Effect Sizes in Task-Based Functional Magnetic Resonance Imaging

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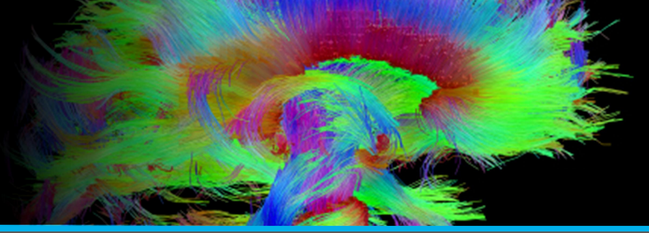

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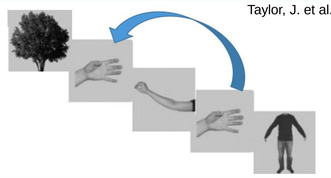
Background

- There are many ways to divide the cerebral cortex in order to determine which areas are responsible for certain behaviors
- Main goal of this research was to find the most precise way to divide the cortex for investigating behavioral tasks in functional-MRI research
- Task-based f-MRI measures blood oxygen level in 3D pixels know as voxels
- Voxels can be grouped and measured in different ways
- Focused on the difference between regions of interest and parcellation

Working Memory Task

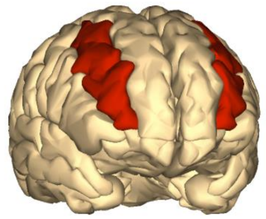
- Focused on working memory
- Task was 2-back > 0-back
- Participants asked to indicate when stimulus is same as 2 previous
- Working memory is more active during 2-back



Taylor, J. et al.(2007)

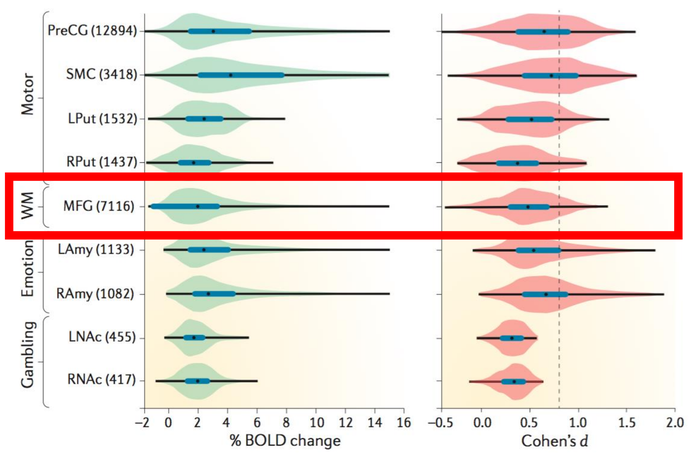
Previous Research

- Used region of interest (ROI)
- Investigated working memory in middle frontal gyrus (MFG)
  - Used meta-analysis of previous studies to create a region of interest
  - This ROI consisted of 7116 voxels



- Used the same 2 > 0 task
- Sample of 186 participants from Human Connectome Project

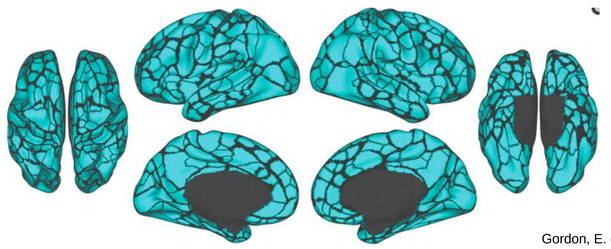
Poldrack, R. et al. (2017)
Van Essen, D. et al. (2013)



Found average effect size of 0.5 for working memory in MFG

Parcellation

- New method of dividing the cortex into 330 parcels
  - Average of 130 voxels per parcel (54x smaller than ROI # of voxels)
- Uses abrupt transitions in resting-state functional connectivity to create parcels



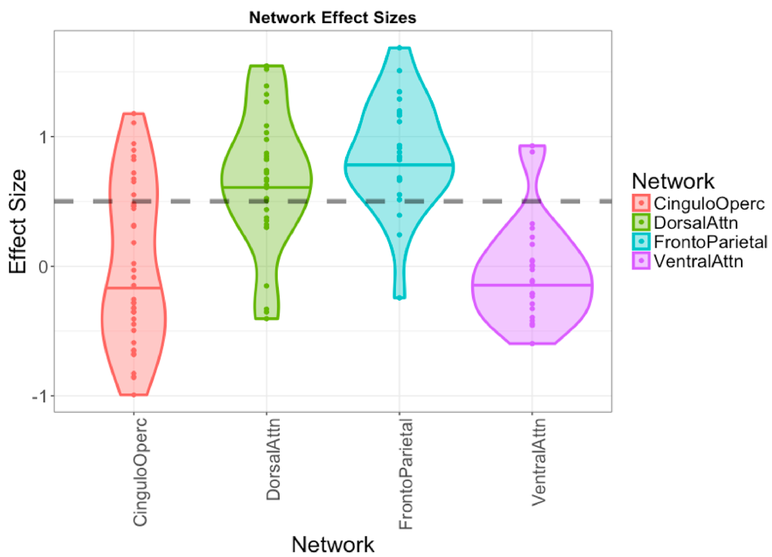
Gordon, E. et al. (2016)

Procedure

- Effect size = difference between working memory activation (2-back > 0-back) / standard deviation
- We analyzed parcels individually and as whole networks that overlapped the MFG

1.Cingulo-opercular (CON)
2.Dorsal attention (DAN)
3.Fronto-parietal (FPN)
4.Ventral attention (VAN)

- Same 186 subjects as previous research



Dashed line represents effect size of 0.5 from previous research

Results

- Dashed line = effect size of 0.5 from previous research
- Dotted line = effect size of 0.8 (large effect size)
- Yellow line = average effect size for each network

Conclusion

- New method of dividing the cortex = more precise effect sizes
  - Allows for a more “fine grain” analysis of brain activity
  - Used the same participants and working memory task; thus change in effect sizes are due to parcellation
- Found effect sizes ranging from -1 to 1.7 for individual parcels

Future Research

- Investigate other tasks, behaviors, and networks
- Use all 1200 participants from HCP
- Look for a correlation between effect size and parcel size
- This was an exploratory study and creates possibilities for hypothesis generation in future studies
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