The M100 Auditory Evoked Field in Noise Stimuli: Indicator of Auditory Objectness?

Maria Chait*, Jonathan Z. Simon**, and David Poeppel***

*Neuroscience and Cognitive Science Program, Cognitive Neurosciences and Language Lab, University of Maryland College Park
**Departments of Biology and Electrical & Computer Engineering, Neuroscience and Cognitive Science Program, University of Maryland College Park
***Neuroscience and Cognitive Science Program, Cognitive Neurosciences and Language Lab, Departments of Biology and Linguistics, University of Maryland College Park

INTRODUCTION

The earliest auditory evoked responses in auditory cortex (AC) peak near 20, 30, and 50 ms. These responses are followed by a deflection at about 120 ms (M150/MSO) which is the most prominent and robust response across listeners and stimulus. The source of the M100 response is localized to Planum Temporale [1]. Its amplitude and latency vary with certain physical and temporal aspects of stimulus. Investigations of the M100 typically employ clicks, tones, or speech stimuli, which almost always elicit the response, leading to a contrasting hypothesis that the M100 reflects the process of detecting changes in sensory input, although the underlying mechanisms remain ambiguous. Specifically, it is not clear whether the M100 detector would operate so late (120 ms post onset) in the processing stream.

The earlier and smaller M10 peak is believed to originate in or near the primary auditory cortex (PAC). A recent study found that the anterior-lateral portion of Heschl’s gyrus and Heschl’s sulcus [2] might reflect activity in the human counterpart of the anterior areas in the core region or in the anterior-lateral belt region described in monkeys.

Here we report on the auditory evoked responses to wide-band noise stimuli, in several experimental settings and discuss their implications for the functional role of the M50 and M100 auditory evoked fields. The evidence described here indicates that the M100 does not result from a process of detecting changes in sensory input, but reflects later, more specialized, stages in processing, related to figure-ground segregation.

EXPERIMENT 1 (N=7)

EXPERIMENT 2 (N=20) and EXPERIMENT 3 (N=16)

EXPERIMENT 4 (N=5)

EXPERIMENT 5 (N=5): What if the noise is replaced by a pure tone?

DISCUSSION

†Experiments with wide-band noise stimuli show that, for the same stimulus, the strength and lateralization of the M100 response are task modulated. The M50 is consistently lateralized to the left and its amplitude appears to be task independent, as long as wide-band noise stimuli are used.

We have demonstrated that task induced (top down) effects significantly modify auditory cortical onset responses in the M100 window.

†The current experiments differ from classic selective attention experiments because in all cases the onset of the noise was within the focus of attention.

†These findings may be interpreted as evidence for a mechanism similar to the one suggested by Kubovy & Van Valenburg [3].

Early processing produces image elements that are grouped together, whereas the groupings produced in perceptual objects are typically more complete as a result of sustained attention. This interpretation of our data would suggest that the processes underling the generation of M100 are responsible for coding ‘perceptual objects’.