
WALK
THIS
WAY

Most of us don't appreciate the thousands of steps we take each day without stumbling or falling. Maybe we should.

"You're within an inch of tripping every time you take a step," says Associate Professor of Kinesiology Chris Rhea. "Yet, most of the time we don't."

Since his doctoral studies, which focused on how people use vision to navigate their environment, Rhea has looked for ways to help those whose walking is impaired due to injury or illness.

"We've been studying how we use vision to walk around in the world," he says. "What if we can control someone's vision and use that to control how they walk?"

Virtual reality technology – which has been getting more compact, cheaper, and more user friendly – is allowing Rhea to do just that.

When he joined UNCG in 2011, he started the Virtual Environment for Assessment and Rehabilitation Laboratory, or VEAR Lab. Since then, a string of projects, applications, and research by Rhea and his colleagues has begun to unlock the technology's potential.

One application, which netted Rhea a patent in 2018, uses virtual reality – or VR – to retrain people who have trouble walking.

Studies of how people walk have revealed that each step we take is a little different from the one before. "Initially," says Rhea, "they looked like random variations in our walking patterns."

But, using pattern recognition algorithms, researchers have begun to identify hidden signatures – like fingerprints – within the seemingly random variations.

"We think these hidden patterns relate to a healthy person's ability to adapt their walking behavior," Rhea says. "If you see you are about to step off a curb, you've got to adapt your walking behavior, so you can do it without falling over."

But for someone who's suffered a stroke, a knee injury, or other medical condition that affects their walking ability – "they're going to have a different signature."

In the VEAR Lab, subjects – wearing goggle-like VR headsets or watching a video monitor – are told to match their steps to those of a virtual avatar as they walk on a treadmill.

"You're just playing a game we all played in kindergarten – follow the leader," Rhea says. But concealed within the avatar's virtual steps are subtle cues designed to shift the patient's movement.

"It's the small hidden patterns that we embed in there," he says, "that we think can build up a person's adaptive capacity, lost due to injury, aging, or disease."

Rhea's new patent is for the technology that embeds these adaptive patterns into the software driving the digital avatar.

There are many ways VR could improve rehabilitation.

Rhea's doctoral student Chanel LoJacono is currently working on a VR headset program to bring a virtual obstacle course to life at a patient's location, rather than having a patient travel to a special facility. This could make cutting-edge therapies less expensive and more accessible.

"We're a ways from this, but imagine if you could check out a VR rehab headset. You're with a human therapist every Monday, but you get to take one of these home," Rhea says. "I get to play a game, and the game is fun. The game gets harder as I get better."

By Mark Tosczak
Learn more at go.uncg.edu/rhea

BACK IN ACTION

With $1 million in funding from the U.S. Department of Defense, Rhea's team has developed a smartphone-based device that can be strapped to someone's thigh to precisely measure their balance, providing objective data to physical therapists and helping them measure a patient's improvement over time.

The military wants the technology to help assess head trauma in people who have been exposed to explosions. But Rhea is also using it to assess the impact of a 12-week rehab program to improve balance in older adults – part of a National Institutes of Health study led by Kinesiology's Dr. Louisa Raisbeck.

Just as Apple Watches can now alert their owners to some types of heart problems, Rhea foresees a day when personal technology could alert us to problems with our movement.