



HUMAN
Connectome
PROJECT

WU-Minn HCP 500 Subjects Data Release: Reference Manual

Appendix VI – Task fMRI and tMEG E-Prime Key Variables

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tfMRI E-Prime Key Variables

This document provides the definitions of the key variables set in E-Prime for HCP Task fMRI for each task in the HCP protocol. For tfMRI analysis, one needs to know the timing and task condition for each trial presented. Key variables in the E-Prime data files provide the information to determine this for each trial. The following E-Prime 'data dictionary' allows the user to know how to compute timing and define task conditions in different ways from what HCP has provided in the TAB.txt files for each task run

Gambling

- Procedure[Block] - establishes list of total number of blocks and type of block, predominantly reward or predominantly punishment trial types
- Procedure[Trial] - establishes current type for each trial within block, allows recognition of "FixationBlockPROC" events
- TrialType - establishes "Reward", "Punishment", "Neutral" designation for correct EV category sorting
- QuestionMark.OnsetTime - onset time of presentation of current trial in ms from script startup
- SyncSlide.OnsetTime – onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials
- QuestionMark.RT - establishes time of response after question mark appears prompting for user input, also establishes if no response was made

Emotion Processing

- Procedure - Used to discriminate between "InitialTR", "TrialsPROC", "ShapesPromptPROC", "FacePromptPROC" and also assign correct events to "Faces" and "Shapes" EV's
- StimSlide.OnsetTime[Block] or StimSlide.OnsetTime - onset time of presentation of current trial in ms from script startup
- StimSlide.ACC[Block] or StimSlide.ACC - used for summary statistics only



- SyncSlide.OnsetTime - onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials
- StimSlide.RT or StimSlide.RT[Block] - used for summary statistics only

Motor

- Procedure[Block] - Used to discriminate between "CountDownPROC" and "MOTORrun" trial blocks
- Procedure[Trial] - Used to discriminate between left hand, foot, right hand, foot conditions to assign trials to appropriate EV's
- LeftHandCue.OnsetTime - Used to establish timing for cue prior to left hand block
- LeftFootCue.OnsetTime - Used to establish timing for cue prior to left foot block
- RightHandCue.OnsetTime - Used to establish timing for cue prior to right hand block
- RightFootCue.OnsetTime - Used to establish timing for cue prior to right foot block
- TongueCue.OnsetTime - Used to establish timing for cue prior to tongue block
- CrossLeft.OnsetTime - Used to establish timing for individual movements in left hand and left foot EV's, foot or hand designation is decided by the cue.OnsetTime
- CrossRight.OnsetTime - Used to establish timing for individual movements in the right hand and right foot EV's, foot or hand designation is decided by cue.OnsetTime
- CrossCenter.OnsetTime - Used to establish timing for individual movements in the tongue condition
- SyncSlide.OnsetTime or CountDownSlide.OnsetTime - onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials

Relational Processing

- Procedure - used to distinguish between "InitialTR" and trials ending in "-PROC"
- RelationalSlide.ACC - used to record accuracy for "Relational" trials, used in summary statistics and to establish error.txt EV
- ControlSlide.ACC - used to record accuracy for "Control" trials, used in summary statistics and to establish error.txt EV
- RelationalSlide.OnsetTime - records timing for "Relational" type events for EV
- ControlSlide.OnsetTime - records timing for "Control" type events for EV
- RelationalSlide.RT - used in summary statistics, and to detect "NLR"
- ControlSlide.RT - used in summary statistics, and to detect "NLR"
- SyncSlide.OnsetTime - onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials
- RelationalPrompt.OnsetTime - used to account for "Relational" trial cue timing and detect start of new block
- ControlPrompt.OnsetTime - used to account for "Control" trial cue timing and detect start of new block

