FENS 2020 Virtual Forum
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The IBC team

Individual functional atlasing for cognitive mapping of the human brain

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Individual Brain Charting
https://project.inria.fr/IBC/

Poster #1069

Link to video chat with Ana during the Poster Session:
https://meet.jit.si/fens2020-1069

Goal

Develop an approach in individual functional atlasing

Link functional segregation of brain regions to mental functions

Background and motivations

- Functional atlasing of cognitive systems requires pooling data from multiple tasks
- Data pooling across studies typically impacted by inter-subject and inter-site variability
- Individual mapping free from data-pooling variability, but not yet integrated into brain function templates

Source Data: IBC first-release

- **Features of the IBC dataset**:
  - High-resolution fMRI data (1.5mm)
  - Multi-task fMRI dataset of a fixed cohort and environment
- **First release of the IBC dataset**:
  - 12 tasks covering many psychological domains
  - 13 subjects

OpenNEURO ds002685

Functional data for atlasing

- IBC data-derivatives: individual, contrast *z*-maps obtained from a mass-univariate GLM analysis of task-fMRI data

NEUROVAULT collection id=6618

Encoding models for atlasing

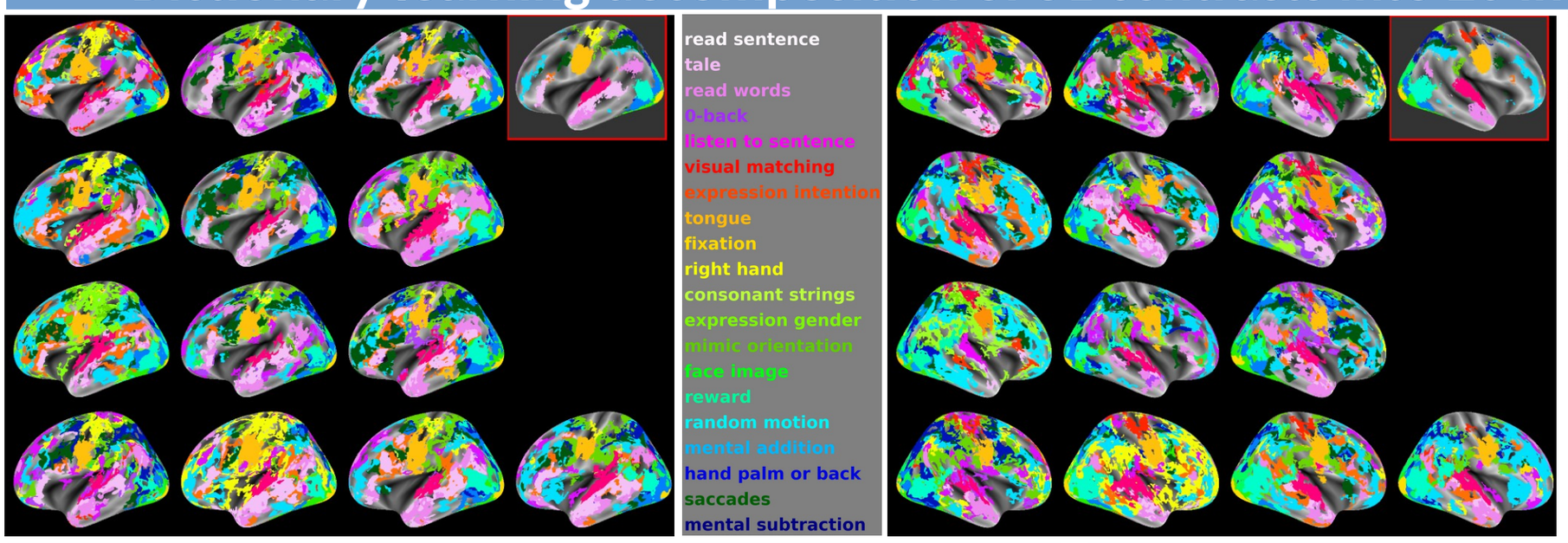
- Sparse dictionary learning to extract individual topographies underlying common representations of the contrasts
- Subject-specific ROI analysis w/ dual regression, using language-specific IBC contrasts, to draw the cognitive profile of the language network

