



UniCAVE: A Unity3D Plugin for Non-Head Mounted Immersive Display Environments

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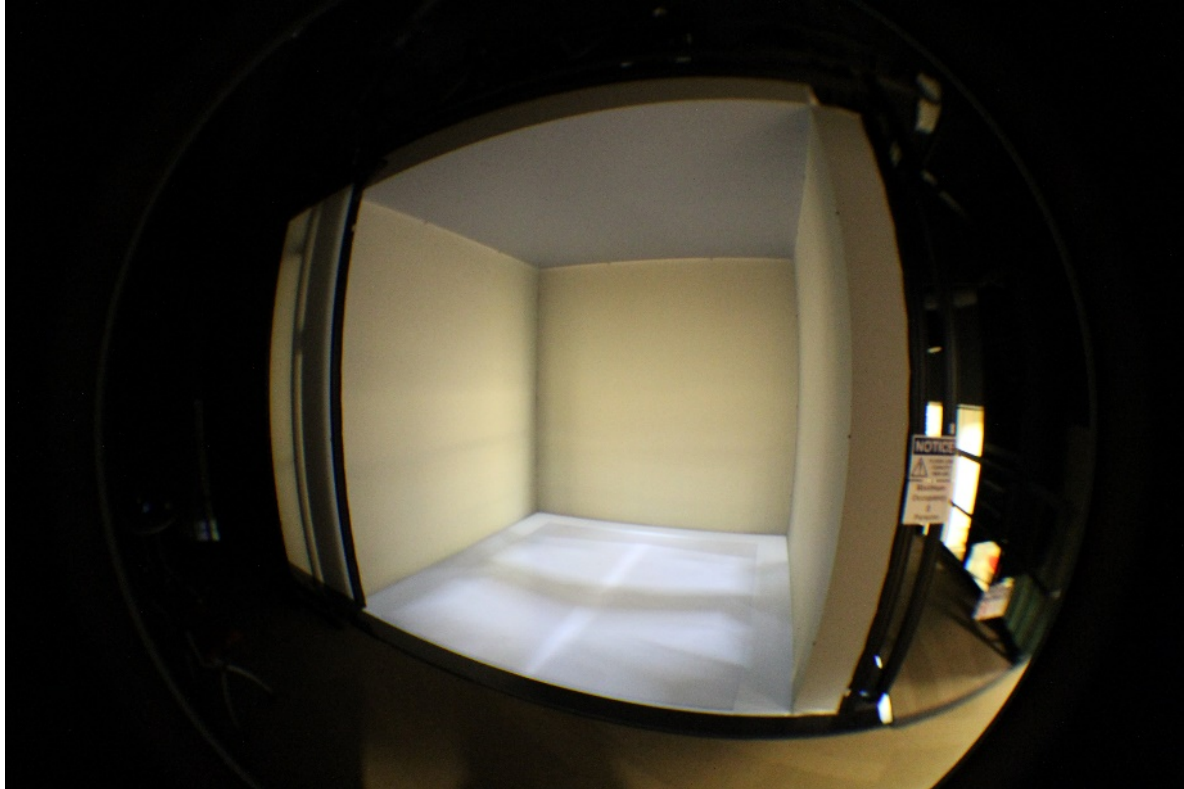
CAAV 2017

