

# EEG frequency-tagging of apparent biological motion dissociates action and body perception

Guido Orgs<sup>1</sup>, Emiel Cracco<sup>2</sup>, Goedele van Belle<sup>3</sup>, Lisa Quenon<sup>3</sup>, Patrick Haggard<sup>4</sup> & Bruno Rossion<sup>3,5,6</sup>

<sup>1</sup>Department of Psychology, Goldsmiths, University of London, <sup>2</sup>Department of Experimental Psychology, Ghent University, <sup>3</sup>Institute of Research in Psychological Science, Université Catholique Louvain <sup>4</sup>Institute of Cognitive Neuroscience, University College London, <sup>5</sup>Université de Lorraine, CNRS, CRAN, F-54000 Nancy, <sup>6</sup>CHRU-Nancy, Service de Neurologie, F-54000, Nancy

## Background

It is often assumed that the observer's brain decomposes the sequential structure of human action into a series of hierarchical representations, corresponding to these different levels, and each represented within a particular brain network (Grafton & de C. Hamilton, 2007; Lingnau & Downing, 2015)

Reconstructing human movement from static input produces body-specific percepts of movement speed and duration (Orgs, Bestmann, Schuur, & Haggard, 2011) and activates primary motor cortex as evident in both PET (Stevens, Fonlupt, Shiffrar, & Decety, 2000) and fMRI studies (Orgs et al., 2016).

In EEG frequency tagging, stimuli are presented periodically to induce periodic responses in the EEG (Norcia et al., 2015), i.e. to dissociate the perception of musical pulses from the perception of lower-frequency beats and meters (Chemin, Mouraux, & Nozaradan, 2014; Nozaradan, Peretz, & Mouraux, 2012).

Can we use frequency tagging to dissociate body and movement processing during apparent biological motion perception?

## Methods

### Participants

N = 10, 9 females, mean age = 22, range = 19-26).

