Proceedings of: ISBET06: 76

17th Meeting of the International Society for Brain Electromagnetic Topography, 27-30 Settembre 2006, Chieti (Italy).

# ERP-fMRI approach to the study of the neural correlates of reading functions

S. Casarotto*, A. M. Bianchi*, S. Cerutti*, N. Vanello‖, E. Ricciardi§, C. Gentili§,†, L. Sani§, D. Bonino§, M. Guazzelli†, P. Pietrini§, L. Landini‡ and G. A. Chiarenza**

* Biomedical Engineering, Polytechnic Milan
‖ MRI Lab., CNR, Pisa
‡ Information Engineering, Univ. Pisa
§ Lab. Clinical Biochemistry and Molecular Biology, Univ. Pisa
† Chair of Clinical Psychology, Univ. Pisa
** UONPIA, Rho Hospital
Email: silvia.casarotto@polimi.it

*Introduction*

ERP and fMRI measurements are correlated and have complementary spatiotemporal resolution. A mathematical approach is presented to combine ERPs and fMRI to investigate the brain correlates of reading processes.

*Methods*

ERPs and fMRI were recorded in separate sessions using the same event-related design involving single *letter* and *symbol presentation* (LP, SP), i.e. passive viewing, and *letter recognition* (LR), i.e. active reading aloud. ERPs were decomposed with Independent Component Analysis (ICA). Low Resolution Electromagnetic Tomography (LORETA) was applied to each independent component (IC). fMRI images time series were analyzed by multiple linear regression. Multimodal combination was quantified in terms of Euclidean distance between LORETA and fMRI local maxima.

*Results*

ICs were associated to N2_P2b (180-300 ms), P2a (200 ms) and LNA (0.5-1 s) potentials, according to their spatiotemporal characteristics. ERPs-fMRI correspondence was mainly observed in the middle-superior temporal-occipital gyrus (BA 22/37/39) and during LR, on the left for N2_P2b and bilaterally for P2a and LNA (Fig. 1).

*Discussion*

The proposed approach does not make *a priori* hypothesis about source configuration. The estimated ICs well represent physiologically meaningful potentials, likely associated to distinct stages of information processing. The experimental paradigm is “ecological” in the sense that single-letter reading allows to evaluate the simplest unit of grapheme-phoneme association mechanisms in the most natural conditions. ERPs and fMRI results suggest that the middle-superior temporal gyrus has a fundamental and multifunctional role in reading: this specialization may be referred to its many interconnections with the primary visual and auditory cortices.