Source reconstruction of auditory steady-state responses using group-ICA

Ehsan Darestani Farahani[a,*], Jan Wouters[a], Astrid van Wieringen[a]

[a] Research Group Experimental ORL, Department of Neurosciences, KU Leuven - University of Leuven, Belgium
* Main author, email address: ehsan.darestani@kuleuven.be

Abstract

Auditory steady-state responses (ASSRs) are electrophysiological responses to acoustic modulations that demonstrate how the brain oscillations aligns to the stimuli. In recent years, ASSRs gained a lot of attention for their clinical applications. Insight into the underlying neural generators of ASSRs adds to the interpretation of these responses. The objective of the current study is to spatiotemporally reconstruct of ASSR sources with no prior assumptions about their number and location.

In order to reconstruct ASSR sources, we used group independent component analysis (group-ICA) with a subsequent equivalent dipole fitting. We applied this approach on EEG data of 19 young adults, 20-30 years of age. The acoustic stimuli were white noise amplitude modulated at 4, 20, 40, or 80 Hz. The independent components that exhibited a significant response at the respective modulation frequencies were recognized as ASSR sources.

The identified sources were divided into two groups of primary and non-primary sources. The primary sources were localized in the left and the right auditory cortices, while the non-primary sources were localized in the left and the right precentral gyrus, the superior parietal lobe, and the right occipital lobe. The average localization accuracy (i.e., distance to the location already reported in literature) for the primary sources was 12mm. Evaluation of group-ICA based on silence EEG data showed a low false positive error in detection of ASSR sources.

Keywords: auditory steady-state responses, EEG, source analysis, group-ICA.