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Does the evaluation of developmental trajectories in movement variability provide prognostic clues in motor adaptation among pediatric motor developmental disorders?

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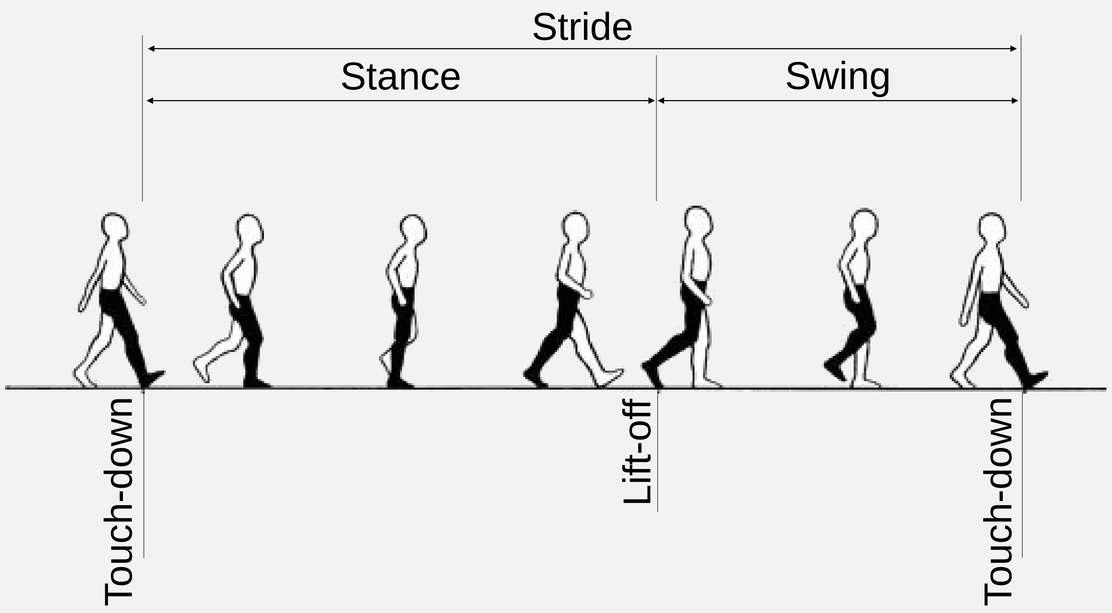
Background

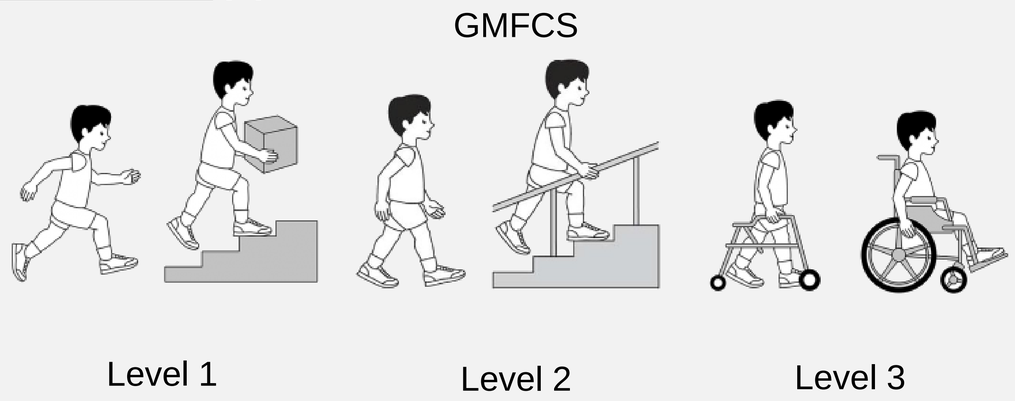
Walking is an essential activity of daily living and allows us to lead an independent life. Its elementary constituent is the **stride**, which involves **stance** and **swing** phases, separated by **touch-down** and **lift-off** events. Repetitions of this stride is integral for continuous locomotion.



Continuous walking is a complex undertaking that involved development of a multitude of motor skills and associated milestones [1]. The observable and quantifiable nature of these skills has led to a large body of literature, indicating that acquisition on walking skills might continue into adolescence [2,3].

Problem

Impairments in neural and musculoskeletal systems, such as in **pediatric motor developmental disorders**, can interrupt or delay the acquisition of motor skills. Leading to deficits in motor function, often quantified in this population using **gross motor function classification system (GMFCS)** [4].



While characterizing adaptation with varying degree of severity, what is critically missing, is the understanding of how this adaptation might differ from typically developing children (TD).

