

# SEX DIFFERENCES OF BRAIN ACTIVITY IN VISUAL CHOICE REACTION TASK

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It is well known phenomenon in psychology that men and women usually make decision/choice using different mind strategies. The existence of such phenomenon is obvious due to different ratio of determinant sex steroids that cause very powerful impact on brain development and functioning as there are specific receptors to estrogen and testosterone in numerous brain structures. However, the neurobiological aspects of men's and women's decision making strategies are still ambiguous and require more data. The knowledge of sex differences of brain activity potentially could provide better rehabilitation for men and women with various brain injuries.

Decision making implies execution of basic cognitive processes which are based on choice reaction. Thereby, in this study visual choice reaction task with 2 simple stimuli was used.

The aim of the study was to investigate whether there are any differences in brain activity and choice reaction time between male and female subjects during choice reaction task performance.

The study involved 30 male volunteers, right-handed, 23,2±3,1 y.o., and 25 female volunteers, right-handed, 18,4±0,6 y.o.. All participants were students of Taras Shevchenko National University of Kyiv and have no health complaints, reported brain injuries or psychiatric disorders.

In the study choice reaction time (CRT) of motor responses made by right (rhCRT) and left hands (lhCRT) were detected. Mean CRT was evaluated as well. CRT data is presented below as Median [Lower Quartile (25%); Upper Quartile (75%)]. EEG was recorded during choice reaction task performance. EEG was done with 19 leads placed on the scalp according to the International 10-20 System. Localization and statistical analysis of 3D distribution of the generating electric neuronal activity were performed applying the LORETA-software package v.20181107 [1,2]. Coherence analysis was performed for all possible coupled pairs of leads in delta (0,5-3,9 Hz), theta (4-7,9 Hz), alpha (8-12 Hz), beta-1 (14-19,9 Hz) and beta-2 (19-35 Hz) bands applying the Neuron-Spectrum software. Significant level of coherence value was established equal or greater than 0,7 [3].

There was no significant difference between results of male and female subjects in mean CRT (409 [392;430] ms vs. 420 [397; 460] ms ( $p=0,185$ )), rhCRT (402 [392; 435] ms vs. 413 [390;462] ms ( $p=0,473$ )) and lhCRT (413 [390;430] ms vs. 426 [409;476] ms ( $p=0,112$ )). Nevertheless, males demonstrated greater activation mostly of right hemisphere compared to females ( $p=0,013$ , threshold=0,487): BA 11 (rectus gyrus, medial frontal gyrus); BA 17, 18, 19, 23 (cuneus, lingual gyrus, fusiform gyrus, inferior occipital gyrus, middle occipital gyrus); BA 19 (inferior temporal gyrus); BA 24, 25, 32, 33 (anterior cingulate cortex); BA 30, 31 (posterior cingulate cortex); BA 28, 34 (parahippocampal gyrus); BA 28, 34, 36, 38 (uncus); BA 31 (precuneus); BA 38 (superior temporal gyrus); BA 22, 37, 39 (middle temporal gyrus); BA 47 (inferior frontal gyrus). There are few left hemispheric brain zones that also were more active in males: BA 11, 17, 18, 19, 24, 25, 28, 32 and 33. Coherence analysis revealed both males and females had distributed fronto-parieto-occipital network in theta band within the left hemisphere. For males the same network in the right hemisphere was interconnected with lateral sites in fronto-temporal regions. Furthermore, females demonstrated no activation of right centro-parieto-occipital networks in alpha and beta-1 bands. Centro-parieto-occipital networks in beta-2 band were present bilaterally in females, while the activation of left fronto-parieto-occipital and right hemispheric centro-parieto-occipital networks was distinctive for males. Also bilateral activation of centro-parieto-occipital networks in delta band was specific solely to females.

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