Transcranial Magnetic Stimulation (TMS) of the Supramarginal Gyrus: A Window to Perception of Upright

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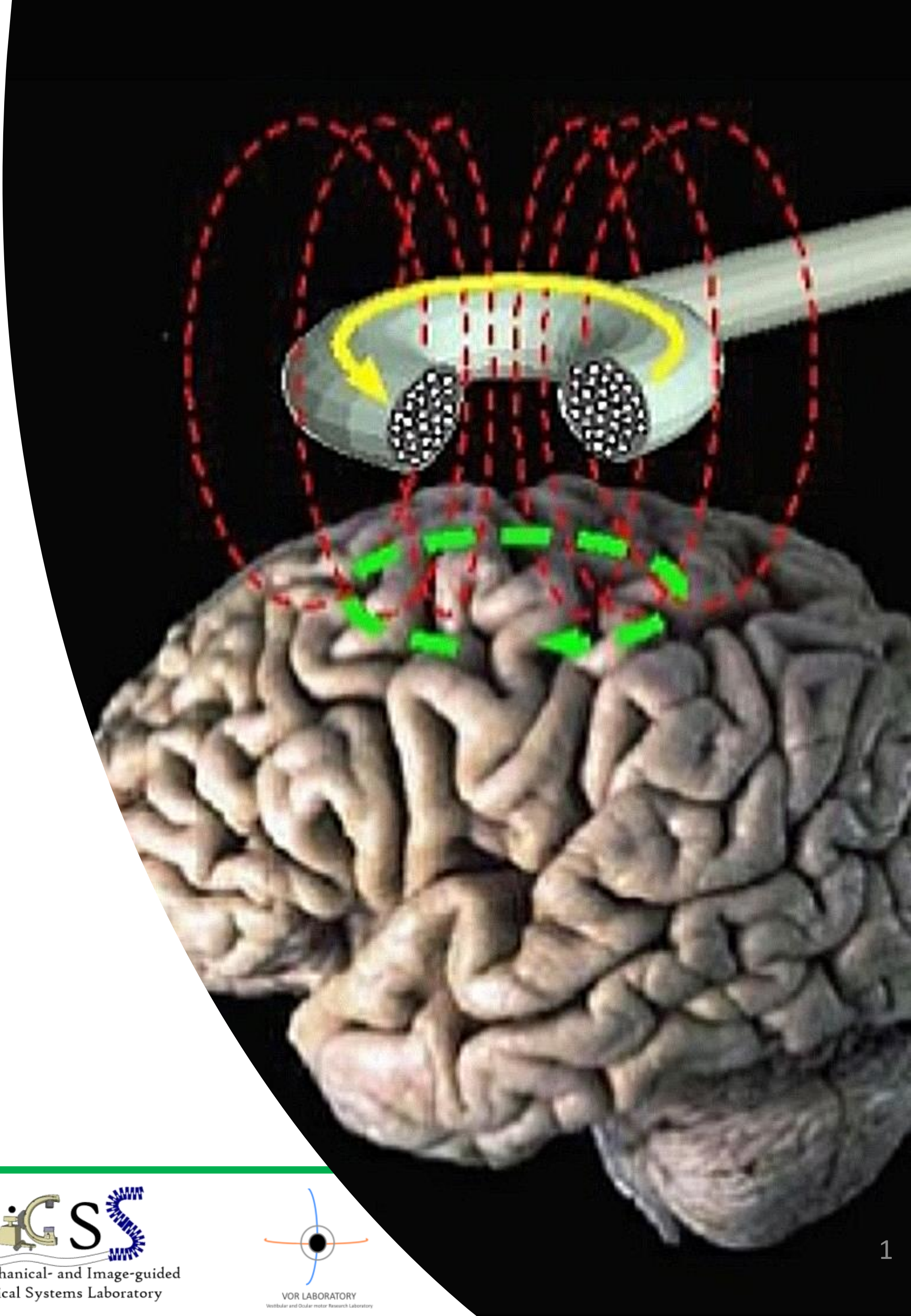

