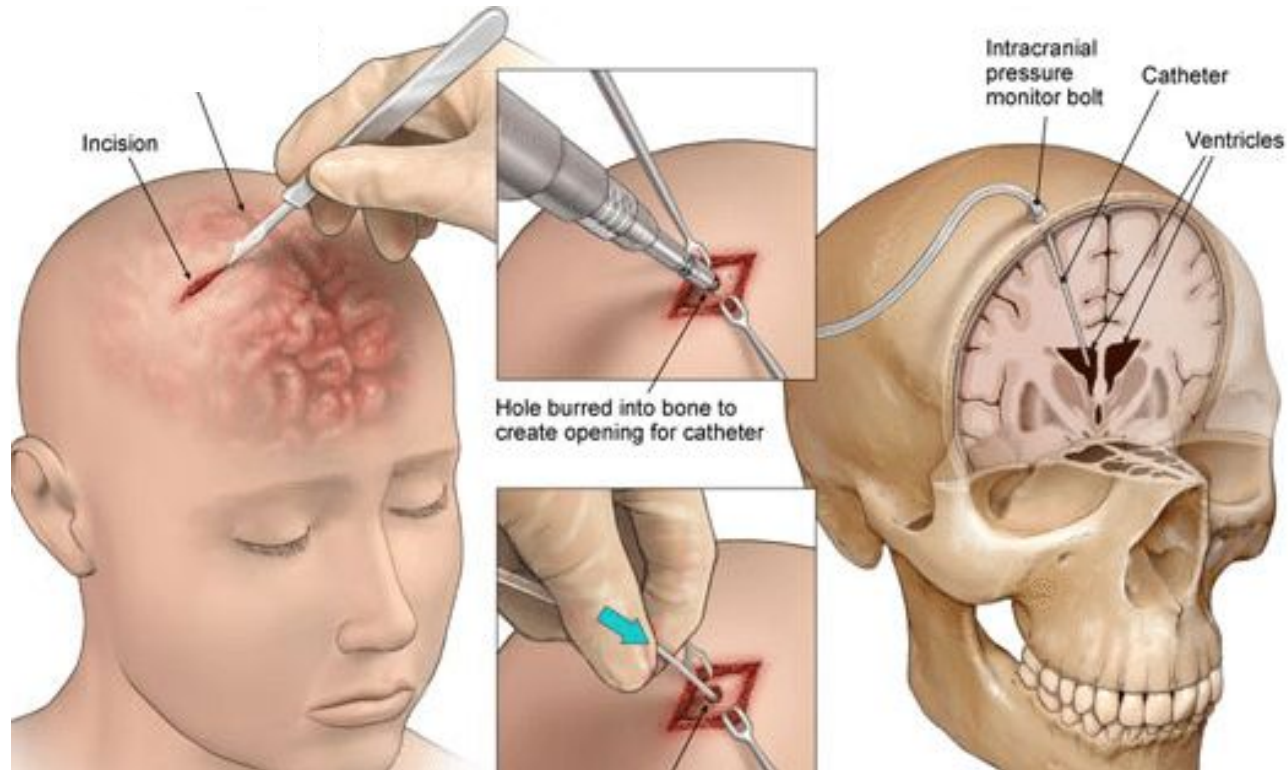# HMD-Based Navigation for Ventriculostomy Checkpoint Presentation

