Cross-modal identification of six subregions within the left PMd and their functional characterization

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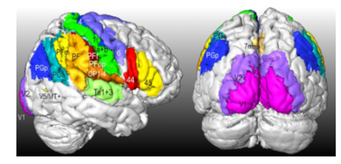
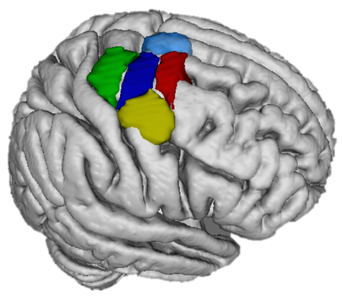


Introduction

Background:

Connectivity Based Parcellation (CBP) based on Meta-analytic connectivity modeling (MACM) of right dorsal premotor (right PMd)[1]:
5 functional subregions



Functional characterization:

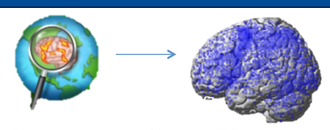
- **Rostral**: high-level **cognition**
- **Caudal**: **motor** system.
- **Ventral: premotor eye field**
- **Dorsal**: **hand-movement.**
- **Central**: **spatio-visuo-motor integrator.**

Topographical organization shows correspondence with CBP based on structural connectivity measured by probabilistic diffusion tractography (PDT)

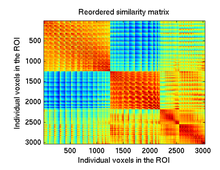
➔ **Aim of the present study:**
Examine whether similar functional subregions/modules may be identified in the left PMd by - crossing MACM-based CBP and DPT-based CBP
- functionally characterize the derived subregions

Methods

1) MACM-based CBP[1,2]

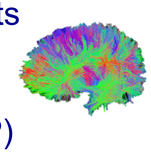


- MACM[1] using BrainMap
- CBP: *k*-means clustering (k range: 2 -> 8)
- Criteria to select stable cluster solutions:
  - information-theoretic characteristics
  - consistency criterion
  - separation characteristics



2) PDT-based CBP[2]:

- Diffusion weighted imaging (DWI) data of 20 healthy subjects
- Probabilistic Diffusion Tractography
- Spectral clustering
- K solution suggested by functional data (MACM-based CBP)



3) Parcellation combination[2]:

k solution MACM-based ∩ k solution PDT-based

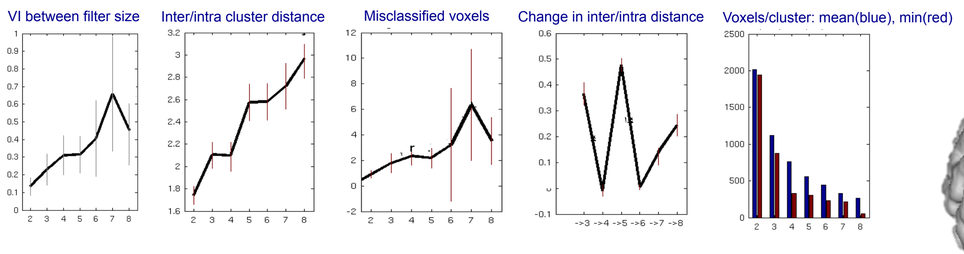
4) Functional characterization of the derived subregions[1,2]

A. Functional connectivity: MACM

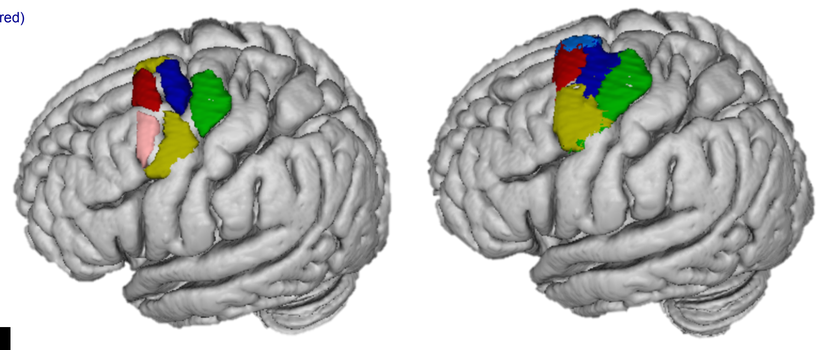
B. Functional Behavioral decoding: forward and reverse inferences across Brainmap metacategories