Social Cognition

- Procedure - Used to detect "CountDownPROC" opposed to "SOCIALrunPROC"
- Type - Used to sort trials by "Mental", "Random"
- MovieSlide.OnsetTime - Used to establish onset of trials
- CountdownSlide.OnsetTime - onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials
- ResponseSlide.RESP - used to detect "NLR" and sort responses based on "mental", "random", "uncertain" to sort trials into correct EV's by response type
- ResponseSlide.RT - used in summary statistics

Language Processing

- Procedure[Block] - used to sort events by "StoryProc", "MathProc", "DummyProc", "PresentChangePROC"; "DummyProc" is the final, open-ended block of math trials
- GetReady.FinishTime - onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials
- SubBlock - Used to track number of trials presented before task change
- PresentStoryFile.OnsetTime - Onset timing for presentation of story audio file to participant
- PresentMathFile.OnsetTime - Onset timing for presentation of math problem to participant
- PresentStoryFile.OffsetTime - Offset timing for end of presentation of story audio file
- PresentMathFile.OffsetTime - Offset timing for end of presentation of math problem to participant
- ResponsePeriod.OnsetTime - Onset timing for start of response period where the participant is allowed to answer the question posed
- ResponsePeriod.OffsetTime - Offset timing for the end of the response period where the participant is allowed to answer
- ThatWasAbout.OnsetTime - Onset timing for the question posed after story audio presentation
- ThatWasAbout.OffsetTime - Offset timing for the question posed after story audio presentation, end of question
- PresentMathOptions.OnsetTime - Onset timing for the question posed after math problem audio presentation
- PresentMathOptions.OffsetTime - Onset timing for the question posted after math problem audio presentations
- FilteredTrialStats.ACC - Used for summary statistics only
- FilteredTrialStats.RTFFromFirstOption - Used for summary statistics and to establish "NLR" trials

Working Memory

- Procedure[Block] - used to detect changes from "TRSyncPROC" to "TrialsPROC"
- BlockType - used to establish "0-back" and "2-back" block designations
- StimType - used to establish type of stimuli presented - "faces", "places", "tools", "body parts"
- Stim.OnsetTime - used to establish timing information for trials when the stimulus was presented
- Stim.ACC - used for summary statistics
- Cue2Back.OnsetTime - used to establish cue onset timing for "2-back" trials, start of a block
- CueTarget.OnsetTime - used to establish cue onset timing for "0-back" trials, start of a block
- SsyncSlide.OnsetTime- onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first TR in E-Prime clock; to ensure correct EV timing, that value should be subtracted from clock time for other trials
- Stim.RT - used for summary statistics and to establish "NLR" trials
- CorrectResponse or Stim.CRESP - used to compare against subject responses for "err" EV's
- Stim.Resp or Stim.RESP - used to compare against correct responses for "err" EV's
- TargetType: identifies individual trials as "lure", "nonlure", or "target" (see Reference Manual for description of those categories)

tMEG E-Prime Key Variables and Associated Trigger Codes

This document provides the definitions of the key variables set in E-Prime for HCP Task MEG for each of the three tasks in the HCP MEG protocol. For tMEG analysis, one needs to know the timing and task condition for each trial presented. Key variables in the E-Prime data files provide the information to determine this for each trial. The following E-Prime ‘data dictionary’ provides information needed to compute timing and define task conditions (in different ways from what HCP has provided as preprocessed tMEG data) from the *.tab/*.xlsx response output files for each task run. Column headers describe events, and the timing of events is reported in milliseconds elapsed from the start of E-Prime script or in the case of certain reaction times from the start of a response period, are reported in rows along with other characteristics of the event.

Additional E-Prime trigger codes (TriggerCode[Trial]) are sent to, and superimposed on, the TRIGGER channel of the MEG record. These should align with event timing from the display projection photodiode (adding to the binary 0 [off] or 256 [on]).