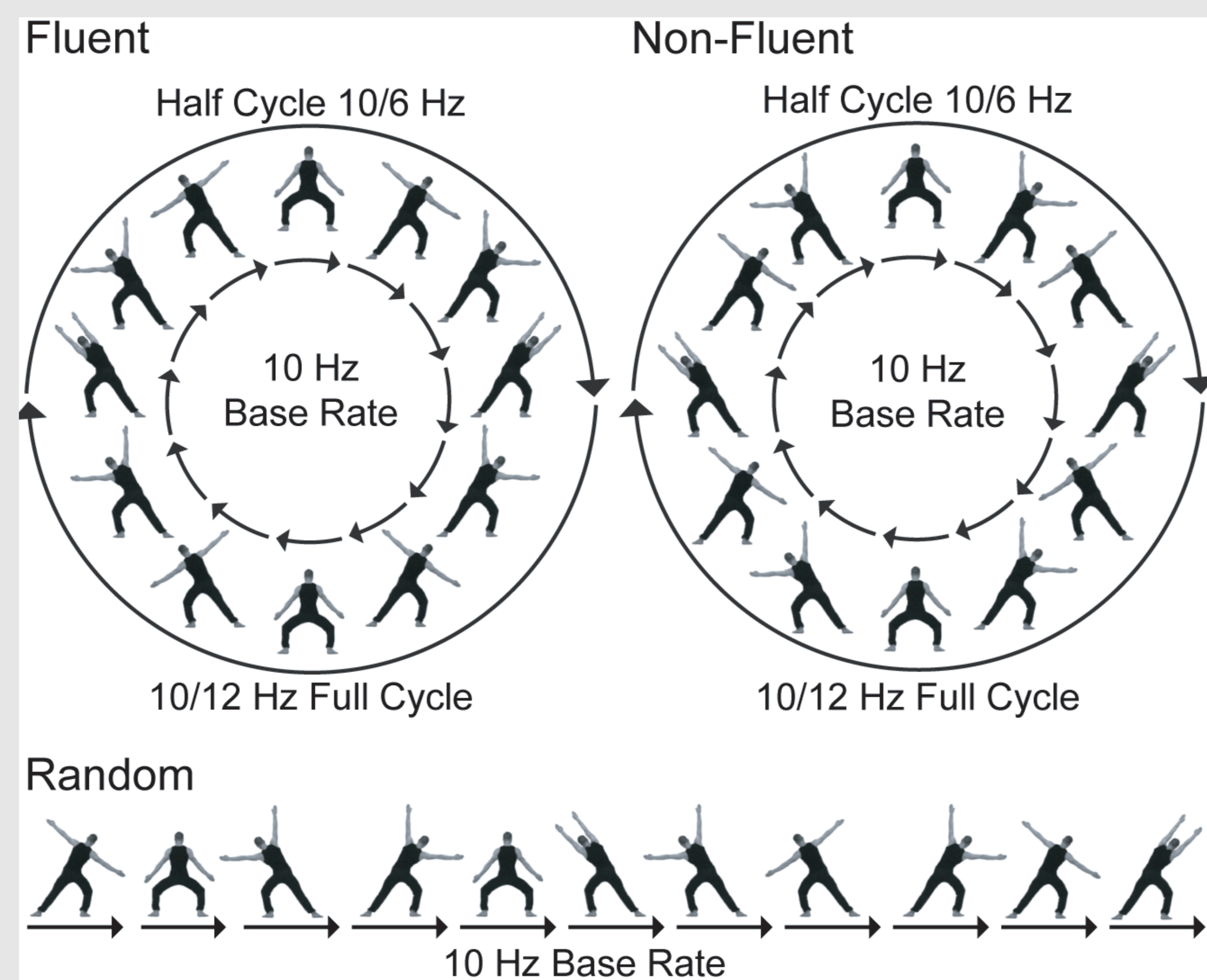
### EEG Recording and Preprocessing

128 Ag/AgCl active electrodes Biosemi. Sampling rate 512 Hz. Offline Bandpass filter 0.1 – 100 Hz. ICA Artifact Rejection. Average reference of all electrodes. 96 s segments. FFT

### Frequency analysis

Sum of first 10 harmonics (SNS) with  $z > 2.32$ ,  $p < 0.01$ , 1-tailed) for base rate, full cycle and half cycle response (Retter & Rossion, 2016).

Four 5-electrode clusters were selected by averaging the topographies of each response across all participants and conditions (Luck & Gaspelin, 2017).

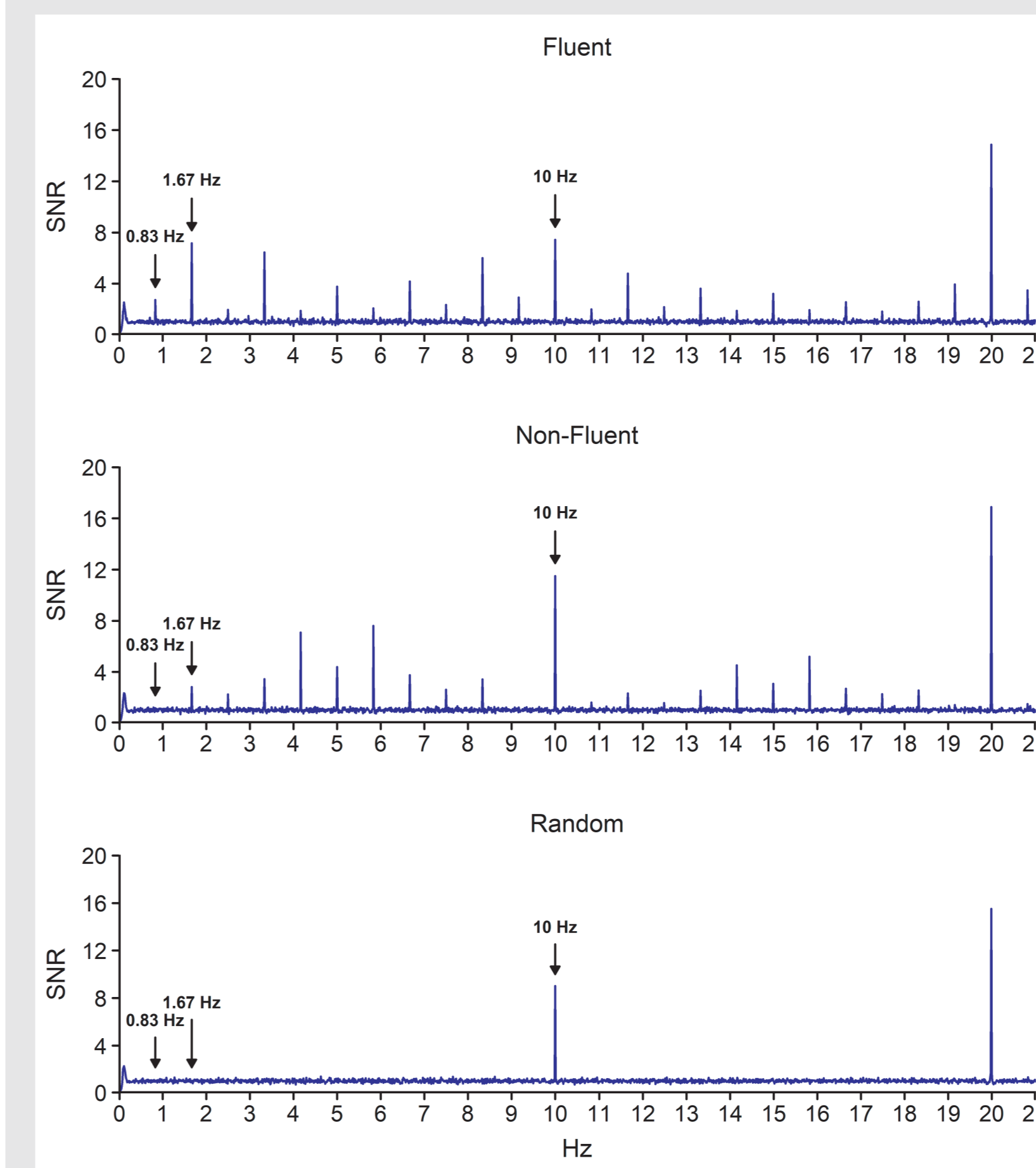


### Experimental Design

Fluent, non-fluent and random sequences of 7 body postures, with three levels of sequential structure:

