Detecting auditory temporal regularities: electrophysiological index of tracking and identification of disambiguating information

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Abstract

Learning, and detection of regularities allows us to make predictions about our environment and process stimuli more efficiently. Using EEG, we found an electrophysiological signature linked to how the brain uses and interprets auditory information in the time domain. We used sequences of five tones with different pitches, with one of three distinct temporal regularities, using a short-long-short-long, long-short-long-short, or isochronous ISI pattern. They were designed so the second tone carried temporal-sequence information, by being presented after a short, medium, or long ISI, allowing recognition of the pattern. Participants heard two tone sequences with the same temporal regularity and had to indicate if the tone pitches were identical. In one experiment, the three types of regularities were randomly intermixed, whereas they were blocked in a control experiment. A frontal and frontocentral positivity increased for the first set of the first experiment (when temporal pattern was not previously known), compared to that same set in the control experiment (pattern known), starting around the earliest time the second tone could be presented, and peaking shortly after actual tone onset. Although these temporal patterns were task irrelevant, and most participants were unaware of them when asked, our results suggest the brain disambiguates its variable environment based on the earliest available information, and that it does so rapidly, pre-attentively, and automatically.

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