

## **32/08 - "Conscious will and voluntary actions: is there a last ventriloquist in the brain?"**

Instituição/*Institution*: Hospital for Sick Children, University of Toronto - Canada

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Investigadores/*Researchers*: Prof. Jose Luis Perez Velazquez, Dr. Richard Wennberg, Dr. Luis Garcia Dominguez

**Objectives:** A fundamental topic in neuroscience is the nature of "free will" and how it is derived from neurophysiological processes. In this study, we investigate decision-making by examining the differences in brain activity underlying free and forced behaviours using magnetoencephalographic (MEG) recordings from subjects performing button pressing tasks that require them to exercise their choice by pushing one of two buttons in response to various cuing methods.

**Methods:** MEG recordings were taken from participants who either act on a choice by pushing one of two buttons when cued to do so, or pushing one particular button in response to a specific instruction. The instructions for the types of button press were supplied using visual or verbal cues that were provided in real time, or using pre-specified cues that instructed the subject to press buttons in the order of a memorized sequence or to freely press buttons for a period of time. Analysis of the directionality of coupling between brain areas (but we work at the sensor level) was assessed using Granger causality.

**Results & Discussion:** The greatest ability to discriminate (>80% classification accuracy) *free* and *forced* trials came from MEG sensors located over the primary sensory cortices specific for the modality used to cue each trial: either visual (occipital) or auditory (left temporal), and minor non-localized differences for trials that were pre-specified.

**Conclusions:** These findings suggest that primary sensory areas play a crucial part of the information processing steps organizing the production of free and forced behaviours, and that, contrary to the current conceptualisation, fronto-parietal processes may not be the principal determinants of these actions.

### **Publications:**

Dominguez LG, Kostecki W, Wennberg R, Pérez Velázquez JL. Distinct dynamical patterns that distinguish willed and forced actions. *Cogn Neurodyn* 5(1): 67-76, 2011.

Kostecki W, Dominguez LG, Pérez Velázquez JL. Single trial classification of magnetoencephalographic recordings using Granger causality. *J Neurosci Meth* 199(2): 183-191, 2011.

**Keywords:** Choice-making; free will; magnetoencephalography; single trial classification