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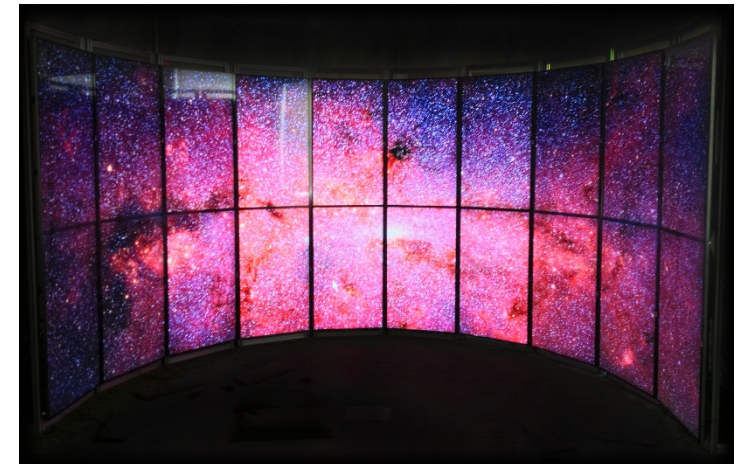
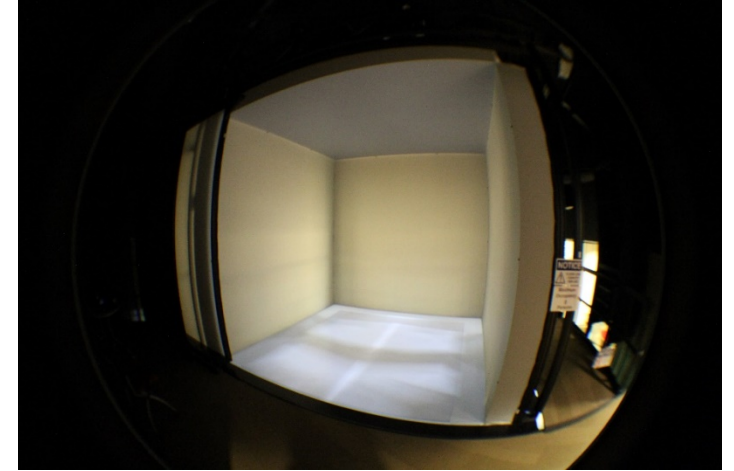


Display Systems



Motivation

- Build the same Unity scene across:



etc...

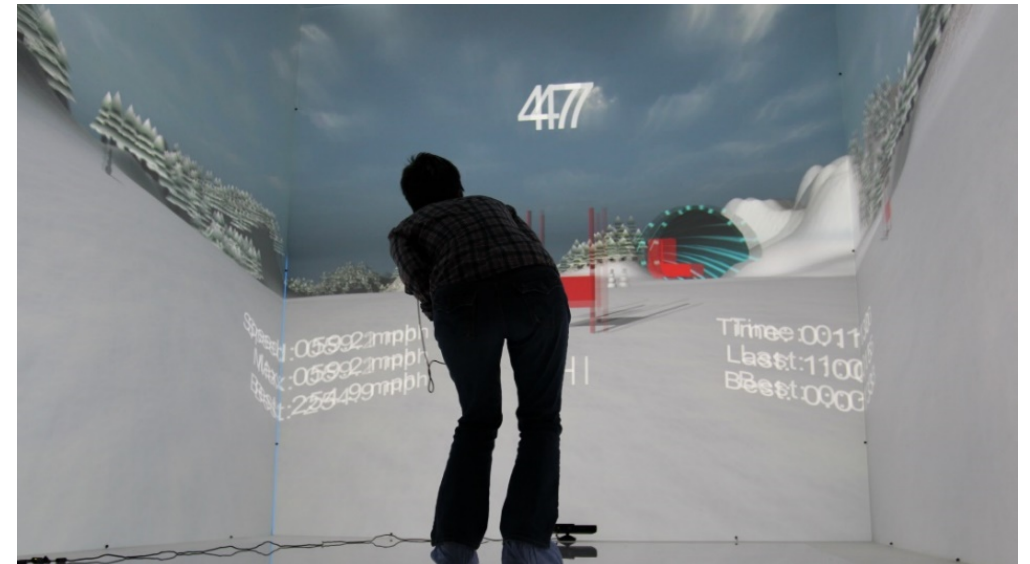


Motivation



Project History

- First crack began 2014
- First Project – internally developed, myself, faculty member, and undergraduate students
- Piggy backed on an internally developed middle ware to distribute MVP matrices all calculated on head node to display nodes
- OpenGL DLL Hack for Stereo Viewing
 - <https://github.com/dtrebilco/glinterscept>
- Positives: It pretty much worked
- Negatives:
 - Not simple
 - Not easily extendible to other systems
 - Not well built into Unity



UniCAVE Motivation

- The goal is to build a solution that:
- Is simple and easy to use
- Utilizes features built into the Unity game engine as opposed to using external tools
- Is open source and available for other research groups to freely use and modify
- “Collaboration is Key”
- Note: Not meant to be nor compete with a “turn key solution”
 - Having a “technical” person to work on this will probably help.



