Perception of dance movements modulates sensorimotor activity: mu suppression as an index for embodied emotions

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Introduction

- Research has shown that we understand others by internally simulating their actions into our body via our own sensorimotor system (1).
- Mu desynchronization has been taken as an index of motor engagement during action observation (2).
- Recent evidence suggests that emotional content can modulate the amplitude of mu rhythm suppression (3), but little is known on the effects of emotional valence on mu desynchronization.

Methods

Participants

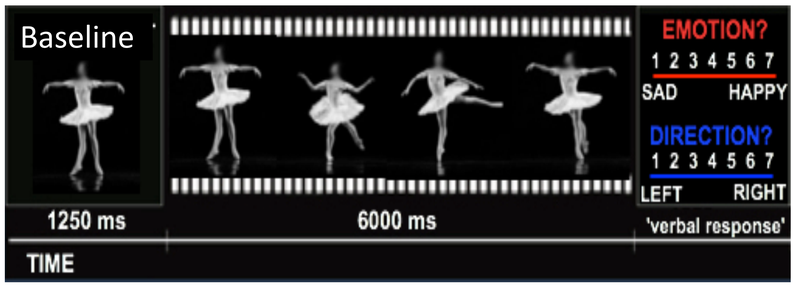
27 participants without dance experience (15 males, mean age = 25.70).

Stimuli

48 videos of emotional ballet movements lasting 5 to 6 seconds, selected from Christensen's library (4,5). 24 videos expressing happiness and 24 expressing sadness. Baselines were still images of the first frame of each video.

Tasks

An emotion recognition task in which participants rated the emotion expressed by the movement of the dancer.
A control task in which participants rated the direction of the movement.



Paradigm

EEG activity was recorded while participants performed both tasks. We extracted the spectral power at central (electrodes 11 and 17) and at occipital areas (electrodes 42 and 44) at band layers corresponding to 8 to 13 Hz at 3 different time frames (early: 200-1732ms, middle: 1734-3266ms, late: 3268-4800ms).

Mu suppression was computed as the log transformed ratio of the power during the video presentation relative to the baseline presentation. This allowed us to compare mu suppression in sensorimotor regions with mu suppression over visual regions for each condition in both tasks.

We performed 2 analyses, an objective analysis based on our emotion categorization (sad, happy) and a subjective analysis based on participants' categorization (rated sad, rated happy).

Discussion

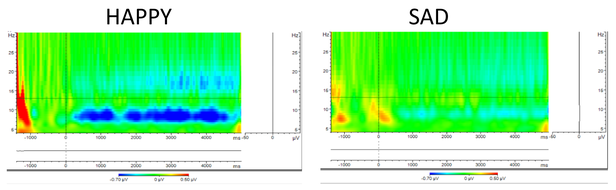
- **Emotion and Time:** significant interaction between valence and time in the sensorimotor cortex but not in the visual cortex indicates that the sensorimotor cortex is sensible to the emotional valence expressed by others' actions, consistent with theories of embodied simulation of emotions (3).
- **Self rating in Emotion:** stronger effects of emotion in subjective analysis than objective analysis.
- **Sensorimotor engagement in emotion perception increases over time:** sensorimotor response increases during movement observation (stronger mu suppression between 3268 and 4800 milliseconds after stimulus onset).

Results I: SUBJECTIVE ANALYSIS

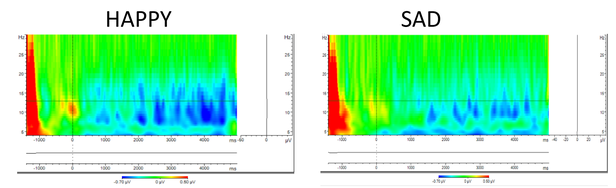
ANOVA Time (early, middle, late), Task (emotion, control), Valence (rated happy, rated sad), Hemisphere (L, R), Cortical Area (sensorimotor cortex, visual cortex).

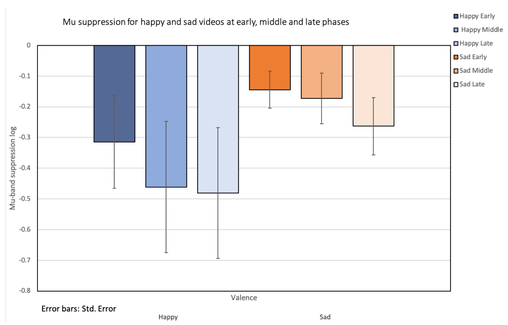
- **Sensorimotor cortices:** We found an overall main effect of time (P<.05) and a significant Emotion x Time interaction (P<.05). No main effect of task was found.
- **Visual cortices**: We observed a significant main effect of time (P<.01), but the Emotion x Time interaction was not significant.

SENSORIMOTOR CORTEX



VISUAL CORTEX



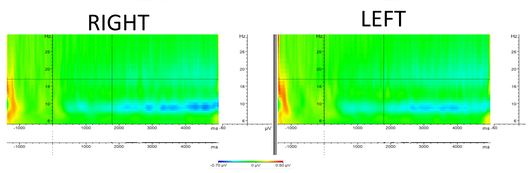


Results I: OBJECTIVE ANALYSIS

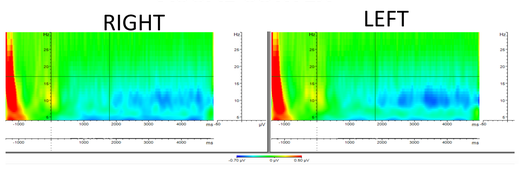
ANOVA Time (early, middle, late), Task (emotion, control), Valence (happy, sad), Hemisphere (L, R), Cortical Area (sensorimotor cortex, visual cortex).

- **Sensorimotor cortices:** We found significant main effect of time (P<.001).
- **Visual cortices**: We found a main effect of time (P<.001) and a significant time x lateralization interaction (P<.01).

SENSORIMOTOR CORTEX



VISUAL CORTEX



References

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