Preregistration

My fMRI preregistration

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Project Title	Enter your response here.
Introduction	Enter your response here.
Aims & Hypotheses	Enter your response here.
Existing Data	**Registration prior to creation of data**
	Registration prior to any human observation of the data
	Registration prior to accessing the data
	Registration prior to analysis of the data
	Registration following analysis of the data

Explanation of Existing Data	Enter your response here.
Details of Larger Study	Is your preregistration part of a larger project? **Yes** **No**
Data Collection Procedures	**Population** Enter your response here. **Recruitment efforts** Enter your response here. **Inclusion/Exclusion criteria** Enter your response here. **Clinical criteria (if applicable)** Enter your response here. **Matching strategy (if applicable)** Enter your response here. **Payment for participation** Enter your response here. **IRB, consent/assent obtained** Enter your response here. **Number of subjects participated and analyzed** Enter your response here. **Age** Enter your response here. **Sex** Enter your response here.

Handedness

Enter your response here.

For group comparisons, what variables (if any) were equated across groups?

Enter your response here.

Study timeline (e.g., number of visits, length of visits, what was measured/collected at each visit)

Enter your response here.

Sample Size & Stopping Rule

Target sample size:

To obtain our target sample size, we plan to recruit: Enter your response here.

Justification of sample size:

Power analyses:

- Effect size: Enter your response here.
- Source of predicted effect size (prior lit, pilot etc.): Enter your response here.
- Significant level: Enter your response here.
- Target power: Enter your response here.
- Specify the type of outcome used as the basis of power computations, e.g. signal in a prespecified ROI, or whole image voxelwise (or clusterwise, peakwise, etc.): Enter your response here.

Stopping rule:

- Time constraints : Enter your response here.
- Money constraints : Enter your response here.
- Personnel constraints : Enter your response here.

Contingencies for if your target sample size is not met:

Enter your response here.

Measured Behavioral Variables

Outcome measures

Enter your response here.

Predictor measures

Enter your response here.

Covariate measures

Enter your response here.

How was behavioral task performance measured

Enter your response here.

Contingency plans for behavioral analysis

Enter your response here.

> E.g., If the X questionnaire is missing for more than 10% of participants we will not use it or if X does not show variability in response (either ceiling or floor effects) in which we cannot look at behavioral pattern of interest, we will not use that questionnaire and use Y questionnaire instea

Additional Operational Definitions

Region Specificity

Enter your response here.

Any other definitions used across study

Enter your response here.

Transformations

Enter your response here.

Contingency plans for transformation

Enter your reponse here.

Code

Enter your response here.

Analysis Data Exclusion

Outliers

Enter your response here.

Reasons for possible rejection

Enter your response here.

Contingency plans

Enter your response here.

Dealing with incomplete/missing data

Enter your response here.

Experimental Design

Design Specifications

- Design type: Enter your response here.
- Conditions & Stimuli: Enter your response here.
- Number of blocks, trials or experimental units per session and/or subject: Enter your response here.
- Timing and Duration: Enter your response here.
- Length of experiment: Enter your response here.
- Was the design optimized for efficiency, and if so, how? Enter your response here.
- Presentation software: Enter your response here.

Task Specification

- Instructions to subjects: Enter your response here.
- Stimuli: Enter your response here.
- Stimuli presentation & response collection Randomization/pseudo-randomized: Enter your response here.
- Run order: Enter your response here.

Data acquisition

Subject Preparation

- Mock scanning: Enter your response here.
- Specific accommodations: Enter your response here.
- Experimental personnel: Enter your response here.

MRI system

- Manufacturer, field strength , model name: Enter your response here.

