



## Games to improve children's rehabilitation and fitness level

Children who are (partly) paralyzed e.g. due to a brain injury, and obese children need to exercise to improve their health. However, it's often difficult to keep them motivated to do the drills that are prescribed by their rehabilitation or fitness coach. And, if they practice at home, it's difficult to know if they perform the exercises correctly.

One thing children don't have to be motivated for, is playing video games. So why not use their preferred pastime as a way to get – and keep – them moving? How to do that is what the wE-MOVE consortium has been investigating for the past 2 years.

In the framework of the wE-MOVE project, researchers and experts from several companies developed an exergaming platform combining video games and exercise. Their solution can track movements highly accurately, uses virtual reality to immerse the children (and their brains) in the exergame, and provides a user-friendly dashboard for the therapist or coach to monitor the children's progress. The focus of the project was on two use cases: a game for children with paralysis on one side of the body (=hemiplegic) who have to learn to use their affected upper limb again, and a game for children with obesity who need more movement overall.

"There are a lot of exergames on the market today," explains wE-MOVE research lead Jan Van Looy (imec - MICT - UGent). "Just think of the Wii Fit games and the Xbox Dance Dance Revolution games. Although these games are fun and make the children move more, they are inadequate for therapeutic use. The main reasons are that the games are often too difficult and that the movements are not tracked in detail: Who hasn't already 'tricked' the Wii Fit by playing a tennis game while sitting on the couch and making small movements with the wrists?"

"Virtual reality offers a unique tool for rehabilitation," says Hilde Van Waelvelde from the Rehabilitation Sciences and Physiotherapy group of UGent. "It immerses our brains into a different world, for example one in which the child can perfectly use all limbs, even those paralyzed in the real world."

## THE OUTCOMES

### 1. Mega Mindy moves your paralyzed arm

The first outcome of the wE-MOVE project is an exergame for children (aged between 4 and 12 years) with hemiplegia. It is based on 'Mirror Therapy' that is often prescribed for patients who are paralyzed on one side of the body. It was invented by Vilayanur S. Ramachandran to help alleviate phantom limb pain, in which patients feel they still have a pain in the limb even after it was amputated. The principle of mirror therapy is the use of a mirror to create a reflective illusion of an affected limb in order to trick the brain into thinking movement has occurred without pain. It involves placing the affected limb behind a mirror. When moving the 'good arm', the reflection in the mirror appears in place of the hidden 'bad arm'.

Hilde Van Waelvelde: "It's very difficult to motivate young children to perform mirror therapy. They think it's boring and the progress is slow. For this reason we have developed a unique solution based on virtual reality that mimics mirror therapy. It's even possible that our virtual reality solution will work better than the traditional mirror therapy because the brains are 'tricked' in a more credible way. Future clinical trials will have to confirm this presumption."

Which technological developments are part of this 'virtual' mirror therapy? Jan Van Looy: "The patient wears virtual reality glasses while cameras are used as tracking sensors. The 'good hand' is being tracked to control the virtual movement of both arms in the game. The 'bad hand' is being tracked to monitor the progress

of the patient's paralyzed limb. We also made a user-friendly platform for the therapist to get a clear overview of the exercise frequency and progress."

Together with Studio 100 Animation, an expert in children's series and games, a game environment was developed by Preview Labs, with 'Mega Mindy' in the lead. This well-known character gives instructions to the children on how to move their hands to pass them through a hole in the wall.

Hilde Van Waelvelde: "The platform was tested on a small scale in the university hospital of Gent. First results with the children were positive. They were fascinated by the virtual reality game and didn't have problems using it. Now it will be key to determine the effectiveness of the game in rehabilitation."

## 2. Get fit with Mega Mindy and Mega Toby

The second exergame developed in the wE-MOVE project is for children who need more movement overall: e.g. obese children, children recovering from a brain tumor, or children with a mild motor disorder. "In the game, both Mega Mindy and Mega Toby are pursuing a thief. The children have to make jumping, climbing and flying movements to catch the stolen goods that the thief is dropping during the chase," explains Hilde Van Waelvelde. Sileni Studios cooperated with Preview Labs and Studio 100 for this game.

"We developed some real unique technology for this application," specifies Jan Van Looy. "A Kinect camera was placed above the screen to track movement of the whole body. Additionally, the children wear high-tech inlay soles, developed by RS Scan, to precisely track movement of the feet. With data fusion, information from the camera and soles was combined, resulting in a very accurate tracking of all movements. Moreover, artificial intelligence is employed to learn from the child's movements: the more the child plays the game, the better the movements are recognized."

"Next to this unique solution for tracking (sensor fusion and artificial intelligence algorithms), a logging platform was set up. Spartanova is well known with top athletes and their coaches who use their platform to input the athlete's data. Within the wE-MOVE project, the platform was extended to enable the automatic input of physiological data measured in the gaming context."

## NEXT STEPS

The results of this project are groundbreaking in multiple areas. For example, the use of virtual reality for mirror therapy for children is new. Neurologists of UZ Gent are interested in using the technology to better understand how the brain reacts to this kind of virtual mirror therapy. Trials will now have to be set up to determine the effectiveness of the therapy. Within the short period of the project it was only possible to do small-scale tests with children to test how they react to the virtual reality environment.

For the two gaming companies – Sileni Studios and PreviewLabs – the project offered a unique way of testing and combining new technologies such as moving trackers, inlay soles, cameras, virtual reality glasses etc. This expertise further extends their portfolio and provides them with a head start in development for these technologies.

## FACTS

NAME	wE-MOVE
OBJECTIVE	Develop a user-friendly and affordable exergaming platform that will keep children motivated during their rehabilitation and that allows coaches to accurately track movements and rehabilitation progress.
TECHNOLOGIES USED	VR goggles, depth cameras, pressure soles
TYPE	imec.icon project
DURATION	01/01/2015 - 31/12/2016
PROJECT LEAD	Friso Hagman, RS Scan International
RESEARCH LEAD	Jan Van Looy, imec - MICT - UGent
BUDGET	1,800,000 euro
PROJECT PARTNERS	Sileni Studios, RS Scan International, Spartanova, PreviewLabs, Studio 100
RESEARCH GROUPS	imec - ETRO-MIT - VUB, UGent - Rehabilitation Sciences and Physiotherapy (REVAKI), UZ Gent - Children Rehabilitation Center, imec - IPI - UGent, imec - MICT - UGent



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wE-MOVE project partners:



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