

ABCD Human Subjects Study

Adolescent Brain Cognitive Development – ABCDSTUDY.org

Release Notes for Annual Release 1.1

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Task-Based Functional Magnetic Resonance Imaging (task-fMRI)

October 31, 2018

List of Instruments

Name of Instrument	Short Name
ABCD Task fMRI MID Average Beta Weights Part 1	midaparc02
ABCD Task fMRI MID Average Beta Weights Part 2	midaparcp202
ABCD Task fMRI MID Run 1 Beta Weights Part 1	abcd_midr1bwp101
ABCD Task fMRI MID Run 1 Beta Weights Part 2	abcd_midr1bwp201
ABCD Task fMRI MID Run 2 Beta Weights Part 1	midr2bwp101
ABCD Task fMRI MID Run 2 Beta Weights Part 2	midr2bwp201
ABCD Task fMRI MID Average Standard Error of the Mean Part 1	abcd_midasemp101
ABCD Task fMRI MID Average Standard Error of the Mean Part 2	abcd_midasemp201
ABCD Task fMRI MID Run 1 Standard Error of the Mean Part 1	abcd_midsemp101
ABCD Task fMRI MID Run 1 Standard Error of the Mean Part 2	abcd_midsemp201
ABCD Task fMRI MID Run 2 Standard Error of the Mean Part 1	abcd_midr2semp101
ABCD Task fMRI MID Run 2 Standard Error of the Mean Part 2	abcd_midr2semp201
ABCD Task fMRI SST Average Beta Weights	mrisst02
ABCD Task fMRI SST Run 1 Beta Weights	mrisstr1bw01

ABCD Task fMRI SST Run 2 Beta Weights	mrisstr2bw01
ABCD Task fMRI SST Average Standard Error of the Mean	mrisstsem01
ABCD Task fMRI SST Run 1 Standard Error of the Mean	mrisstr1sem01
ABCD Task fMRI SST Run 2 Standard Error of the Mean	mrisstr2bwsem01
ABCD Task fMRI nBack Average Beta Weights	nback_bwroi02
ABCD Task fMRI nBack Run 1 Beta Weights	nbackr101
ABCD Task fMRI nBack Run 2 Beta Weights	nbackr201
ABCD Task fMRI nBack Average Standard Error of the Mean	nbackallsem01
ABCD Task fMRI nBack Run 1 Standard Error of the Mean	nbackr1sem01
ABCD Task fMRI nBack Run 2 Standard Error of the Mean	nbackr2sem01

General Information

The following information refers to the Adolescent Brain Cognitive Development (ABCD) Study October 2018 patch release (ABCD Release 1.1) available from <https://data-archive.nimh.nih.gov/abcd>. An overview of the ABCD Study is at <https://abcdstudy.org> and detailed descriptions of elements of the study are listed in <https://abcdstudy.org/scientists-publications>.

This document describes the contents of various instruments available for download. To understand the context of this information, see *Release Notes ABCD README FIRST* and *Release Notes ABCD Imaging Instruments*.

- Image types
 - field maps: spin echo images with opposite phase encode polarity
 - multi-frame, gradient echo, echo-planar imaging
- Image processing (common to all fMRI)
 - head motion corrected by registering each frame to the first using AFNI's 3dvolreg (Cox, 1996)
 - B_0 distortions were corrected using the reversing gradient method (Holland, et al., 2010)
 - displacement field estimated from spin-echo field map scans
 - applied to gradient-echo images after adjustment for between-scan head motion
 - corrected for gradient nonlinearity distortions (Jovicich, et al., 2006)

- between scan motion correction across all fMRI scans in imaging event
- registration between T_2 -weighted, spin-echo B_0 calibration scans and T_1 -weighted structural images performed using mutual information (Wells, et al., 1996)
- task-fMRI specific pre-processing
 - removal of initial volumes
 - Siemens: 8 TRs
 - Philips: 8 TRs
 - GE DV25: 5 TRs
 - GE DV26: 16 TRs
 - normalization and demean
 - divide by the mean of each voxel, subtract 1, multiply by 100
- Estimation of task-related activation strength
 - general linear model (GLM) using AFNI's 3dDeconvolve (Cox, 1996)
 - nuisance regressors to model baseline, quadratic trend, and motion (Power, et al., 2014)
 - motion estimates, derivatives, and squared estimates and derivatives included
 - time points with framewise displacement (FD) > 0.9 mm censored (Siegel, et al., 2014)
 - hemodynamic response function
 - modelled as gamma functions with temporal derivatives, using AFNI's SPMG model
 - for MID and SST models, events modeled as instantaneous
 - for n-back, duration of cues (~3 s) and trial blocks (~24 s) modeled as square waves convolved with SPMG
 - GLM coefficients and t-statistics sampled onto cortical surface
 - projected 1mm into cortical gray matter along surface normal vector
 - Monetary Incentive Delay (MID)
 - predictors for anticipation of large, small, and no rewards and feedback for large, small, and no rewards for wins and losses
 - linear contrasts computed for anticipation of large and small reward vs. no reward, anticipation of large and small loss vs. no reward, feedback of win vs. no reward, and feedback of loss vs. no reward
 - Stop Signal Task (SST)
 - predictors for successful go trial, failed go trial, successful stop trial, and failed stop trial
 - contrasts computed for successful vs. failed stop trials and successful vs. failed go trials
 - Emotional n-back (n-back)
 - predictors for each type of stimulus (i.e. place and emotional face) in each of the n-back conditions (i.e., 0-back and 2-back) plus fixation

- linear contrasts computed for 2-back vs. 0-back across stimulus types, emotional faces vs. places across memory loads, 2-back vs. 0-back for each stimulus type, and each memory load and each stimulus type vs. fixation
- Regions of interest (ROIs)
 - subcortical structures labeled with atlas-based segmentation (Fischl, et al., 2002)
 - cortical regions labeled with atlas-based classification (Desikan, et al., 2006)
 - functionally-defined parcels derived from resting-state functional connectivity patterns (Gordon, et al., 2014)
 - ROI average coefficients and t-statistics for each run were averaged across two runs, weighted by degrees of freedom

References

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