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REACTIVITY OF SENSORIMOTOR BETA-RHYTHM IS CONNECTED WITH INTELLIGENCE IN CHILDREN AS IT REFLECTS THE ACTIVITY OF MIRROR AND ANTI-MIRROR BRAIN SYSTEMS

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The aim of the work was to examine the interrelations between verbal, nonverbal and general intelligence and the reactivity of the sensorimotor beta-rhythm in children. The study involved 36 children aged 5 to 14 years (16 boys and 20 girls). The intelligence level was assessed with the help of the Wechsler test (WISC). The EEG was recorded in four experimental situations: (a) self-paced rhythmic circular hand movements with a computer mouse; (B) observation of similar movements performed by the experimenter; (C) imitation of the experimenter’s movements; (D) auditory perception of sounds accompanying the movements performed by the experimenter (subject’s eyes closed). There was analyzed the EEG reactivity under the central leads C3, C4 and Cz. The average powers of the EEG beta1 and beta2 rhythms were calculated for the frequency bands of respectively 14–20 and 21–30 Hz. The synchronization / desynchronization index (SDI) was used as a measure of reactivity level. The higher the beta-rhythm power was during self-paced movements, observation of the experimenter’s movements or movement imitation relative to the baseline, the bigger the SDI values were.

There have been found the significant positive correlations between the nonverbal intelligence level and the beta1 SDI during self-paced movements and observation of movements. The higher the power of the beta-rhythm was during these situations, the higher score of intelligence the child had. The acquired data are interpreted by the authors as follows. The pronounced beta-rhythm during self-paced movements indicates the achievement of an optimal balance of excitation and inhibition, thus supporting the execution of the current motor program. Children, whose nervous system allows such a balance, are successful in many activities, which is manifested in higher intelligence levels. The pronounced beta-rhythm in the situation of movement observation testifies to the existence of the so-called anti-mirror neuron system. Children, whose beta-rhythm is prone to synchronize in the situation of movement observation, possess a more developed anti-mirror system, which helps to reduce the unnecessary imitation of other people's actions. Well developed mirror and anti-mirror systems provide better learning capabilities accompanied by the implementation of independent thinking, which is reflected in higher rates of cognitive development.

Keywords: EEG, intelligence, beta-rhythm, movement, children, mirror and anti-mirror neurons.

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