

# Neurofeedback as a Non-pharmacologic Countermeasure to the Negative Effects of Microgravity on Human Performance

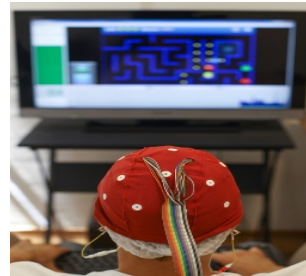
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There is a limited amount of published research on the effects of actual microgravity on the EEG (electroencephalogram). But in simulated micro-G (MGS using head tilt bed rest experiments), there is an abundance. Overall, the research indicates that the Central Nervous System is thrown into a state of dysregulation in the new environment –resulting in impairments in cognition, attention, sleep, muscle coordination and other areas of functioning. After all, gravity has been the one constant physical force here on Earth since the emergence of life –i.e., the developmental trajectory of all living things on this planet has been guided by 1G. As such, when you slam shift a sophisticated & delicate living organism with a major change in G loading, there will certainly be short and long term effects.

In general, any sort of disruption of the CNS can be viewed as a challenge to its normal functioning -which will almost always manifest as some form of dysregulation in attention, impulse control and cognitive ability. Pretty much any illness or impairment that affects the brain will impact attention and focus. When the brain doesn't "feel well", is injured or is distracted by a "hasty" adaptation -task, it will tend to not pay attention at an optimum level. As such, tracking attention and impulse control gives us an overall read on the functioning of the brain. The objective measure used for attention and impulse control is something called a "Continuous Performance Test" or CPT. It is primarily used to measure improvements in brain function resulting from pharmacological or behavioral interventions.

Neurofeedback has been used successfully for attention deficit disorders, cognitive impairments and mood disorders here on terra firma. Neurofeedback is a non-pharmacological intervention that serves as an exercise for the regulatory centers in the brain which govern attention, arousal, impulse control and overall mood stability.

Neurofeedback is actually a very specific form of biofeedback that concerns the human electroencephalograph (EEG). Dr. Barry Sterman of UCLA first discovered its effectiveness with seizures when experimenting with cats in the mid-1960s. He found that when the cats increased the 12-15 Hz activity over the cortex, their seizure activity would decrease. The reward system involved providing cat food for the animal whenever the 12-15 Hz (called the Sensory-Motor rhythm) activity reached beyond a certain amplitude threshold.



This operant conditioning -exercise reduced seizure activity by more than 80%. When NASA heard about his research, they asked Sterman to train some of the technicians who were having tonic-clonic seizures, following exposure to monomethyl hydrazine -which is extremely toxic to the human nervous system and the body in general. NASA was quite impressed with the results and started doing their own research at Langley RC. Despite the successful results, public awareness of neurofeedback has only been modest –at best. More recently, NF has found clinical application with children and adults with ADHD, learning disabilities, mood disorders and behavioral problems. We have also used it extensively with soldiers who suffered IED related head injuries –with generally positive effect.

Results of NF training will be discussed during the presentation.