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# ABCD Human Subjects Study

Adolescent Brain Cognitive Development – ABCDSTUDY.org

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## Release Notes for Annual Release 1.1

<http://dx.doi.org/10.15154/1460401>

### Behavioral Performance During task-fMRI

October 31, 2018

#### List Instruments

| Name of Instrument            | Short Name      |
|-------------------------------|-----------------|
| ABCD Task fMRI MID Behavior   | abcd_mid02      |
| ABCD Task fMRI nBack Behavior | abcd_mrinback02 |
| ABCD Task fMRI SST Behavior   | abcd_sst02      |
| MRI Task fMRI REC Behavior    | mribrec02       |

#### 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*.

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

Some participants who were unable to complete one or more of the fMRI behavioral tasks (MID, SST, or EN-back), instead performed the missing task or tasks outside the scanner on a laptop computer. Whether a participant performed the MID, SST, or EN-back 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.

## 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 ().

## fMRI Emotional N-back Working Memory Task

The fMRI Emotional N-back task assesses memory, emotion and face and place perceptual processes. The task is a block design working memory task using four categories of stimuli

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(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.

### *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
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- 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
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- 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

## 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.

The data release contains flags (tfmri\_mid\_beh\_performflag) identifying subjects with suboptimal performance. However, in many cases, the threshold for suboptimal is subjective so investigators should choose inclusion/exclusion performance criteria that are appropriate for their analyses. Participants were flagged for suboptimal performance the following reasons:

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### **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%

### ***Signal Stop Reaction Time (SSRT)***

Average SSRT for the entire sample is 300+/-77 msec. Seven subjects have negative SSRTs. These subjects have relatively few Correct Go trials and substantial numbers of non-responses on Go trials. As a consequence, the high rate of non-responding results in an artifactually high Correct STOP rate, the adaptive algorithm generates long SSD's, and the calculation of SSRT is invalidated.

Thirty subjects have SSRTs between 0 and 100 msec. Correct GO performance is low in many of these subjects, some have too many Late GO responses, and most have too many missing GO responses. However, no flags are required as exclusions arising from the preceding flags correct these problems - see below. Users not employing the flags above should carefully consider SSRT values when choosing which subjects to include in an analysis.

## **N-Back Recognition Memory (RECMEM) Task**

The Emotional N-back Recognition Memory task engages short-term memory for items presented during the fMRI Emotional N-back task. This task was performed outside the scanner after the completion of the fMRI en-back 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
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- 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 [  $z(\text{HR}) - z(\text{FA})$  ]