Intracranial EEG Phantom for Brain Stimulation Studies

Date: 12/04/2025

Client: Dr. Raheel Ahmed

Alternative Contact: Dr. Arun Karumattu Manattu

Advisor: Dr. Paul Campagnola

Team:

Avery Schuda *(Team Leader)*

Lilly Mackenzie *(Communicator)*

Helene Schroeder *(BSAC)*

Orla Ryan *(BWIG)*

Corissa Hutmaker *(BPAG)*

Problem statement

Intracranial electroencephalography (iEEG) is routinely used in surgical planning for individuals with uncontrolled seizures. Transcranial magnetic stimulation (TMS) may provide complementary information for mapping out critical brain regions that should be avoided during surgery, however, there are still safety concerns around the use of TMS in patients with iEEG. The major safety concerns are the induction of electrical currents, heating, and displacement of the implanted electrodes. The goal of this project is to develop a phantom that can be used to simulate the effect of TMS on electrode currents, temperatures, and changes in position.

Brief status update

This Friday (12/5) the team will be presenting our work this semester at the Poster Session. Before Thanksgiving, we completed thermal testing and created several more gels. In addition to this, we met with a grad student in the Franck lab who recommended we use MRI scans to be able to create CAD models for both the skull and brain from one scan.

Difficulties / advice requests

We are still waiting to receive MRI scans to be able to move forward with creating the final CAD model of the brain.

Major team goals for the next week

1. Present poster at Fall Poster Session (Friday, 12/5)
2. Complete final report
3. Meet with Dr Campagnola to discuss this semester and set goals for next semester
4. Meet with Dr TJ Puccinelli to finalize outreach plan for next semester

Next week's individual goals

- Avery
    - Complete final report with team
    - Process MRI scans if received
    - Meet with Dr Campagnola and TJP
- Lilly
    - Complete final report
    - Work on a schedule for the upcoming semester
- Helene
    - Finish the final report with the team
    - Meet with Dr. Campagnola to wrap up the semester and discuss plans for next semester
- Orla
    - Finish up with final report
    - Meet with Dr. Campagnola to discuss next semester
    - Talk with Dr. TJP about outreach plan
- Corissa
    - Write the remainder of the final report
    - Complete any end remaining of semester tasks

Timeline

Task	Sept				Oct					Nov				Dec	
	5	12	19	26	3	10	17	24	31	7	14	21	28	5	10
Project R&D															
Empathize	X	X													
Background		X	X	X	X	X									
Prototyping						X	X	X	X	X					
Testings								X	X	X	X	X			
Deliverables															
Progress Reports		X	X	X	X	X	X	X	X	X	X	X	X	X	
PDS			X												
Prelim Presentation					X										
Final Poster														X	
Final Report/Notebook															
Meetings															

Client		X			X			X							
Advisor	X	X	X	X	X		X	X		X	X	X			
Website															
Update	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Filled boxes = projected timeline
X = task was worked on or completed

Previous week's goals and accomplishments

- Avery
  - Helped to compete and print final poster
  - Worked on documenting formal protocols
  - Processed STL files from CT scans into formal Solidworks model
- Lilly
  - Worked on final deliverables
  - Created gelatin test pieces and gelatin for final presentation
- Helene
  - Complete and rehearse our presentation for the upcoming poster presentation
  - Began to work on finalizing the report
- Orla
  - Formulated electrical testing protocol
  - Practiced for poster session with team
  - Helped format final poster
- Corissa
  - Wrapped up final testing for this semester
  - Worked on the final poster sections
  - Practiced presenting with the team

