Artefact

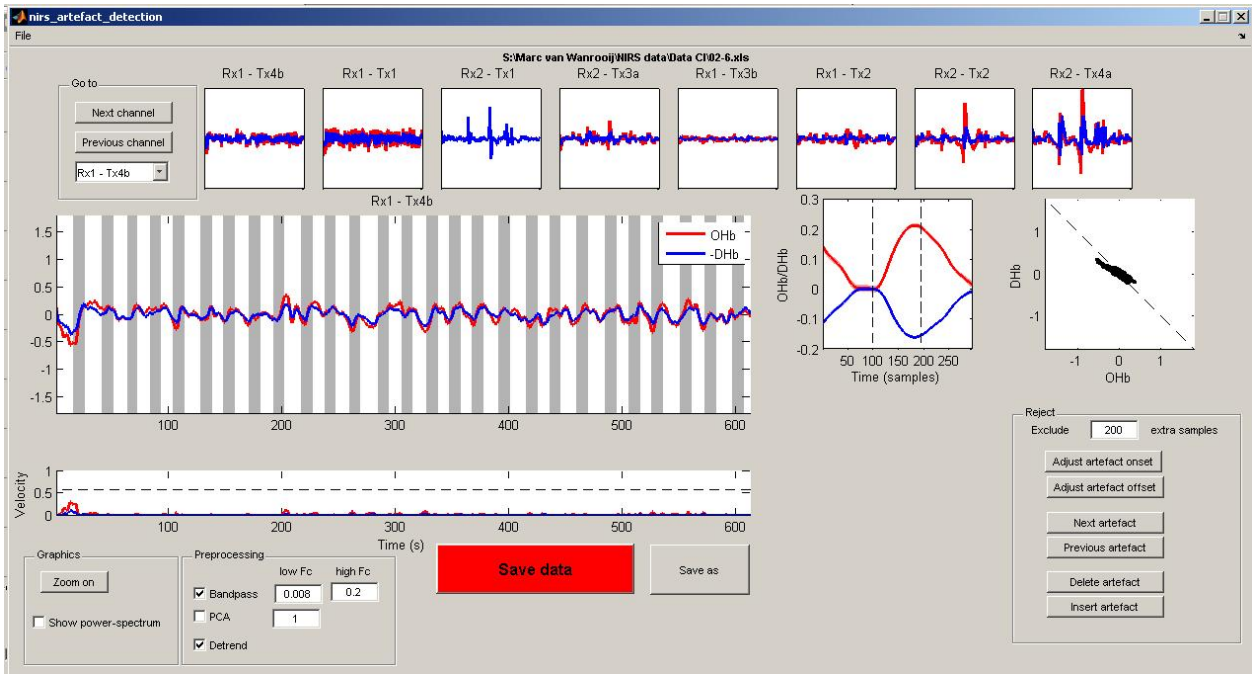

Figure 0. Graphical user interface for automatic artifact rejection & visual inspection.

