

Supplementary Material

Artifactual Channels: We excluded recording channels with standard deviations greater than twice the median for each session in order to eliminate frequent electrical artifacts. We tested this exclusion criterion relative to artifactual channels identified by human review in 20 sessions randomly drawn from all subjects. The exclusion criteria correctly identified 69% of the manually-marked artifactual channels while incorrectly excluding only 2.3% of the non-artifactual channels. When choosing an exclusion criterion, four measures were considered: kurtosis, standard deviation, maximum amplitude, and mean amplitude. Fig. S1 shows the ROC (receiver operating characteristic) curve for each measure. The standard deviation had the largest area under the ROC curve of the four (0.91). We set the threshold to twice the median value across channels in order to ensure a small number of false positives (non-artifactual channels excluded) while still excluding many artifactual channels. Fig. S2 gives examples of each type of exclusion outcome. Across the 20 validation sessions, there were a total of 59 true rejections, 54 false rejections, 27 false negatives, and 2277 true negatives.

Time-Locked Detections: We identified some false IED detections by plotting IED rates as a function of time relative to word presentations. We began by creating a Boolean array of 100 samples evenly spaced throughout each 1.6 second word presentation. Each sample indicated whether it overlapped in time with an IED (value 1) or not (value 0). IEDs were defined as having duration of 125ms, similar to values used in previous studies.^{22,23} Additionally, IEDs occurring within 1 second of each other became single continuous events. For each subject, we averaged these Boolean arrays across trials and plotted the results for all channels as in Fig. S3. In a few instances, IED rates appeared to be strongly time-locked to the word presentations. Upon further investigation, we found that the task-locked detections corresponded to sharp event-related potentials such as those illustrated in Fig. S4. We hypothesized that these reflected early visual processing and so manually excluded such channels in order to avoid confounding the IED detector (a total of 10 channels across 5 subjects). While identifying channels for exclusion, the operator was not aware of their location.

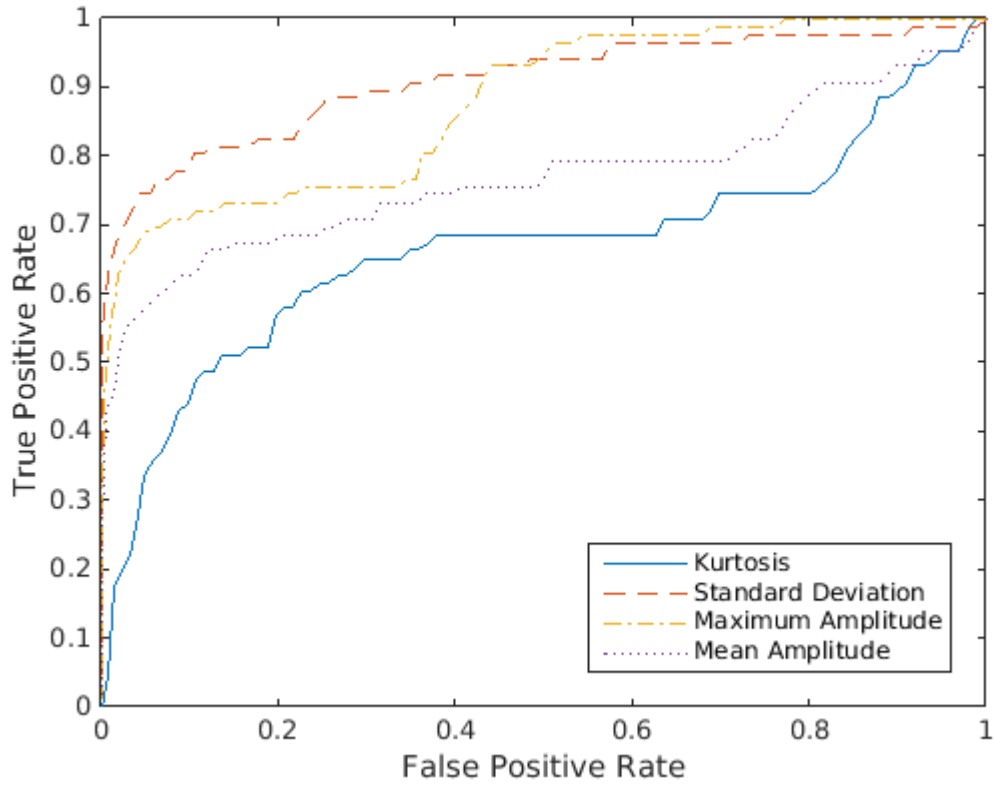


Figure S1. ROC curves for the four different measures tested for excluding artifactual channels. Exclusion was based on a threshold criterion. The four measures were evaluated with respect to human review.