MRI acquisition

- Pulse sequence: Enter your response here.
- Image type: Enter your response here.
- *Essential sequence & imaging parameters*
  - For all acquisitions:
    - Echo time (TE): Enter your response here.
    - Repetition time (TR): Enter your response here.
      - For multishot acquisitions, additionally the time per volume: Enter your response here.
    - Flip angle (FA): Enter your response here.
    - Acquisition time : Enter your response here.
  - Functional MRI:
    - Number of volumes: Enter your response here.
    - Sparse sampling delay (delay in TR) if used: Enter your response here.
  - Inversion recovery sequences:
    - Inversion time (TI): Enter your response here.
  - B0 field maps:
    - Echo time difference (dTE). Diffusion MRI: Enter your response here.

    - Number of directions : Enter your response here.
    - b-values: Enter your response here.
    - Number of b=0 images: Enter your response here.
    - Number of averages (if any): Enter your response here.
    - Single shell, multishell : Enter your response here.
    - Single or dualspinecho, gradient mode : Enter your response here.
    - If cardiac gating used: Enter your response here.
  - Imaging parameters:
    - Field of view: Enter your response here.
    - Inplane matrix size, slice thickness and interslice gap, for 2D acquisitions: Enter your response here.
    - Slice orientation : Enter your response here.
    - Angulation : Enter your response here.
    - 3D matrix size, for 3D acquisitions: Enter your response here.
- Phase encoding: Enter your response here.
- Parallel imaging method & parameters_ Enter your response here.
- Multiband parameters: Enter your response here.
- Readout parameters: Enter your response here.
- Fat suppression: Enter your response here.
- Shimming_ Enter your response here.
- Slice order & timing: Enter your response here.
- Brain coverage: Enter your response here.
- Scanner-side preprocessing: Enter your response here.
- Scan duration (in seconds): Enter your response here.
- Other non-standard procedures: Enter your response here.
- T1 stabilization: Enter your response here.
- Diffusion MRI gradient table: Enter your response here.

- Perfusion: Arterial Spin Labelling MRI
  - ASL Labelling method: Enter your response here.
  - Use of background suppression pulses and their timing: Enter your response here.
  - For either PCASL or CASL report:
    * Label Duration: Enter your response here.
    * Postlabeling delay (PLD): Enter your response here.
    * Location of the labeling plane: Enter your response here.
  - For PCASL also report:
    * Average labeling gradient: Enter your response here.
    * Sliceselective labeling gradient: Enter your response here.
    * Flip angle of B1 pulses: Enter your response here.
    * Assessment of inversion efficiency; QC used to ensureoffresonance artifacts not problematic, signal obtained over wholebrain: Enter your response here.
  - For CASL also report:
    * Use of a separate labeling coil: Enter your response here.
    * Control scan/pulse used: Enter your response here.
    * B1 amplitude: Enter your response here.
  - For PASL report:
    * TI: Enter your response here.
    * Labeling slab thickness: Enter your response here.
    * Use of QUIPSS pulses and their timing: Enter your response here.
  - For VSASL:
    * TI: Enter your response here.
    * Choice of velocity selection cutoff ("VENC"): Enter your response here.
- Perfusion: Dynamic Susceptibility Contrast MRI Specify
  - Number of baseline volumes: Enter your response here.

- Type, name and manufacturer of intravenous bolus: <! –e.g. gadobutrol,Gadavist, Bayer –> Enter your response here.
- Bolus amount and concentration: Enter your response here.
- Injection rate: Enter your response here.
- Postinjection of saline: Enter your response here.
- Injection method: Enter your response here.

Preprocessing

Preliminary quality control

- Motion monitoring:

Enter your response here.

- Incidental findings:

Enter your response here.

Data preprocessing

Enter your response here.

