



Investigating the Neural Correlates of Immersion in Virtual Reality

Alexander Litovchenko, Matthew Granson, Brian Mohseni, Ata Yilmazemre, Alan Su, Mark Faust



Introduction & Background

Immersion is a unified conscious phenomenon that has been proposed to have multiple dimensions

Challenge Immersion

Increases with cognitive and motor demands

Physical Immersion

Increases with more realistic sensory input

Prior EEG studies of neurocorrelates of immersion have implicated changes in Theta (4-8 Hz) and Gamma (35-50 Hz) frequency bands

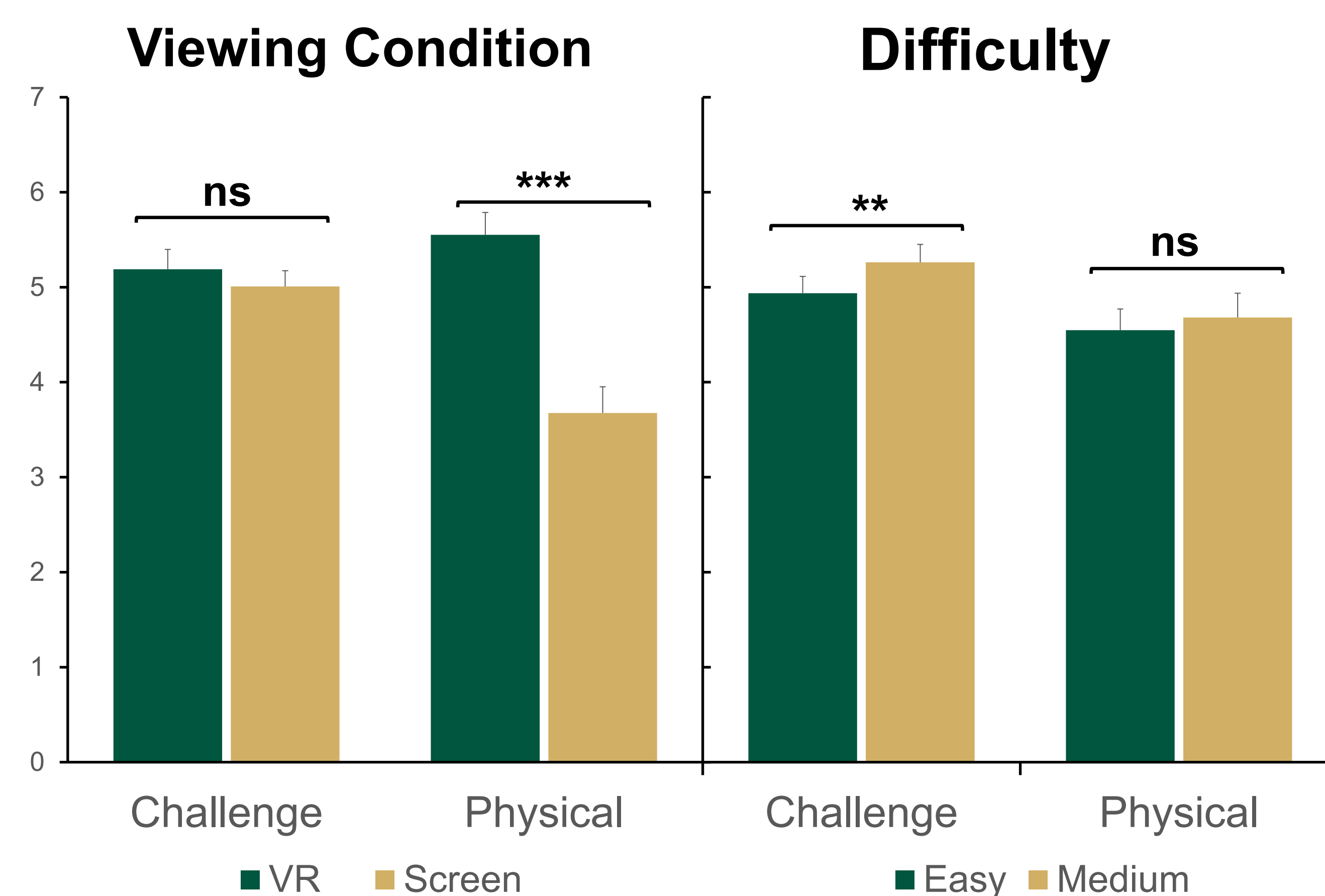
Objective

Further examine Theta & Gamma neurocorrelates of immersion while simultaneously manipulating challenge and physical immersion

