KEYNOTE TALK

ISVC 2018: International Symposium on Visual Computing
Las Vegas, NV, USA

Wednesday, November 21, 2018 at 9:00am

Interaction in Multi-Scale Environments on Virtual Reality Systems

Zachary Wartell
University of North Carolina at Charlotte

Abstract

The terms “scale”, “zoom” and “multi-scale” have subtly but significantly different definitions across zoomable 2D user interfaces (UI) and 3D user interfaces. Further, 3D UI’s can execute on Window-Icon-Menu-Pointer desktop systems or execute on systems using a combination of **v**isually **c**oupled display (typically implemented via head-tracking), true **3D** display (typically implemented via binocular stereoscopy), and/or 6 degree-of-freedom (6DOF) **d**irect **m**anipulation. (The abbreviation *VC-3D-DM* distinguishes such systems). For simplicity, define a virtual reality (VR) 3D UI as an UI on a system with one or more of the VC-3D-DM properties and define a non-VR 3D UI as UI on a system lacking all VC-3D-DM properties. Perceptual differences between 2D zoomable UIs, and VR and non-VR 3D UIs complicate transferring concepts and theory as well as porting interaction techniques between these systems. This is particularly important in *multi-scale* virtual environments, which have geometric details at multiple orders of magnitude in size all of which are relevant to the application. Zoom view maneuvers are fundamental to such environments. I will briefly present preliminary results from two geometric theorems regarding the “perspective equivalence*”* of the two most common types of zooms in 3D UIs: “scale” zooms and “translation” zooms (called *dollying* in cinematography). I will briefly discuss how these theoretical results relate to well-known empirical experience that shows that VR 3D UIs for multi-scale environments require treating scale as a separate 7th DOF within the view model. Finally, I will present experimental evaluations of several ways to semi-automate the adjustment of this 7th DOF during travel in multi-scale VEs in two VR display systems.

Speaker Bio-Sketch: Zachary Wartell is an Associate Professor in the Department of Computer Science in the College of Computing and Informatics at the University of North Carolina at Charlotte (UNC Charlotte). He is the Co-Director of The Charlotte Visualization Center. Dr. Wartell received his Ph.D. from the College of Computing at the Georgia Institute of Technology in 2001. He worked for several years at the Human Interface Technology Center at NCR. He joined UNC Charlotte in 2005. Dr. Wartell’s research interests include 3D visualization and 3D graphics and advanced user interfaces including virtual and mixed reality interfaces and multi-touch displays. A common thread through his research has been 2D and 3D geo-spatial interactive visualizations and stereoscopic display systems. His recent collaborative projects have broadened to visual analytics in particular for power distribution systems. Dr. Wartell has served the IEEE VR conferences in various capacities including Local Arrangements co-Chair in 2007 and General co-Chair in 2016. His work has been

published in IEEE 3DUI, IEEE VR, ACM SUI and IEEE TVCG. His research has been funded by research grants and contracts from NSF, ARO and DHS and various state agencies.