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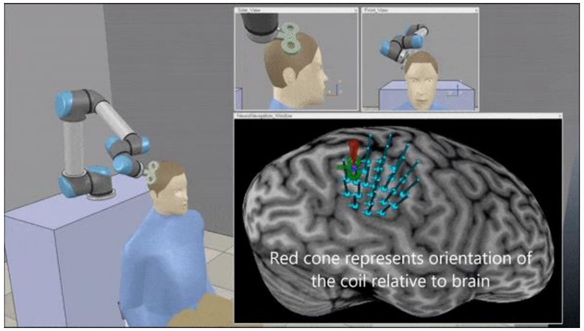
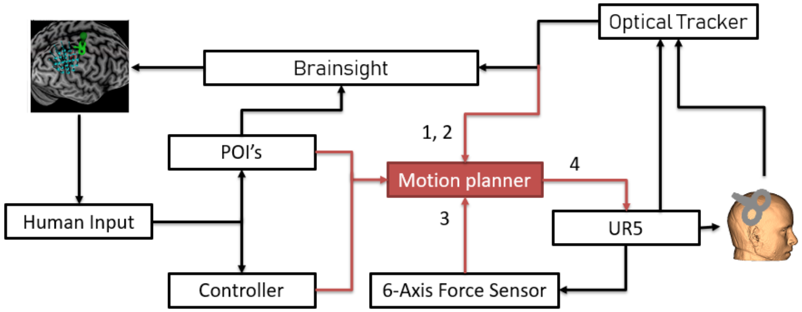
Robot-Assisted Transcranial Magnetic Stimulation (RA-TMS)

Topic: Assess subjective visual vertical (SVV) perception via eye tracking and relationship between SVV and the SMGp.

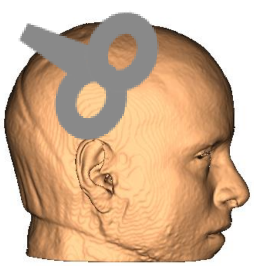
Solution: Create a robotic tool that can perform transcranial magnetic stimulation (TMS) automatically to measure areas of activity around the brain.





Paper Selection

- Transcranial Magnetic Stimulation (TMS) of the Supramarginal Gyrus: A Window to Perception of Upright
  - Explanation of TMS
  - Outlines need for robotic tool
  - Specifies durations and site



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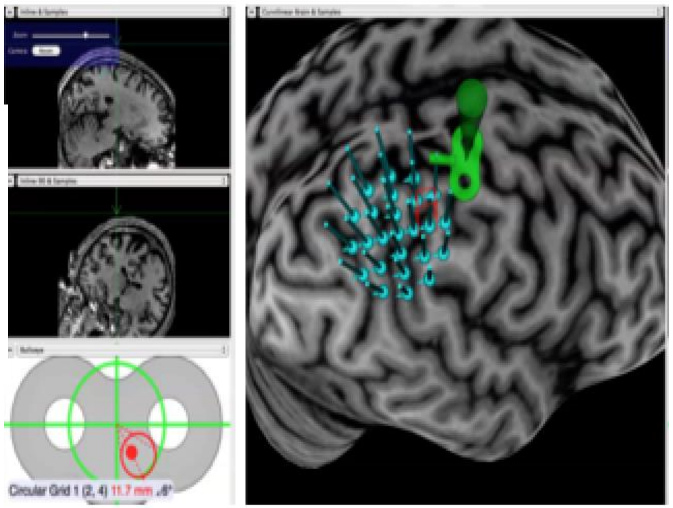