See the **Task MEG files and protocol details** section of the [500 Subjects Reference Manual](#) for more information on the protocols and for the photodiode trigger codes that also appear in the raw data TRIGGER channel for each task. See the section **tMEG Channel-level Analysis Pipelines – How was the E-Prime trigger sequence reproduced for the scans in which no parallel port triggers were recorded?** for further explanation of the differences between the E-Prime and photodiode trigger codes.

Working Memory

- SyncSlide.OnsetTime- onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first fixation after instructions have been given, in the E-Prime elapsed millisecond clock. To ensure correct epoch timing this value can be subtracted from the clock time for other trials to set a t=0 that will match the other data.
- Procedure[Block] - used to detect changes from:
 - “TRSyncPROC” (a pre-task countdown) to
 - “Cue0BackPROC” (start of a zero-back block including the target image) to
 - “Cue2BackPROC” (start of a two-back block with no image) to
 - “TrialsPROC” (start of each trial, see StimType and TargetType for category, and Stimulus[Block] for exact image presented)

- BlockType - text, used to establish "0-back" and "2-back" block designations
- StimType - text, used to establish type of stimuli presented - "faces" or "tools"
- Stim.OnsetTime - Start of stimulus presentation per trial, timing should match up to dual trigger channel spikes from parallel port and photodiode.
- Stim.ACC - used for summary statistics; (1=correct 0=incorrect)
- Cue2Back.OnsetTime - used to establish cue onset timing for "2-back" trials, start of a block
- CueTarget.OnsetTime - used to establish cue onset timing for "0-back" trials, start of a block
- Fix.OnsetTime – onset of fixation point between trials
- Fix15sec.OnsetTime – onset of fixation point between blocks, for subject to rest
- FeelFreeToRest.OnsetTime – is a marker for the final "hold still" slide at completion of run; additional time may contain motion etc.
- Stim.RT - reaction time from start of response period in a single trial
- Stim.RTTime – reaction time from start of E-Prime clock
- CorrectResponse or Stim.CRESP - integer "7" or "8" used to compare against subject responses for "error" epochs
- Stim.Resp or Stim.RESP - integer "7" or "8" used to compare against correct responses for "error" epochs
- TargetType: identifies individual trials as "lure", "nonlure", or "target" (see [500 Subjects Reference Manual](#) **Details of the tMEG Working Memory task – Stimulus Overview** for description of those categories)
- Stimulus[Block] – unique image filename presented; may help in troubleshooting.
- TriggerCode[Trial] - indicates the additional E-Prime encoded trigger stamped on the raw data trigger channel; rides on signal from the display projection photodiode (adding to the binary 0 [off] or 256 [on]).

Working Memory E-Prime Trigger Codes

Parallel Port Descriptor	<256 code on MEG
Fixation cross	2
0-back nontarget faces	10
0-back target faces	14
0-back lure faces	12
0-back nontarget tools	42
0-back target tools	46
0-back lure tools	44
2-back nontarget faces	74
2-back target faces	78
2-back lure faces	76
2-back nontarget tools	106
2-back target tools	110
2-back lure tools	108

Language Processing (Story-Math)

- SyncSlide.OnsetTime- onset time of countdown slides before task; the first row in the SyncSlide.OnsetTime column reflects the onset of the first fixation after instructions have been given, in E-Prime elapsed millisecond clock. To ensure correct epoch timing this value can be subtracted from clock time for other trials to set a t=0 that will match other data.
- Procedure[Block] - used to detect changes from
 - PracticePROC (a pre-task countdown) to
 - StoryPROC (start of a zero-back block including the target image) to
 - MathPROC (start of a two-back block with no image)
- StimType – text, used to establish type of stimuli presented - "story" or "math"
- Stim.OnsetTime – Start of stimulus presentation per trial, timing should match up to dual trigger channel spikes from parallel port and photodiode.
- Stim.ACC - used for summary statistics; (1=correct 0=incorrect)

