IMMERSIVE ENVIRONMENTS MEET 3D GAMING

In a world where TVs are big and getting bigger, the idea of large screens has become endemic to our way of visualising things. But even the largest plasma screens are old hat for Paul Bourke, an associate professor within the University of Western Australia's WA Supercomputer Program.

Bourke devotes his research focus to work with super high-resolution displays that are used for visualising high-resolution data and all manner of experimental results using technologies such as 3D stereoscopic vision. One of Bourke's major research projects, the iDome, was the focus when Wheels first spoke with him in 2007, but in the intervening years he has continued his work to provide new and innovative methods of displaying data.

One widely used display technology is the unit's tiled high-resolution display, which provides a 6000x5000 pixel interface providing very high-resolution imaging of complex data sets. "When you look at your computer monitor, you're not engaging the full resolution that the human eye is capable of," Bourke explains.

Another is a custom-built stereoscopic system that uses two data projectors, connected to Mac Pros, to project massive and interactive images representing research data. "Many researchers have data sets that are geometrically complicated enough that they can glean information faster by looking at them in 3D," Bourke explains. "Researchers come to me with problems they have, or things they would like to view in better ways, and I develop the tools for them."

Bringing it all together. While the stereoscopic and high-resolution visualisation panels serve particular needs, Bourke's attention has more recently turned to ways in which their techniques can be applied to the iDome's immersive environment.

For example, one project allows iDome users to walk through the Australian Square Kilometer Array Pathfinder (ASKAP) project site, with the dome's peripheral projection providing a fully immersive environment that Bourke says makes it ideal for simulations and immersive design.

Another project, being completed in conjunction with UWA digital media lecturer Dr Peter Morse, is looking at ways to visualise the home base of Douglas Mawson's 1911-14 Australasian Antarctic Expedition. Despite the remoteness of the site – Cape Denision is the windiest place on earth at sea level – Morse has been able to capture extensive panoramic still images and 360-degree video.

Working with this raw data and building on the popular Unity game engine, Bourke has helped Morse build an interactive walkthrough of the site, which remains well preserved but is so remote that it is almost never visited.

The project, and its promise to make remote sites accessible in an interactive way, offer great interest for researchers in a variety of fields – but it hasn't been a walk in the park for Bourke and his team. The unique geometry of the iDome requires extensive image processing to ensure that the projected image is correctly shaped and that geometric issues such as perspective are correctly dealt with.

However, extensive work in Unity and Blender, a similar game environment that's available under an open-source license, has produced some methods for automatically generating the correct fisheye projections on the highly-specced Mac Pros used for the projections.

"Many of these things are based on OpenGL," Bourke explains. "It provides you with perspective projection, but that's no use in a dome because you need fisheye projection. However, it turns out that even though Unity is not open source, its internal scripting and development language is powerful enough that there are some techniques we can teach it to recreate the fisheye projections."

This technique is enabling the creation of fully immersive 3D games, which can be played in the iDome by participants building on Bourke's tools.

In the long term, Bourke continues to explore ways the various types of visualisation environments can be brought together more effectively. For example, he's working out methods for increasing the resolution in the iDome using multiple projectors, and ultimately for a way to transfer stereo projection techniques into the iDome – which would create the world's first spherical 3D environment in which multiple viewers could each look in different directions and still get a 3D effect.

"It's not a simple process, and we still have some hurdles to get over – particularly for real-time materials," Bourke laughs. "But it's going to be interesting."

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