

Disentangling components of sensory-motor synchronization in surface EEG

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Introduction

It is increasingly recognized that sensory-motor interaction is not only a matter of synchronization, but that **both modalities actually modulate each other**. For example, music entrains people to dance and, in return, moving to music shapes the way we feel its rhythm (1).

In this study, we investigate the dynamics of sensory-motor integration for auditory and visual modalities. We used electroencephalographic (EEG) recordings of **steady-state evoked potentials** (SS-EPs) to tag periodic neural activities (2).

Aim: To disentangle the specificities of SS-EPs elicited by cross-modal interaction from those elicited by one modality alone.

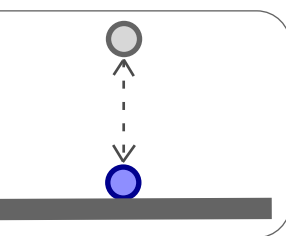
Here, we present preliminary results obtained from 4 pilots.

Better understanding of dynamic influences between sensory and motor cortices is relevant, among others, in the field of clinical motor rehabilitation.

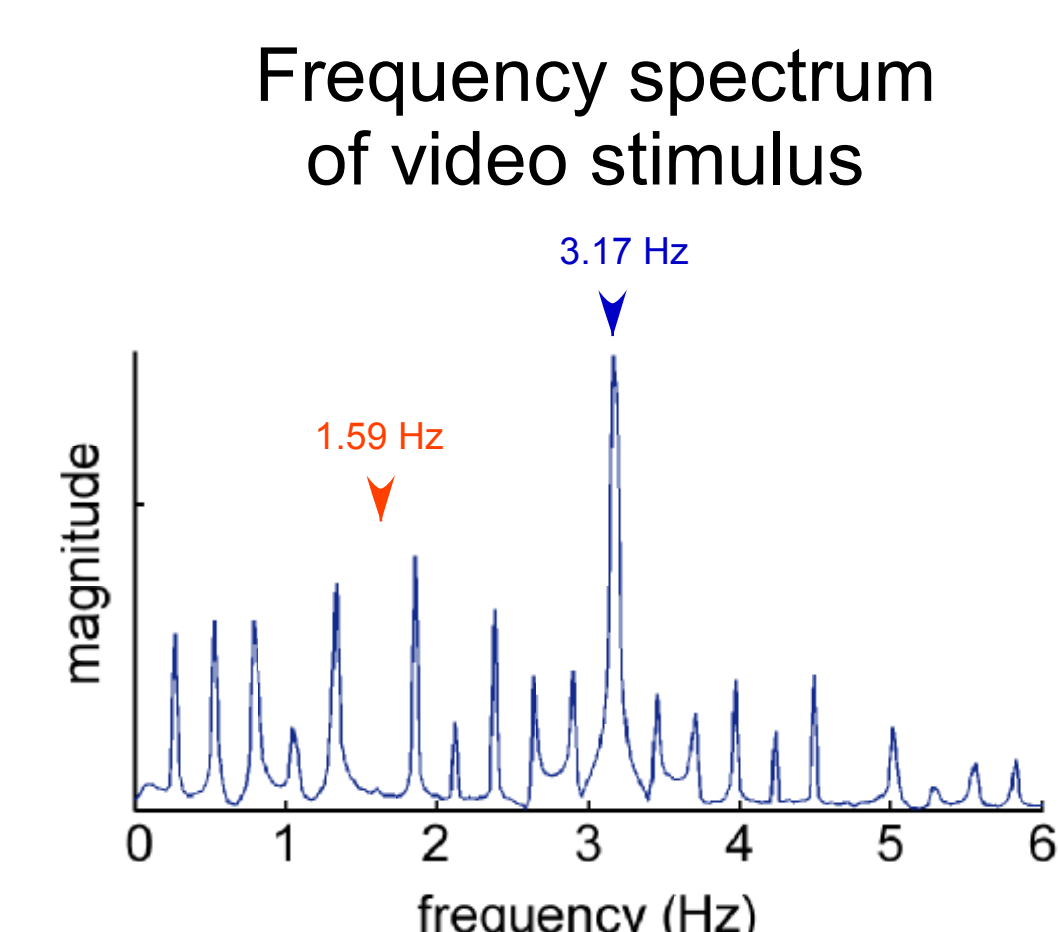
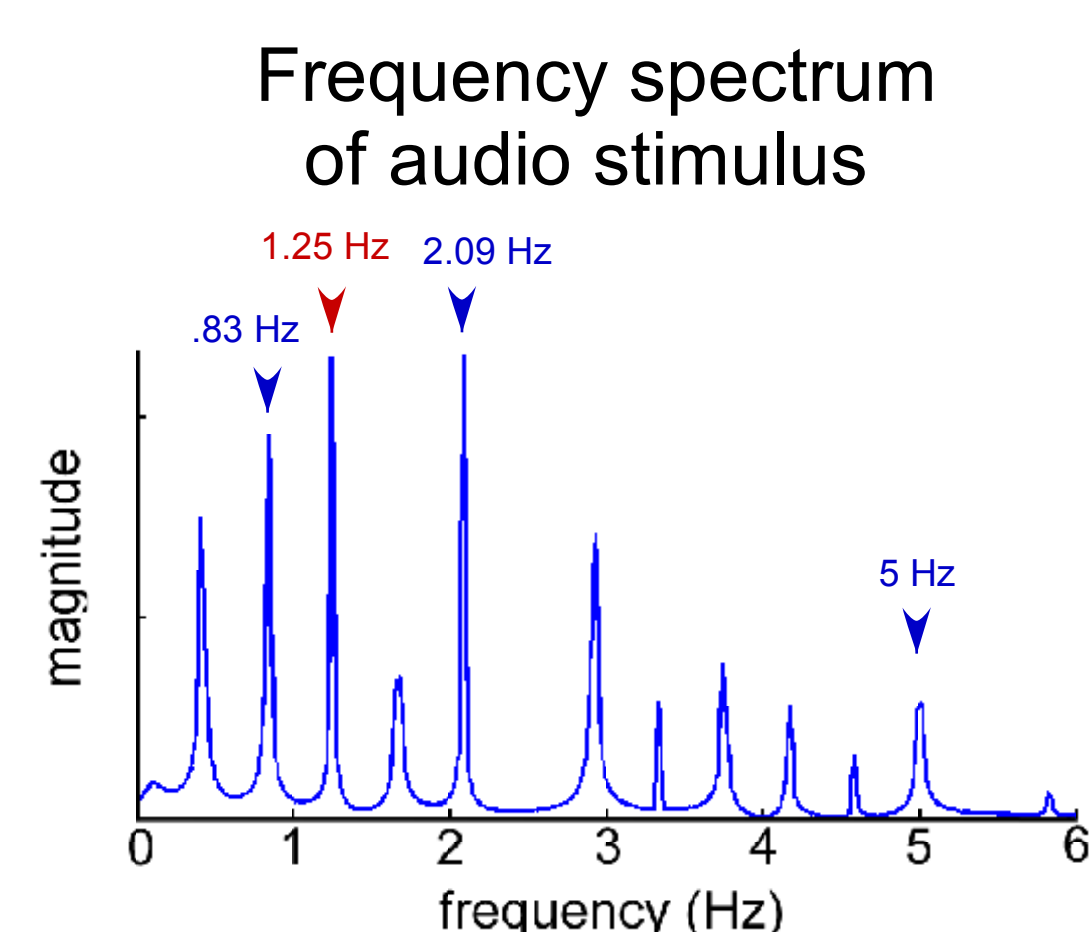
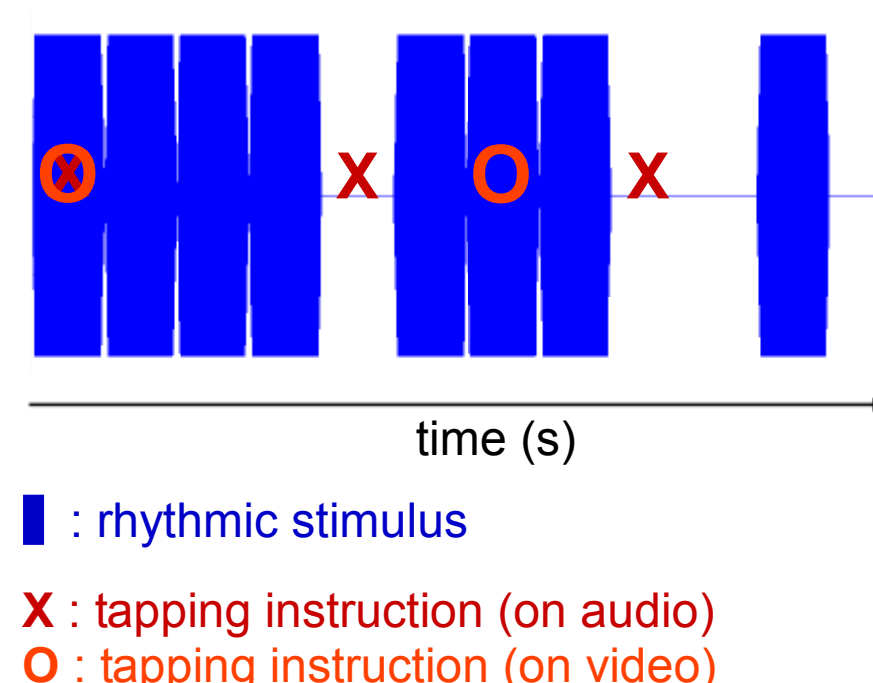
Materials and methods

