

ABCD Human Subjects Study

Adolescent Brain Cognitive Development – ABCDSTUDY.org

Release Notes: Adolescent Brain Cognitive Development Study (ABCD) Data Release 2.0

Behavioral Performance During task-fMRI

<http://dx.doi.org/10.15154/1503209>

March 2019

Change Log

March 2019

- Initial release

List Instruments

Name of Instrument	Short Name
ABCD Task fMRI MID Behavior	abcd_mid02
ABCD Task fMRI SST Behavior	abcd_sst02
ABCD Task fMRI nBack Behavior	abcd_mrinback02
MRI Task fMRI REC Behavior	mrilibrec02

General Information

The following information refers to the Adolescent Brain Cognitive Development (ABCD) Study Annual Release 2.0 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/protocols>.

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*.

The tasks and stimuli listed in this document are also available at <http://fablab.yale.edu/page/assays-tools>.

fMRI Monetary Incentive Delay (MID) task

The fMRI Monetary Incentive Delay (MID) task measures domains of reward processing, including anticipation and receipt of reward and losses, and trial-by-trial motivation in speeded responses to win or avoid loss. Each trial of the MID task begins with an incentive cue of five possible trial types (Win \$20, Win \$5, Lose \$20, Lose \$5, \$0-no money at stake), a delay, a target during which the participant responds to either win money or avoid losing money and feedback.

Task performance is individualized to maintain a 60% accuracy rate. When possible, participants who were unable to complete the task in the scanner, completed the task behaviorally outside the scanner. Flags are provided to identify subjects with incomplete data for anticipation analyses or suboptimal for feedback analyses. However, the threshold for suboptimal is subjective so investigators should choose inclusion/exclusion performance criteria that are appropriate for their analyses.

- **Anticipation flag** If data capture is incomplete for either run 1 or run 2, this will affect the number of anticipation trials modelled. These data are flagged and investigators should decide if it is appropriate for their analysis to exclude these subjects.
- **Feedback flag** If any trial type across both runs yields less than 4 events in either the positive feedback or negative feedback, the data is flagged. Investigators should decide if it is appropriate for their analysis to exclude these subjects.

Due to an error in data capture, only reaction time (RT) for positive feedback trials are included (variable names: “* *pos.feedback_mean.rt) - future releases will include RT for all trials ().

Poor performance in the MID task is determined as any trial type across both runs that yields less than four events in either the positive or negative feedback, indicated by the behavioral performance flag `tfmri_mid_beh_performflag = 0`.

fMRI Stop Signal Task (SST)

The fMRI Stop Signal Task (SST) measures impulse control and impulsivity. The task requires participants to withhold or interrupt a motor response to a “Go” stimulus when it is followed unpredictably by a signal to stop. To ensure approximately 50% successful and 50% unsuccessful Stop trials, a tracking algorithm varies the interval between the onset of the Go stimulus and the onset of the Stop Signal based on individual performance. When possible, participants who were unable to complete the task in the scanner, completed the task behaviorally outside the scanner.

Poor performance in the SST task (tfmri_sst_beh_performflag = 0) is indicated if:

Go trials

- <150 GO trials
- Correct GO trial percentage <60%
- Incorrect GO trial percentage >30%
- Late GO trial percentage (summing correct and incorrect trials) >30%
- No Response GO trial percentage >30%

STOP trials

- <30 STOP trials.
- STOP trial accuracy (i.e., successful inhibitions) <20% or >80%

However, in many cases, the threshold for suboptimal is subjective so investigators should choose inclusion/exclusion performance criteria that are appropriate for their analyses.

fMRI Emotional nBack Working Memory Task

The fMRI Emotional nBack task assesses memory, emotion and face and place perceptual processes. The task is a block design working memory task using four categories of stimuli (places, positive faces, negative faces and neutral faces) and two memory load conditions (0 and 2 back). The task includes 80 trials for each of the two memory load conditions, 20 trials for each stimulus type in each of the two memory load conditions and 40 trials of each stimulus type.

Accuracy and reaction time (RT) are provided for all conditions. When possible, participants who were unable to complete the task in the scanner, completed the task behaviorally outside the scanner.

Poor performance in the nBack task is indicated if the overall response accuracy for the 0-back or 2-back blocks is less than 60% (tfmri_nback_beh_performflag = 0).

Definition of terms

- all_beh_0.back = all of the 0_back trials in the session
- run1_beh_0.back = all 0_back trials in run 1
- run2_beh_0.back = all 0_back trials in run 2
- all_beh_2.back = all of the 2_back trials in the session
- run1_beh_2.back = all 2_back trials in run 1
- run2_beh_2.back = all 2_back trials in run 2

- pos.face = all trials with happy stimuli
- neg.face = all trials with fear stimuli
- neut.face = all trials with neutral stimuli
- place = all trials with place stimuli

- run1_beh_0.back.pos.face= all 0_back trials with happy stimuli in run 1
- run2_beh_2.back.neg.face= all 2_back trials with fear stimuli in run 2
- run1_beh_0.back.place_rate = accuracy for all 0_back trials with place stimuli in run 1

nBack Recognition Memory (RECMEM) Task

The Emotional nBack Recognition Memory task engages short-term memory for items presented during the fMRI Emotional nBack task. This task was performed outside the scanner after the completion of the fMRI nBack task. Both HitRate (HR) and False Alarms (FA) are provided for each condition along with key dependent variables of response bias, corrected accuracy, and d-prime.

Definition of terms

- NEW = any stimuli that were NOT present in the nBack task
- OLD = any stimuli that were present in the nBack task
- neut.face = neutral face stimuli
- pos.face = happy face stimuli
- neg.face = fearful face stimuli
- place = place stimuli
- 0.back denotes if the stimuli were presented during 0-back
- 2.back denotes if the stimuli were presented from 2-back

Key dependent variables

- hr = hit rate
 - fa = false alarms
-

- br is for response bias [$(\text{mean}(\text{FA}) / (1 - \text{mean}(\text{HR}) - \text{mean}(\text{FA}))) - 0.5$]
- pr is for corrected recognition [$\text{mean}(\text{HR}) - \text{mean}(\text{FA})$]
- dprime is for discriminability index [$z(\text{HR}) - z(\text{FA})$]

Behavioral tasks performed outside of the scanner

Some participants were unable to complete one or more of the fMRI behavioral tasks in the scanner (MID, SST, or nBack), instead performed the missing task or tasks outside the scanner on a laptop computer. Whether a participant performed the MID, SST, or nBack task in the scanner or on a laptop is indicated respectively, by the following variables:

ra_scan_cl_mid_scan_lap, *ra_scan_cl_nbac_scan_lap*, *ra_scan_cl_sst_scan_lap*. For more details, see the *ABCD RA Scanning Checklist and Notes*.