

Introduction

Up to now, no event-related potentials component can be considered as an indicator of successful lexical access during speech recognition.

⇒ what about oscillatory activity? The induced activities could reflect a non-phase-locked comprehension process.

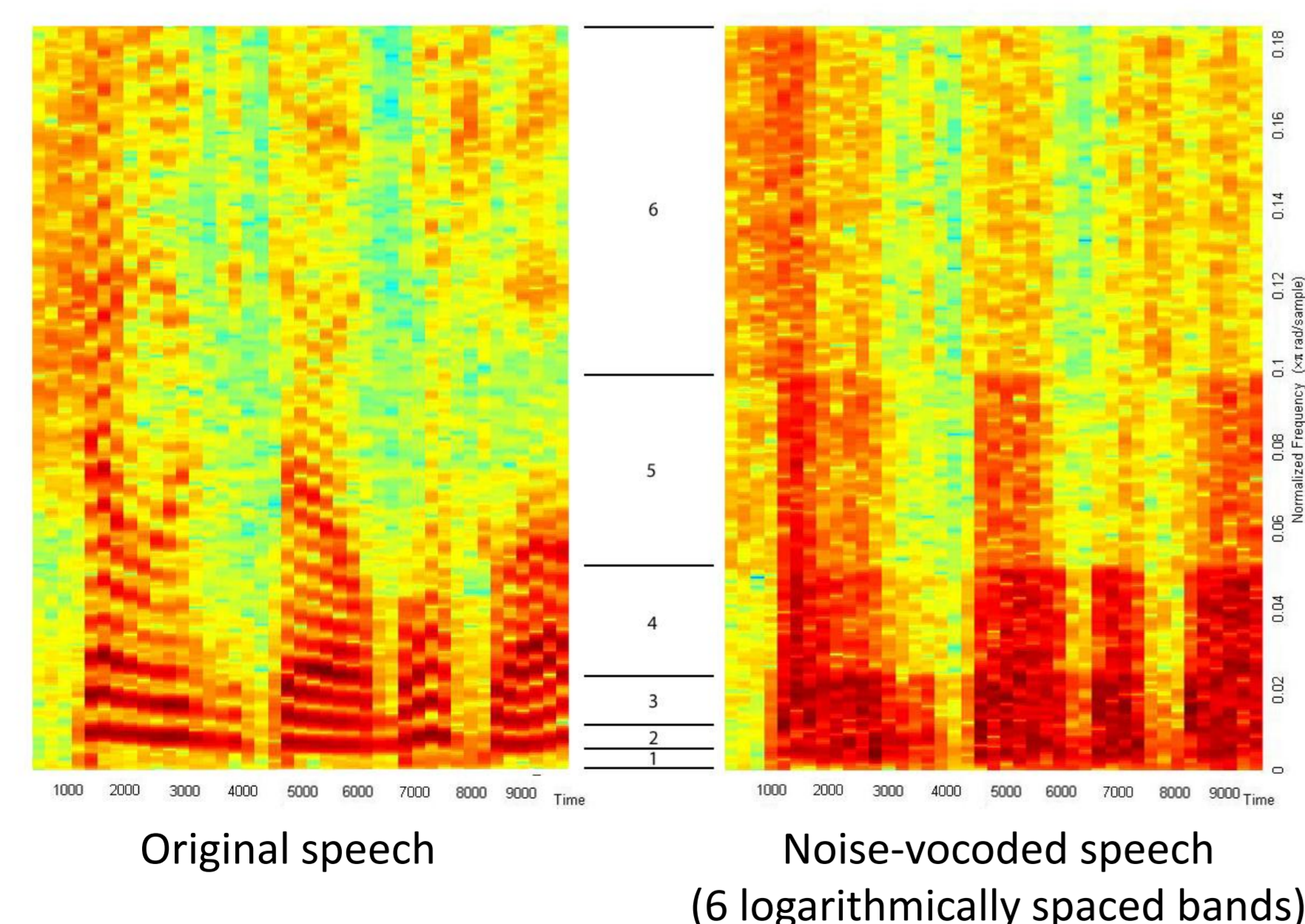
In previous studies, gamma-band synchronisations have been shown to be involved in perception of coherent objects in the visual modality (Tallon-Baudry et al., 1998).

Furthermore the comprehension of degraded speech seems to be associated with a pattern “alpha decrease / gamma burst” (Obleser & Weisz, 2011 ; Hannemann et al., 2007).

Our aim : identify time-frequency areas in the oscillatory cortical activity that are correlated with the intelligibility of degraded speech.