Methods

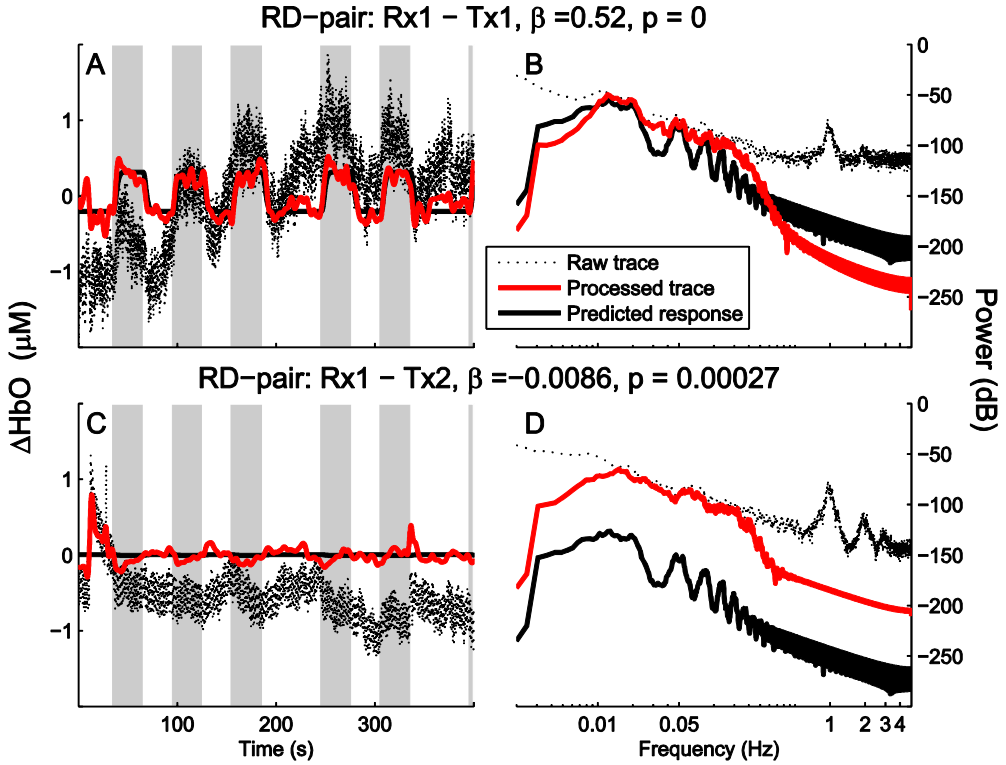

Figure 1. Example processing of raw NIRS measurements. Shown are changes in oxyhemoglobin concentrations of two transmitter-receiver channels, one with A,B) event-related activity and the other without C,D) event-related activity, for one patient. A,C) show time traces, B,D) show power spectrum of those traces. Dotted traces indicate raw data, bold red lines indicate trace after band-pass filtering (removing heart rate), removal of first principal component (removing large movement artefacts) and detrending; bold black line indicates best-fit predicted response (gamma-variate function convolved with stimulus timing, beta-weight and p-value for fit are indicated in titles). Note that the processed trace in A highly resembles the predicted response.

Results

Speech-related activity in cochlear implant patient.

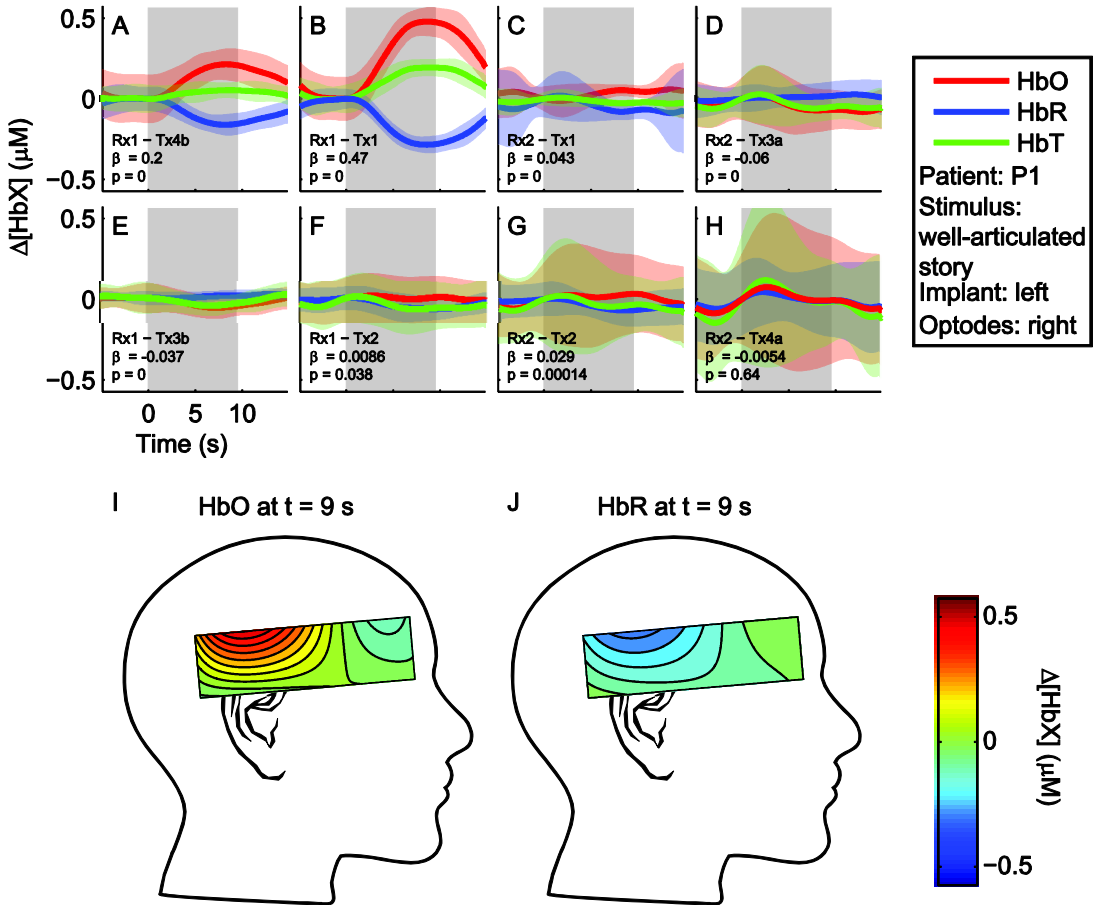

Figure 2. Changes in hemoglobin concentrations in patient P1 during story presentation. A-H) Average time trace of oxy- (red line), deoxy- (blue line) and total (green line) hemoglobin concentration for various receiver-transmitter pair channels, as indicated in the panels (e.g. panel B depicts the Rx1-Tx1 channel above T3, putative auditory cortex). Colored patches around bold lines indicate 95% confidence interval. Grey patch in each panel indicates story presentation. Beta-weights and p-values for best-fit predicted response are also indicated in panels. Optodes were placed on the right side, contralateral to the cochlear implant. I-J) Topographic representation of average change in oxy- and deoxy-hemoglobin

concentration, respectively, at t = 9 s after story onset. Note that the increase/decrease for oxy/deoxyhemoglobin is well-localized near the putative location of auditory cortex.