Maia Stiber
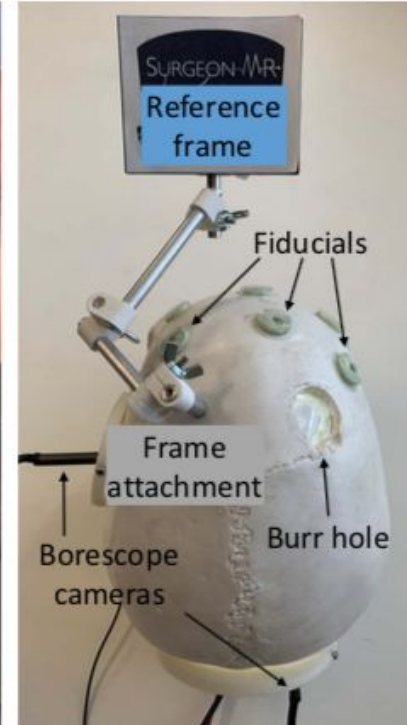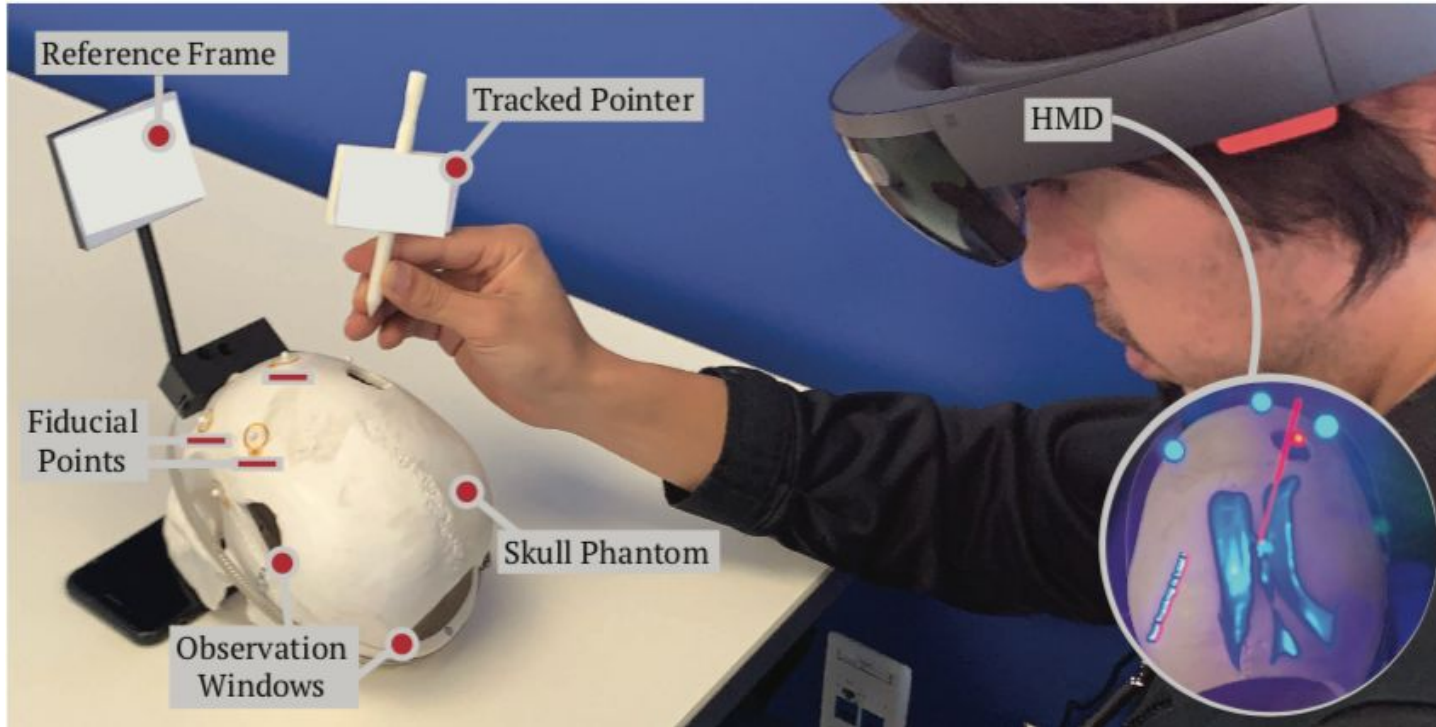
Mentors: Ehsan Azimi, Peter Kazanzides, Chien-Ming Huang, Dr. Judy Huang, and Dr. Camilo Molina

Summary: Ventriculostomy

Summary: Current HMD System Approach

Deliverables

Minimum:	● User Study Results ● MICCAI 2020 paper	✓
Expected:	● Video Analysis Results	

Maximum	● Script to improve aid in depth perception
	    ○ Adaptive prompts based on wearer's behavior
	    ○ Improved visualizations	