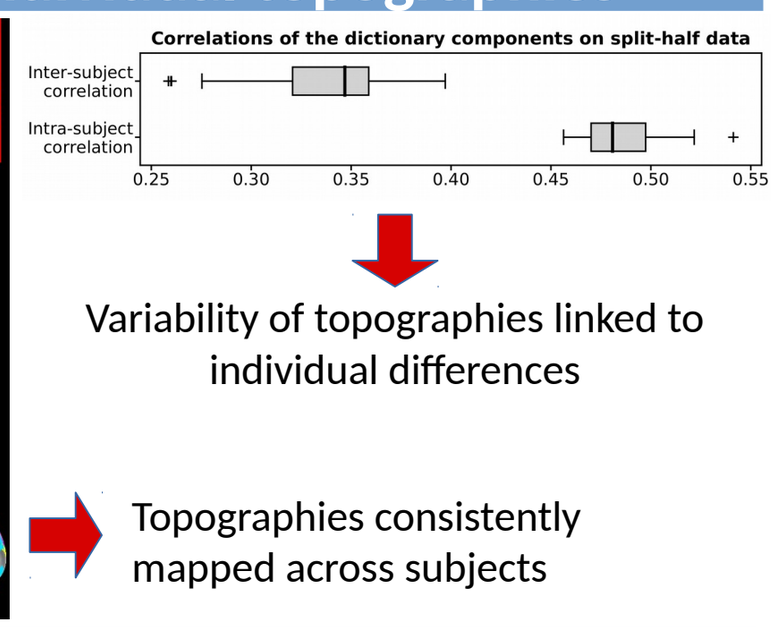
Decoding model for validation

- Leave-p-out CV (p=3 subjects),
- Ridge-Regression model to reconstruct
- contrasts of 1 task from contrasts
- of the other 11 tasks

Audio summary of the poster
https://project.inria.fr/IBC/files/2020/07/fens2020_analuisa.mp3

Dictionary-learning decomposition of 51 contrasts into 20 individual topographies