Modality-dependent activity in cochlear implant patient

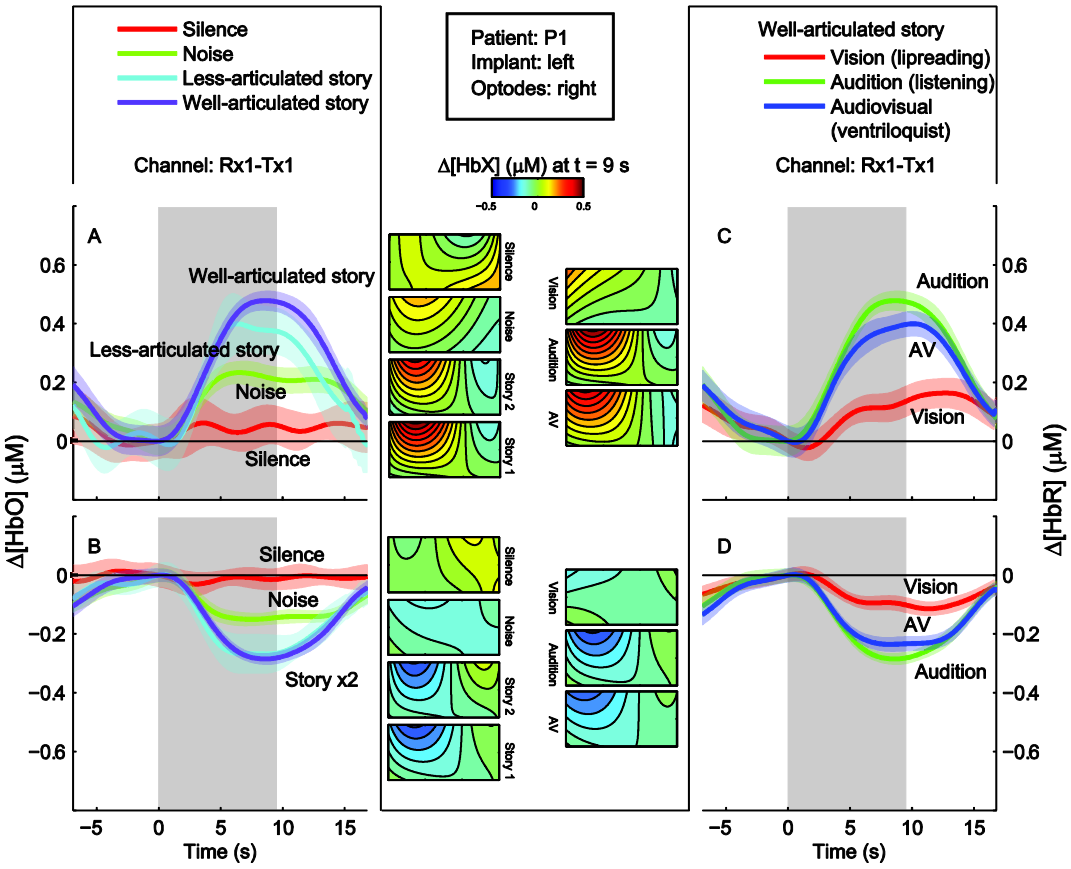

Figure 3. Differential changes in hemoglobin concentrations for silence, noise, speech, visual, auditory and audiovisual stimuli in patient P1. Graph format is similar to figure 2, unless otherwise indicated. A) Average time trace of change in oxyhemoglobin concentration for channel Rx1-Tx1 (T3, strongest response channel) for “silence” (red line), noise stimuli (green line), ??? story (cyan line), and a well-articulated??? Story (blue line). Note the slow, gradual increase of oxyhemoglobin after onset of all auditory stimuli, and the higher response in the story stimuli compared to the noise stimulus. B) As in A), but for deoxyhemoglobin concentration. C) As in A, but stimuli are now the auditory component of the story (green line), the visual component (red line, as told by a storyteller, lip-reading is potential cue), and both components (blue line). D) As in C, for deoxyhemoglobin. The middle panel contains the topographic representations of the hemoglobin concentrations at t = 9s after stimulus onset. Note that concentration changes are again well-localized.

