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Anticipatory Timing Precision in Synchronizaion Tapping: A Matter of Attention

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Abstract

A recent study on the mechanism of anticipatory timing control (Miyake et al., 2004) figured out two essential processes responsible for synchronization tasks to an external signal. One is the implicite automatic anticipation and the other is the explicite processing of temporal information. A dual-task method was used during synchronization tapping to clarify the effects of higher brain functions like attention. The amount of the negative synchronization error at which the tap onset preceedes the auditory stimulus onset (Aschersleben & Prinz, 1995) was used as an indicator of possible changes in the tapping performance. A word memory task was used as a secondary task to minimize the capacity of the working memory (Baddeley, 1986) during trials. Miyake et al. (2004) conclude that tapping to an interstimulus-onset interval (ISI) $<$ 1500 ms (ISI $>$ 450 ms) is mainly based on automatic processes (low level) which are not influenced by the second task. Tapping to an ISI $>$ 1800 ms (ISI $<$ 4000 ms) depends on resources of the working memory (high level) which is limited in the case of dual-tasks.

Since Miyake et al. (2004) carried out their experiments with subjects which had no certain experience in timing precision like musicians, our aim was to examine whether timing experts show a change in performance when they have to draw their attention to another task. Here, we investigated the tapping behaviour of professional drummers by using the same experimental design with ISI $<$ 800 ms. Prior experiments showed that experts are very precise (low synchronization error $\emptyset$ +/- 2 ms) when tapping to a metronome (Fischer et al., 2005).

In contrast to Miyake et al. (2004) our results show a considerable effect in tapping performance for the dual-task condition with ISI $<$ 600 ms.

In conclusion, timing accuracy of very precise rhythmic action depends on attentional resources of higher brain functions. If these monitoring processes (timing control and correction) are disturbed by a additional task that minimizes the capacity of the working memory, timing control falls back on a secondary processing pathway that is driven by an 'automatic' system.

Key words:

anticipation, timing control, synchronization tapping, attention, working memory, negative synchronization error

References

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