

EVOKING A CHANGE IN REHABILITATION

THE UNIVERSITY OF STRATHCLYDE
WANTS TO DEMOCRATIZE THE PROCESS
OF PHYSICAL REHABILITATION



While motion capture has proven itself to be an invaluable technology in rehabilitating subjects with impaired movement, the funds and technical expertise required remain prohibitive. For the biomechanics department at the University of Strathclyde, however, the tools for overcoming those barriers already exist elsewhere in the world of motion capture.



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The university recently opened the Sir Jules Thorn Centre for Co-Creation of Rehabilitation Technology, funded in part by a £449,000 grant from the Sir Jules Thorn Charitable Trust. In it, the university is pioneering applications that will use Vicon technology to make motion-capture-powered rehab methods accessible at scale.

The use case for motion tracking in improving movement is clear — visual and haptic feedback are both extremely effective in helping subjects form new neural pathways to improve physical movement. Philip Rowe, Professor Of Rehabilitation Science for the university's Biomedical Engineering department, points to the massive improvement in Team GB's performance between the Atlanta and Beijing Olympics, attributing much of that success to improvements in the biomechanics technology the athletes were training with.

"The trouble for us is that they have huge resources that we don't have for clinical rehabilitation. We're trying to get that kind of performance enhancement at scale for patients, using the same type of technology," says Rowe.

IF IT'S NOT USER-FRIENDLY, IT DOESN'T GET USED

Even where the budget and technology exist, says Dr Andrew Kerr, Senior Lecturer in Biomedical Engineering, the time and expertise required to operate such systems offers another hurdle.

"A good example is the Lokomat, which is a walking exercise that was designed a few decades ago for spinal cord injury patients," says Kerr. "It's a treadmill and exoskeleton that helps them relearn their ability to walk."



Dr Andrew Kerr,
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"I have come across places where it is not used anymore. It literally has a thick layer of dust on it. When you speak to the physiotherapists they say, well, it takes 20 minutes to get it all set up and we just don't have the time to do that. And of course, the less people use it, the less people remember how to use it. It's a brilliant piece of technology, but it's not helping anyone because it's not user-friendly."

It's not a case of needing to invent brand new methods and technology, then. Rather, Rowe and Kerr's team is finding ways to make existing processes more affordable and more accessible.

The Strathclyde team isn't working with the suite of Vicon tools typically used by biomechanists. Rather than using Nexus, they're using Evoke, the Vicon software designed for location-based VR (LBVR) applications.

CROSSOVER TECHNOLOGY

Rowe says that while motion capture began as a tool used in the world of biomechanics, advances made in the VFX and videogames industries have eclipsed those in the medical sector.

"We're trying to use the efficiency gains that those two sectors have brought about, and use them in rehabilitation," says Rowe. "We're building a rehabilitation gym, using Vicon technology to provide feedback and gamification and exercise to our clients."

"The question we're asking in our center is, can we make our entire lab spaces motion capture volumes, utilizing Evoke and marker clusters? And can we have multiple users in our gym spaces, using different pieces of equipment and getting visual feedback from the system in real time?"

Evoke, which is designed to be run by operators with minimal technical expertise at costs that make it viable for use on the high street, is a strong fit for patients' needs.

"We know that there are four main pillars associated with a more successful rehabilitation process," says Kerr. "The first one is the intensity of the movements. The NICE guidelines recommend 45 minutes a day after a stroke. I'm using stroke as an example of rehabilitation, because it's probably the biggest challenge in the UK."

"The second pillar is cognitive engagement with the task. So, the idea that randomizing some of the tasks through gamification or introducing more complexity, in order that the users are focused on the task, helps relearning. The third is feedback so they can correct errors, and also that helps to motivate them. Finally there's an aerobic component, which helps because it stimulates blood flow through your brain."

A system based on Evoke ticks all those boxes. "Patients can come in, they're in control, they can do the practice themselves, they'll get feedback, monitoring, progression and cognitive engagement from the technology," says Rowe.

PUTTING RECOVERY BACK IN THE PATIENT'S HANDS

"We use the term democratic rehabilitation," says Kerr, "because in the past, it's always been, here's a therapist, you have to come in and work with them. But it's your rehabilitation, your body, your life, and to give people the tools for them to recover their movement and to manage their own rehabilitation can be incredibly effective."

"We also talk about liberating rehabilitation," says Rowe. "At the moment it's constrained to a service delivery model that we think is failing. Physiotherapy professionals need to support people undertaking their own process of rehabilitation, rather than providing it. We call this supported self-management. Our dream is that we will produce technology that can then be put into community spaces where people can access it alongside professional advice."

"We're in talks about using leisure and community centers, and about suitable technology for people's homes. The process is simple enough for that. If it's on the high street as LBVR, people will think well, we could use that too. When LBVR gaming centers become common, I think people will just accept that the technology is also available in the gym."

It wasn't just the fact that Evoke fits the department's goals that made Vicon the right supplier, "I think we share the same vision," says Rowe. "Vicon has always supported the rehabilitation and clinical biomechanics community, even if it's not the most profitable market. Vicon understands the social value of motion capture for clinical populations."

"In terms of companies, I think it's by far the market leader in motion capture. And then we get to the LBVR technology. What we're trying to do in real time, with multiple marker analysis of multiple subjects, simply and inexpensively; that requires high quality data and reliable technology. I can trust the Evoke software and its cluster tracking algorithms, I think the Origin hardware is stable."

"I don't think I would have attempted what we're trying to attempt with any other mocap company."

For all Rowe's faith in the technology he's using, an exciting question mark still hangs over the work his department is doing.

"It's an ambitious experiment to see if motion capture can be used to routinely support rehabilitation," he says. "I don't think we know yet. We have a vision of what we'd like to achieve, but whether we can achieve it, whether patients will think it's usable and beneficial, that's our big experiment. Without Origin and Evoke we would not be able to try it."

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