Current design

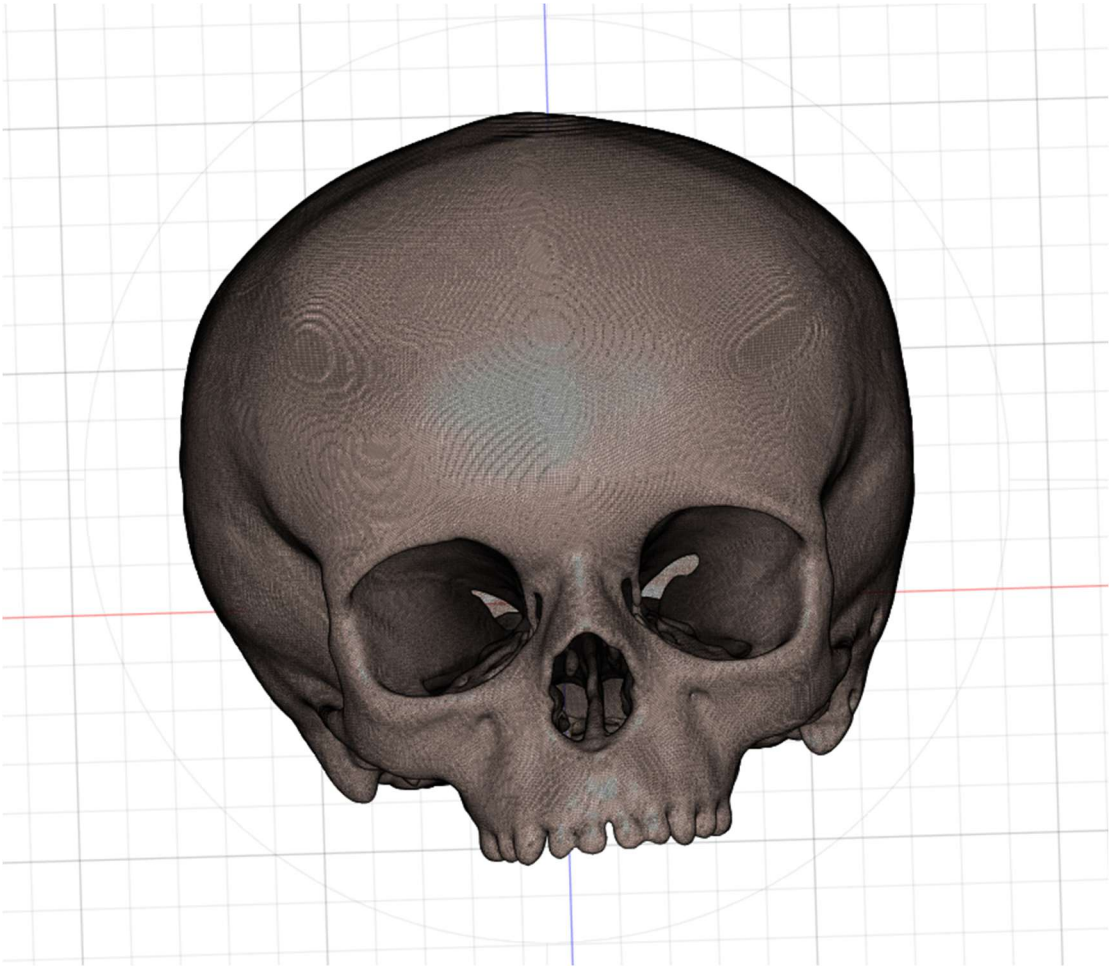

Figure 1: CAD model of pediatric skull created from CT scan

Materials and expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
3D prints										
Formlabs BioMed Clear Sample Swatch	Step wedge with thicknesses of 0.1, 0.2, and 0.3 inches for prelim presentation prop	UW Design and Innovation Lab	N/A	N/A	N/A	10/1	1	$7.14	$7.14	
Rectangular Box Phantom	Box to hold gel for potential displacement testing and poster presentation	UW Design and Innovation Lab	N/A	N/A	N/A	11/21	1	$3.16	$3.16	
Half Scale Skull Phantom	50% scale skull phantom for poster presentation demonstration	UW Design and Innovation	N/A	N/A	N/A	11/24		$1.66	$1.66	
Hydrogel Materials										
Agar Powder, 500g	500g of agar powder for initial brain phantom fabrication	Thermo Fisher Scientific	A10752.36	Thermo Fisher Scientific	A10752.36	10/20	1	$128.65	$149.15	https://www.thermofisher.com/order/catalog/product/A10752.36
Gelatin Type A, 100g	100g of Type A gelatin powder from porcine skin for brain phantom fabrication	Millipore Sigma	9000-70-8	Sigma Aldrich	G1890	11/25	1	$53.40	$53.40	https://www.sigmaaldrich.com/US/en/product/sigma/g1890
								TOTAL:	**$214.51**	