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HST.583 Functional Magnetic Resonance Imaging: Data Acquisition and Analysis  
Fall 2008

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## **HST.583 Fall 2008: fMRI Acquisition Lab**

### **Self Reference Task**

Total task time: 3:48 min (includes 4DDAs w/TR = 3s)

Time frames: 72 per session, 3 sessions

Words are presented in a blocked design. Each word is presented for 3 sec in blocks of six and prior to each block onset subjects view a 3 sec cue describing their task for the upcoming block. Each session has 10 blocks, 2 per self reference, case, mother, semantic and rest conditions. The blocks appear in random order and no words are repeated.

Scanner triggers the paradigm (after the dummy scans).

### **Sternberg Item Recognition Paradigm (A test of working memory):**

Total task time: 6:02 min (includes 4DDAs w/TR = 2s)

Time frames: 177 per session, 1 session

### **Overall task:**

There are three working memory set sizes consisting of one, three, or five target digits [1, 3, 5] providing a range of task difficulty.

A block of each set size occurs twice in random order within a single run.

Each block is composed of three epochs: learn, encode, and probe.

The duration of each epoch is fixed:

1.5 seconds for the "learn" prompt followed by .5 seconds blank screen,

6 seconds for encode during which time subjects are presented with the target digits

38 seconds for the probe digits (sequential presentation of digits- see below).

This means each working memory set lasts a total of 46 seconds.

Each working memory set is sandwiched between fixation blocks.

The duration of the fixation blocks within a run is random:

Total time for all fixation blocks within a run = 78 seconds, minimum time = 4 seconds,

maximum time = 20 seconds. The duration of the fixation block must be an integer

multiple of 2 seconds. The last fixation block is fixed at 14 seconds.

Total scan time is thus  $46 \text{ seconds} * 6 + 78 \text{ seconds} + 8 \text{ seconds of Discarded Acquisitions at the beginning of the run} = 362 \text{ seconds}$

### **Memory sets to be encoded:**

Target in the memory set is a random integer between 0 and 9.

No x encode digit can be repeated within a single memory set.

For set sizes of [1], the single encode digit can't be the same across the two blocks within a run.

Also, no single digit can be used more than 60% of the time as an encode digit across the 6 runs of the experiment (2 practice and 4 task runs) as this could create response biases.

We should be especially careful of this within a single task run.

## **Probe digits:**

Each probe digit is a random integer between 0 and 9.

Each probe epoch has 7 targets (included in the memorized set) and 7 foils (not included in the memorized set).

The order of targets and foils within a probe epoch is random.

No more than 3 consecutive digits can be targets.

Each target digit in the encode set must be presented at least once within a probe epoch.

For a WM load of 3, each target digit must be presented at least twice.

Each probe digit is displayed for 1.1 seconds.

The presentation of the probe digits is serial.

The onset of the first probe occurs 1 second after the encode epoch ends. The delay after each probe is randomized within such that the onset of the digits is jittered

The time before the first probe digit is fixed at 1 second.

The time after all the probe digits is random, but must satisfy the following set of rules:

1. The sum of all 14 delays must equal 21.6 seconds so that each probe epoch lasts 38 seconds.
2. The minimum delay is 0.6 seconds. \*This makes the minimum time to respond equal to 1.1+0.6 seconds, or 1.7 seconds\*
3. The maximum delay is equal to 2.486 seconds. \*This makes the maximum time to respond equal 1.1+2.486 seconds, or 3.586 seconds\* This number was chosen so that the mean of the 14 delay times is equal to 1.543 seconds (i.e. 21.6/14, or the average delay time).

Scanner triggers the paradigm (after the dummy scans).

## **Sensory-Motor Task**

Total task time: 8:08 min (includes 4 DDAs w/TR = 2s)

Time frames: 240 per session, 1 session

The task consists of a block design with block durations of 16s on/off. During the on-block, a checkerboard stimulus appears at irregular intervals. When checkerboard appears, subject taps fingers using their dominant hand only. This is a block design with intentionally short block durations of 16s on/off. The off-block is fixation/no tapping.

On block parameters: ISI ranges from 500-1000ms, average ISI = 762ms, std. dev = 156ms. 21 checkerboard flashes per on block, each checkerboard flash duration = 200ms. 15 total 16s blocks.

The sequence begins with an off block

Scanner triggers the paradigm (after the dummy scans).

The task will be demonstrated with **Neuro3D** application (Siemens) to see real time activation on pre-defined region of interests.