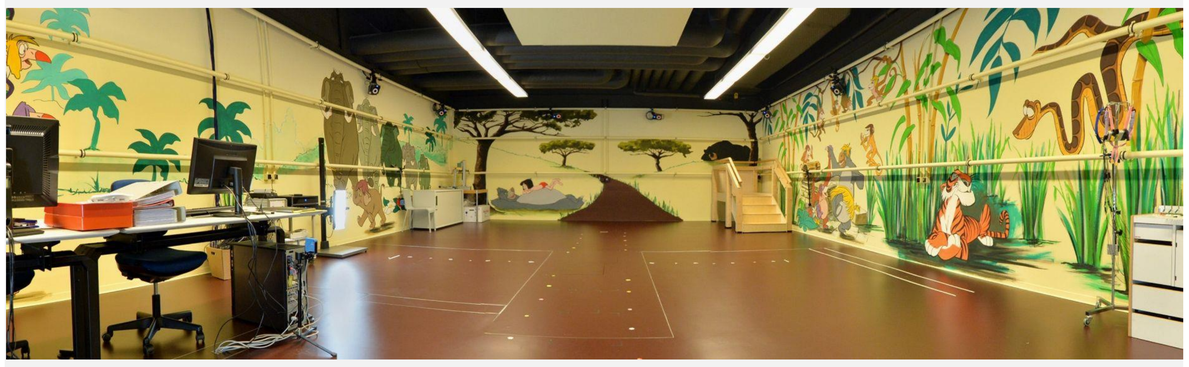
Fluctuations of strides during walking, commonly referred to as **gait variability**, have recently shown promise in delineating complex neuromuscular traits such as skill exploration, development, but also impairment and degeneration [2,5].

In order to provide a functional map of asymptomatic motor development, this study benchmarked the thresholds on optimum variability.

Methods

Clinical gait data of 438 children (during 533 sessions), aged between 4-20, diagnosed with motor developmental disorders and classified at GMFCS levels 1 or 2, were retrospectively included.

These children walked barefoot over a 10m walk-way on self-selected walking speed. Their motion patterns were recorded using 3D motion capture system and processed with the standard Plug-in-Gait pipe-line (Nexus, Vicon Motion Systems Ltd, UK).



Their age, GMFCS levels, diagnosis, and stride time values for 6 strides were extracted from the database.

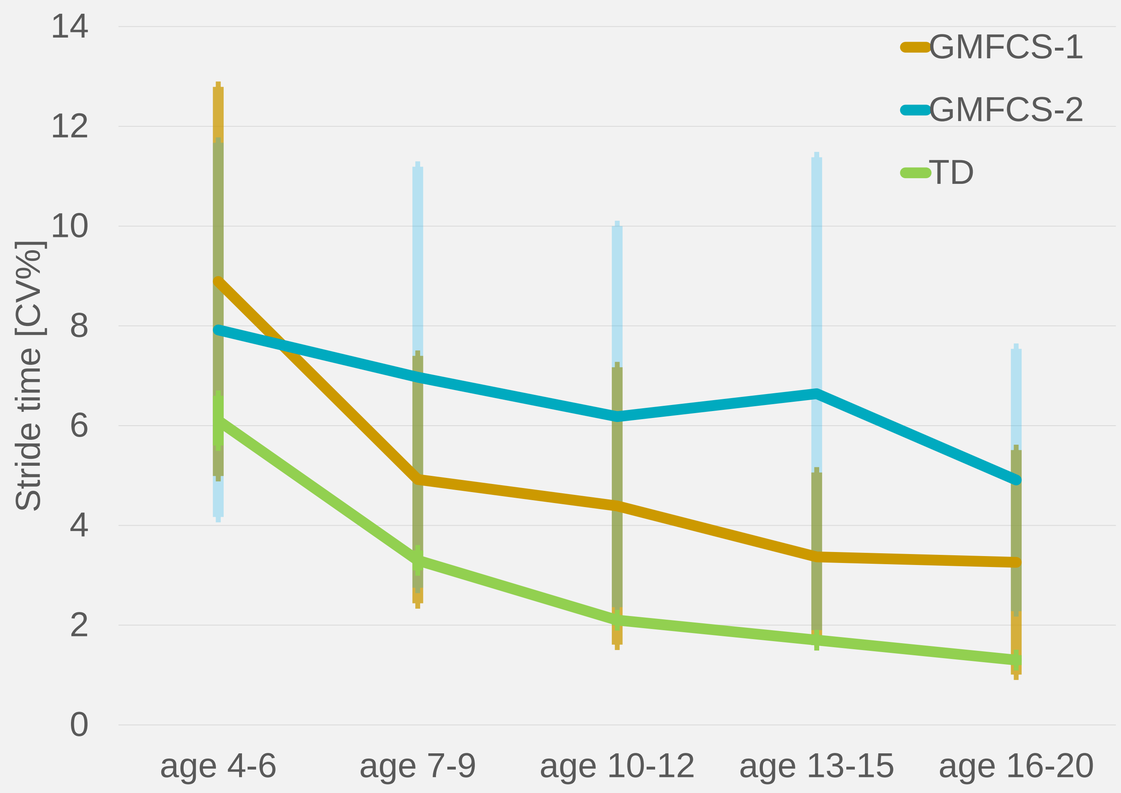
Stride time variability (coefficient of variance CV%) = $\frac{SD}{Average} \times 100\%$

	Age 4-6	Age 7-9	Age 10-12	Age 13-15	Age 16-20
GMFCS 1 [n]	12	51	86	60	54
GMFCS 2 [n]	4	12	24	18	28
TD [n]	11	20	12		10

Pilot Results

Gait variability, quantified using stride time CV%, showed promise to be able to discriminate pathological from TD walking abilities.

Further data per age group for TD will be needed to perform statistical tests. Further research is needed to evaluate if gait variability can also be used to identify subgroups within the pathological population.



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