Localizing the primary auditory cortex using structural and functional MRI at 7 Tesla

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The localization of the primary auditory cortex (PAC, i.e. the core areas) of humans in vivo and its delineation form the neighbouring belt areas is still an unsolved issue. There is only one fMRI study, performed at 7 Tesla, which convincingly revealed the mirror-symmetric tonotopic organization of two PAC fields (Formisano et. al 2004), however, this functional mapping approach has not developed into a standard method to delineate primary from secondary auditory cortex fields. Furthermore, there is still a debate how the PAC relates to macro-anatomical structures like the first and second transverse sulci which define the 1st Heschl's gyrus.

Recently we investigated the possibility to localize the PAC in vivo using structural MRI at 3 Tesla. The idea was that the PAC's particular anatomical characteristics with increased myelin content should result in slightly brighter gray matter in T1 weighted and slightly darker gray matter in T2 weighted images. We developed an algorithm which automatically estimates the spatial distribution of grey values near Heschl's gyrus without using cortical curvature or thickness information. The result is a map that supposedly indicates increased myelin-content on a surface reconstruction of the brain. The patterns visible on this map are robust and replicable and the extend of the area is consistent to the proposed size of the PAC. Therefore, we want to exploit the higher SNR of 7 Tesla to localize the PAC in more detail in anatomical scans using the 24 channel array coil and explore two different tonotopic mapping approaches to define the best-frequencies of the voxels within the anatomically defined region.

For the anatomical scans T1-, T2-weighted, phase-images, we need one or two sessions with 10 subjects. The functional scans with the 8 channel coil include 3 pilot scans for each mapping approach and depending on the results one or two more sessions with each of the 10 subjects.