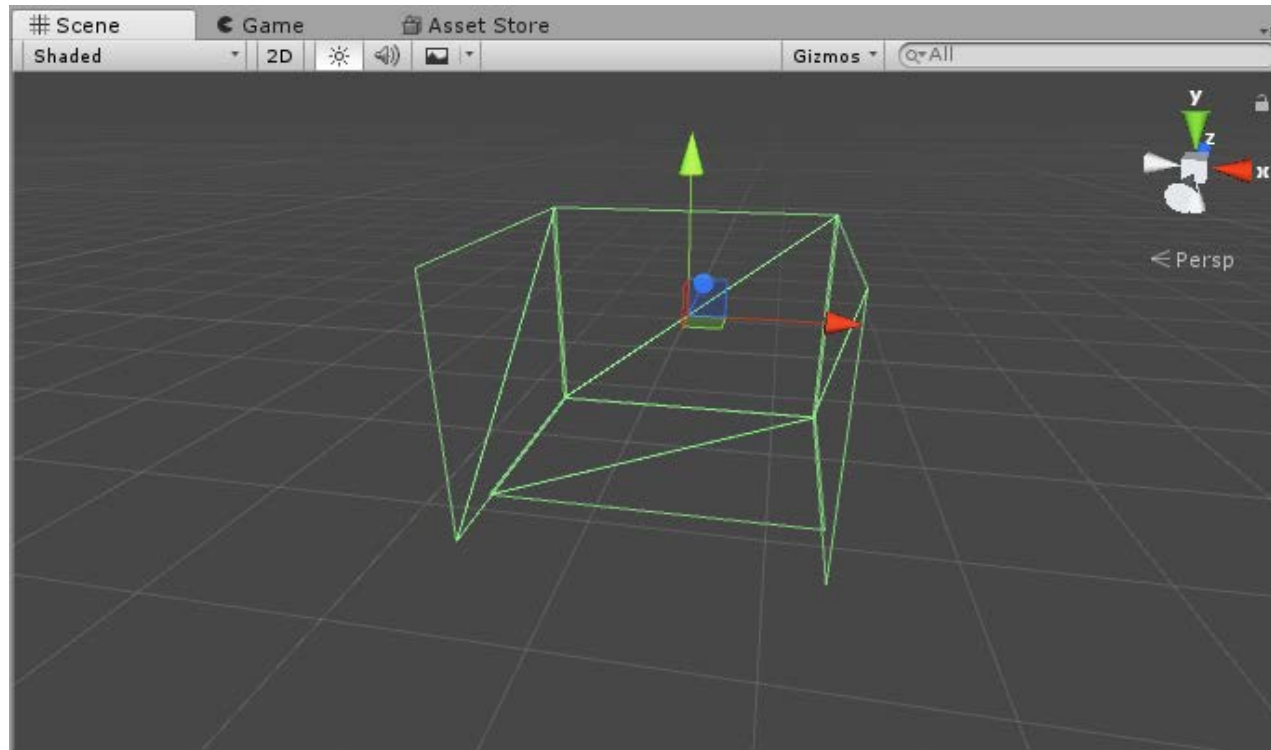
UniCAVE

- UniCAVE - builds upon knowledge from first project, but mostly a re-write.
- Basic input, 6-dof tracking (VRPN), and navigation
- Setup directly in Unity
- Supports different stereo types (sequential, side-by-side, top-down, dual-pipe)
- Cluster support
- Basic Kinect support
- Physics
- Node synchronization



