

## Temporal dynamics of complex networks in the brain 722.02/XX54 Auditory scene segmentation from network patterns

### Introduction

Event segmentation is a fundamental task of the human mind in planning, perceiving and consciously understanding reality. Segmentation is thought to happen in a hierarchical fashion, from low-level processing of acoustic properties, to higher-level complex features, involving bottom-up and top-down neuronal mechanisms.

## Methods

**Data:** fMRI data collected for 41 subjects with naturalistic paradigm: free listening/ watching of stimuli (EPI at 3T, TR=2s, 4mm slices, 2mm MNI co-registered). **Stimuli:** audio (music, speech, singing) and audiovisual (feature film and music). Analysis i - network model: time varying complex network computed with seedbased phase synchronization (Glerean et al., submitted, Fig A) over 646 ROIs covering the cerebral cortex, sub-cortex and cerebellum.

Analysis ii - network patterns in time: the network pattern for each node is compared at all time-points as a distance matrix over time (**Fig B**). Analysis iii - acoustic patterns in time: acoustic spectral features (Bark scale and Mel Frequency Cepstrum Coefficients) are compared for all time intervals (interval length = 1 TR) as a distance matrix over time (**Fig C**).

**Analysis iv - pattern matching:** single node temporal structure (ii) compared with acoustic temporal structure (iii) with Representational Similarity Analysis (Kriegeskorte et al., Front. Syst. Neurosci. 2008) with spearman correlation (p<0.001) multiple comparison corrected with bootstrap resampling). Significant nodes shown in main figure and **Fig D & E**.

Analysis v - network motifs: most frequent connectivity patterns for the significant nodes from step (iv) using infomap (Rosvall, PNAS 2008, Fig F). In yellow the nodes whose temporal patterns follow the acoustic patterns significantly (iv).

# Highlights

 network patterns follow segmentation of the auditory stream

 dorso frontal networks and subcortical regions are integrated by the cerebellum during the perception of temporal structure – identification of temporal network patterns with novel method: time-varying complex networks with fMRI phase synchronization

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