Egocentric Distance Estimation in Virtual Environments

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Motivation

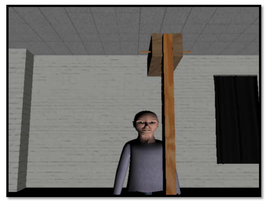
•Do distance estimates differ between real and virtual environments? The potential discrepancy between these estimates is important for various virtual-reality simulations (driving, flight etc.)

•The purpose of this project was to model and design a virtual environment that would imitate a real, tracked one. This will be used in an experiment that compares reaching distance estimations between virtual and real environments

Experimental Background

• In the experiment, subjects view a target once and then, while blindfolded, reach to it

•The range of possible target distances is a fraction of each subject's arm length



Maya Screenshot

Equipment

•Movements and reach positions are tracked using a Polhemus tracking system

Polhemus Trackers

VR1288 HMD

•The environment is viewed through a head-mounted display (HMD)

Methodology

Maya Models

•We used Maya to model the room and the objects to scale

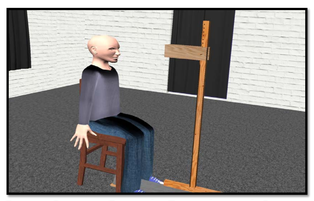
•These objects will be used during the actual experiment

OpenSceneGraph

•We used OSG to integrate the objects in the environment and to provide virtual reality functionality

•Lights were also placed in the scene through code

•OSG is a set of open source libraries and is used in visualization and simulation



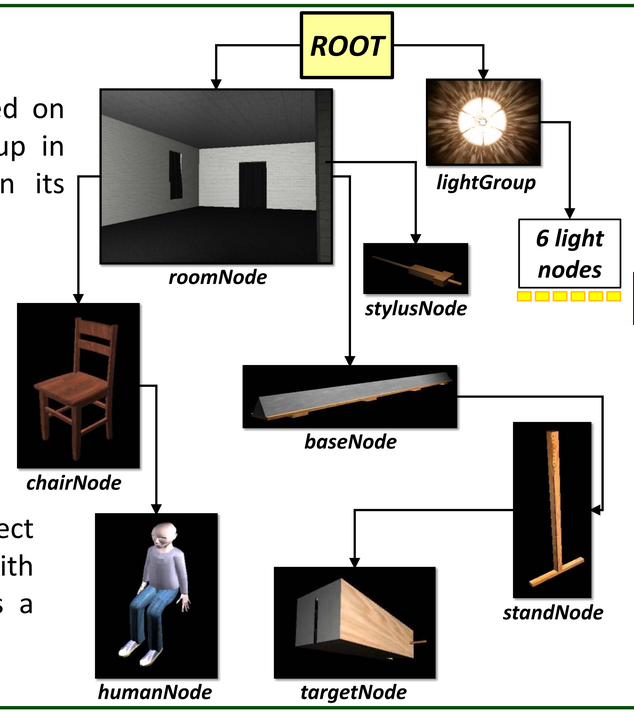
OpenSceneGraph Rendered Scene

Node Hierarchy

•A transformation applied on a parent node (higher up in tree) is also applied on its child nodes

• A transformation applied on a child node (further down in the tree) is applied only on that node and on its child nodes

•In our model, an object that needs to move with another object is set as a child of that parent node



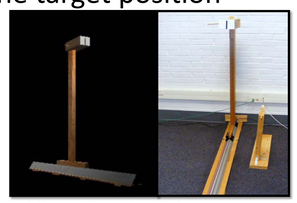
Interaction

• The HMD and tracking system were integrated into the code

•Participants move naturally, by walking in the real environment

•The target is moved by the experimenter to the subject's height by using keystrokes

•Keystrokes also register the hand-reach position of the subject and the target position



Virtual vs. Real Apparatus

Results and Contributions

•The experimental room was modeled, as well as a chair, a human avatar, and the measurement apparatus

•A computer application was created as the set-up for the experiment

•The head-mounted display is tracked and provides intuitive interaction with the environment

Virtual vs. Real Experimental Set-Up

•Precise movements of the stand are tracked and the position of the target is computed and logged, as well as the reaching distance estimates

Future Work

•The distance estimation experiment will be conducted at Clemson University during the fall semester, as a collaboration between the School of Computing and the Department of Psychology

•The experiment will alternate between the real and virtual environments, and the estimation results will be contrasted

•This set-up will also form the basis of other similar experiments

Acknowledgements

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References

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[2] Klein, E., Swan, J. E., Schmidt, G. S., Livingston, M. A., and Staadt, O. G. (2009). Measurement protocols for medium-field distance perception in large-screen immersive displays. In Proceedings of the Virtual Reality Conference (VR'09). 107—113.