1 Introduction

Sensitivity to changes in sound is important to auditory scene analysis and detection of the appearance of new objects in the environment. In this chapter we describe two experiments that used Magnetoencephalography (MEG) to investigate the temporal dynamics of auditory cortical responses to changes in ongoing stimuli. The experiments used very different stimuli (dichotic vs diotic, noiselike vs tonal, stationary vs dynamic), but shared the abstract characteristic that they both involved a transition from a state of order to disorder, or vice-versa (Fig. 1). In one experiment (Chait et al. 2005) we studied changes in the interaural correlation (IAC) of wide-band noise. Stimuli consisted of interaurally correlated noise (identical noise signals played to the two ears) that changed into uncorrelated noise (different noise signals at the two ears) or vice versa. The stimuli of the second experiment (Chait et al. 2007) were designed to mimic the abstract properties of those in the IAC experiment, while changing the acoustic properties completely. Signals consisted of a constant tone that changed into a sequence of random tone pips, or vice versa. In both experiments, magnetic responses were gathered while subjects attended to an auditory task unrelated to the dimension along which the stimuli varied. The responses are thus presumed to reflect pre-attentive ‘bottom-up’ mechanisms, processing aspects of sound that the subject does not attend to consciously.

We show that early auditory cortical responses are remarkably similar between experiments. For both experiments, the response pattern differed radically between transitions from order to disorder and vice-versa. We interpret this result as possibly reflecting the different requirements of the process that estimates the regularity of the stimulus (interaural correlation vs decorrelation, constant tone vs random pip sequence) according to the direction of...
the change. The data shed light on the heuristics with which auditory cortex samples, represents, and detects changes in the environment, including those that are not the immediate focus of attention.

2 Materials and Methods

Methods are described in full in Chait et al. (2005).

Subjects – 18 and 24, right handed, paid subjects gave written informed consent to participate in the IAC and tone experiments, respectively. We also conducted behavioral experiments with the same subjects and stimuli, the results of which are reported elsewhere (Chait et al. 2005; Chait et al. in preparation).

Stimuli – the signals in the IAC experiment were 1100 ms-long wide-band noise bursts, consisting of an initial 800 ms-long segment (reference correlation) that was either interaurally correlated (IAC = 1) or interaurally uncorrelated (IAC = 0), followed by a 300-ms segment with one of six fixed values of IAC: 1.0, 0.8, 0.6, 0.4, 0.2, 0.0. The purpose of the relatively long initial segment was to ensure that responses to change in IAC do not overlap with those associated with stimulus onset. Stimuli were ramped on and off with 15-ms cosine-squared ramps and presented in random order with an inter-stimulus interval that was varied randomly between 600 and 1400 ms.

The signals in the tone experiment were 1440 ms long, consisting of an initial 840 ms pre-transition segment (either random or constant), immediately