Imperceptible manipulation of lateral camera motion for improved virtual reality applications

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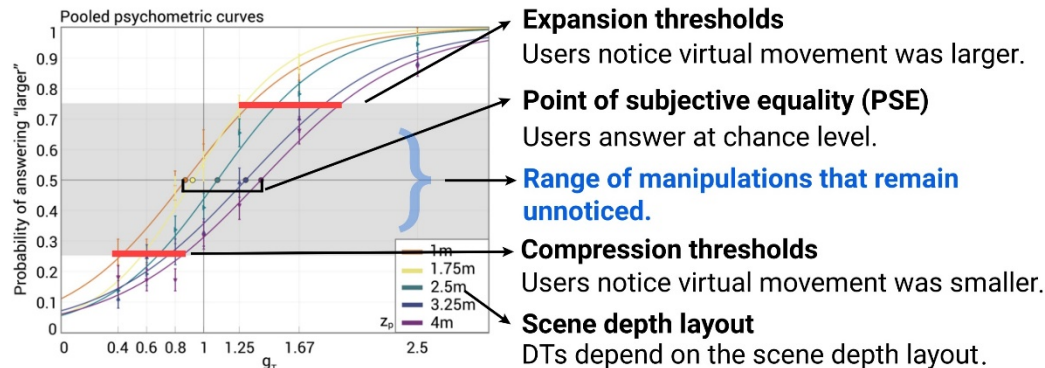[1] Universidad de Zaragoza, I3A   [2] Max Planck Institute for Informatics

Problem

- Many VR applications require that the user be seated or standing.
- Users only have head and upper body motion available.
- Lateral head translations are therefore very relevant.

We investigate manipulation of virtual camera motion to obtain detection thresholds for translation gains.

Psychophysical experiments and detection thresholds

Users are presented different stimuli and asked:
Was the virtual movement smaller or larger than the real movement?

With their answers, a psychometric curve is fitted:

Expansion thresholds
Users notice virtual movement was larger.

Point of subjective equality (PSE)
Users answer at chance level.

Range of manipulations that remain unnoticed.

Compression thresholds
Users notice virtual movement was smaller.

Scene depth layout
DTs depend on the scene depth layout.

Translation gains

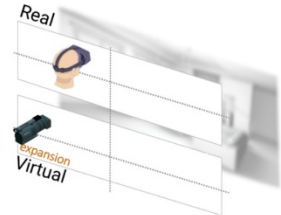The ratio between the virtual and the real movement:

Compression
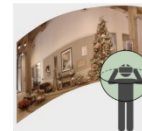Virtual camera moves less than users' head.
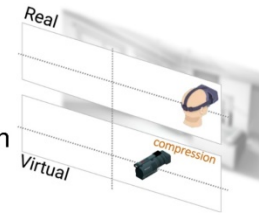
Expansion
Virtual camera moves more than users' head.

Applications

Improving visual quality of 6-DoF systems
We compress virtual movement to reduce the visibility of artifacts when users translate.

Overcoming physical space constraints
We expand virtual movement, so that the same virtual task can be completed in a smaller physical space.

Reducing motion sickness
We compress virtual movement to reduce compound movements between camera and users' head translations.

* Equal contribution