Pre-processing: general

- Order of preprocessing operations: Enter your response here.
- Describe any data quality control measuresUnwarping of B0 distortionsSlice timing correctionReference slice and type of interpolation used (e.g., "Slice timing correction to the first slice as performed, using SPM5's Fourier phase shift interpolation")Motion correctionReference scan, image similarity metric, type of interpolation used, degrees-of-freedom (if not rigid body) and, ideally, optimization method, e.g., "Head motion corrected with FSL's MCFLIRT by maximizing the correlation ratio between each timepoint and the middle volume, using linear interpolation."Motion susceptibility correction usedSmoothingSize

and type of smoothing kernel (provide justification for size; e.g., for a group study,“12 mm FHWM Gaussian smoothing applied to ameliorate differences in intersubject localization”; for single subject fMRI “6 mm FWHM Gaussian smoothing used to reduce noise”)Intersubject registrationIntersubject registration method usedIllustration of the voxels present in all subjects (“mask image”) can be helpful, particularly for restricted fields of view (to illustrate overlap of slices across all subjects). Better still would be an indication of average BOLD sensitivity within each voxel in the maskTransformation model and optimizationTransformation model (linear/affine, nonlinear), type of any non-linear transformations (polynomial, discrete cosine basis), number of parameters (e.g., 12 parameter affine, $3 \times 2 \times 3$ DCT basis), regularization, image-similarity metric, and interpolation methodObject image information (image used to determine transformation to atlas)Anatomical MRI? Image properties (see above)Co-planar with functional acquisition?Functional acquisition co-registered to anatomical? if so, how?Segmented gray image? fMRI preregistration template | Jessica FlanneryFunctional image (single or mean)Atlas/target informationBrain image template space, name, modality and resolution (e.g., “FSL’s MNI Avg152, T1 $2 \times 2 \times 2$ mm”; “SPM2’s MNI gray matter template $2 \times 2 \times 2$ mm”)Coordinate space (Typically MNI, Talairach, or MNI converted to TalairachIf MNI converted to Talairach, what method? e.g., Brett’s mni2tal?How were anatomical locations (e.g., gyral anatomy, Brodmann areas) determined? (e.g., paper atlas, Talairach Daemon, manual inspection of individuals’ anatomy, etc.)SmoothingSize and type of smoothing kernel (provide justification for size; e.g., for a group study, “12 mm FHWM Gaussian smoothing applied to ameliorate differences in intersubject localization”; for single subject fMRI “6 mm FWHM Gaussian smoothing used to reduce noise”)Recommendations of fMRI details come from Nichols et al., 2016; Poldrack et al., 2008.For extended checklist guidelines for this section following data analysis, see PHBM COBIDAS report Nichols et al., 2016. Statistical modelingFor all prompts and tables, can fill in the table or write paragraph below as you would for paper and use table as checklist of topics covered.Planned comparison If the experiment has multiple conditions, what are the specific planned comparisons, or is an omnibus ANOVA used?General issuesFor novel methods that are not described in detail in a separate paper,

provide explicit descriptionand validation of method.Remember to include package and package version used for each test.First level (fx) modelingEventrelated design predictors.- Modeled duration, if other than zero.- Parametric modulation.Block Design predictors.(Note whether baseline was explicitly modeled.)HRF basis, typically one of:Canonical only.Canonical plus temporal derivative.Canonical plus temporal and dispersion derivative. Smooth basis (e.g. SPM "informed" or Fourier basis; FSL's FLOBS).Finite Impulse Response model.Drift regressors (e.g. DCT basis in SPM, with specified cutoff). fMRI preregistration template | Jessica FlanneryMovement regressors; specify if squares and/or temporal derivative used.Any other nuisance regressors, and whether they were entered as interactions (e.g. with a task effect in 1st level fMRI, or with group effect).Any orthogonalization of regressors, and set of other regressors used to orthogonalize against.Contrast construction (Exactly what terms are subtracted from what? Define these in terms of task or stimulus conditions (e.g., using abstract names such as AUDSTIM, VISSTIM) instead ofunderlying psychological concepts.Autocorrelation model type (e.g., AR(1), AR(1) + WN, or arbitrary autocorrelation function), and whether global or local.(e.g., for SPM2/SPM5, 'Approximate AR(1) autocorrelation model estimated at omnibus F-significant voxels ($P < 0.001$), used globally over the whole brain'; for FSL, 'Autocorrelation function estimated locally at each voxel, tapered and regularized in space.').Second level (group) modelingStatistical model and estimation method, inference type (mixed/random effects or fixed), e.g., "Mixed effects inference with one sample t-test on summary statistic" (SPM2/SPM5), e.g., "Mixed effects inference with Bayesian 2-level model with fast approximation to posterior probability of activation." (FSL)If fixed effects inference used, justifyIf more than 2-levels, describe the levels and assumptions of the model (e.g., are variances assumed equal between groups)Repeated measures? If multiple measurements per subject, list method to account for within subject correlation, exact assumptions made about correlation/variancee.g., SPM: "Within-subject correlation estimated at F-significant voxels ($P < 0.001$), then used globally over whole brain"; or, if variances for each measure are allowed to vary, "Within-subject correlation and relative variance estimated. . . "For group model with repeated measures, specify:- How condition effects are modeled (e.g. as factors, or as linear trends).-