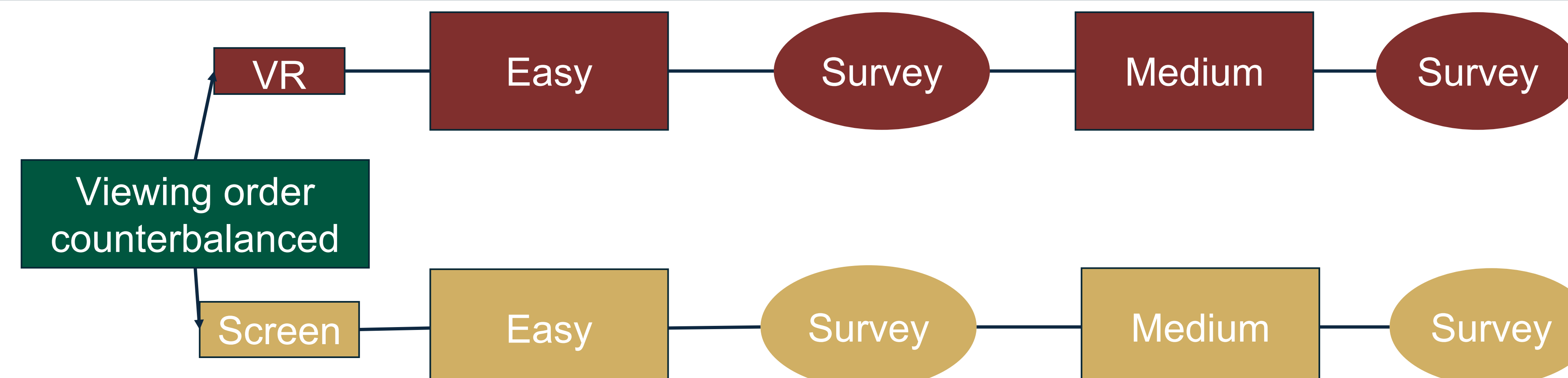
Hypotheses

- Mean challenge immersion score will be greater for the medium than the easy track
- Mean physical immersion score will be greater for VR than 2D screen viewing
- There will be main effects of viewing condition and difficulty on Theta and Gamma band power, but no interactions

