Increasing cognitive load attenuates right arm swing in healthy human walking

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Human arm swing looks and feels highly automated, yet it is increasingly apparent that higher centres, including the cortex, are involved in many aspects of locomotor control. The addition of a cognitive task increases arm swing asymmetry during walking, but the characteristics and mechanism of this asymmetry are unclear. We hypothesized that this effect is lateralized and a Stroop word-colour naming task—primarily involving left hemisphere structures—would reduce right arm swing only. We recorded gait in 83 healthy subjects aged 18–80 walking normally on a treadmill and while performing a congruent and incongruent Stroop task. The primary measure of arm swing asymmetry—an index based on both three-dimensional wrist trajectories in which positive values indicate proportionally smaller movements on the right—increased significantly under dual-task conditions in those aged 40–59 and further still in the over-60s, driven by reduced right arm flexion. Right arm swing attenuation appears to be the norm in humans performing a locomotor-cognitive dual-task, confirming a prominent role of the brain in locomotor behaviour. Women under 60 are surprisingly resistant to this effect, revealing unexpected gender differences atop the hierarchical chain of locomotor control.

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