Vehicle Control and Driver Workload During Simulated Driving: Can Cue Substitution Compensate for Lower Simulator Feature Fidelity?

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Simulator Fidelity and Cue Substitution

**Visual Cues:** Wraparound screens and projectors

**Motion Cues:** 6-DoF Motion Platform

**Visual Cues:** Virtual Reality Headset

**Motion Cues:** Fixed-base
## Apparatus and Analysis

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Higher Fidelity Features</th>
<th>Lower Fidelity Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Display</td>
<td>Wraparound Screens + HD Projectors</td>
<td>Virtual Reality Headset</td>
</tr>
<tr>
<td>Vehicle Controls</td>
<td>Active force feedback wheel + pedals</td>
<td>Passive force feedback wheel + pedals</td>
</tr>
<tr>
<td>Motion Platform</td>
<td>Static/Fixed-base</td>
<td>6 DoF Dynamic</td>
</tr>
</tbody>
</table>

**Measures:** Lateral (SDLP) and longitudinal control (coefficient of variation)

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```
Start

Q1. Significant difference between high and low fidelity features?
    Yes  No  Done

Check for cue substitution

Q2. Does inclusion of a higher fidelity display or motion system reduce/eliminate the difference?
    Yes  No

Driver was able to substitute

Driver was not able to substitute
```
Results and Conclusions

Q1. Significant difference within subsystem?

- Only between the higher and lower fidelity vehicle controls

Q2. Did the inclusion of a higher fidelity display or motion system reduce/eliminate the difference?

- Some evidence that cues from the motion platform could compensate for lower fidelity steering wheel and pedal feedback

Conclusions

- Provides a method to quantify cue substitution
- Can cue substitution compensate for lower simulator feature fidelity?