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# Comprehension of metaphors in patients with schizophrenia-spectrum disorders

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**Abstract**

**Background:** Metaphors, mainly proverbs and idiomatic expressions of ordinary life are commonly used as a model for concretism. Previous studies have shown impaired metaphor comprehension in patients with schizophrenia-spectrum disorders compared to either psychiatric or non-psychiatric control subject. The aim of this study was to detect possible quantitative differences in figurative processing between patients with schizophrenia-spectrum disorders and healthy controls.
**Methods:** In order to analyse possible dissociations of different aspects of figurative speech, a range of metaphor tasks was used to distinguish between recognition of familiar metaphors, paraphrasing the meaning of the latter and generating novel metaphors: we used a standard proverb test for conventional metaphors consisting of a multiple-choice and a paraphrasing task, and the Metaphoric Triads Test for the assessment of novel metaphors. We included 40 patients with schizophrenia-spectrum disorders and 43 healthy control subjects.
**Results:** Our results showed that patients had impaired figurative speech processing regarding novel and conventional metaphors. Associations with cognitive functions were detected. Performance on the paraphrasing task was associated with the severity of negative symptoms.
**Conclusion:** We conclude that patients with schizophrenia-spectrum disorders do exhibit impairments in the recognition and paraphrasing of conventional and the generation of novel metaphors and that some cognitive domains as well the extent of negative symptoms might be associated with these deficits.


## 1. Introduction

Patients with schizophrenia have long been shown to often exhibit language impairments, such as concretism [1–7], a characteristical deficit in non-literal language comprehension, where metaphoric meaning is not understood. However, the manifestation of abnormal language in schizophrenia disorders varies [8]. The basic structure of language, in particular the understanding of literal language, often remains intact [9,10]. Deficits are mainly related to the processing of high-level language, i.e. the pragmatic aspect of language, usually impacting the processing and comprehension of figurative language in particular metaphors, proverbs, idiomatic expressions and irony [2,3,11]. Figurative language requires the ability to process more than just the literal meaning of a statement in order to comprehend the speaker's intention [9,11,12]. Metaphors, mainly proverbs and idiomatic expressions of ordinary life are commonly used as a model for concretism.

The neuroanatomical basis of metaphorical comprehension somewhat parallels that of schizophrenia-spectrum disorders [13–17] with functional MRI studies showing that the following regions seem related to figurative language in both controls and patients with schizophrenia: left inferior frontal gyrus [17,18], right lateral temporal cortex [17]. Furthermore, some groups showed a lateralisation, yet data seem inconclusive [19], as some findings point towards an importance of the left hemisphere [18,20,21]; whereas

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others, more often in the context of innovative metaphors and possibly depending on familiarity and difficulty of the metaphor, enforce the importance of an intact right hemisphere [22–24]. Furthermore, from a neurobiological point of view the ability to adequately interpret metaphors has exhibited some association with dopaminergic activity in the frontotemporal region [25,26]. Studies in neurological patients with frontal lobe damage have demonstrated massive deficits in metaphor comprehension and a tendency to interpret these on a literal level [27–29]. Here too, overlaps with brain regions affected in schizophrenia are evident [30,31]. Furthermore, the frontal lobe is an important region for cognitive functions such as semantic processing [32] and is involved in higher executive processes [33], such as working memory, cognitive flexibility, reasoning, attention, as well as verbal fluency, inhibition and information processing speed [34].

As comprehension of figurative language is an essential part of social interaction, further understanding of concretism in patients with schizophrenia might lead to more insight into specificities of social and cognitive impairments in schizophrenia. Those studies that have analysed concretism, have mainly used figurative proverbs to assess metaphoric comprehension and have shown reduced capacity of abstraction in patients with schizophrenia compared to healthy controls [2,35,36] or to patients with depressive disorders [37]. Conventional metaphors include previously novel expressions that have lost their metaphorical novelty through time and have been completely integrated into everyday language. Metaphoric proverbs are therefore defined as being conventional metaphors, because they do not need to be newly invented, but are present in popular language [38]. According to the Contemporary Theory of Metaphors, conventional metaphors are described as belonging to an underlying conceptual mapping system of a language [39] (in [40]), whereas the Career of Metaphor Model assumes an evolution from novel metaphors that have a comparative nature to the adoption of a metaphoric categorization in the process of being conventionalized [41]. On the other hand, non-conventional, innovative or novel metaphors refer to the creation of novel "images". Note, that the differentiation between conventional and novel metaphors can be seen as being on a gradual continuum, rather than being dichotomous [42]. Also, conventional metaphors are described as being more salient than novel metaphors due to their familiarity (Gradient Salience model, [43]). Indeed, the sole use of assessments of proverb comprehension in studies has sometimes shown insufficient reliability [44] due to the influence of familiarity.

Therefore, in this study, additionally to metaphoric proverbs, we assessed figurative language comprehension in an operationalised manner with the Metaphoric Triads Test [45] — a test in which innovative metaphors have to be developed by the individual.

The aim of this study was to detect possible quantitative differences in figurative processing between patients with schizophrenia or schizoaffective disorders and healthy controls. In order to analyze possible dissociations of different aspects of figurative speech, we used a range of metaphor tasks to distinguish between recognition of familiar metaphors, paraphrasing the meaning of the latter and generating novel metaphors. We hypothesized that patients would show reduced comprehension of figurative language in both conventional and novel metaphor tasks and that this impairment would be associated to frontally mediated cognitive dysfunctions and to psychopathology.

## 2. Materials and Methods

### 2.1. Subjects

Patients were recruited from in- and outpatient services of the Psychiatric Hospital Social–Medical Centre Otto-Wagner, Vienna, the Department of Psychiatry Social–Medical Centre East, Vienna, a therapeutic service in Vienna and the Sociopsychiatric Service Moedling, all of the above being in Austria.

Of the initial 46 patients recruited for the study two were excluded due to discrepancies between clinician- and SCID-interview diagnosis, further three dropped out during the assessments without specific reason, one was excluded for more adequate comparison with the control group. Inclusion diagnoses were assessed by the treating psychiatrist and re-assessed through the German version of the Structured Clinical Interview for DSM-IV (SCID Axis I and II, [46,47]). Consensus diagnoses were made by two experienced, independent and blinded clinicians using information from the SCID I/II and from blinded case reports and hospital records. Prior to testing, a PANSS (Positive and Negative Syndrome Scale [48]) rating was performed. In order to avoid potential biases due to acute conditions, only patients with a PANSS total score of up to 95 (with a score on the positive symptoms scale under 38 and on the negative symptoms score under 36) were included in the study.

Healthy controls without any psychiatric disorder were recruited through concentric circles and matched with the patient group for sociodemographic variables. To ensure lack of psychiatric diagnoses, all healthy individuals also underwent SCID-interviews.

All participants were native speakers. The study was approved by the local ethics committee and was conducted according to the Declaration of Helsinki and Tokyo (1975) and further amendments. All participants were thoroughly informed about the study procedure and testing was started only after subjects had signed the informed consent form. The duration of the entire assessment was approximately 3–10 h, performed in several sessions where necessary.

### 2.2. Assessment of psychopathology

Current psychopathology of patients was assessed by a trained rater using the PANSS [48], a widely used and well-known semi-structured interview, which characterises