Walk This Way: Adaptive Control of Walking Reveals Principles of Locomotor Learning

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Stroke is a leading cause of long-term disability in the United States and approximately 30% of stroke survivors are unable to walk without assistance. Given the prevalence of walking impairments in this population, one of the key challenges in stroke rehabilitation is to produce larger gains in walking ability through training. The premise of my research is that conventional training is limited by a lack of understanding of the processes that drive locomotor learning. My recent research has focused on understanding some of these factors in the context of learning to walk on a split-belt treadmill. When naive individuals are exposed to walking on this device, they walk with steps of unequal length, but over time adapt to produce steps of equal length. I will first demonstrate that the reduction in asymmetry during adaptation is associated with a reduction in muscle activity and metabolic cost. These findings provide evidence that locomotor adaptation may be driven by an energetic optimization process. I will then show that this adaptation process can be accelerated by implementing novel patterns of optic flow during adaptation. This leads to the exciting possibility that intelligent use of augmented reality may be able to promote learning and rehabilitation. I will conclude by sharing some recent findings that provide insight into how the asymmetric walking patterns commonly observed following stroke contribute to the increased energy cost of walking in these individuals.