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Quantitative Evaluation of Magnetic Susceptibility Dynamics during Brain Function

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Functional Quantitative Susceptibility Mapping (fQSM) is a recent method that, based on the same acquisition technique as conventional functional Magnetic Resonance Imaging (fMRI), has two very appealing features: it is quantitative and it is less affected by non-local effects than the Blood Oxygenation Level-Dependent (BOLD) signal. Here, for the first time, the response of the auditory cortex to the presentation of relatively short (4 s) acoustic stimuli has been studied with fQSM. Activated voxels in fQSM were fewer than in BOLD fMRI, consistently with what has previously been shown in the literature, as the magnetic dipole deconvolution step removed the spurious and non-local signal changes observed in conventional fMRI. The most significant activations co-localized with veins, but both positive and negative fQSM responses were observed also in gray matter tissue, suggesting that this technique is sensitive to subtle changes in deoxyhemoglobin in the parenchyma and might be a useful tool to study small-scale functional architectures.

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