Dissertation: „FMRI-studies in human auditory cortex on auditory perception in cocktail-party-situations" by Linguist (Magister Artium) Susann Deike

Abstract

Natural auditory scenes are characterized by their complexity; a number of sources produce sounds which overlap in time and have to be segregated by the auditory system. This ability of the auditory system is well known under the term "Cocktail-Party–Effect" and encloses different aspects of processing, two of which, the processing of a *simultaneously masked* target sound and the *sequential grouping* of consecutive sounds, were studied in the present dissertation in human auditory cortex (AC) using functional magnetic resonance imaging (fMRI).

In study I a parametric approach was used to investigate the influence of masking strength of continuous white noise on the processing of a scattered occurring complex harmonic tone. Furthermore, the separate presentation of the complex harmonic tone and the white noise at the same sound pressure level (SPL) as in the masking condition should provide to give evidence on the effect of masking itself. The fMRI activation did not show a linear correlation with the masking strength but an exclusive effect of the medial masking level (SPL) was observed with higher activation compared to all other levels (SPL). In addition, the AC of both hemispheres seems to be involved differentially in the processing of the masked and unmasked complex harmonic tone.

The main focus of this work was to investigate the neural representation of "auditory stream segregation" in human AC which is psychophysically described by the influential work of Albert S. Bregman. Experimentally, sequences of alternating tones differ in timbre (study II) or pitch (study III) were used with acoustic parameters allowing the perception of either two separate streams or one alternating stream (ambiguous perceptual domain). However, the subjects were instructed to actively and continuously segregate streams according to differences in timbre or pitch respectively. The combined approach of identical stimulation paradigms and varying stimulus parameters (timbre, pitch) allowed the identification and differentiation of areas in human AC which show segregation specific effects both independent and dependent of the cue used for segregation. The most important result of both studies was that stream segregation on timbre and on pitch concordantly involved specifically the left AC. However, within left AC cue dependent differences were found: whereas posterior areas were involved for both acoustic cues, anterior areas are exclusively involved for stream segregation based on pitch.