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Abstract

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ERPs in long and short ISI dishabituation tasks: A comparison using PCA

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The Orienting Reflex (OR) is an adaptive mechanism that focuses an organism's attention towards changes in the environment, and is particularly sensitive to stimulus novelty and significance. The Late Positive Complex (LPC) of the event-related potential (ERP) is thought to be a central analogue of the OR. The LPC contains several overlapping components (P3a, P3b, HabP3/NoveltyP3) that differ in latency, topography, and response characteristics. Using components of the LPC as our OR index, we explored whether the rate of stimulus presentation affected the OR, in the context of indifferent and significant (counting) stimuli. EEG data were recorded from forty young adults whilst they completed an auditory dishabituation task with two counterbalanced conditions (indifferent and significant). The stimulus sequence was 10 standard stimuli, 1 deviant, 2-4 standards; counterbalanced 1000 and 1500 Hz tones at 60 dB. Half the participants received a "short"-ISI version of the task (5–7 s stimulus onset asynchrony), and half received a "long"-ISI version (13–15 s). Our study of habituation included response decrement over the first 10 trials, response recovery to the deviant (trial 11 c.f. 10), and dishabituation to the post-deviant tone (trial 12 c.f. 10). Single-trial EOG-corrected epochs from 30 scalp sites were submitted to two separate principal components analyses (short and long-ISIs) with Varimax rotation, from which three identifiable LPC components were extracted: P3a, P3b, and HabP3. P3a, P3b, and HabP3 demonstrated similar topographies for long and short conditions, but overall, latencies were delayed (12–17 ms) in the long-ISI condition. Parietal P3b and parietal HabP3 showed decrement over trials 1–10; HabP3 showed a greater decrease for the short versus long ISIs. HabP3 showed recovery, but no dishabituation. Across all trials P3b, HabP3, and central P3a were larger for significant than indifferent stimuli, and P3b was larger for long versus short ISIs. The LPC components identified did not demonstrate a uniform response-pattern across trials, conditions, and ISIs. The findings were broadly compatible with previous research: HabP3 was sensitive to stimulus novelty, showing decrement over trials and recovery, P3b decreased over trials and was larger for the long versus short ISI group, and all components were larger to significant than indifferent stimuli. Findings suggest that although ISI manipulations affect LPC component latencies, these changes do not largely affect the mechanisms underlying the habituation of LPC components.