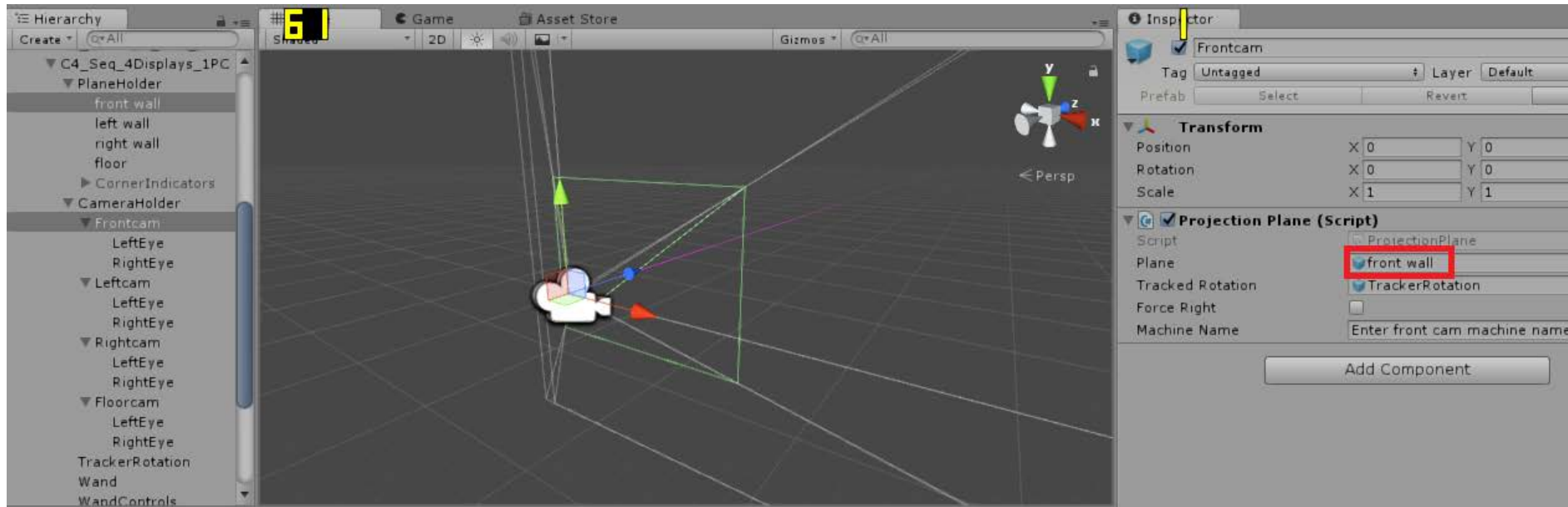
UniCAVE – Making a Display Prefab

- Create Unity Game Objects with quad meshes that match the size of your display system's physical surfaces
 - Example – 4 sided CAVE
 - Orient quads so normal vectors face “out” – (blue arrow facing away from center of space in Unity)



UniCAVE – Making a Display Prefab

- Create Camera objects, one or two for each surface (mono or stereo) – one parent object for each set of cameras
 - Example – 4 sided CAVE
 - All parent camera objects – identity transform
 - All child cameras – set IPD (x value of position typically)
