Mixed Reality Creates Powerful Learning Tool

National University of Singapore

When science fiction author William Gibson introduced the world to the concept of cyberspace in his novel “Neuromancer” in 1984, readers were intrigued by the notion of human beings living immersed in a computer generated reality. Today, more than 20 years later, the notion of cyberspace and virtual reality are readily understood and even embraced by society.

The Interactive Multimedia Lab at the National University of Singapore is taking this understanding to a new level and stands poised to change the way we live, work, learn and play. By combining technology and creative art, researchers at the lab are developing new software interfaces using “augmented“ or mixed reality technology developed at the university’s Mixed Reality Lab. The technology is aimed at making machines more natural, more intuitive and easier to use. Mixed reality merges the physical with the virtual worlds to allow users to interact with imaginary or fictional three-dimensional objects as if they were in the real, physical world.

MXR Corp.: A Collaboration of Two Laboratories

Kenny Lew was the NUS intellectual property manager who evaluated and patented the interactive computer

technology developed by professor Steven Zhou, director of the Interactive Multimedia Lab, and professor Adrian

Cheok, director of the Mixed Reality Lab. After working with the Singapore military to develop training programs using interactive human computer systems, the two researchers worked together to spin out the Mixed Reality Corp. to commercialize related technologies.

In the beginning, this new collaborative venture needed critically important funding to get off the ground. NUS Venture Support, which promotes innovation and entrepreneurship within the National University of Singapore community, provided a $40,000 grant that matched $10,000 from Zhou. This grant sustained MXR Corp. through its first year of existence. Thanks to its partnership and support, NUS Venture Support gives fledgling startups like MXR Corp. a strong foundation on which to thrive.

The company's flagship commercial product is wIzQubes, a virtual, three-dimensional storytelling tool. Zhou and Cheok worked together to develop this brilliant educational toy, which took top honors at the prestigious International Idea2Product Competition in 2004, held in Austin, Texas.

Zhou says he got the idea for wIzQubes on a whim. "I was thinking of a natural and intuitive interface for storytelling," he says. "I happened to see the foldable story cube of 'Noah's Ark,' and thought that it would be a great experience for kids if the story could be played in three-dimensions using mixed reality by physically manipulating the cubes."

It took three years of hard work and $1,200,000 to develop the technology on which wIzQubesTM is based, but it eventually paid off.

A New Way of Learning

Frequently referred to as the "next generation of children's books," the colorful plastic cubes allow children to actively participate in storytelling and directly engage with fictional characters. In early tests of the toy, children said they enjoyed the magic cubes more than a picture book.

> *The wIzQubes work with two small cubes, each with images on them. Each cube is made up of smaller plastic cubes connected at various edges. Cheok and Zhou worked together to combine the cube structures with virtual reality software and a digital camera to superimpose computer graphics on the real world, creating an animated version of the story.*

A Web camera in one of the cubes captures the image on the cube and software calls up an animated story, which is stored on a CD. The user watches the story unfold on a computer screen that displays the scenes. The technology allows the users not just to view the story in an all-around three-dimensional format, but also to interact with the characters and play an active part in the story by simply manipulating the cubes.

The new medium opens up a new avenue for education. Educational researchers have long studied how children learn, and found they do it best by taking in visual and auditory information that reinforce each other. This unique combination of media increases their understanding of new concepts. Adding a third sense — the sense of physicality — mixed reality provides a new dimension to learning.

"Education has always been an important topic in our everyday lives," says Zhou, who today serves as CEO and director of the company. "The tools of the trade have changed over the times, but interaction has always been necessary to provide children with a better understanding of the topic."

Zhou says it's difficult for children to get their minds around topics for which hands-on material is not available. He cites scientific topics such as how dinosaurs once lived, and sociological and historical topics like the ancient Roman city of Pompeii. The wIzQubes product can bridge that gap by providing a physical experience.

"With mixed reality, we bring together the physical and virtual world and allow the user to fully interact with the virtual contents in physical surroundings," he says. "This in turn allows the user to absorb what is being taught faster, because of the clarity and detailed modeling in three-dimensional graphics and the interaction element thrown into the mix."

Children, Zhou says, "learn by doing, using their hands, and feeling the entire link with the imaginary world."

Not only are the cubes a fun way for kids to learn, it's a boon to parents and teachers, too, because it is proven to increase the attention span of kids, according to Zhou. "The wIzQubes achieved a record of 3.5 hours of continuous usage by an eight-year-old girl during the product launch at IT Show 2007," he says. The product also may develop children's language skills, and encourage innovative and critical thinking, as well as sharpen their psycho-motor skills, he adds.

The cubes differ in size; some are as small as a deck of cards. Creating a computer reality game in this portable size was one of the key technological challenges, according to Zhou.

"Mixed reality requires using a camera to do the real-time tracking of physical objects," he says. "The portable size means that fewer pixels are being captured by the camera and hence, there is less tracking accuracy. In addition, portable-sized objects are easily held by hands, which introduces a lot of occlusions that make the tracking harder."

The product, which was licensed by MXR Corporation in 2004, has been available at stores in Singapore since early 2007 and will soon be available at retailers in the United States. The cubes, which feature classic tales such as *Cinderella, Little Red Riding Hood,* and *Jack and the Beanstalk*, sell for approximately $85 U.S.

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