

Correct detection of tempo-change is reflected in the P3a and P3b component of event-related potentials: different mechanisms for detecting accelerations and decelerations
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Event related potentials (ERPs) are fluctuations in the EEG resulting from cognitive neural activity. The P300 appears about 300 ms after a meaningful stimulus and consists of two parts, the P3a and P3b. In this study, we measured P3s elicited by target stimuli that deviated from background stimuli in their temporal relation.

ERPs were elicited by presenting target beats that were either accelerated or decelerated in comparison to 4 preceding beats. The amount of tempo change was 0%, 2%, 5% or 10%. The time between targets and preceding beats was always 600 ms. After each trial, participants (16) had to respond according a forced choice task, indicating whether targets occurred “too early” or “too late”.

Percentages right responses appeared dependent on the percentage tempo change. Participants were divided in good (n=8) and poor responders (n=8). Good responders had in general some musical experience whereas poor responders had not. No P3 effects were observed in the group of poor responders. However, in the group of good responders increases of the P3a with deceleration, and of the P3b with acceleration, were observed when targets were correctly assessed.

We found that the P3 is sensitive to subtle changes in tempo change but only when the participant is able to correctly detect such a change above change level, probably due to musical experience. Detection of deceleration appears to be easier and is reflected in the P3a whereas detection of acceleration seems harder and is reflected in the P3b. We propose that detecting a deceleration can rely on both a feed-forward mechanism (activated when the target is expected, but does not appear), and a feed-back mechanism (activated when a delayed target appears), whereas the detection of an acceleration can only rely on a feed-back mechanism (activated when the target is unexpectedly presented too early in time).

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