 - Drag n Drop quad object onto parent camera's Projection Plane script



UniCAVE – Making a Display Prefab

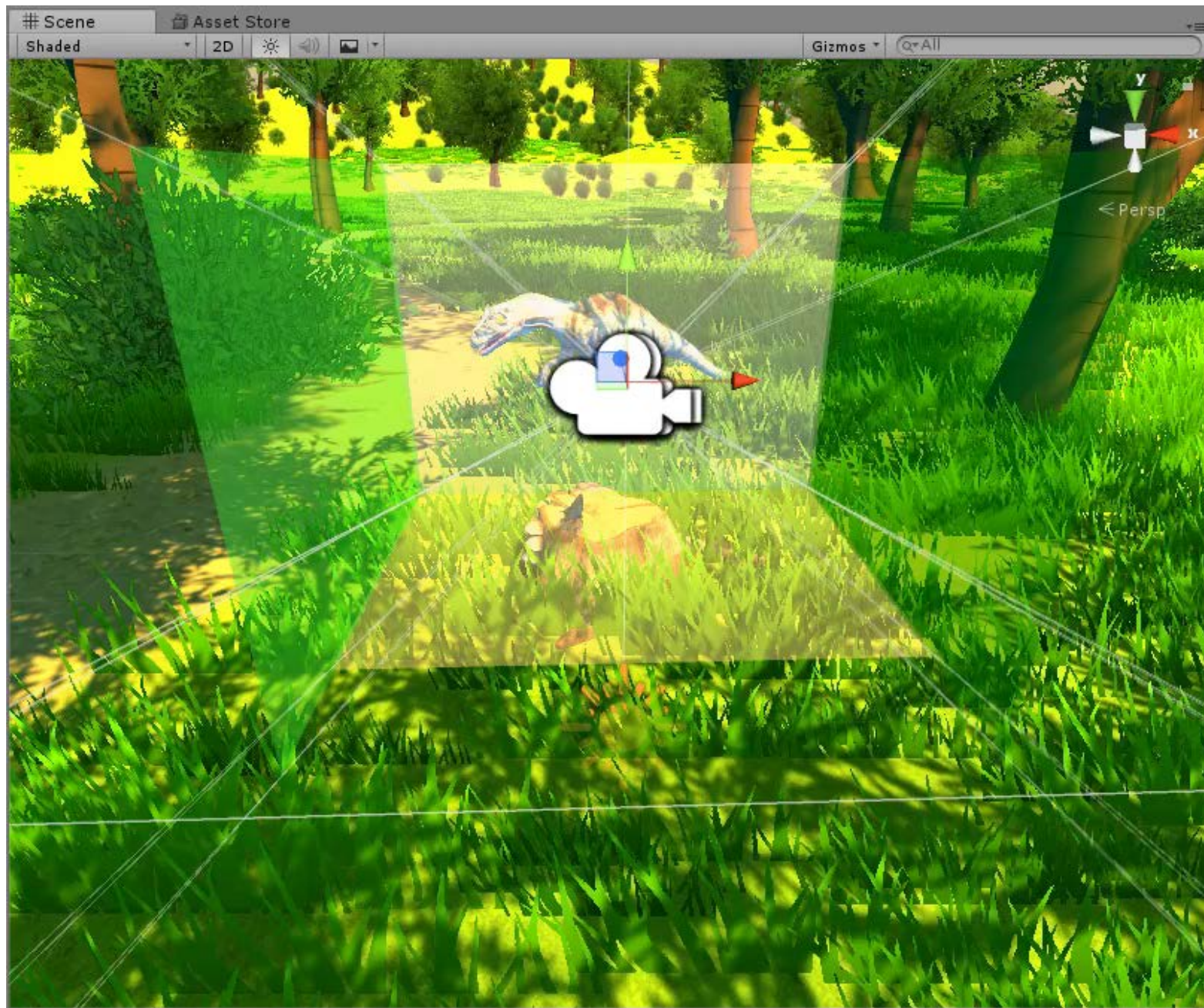
- Displays:
 - Camera Properties: Viewports, Target Display – dependent on Windows Desktop Setup, OpenGL vs. DirectX
 - “Multiple Display” checkbox – activates additional displays in Unity
 - DirectX only – needed if single node has multiple displays.
- Stereo: Steps depend on your particular 3D setup
 - Sequential – “Virtual Reality Supported” - Stereo Non-Head Mounted
 - Windows 8.1, DirectX
 - OpenGL – glIntercept still needed
 - Top/Bottom, Side by Side, Dual Pipe – VR Supported not required



