

Phase analysis for the characterization of ECoG recordings in human speech production

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Behaviour: production of consonant-vowel syllables

raa

dee

laa

shee

yee

ruu

yoo

koo

yee

baa

fee

maa

zee

hee

moo

ghee

vaa

nee

kee

luu

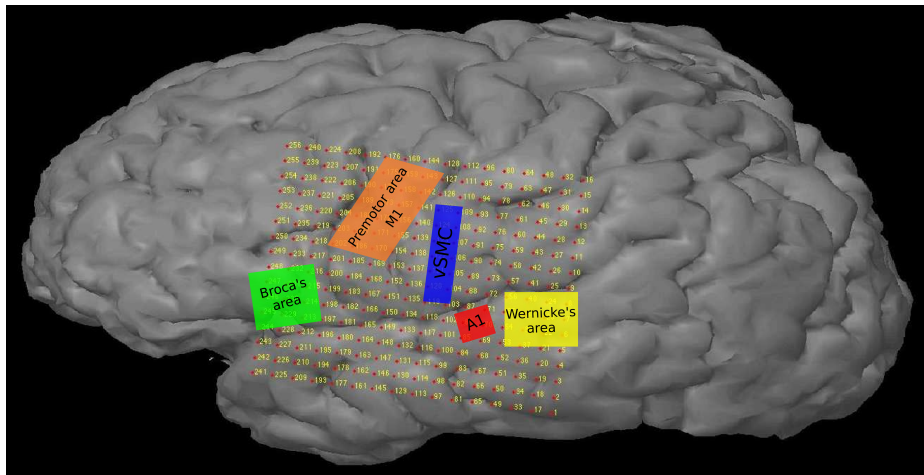
who

ree

who

luu

Recordings: high-density and large coverage ECoG



Phase relationships across trials: inter-trial coherence (ITC)

ITC plots: Figures 1 and 2 in **Entrainment of travelling waves to rhythmic motor acts** (page 3).

Steps to compute the Inter-Trial Coherence (ITC):

- 1 perform time-frequency decompositions of several trials,
- 2 for each time and frequency bin, build a circular histogram of phases
- 3 plot the mean resultant length from the previous histogram.

Circular statistics methods: Section A.1.1 Circular statistics concepts in **Entrainment of travelling waves to rhythmic motor acts**.

Phase relationships across electrodes: travelling waves (TWs)

TWs in time: Figure 6 in **Entrainment of travelling waves to rhythmic motor acts** (page 9).

Steps to find travelling waves (TWs):

- 1 narrow bandpass LFPs around a frequency of interest (e.g., 0.62 Hz in the speech production examples).
- 2 extract phases from the Hilbert transform of the filtered LFPs for all electrodes.
- 3 check if there exists a linear relationship between phases and electrode locations (see next point).

Detection of travelling waves events: Figure 5 in **Travelling waves appear and disappear in unison with produced speech**.

Phase relationships across electrodes: travelling waves (TWs)

Phase relations across all grid electrodes: Figure 16 in [Rhythmic production of consonant-vowel syllables synchronises travelling waves in speech-processing brain regions](#) (page 27, note caption).

Phase alignment with the initiation of the production of a consonant-vowel syllable: Figure 10 in [Rhythmic production of consonant-vowel syllables synchronises travelling waves in speech-processing brain regions](#) (page 21, note caption).

Recommended readings

- Buzsaki (2006)
- Winfree (1980)

Summary

- Buzsaki, G. (2006). *Rhythms of the Brain*. Oxford university press.
- Winfree, A. T. (1980). *The geometry of biological time*, volume 2. Springer.