Noise-vocoding

- Speech signal degradation
- Deletes a major part of the spectral cues (prosody, formantic structure) but preserves temporal envelopes
- Allows perceptual learning

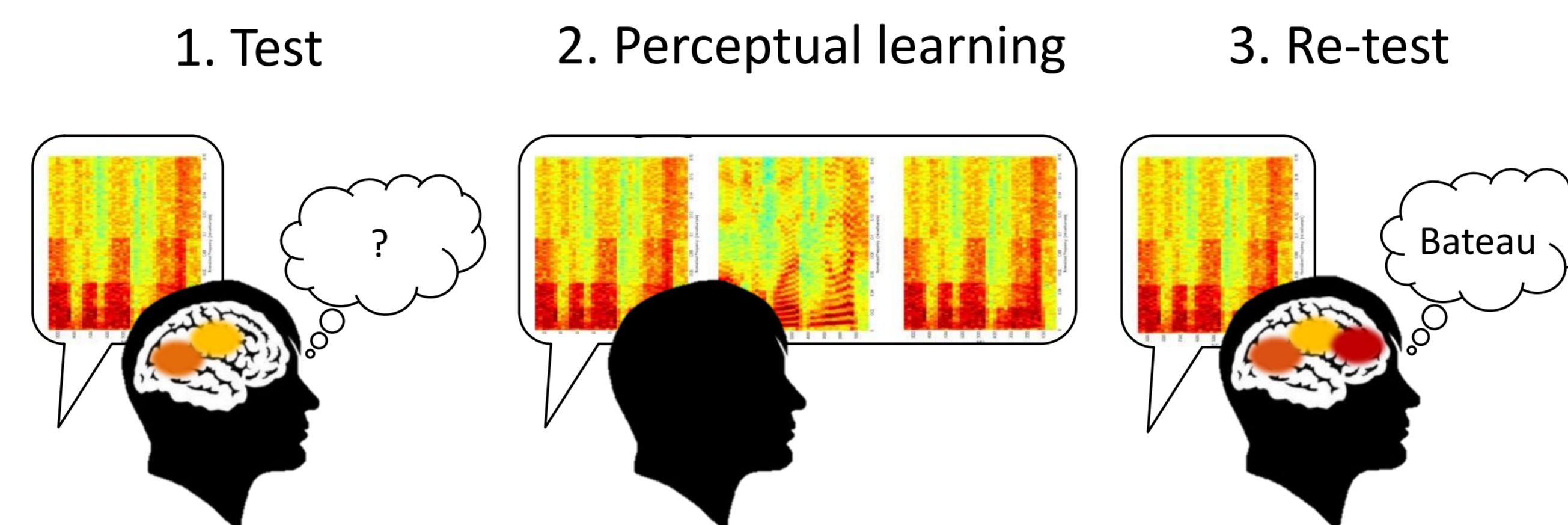


Materials and Methods

Stimuli : 400 disyllabic nouns, degraded by noise-vocoded speech.

Participants : 12 (9 female), naïve towards noise-vocoded speech.

Experimental design : Experiment split into three phases:



1. Test
 250 degraded words.
 For each stimuli :
 - Rate its intelligibility (from 0 to 3)
 - Repeat if possible
 ⇒ Stimuli mostly unintelligible

2. Perceptual learning
 150 other stimuli, each followed by a double feedback (clear then distorted word).
 Participants listens carefully.