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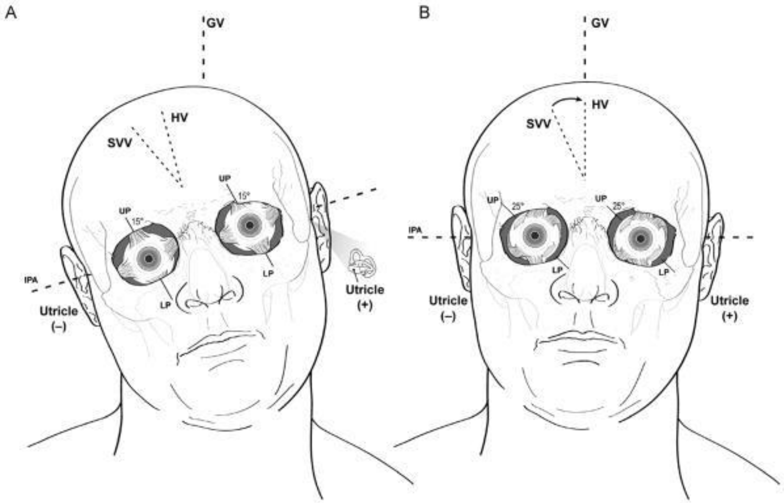
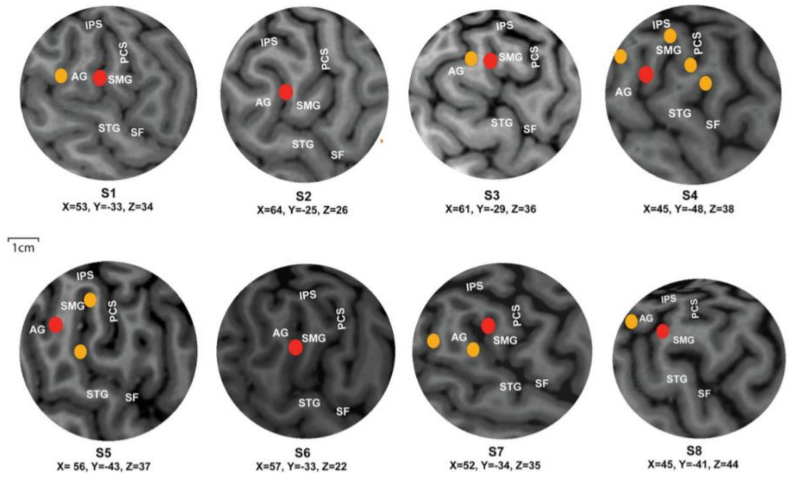
Problem Summary

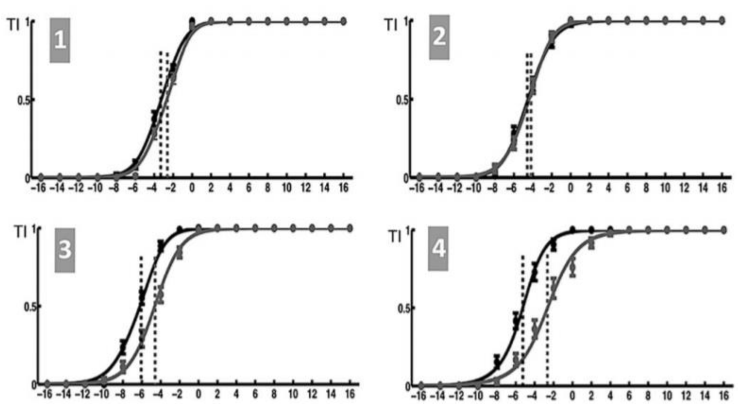
- Perception of upright
  - Vestibular feedback
  - Subjective Visual Vertical (SVV)
- Localization of activity
  - Supramarginal Gyrus (SMGp)
  - Pathway?
- Eye torsion and link to SMGp



