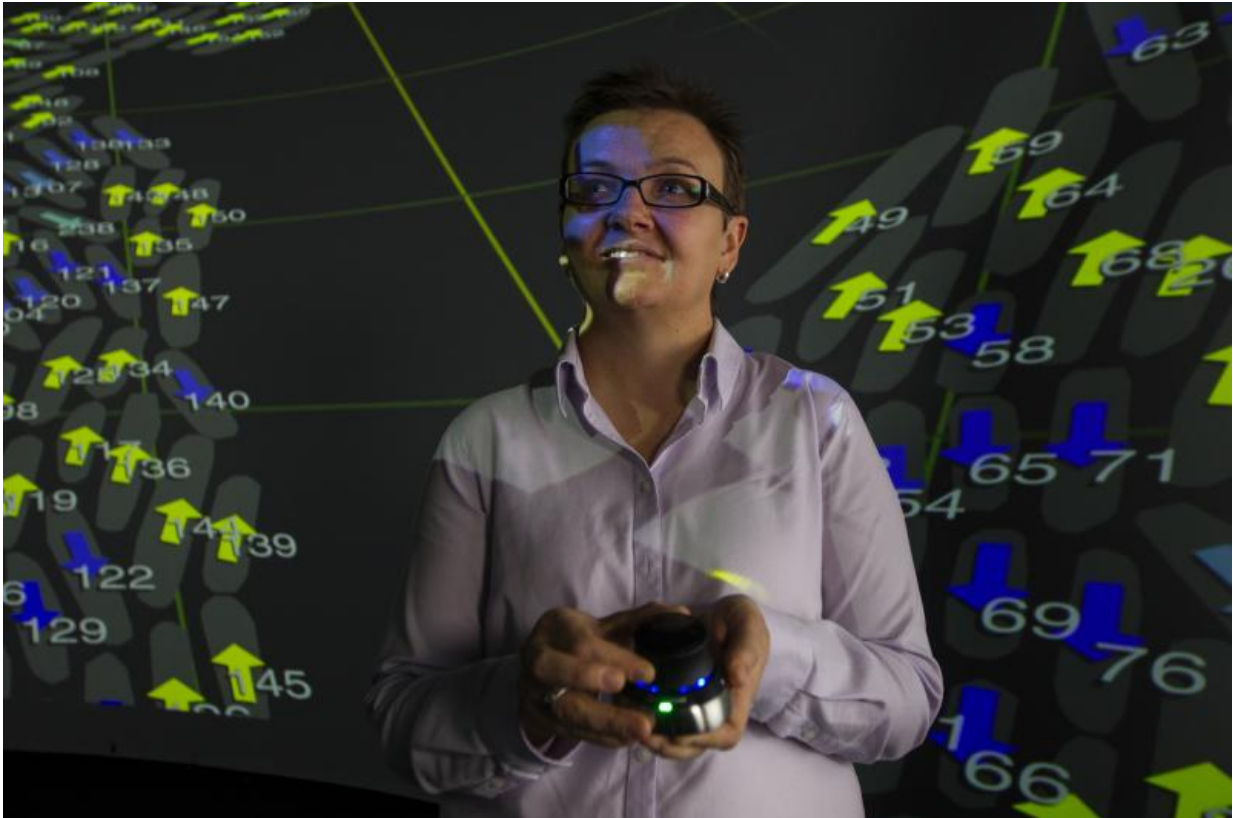![PHYS.ORG]

Turning numbers into pictures

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Microbiologist Cynthia Whitchurch uses the Data Arena to track movement of bacteria. Credit: Sahlan Hayes

Predictably, the cave is dark. Red lights glow overhead, scattering a faint, rosy lustre across the floor.

Small, spherical knobs glimmer below. As if someone has pressed the

mute button on the world outside, there is not a sound. The blackness swallows voices as soon as the words are out.

But in this cave, it seems anything is possible.

We are just metres from one of the busiest roads in the Sydney CBD – Broadway, near the city centre. And this is the Data Arena at the University of Technology, Sydney (UTS). Step inside and you find yourself inside the Matrix.

In here, bacterial cells – in reality just a few micrometres (a millionth of a metre) long – are enlarged to half a metre each and dance around the surrounding wall.

In here, the stitching in a fashion graduate's garment can be examined in 3D at hundreds of times its actual size. The mannequin on which the clothes are displayed can be rotated with the slight shift of a finger on a hand-held SpaceNav controller.

In here, you can stand in the Wombeyan Caves, the stalactite-strewn limestone caves in the Southern Highlands, about 300 kilometres from inner-Sydney, and delve into their shadows, fly past their walls.

Physically, the arena's screen is a cylinder four metres high and 10 metres across, padded around the exterior with heavy, black woollen acoustic curtains.

The custom-made, perforated screen stretches around the room's interior wall. On to it, six projectors beam images in visual stereo from a cluster of six computers that work as one.

Surround sound is achieved with 14 speakers.

In visual effects language, the image encircling you is 10,000 pixels around, 1200 pixels high and two pixels deep (one for each eye).

However, the UTS Data Arena, which will be officially opened next month, is not just a physical space.

It is also a concept, a dream in which researchers, students, teachers, scientists, artists, industry and the public can share masses of data, observe it, interact with it, change it, refine it, improve it, explore and learn from it.

It is a room where data – such as millions of numbers from spreadsheets that plot the chemical composition of stars, or the location of bacteria as it multiplies and moves – becomes a place.

"The Data Arena turns numbers into pictures," says lead developer Ben Simons.

"And, as we're getting into bigger and bigger data, it becomes more and more important to figure out what we've got."

Simons brings to the task computer graphics know-how developed while working on 15 feature films, including Happy Feet Two.

"The way to make sense of all this big data is to visualise it," he says. And the larger the data sets become, the harder it is to track changes.

"Everyone knows big data is being collected, but what if it's changed – how do we know?

"A website can change every second … how do you see that?"

Simons says we have grown used to Big Data, but are only just beginning

to appreciate the importance of Data Provenance, the transaction records that show changes to data.

For Associate Professor Cynthia Whitchurch, a microbiologist with the university's ithree Institute, seeing [bacterial cells](#) transformed into a larger-than-life, moving image is mind blowing.

She has been studying the species Pseudomonas aeruginosa, a common cause of infections in hospitals introduced through medical equipment such as catheters. Typically, her data on bacteria would be represented by thousands of numbers on her computer screen.

Simons has used Houdini software – designed for 3D animation and [visual effects](#) in the film industry – to make a movie of her data, plotting the communal and individual movements of bacteria across a surface.

"They're actually gouging out their own network of roadways," Associate Professor Whitchurch says of the bacteria. "It really is a lot like smooth traffic flow."

The Data Arena will enable her to interact with the results of the research without the need for a computer programmer middleman.

While the arena is not the only virtual reality theatre of its kind in Australia, Simons has a philosophy that makes it unique.

Using open-source software to power the metamorphosis from numbers into interactive 3D geometry, Simons wants the technology to be user friendly and shared by all.

Ultimately, he plans to virtualise the Data Arena so anyone can access it, anywhere.