Polytrauma is a serious health condition that arises following traumatic events. Research into new technologies for diagnosing polytrauma is essential to improving health outcomes for patients. Technology development in this domain would be aided by better research tools that allow for simultaneous analysis of traditional evaluations and novel biosignals. There are currently no analysis pipelines designed for polytrauma-specific research. Based on previous research and models, we developed a web application designed specifically for speech and neural data analysis relating to polytrauma research. It allows users to make a secure account, store and analyze study data and results. The user study showed that there was a favorable response to our system, and inspired ideas for future improvement to support a variety of users.

**Polytrauma**

**Definition:** The development of various mental and physical ailments due to a traumatic event.

**Comorbidities:**
- Post Traumatic Stress Disorder
- Major Depressive Disorder
- Generalised Anxiety Disorder
- Chronic Pain
- Postconcussive Syndrome

**Diagnosis:**
Psychiatric evaluations & Objective biosignal analysis

**Need:** Continuous, low-cost monitoring of patient progress.

**Goal:** Develop a web-based pipeline that allows for the simultaneous analysis of biosignals and psychiatric evaluations to facilitate multifaceted polytrauma research.

### User Testing

To assess BATS, our team decided to conduct a user study that simulates ways in which a user would use the application to determine the usability and effectiveness of our system for a wide variety of potential users.

The user testing followed three scenarios that tested BATS’ important features:
- **Scenario 1:** Creating an account, creating a study, and uploading the data provided.
- **Scenario 2:** Graphing the data provided.
- **Scenario 3:** Analyzing the data with a specific analysis tool and downloading the results.

Seventeen individuals participated in our virtual user study.

### Results & Discussion

**Group Comparison:**

<table>
<thead>
<tr>
<th>User Metric Averages</th>
<th>Prototype Group</th>
<th>Final Group</th>
<th>Percentage Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Time Taken</td>
<td>12.4</td>
<td>10.9</td>
<td>13.9%</td>
</tr>
<tr>
<td>Total Negative score</td>
<td>40.3</td>
<td>31.5</td>
<td>27.5%</td>
</tr>
<tr>
<td>Filled Silences per min</td>
<td>5.57</td>
<td>3.93</td>
<td>41.7%</td>
</tr>
<tr>
<td>User Score (1=Bad-5=Best)</td>
<td>3.67</td>
<td>4.27</td>
<td>14.2%</td>
</tr>
</tbody>
</table>

We saw improvements in Final Group performance compared to Prototype Group. User score was nearly statistically significant: t(15)=-2.07 and p=0.057.

**Metric Analysis:** We investigated filled silences vs. total negative score, with results of r(8)=0.509 and p=0.0663. This indicates a positive association between the user pausing in speech (um, hm) and difficulty completing tasks.

- **Group comparison confirms that the changes to the system improved user friendliness.**
- **Comprehensive metric analysis suggests that BATS is easily operated and efficient.**

### Future Improvements

- **Ability to create a “biomarker”**
- **Ability to upload custom analysis tools written in Java, Python, or MATLAB**
- **Ability to revisit previous analysis results**
- **Ability to share studies and data between users**

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**BATS Flow Diagram**

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**Learn More**

To view our bibliography, learn more about the system, and watch BATS in action, please scan the QR code.