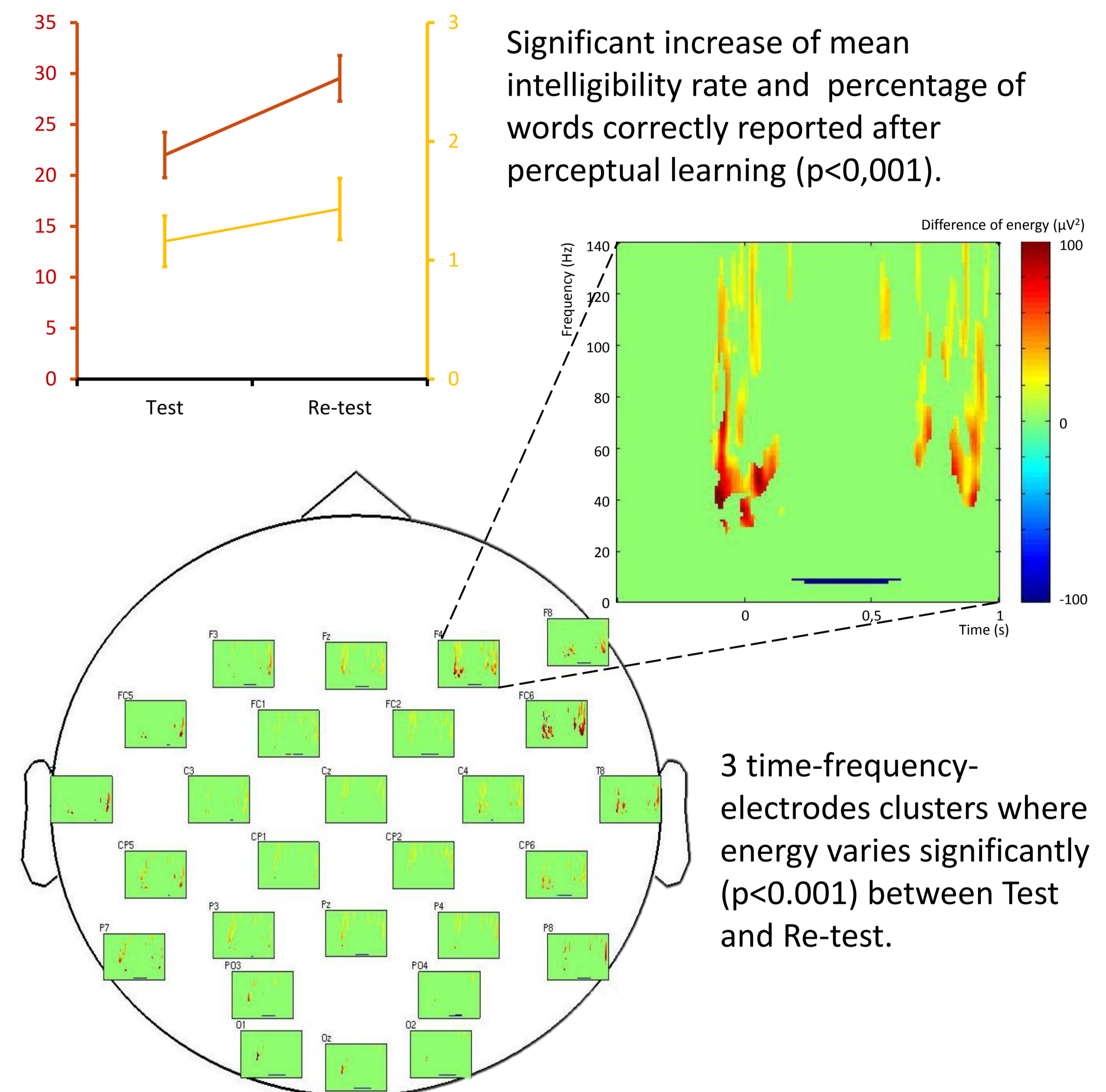
3. Re-test
 Same list of 250 stimuli as in the test sequence, but in randomized order. Same instructions.
 ⇒ Stimuli better comprehended

Data acquisition and analysis : EEG recording from 32 active electrodes (Biosemi, ActiveTwo system).
 Trial length : 1 second after stimulus onset. Baseline from -200 to 0 ms.
 Compute discrete Morlet-wavelet transform, then ERS (comparison between Test and Re-test) in order to analyze oscillatory activities (phase-locked and non-phase-locked) from 1 to 140 Hz.

Bibliography

- Tallon-Baudry C., Bertrand O., Peronnet F., Pernier J. (1998). Oscillatory γ -Band (30–70 Hz) Activity Induced by a Visual Search Task in Humans. *Journal of Neuroscience*, 18, 4244-4254.
- Obleser, J. & Weisz, N. (2011). Suppressed alpha oscillations predict intelligibility of speech and its acoustic details. *Cerebral Cortex*.
- Hannemann, R., Obleser, J., Eulitz, C. (2007). Top-down knowledge supports the retrieval of lexical information from degraded speech. *Brain Research*, 1153, 134-143

Results



Interpretation : Classic “alpha decrease / gamma burst” pattern

- Late gamma cluster (35-140 Hz, 0.5-1 s) : indicator of semantic access. Supports a distributed model of speech comprehension.
- Alpha cluster (8-13 Hz, 0.2-0.7 s) : Inhibition mechanism of local gamma oscillatory activity for unintelligible stimuli.
- Anticipatory gamma cluster (35-140 Hz, before 0 s) : attentional process.

Conclusion : These preliminary results suggest that an oscillatory signature of intelligibility could be found either in alpha- or gamma-bands.
 Further studies need to be carried out to confirm these findings and clarify the functional role of each oscillatory activity type.

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