

# Cortical Oscillations and Language Variation: Towards a Cross-Linguistic Perspective

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## ABSTRACT

The last decade has witnessed a growing interest in the way the listener's brain tracks speech signals for comprehension. Highlighting the remarkable correspondence between speech and brain intrinsic rhythms, an abundant literature has convincingly shown that cortical oscillations and their coupling are related to the human faculty to track and process speech at different timescales (Ding & Simon, 2014; Ghitza, 2011; Giraud & Poeppel, 2012; Peelle & Davis, 2012; Zoefel & VanRullen, 2015, among others). This faculty is decisive to extract meaning from a continuous acoustic waveform, and its flexibility is a key factor of our capacity to adapt to variation. Brain oscillations at syllabic and phonemic timescales (theta- (4-7 Hz) and gamma-band (25-45 Hz) oscillations, respectively) are entrenched in speech rhythmic regularities, although phoneticians and linguists have clearly shown that speech is only a *pseudo*-rhythmic signal in which variation is ubiquitous. Each speaker can modulate her speaking rate within and across utterances, while durations of syllables or phonemes vary between communication conditions (clear vs. degraded transmission or fast vs. slow speech rate for instance) and linguistic systems (linguistic rhythmic class, distribution of information within the phonological and syllabic systems). Each new experiment or plausible model sheds additional light on the mechanisms underlying brain-to-speech synchronization, yet open issues are still numerous.

In this presentation, our goal is to contribute to the elaboration of a roadmap towards the integration of the cortical oscillation paradigm into the general questioning of the workshop (bidirectional connections between linguistic systems and neurocognitive mechanisms). We will thus highlight some of those open issues from a neurocognitive and linguistic cross-perspective, among which:

- Speech rate varies within and between speakers: how does the developing and adult auditory system deal with such variation? To what extent is auditory cortical entrainment to speech efficient? Is it complemented by sensorimotor integration networks?
- Speech rhythm and average speech rate vary among languages: is the cortical system attuned to the speaker's mother tongue characteristics? What happens in foreign language communication? More precisely, would some languages challenge the speaker's capacity to track their speech rhythm because of their characteristics in terms of speech or information rate?
- The notion of information and information transfer is essential in neuroscience and cognition, and recent linguistic studies also suggest that mechanisms of information regulation are active both during speech communication and amongst languages, with a potential attractor in terms of average rate (Aylett & Turk, 2004; Jaeger, 2010; Oh *et al.*, in prep). Can we bridge these dimensions, with for instance the notions of  $\theta$ -syllable and auditory channel capacity (Ghitza, 2013)?

To shape the discussion, we will build upon the existing literature as well as several recent studies on brain alignment to speech rate in adults and typically-developing children (Guiraud *et al.*, in prep.; Hincapié *et al.*, in prep.) and cross-linguistic investigation of speech and information rates (Pellegrino *et al.*, 2011; Oh *et al.*, in prep.) as well as the distribution of information within phonological systems (Oh *et al.*, 2015).

(492 words).

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