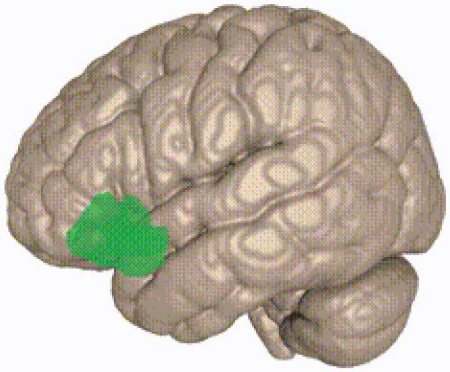
Frontoparietal Representations of Task Context Support the Flexible Control of Goal-Directed Cognition
Waskom et al, 2014

Louis Richez, Julian Willett



Wikimedia Commons, 2010

Paper Summary

- Objective: determine how prefrontal cortex executes decision making
- Observed highlighting of **inferior frontal sulcus** during tasks, validated others' findings from other works
- Arguably was able to observe and catalogue humans conducting complex tasks

Wikimedia Commons, 2010

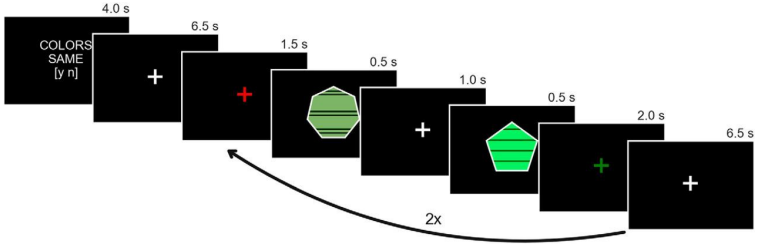
Subjects and Imaging

- Subjects:
  - Authors had “**fifteen healthy**, **right-handed native English speakers** (18-26 years old, 7 females)” in their cohort (Waskom et al, 2014).
  - This suggests recruitment of local undergraduate and graduate students.
- Imaging:
  - fMRI scanner: Authors used a 3T MRI system capable of fMRI
  - Scanners with similar capabilities are reasonably accessible, McGill has capacity

Limitations of Subjects and Imaging

- Subjects:
  - Small sample size (n=15, ~50% female)
  - Poor sharing of demographic information (age and sex distribution only)
  - Unclear meaning of “healthy” subjects
  - Documentation suggestive of recruitment of local, Stanford undergraduate and graduate students. Limits generalizability
  - **Financial incentive with a “bonus”** based on performance, potentially introducing bias.

Experimental Design



Waskom et al, 2014

- “Cued sorting” involving sorting polygons by pattern, shape, color (Waskom et al, 2014). Two options available for each of these variables (binary decisions).
- Participants responded either yes or no for whether sorting rule met using buttons with their right hand (button mapping interchanged throughout).
- Structured trials, subjects advised to respond accurately and quickly. Twenty four for each variable
- Subjects practiced task outside scanner and in the scanner before trials

Limitations of Experimental Design

- The protocol suggests that subjects were not used as their own controls, which would improve trustworthiness of data. It is unclear if results can truly be compared between subjects
- Varying the button mapping introduces a second task context behavior in addition to computation of pattern task. Pathway involved in second task could vary from first, introducing confounding

Software

- All software used by the authors was readily located online and open-source.
- Data can be imported from personal lyman libraries. No other access to raw data.
- They used: FSL, Freesurfer, Nipype, Scikit-Learn, Python and R.
- Freesurfer only compatible with Mac and Linux OS.
    - Windows requires Windows Subsystem for Linux
- Large number of python and anaconda dependencies.
- In theory easy to install via file format.
    - In practice, packages were not available in current anaconda channels.

Decoding Analysis

- Decoded task variables from fMRI BOLD data using logistic regression.
- Used one-versus-rest method for multi-class classification.
    - No consideration of other classifiers such as KNN.
- Representational strength determined by normalizing positive classes.
- No discussion of model parameters or size of training data.
- Training performed using LIBLINEAR.
    - Designed for large sparse data sets.

The FORCE Criteria

- Findable: how easy was it to locate the resources?
- Accessible: how easy was it to access the resources?
- Interoperable: are the resources accessible for someone not necessarily using the same data cluster?
- Reusable: can the study's data be used for other analyses?
- Citable: are the findings of this paper worth a citation in another paper?

The FORCE Criteria

- Findable: Computational methods available via Github.
- Accessible: Some softwares limited to Mac and Linux OS. Raw data not explicitly available.
- Interoperable: Analysis performed with R and Python packages. Preprocessing limited by OS.
- Reusable: Analysis well documented. Lack of raw data availability.
- Citable: Citable in this field (119 citations). Some concerns regarding experimental design and analysis.

References

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