WHICH WAY IS UP? LESSONS LEARNED FROM SPACE SHUTTLE SENSORIMOTOR RESEARCH

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The Space Shuttle Program provided the opportunity to examine sensorimotor adaptation to space flight in unprecedented numbers of astronauts, including many over multiple missions. Space motion sickness (SMS) severity was highly variable across crewmembers. SMS generally lasted 2–3 days in-flight with ~1/3 of crewmembers experiencing moderate to severe symptoms, and decreased incidence in repeat flyers. While SMS has proven difficult to predict from susceptibility to terrestrial analogs, symptoms were alleviated by medications, restriction of early activities, maintaining familiar orientation with respect to the visual environment and maintaining contact cues. Adaptive changes were also reflected by the oculomotor and perceptual disturbances experienced early inflight and by the perceptual and motor coordination problems experienced during re-entry and landing. According to crew self-reports, systematic head movements performed during reentry, as long as paced within one's threshold for motion tolerance, facilitated the early readaptation process. The Shuttle provided early postflight crew access to document the initial performance decrements and time course of recovery. These early postflight measurements were critical to inform the program of risks associated with extending the duration of Shuttle missions. Neurological postflight deficits were documented using a standardized subjective rating by flight surgeons. Computerized dynamic posturography was also implemented as a quantitative means of assessing sensorimotor function to support crew return-to-duty assessments. Towards the end of the Shuttle Program, more emphasis has been placed on mapping physiological changes to functional performance. Future commercial flights will benefit from pre-mission training including exposures to launch and entry G transitions and sensorimotor adaptability assessments. While SMS medication usage will continue to be refined, non-pharmacological countermeasures (e.g., sensory aids) will have both space and Earth-based applications. Early postflight field tests are recommended to provide the evidence base for best practices for future commercial flight programs.

Learning Objective: Overview of the Space Shuttle Program regarding adaptive changes in sensorimotor function, including what was learned from research, what was implemented for medical operations, and what is recommended for commercial flights.

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