

# Source monitoring task in a sample of in-patients with verbal auditory hallucinations compared to control sample

## *Source monitoring task in un campione di pazienti con allucinazioni uditive verbali e in un campione di controllo*

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**SUMMARY.** Patients with psychosis, especially those with specific positive symptoms such as auditory verbal hallucinations, show a source monitoring deficit, the cognitive process involved in the recognition of the information source. This defect can lead to the erroneous conclusion that self-generated thoughts are not “proper” but derive from an external source. We evaluated 37 patients diagnosed with psychotic disorder and 40 healthy controls using a modified version of the Reality Monitoring Task developed by Larøi et al. in 2004. The patients were also evaluated with PANSS, VGF, PSP. We have found that the performance of the Source Monitoring Task differs between patients with hallucinations and controls. According to the literature we can therefore state that patients with hallucinations are characterized by a difficulty in identifying the source of the information they perceive. Our study also adds a new finding to the literature: the source monitoring dysfunction is not due to the presence of current hallucinatory symptomatology but could be considered a stable trait in psychotic patients.

**KEY WORDS:** verbal auditory hallucinations, source monitoring, reality monitoring task.

**RIASSUNTO.** I pazienti con psicosi, specialmente quelli con sintomi positivi specifici come le allucinazioni verbali uditive, mostrano un deficit nel “source monitoring”, il processo cognitivo coinvolto nel riconoscimento della fonte di informazione. Questo difetto può portare alla conclusione erranea che i pensieri auto-generati non sono “appropriati” ma derivano da una fonte esterna. Abbiamo valutato 37 pazienti con diagnosi di disturbo psicotico e 40 controlli sani utilizzando una versione modificata del Reality Monitoring Task sviluppato da Larøi et al. nel 2004. I pazienti sono stati valutati anche con PANSS, VGF, PSP. Abbiamo riscontrato che le prestazioni del Source Monitoring Task dei pazienti con allucinazioni differiscono rispetto ai controlli sani. In accordo con la letteratura possiamo quindi affermare che i pazienti con allucinazioni sono caratterizzati da una difficoltà nell'individuare la fonte delle informazioni che percepiscono. Il nostro studio aggiunge anche una nuova scoperta alla letteratura: la disfunzione del monitoraggio della sorgente delle percezioni non è dovuta alla presenza di una sintomatologia allucinatoria corrente, ma potrebbe essere considerata un tratto stabile nei pazienti psicotici.

**PAROLE CHIAVE:** allucinazioni uditive verbali, source monitoring, reality monitoring task.

## INTRODUCTION

The term “hallucinations” is described and widely used in current diagnostic manuals as «perception-like experiences that occur without an external stimulus»<sup>1</sup>.

Hallucinations may involve all five senses; however auditory hallucinations are the most common type in schizophrenia and related disorders<sup>2</sup>.

Among auditory hallucinations, verbal hallucinations are of particular relevance in clinical practice. Auditory verbal hallucinations (AVHs) consist of the experience of hearing voices in the absence of any speaker<sup>3</sup>, with a strong affective resonance, determined both by form and content of the hallucinatory experience. As reported in Toh et al.'s revision<sup>4</sup>,

AVHs are found in patients with mood disorders, as well as in non-clinical populations<sup>5-8</sup>.

One of the most successful neurocognitive models of AVHs is the source monitoring (SM) deficit model. SM is the ability to discriminate whether a mental content originates within or outside one own self. According to the SM model, AVHs are the result of a general tendency to externally identify the source of the information facing the conscience<sup>9-11</sup>. AVH are similar to internal dialogues, but those who experience them lack the ability to recognize them as originating from themselves, an aspect that reflects the more general inability to distinguish between external and internal source of mental objects, between real and imaginary, central in psychotic experience<sup>9-13</sup>.

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The SM model is declined in 3 paradigms, based on the type of information to which it is applied; in fact, the subject may find himself having to discriminate between information coming from different sources: external SM; internal SM or SM; Reality Monitoring. The authors specify that these are independent functions: low performance in one of the three areas is not necessarily associated to low performance in the other two<sup>10</sup>.

