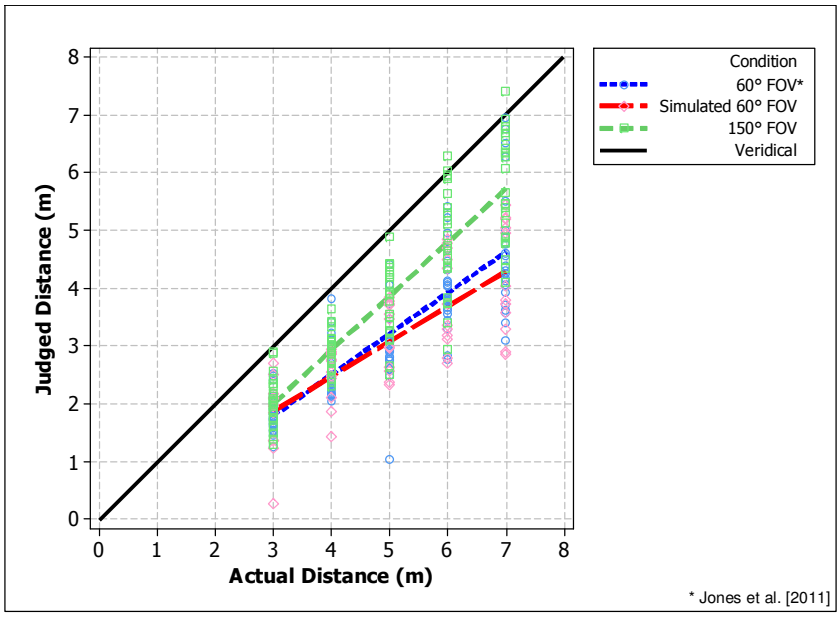
Comparability of Narrow and Wide Field-Of-View Head-Mounted Displays for Medium-Field Distance Judgments. Symposium in Applied Perception, p. 119, 2012.

Comparability of Narrow and Wide Field-Of-View Head-Mounted Displays for Medium-Field Distance Judgments

J. Adam Jones[*] Evan A. Suma[*] David M. Krum[*] Mark Bolas[*†]
[*]Institute for Creative Technologies [†]School of Cinematic Arts
University of Southern California



ABSTRACT

As wider field-of-view displays become more common, the question arises as to whether or not data collected on these displays are comparable to those collected with smaller field-of-view displays. This document describes a pilot study that aimed to address these concerns by comparing medium-field distance judgments in a 60° FOV display, a 150° FOV display, and a simulated 60° FOV within the 150° FOV display. The results indicate that participants performed similarly in both the actual and simulated 60° FOV displays. On average, participants in the 150° FOV display improved distance judgments by 13% over the 60° FOV displays.

Comparability of Narrow and Wide Field-Of-View Head-Mounted Displays for Medium-Field Distance Judgments

J. Adam Jones* Evan A. Suma* David M. Krum* Mark Bolas*†
*Institute for Creative Technologies †School of Cinematic Arts
University of Southern California

ABSTRACT

As wider field-of-view displays become more common, the question arises as to whether or not data collected on these displays are comparable to those collected with smaller field-of-view displays. This document describes a pilot study that aimed to address these concerns by comparing medium-field distance judgments in a 60° FOV display, a 150° FOV display, and a simulated 60° FOV within the 150° FOV display. The results indicate that participants performed similarly in both the actual and simulated 60° FOV displays. On average, participants in the 150° FOV display improved distance judgments by 13% over the 60° FOV displays.

1 INTRODUCTION

Wide fields-of-view are becoming a more common feature in immersive, head-mounted displays. This is generally seen as a positive move as displays are now beginning to approach the natural field-of-view of their users. However, decades of research have been conducted in smaller field-of-view displays. It is important to establish whether or not the results of studies using differing field-of-view displays are indeed cross-comparable. Another important question is whether or not previous studies using small fields-of-view can be duplicated with larger field-of-view displays.