We recorded surface EEG while participants listened to or watched a non-isochronous rhythmic stimulus, and then while they synchronized a strictly isochronous motor action to the same sensory input.

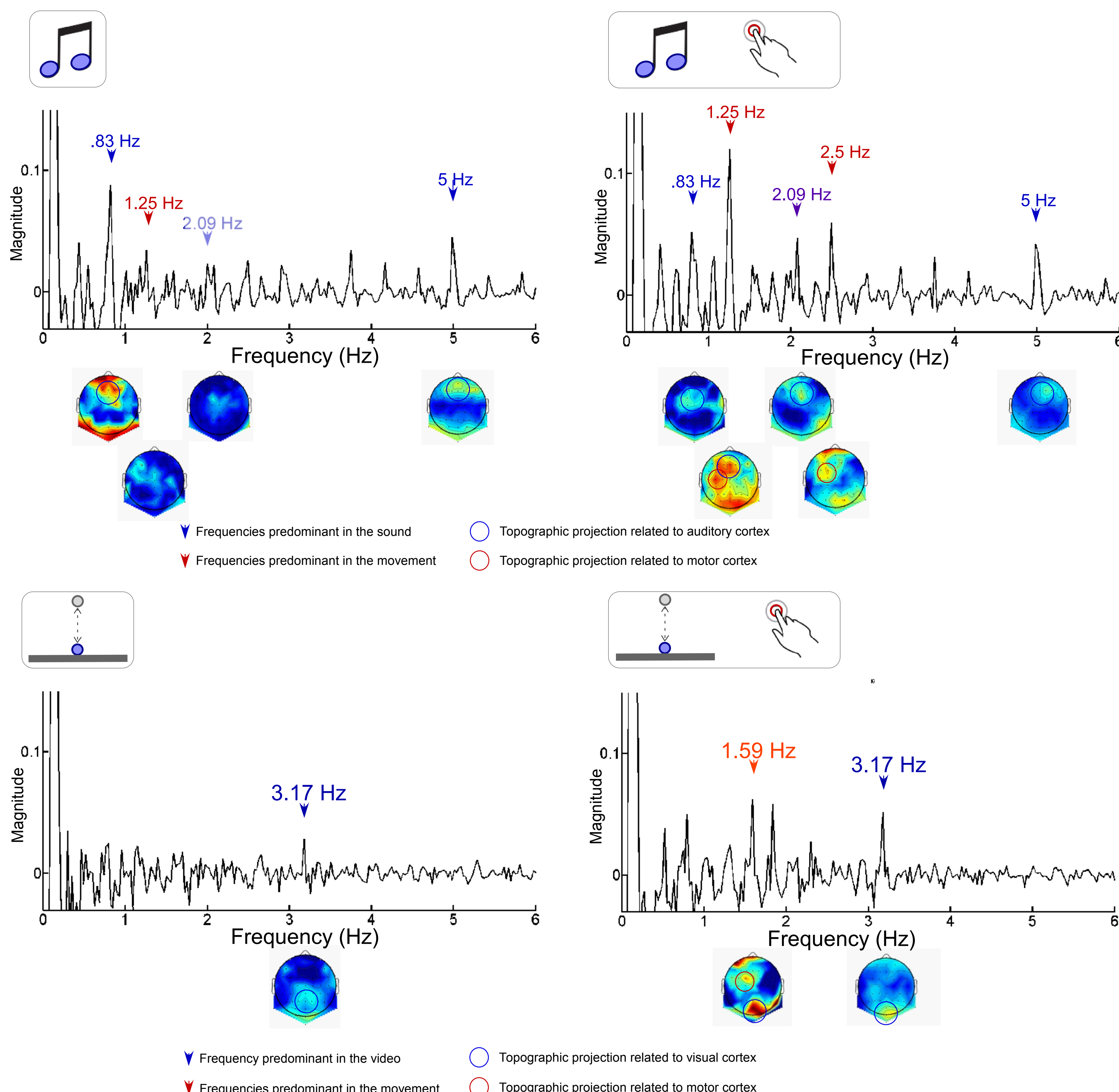
Experimental design:

