SENSORIMOTOR ADAPTABILITY TRAINING IMPROVES MOTOR AND DUAL-TASK PERFORMANCE

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INTRODUCTION

The overall objective of our project is to develop a sensorimotor adaptability (SA) training program designed to facilitate recovery of functional capabilities when astronauts transition to different gravitational environments. The goal of our current study was to determine if SA training using variation in visual flow and support surface motion produces improved performance in a novel sensory environment and demonstrate the retention characteristics of SA training.

METHODS

Training: Twenty subjects (10 training, 10 control) completed three training sessions consisting of exposure to congruent and incongruent visual flow along with support surface movement. Support surface variation was produced using a six degree-of-freedom motion base on which a treadmill was mounted. A computer-generated virtual hallway scene projected onto a large screen positioned 2 m in front the subjects served as the visual stimulus for all sessions. The 31-minute training profile presented four 5-minute exposures to various combinations of support surface and visual scene manipulations. The order of presentations was randomized at each visit. Control group participants walked on the treadmill but did not receive any visual or support surface oscillations, although their exposure time was broken into blocks to mirror the condition used for the training group.

Transfer/Retention Test: To determine the efficacy of training all subjects performed the Transfer/Retention Test upon completion of training. For this test subjects were exposed to novel visual flow and support surface movement, not previously experienced during training. The Transfer/Retention Test was performed 20 minutes, 1 week, 1, 3 and 6 months after the final training session.

During both training and testing sessions subjects were given a hand-held switch used to measure their reaction time to a series of audible tones to provide a measure of change in dual-tasking capability resulting from training. Footswitches affixed to shoe soles at the heels were used to define heel-strike events to measure stride frequency.

RESULTS

Subjects who received SA training showed improved locomotor performance (less change in stride frequency) and enhanced dual-task capability (faster reaction times) compared to control subjects during exposure to novel sensory stimuli during the Transfer/Retention Test. This capability was retained for up to 6 months.

DISCUSSION

These data indicate that SA training enhanced performance during exposure to novel sensorimotor challenges. Importantly, SA training improved both locomotor and dual-task capabilities. Therefore, SA training facilitates both motor learning and multi-tasking capability during exposure to novel environments.

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