Example patient with no modality-specific activity

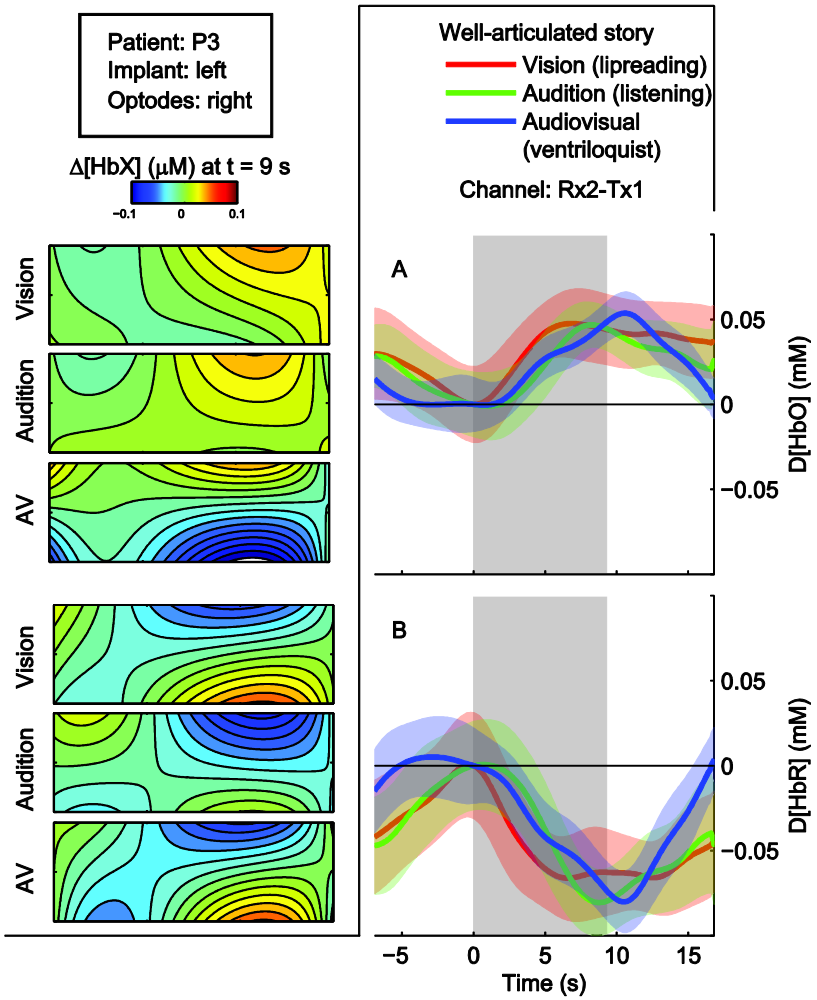

Figure 4. Same format as figure 3.

Normal-hearing subject with ripple-detection task

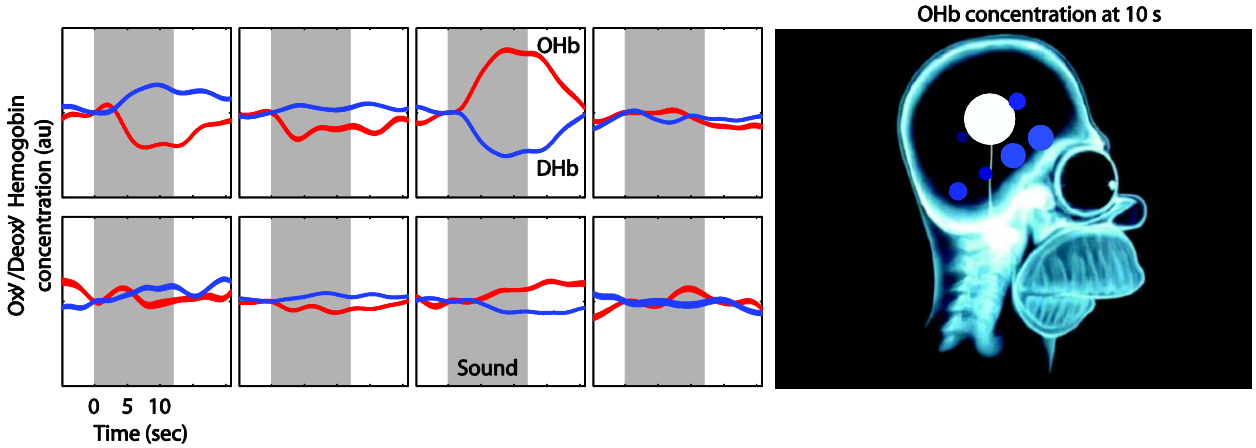

Figure 5. Changes in hemoglobin concentrations during a ripple-detection task.