Hypothesis
Neuroimaging studies (Krumholz 2004, Kaiser et al 2000) have shown that perception of auditory space is processed asymmetrically beyond AI with a right-hemisphere dominance for both contralateral and ipsilateral auditory hemifield that parallels the asymmetry in visuospatial attention (Corbetta & Shulman 2002). This functional asymmetry is known as the ‘Neglect Model’ as opposed to the ‘Contralateral Bias Model’ (Mesulam 1999, Teshiba 2012).

Paradigm
We recorded 64-channel electroencephalography (EEG) from 12 healthy adults (age 21-35) during an auditory location oddball paradigm. Pure tones of duration 75 ms were presented every 500 ms. Frequent tones presented in stereo had 80% probability of occurrence. Rare tones presented at 20% probability were randomly interleaved among frequent tones. Interaural time delay (ITD) of 800 μs between left and right ear created the perception of an oddball in subjective left (10%) and right auditory space (10%). Spectral, amplitude and duration parameters were kept constant.

Dynamic Causal Modeling
Using DCM for evoked responses (David et al 2006, Kiebel et al 2006) we compared a set of plausible hypotheses for the cortical neuronal network that generated observed ERP responses to left and right auditory space. These network models were build upon prior connectivity work on MMN generation (Garrido et al 2009). Bayesian Model Comparison and Bayesian Model Selection (BMS) of DCs was performed in terms of the log Group Bayes Factor (GBF) using a Variational Bayesian approximation to the model evidence ̃p(y|m) known as the negative Free Energy (Friston et al 2006).

Sensor Statistical Parametric Maps
Group-level SPMs of time-averaged responses to left and right stimuli both show a classical mismatch negativity (MMN) at 144 ms (left) and at 128 ms (right). Crucially, an asymmetrical distribution over parieto-frontal sensors indicates a spatiotemporal asymmetry at the source-level.

Effective connectivity
Random-effects (RFX) t-tests confirmed significant increases in coupling strength between cortical regions in the hemisphere contralateral to the perceived side of audiospace.

Conclusion
We hypothesised an asymmetry in the neuronal network generating responses to left and right auditory space. Both sensor SPMs and Bayesian Model Comparison of DCs show strong evidence of such an asymmetry in the brain corresponding to the ‘Neglect Model’.

References
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