User Experience with Semi-Natural Locomotion Techniques in Virtual Reality: The Case of the Virtuix Omni

Motivation
The benefits of real walking for locomotion in virtual reality (VR) have been well documented. Prior studies have shown that semi-natural VR locomotion techniques can produce an inferior user experience compared to both real walking and non-natural locomotion techniques, but it is not known whether all semi-natural VR locomotion interfaces suffer from the same problems.

Research Questions
1. How does the user experience (including speed, accuracy, spatial orientation, game experience, simulator sickness, presence, and user preference) with the semi-natural Virtuix Omni compare to a traditional non-natural VR locomotion interface?
2. Do these results support the uncanny valley hypothesis of McMahan et al.?
3. Compared to earlier semi-natural VR locomotion techniques, does the Omni provide higher interaction fidelity and correspondingly higher levels of user experience?

FIFA Analysis

<table>
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<tr>
<th>Game Controller</th>
<th>Virtuix Omni</th>
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<tr>
<td>Biomechanical Symmetry</td>
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<tr>
<td>Kinematic Symmetry</td>
<td>Move thumb to translate</td>
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<td>Kinetic Symmetry</td>
<td>Apply force in movement direction by thumb</td>
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<td>Anthropomorphic Symmetry</td>
<td>Thumbs</td>
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<td>Control Symmetry</td>
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<td>Dimensional Symmetry</td>
<td>x + y</td>
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<td>Transfer Function Symmetry</td>
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<td>Termination Symmetry</td>
<td>Stop tilting joystick</td>
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<td>System Appropriateness</td>
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<td>Input Accuracy</td>
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<td>Input Precision</td>
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<td>Latency</td>
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<tr>
<td>Form Factor</td>
<td>Handheld</td>
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<td>Use Fidelity</td>
<td>Handheld</td>
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Experiment
The experiment compared two different locomotion interfaces: the Virtuix Omni and a game controller technique. We used the tasks from an existing locomotion testbed. The testbed includes tasks emphasizing accuracy, speed, and spatial orientation, and uses a variety of measures to get a comprehensive view of locomotion user experience.

Research Questions

Key Findings

- Overall, we found few objective differences in task performance.
- Only the most difficult path following task resulted in significantly more deviation.
- The relationship between the level of interaction fidelity in a technique and its effectiveness is not a simple “more is better.”
- Our results suggest that newer semi-natural devices with increased fidelity have the potential to climb out of the uncanny valley.

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