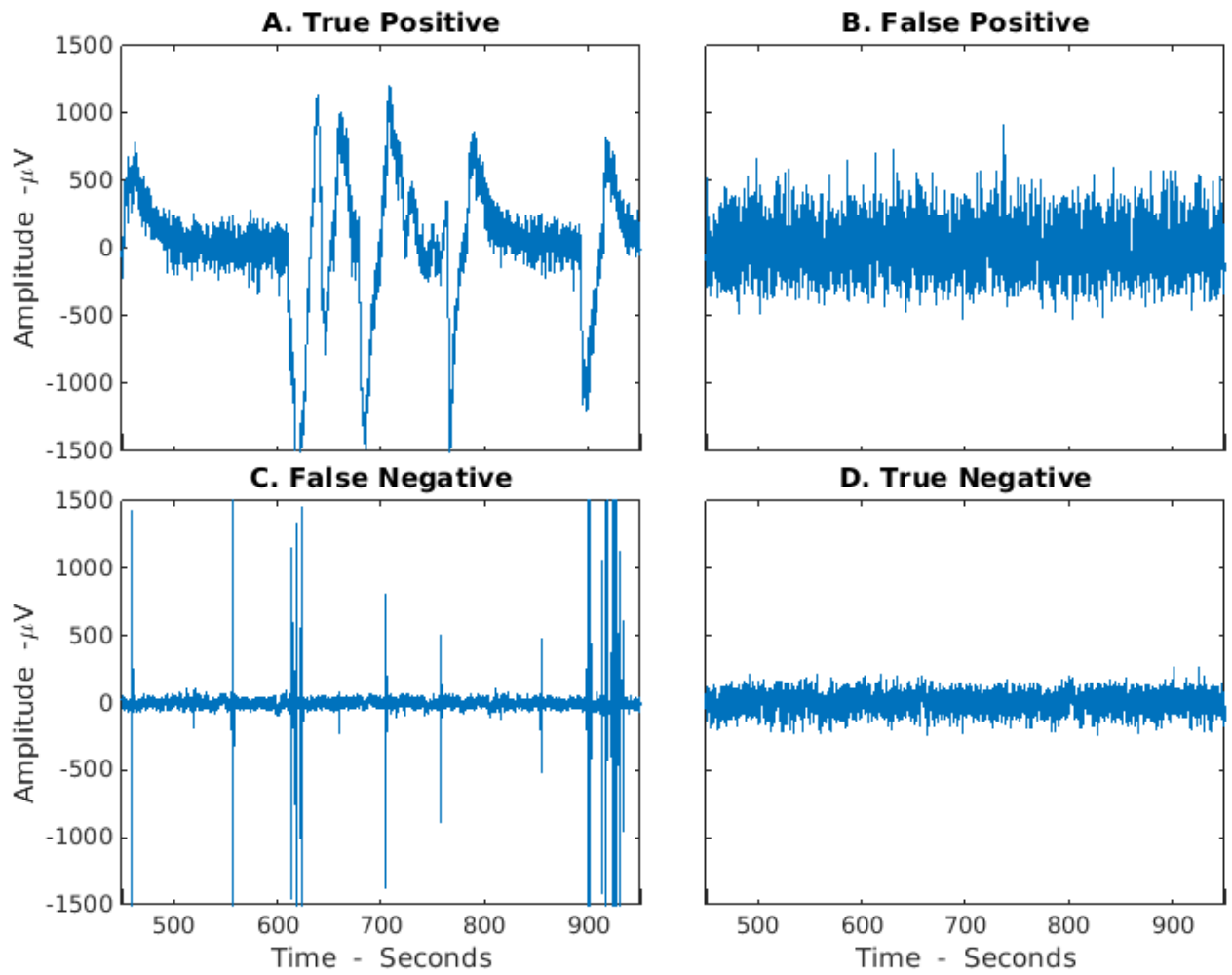


Figure S2. Recording clips from example channels that were correctly and incorrectly identified as artifactual by our standard deviation threshold criterion. (A) Rejected artifactual channel. (B) Rejected non-artifactual channel. (C) Missed artifactual channel. (D) Passed non-artifactual channel.