Whether subject effects are modeled (i.e. as regressors, as opposed towith a covariance structure).For group effects: clearly state whether or not covariates are split by group (i.e. fit as a groupby-covariate interaction).Model type (Some suggested terms include:- “Mass Univariate”.- “Multivariate” (e.g. ICA on whole brain data).- “Mass Multivariate” (e.g. MANOVA on diffusion or morphometry tensordata).- “Local Multivariate” (e.g. “searchlight”).- “Multivariate, intrasubject predictive” (e.g. classify individual trials ineventrelated fMRI).- “Multivariate intersubject predictive” (e.g. classify subjects as patient vs.control).- “Representational Similarity Analysis”.)Model settings (The essential details of the model. For massunivariate, first level fMRI, these include:- Drift model, if not already specified as a dependent variable (e.g. locally linear fMRI preregistration template | Jessica Flannerydetrending of data & regressors, as in FSL).- Autocorrelation model (e.g. global approximate AR(1) in SPM; locally regularized autocorrelation function in FSL).For massunivariate second level fMRI these include:- Fixed effects (all subjects’ data in one model).- Random or mixedeffects model, implemented with:- Ordinary least squares (OLS, aka unweighted summary statistics approach; SPM default, FSL FEAT’s “Simple OLS”).- weighted least squares (i.e. FSL FEAT’s “FLAME 1”), using voxelwise estimate of between subject variance.- Global weighted least squares (i.e. SPM’s MFX).With any group (multisubject) model, indicate any specific variance structure, e.g.- Unequal variance between groups (and if globally pooled, as in SPM).- If repeated measures, the specific covariance structure assumed (e.g.compound symmetric, or arbitrary; if globally pooled).For local-multivariate report:- The number of voxels in the local model.- Local model used (e.g. Canonical Correlation Analysis) with anyconstraints (e.g. positive weights only).ROI analysisHow were ROIs defined (e.g., functional, anatomical, parcel localizer)?How was signal extracted within ROI?(e.g., average parameter estimates, FIR deconvolution?)If percent signal change reported, how was scaling factor determined (e.g., height of block regressor or height of isolated event regressor)?Is change relative to voxel-mean, or whole-brain mean?Justify definition of ROI and analysis conducted with it: (e.g., if your ROI is defined based on the cluster; how will you ensure your ROI analyses are not circular?)If not previously specified above, what statistical model will you use to test each hypothesis? Please include the type of model (e.g. ANOVA, multiple regression,

SEM, etc) and the specification of the model (this includes each variable that will be included as predictors, outcomes, or covariates). Please specify any interactions that will be tested and remember that any test not included here must be noted as an exploratory test in your final article.Recommendations of fMRI details come from Nichols et al., 2016; Poldrack et al., 2008.For extended checklist guidelines for this section following data analysis, see PHBM COBIDAS report Nichols et al., 2016.

References