Findings and Future Work

**Findings:**
- Collected data from 48 participants, over 4 immersive conditions
- Traditional data measures (i.e. time, presence) do not show statistical significance between conditions
- Preliminary analysis shows differences in fNIRS signal, depending on difficulty level and immersive cues. The response varies by fNIRS channel location.

**Future Work:**
- Deeper analysis on the spatial activation patterns
- Combine brain activity with other measures to distinguish interaction-related workload from task-related workload
- Establish best practices for using fNIRS to deeply investigate user experience with novel input devices

**Testing Conditions**

<table>
<thead>
<tr>
<th>Immersive Cues</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereo vision</td>
<td>✔</td>
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<tr>
<td>Haptic feedback</td>
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<td>6-DOF Stylus</td>
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</tbody>
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**Methodology**

- **zSpace:**
  - Head tracking with 3D glasses
  - Stereoscopic Vision
  - 6 Degrees of Freedom
  - Haptic feedback

- **Functional Near-Infrared Spectroscopy (fNIRS):**
  - Non-invasive method of measuring brain activity
  - Proven useful as a new method of evaluation in HCI settings
  - 10 sensors and two detectors collect data based on hemoglobin levels

- **Testing zPuzzle with fNIRS:**
  - Measurements taken of user’s head
  - Baseline brain activity is established with fNIRS
  - zPuzzle conditions are assigned and completed
  - Post-task survey administered with NASA-TLX and MEC-SPQ
  - Paper and pencil tests examine spatial reasoning skills