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# Selective attention impairment in schizophrenia

## Can it explain source monitoring failure?

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**Abstract:** Impairments in selective attention have been proposed as an explanation for the source monitoring deficits in schizophrenia. We tested this hypothesis by examining correlations between source monitoring variables and a measure of selective attention (from the Stroop Test) in 54 schizophrenic subjects and 42 normal controls. We did not find significant correlations between source monitoring measures and selective attention. Selective attention impairments do not explain source monitoring deficits observed in schizophrenia.

Source monitoring deficits deserve continued efforts to elucidate their causes and consequences.

**Keywords:** source monitoring, selective attention, schizophrenia, positive symptoms.

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## **Introduction**

Source monitoring refers to the ability to discriminate between several possible sources of memories. The Source monitoring framework proposed by Johnson et al. (1993) distinguishes 3 different types of source monitoring: internal, external and reality monitoring (i.e., discrimination between internal and external sources). Source monitoring errors have been proposed as potential explanation for the positive symptoms in schizophrenia. Some, but not all, studies lent support to this hypothesis. For example, some authors found a correlation between global positive symptomatology and source monitoring deficit in schizophrenic patients (Brébion et al. 2002; Stirling et al., 2001). This correlation seems to be more specific of particular positive symptoms such as hallucinations, thought intrusion, or alien control (Frith and Done, 1989; Keefe et al., 2002). There is also some specificity of the source monitoring errors produced by these patients. For example, patients with hallucinations seem to produce more “false alarms” (i.e., taking a new event for an old one) and more misattributions of self generated events to an external source than patients with no hallucinations (Bentall et al. 1991; Brébion et al., 2000; Brunelin et al., 2006; Woodward et al., 2007).

Thus, understanding the mechanisms underlying source monitoring deficits could lead to a better understanding of schizophrenic symptoms and perhaps to more specific and successful therapeutic strategies. Brébion et al. (1996) suggested that, in schizophrenic subjects, source monitoring deficits are the consequence of impairments in selective attention. These authors assessed selective attention using the Stroop Word Color Test (SWCT) and

source monitoring performances in schizophrenic subjects (n=32) and normal controls (n=32). They found that several measures of source monitoring (number of false alarms and oral/picture discrimination) were correlated with selective attention measures (SWCT interference score) in schizophrenic subjects (but not in normal controls). Based on these results, the authors suggested that source monitoring failure was the consequence of deficits in selective attention. This finding, if confirmed, “might be relevant for clinical research and treatment (of schizophrenia)” (Brébion et al., 1996) in that it suggests that more efforts have to be devoted to the study of selective attention (and less to the study of source monitoring). In a small mixed sample of schizophrenics and normal controls (n=30), Henquet et al. (2005), using a different source monitoring test, found only partial support for this hypothesis. However, to date, these results have been neither confirmed nor clearly contradicted in larger samples.

Given the theoretical and practical importance of the hypothesis of Brébion et al. (1996), we decided to test it in 2 samples of subjects (schizophrenic subjects and controls) which were assessed for source monitoring performances with a similar task, and for selective attention with the SWCT.

## **Methods**

### *Subjects*

We included 54 schizophrenic subjects and 42 normal controls. Patients recruited meet DSM-IV (American Psychiatric Association, 1994) criteria for schizophrenia or schizoaffective disorder. Diagnoses were confirmed using the DIGS (Diagnostic Interview for Genetic Studies) (Nurnberger et al., 1994). Patients have a mean age of 33.8 years (SD=9.5), and 20 of them (37%) have a high school level. Most of the schizophrenic subjects were inpatients at the time of the study. All were on regimens of either typical or atypical antipsychotics and were receiving fixed doses at testing. Patients had mild symptoms

according to the Signs and Symptoms of Psychotic Illness scale (Liddle et al., 2002): a mean positive dimension score of 2.57 (SD=2.47), a mean negative dimension score of 3.16 (SD=3.08), and a mean disorganisation dimension score of 1.56 (SD=1.59).

Healthy controls were blood donors at the “Etablissement Français du sang” in Créteil. Controls were included after being interviewed with the DIGS and the FIGS (Family Interview for Genetic Studies) (Maxwell, 1992) to confirm the absence of personal or family history of psychiatric disorders. They have a mean age of 41.5 (SD=13.46) and 35 of them (83.3%) have a High school level.

All subjects have no history of neurological disease or current substance abuse. Written informed consent was obtained for each subject.

### ***Measurements***

All subjects were tested with a source monitoring task and the SWCT.