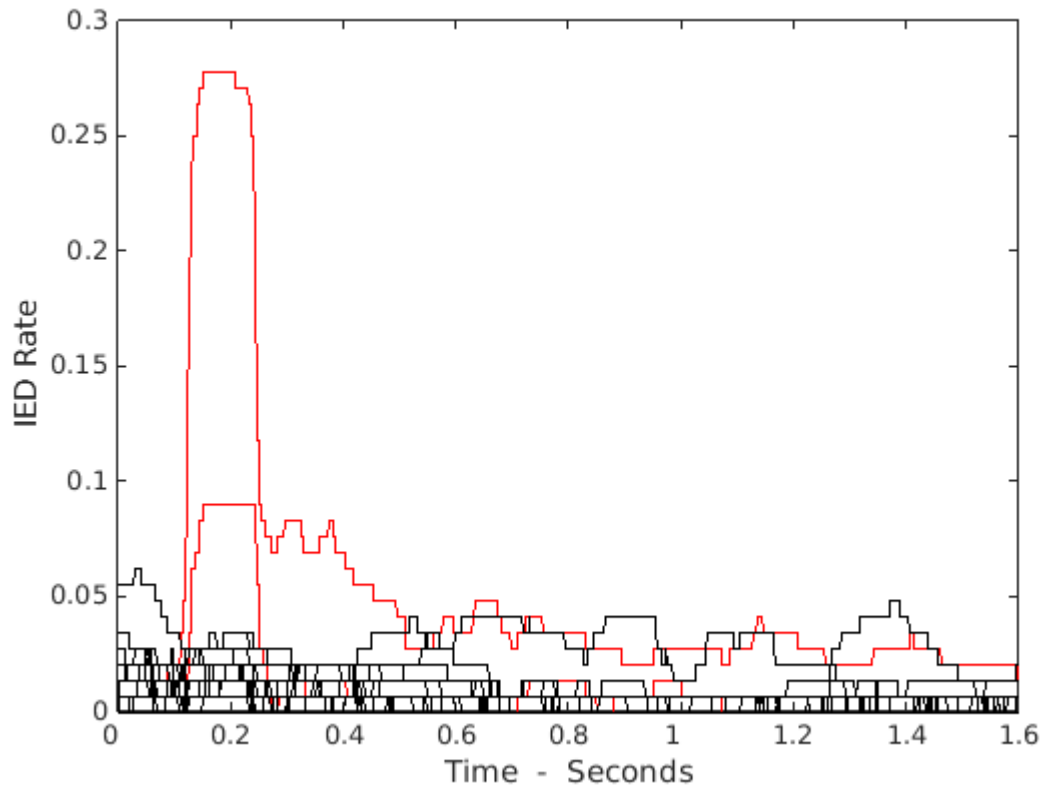


Figure S3: IED rates across trials as a function of time. Each trace represents one channel. We manually excluded channels that exhibited clear time-locked changes in IED rate (red in the plot).

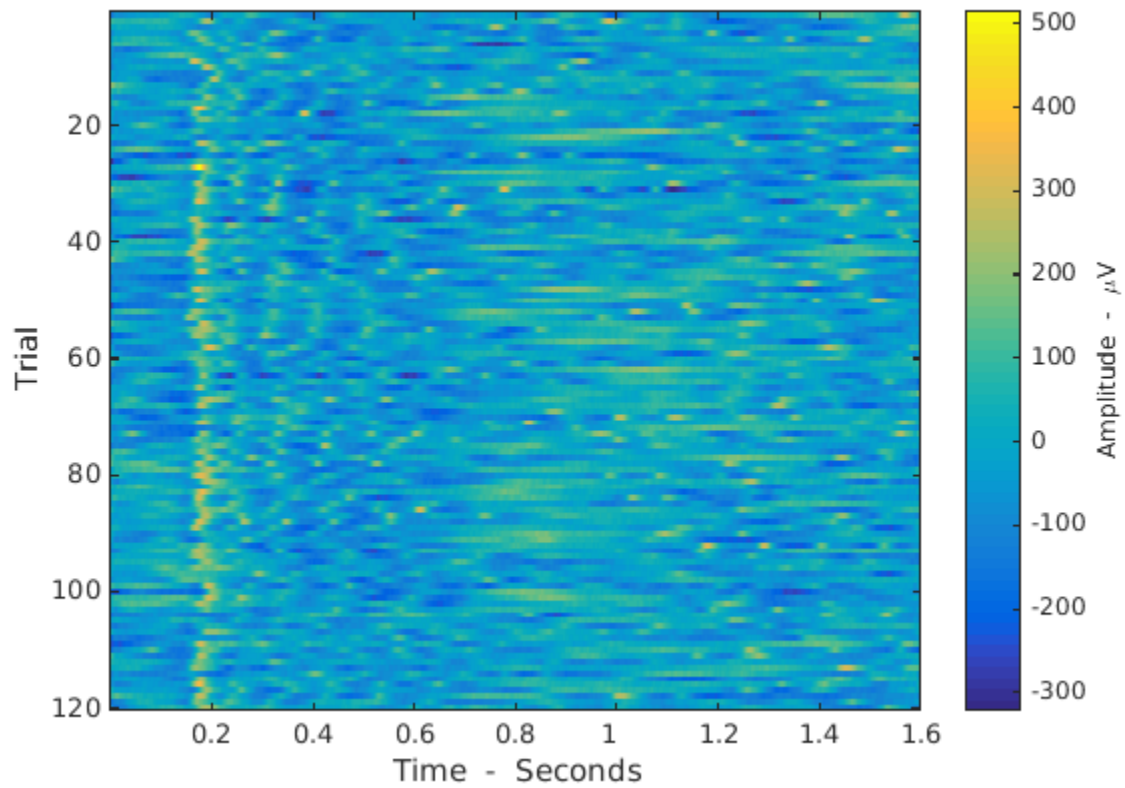


Figure S4: Intracranial EEG traces from one electrode during word presentations. The recordings were notch filtered for line noise at 60, 120, and 180 Hz. The color scale indicates the signal amplitude. Deflections are clearly visible approximately 0.2 seconds after the word presentations. They were marked as IEDs by the automated detector. However, their time-locked nature lead us to conclude that they reflected visual processing and exclude them from analysis.