



Background

Gravity is always present, it is stable and unchanging.

Humans have evolved in a “1g” gravitational environment. Gravity may play a role in regulating behaviour, perception and cognition.

Responding to changes in the environment is crucial for survival. Alterations in gravity may impact response behaviour, potentially leading to harm.

The VESTIBULAR SYSTEM

senses the orientation of the head relative to gravity.

A widespread network of cortical and subcortical areas in the human brain receives signals from the vestibular organs, including the Temporo-Parietal Junction, Inferior Parietal Lobule, Anterior Cingulate Cortex, and Prefrontal Cortex.¹



AIM

To investigate whether alterations of vestibular-gravitational signalling modulate adaptive responding in controlled lab-settings

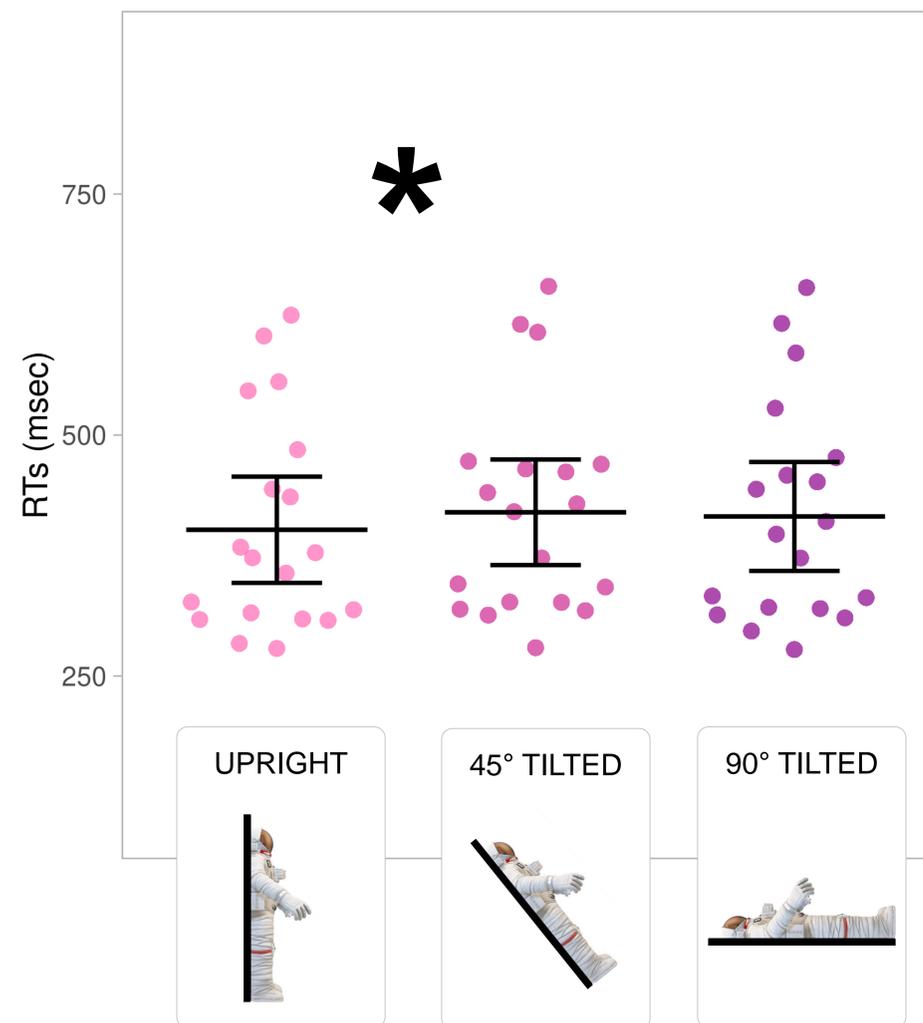
A proxy for adapting responding

The ODDBALL TASK

has been widely used as a test responding.² Participants were asked to respond to changes in auditory tone. A train of beep sounds was presented, in which 80% of trials were STANDARDS (500Hz) and 20% TARGET (1000Hz) stimuli. Participants were asked to respond as quickly as possible to TARGET sounds.

Simulated Altered Gravity: Vestibular Signaling

A 3D Human Tilt table was used to passively tilt participants in different body orientations, which triggers different vestibular-gravitational signals.

