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## DECODING THE KINEMATICS OF OBSERVED ACTIONS FROM THE VISUAL RESPONSES OF MOTOR AREAS

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**Background:** Consistent pieces of experimental evidence have compellingly shown that action perception, far from being a purely visual process, involves also the activation of motor areas in the observer's brain. Despite more than 20 years of research we are still missing a precise characterization of the stimulus-response characteristics of the activation of motor during action observation. That is, which features of an observed action are encoded in the visual responses of motor areas.

**Aims:** The goal of this project is to tackle this question in humans by means of EEG recordings. Our specific aim was to quantitatively compare patterns of neuronal responses measured during observation of the same actions in different presentation modalities. Indeed, almost all previous studies have presented human movements by means of movies. However, in our everyday life we interact with real persons and thus movie stimuli might not elicit the same neuronal and cognitive processes that are activated under naturalistic conditions.

**Method:** To quantitatively compare movie with naturalistic action presentation we recorded the EEG responses of 17 subjects while they observed goal-directed (grasping an object) and non goal-directed (placing the hand on an object) actions presented in three different modalities: (1) executed live in front of them ("live" condition) or displayed on a screen by means of movies showing either a (2) real person ("movie person" condition) or a (3) photorealistic avatar ("movie avatar" condition).

**Preliminary results:** Observation of live goal-directed actions, compared to the same actions displayed in movies or by means of an avatar, produced patterns of stronger mu suppression across a spatially distributed set of electrodes. Observation of goal-directed actions displayed by means of movies and avatars produced similar levels of mu suppression across all electrodes. Observation of non-manipulative actions produced instead patterns of mu suppression that were similar both in magnitude and spatial arrangement across all three observation modalities. These results suggest a dissociation in the neuronal processes activated by the observation of goal-directed and non-manipulative actions respectively. That is, for goal-directed actions, observation of movies representing either humans or avatars produces a weaker activation of motor processes compared to "live" conditions. This does not seem to be the case for non-manipulative actions for which different observation modalities produced similar levels of mu suppression.

**Keywords:** Action observation; EEG; Movement kinematics; Photorealistic animation

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