**OBJECTIVES**

1. Decompose EEG data from 302 subjects comprising subjects with major depressive disorder (MDD), previous episode(s) of MDD or non-depressed controls.  
2. Identify independent modulators of spectral power that vary in spatial distribution between depressed and non-depressed subjects.

**METHODS**

**SUBJECTS AND TASK.**

The 302 subjects were recruited, with approval from the local institutional human subjects review board, from all introductory psychology classes at the University of Arizona, Tucson. All students were free of past or present depression. The Hamilton Rating Scale for Depression (HRSD) and the BDI_II were administered on the intake day.

All subject IMs were recorded for 30 minutes for the EEG recording. Resting EEG was recorded for 15 minutes, alternating between eyes open and closed. Between the frontal electrodes testing eyes specific signals, subjects performed a directed facial action and identified contraction of specified facial muscles was described to subjects and their task was to mimic these contractions as closely as possible and hold the expression for 1 minute. Subjects were informed that the contractions were meant to help the experimenters understand the impact of muscle contraction on EEG recordings due to fact each facial contraction was characteristic of a particular emotion (happiness, sadness, fear or anger) and the true intention of the task was to determine whether depressed subjects were able to increase the intensity of muscle feedback effects of parietal temporal facial expressions.

**EEG ANALYSIS.**

Data from all conditions were decomposed with independent component analysis (ICA) to find independent source activations associated. Data for each brain-dense independent component IC was divided into spectral windows for the spectral decomposition between 10 and 150 Hz using 10 Hz window. The results of this decomposition were transformed into log power (dB – 10 log(frequency)). For each IC, the mean power spectrum was removed from each window, leaving only variations from the mean spectrum (see diagram). Power vacanies for 100 selected IC per subject were then concatenated to yield a matrix of log vacanies by frequencies. The resulting matrix was submitted to multiple component analysis (PCA) to find the 15 principal dimensions by principal component analysis (PCA) K/L found. Each independently modulated IC can be seen in several frequency bands, at different moments in time, or both. The rationale for this method is that several independent process influences (independent modulators) may be able to affect the same cortex area or more central area simultaneously (see diagram).

**DEPRESSION SCORES**

Depression scores were derived from the BDI and Hamilton (HRSD) Depression Scores.

- **Beck BDI** and Hamilton (HRSD) Depression Scores
  - Nondepressed
  - Previous MDD
  - Current MDD

**SPECTRAL MODULATOR DISTRIBUTIONS**

- **Depressives minus nondepressed**
  - All subject IM dipole density
  - Anterior cingulate BA 32/24
  - Posterior cingulate BA 29
  - Medial frontal BA 9/10
  - Cingulate gyrus BA 24/32/9

**SUMMARY**

1. ICA decompositions did not show any systematic differences in IC (EEG source) distribution between depressed and non-depressed subjects.  
2. Spectral decomposition of IC activations revealed significant spatial differences in several frequency modulators including theta, alpha and gamma in depressed subjects.  
3. Peak alpha magnitude change by experimental condition showing that depressed subjects were more likely to show a decrease in left frontal alpha and an increase in right frontal alpha over the course of the session (less depressed?)