

Accepted Manuscript

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PII: S1053-8119(18)31858-5

DOI: [10.1016/j.neuroimage.2018.09.053](https://doi.org/10.1016/j.neuroimage.2018.09.053)

Reference: YNIMG 15289

To appear in: *NeuroImage*

Received Date: 18 June 2018

Revised Date: 10 September 2018

Accepted Date: 18 September 2018

Please cite this article as: Debnath, R., Salo, V.C., Buzzell, G.A., Yoo, K.H., Fox, N.A., Mu rhythm desynchronization is specific to action execution and observation: Evidence from time-frequency and connectivity analysis, *NeuroImage* (2018), doi: <https://doi.org/10.1016/j.neuroimage.2018.09.053>.

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Mu rhythm desynchronization is specific to action execution and observation: evidence from time-frequency and connectivity analysis

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Abstract

Mu desynchronization is the attenuation of EEG power in the alpha frequency range recorded over central scalp locations thought to reflect motor cortex activation. Mu desynchronization during observation of an action is believed to reflect mirroring system activation in humans. However, this notion has recently been questioned because, among other reasons, the potential contamination of mu rhythm and occipital alpha activity induced by attention processes following presentation of visual stimuli in observation conditions. This study examined the validity of mu desynchronization as a measure of mirroring system activation in infants and further investigated the pattern of functional connectivity between the central and occipital regions during execution and observation of movement. EEG was recorded while 46 9-month-old infants executed grasping actions and observed an experimenter grasping. Current source density (CSD) was applied to EEG data and, time-frequency and connectivity analyses were performed in CSD transformed data. Mu desynchronization was evident over central regions during both execution and observation of movements. Independent alpha desynchronization over occipital region was also present in both conditions. The connectivity analyses revealed that central-occipital areas were functionally more connected compared to other areas of the brain during observation of movements. Collectively, the results demonstrate the validity of mu desynchronization as an index of infant mirroring system activity and support the proposal of a functional connection between distinct mirroring and attention processes during observation of action.

Keywords: mu rhythm, occipital alpha, motor cortex, mirroring system, functional connectivity

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