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

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Lab 2: fMRI Acquisition

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Detailed Explanation of Scanning Protocols

Localizer:

The localizer is a 2D gradient echo sequence that acquires three images, one in each orientation (Sagittal, Coronal, and Transverse). It is a low resolution, quick scan that allows you to see where the brain is in relation to its placement within the magnet.

AA Scout:

The AA scout is a sequence that compares the acquired image to a reference atlas that allows automated placement of the preceding sequences. In our case it is aligning the slices to the AC-PC line (Anterior commissure - Posterior commissure).

MPRAGE:

The MPRAGE is a 3D gradient echo sequence which acquires a high resolution T1 sagittal structural data set. These images are used to define your functional slices to make sure you are covering the required anatomy. Because it is a 3D scan, you can view it in any orientation. This structural scan is also what you can overlay your activations on.

Field Map:

The field map is a 2D gradient echo sequence which acquires an image at 2 different echo times. This sequence generates 2 types of images, a magnitude image and a phase map. The phase map represents the phase differences of the spins which ultimately represent the local field inhomogeneities. This info is used in fMRI analysis to exclude areas of susceptibility artefacts and thus discard activations of those areas. It is important to acquire exactly the same slices as your functional data (slice thickness, gap and # of slices).

EPI

The EPI is a T2* sequence that is sensitive to the changes in oxy-hemoglobin and therefore is used to generate brain activated areas.

Trigger

Accuracy of timing is critical for the quality of fMRI-analysis. The scanner produces a fiber-optic trigger signal, with every TR on an fMRI (EPI) sequence, which converted to a TTL pulse, which is then transferred to the PC running the paradigm as “5” from the trigger/cedrus interface or as “+” from the trigger/number pad interface. In addition, the trigger interface has a pulse stretcher and an output jack for trigger recording. As the software package presenting the stimuli is set up to start the paradigm only after seeing the first trigger signal from the scanner, we get accurate timing for the fMRI experiment.

Typically, SuperLab, E-prime and Presentation uses the cedrus interface and MATLAB, Psychtoolbox and Vision Egg uses the number pad interface.