The source monitoring task was derived from Brébion et al. (1996) study. The task is described in detail elsewhere (Szöke et al., 2009). We defined four semantic categories: temperate climate fruits, Olympic sports, European countries and numbers from 50 to 70. Each possible example from these categories was printed on a unique card. At the first stage of the test, 12 items were selected from each category: 6 were generated by the subject (either spontaneously, by reading aloud or reading silently), 2 were read aloud by the examiner and 4 were added from the remaining cards (“new” items). The recognition stage took place after the subject underwent the SWCT and only at this time of the task the subject was informed that he/she had to identify the source of items produced and differentiate them from new items. We used the same source monitoring indices than Brébion et al. (1996) (old-new discrimination, omissions, false alarms and self-external discrimination) with the exception of the oral/picture discrimination index (because there were no pictorial items in our task). The old-new discrimination index is the proportion of items properly identified as old or new out

of all items. Omissions are the previously seen items not recognized as such. False alarms are new items wrongly recognized as old ones. Finally, self-external discrimination index is the proportion of items correctly attributed either to oneself or to an external source of the items properly recognized as old.

As Brébion et al. (1996) did, we used the Stroop Word Color Test to measure selective attention. The SWCT consisted of three trials of 45 seconds each, in which the subject successively reads aloud the names of colors that are printed in black, names the color with which strings of “X”s are printed and finally names the color with which the name of a different color is printed (ex. RED printed in blue – correct answer blue). In the present analysis, to match the analysis done by Brébion et al. (1996), we used the number of items from the 2 last trials.

### *Statistical analysis*

To assess correlation between source monitoring variables and selective attention we used the method described by Brébion et al. (1996). For this, we calculated the Pearson correlations between source monitoring variables and the number of items in the last trial of the SCWT after partialling out the number of items in the naming condition of the SCWT (second trial). These analyses were done using the SAS V9 software.

### **Results**

In comparison to normal controls, schizophrenic subjects appeared to be significantly impaired on total number of correct items, and self discrimination index in the source monitoring assessment. They were also significantly impaired on total items and interference score indices in the Stroop test. [Table 1]

All correlations between source monitoring and selective attention measures were less than 0.3 and non significant ( $p > 0.05$ ). [Table 2]

**Table 1** Mean scores in source monitoring and Stroop test in schizophrenic subjects and normal controls

		Schizophrenic Subjects	Normal Controls
Source Monitoring [Mean (SD)]	Old-New discrimination	0.776 (0.096) *	0.838 (0.058)
	Omissions	7.69 (5.15) *	5.07 (2.65)
	False Alarms	3.06 (4.10)	2.83 (2.87)
	Self-External discrimination	0.912 (0.102) *	0.964 (0.041)
Stroop test [Mean (SD)]	Total items	34.56 (9.20) *	47.67 (10.05)
	Interference Score	0.67 (0.50) *	0.43 (0.18)

\*  $p < 0.008$  (significance threshold after Bonferroni correction for six comparisons) compared with controls.

SD indicates standard deviation

**Table 2** Correlations between selective attention and source monitoring indices

Correlations	Schizophrenic Subjects (N=54)		Controls (N=42)	
	R	p	R	p
Selective attention / old-new discrimination	0.11	0.43	-0.19	0.23
Selective attention / omissions	-0.14	0.32	0.02	0.90
Selective attention / false alarms	0.05	0.72	0.17	0.30
Selective attention / self-external discrimination	-0.15	0.30	-0.03	0.86

R indicates Pearson correlation.

## **Discussion**

Although our methodology was very similar to that used by Brébion et al. (1996), we failed to replicate their findings of a significant correlation between selective attention and source monitoring variables in schizophrenic patients. As to date there is no standardized task for measuring source monitoring, some differences exist between the methods used in the two studies and could explain part of the differences (for example our source monitoring task did not include pictorial items). Another possible explanation is the inclusion of different schizophrenic subjects samples. Although our sample and the sample described in the study of Brébion et al. (1996) were composed of patients with mild symptoms, other differences could exist (for example in types and doses of antipsychotics used, or in the specific pattern of symptoms) and explain the discordant findings.

Our results are concordant with the fact that, when clinical-cognitive correlations are examined, the two deficits (in selective attention and in source monitoring) are associated with different symptomatic dimensions. Selective attention correlates with the disorganisation dimension (Baxter and Liddle, 1998) although, as mentioned before, source monitoring is linked to the positive symptomatology.

## **Conclusions**

Our results suggest that the study of source monitoring deficits, which on one hand are not the result of selective attention deficits and on the other hand are among the very rare cognitive deficits to show an association with the positive dimension of psychosis, deserve to be pursued.

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