Auditory Cortical Responses at 100ms Post Onset Are Modulated by Figure/Ground Status of the Stimulus

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

*Neuroscience and Cognitive Science Program, Cognitive Neuroscience of 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 Neuroscience of 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 100 ms (M100/m1) which is the most prominent and robust response across listeners and stimuli. The source of the M100 response is localized to Planum Temporale (PT)[1]. Its amplitude and latency vary with certain physical and temporal aspects of stimuli. Investigations of the M100 typically employ clicks, tones, or speech stimuli, which always elicit the response, leading to a commonly held hypothesis that the M100 reflects the process of detecting changes in sensory input, although the underlying mechanisms remain ambiguous. Specifically, it is not clear why an onset detector would operate so late (100 ms post onset) in the processing stream.

The earlier and smaller M50 peak is believed to originate in or near the primary auditory cortex (PAC). A recent study found it to activate the anterior-lateral portion of Heschl’s gyr and Heschl’s sulcus[2]. This might reflect activity in the human counterpart in the anterior areas in the core line region or in the anterior-lateral belt region described in monkeys.

DISCUSSION

Experiment 2 and 3 were designed to investigate how the M50 and M100 responses are modulated by stimulus type and task conditions. The M50 response was modulated by the task, with the earliest response (50 ms) occurring in the pure tone condition (Exp 2) and the latest response (80 ms) occurring in the correlated noise condition (Exp 3).

The early stronger M50 in Exp 2 compared to Exp 3 may be due to the different methods of stimulus presentation. The stimuli in Exp 2 were presented as 500ms click trains embedded in wide-band noise, whereas in Exp 3, the stimuli were pure tones presented at 1000Hz. The different methods of stimulus presentation may have led to different levels of masking, which in turn affected the M50 response.

REFERENCES AND ACKNOWLEDGEMENTS


M50 showed significant LH lateralization in all task and experimental conditions tested. M100 lateralization (and amplitude) is task dependent (compare Experiments 2 and 3 to Experiment 1).

Although no lateralization is observed in the pure tone condition (and Exp 2, 3), a right lateralization is observed in Exp 1. This is attributable to the detection of slow-modulations hypothesized to be sub-served by the right hemisphere. Crucially, modulations appear only in the target stimuli (which are not analyzed)