2 EXPERIMENT

This pilot study examined the egocentric distance judgments of 12 participants using a Fakespace Wide5 head-mounted display. This display has a diagonal field-of-view of 150°. Participants viewed one of two conditions: a simulated 60° diagonal field-of-view or the full 150° diagonal field-of-view. To simulate a 60° diagonal field-of-view, only the 48°×40° center of the display area was utilized with the remaining space left black. These dimensions were used to match the horizontal, vertical, and diagonal fields-of-view of the NVIS nVisor ST60 used in Jones et al. [2011], which served as a point of comparison for this study.

2.1 METHOD

A group of 12 participants were recruited from the USC Institute for Creative Technologies. Four participants experienced the *Simulated 60° FOV* condition, while eight participants experienced the *150° FOV* condition. For all conditions, participants judged distances using visually directed walking. This study was intended to otherwise replicate the procedures described in Jones et al. [2011] for the Fully Occluded VR condition. Participants judged distances to objects along the ground plane ranging from 3 to 7 meters at 1 meter increments. Distance order was randomly shuffled with the restriction that a given distance could not be presented twice in direct succession.

3 RESULTS

Participants' distance judgments in the *Simulated 60° FOV* condition did not significantly differ from those of eight participants using an actual 60° FOV display in Jones et al. [2011] ($F(1, 10) = 0.018$, $p = 0.897$). On average, participants in the *Simulated 60° FOV* condition underestimated distances by 37%. Additionally, these participants did not exhibit any change in performance as an effect of time ($F(2, 6) = 1.206$, $p = 0.363$). These results very closely match those described in Jones et al. [2011].

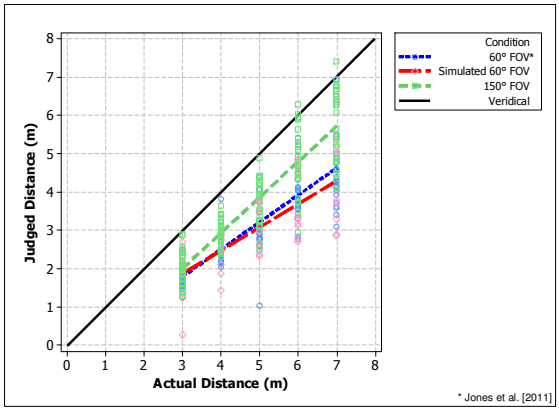


Figure 1: Distance judgments in the *150° FOV* and *Simulated 60° FOV* conditions and in an actual *60° FOV*.

However, participants in the *150° FOV* condition demonstrated significantly improved distance judgments over those who viewed an actual 60° FOV in Jones et al. [2011] ($F(1, 14) = 6.085$, $p = 0.027$). On average, participants in the *150° FOV* condition underestimated distances by 24%. As in Jones et al. [2011], participants in the *150° FOV* condition did not exhibit any significant change in performance as a function of time ($F(2, 14) = 0.144$, $p = 0.867$).

These results, seen in Figure 1, indicate that comparable results can be achieved between actual and simulated 60° fields-of-view. However, distance judgments in the larger field-of-view condition were significantly more accurate than those seen in either the actual or simulated 60° displays. These results are not entirely unexpected as Wu et al. [2004] demonstrated improved distance judgments in the real-world as field-of-view increased. However, a similar study by Knapp and Loomis [2004] saw no effect of field-of-view on distance judgments.

REFERENCES

JONES, J.A., SWAN II, J.E., SINGH, G., AND ELLIS, S.R. 2011. Peripheral Visual Information and Its Effect on Distance Judgments in Virtual and Augmented Environments. *Proceedings of the Symposium on Applied Perception in Graphics and Visualization*, 29-35.

WU, B., OOI, T.L., AND HE, Z.J. 2004. Perceiving Distance Accurately by a Directional Process of Integrating Ground Information, *Nature*, 428 (Mar.), 73-77.

KNAPP, J.M., AND LOOMIS, J.M. 2004. Limited Field of View of Head-Mounted Displays is Not the Cause of Distance Underestimation in Virtual Environments, *Presence*, 13, 5. 572-577.

*{jajones, suma, krum, bolas}@ict.usc.edu

SAP 2012, Los Angeles, CA, August 3 – 4, 2012.
ISBN 978-1-4503-1431-2/12/0008 $15.00