	Perception	Perception + Motor
Auditory modality		
Visual modality		

Rhythmic stimuli:



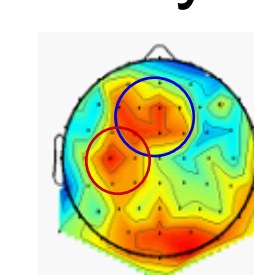
Results



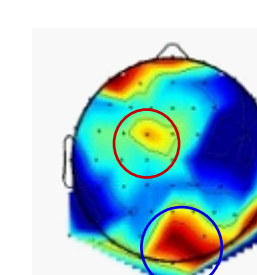
Discussion

Preliminary results suggest that

- topographic projections of neural activity related to visual cortex and motor cortex are easily distinguishable, while topographic projections of auditory and motor cortical areas tend to overlap. This phenomenon limits the assessment of changes in dynamics occurring specifically in one of those two areas;



Partial overlap of auditory and motor topographic projections



Distinct visual and motor projections

- the neural activity attributed to **visual** cortex was enhanced at both frequency of spontaneous entrainment (3.17 Hz) and at the frequency of performed movement (1.59 Hz);

- the neural activity attributed to **auditory** cortex shows a better integration of the multiple frequencies present in the spectrum of the sound envelope. Its modulation by the synchronized movements seems to be more complex, with

- a decrease of the main frequency of spontaneous entrainment (0.83 Hz);
- an enhancement of the frequency of performed movement (1.25 Hz);
- the emergence of a frequency present in the sound but to which subjects did not spontaneously responded (2.09 Hz).

Those results may be explained by a switch of attention to task-relevant frequencies. Further testing will allow us to study whether this modulation occurs specifically in sensory cortexes, or whether it requires broader sensory-motor neural network.

References

- (1) Chemin B., Mouraux A., Nozaradan S. (2014), Body Movement Selectively Shapes the Neural Representation of Musical Rhythms. *Psychological Science*, in press
 (2) Nozaradan S., Peretz I., Missal M., Mouraux A., (2011). Tagging the neuronal entrainment to beat and meter. *J Neurosci* 31(28):10234-40