Visual Bias Predicts Gait Adaptability in Novel Sensory Discordant Conditions

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We designed a gait training study that presented combinations of visual flow and support-surface manipulations to investigate the response of healthy adults to novel discordant sensorimotor conditions. We aimed to determine whether a relationship existed between subjects' visual dependence and their postural stability and cognitive performance in a new discordant environment presented at the conclusion of training (Transfer Test). Our training system comprised a treadmill placed on a motion base facing a virtual visual scene that provided a variety of sensory challenges. Ten healthy adults completed 3 training sessions during which they walked on a treadmill at 1.1 m/s while receiving discordant support-surface and visual manipulations. At the first visit, in an analysis of normalized torso translation measured in a scene-movement-only condition, 3 of 10 subjects were classified as visually dependent. During the Transfer Test, all participants received a 2-minute novel exposure. In a combined measure of stride frequency and reaction time, the non-visually dependent subjects showed improved adaptation on the Transfer Test compared to their visually dependent counterparts. This finding suggests that individual differences in the ability to adapt to new sensorimotor conditions may be explained by individuals' innate sensory biases. An accurate preflight assessment of crewmembers' biases for visual dependence could be used to predict their propensities to adapt to novel sensory conditions. It may also facilitate the development of customized training regimens that could expedite adaptation to alternate gravitational environments.