→ SUCCESS STORY

When space slows your brain

Background

Our brains are changing all the time – nerves and connecting cells are rearranging themselves with every new experience. In space, astronauts need to adapt to a whole new environment. Living in weightlessness can be very disorienting because our Earthly perception of up or down no longer applies.

Facts and figures

- Five astronauts, 62 electrodes and a huge stream of data were used to help understand how the human brain works
- First experiment ever using ESA's Multi-electrode Electroencephalography Module in the Columbus Lab
- This neuroscience study was possible in part thanks to the SURE programme, an initiative which opened up new research opportunities in space for Eastern European countries
- Neurospat provided insight into the astronauts' occasional slips in performance. A diminished cognitive capacity should be taken into account when planning key activities, such as spacewalks and operating spacecraft

> **This European science collaboration worked very well together. Each team benefitted from the other.**
>
> *Jennifer Ngo-Anh, ESA project scientist for the Neurospat experiment*

Astronauts have to interpret spatial cues, reorient them and coordinate every movement. It is a heavy burden on the brain and there is little knowledge on how it deals with it. Sleep disturbance and fatigue add to the stress affecting the brain. Are perception and focus dramatically altered in space?

Solution

The Neurospat experiment peered inside astronauts' heads to detect changes in spatial orientation and perception before, during and after spaceflight.

Brain activity was recorded to detect differences in how the brain interprets spatial cues on Earth and in space. The astronauts completed tasks such as judging object orientation and navigating a virtual space. Speed, accuracy and reaction to new stimuli were measured, as well as how crucial parts of the cerebral cortex reacted.

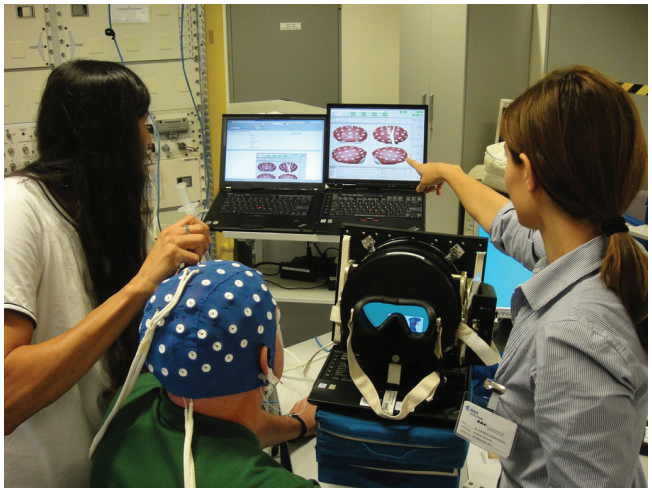
Outcome

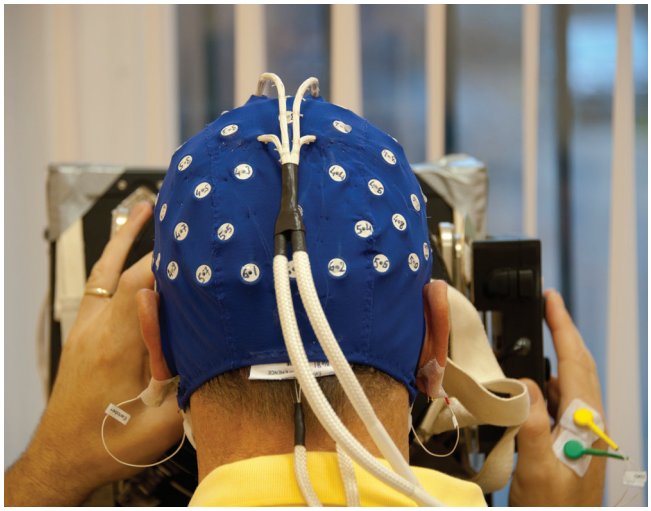
It appears that the brain works in low gear during spaceflight. The Neurospat experiment provided firm evidence of lasting cognitive impairment for astronauts on long-term missions.

The most prominent result was the decline of reaction time, accuracy and attention in weightlessness. The prefrontal cortex, in charge of executive and control functions, appeared to be particularly affected. Sleep deprivation, stress and heavy workload during the mission are also to blame.

In the long run, if we want to send people to the Moon and Mars we would need to know what happens to the brain. Future research should also identify countermeasures, training methods and adaptation strategies to alleviate the adverse influence of spaceflight.

Back on Earth, European scientists hope that results could provide new tools for testing spatial cognition in ageing and pathological diseases. Everybody particularly exposed to stressors such as extreme fatigue, sleep loss or hypoxia could also benefit from it.





Taking your experiment to space is everybody's dream, and it was an exciting challenge.

László Balázs, Principal Investigator of the Neurospat experiment