- Fix.OnsetTime – onset of fixation point between trials
- Fix.OnsetTime – onset of fixation point between trials
- Fix15sec.OnsetTime – onset of fixation point between blocks, for subject to rest
- FeelFreeToRest.OnsetTime – is a marker for the final "hold still" slide at completion of run; additional time may contain motion etc.
- Stim.RT – reaction time from start of response period in a single trial
- Stim.RTTime – reaction time from start of E-Prime clock
- CorrectResponse or Stim.CRESP - integer "7" or "8" used to compare against subject responses for "error" epochs
- Stim.Resp or Stim.RESP - integer "7" or "8" used to compare against correct responses for "error" epochs
- TargetType: identifies individual trials as “story”, or “math” (see [500 Subjects Reference Manual](#) **Details of the tMEG Language Processing (Story-Math) task – Stimulus Overview** for description of those categories)
- MathFile, StoryFile – unique audio filename presented; may help in troubleshooting.
 - Option1, Option2, text choices for responses presented (on the left for first option, on the right for second option)
 - StoryOption1, StoryOption2, audio choices for responses presented
- ChangingBlockTypeTo - audio file indicating to the participant whether the upcoming block will be story type or math type
- TriggerCode[Trial] - indicates the additional E-Prime encoded trigger stamped on the raw data trigger channel.

Language Processing (Story-Math) E-Prime Trigger Codes

Parallel Port Descriptor	<256 code on MEG
TrigCodStoryMathNumLevel	128
TrigCodStoryCue	96
TrigCodMathCue	112
TrigCodStoryBase	32

TrigCodStoryTrigStart	24
TrigCodStoryTrig	26
TrigCodStoryEndWait	16
TrigCodStoryThat	14
TrigCodStoryOptUnCor	12
TrigCodStoryOptCor	10
TrigCodStoryOR	8
TrigCodStoryResp	2
TrigCodMathBase	64
TrigCodMathQuestBlock	16
TrigCodMathQuestTrig	8
TrigCodMathEqualBlockUnCor	8
TrigCodMathEqualBlockCor	0
TrigCodMathEqualTrig	4
TrigCodMathResp	2

Motor

- SyncSlide.OnsetTime - the first row in the SyncSlide.OnsetTime column reflects the onset of the first stamp after start of experiment in E-Prime clock; to ensure correct timing that value should be subtracted from clock time for other trials.
- CrossLeft.OnsetTime - Arrow on the display points to the left, used to establish timing for individual movements in left hand and left foot events, foot or hand designation is decided by the cue.OnsetTime and motion is initiated by the participant to match the cue of each trial.
- CrossRight.OnsetTime - Arrow on the display points to the right, used to establish timing for individual movements in right hand and right foot events, foot or hand designation is decided by the cue.OnsetTime and motion is initiated by the participant to match the cue of each trial.
- Fixdot.OnsetTime - centered dot presented to allow participant to briefly relax their body (and fixate) before the next block.
- LeftFootCue.OnsetTime - slide displays the words "Left Foot" to start a block of motions.

- LeftHandCue.OnsetTime - slide displays the words "Left Hand" to start a block of motions.
- RightFootCue.OnsetTime - slide displays the words "Right Foot" to start a block of motions.
- RightHandCue.OnsetTime - slide displays the words "Right Hand" to start a block of motions.
- Procedure[Trial] - indicates the trial type of 362 trials including fixation.
- TriggerCode[Trial] - indicates the additional E-Prime encoded trigger stamped on the raw data trigger channel; rides on signal from the display projection photodiode (adding to the binary 0 [off] or 256 [on]):

Motor E-Prime Trigger Codes

Parallel Port Descriptor	<256 code on MEG
TrigCodFixation	2
TrigCodLeftFoot	38
TrigCodLeftFootCue	34
TrigCodLeftHand	22
TrigCodLeftHandCue	18
TrigCodRightFoot	134
TrigCodRightFootCue	130
TrigCodRightHand	70
TrigCodRightHandCue	66
TriggerCode[Session]	7