differences between medicated and unmedicated patients were observed in response bias or memory capacity. Symptomatology as measured with the STA and PANSS did not correlate significantly with total scores on the source-monitoring task (all $r$’s<0.14; all $P$’s>0.49).

4. Discussion

This study demonstrates different patterns of source-monitoring performance in patients with schizophrenia and normal controls. Thus, compared with normal control subjects, patients showed more difficulties in discriminating between covert and expressed thoughts, a finding that is in accordance with previous research (e.g., Brébion et al., 1997). We also found some tentative evidence to suggest that relative to controls, patients exhibited a stronger tendency to identify an item as verbalized, when in fact it was only covertly prepared. However, this difference was statistically imprecise, which may have to do with the small sample size. Note that this tendency is well in line with other studies documenting schizophrenic patients’ bias to attribute internal stimuli to external sources (Brébion et al., 1998, 2000; Keefe et al., 1999; Franck et al., 2000). Interestingly, we found no group differences in the opposite tendency, i.e., the tendency to falsely attribute verbalized items to imagined thoughts. However, group differences in source-monitoring errors were not reflected in response-bias elevations (which include overall source-monitoring accuracy). This might indicate that our finding of higher false-alarm level in patients reflects overall inaccuracy of source-monitoring performance instead of response bias. On the other hand, the design of the task might have elicited floor effects in response bias.

Regression analysis showed that selective attention as indexed by the Stroop task, more than general memory capacities, statistically predicts source-monitoring performance. Interestingly, these findings replicate results reported by Brébion et al. (1996). Perhaps, deficits in selective attention lead to dis-

<table>
<thead>
<tr>
<th>Discrimination index</th>
<th>Level of education</th>
<th>IQ (GIT)</th>
<th>Stroop interference</th>
<th>Memory</th>
<th>STA</th>
<th>PANSS*</th>
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<tr>
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<tr>
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<td></td>
<td></td>
<td>0.37</td>
<td>0.04</td>
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<tr>
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<td>-0.14</td>
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<tr>
<td>Memory</td>
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<td>STA</td>
<td>-0.14</td>
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<td>PANSS*</td>
<td>-0.06</td>
<td>0.84</td>
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* Positive and Negative Syndrome Scale.
turbances in the primary encoding process of information, which could then result in decreased quality of source monitoring. The fact that IQ also contributed significantly to source-monitoring performance is a finding that has been described earlier in schizophrenia research (Seal et al., 1997), although other studies did not describe such a relationship between source-monitoring performance and overall cognitive functioning (Stirling et al., 1998).

Although there were differences in source-monitoring performance between medicated and unmedicated patients, regression analyses showed that medication was not a pure independent predictor for source-monitoring performance, which is well in line with the general notion that memory deficits in schizophrenia patients have little or nothing to do with anti-psychotic medication (Aleman et al., 1999).

There is some debate as to whether positive symptoms are specifically linked to source-monitoring deficits. Whereas Franck et al. (2000) and Brébion et al. (2000) found evidence for such a specific link, Keefe et al. (1999) found schizophrenic patients’ tendency to misclassify imagined words as externally perceived not related to their positive symptoms. The current study concurs with that of Keefe et al. (1999) in that we were also unable to find a significant correlation between psychosis-related traits or symptomatology, on the one hand, and source-monitoring performance, on the other. However, a methodological restriction might underlie this null finding. Because of our limited sample size, STA scores lacked sufficient variation, with especially low rates of psychosis-related traits in the control group. A larger sample with more variation among trait scores might reveal a relationship between psychosis-related traits and source monitoring more clearly.

It has generally been assumed that failures in source-monitoring performance reflect a state-dependent deficit related to the positive symptoms of schizophrenia (Frith and Done, 1989; Slade and Bentall, 1988; Stirling et al., 1998; Brébion et al., 2000), as opposed to other cognitive deficits which seem to persist during clinical remission (Nopoulos et al., 1994; Cantor Graae et al., 1995). Yet, the fact that straightforward failures in source monitoring were identified in patients with few acute positive symptoms contradicts the alleged state-dependent character of these deficits.

As argued in the Section 1, many laboratory experiments on source monitoring expose participants to situations that rarely occur in everyday life. We feel that the procedure used in this study has better ecological validity because it focuses on an everyday life situation: ‘Did I just answer your question, or do I only think I did?’ Our results show that patients with schizophrenia have great difficulty with this task.

In conclusion, internal source monitoring is impaired in patients with schizophrenia. The defective memory performance generally found in these patients does not seem to underlie this impairment, but selective attention and general intelligence do contribute to variation in source-monitoring performance. A relation with the severity of positive symptoms could not be found in this study, possibly due to limited variation in symptoms in the current sample. Yet, failures in internal source monitoring are present in psychotic disorders independent of positive psychotic symptoms, indicating that these deficits are at least to some extent part of an enduring cognitive vulnerability in schizophrenia.

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References