Results

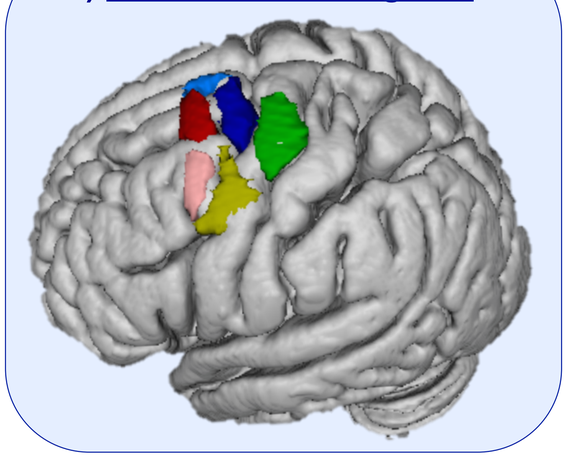
1) MACM-based CBP: 5k as a stable cluster solution



2) 5k PDT-based CBP

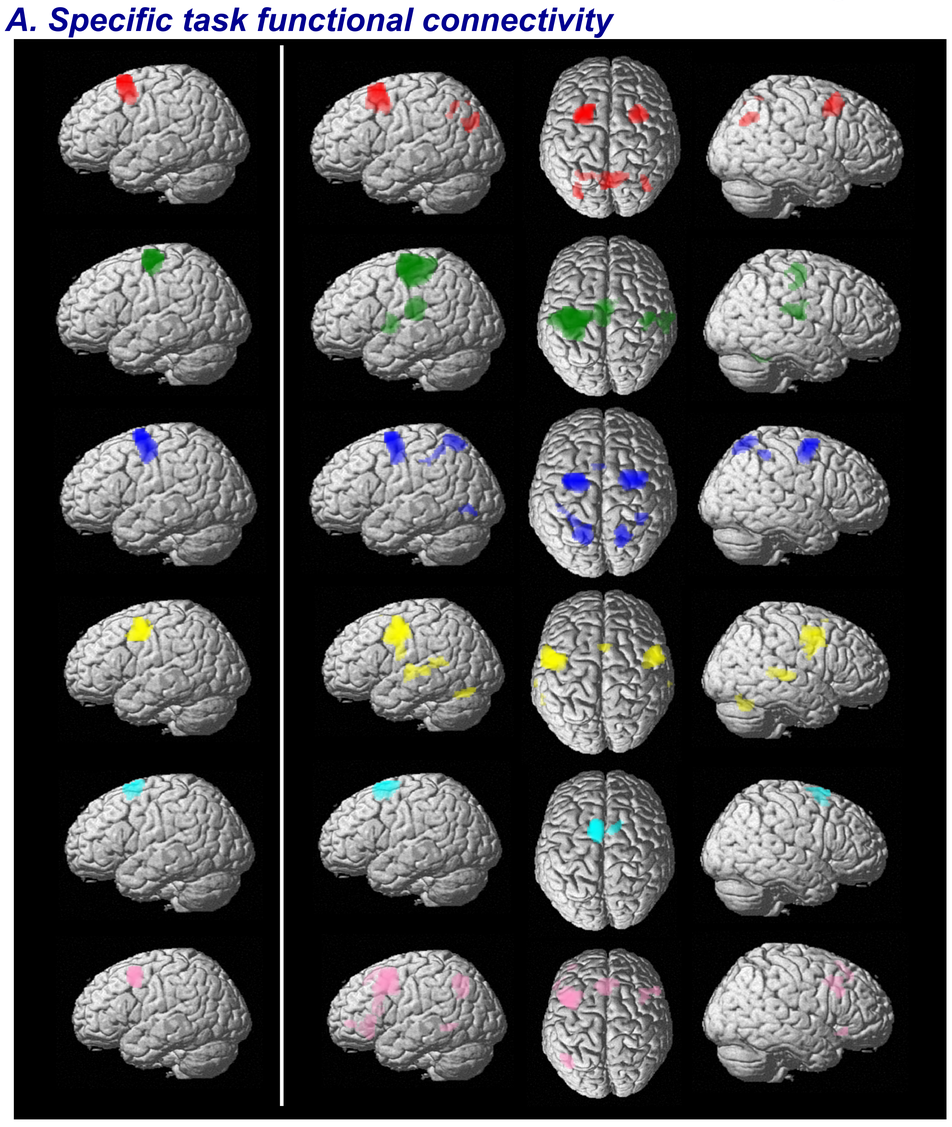


3) Combined subregions



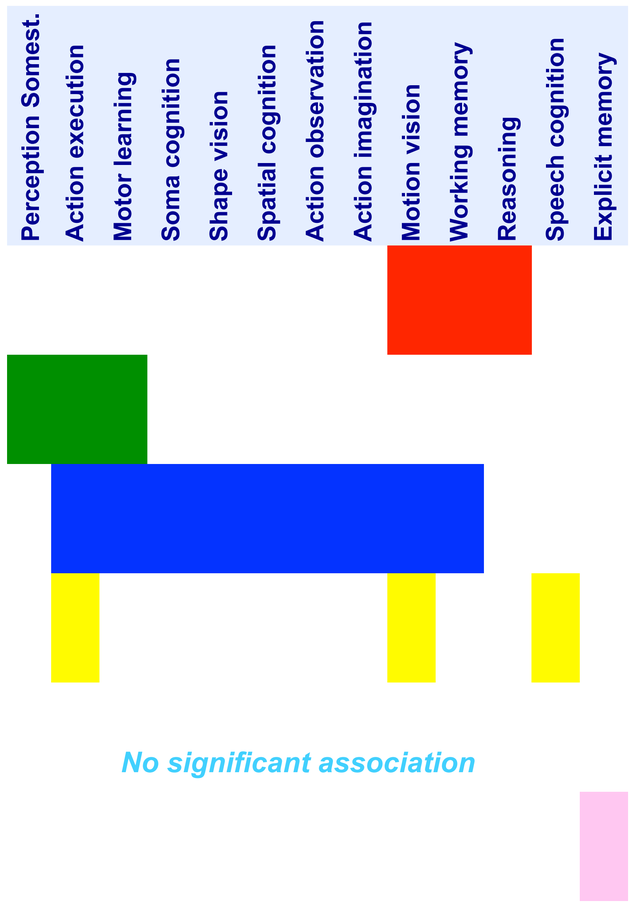
4) Functional characterization of the combined subregions

A. Specific task functional connectivity

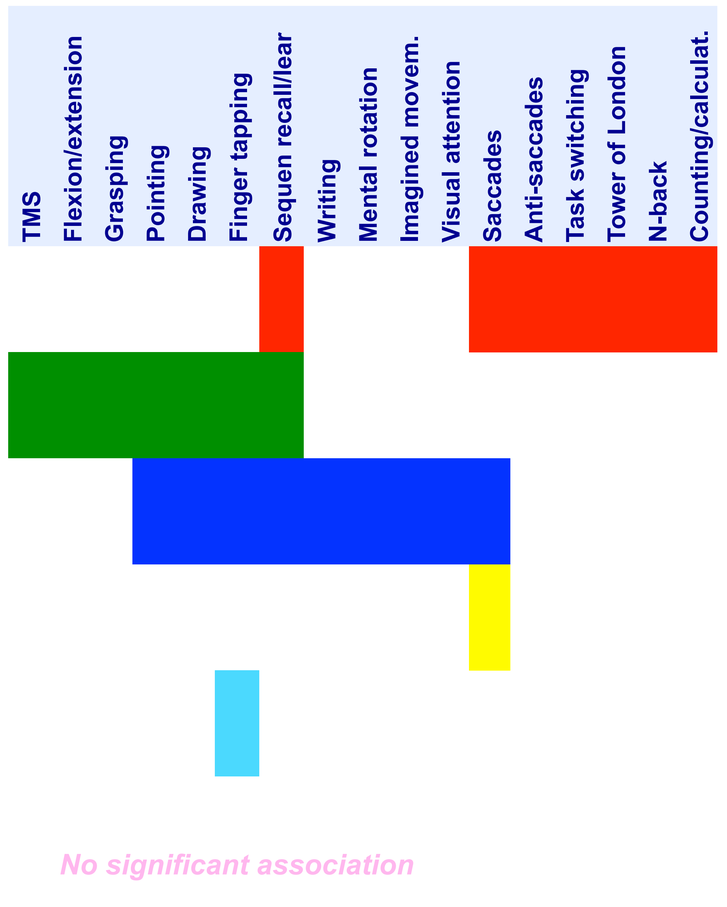


B. Functional behavioral decoding:

Behavioral domains



Paradigm classes



Conclusions

Parcellation of left PMd combining MACM and PDT -based CBP:
topographical organization along both a rostro-caudal and a ventro-dorsal axes
-> **partly mirrors the topographical organization found in the right PMd**.

Functional profile of the left PMd subregions **mirror those found in the right PMd**
Rostral: high-level cognition **Caudal**: motor system **Dorsal**: hand-movement
Central: spatio-visuo-motor integrator **Ventral:** premotor eye field

However, **functional hemispheric differences**:
left ventral PMd contains a posterior functional module related to both basic eye movements and speech and an anterior one engaged in long-term memory.

=> combining MACM-based and PDT-based CBP provided a new insight of the organization of the left PMd into six subregions.

References:
[1] Genon, S., Müller, V.I., Cieslik, E., Hoffstaedter, F., Langner, R., Fox, P.T., Eickhoff, S.B. (2014). 'Examining the right dorsal premotor mosaic: a connectivity-based parcellation approach'. OHBM Annual Meeting.
[2] Wang, J., Yang, Y., Fan, L., Xu, J., Li, C., Liu, Y., Fox, P.T., Eickhoff, S.B., Yu, C., Jiang, T. (2015). Convergent functional architecture of the superior parietal lobule unraveled with multimodal neuroimaging approaches. Human brain mapping 36:238-257.

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