Rostral Cingulate Zone and correct response monitoring: ICA and source localization evidences for the unicity of correct– and error–negativities

Supplementary material

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1 Raster-plot representations of the selected component time-course for two representative subjects

Figure 5B of the manuscript suggests that the second negative peak observed on the grand average (stimulus-locked) of the selected components is largely due to the post-EMG activity, namely the Ne. To further establish this point, we analyzed the data with the "ERP-Image" technique (Jung et al., 2001; Delorme and Makeig, 2004), which represents the data in a Raster-like plot: each line corresponds to the activity obtained on a single trial, and the activities across trials are represented as parallel colored lines. The trials are sorted in ascending order as a function of their RT. The vertical black line represents the moment occurrence of the stimulus, and the S-shaped one indicates the moment of the EMG-response. Figure S1 presents the raster plots for two representative subjects. For each of them one can see an early negative activity around 100 ms which is clearly stimulus-locked, and another one occurring later and which closely follows the response.

2 Occipital activities, stimulus-locked

Besides the RCZ activity, figure 7 also shows an occipital source, at least for correct and partial errors trials. In order to clarify the origin of this occipital source, we analyzed in more details the time course of the scalp current densities recorded at occipital electrodes. We measured the energy of the activities recorded over the occipital electrodes (Oz, O1, O2, POz, PO7, PO8, PO3 and PO4). To get a spatially focused measure, we computed the global energy (defined as the sum of the squared

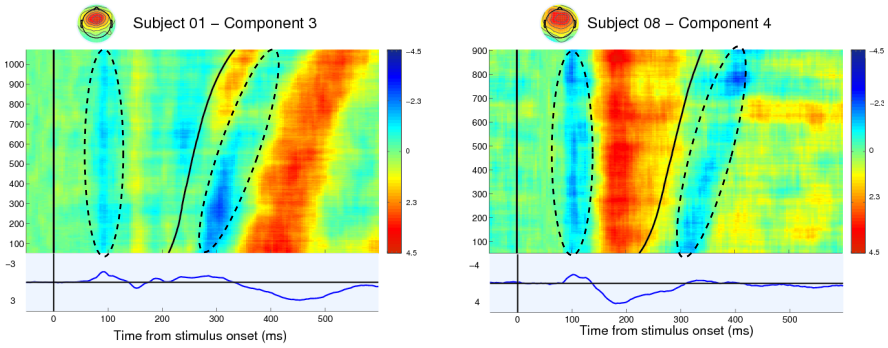

Figure S1: Raster-like (ERP-images) representations of the time course of the selected components for two representative subjects. For each subject, one clearly sees two negative activities: an early one, time-locked to the stimulus, occurring around 100 ms, and a later one, time-locked to the response.

activity over the selected electrodes - this measure is equivalent to a global field power over a limited set of electrodes) of the CSD values obtained over those electrodes. This analysis revealed two main energy peaks, one peaking around 100 ms and a second one around 150 ms (see Figure S2), which correspond to the visual evoked potentials. More interestingly for our purpose, following those phasic evoked potentials, one can see a sustained, plateau-like, activity between at least 200 and 400 ms. This time windows corresponds roughly to the period with the maximal density of (EMG) responses (see Figure 5B). Thus, when one averages the activity time-locked to the (EMG) responses, such a tonic activity will also sum-up and an occipital activity will appear on the grand average. During the inversion process, such an occipital activity will naturally generate active sources on the occipital brain areas. Such activity, however, has nothing to do with the fronto-central one generating the RCZ solution.

References

Delorme, A., Makeig, S., 2004. EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics. J. Neurosci. Meth. 134, 9–21.

Jung, T.-P., Makeig, S., Westerfield, M., Townsend, J., Courchesne, E., Sejnowski, T. J., 2001. Analysis and visualizations of single-trial event related potentials. Hum. Br. Mapp. 14, 166–185.

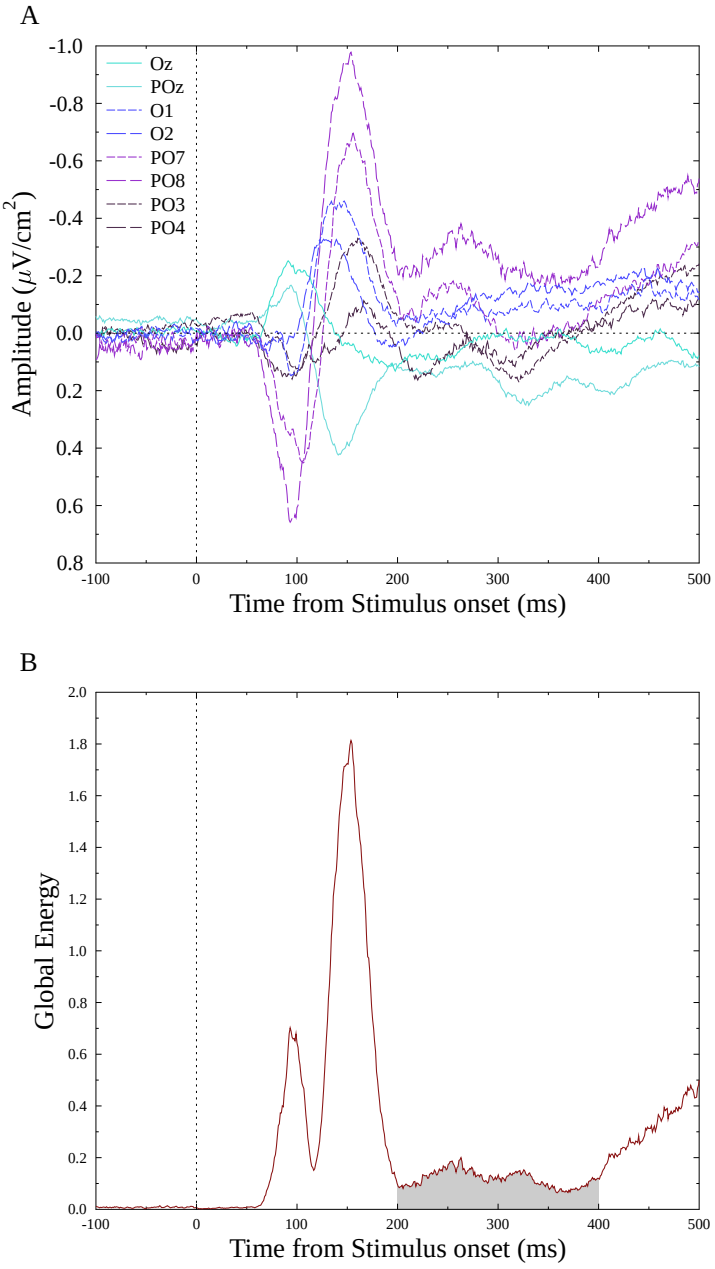

Figure S2: A: CSD waveforms obtained for the occipital electrodes (Oz, O1, O2, POz, PO7, PO8, PO3 and PO4). B. Global energy over the occipital electrodes measured as the sum of the squared amplitudes of the CSD. One can clearly see two peaks in energy corresponding to the classical evoked activities. More importantly, between 200 and 400 ms, one observes a sustained, plateau-like, activity (gray area). Such an activity likely reflects the ongoing processing of the visual stimulus. This tonic activity lasting during the period where responses are given (see figure 5B), it will emerge on the response-locked average. Such an occipital activity being present on the grand average, the inverse solution will recover its source(s) in the occipital cortex.