

# An Entirely New REALITY

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MIXED REALITY COULD BE A BREAKTHROUGH  
IN TREATING TRAUMATIC BRAIN INJURIES

» Recovering from a traumatic brain injury can be as distressing as the event that caused it. Often it requires the injured individual to re-learn entire aspects of everyday life, from making coffee to tying shoelaces. It's a labor-intensive process in which only a few transitional learning centers around the U.S. specialize, and the current methodology doesn't always work well once the he or she returns home.



PHOTO COURTESY OF MEDIA CONVERGENCE LABORATORY, UNIVERSITY OF CENTRAL FLORIDA

Some feel that these learning centers fall short because they use generic situations – rather than those specific to the individual – to teach and rehabilitate. Research currently being conducted by UCF's Institute for Simulation and Training (IST) and its Media Convergence Lab using mixed reality could change all that.

"Right now the standard procedure for treating people with brain injuries is to rehabilitate in the hospital, then in a transitional learning center and finally back home," says Eileen Smith, Director of Experiential Learning at UCF and one of the leaders of the 'Kitchen Project.' "Normally patients just re-learn

their way around a generic room at a learning center, but studies show that when the person transitions back to their own homes things can go very badly." The project's basic premise when it began in 2005 was that a person would learn faster and more effectively in a specific, but still highly controlled, set-

ting versus a generic one.

"We chose a kitchen for our project because it's the most dangerous room in the house," says Smith. "We wanted to see what would happen if we recreated a patient's actual kitchen and moved it into our lab. We thought that if we could laser scan, photograph and video tape a kitchen, by the time the patient was ready to enter a transitional learning center, we could have a replica of their kitchen ready for him to work in."

Obviously researchers and clinics can't actually build an exact copy of every patient's kitchen, but through the use of virtual reality and real objects, a medium referred to as mixed reality, the exact room and its contents are recreated. The Media Convergence Lab at UCF excels at this type of virtual reality.

"We use real cabinetry, cups, plates and such that we can configure as necessary — all initially painted in a uniform color, 'chromagreen' — and then we overlay the specific finishes, colors and textures with virtual images. Patients wear a head-mounted display, but when they move a cup in the simulation, they are actually picking up a real cup, moving it, for instance, from a cabinet to a counter. We make the cabinets and counter look like those in their own kitchen, allowing spatial training based on the person's home. Just as importantly for our research, however, the headgear also tracks where and how the person moves over time, allowing us to quantify the progress.

"For example, with our first test patient we documented that at Day One he was all over the place attempting to make coffee, cereal and toast a bagel. It was a little like following Jeffy around the house in the comic strip *Family Circus*. By Day Eight, the difference was startling. His time for these tasks dropped by half and we could document the progress and his pattern exactly. Interestingly, we found that he could not remember the researchers' names or even explain the steps he took to accomplish the tasks, but he could do them. The results actually tell us a lot about the cognitive process."

Smith feels that the need for more transitional learning centers will increase,


especially with more and more people surviving serious head injuries, whether industrial, accidental or combat related, due to better medical care. As a result, UCF's current focus has become making the engine for the mixed-reality program readily available. With the help of San Diego-based Virtual Reality Medical Centers (VRMC), and funding from the Air Force and the National Science Foundation (NSF) they are doing just that.

"When we found out about the mixed-reality research going on at UCF's Institute for Simulation and Training we wanted to be involved," says Dr. Mark Wiederhold, president of VRMC. "They are the world leaders in mixed-reality technology and we knew that, combined with our expertise, we could make the Mixed Reality Rehabilitation System (MRRS) possible. It was a natural fit." VRMC specializes in using virtual reality to help treat phobias, such as the fear of flying, at a number of clinics on the West Coast. "Smith's team has the expertise in the clinical aspects of the technology and research; we offer the know-how for making it practical in a clinical setting. We've conducted over 6,000 sessions of virtual reality treatments and now we want to help make this new technology available wherever

it's needed, not just at a few centers nationwide. To do this, we are creating an entirely new company with the help of UCF's incubator program and the plan is to open the first clinic in Orlando.

"It's a dynamic area of research. The MRRS has tremendous implications for treating traumatic brain injuries. The next step in this joint project is largely funded by the NSF and has theoretical implications for studying mixed reality's effect on neurogenesis, or the growth of new neurons," says Wiederhold.

Smith also believes that future theoretical applications for this technology could include determining stress levels under a variety of conditions, including combat or job-related situations and possibly even treating autism.

"We are very excited about the prospects of the MRRS and working with the team here at UCF, to build the new company," says Angela Salva, President of the start-up company for VRMC, which has yet to be named. "Eventually this may lead to other forms of physical and cognitive therapies, but it will definitely lead to making mixed reality a more accessible and effective treatment for all types of brain injuries in the near future." 

## BREAKTHROUGHS IN AUTISM

Adapting technology to benefit people with disabilities is also a specialty of Cnow, Inc., a Mt. Dora-based company that specializes in "telehealth", or providing training and solutions via interactive video conferencing. Most recently, Cnow has provided technical support for a remarkable project researching ways in which such technology can be used to help families of autistic children. Funded by a grant from the U.S. Department of Education, the program links families and professionals, providing "live" in-home support from medical and behavioral experts.

The protocol for the research, administered by the Celeste Foundation, a non-profit organization also based on Mt. Dora, started with families of autistic children between 2 and 5 years old. Each family began with individualized program development at the closely-affiliated National Institute of Telehealth (NIT), where they worked directly with a team that included behavior analysts, speech pathologists, special educators and clinical psychologists. The families learned strategies and techniques to encourage their child's behavioral, social, communicative and adaptive skills. They then returned home with a plan for services and a Cnow videoconferencing device that allowed them to connect directly to the Central Florida team of professionals whenever they needed help.

To date, results have been impressive. The interactive video medium allowed between 8 and 16 hours per week of communication and over 4,000 "telehealth" consultations. Data show a reduction in family stress and improvement in their perception of their quality of life. Most importantly, significant advances have been made by the autistic children involved. Ultimately, these results have important implications for services that extend into remote training, medical services, behavioral analysis, case management, psychiatric services and education.