Overall Schedule

Milestones

Milestone	Expected Date Done By	Status
User Study Conducted	**3/13/20**	**Completed**
• Questionnaire Created	2/21/20	Completed
• Video Tutorial Created	2/19/20	Completed
• IRB Approval	2/17/20	Completed
• Neurosurgeon Approval of User Study Questionnaire and Tutorial	2/24/20	Completed
• Pilot Study Conducted	2/29/20	Completed
• Actual User Study Conducted	3/13/20	Completed
Data Analysis of the User Study	**3/20/20**	**Completed**
• Accuracy	3/20/20	Completed
• SUS/NASA TLX scales analyzed	3/20/20	Completed
Reading Preliminary Papers	**3/17/20**	**Completed**
Video Analysis	**4/15/20**	**In Progress**
• Video Coding	4/10/20	In Progress
• Statistical Analysis of the coded video	4/15/20	Not Started
Improved Visualization and Prompt Script for AR-Guided Ventriculostomy	**4/30/20**	**In Progress**
• Edited of guide line to improve depth perception	4/15/20	Not Started
• Determination of whether the user has moved his head	4/22/20	Not Started
• Create script that provides prompt when user hasn't moved head	4/30/20	Not Started
Report	**5/5/20**	**Not Started**

Dependencies (Part 1)

Dependency	Contact	Solution	Alternative Plan	Completed?
Hololens	Peter Kazanzides	Lab has one	Computer Webcam	✓
Computer	N/A	Lab Computer	My laptop	✓
Catheter	Ehsan A	Get one from Ehsan	Buy a catheter	✓
Cameras	N/A	Camcorder from Lab	Iphone camera	✓
Skull Phantom	Ehsan A	Get the one built in lab	N/A	✓
Neurosurgeon Availability	Dr. Judy Huang	Contact Dr. Judy Huang. She will do scheduling	Use people from the local community	✓
Data/Code Backup		Github	External HD	✓

Dependencies (Part 2)

Dependency	Contact	Solution	Backup	Completed?
SD Card Reader	N/A	My laptop's SD card reader	USB SD card reader	✓
IRB	PI: Peter Kazanzides	Get added to the IRB	N/A	✓
Doctored CT Images	Ruby Liu	CT scan of skull, doctored so that the balls in phantom are vesicle.	N/A	✓

Management

- Meet with Chien-Ming Huang Monday 2-2:30
- Meet with all of my mentors biweekly Wednesday 4-5
- Otherwise, contact using Slack/Email

Checkpoint / Results

User Study: Overview

- Within-subject study (with and without AR guidance)
- 3 targets
- 10 participants
  - Age (M = 25.44, SD = 5.11)
  - All Medical or Engineering backgrounds
  - Somewhat familiar with MR devices (M = 2.7, SD = 0.82 on a 5-point scale)
- Note: One of the participants consisted of Neurosurgeon
- Statistical Model: Analysis of variance (ANOVA)
  - Fixed effect: condition (baseline or mixed reality)
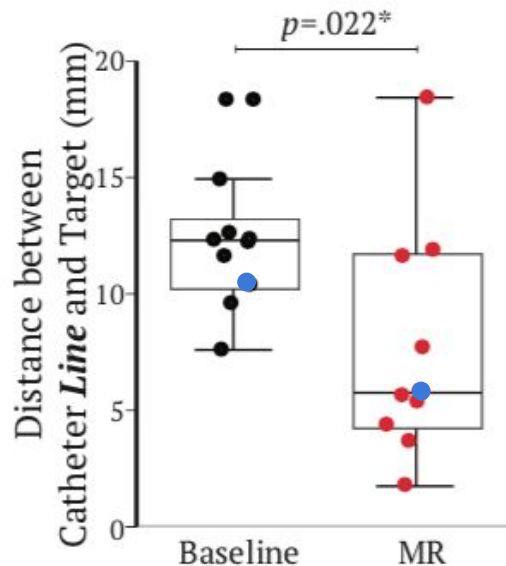 - Random effect: participants

