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The speaking brain: a tutorial introduction to fMRI experiments in the production of speech, prosody and syntax.

Abstract

In the course I will give an overview of the neurophysiological correlates of language and speech production performed in our laboratory in recent years. I will introduce to the technology and the methodology of event-related fMRI and the experimental paradigms that we employ. Then I will discuss the results of our experiments on speech, prosody and syntax (Dogil et al 2002).

The experiments on the production (and perception) of speech show that the large distributed motor speech control networks are only active in planning and execution of simple articulatory movements. Increased articulatory complexity leads to more focused activation, and high linguistic phonetic specificity leads to even more unexpected activation patterns. I will argue that these neurophysiological patterns are "hard-wired" in the human brain a nd that they emerge due to the learning path which is specific to human speech (Dogil 2007).

The experiments on the production (and perception) of prosody suggest that there are specific areas of the brain which are activated in both production and perception of prosody. These are are bilaterally located and they are interconnected with many other cortical areas correlate with linguistic but also with emotional processing. However, we will advance a hypothesis that it is not the function of prosody (linguistic vs affective) but the size of the prosodic frame, that is responsible for the apparent lateralization of prosody to different parts of the brain.

In the experiments on the processing of syntax (Dogil et al 2004) we use an advanced methodology which combines the measurements of the event-related fMRI signal with the estimation of the event-related band power (ERBP) of the EEG signal. The experimental technique allows us to approach the relation between cortical structure and cognitive function. In particular, we can formulate and test original working hypotheses about the language- and speech-induced changes in the ongoing brain dynamics.

Literature:

Dogil, G., H. Ackermann, W. Grood, H. Haider, H. Kamp, J. Mayer, A. Riecker, D. Wildgruber (2002). The speaking brain: a tutorial introduction to fMRI experiments in the production of speech, prosody and syntax. *Journal of Neurolinguistics* 15, 59-90. [dogil.2002.pdf]

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Dogil, G. (2007). Hard-wired phonology: limits and latitude of phonological variation in pathological speech. Ms. IMS, Stuttgart [dogil.2007.pdf]