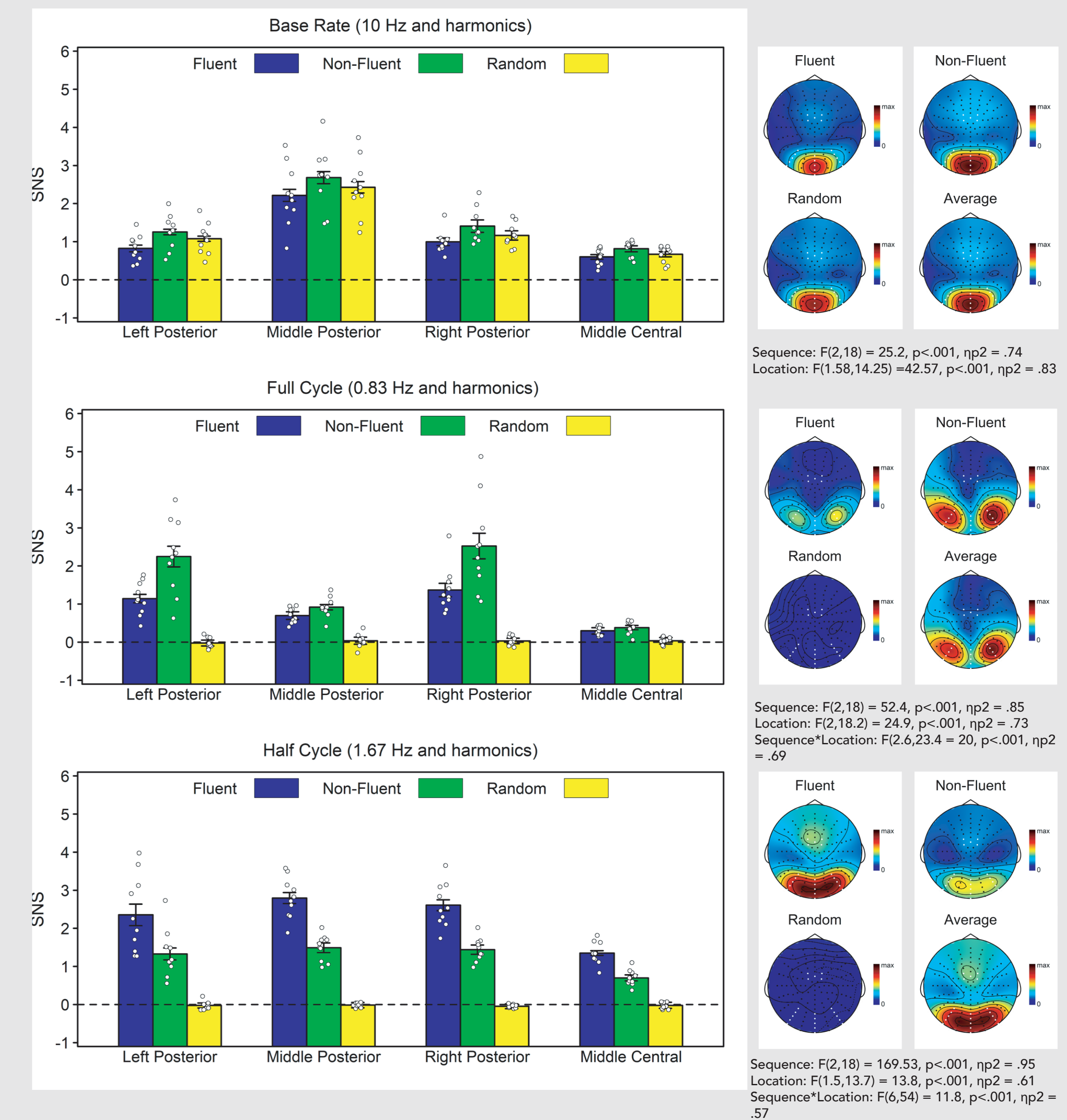
Image presentation frequency. Base Rate 10Hz. Body posture repetition. Full cycle 10/12 Hz side-to-side movement. Half cycle 10/6 Hz

## Results



Frequency spectra across all three experimental conditions. Signal-to-noise ratio (SNR) in the three conditions across the 20 electrodes of interest.

Only fluent and non-fluent sequences neural responses at full and half cycle frequencies and harmonics.



## Discussion

Frequency tagging of apparent biological motion dissociates processing of static and moving bodies with distinct occipito-central and occipito-temporal topographies (Orgs et al., 2011, 2016)

Frequency tagging reveals neural entrainment to the visual rhythm of apparent movement, similar to the entrainment to musical beat and meter (Nozaradan et al., 2012).

Body Specificity? Movement synchrony of multiple agents and inversion modulate neural response (Cracco, Lee & Orgs, see Poster D113).

Stimulus or stimulation frequency? Same pattern of results for a base rate of 7.5 Hz (Cracco, Lee & Orgs, see Poster D113).

### References

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