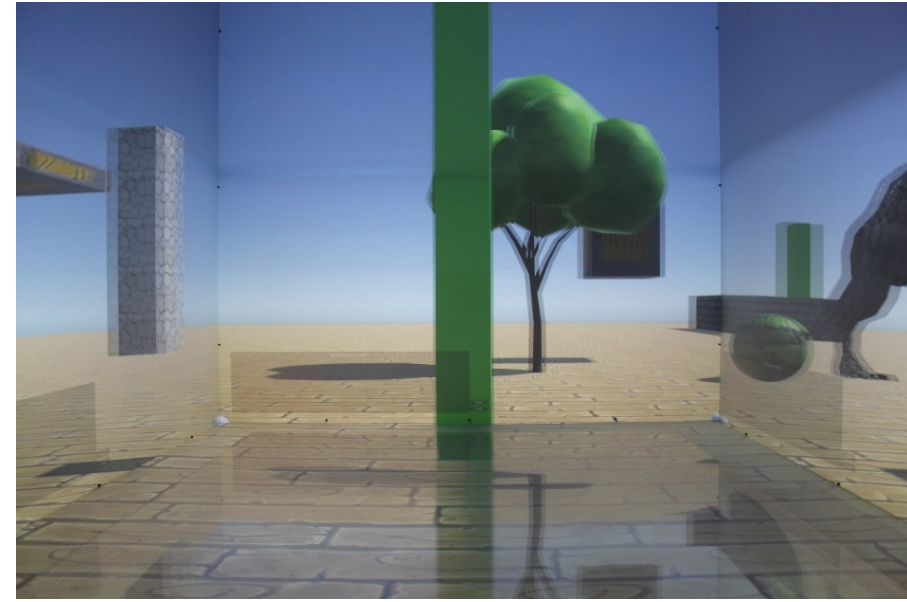
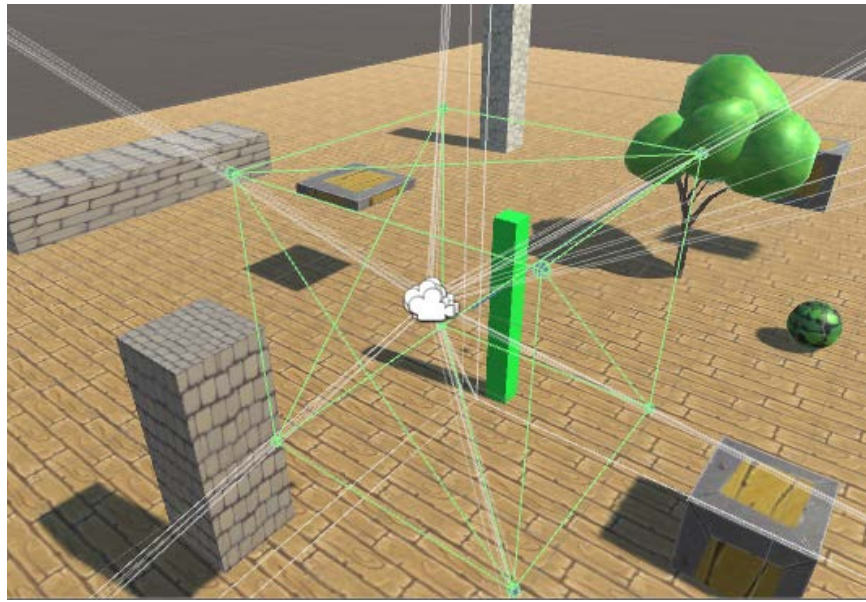
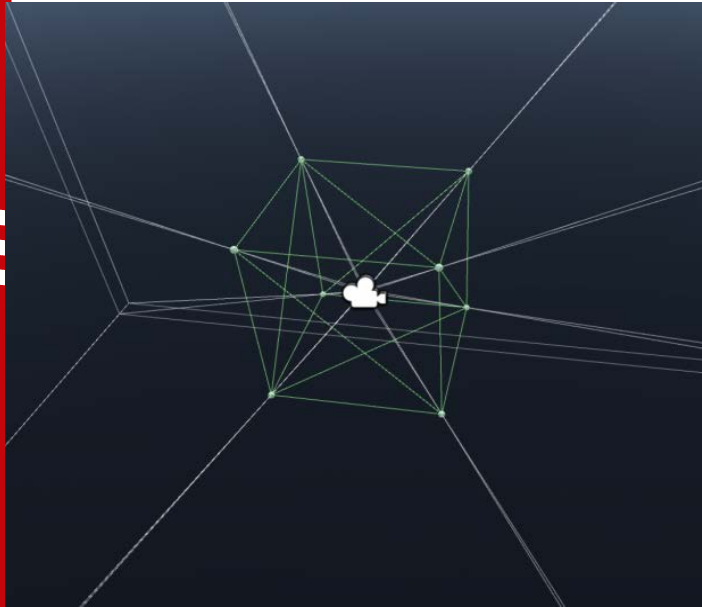
UniCAVE – Making a Display Prefab

