**An fMRI investigation of the relation between understanding metaphoric expressions and language lateralization in schizophrenia**

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**Abstract**

The following study attempted to shed light on the controversy regarding the dominant hemisphere during the analysis of figurative language, as well as the degree of the right hemispheres involvement in two different groups. Namely patients diagnosed with schizophrenia, as well as healthy people with two different linguistic activity areas (IFG, STG). Two independent tasks were studied for this purpose, understanding of metaphors as well as the verb task. Throughout this study the variation in lateralization will be assessed by calculating the index lateralization of various language regions between the two groups. As a result, this study will examine four key points.

First, examining of brain-lateralization indexes in the research group preforming metaphorical language comprehension tasks. Second, the relationship between the symptoms presented in schizophrenic patients and the brain's index lateralization during tasks involving the analysis of metaphors. Third, the relationship between the symptoms presented in schizophrenic patients and brain lateralization index during tasks involving generating verbs. And lastly a comparison of the relationship between metaphor comprehension, as measured in the questionnaire, and the index lateralization of the brain during metaphor comprehension. This study included 22 participants aged 19-38, half of which are healthy adults, and half of which are patients diagnosed with schizophrenia. This study was based on data collected by Dr. Mashal and her colleagues (Mashal, Vishne, Laor & Titone) during her study involving patients with schizophrenia in 2013. In her study, a group of patients with schizophrenia were asked to perform two different tasks during a brain scan. The first task involved the understanding of word pairs (Experiment Understanding novel and conventional metaphors). The second task involved verbs generation (the VG experiment). While the healthy participants were only required to dometaphor comprehension. The experiments were performed under a functional Magnetic Resonance Imaging scan (fMRI). In addition, participants were required to complete a questionnaire on metaphor comprehension, immediately following the scan.
The results of the study found that among healthy subjects the brain lateralization index in IFG was higher compared to brain lateralization index in patients with schizophrenia when preforming metaphor comprehension (novel and conventional). As a result it was found that brain activity tended to be less asymmetric in patients with schizophrenia during metaphor comprehension tasks (novel and conventional) compared to healthy subjects. Results also showed that the brain activity of schizophrenic patients with difficulty in abstract thinking tended to be less asymmetric in the left IFG. It was also found that the severe the positive symptoms of schizophrenia were in the patient, the decrease in the brain lateralization index in the STG during verb tasks. I.e. the relevant brain activity tends to be less asymmetric. Finally, as the level of metaphor comprehension decreased, as measured by the questionnaire, so too did the brain lateralization Index in the STG during conventional metaphor comprehension tasks decrease. This means that the decrease in the understanding of metaphorical language, and increase in the difficulty of generating of verbs are reflected in the asymmetric activity of the brain in patients with schizophrenia.

This work has several implications for theoretical neuroscience issues in patients with schizophrenia. The study reinforces the findings of the literature review by Rapp (Rapp, 2012) regarding the dominance of the left hemisphere in tasks involving the understanding of novel metaphors in healthy subjects as well as patients with schizophrenia. In addition it was found that the activity that was observed among patients with schizophrenia was the opposite of that found in healthy patients (increased activity in the right hemisphere in schizophrenia contrary to increased activity in the left hemisphere in healthy subjects for conventional metaphor comprehension tasks). A possible explanation for this, based on (Milev, Ho, Arndt, & Andreasen, 2005) findings, that show the dysfunction of working memory and attention in patients with schizophrenia cause difficulties in the understanding of figurative language. The practical applications of early identification of difficulty in metaphorical language comprehension should encourage the creation of therapeutic tools to revise the education system and assist in dealing with this issue in the patients with schizophrenia.