Key Results and Significance

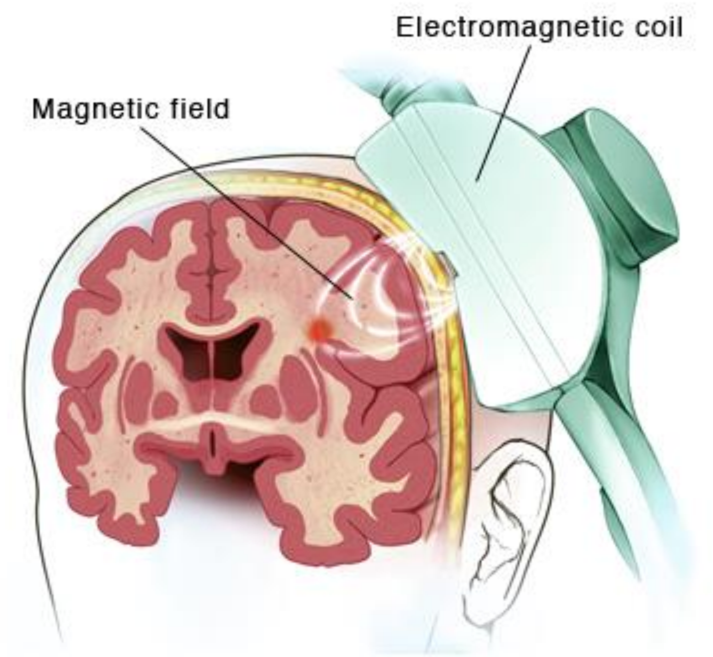
- Spatial reference frame integration
  - Vestibular pathway elements
- SMGp linked to SVV tilt post-TMS application (p = 0.0039)
  - +2.7° when head tilted left
  - -3.6° when head tilted right





Background

- Vestibular information
  - Spatial orientation
  - Navigation
- Supramarginal gyrus (SMGp)
  - Functional neuroimaging studies
  - Cortical lesions + behavior analysis
- Subjective Visual Vertical (SVV)
  - "Earth vertical"
- Transcranial Magnetic Stimulation (TMS)
  - Disruptive effect on cortex



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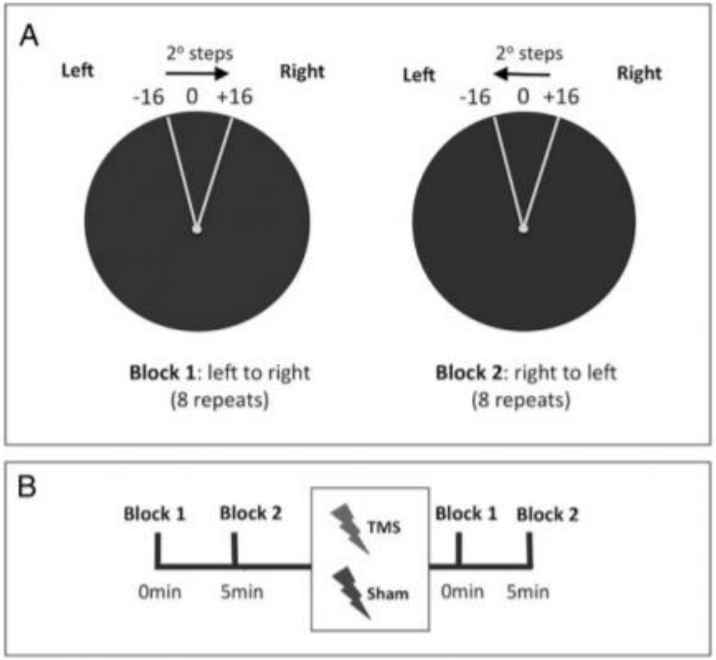
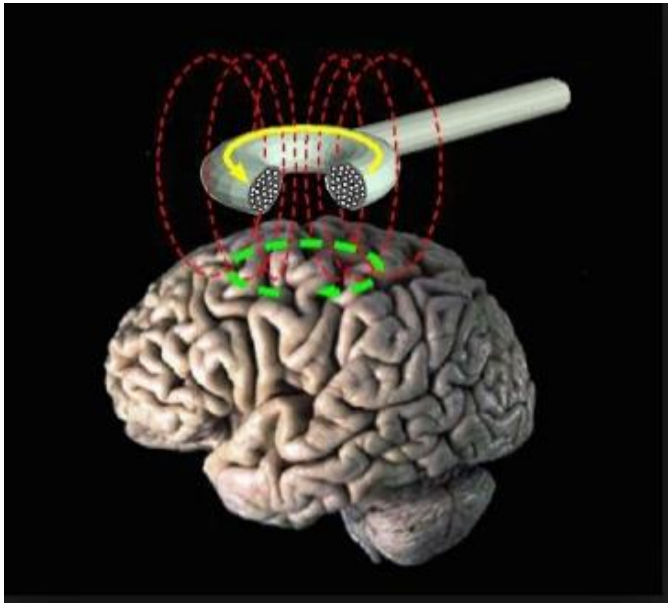
Methodology

