

## Properties of the EEG $\mu$ Rhythm and Its Reactivity during the Performance, Observation, Imitation, and Auditory Recognition of Movements in Children Aged 4–14 Years

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**Abstract**—We studied the frequency and amplitude properties of the EEG  $\mu$  rhythm in children ( $n = 38$ ) aged 4–14 years under the condition of visual fixation (VF) on a video image of a computer mouse, as well as the parameters of its desynchronization during the tasks involving self-controlled performance, observation, imitation, and auditory recognition of the hand circular movements (SPM, OM, IM, and ARM, respectively) with a computer mouse. We observed age-related increment in the modal frequency of  $\mu$  rhythm in loci  $C_3$  and  $C_z$ . During the SPM process, a significant decrease in the amplitude of  $\mu$  rhythm was found in loci  $C_3$  (26.7%) and  $C_z$  (10.3%); during the OM, in locus  $C_z$  only (9.9%). The effects of the  $\mu$  rhythm desynchronization during both self-paced and observed movements might be an evidence of well-developed neural matching mechanisms that provide the processes of performing and observing similar actions in children aged 4 to 14 years. During the IM, the desynchronization of  $\mu$  rhythm was significant in loci  $C_3$  (27.4%) and  $C_z$  (15.3%). We hypothesize that the statistically significant increase (from SPM to IM) in the depression of  $\mu$  rhythm in locus  $C_z$  is likely to be an effect of a social gaming context common for the situations when children imitate the movements of adults. The index of desynchronization of  $\mu$  rhythm under the studied conditions did not depend on the age of children. Possible relations of identified modulations of the  $\mu$  rhythm to the activity of the mirror neuron system were also discussed.

**Keywords:** children, EEG,  $\mu$  rhythm, movements, imitation, observation, mirror neuron system

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