Sensorimotor synchronization in stuttering children and adolescents

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Abstract

In recent years, the idea has been advanced that stuttering is associated to timing deficits in motor control (Ludlow & Loucks, 2003; Max et al., 2004). Previous studies have examined whether these deficits emerge in this population in non-verbal tasks. Unfortunately, results are non-conclusive. Olander et al. (2010) observed that 17 stuttering children aged between 4 and 6 years were less consistent (i.e., more variable) when they clapped bimanually to a metronome or in a synchronization-continuation task, with an IOI of 600 ms. Stuttering adults are also less accurate in a bimanual synchronization task than controls (Zelaznik et al., 1997). In another study, Max and Yudman (2003) examined both articulatory and manual synchronization to a metronome in 10 adult stutterers at three different tempi. Unlike young children who stutter, adult stutterers were not less accurate or less consistent than controls in verbal and non-verbal motor synchronization. It is possible that developmental aspects can account for the discrepant findings in previous studies. Young children who stutter may be less consistent in their motor timing than their peers, but catch up at a later age.

The goal of this study was to assess the effect of age on motor timing in children and adolescents who stutter, and systematically examine synchronization abilities in this population. To this aim, we tested 20 stutterers (10 children, aged 8-11 and 10 adolescents, aged 12-16 years) and 43 non-stuttering control participants (22 children, 21 adolescents) matched for age and musical training on sensorimotor synchronization tasks. Participants were asked to synchronize via finger tapping to isochronous metronome sequences (with IOI = 450, 600, and 750 ms) and to two excerpts of classical music (IOI = 600 ms). These tasks are part of the Battery for the Assessment of Auditory Sensorimotor and Timing Abilities (BAASTA; Dalla Bella et al., in preparation). Synchronization accuracy and consistency were calculated as done in previous studies, using circular statistics (Sowiński & Dalla Bella, 2013). All participants tapped more consistently to the metronome sequences than to more complex musical stimuli. Differences in terms of synchronization consistency between the age groups were generally more visible with

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music than with the isochronous metronome sequences. The control group exhibited an increase in synchronization consistency with age. Notably, however, this was not found in stutterers. Adolescents who stutter showed lower synchronization consistency as compared to adolescents without stuttering. In addition, participants who stutter tapped earlier than controls in most of the synchronization tasks, irrespective of age. Further analysis of individual differences revealed that stutterers showing low synchronization consistency were also those with the highest degree of stuttering severity.

To summarize, our results support the idea that children and adolescents with developmental stuttering differ from normally developing peers in their ability to synchronize movement to an external auditory stimulus. In addition, our results point to a link between stuttering severity and non-verbal motor timing. These findings are in keeping with the hypothesis of a more generalized timing deficit in some forms of developmental stuttering.

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