



Research report

Task difficulty modulates voluntary attention allocation, but not distraction in an auditory distraction paradigm

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HIGHLIGHTS

- Attentional effort may influence the attention-distraction balance.
- The difficulty of a short-long tone duration discrimination task was manipulated.
- Increased difficulty lead to lower discrimination performance.
- Tone onset-, and offset-related ERPs reflected stronger auditory focus.
- Difficulty did not significantly affect distraction-related processing.

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ABSTRACT

Keeping task-relevant sensory events in the focus of attention while ignoring irrelevant ones is crucial for optimizing task behavior. This attention-distraction balance might change with the perceptual demands of the ongoing task: while easy tasks might be performed with low attentional effort, difficult ones require enhanced attention. The goal of the present study was to investigate how task difficulty affected allocation of attention and distractibility in an auditory distraction paradigm. Participants performed a tone duration discrimination task in which tones were rarely, occasionally presented at a rare pitch (distracters), and task difficulty was manipulated by the duration difference between short and long tones. Short tones were consistently 200 ms long, while long tone duration was 400 ms in the easy, and 260 ms in the difficult condition. Behavioral results and deviant-minus-standard event-related potential (ERP) waveforms suggested similar magnitudes of distraction in both conditions. ERPs without such a subtraction showed that tone onsets were preceded by a negative-going trend, suggesting that participants prepared for tone onsets. In the difficult condition, N1 amplitudes to tone onsets were enhanced, indicating that participants invested more attentional resources. Increased difficulty also slowed down tone offset processing as reflected by significantly delayed offset-related P1 and N1/N2 waveforms. These results suggest that although task difficulty compels participants to attend the tones more strongly, this does not have significant impact on distraction-related processing.

1. Introduction

In many everyday tasks, overall performance depends on our ability to keep focusing on potentially task-relevant stimuli while filtering out task-irrelevant ones. In many cases, however, it is impossible to completely ignore distracting sensory events, especially those in the auditory modality. Although reducing overall performance, being distracted is potentially useful, because it allows the re-assessment of the situation (i.e. whether the ongoing behavior is still optimal or adaptive). It has

been suggested that normal functioning is characterized by a balance between processes maintaining a task-oriented attentional focus and processes allowing to be distracted by task-irrelevant stimulation (Parmentier, 2014; Schröger, 1996; Volosin et al., 2016). Schröger (1997) suggested that a stronger focus on one's task allows to set a lower threshold which rare, unpredictably occurring task-irrelevant stimuli have to exceed to enter consciousness and trigger distraction. Although this *variable threshold* concept intuitively captures how task demands may influence the attention-distraction balance when task-

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