User Study: Task Accuracy

- Distance between catheter **tip** and target
- Distance between catheter **line** and target
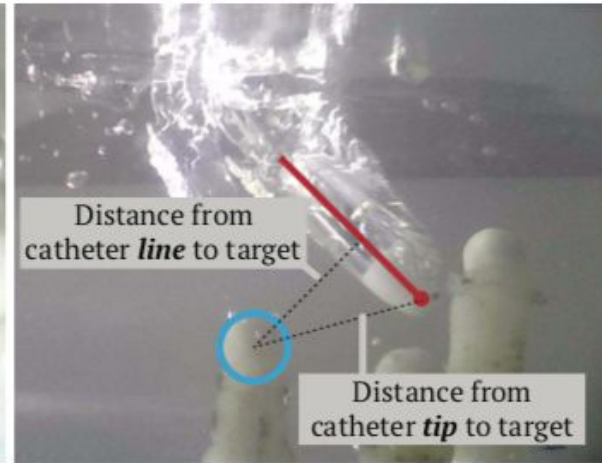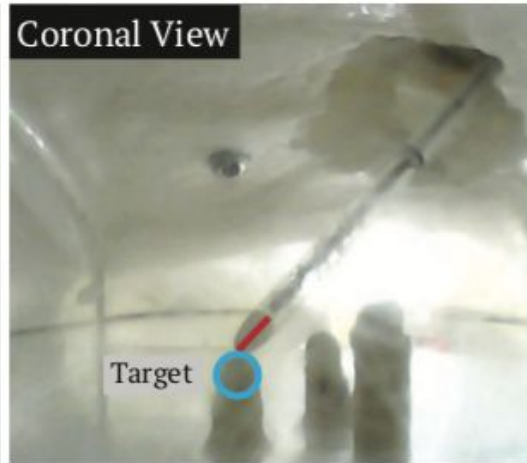
User Study: Task Accuracy (Line)

- Significant improvement from Baseline to MR
  - $F_{(1, 18)} = 6.24$, $p = .022$
- Average MR Distance: 7.63mm
  - Neurosurgeon Average: 7.7mm
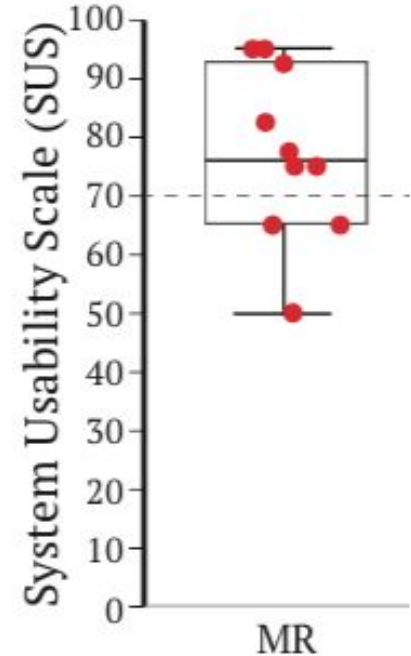- Average Baseline Distance: 12.21mm
  - Neurosurgeon Average: 10.4mm

User Study: Task Accuracy (Tip)

- Marginal improvement from Baseline to MR
  - $F_{(1, 18)} = 4.14$, $p = .057$
- Average MR Distance: 10.96mm
  - Neurosurgeon Average: 9.37mm
- Average Baseline Distance: 16.93mm
  - Neurosurgeon Average: 13.3mm
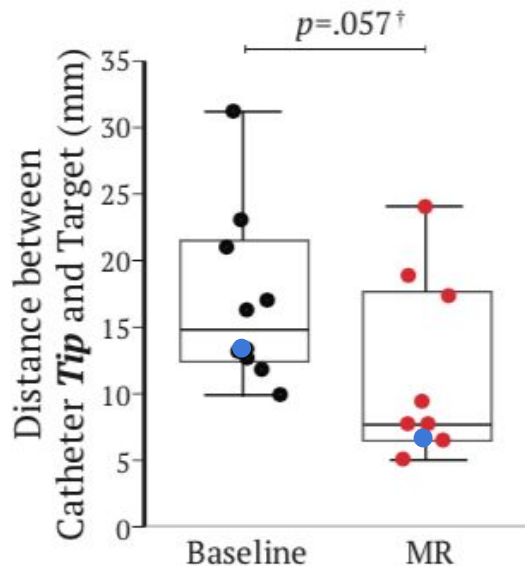
User Study: System Usability Scale

- MR system reasonably usable for performing procedure
  - M = 77.25, SD = 14.69
  - Suggested usability score of 70
  - Neurosurgeon Reponse: 75

User Study: NASA TLX