Training to Facilitate Adaptation to Novel Sensory Environments

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After spaceflight, the process of readapting to Earth's gravity causes locomotor dysfunction. We are developing a gait training countermeasure to facilitate adaptive responses in locomotor function. Our training system is comprised of a treadmill placed on a motion-base facing a virtual visual scene that provides an unstable walking surface combined with incongruent visual flow designed to train subjects to rapidly adapt their gait patterns to changes in the sensory environment. The goal of our present study was to determine if training improved both the locomotor and dual-tasking ability responses to a novel sensory environment and to quantify the retention of training. Subjects completed three, 30-minute training sessions during which they walked on the treadmill while receiving discordant support surface and visual input. Control subjects walked on the treadmill without any support surface or visual alterations. To determine the efficacy of training, all subjects were then tested using a novel visual flow and support surface movement not previously experienced during training. This test was performed 20 minutes, 1 week, and 1, 3, and 6 months after the final training session. Stride frequency and auditory reaction time were collected as measures of postural stability and cognitive effort, respectively. Subjects who received training showed less alteration in stride frequency and auditory reaction time compared to controls. Trained subjects maintained their level of performance over 6 months. We conclude that, with training, individuals became more proficient at walking in novel discordant sensorimotor conditions and were able to devote more attention to competing tasks.

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