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Connections During Creating Original and
Humorous Phrases via Insight

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SIMILARITY OR UNITY? THE EEG COHERENT CONNECTIONS DURING CREATING ORIGINAL AND HUMOROUS PHRASES VIA INSIGHT ¹

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The brain correlates of creativity studies have been developing intensively in the last decades. The variability of tasks performed by test subjects (from divergent tasks to musical improvisation and creating works of visual art) has led to the wide variety, and even controversy, of results (Abraham 2014, Dikaia and Dikiy 2018).

To aid in the search of the creativity's universal brain correlates one could study other complex forms of psychic activity, alike the creative one. We suppose that such a form of psychic activity, akin to creativity and, close to insight in its psychological mechanisms, could be humour. In addition, one of the unquestionable components of creativity is insight – the sudden finding of solution.

The psychological similarities of insight and humour are noted in a series of qualities: the momentarily character of understanding; being accompanied by positive emotions, connected to understanding a task or a joke; the inner conflict; breaking the taboos and overcoming the functional fixation (Martin and Ford 2018).

The neurophysiological studies of humour creation as an example of creative idea generation are single to none these days (Amir et al. 2015).

However, the discussion character of problems in similarity and even unity of psychophysiological correlates of humour generation and creativity in modern scientific papers makes us consider it a perspective direction of scientific studies.

The aim of the research was the study of the EEG coherent connections during creating original and humorous phrases via insight.

The empirical study's test subjects were right-handed 78 students with special educational needs in the field of creative expression (students-actors, directors); the mean age being 23, with 38 men and 40 women.

The **empirical goals** of the study:

1. Study the power and character of EEG coherent connections division in artistic sphere specialists in generating original and humorous ideas using the insight-based and non-insight-based methods.

2. Conduct a comparative analysis of the EEG coherent connections prominence in test subjects during the original phrase generation via insight- and non-insight-based methods, during the humorous phrase generation via insight- and non-insight-based methods, during insight-based creation of original and humorous phrases.

Methods. We used method of electroencephalography (EEG).

Statistical processing of data was done using STATISTICA 13.0. The ANOVA/MANOVA analysis and the post hoc analysis according to the HSD Tukey criteria were used.

The EEG Registration was performed using 64 scalp electrodes (monopolar), with two referents using the multichannel electroencephalograph «Neirovizor-136» («MKS», Russia). The electrode resistance didn't exceed 20 kOhm.

The EEG registration was performed in the calm state (eyes closed) and in the process of performing the function tests - verbal activity based on the verbal and visual material. The

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instructions were formulated in the way that could make the subject look for original and humorous solutions.

After finding the answer, each subject was asked to answer the question, «Is it so, that the solution was found via the insight (yes/no)?». Considering all the given answers, the EEG recordings of functional tests were differentiated into four groups for analysis: 1) Finding the original solution via insight; 2) Finding the original solution via non-insight; 3) Finding the humorous solution via insight; 4) Finding the humorous solution via non-insight.

To analyse, 5-second artefactless EEG samples were chosen in the following frequency bands: teta (4-8 Hz), alpha (8-14 Hz), beta (14-35 Hz), and gamma (35-70 Hz).

Results. It has been shown that in generating the original solution via the non-insight method, the coherent connections in the right hemisphere posterior cortex areas are stressed reliably stronger, than those in the left ($p < 0.05$). Also have been discovered the reliable differences in the coherent connection power between the insight- and noninsight-based methods of generating a humorous phrase: in the insight-based method, in teta- and alpha bands the coherent connections power in right hemisphere posterior cortex areas, also the power of interhemispherical coherent connections and intrahemispherical in anterior cortex is stronger than in other areas ($p < 0.05$). Based on these findings, we can conclude that the insight-based method of generating humorous ideas needs higher emotional stress from test subjects, which shows in the EEG coherence in teta band. The above-mentioned results confirm the hypothesis about the psychophysiological correlates of original and humorous ideas being different from each other based on the insight- or noninsight-based method of solving the creative task.

In generating the original and humorous idea in alpha band, the strong coherent connections were found in right hemisphere prefrontal cortex areas and left hemisphere posterior cortex areas. This is a natural connection, known as the «creativity axis», and has been described in the studies of other types of creative tasks (Sviderskaya 2011).

Conclusions.

1. Outlined were the EEG coherent connection, most strongly stressed in the artistic field specialists in generating original and humorous ideas. Those are the intra- and interhemispherical coherent connections in anterior, mostly prefrontal, and posterior, mostly occipital cortex areas.

2. EEG coherent connections in the right hemisphere prefrontal cortex areas and interhemispherical connection in the occipital cortex areas of both hemispheres in all the studied bands are stressed in the insight-based method (both original and humorous solutions). Based on that we can conclude the similarity of these EEG correlates of creativity and humour.

3. The differences between these EEG correlates show in that the specific areas for the insight-based humour generation were the right hemisphere occipital areas.

- Abraham A. 2014 Creative thinking as orchestrated by semantic processing vs. cognitive control brain networks. *Frontiers in Human Neuroscience* 8, 95.
- Amir O., Biederman I., Wang Z., Xu X. 2015 Ha Ha! Versus Aha! A direct comparison of humor to nonhumorous insight for determining the neural correlates of mirth. *Cerebral Cortex* 25 (5), 1405-1413.
- Dikaia L., Dikiy I. 2018 Bioelectrical activity of cerebral cortex at different stages of the creative artistic process in artists. *International Journal of Psychophysiology* 131 S, 19.
- Rod A. Martin, Thomas E. Ford 2018 *The Psychology of Humor: An Integrative Approach*. London, San Diego, Cambridge, Oxford: Elsevier Science, Academic Press.
- Sviderskaya, N.E 2011 Features of the spatial organization of EEG and psychophysiological characteristics of the person with the divergent and convergent thinking types. *Human Physiology* 37(1), 36–44.