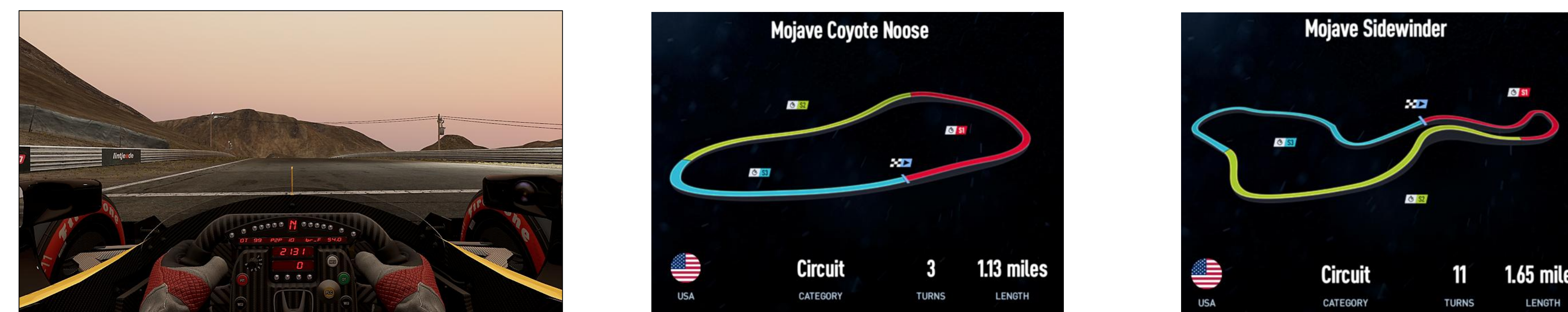
Immersion Subscale Analysis



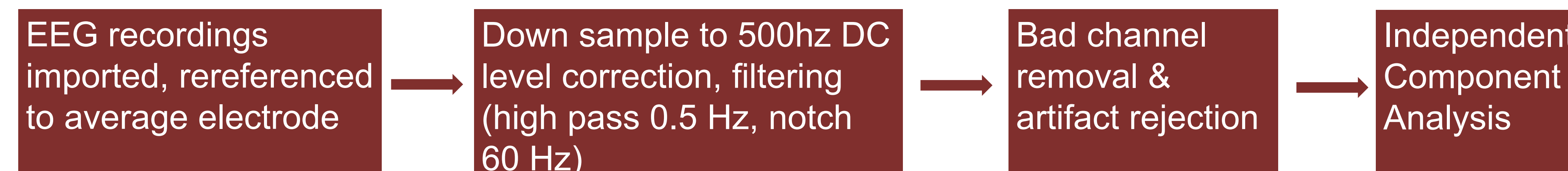
Experimental Design



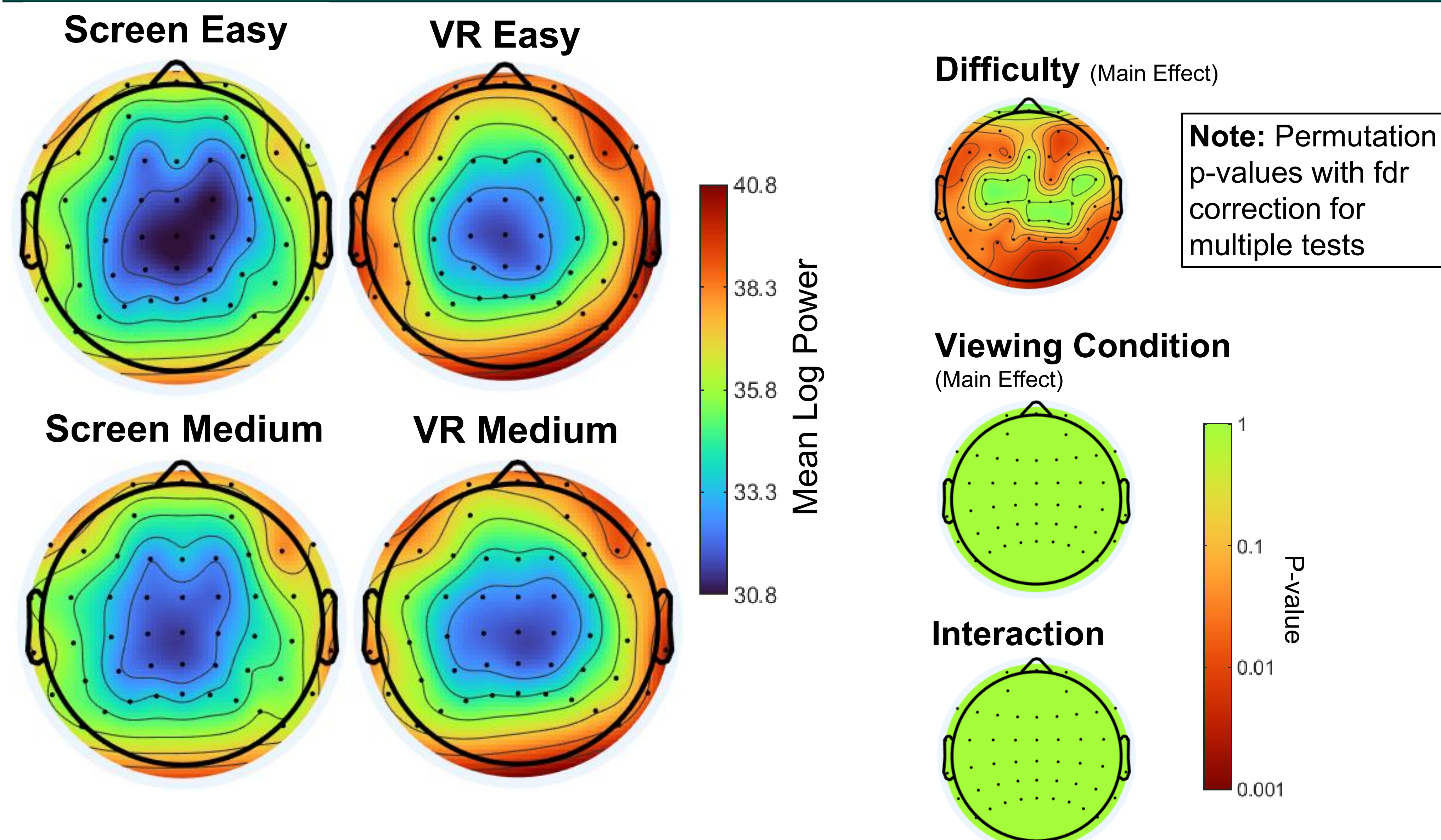
Driving Simulator Conditions



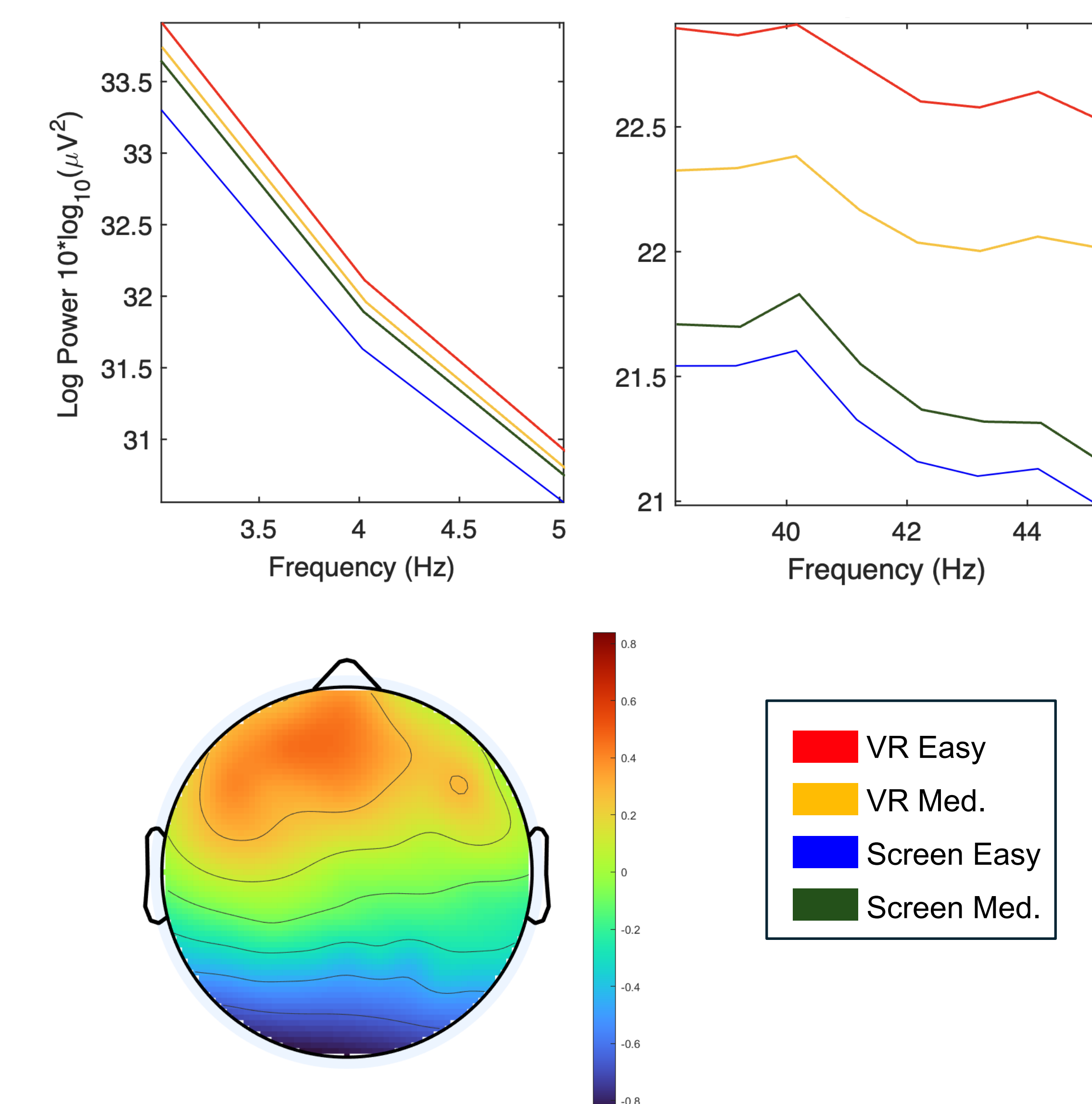
EEG Processing Pipeline



Gamma (38-46 Hz) Power Scalp Topography



ICA Cluster Analysis

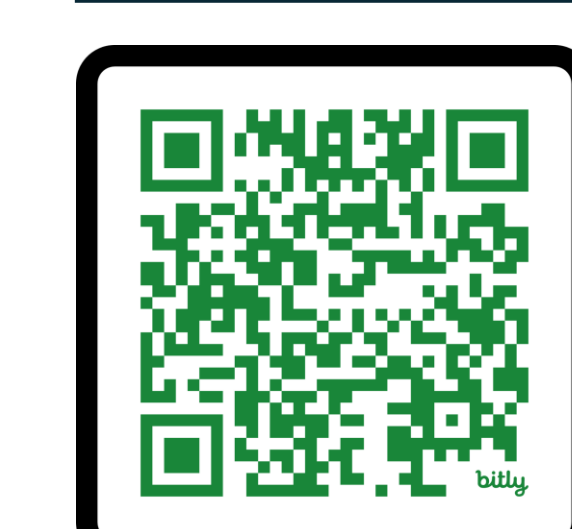


Note: Theta sig. main effect difficulty, & interaction, sig. p<.01 fdr corrected. Gamma, main effect of difficulty & interaction, p<.01, fdr corrected. Marginal trend for main effect of viewing condition. Major finding to emphasize is that there is a constant interaction such that power increases from SE to SM but decreases from VE to VM.

Discussion & Future Directions

- Crossover interaction in the gamma band
- Theta is driven by differences in screen viewing
- Gamma is driven by differences in VR
- VR Enhancement of motor control related activity
- *Dipole estimation to solidify ICA*
- *Counterbalance of difficulty conditions*
- *Structured State Space Modeling Approach*

References



Supplement