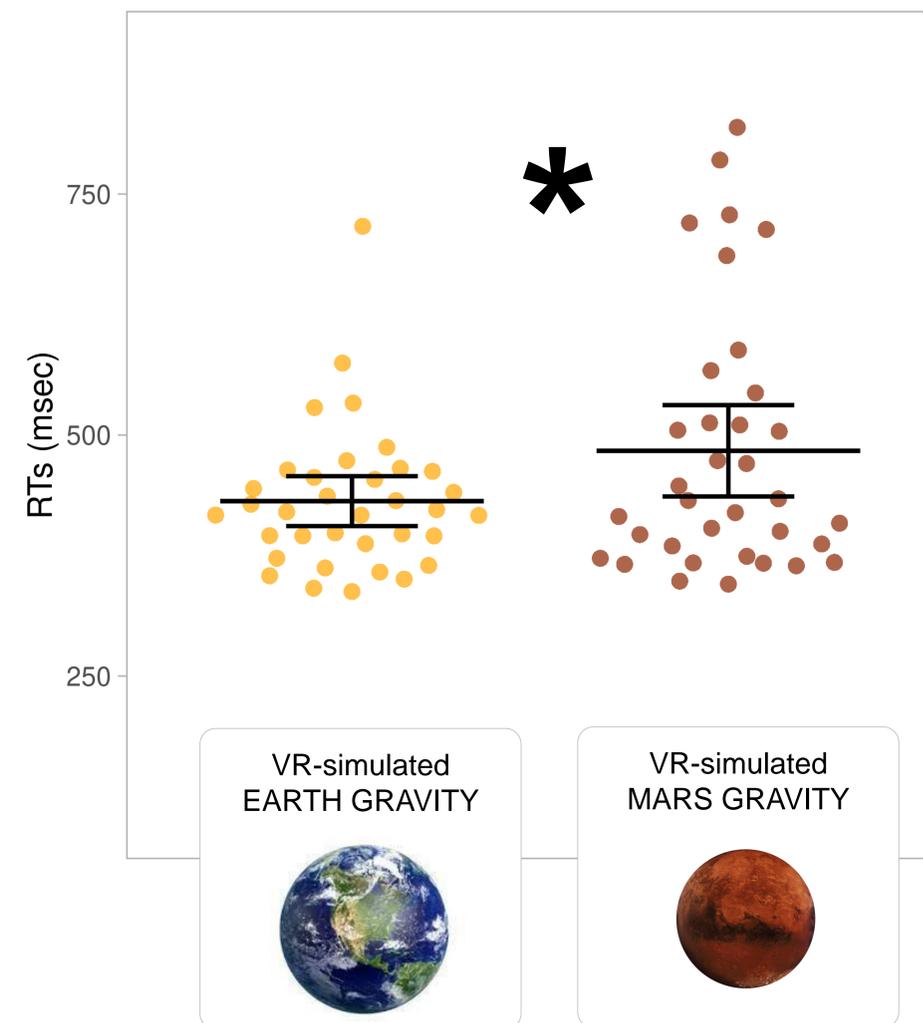


Reaction times differed significantly ($F(2, 36) = 3.796, p = .032, \eta^2 = .174$) between orientation conditions.

Physical alterations in vestibular-gravitational signals INCREASED reaction times in the Oddball Task

Simulated Altered Gravity: Visual Capture

Virtual Reality (VR) was used to simulate a virtual environment in which a ball was free falling accordingly with Terrestrial or Martial acceleration.



Reaction times differed significantly ($t(34) = -2.561, p = .015$; Cohen's $d = 0.44$) between Mars and Earth VR.

Non-Terrestrial VR-simulated gravity INCREASED reaction times in the Oddball Task

Conclusion

Both VESTIBULAR and VISUAL alterations in gravity increase reaction times to environmental events. Gravity may influence the brain's ability to adapt to changes in the external environment.

References:

- 1 Lopez, C., Blanke, O., & Mast, F. W. (2012). *Neuroscience*.
- 2 Volpe, U., Mucci, A., Bucci, P., Merlotti, E., Galderisi, S., & Maj, M. (2007). *Brain Research Bulletin*, 73(4-6), 220-230.