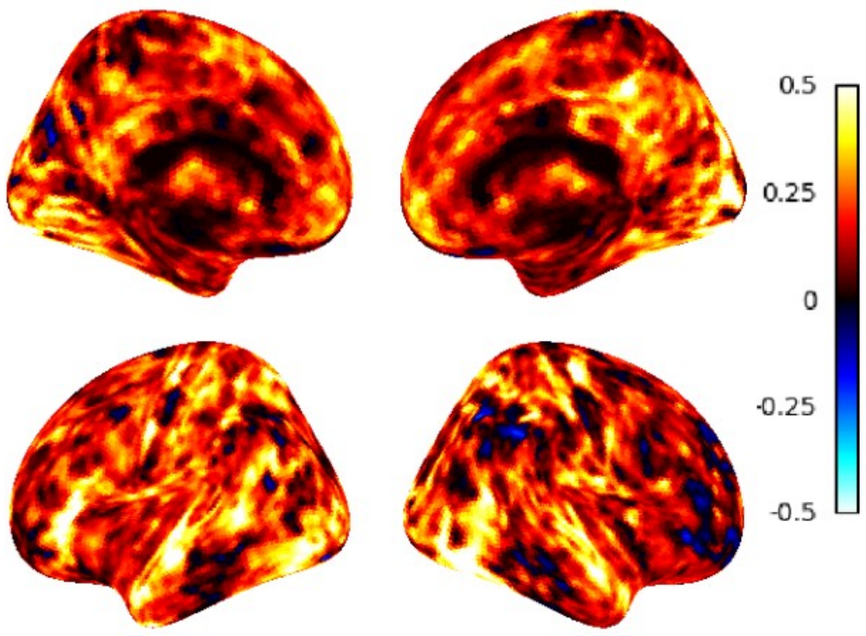


Variability of topographies linked to individual differences

Topographies consistently mapped across subjects

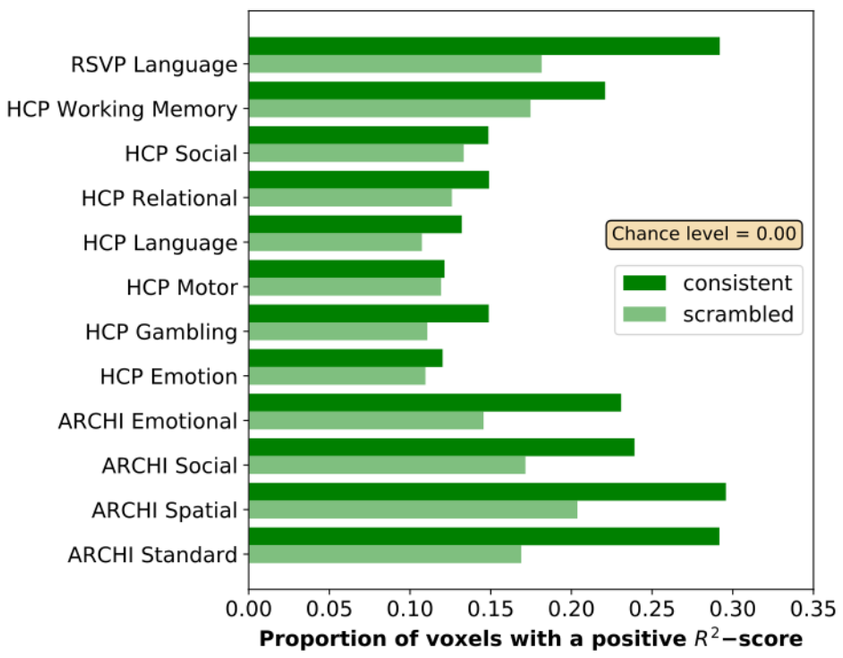
Reconstruction of functional contrasts

Most of brain regions covered by the predicted functional signatures

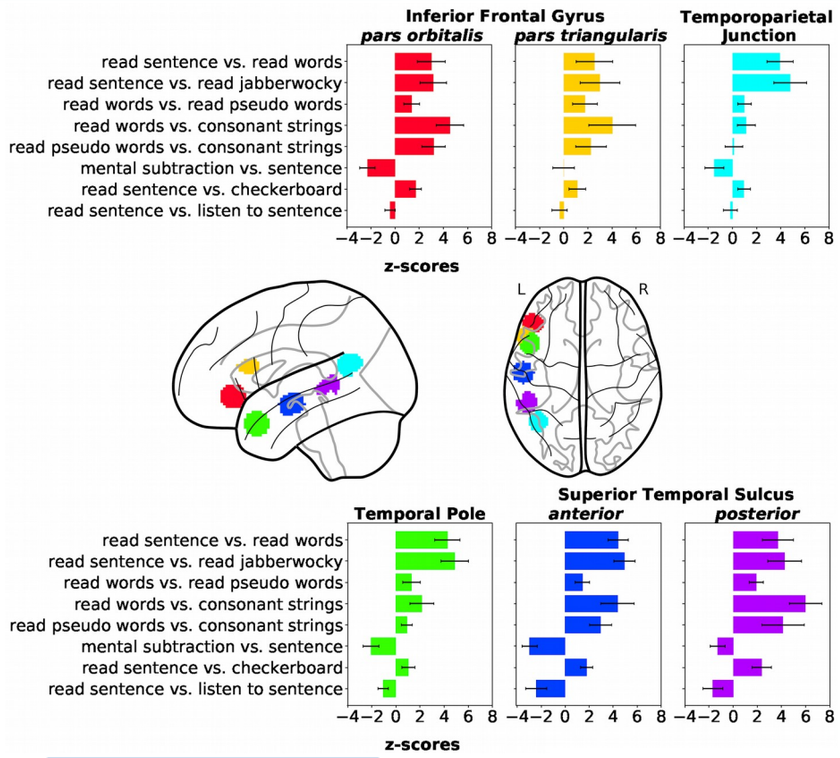


Proportion of voxels with $R^2 > 0$ lower when subjects are permuted

Topographies driven by subject-specific variability



Functional mapping of the language network

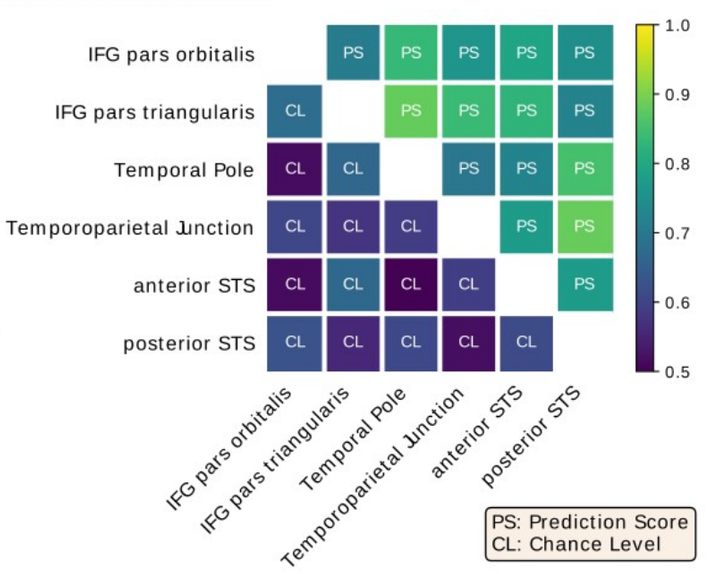


Cognitive profile using IBC contrasts of 6 ROIs from the language network

Brain-region profiles highlight their functional specificity

Prediction within pairs of ROIs

Linear SVC (upper triangle)
Dummy Clf. (lower triangle)
LOGOCV scheme
13 groups = 13 participants



Human Brain Project

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