- Forced-choice paradigm
- 2 blocks pre and post-TMS
- Rotation of laser
  - Projected on screen far away
  - Rotated ±16° w/ 2° increments
- Rotation of dial
  - Subjects align with laser
  - Weights: Left = 0, middle = 0.5, right = 1
  - Logistic regression to fit data, then where 0.5 reached is overall angle



Experimental Setup

- 8 healthy (5 m, 3 f) volunteers
- Bite bar
- Training = 1 block
- TMS Application
  - Figure-eight coil held tangent to head
  - Continuous theta burst stimulation (cTBS)
    - 200 bursts every 200 ms
    - Each burst had 3 pulses at 50 Hz
  - Site of application monitored using external software (Brainsight)
- Previously mentioned block setup



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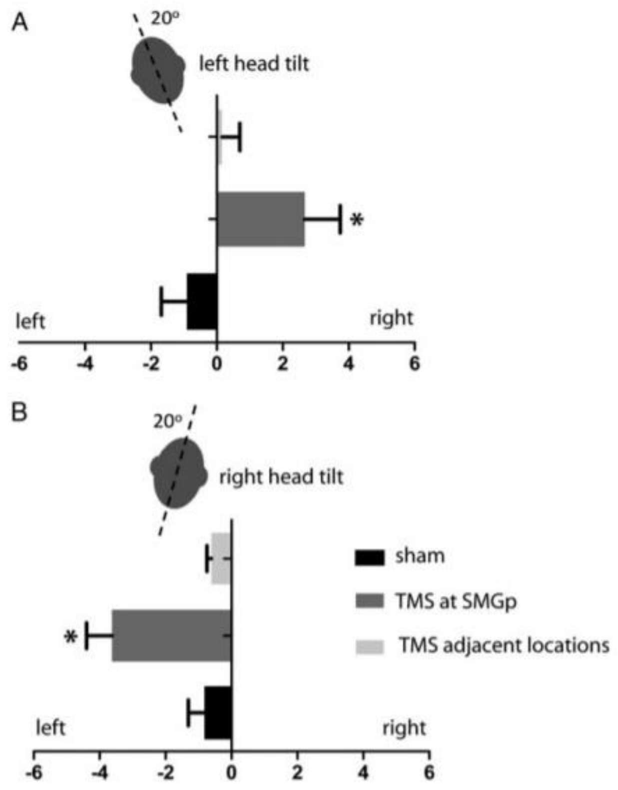
Assessment

- Importance
  - Demonstrates significance of TMS
  - Highlights complexity of vestibular information processing
- Relevance
  - Tangency to head (safety)
  - Model of TMS coil being used
  - Duration of exposure
  - Length of time spent at each location
  - Visualization software



Assessment (cont.)

Pros	Cons
• Clear methodology and setup • Described application of TMS well • Effects clearly demonstrated impact of SMGp inhibition • Vestibular processing pathway was well researched	• Too few subjects • Pre-TMS SVV not zeroed • Few important figures • Could always use more data analysis and graphs

Conclusions

- Solid foundation
- Linked SMGp to eye torsion successfully
- Demonstrated need for robotic tool to conduct experiment
- Next steps:
  - Functional mapping of SMGp (current project)
  - Eye torsion tracking (current project)
  - Repeat for left cerebral hemisphere

Questions?

References

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