Adaptability of Human Gait: Effect of Training with Red Noise Auditory Stimuli on Gait Fluctuation Patterns

Cecilia Power, Janessa Drake, William Gage

School of Kinesiology and Health Science, York University

Falls are the most common cause of injury for older adults in Canada and can lead to other serious consequences (StatCan, 2015). Falls can occur when gait becomes unstable. Stable movement is produced when environmental, biomechanical, and morphological constraints are accounted for by the neuromuscular system and variability or fluctuations within the gait patterns are within a healthy range (Stergiou & Decker, 2011). Variability between consecutive strides while walking has been shown to fluctuate at a specific frequency, called pink noise (Hausdorff, Peng, Ladin, Wei, & Goldberger, 1995). This means that the fluctuations in stride timing have long-range correlations such that each stride is influenced by many past strides (Hausdorff et al., 1995). However, these fluctuations can be altered using sensory stimuli in varying directions; either towards white noise (less structure) or towards red noise (more structure) (Hunt, McGrath, & Stergiou, 2014; Kiriella, 2017; Rhea, Kiefer, D'Andrea, Warren, & Aaron, 2014). While studies have shown that healthy individuals can adapt gait variability to match either white or pink noise, it has also been shown that the gait pattern can only approach red noise characteristics, but not actually produce it (Hunt et al., 2014; Kiriella, 2017). For this reason, the proposed study is designed to test the adaptability of gait further and to examine whether participants can, through training, produce red noise fluctuations. To do this, I will be applying a detrended fluctuation analysis to an inter-stride (or between consecutive stride) interval time series to analyze the fluctuation patterns within the series. Ten participants will complete a 1 to 2 week daily training protocol that will involve walking on a treadmill with a red noise fluctuating auditory metronome for a minimum of 1000 strides per training session. Daily training sessions will also include an initial baseline walking session without the stimulus. It is anticipated that the results of this study will provide further insight into the neuromechanics of gait and the ability of the system to produce varying fluctuation patterns.

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