**Box S1** | **Effect-size estimates for common neuroimaging experimental paradigms.**

The aim of this analysis is to demonstrate typical effect sizes of blood oxygen level-dependent changes in fMRI signal associated with common psychological paradigms. **[Au:OK?]** We focus on four experiments administered by the Human Connectome Project (HCP)[2](https://paperpile.com/c/Sro5Yn/On7Ie): an emotion task, gambling task, working memory task and motor task (detailed below). We choose data from the HCP for its high sample size (500 subjects), which results in high-powered results and stable effect size estimates. The pipeline for analysis, and the data and code used are available at <https://github.com/poldracklab/power>.

Briefly, the processing of data from the Human Connectome Project was carried out in 4 main steps (each separated into an individual folder in the repository):

1. **SubjectSelection**: The analyses are performed on the 500 subjects release of the HCP data, freely available at [www.humanconnectome.org](http://www.humanconnectome.org). We analyzed the data from 186 independent subjects. In this folder, the code selects these subjects on the bases that (1) all subjects have results for all four of the tasks and (2) there are no genetically related subjects in the analysis.

2. **GroupAnalyses**: The first-level analyses, that summarise the relation between the experimental design and the measured timeseries, are shared by the Human Connectome Project. The pipelines for these analyses are shared together with the data. Here we perform second-level analyses — that is, average the effect of the task on BOLD signal over subjects — with the widely used FSL (Oxford Centre for Functional MRI of the Brain Software Library) program flame1[1](https://paperpile.com/c/Sro5Yn/WnSiY): a linear mixed-effects regression at each voxel, using generalized least squares with a local estimate of random effects variance. This analysis averages over subjects, while separating within-subject and between-subject variability to ensure control of unobserved heterogeneity. The specific contrasts that have been tested are:

* Motor: average activation for tongue, hand and foot movements
* Emotion: looking at faces with a fearful expression versusneutral faces **[Au:OK?]**
* Gambling: financial reward versus punishment
* Working memory: a contrast between conditions in which the participants indicate wether the current stimulus matches the one from 2 steps earlier in the sequence versus the one from the same step

3. **CreateMasks**: The masks used for the analyses are the intersections of anatomical and functional masks for each contrast. The rationale behind this is to find effect sizes in regions that are functionally related to the task, but restricted to certain anatomical regions.

* Functional: We created masks using www.neurosynth.org[3](https://paperpile.com/c/Sro5Yn/Qk6VV). To do this, we used **[Au:OK?]** the search terms "Motor","Emotion","Gambling","Working memory" and used meta-analyses with false discovery rate (FDR) control at 0.01, the default threshold on neurosynth, and forward inference. The generated mask represents an average map of the regions consistently found to be activated in studies investigating the effects of, for example, motor tasks.
* Anatomical: We have used Harvard-Oxford probabilistic atlas[4](https://paperpile.com/c/Sro5Yn/UBWgN) at p>0. Because of their well studied relationship with the task in the literature, we've selected the following anatomical regions for the contrasts. The size of the masks was assessed by the number of voxels in the mask.

|  |  |
| --- | --- |
| **Task** | **Anatomical Mask** |
| Motor | * Precentral gyrus * Supplementary motor cortex * Left putamen * Right putamen |
| Working memory | Middle frontal gyrus |
| Emotion | * Left amygdala * Right amygdala |
| Gambling | * Left accumbens * Right accumbens |

4. **EffectSize**: The intersection masks created above were used to isolate the regions of interest in the second-level-analysed BOLD signal data. From these mask-isolated data sets, the size of the task-related effect (Cohen’s D medians, 10th percentiles and 90th percentiles) were computed for each relevant region. FSL’s Featquery computes the median % BOLD change in the data within the masks, as well as the 10 and 90 percentile.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paradigm** | **Intersection mask** | **Mask size**  **(voxels)** | **Cohen’s D** | | | **BOLD change (% signal change from baseline)** | | |
| **P10** | **Median** | **P90** | **P10** | **Median** | **P90** |
| Motor | Bilateral Precentral gyrus | 12894 | 0.158 | 0.628 | 1.070 | 0.505 | 2.707 | 8.582 |
| Bilateral Supplementary motor cortex | 3418 | 0.211 | 0.716 | 1.197 | 0.911 | 4.033 | 12.510 |
| Left putamen | 1532 | 0.114 | 0.513 | 0.864 | 0.586 | 2.388 | 4.318 |
| Right putamen | 1437 | -0.008 | 0.369 | 0.749 | -0.045 | 1.696 | 3.609 |
| Working memory | Bilateral Middle frontal gyrus | 7116 | 0.101 | 0.474 | 0.837 | 0.130 | 0.986 | 2.504 |
| Emotion | Left amygdala | 1133 | 0.265 | 0.534 | 1.065 | 0.516 | 1.198 | 3.379 |
| Right amygdala | 1082 | 0.308 | 0.645 | 1.140 | 0.581 | 1.350 | 3.557 |
| Gambling | Left accumbens | 455 | 0.138 | 0.310 | 0.461 | 0.369 | 0.849 | 1.440 |
| Right accumbens | 417 | 0.141 | 0.332 | 0.488 | 0.373 | 0.981 | 1.618 |

1. [Jenkinson, M., Beckmann, C. F., Behrens, T. E. J., Woolrich, M. W. & Smith, S. M. FSL. *Neuroimage* **62,** 782–790 (2012).](http://paperpile.com/b/Sro5Yn/WnSiY)

2. [Van Essen, D. C. *et al.* The WU-Minn Human Connectome Project: An overview. *Neuroimage* **80,** 62–79 (2013).](http://paperpile.com/b/Sro5Yn/On7Ie)

3. [Yarkoni, T., Poldrack, R. A., Nichols, T. E., Van Essen, D. C. & Wager, T. D. Large-scale automated synthesis of human functional neuroimaging data. *Nat. Methods* **8,** 665–670 (2011).](http://paperpile.com/b/Sro5Yn/Qk6VV)

4. [Desikan, R. S. *et al.* An automated labeling system for subdividing the human cerebral cortex on MRI scans into gyral based regions of interest. *Neuroimage* **31,** 968–980 (2006).](http://paperpile.com/b/Sro5Yn/UBWgN)