Neural oscillatory dynamics in encoding and retrieval of verbal and non-verbal narratives
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INTRODUCTION

• We investigated the neural oscillations supporting verbal and non-verbal context-dependent semantic processing during memory encoding and retrieval.

• We examined how subjective semantic coherence, stimulus modality, and performance in a memory task modulated alpha-beta neural oscillations during the encoding and retrieval of semantic information.

• We hypothesized that subjective semantic coherence would modulate neural alpha-beta activity (8-30Hz) during the encoding of information, and that changes would predict performance in a subsequent episodic memory task. Additionally, we anticipated that subjective coherence would influence alpha power during story recollection.

• We expected non-verbal stories to be perceived as less semantically coherent overall and that would result in an alpha-beta power decrease during encoding, and reduced accuracy along with an increase in alpha-beta power during the subsequent memory task.

METHODS & EXPERIMENTAL PROCEDURE

• Participants: 30 right-handed neurotypical and native English speakers.

• Story Encoding: 18 Verbal and 18 equivalent Non-verbal (i.e., soundscapes) auditory stories with the same meaning, each lasting 40 seconds. After each story, participants rated its coherence as follows: 1 = don’t know, 2 = very incoherent, 3 = somewhat incoherent, 4 = somewhat coherent, 5 = very coherent.

• Story Retrieval: Participants were cued with a brief 5-s segment from a previously encoded story (“Listen”) and were given additional 5s to silently recall the corresponding story (“Remember”). 4 pictures appeared on the screen and participants had to indicate which one depicted an event from the cued story (four-alternative-forced-choice). Each story was tested two times (with different cues and probe pictures; 36 trials per participant).

• EEG data recording and analysis: EEG was recorded from 64 channels during the whole procedure (story encoding + retrieval). The time-locked EEG data was reconstructed at the source level using a Linearly Constrained Minimum Variance beamformer during the last 8 seconds of the stories (Encoding) and the “Remember” epochs of correct trials (Retrieval).

• Spectral power was modelled using a GLM with three predictors: modality, subjective coherence and memory scores. Beta coefficients were extracted, averaged across participants, and subjected to cluster-based permutation tests to establish whether the modality, subjective coherence during encoding as well as memory during retrieval, predicted modulations in spectral power in the last 8 seconds of each story encoding.

RESULTS – Story Encoding

• Subjective coherence modulates neural activity in the alpha-beta range during the retrieval, but not encoding of information. Changes in alpha-beta activity have been previously associated with lexical-semantic processing. During retrieval, stories that have been perceived as more coherent induced less desynchronisation in the right posterior temporal areas and right inferior parietal cortex, i.e., brain regions reflecting control processes for retrieving semantic information.

• Non-verbal stories are perceived as less coherent and possibly harder to process, as suggested by the alpha-beta decrease during encoding and the reduced accuracy along with an alpha-beta power increase during the subsequent memory task.

• The time course of alpha-beta power modulations during recall shows similarities between modalities, but also differences in the time course of the effects.

REFERENCES