Most studies show how psychotic patients are characterized by an “externalizing” cognitive style, they attribute the source of thoughts coming from themselves to the outside<sup>11,14</sup>.

The aim of the present study was to evaluate the prevalence of externalizing bias in patients with hallucinations and to correlate the prevalence of such bias with other demographic and clinical variables.

## METHOD

37 consecutive patients admitted to the Psychiatric Unit of “San Salvatore” Hospital during a 13 months period, presenting AVHs were recruited. Inclusion criteria were: diagnosis of psychotic disorder assessed according to Italian version of Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) and presence of AVHs (current or in anamnesis). Exclusion criteria for the study were the presence of severe neurological disorders, epilepsy or mental retardation and age over 65, assuming that above this threshold it was difficult to establish the weight of a possible cognitive impairment also determined by the persistence of psychopathology on the tasks of SM.

A control group of 40 subjects was recruited for comparison among non-clinical population. We have adopted the same inclusion and exclusion criteria of the experimental group, except for the presence of hallucinations that we propose to investigate in the experimental group.

The study was approved by the local university ethic committee and all participants provided written informed consent.

The current psychopathological characteristics were assessed using the Positive and Negative Syndrome Scale for Schizophrenia (PANSS)<sup>15</sup>, administered by trained researchers. The PANSS is a 30-item scale designed to obtain a measure of positive (P), negative (N) and general psychopathology (G) symptoms in patients with schizophrenia. Particularly, we have used the third positive symptoms item (P3) and the twelfth general symptoms item (G12) as indicators of hallucinatory behavior and loss of insight.

Global functioning was assessed using the Global Assessment of Functioning (GAF) Scale – from DSM-IV-TR<sup>16</sup>. This is a clinical test to assess overall functioning level. Impairments in psychological, social and occupational/school functioning are considered, but those related to physical or environmental limitations are not. The scale ranges from 0 to 100; higher scores represent better functioning.

Psychosocial functioning was assessed using the Personal and Social Performance (PSP) Scale<sup>17</sup>. This is a clinical scale that evaluate social and personal functioning. It consist in four areas of social and individual performance as socially useful activities, including work and study; personal and social relationships; self-care; disturbing and aggressive behaviors. Higher scores of PSP represent better personal and social functioning.

SM was assessed using the listen-say paradigm, by means of the modified version of the Reality Monitoring Task developed by Larøi et al.<sup>18</sup>.

The administration of the test is divided into two phases.

At first the experimenter reads a list of 30 words to the subject, who in turn proposes the first word that comes to his mind for each of them. The words presented vary in terms of emotional salience (10 positive, 10 negative, 10 neutral) and cognitive effort that require. In the second phase, the same words presented by the experimenter in the first phase are presented again (in oral and visual form) together with those generated by the subject (in both cases it is material already known to the patient), along with other new words.

For each presented word, the subject is asked to determine whether it is an already known word or new words; in the first case, the subject is asked to specify whether it was a word proposed by the experimenter or generated by the patient. Answers given by the subject can be categorized into nine possibilities:

1. the subject correctly recognizes the words proposed by the experimenter as such (input task recognition; task-task=TT);
2. the subject wrongly attributes the words proposed by the experimenter to himself (internalizing bias or internal assignment error input; task-patient=TP);
3. the subject mistakenly recognizes the words proposed by the experimenter as new (disregard of input task; task-distractor=TD);
4. the subject correctly recognizes the words self-generated as such (own input recognition; patient-patient=PP);
5. the subject disregards the self-generated words mistakenly attributing them to the experimenter (externalizing bias or external attribution of own input; patient-task=PT);
6. the subject disregards the self-generated words by mistakenly recognizing them as new (disregard of their own input; patient-distractor=PD);
7. the subject correctly recognizes the new words as such (recognition distractor input; distractor-distractor=DD);
8. the subject discovers the new words by mistakenly assigning them to the experimenter (external attribution of input distractor; distractor-task=DT);
9. the subject disregards the new words by mistakenly assigning them to himself (internal attribution of input distractor; distractor-patient=DP).