- VRPN support
 - Via separate OpenSource Unity VRPN plugin
 - Fill in relevant info in “VRPN Track” and “VRPN Input” scripts
- Fill in Machine names on “Master Tracking Data” and “Projection Plane” scripts
 - Most common user error so far...
- If using a cluster – fill in items on “Networking Sync” script
 - Port
 - Head Node IP
 - Send Rate
 - Network view components handle transmission of shared data
- More documentation and walkthroughs at:
 - <https://unicave.discovery.wisc.edu/>

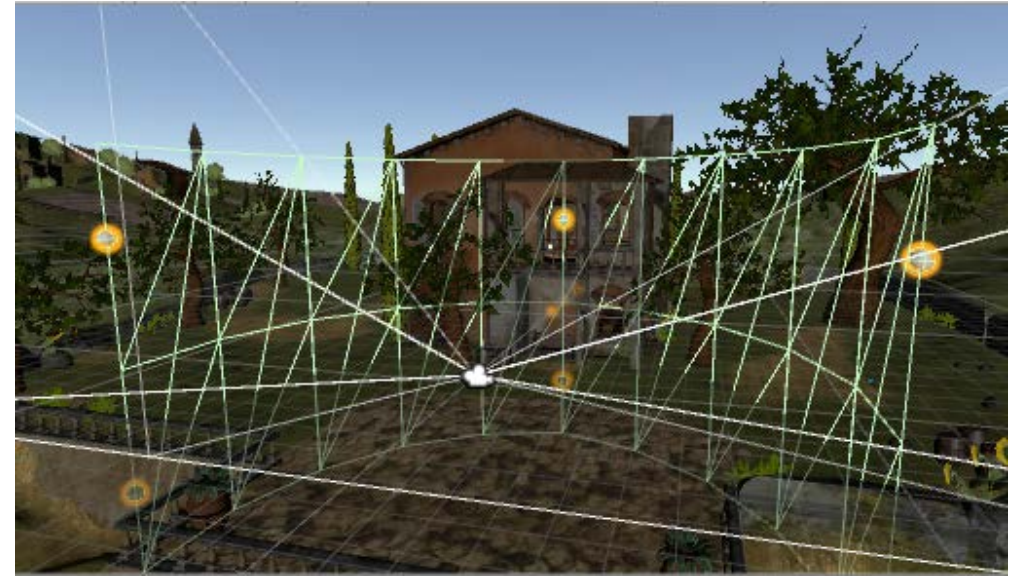
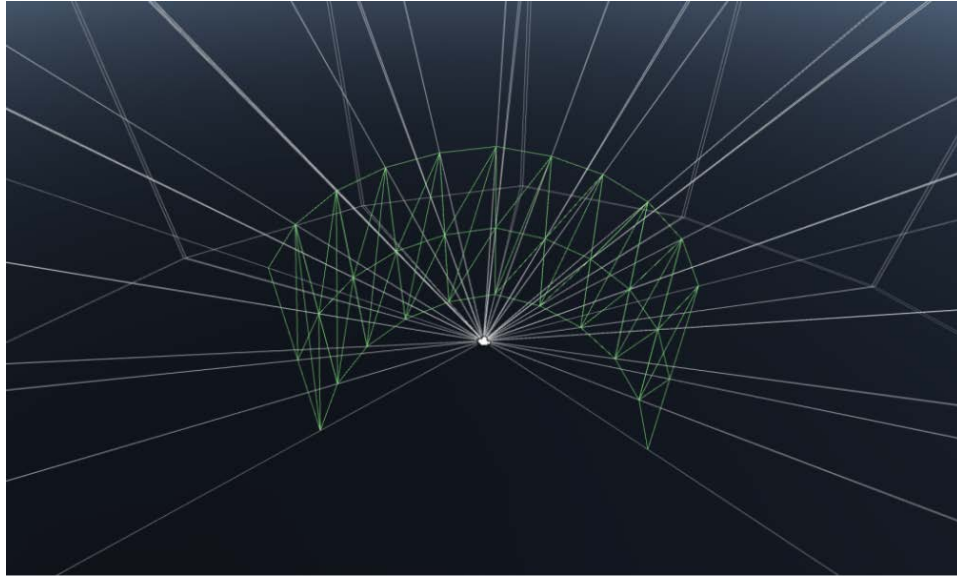




UniCAVE Examples



UniCAVE Examples



Known Partners / Users



Known Limitations

- Clustered input - improving
- Existing knowledge of Unity3D editing environment & prefab system helps.
- Can't change where an exe runs without a rebuild
- NetworkViews = Deprecated
- Manual adjustment of scene-specific scripts often still needed
- First crack at anything “Open Source”...
- Untested on Mac – does anyone run Mac?
- 2017 – multi GPU bug
- No Launcher



Future Directions

- More streamlining of the setup
- More input device support
 - Oculus Touch controllers?
- In search of more partners for development!
 - And more systems to test on!
 - Not grant funded – “5% time”
 - Open Source Sponsorship?
- Unity Asset Store?
- Real-time editing?
- Let's make a logo!
- Build your own display system prefabs and add them to the project!



Other Lab Projects

- Point Cloud (LiDAR) projects
 - vizHOME (AHRQ)
 - Crime Scene Investigation (DOJ)
 - Cultural Heritage Museum Exhibit (Local Charitable Trust)
- IceCube touch table + HMD informal learning (Unity) (NSF)
- Virtual Brain project (Psychology Department)
 - Uses UniCAVE & HMDs
- Ethics of Investigational & Interventional Uses of Immersive VR Conference



Thank you!

- If using, please cite:
- Tredinnick, R., Boettcher, B., Smith, S., Solovy, S., & Ponto, K. (2017, March). Uni-CAVE: A Unity3D plugin for non-head mounted VR display systems. In *Virtual Reality (VR), 2017 IEEE* (pp. 393-394). IEEE.
- <https://unicave.discovery.wisc.edu>
- <https://github.com/livingenvironmentslab/UniCAVE>
- https://github.com/livingenvironmentslab/UniCAVE_Examples