## Statistical analysis

Differences between patients with and without AVHs in socio-demographical variables were assessed used the t-test or chi-square test as appropriate. Difference in SM variables between cases and controls, as well as between cases with current or past AVHs were assessed using Student t-test. Correlations were performed using the Pearson correlation coefficient in order to highlight the possible association between the internal and external attribution bias and some psychopathological and clinical variables. The agreed statistical significance was  $p \leq .05$ . D prime for statistically significant differences was measured as recommended by Cohen<sup>19</sup>.

Statistical analysis was performed using the Statistical Package for the Social Sciences software (SPSS V17; SPSS Inc., Chicago, IL, USA).

## RESULTS

Patients and control group characteristics and relative comparisons are presented in Table 1. Patients and control

Table 1. Patients and control group characteristics and relative comparisons.

Demographic and clinical variable	Patients n. 37	Controls n. 40	t- or $\chi^2$ - test; Effect size (d)
Age (years)	44±11	40±12	t=1.51; ns
Education years	12±3	13±2	t=-2.04; p<0.05; d=0.46;
Illness duration (years)	18.5±11.9	-	-
Gender (Male:female)	22:15	19:21	$\chi^2$ =0.16; ns
PANSS total	75.6±9.9	-	-
PANSS general	36.9±5.4	-	-
PANSS positive	18.3±4.3	-	-
PANSS negative	20.4±5.2	-	-
PSP total	44.7±12.2	-	-
GAF total	44.6±9.6	-	-

ns= not significant.

groups differ for education level but not for gender distribution and average age.

27 patients were affected by schizophrenia, 7 by psychosis NOS, 3 by schizoaffective disorder; 24 patients had current hallucinations while 13 patients had past hallucinations. Patients and control groups characteristics are summarized in Table 1. Current and past AVH group, SM results and relative comparisons are presented in Table 2 and Table 3. SM results are significantly different between patients and controls for all scores except those related to distractor inputs while no scores differ significantly between current and past AVH groups. A significant difference is shown as regards the effects size, mainly for TT and TD.

We correlated the internal and the external attribution bias with some psychopathological variables of the PANSS. The internal attribution bias is not significantly correlated neither to all PANSS scales, nor to the psychosocial functioning assessed with total PSP score, but is positively related to disturbing and aggressive behaviors assessed with PSP subscale ( $r=0.327$ ,  $p=0.034$ ). The external attribution bias is not significantly correlated neither to all PANSS scales, but is negatively correlated to PSP total score ( $r=-0.290$ ,  $p=0.05$ ) and positively to socially useful activities, including work and

Table 2. Patients and control group SM results and relative comparisons.

SM variable	Patients group	Control group	t- test; Effect size (d)
Input task recognition (TT)	21.1±6.4	26.1±2.8	t=-4.5; Sig=0.001; d=1.02
Internal assignment error input task (TP)	4±4	2±2	t=2.6; Sig=0.009; d=0.593
Disregard of input task (TD)	4±4	1±1	t=4.2; Sig=0.00; d=0.958
Own input recognition (PP)	20.5±5.7	24.7±4.2	t=-3.6; Sig=0.001; d=0.821
External attribution of own input (PT)	4±4	2±2	t=2.3; Sig=0.02; d=0.525
Disregard of their own input (PD)	4±4	2±1	t=3.3; Sig=0.001; d=0.753
Recognition distractor input (DD)	25.3±4.4	26.9±2.7	t=-1.8; ns;
External attribution of input distractor (DT)	3±3	2±2	t=1.4; ns
Internal attribution of input distractor (DP)	2±2	1±1	t=1.4; ns;

ns= not significant.

Table 3. Current and past AVH group SM results and relative comparisons.

SM variable	Current AVH group	Past AVH group	t- test
Input task recognition (TT)	20.6±7.7	23.2±3.7	t=1.3; ns
Internal assignment error input task (TP)	4±4	3±2	t=-0.83; ns
Disregard of input task (TD)	5±4	3±3	t=-1.1; ns
Own input recognition (PP)	19.8±5.3	22.7±5.5	t=1.7; ns
External attribution of own input (PT)	4±4	3±3	t=-1.2; ns
Disregard of their own input (PD)	5±4	4±4	t=-0.67; ns
Recognition distractor input (DD)	25.7±3.9	25.3±4.5	t=-0.35; ns
External attribution of input distractor (DT)	2±2	3±3	t=1.1; ns
Internal attribution of input distractor (DP)	2±2	1±1	t=-1.0; ns

ns= not significant.

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study and to self-care assessed with PSP subscales ( $r=0.324$ ,  $p=0.036$ ;  $r=0.351$ ,  $p=0.022$ ). Additionally, we found a significant positive correlation between duration of illness and the internal attribution errors ( $r=0.307$ ,  $p=0.05$ ).

## DISCUSSION

The function of Reality Monitoring is the ability to discriminate between self-generated information and information generated by an external source (the experimenter).

We aim to compare our results with those of the literature, where an externalizing bias was found in schizophrenic patients with hallucinations compared to non-schizophrenic controls<sup>9,20,21</sup> and in patients with hallucinations both to patients without hallucinations<sup>18</sup> and to controls<sup>22</sup>. We propose the study of an overlooked aspect: if the externalizing bias is present both in patients with current hallucinations as in patients with previous hallucinatory experiences. This would allow us to understand if the SM dysfunction is the result of a particular acute psychopathological state, linked to the current hallucinatory symptomatology, or if it can be considered a more stable trait, which reflects a perceptual bias modality of psychotic organization.

Our study confirms some elements reported in the literature<sup>9,20,21</sup>, but also highlights others that are not described.

We have found that the performance of the Source Monitoring Task differs between patients with hallucinations and controls. According to the literature we can therefore state that patients with hallucinations (PH) are characterized by a difficulty in identifying the source of the information they perceive. PH show the external attribution bias of the self-generated words (PT and PD) to a greater extent than the controls, similar to what is reported in the literature<sup>9</sup>. However, our study highlights that patients with hallucinations also have difficulty in recognizing the source of the words generated by the investigator (TT, TP and TD), and that the most widely represented error in the patient group is TT, so the word proposed by experimenter is not recognized as task.

We could advance the hypothesis that performance at the Reality Monitoring Task is heavily influenced by cognitive abilities, such as attention and memory, which literature<sup>23-26</sup> often describes as impairments in various degrees in psychosis.

As the performance of PH and those of controls does not differ as regards the recognition of distracting stimuli (i.e., DD, DT, DP), would make us suppose that the SM dysfunction that characterizes PH is determined more by mnemonic functions. These would seem more compromised, preventing recognition of already known words, whose origins are confused, while attentive functions, which would seem more conserved, allowing the recognition of new words (i.e., distracting words).

Our study also adds a new finding to the literature: the performance at the Source Monitoring Task differs between PH compared to controls, but they do not differ between patients with current hallucinations and patients with a history of hallucinations. This data would indicate that the SM dysfunction, and the specifically externalizing bias that would characterize patients with misdirections, is not due to the presence of current hallucinatory symptomatology but could be considered a stable trait in psychotic patients<sup>27</sup>.

In our sample, the SM dysfunction correlates, more than with hallucinatory symptomatology, with more general and pervasive aspects such as psychosocial functioning and years of illness.

## CONCLUSIONS

In conclusion, besides of a desirable expansion of the sample, it emerges the need to include in the experimental design other tools that evaluate the cognitive and neuropsychological functions, in order to clarify if, and to what extent, the aspects may affect the ability to identify the source information.

Finally, it would be of considerable interest to replicate those findings of the literature that evaluate the impact of the emotional value of the stimuli proposed and the degree of cognitive commitment required on the performance at the Source Monitoring Task.

A better phenomenological analysis of hallucination could help to delineate better treatment option<sup>2,28</sup>.

*Conflict of interests:* the authors have no conflict of interests to declare.

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