

## Preface

Rehabilitation, both its motor and cognitive forms, is a complex universe, or should I say, a complex multiverse. It gathers several disciplines, a multitude of approaches, a myriad objectives, and a swarm of cultural and (pre)defined ideas and praxis. The rise of information and communication technologies (ICT) has added a new layer to this field. New exercises and new forms of interaction with the equipment, and with the caregivers, are slowly becoming an option in rehab clinics. They include motion capture, hardware and software, and 3D interactive and immersive applications that try to substitute real-life exercises in a more pleasant and motivating way.

Hardware, such as Microsoft's Kinect or Nintendo's Wii, although not designed nor developed with a rehab aim in mind, are being used since their first release, especially by research and development groups, for rehab purposes. The main reason for this rests behind the idea (or wishful thought) that motion capture could be used as a natural way to interact with the exercise.

3D worlds have long been used for clinical purposes and are a way to provide a natural and meaningful environment that intends to mimic real-life events while being fully controlled by the therapist. 3D digital environments, with or without the motion capture systems, are being developed and tested to assist patients with a wide range of disabilities. Some researchers are using virtual reality (VR) systems to help patients with chronic back pain to overcome their kinesiophobia through the manipulation of visual feedback. Others are using multilevel exercises to stimulate a wide range of cognitive functions that were compromised by acquired brain impairments. Such platforms are based on instrumental activities of daily life where the patients exercise activities, and the cognitive functions required to complete them, that they usually perform on a regular basis on a normal day. And yet others are using VR for both cognitive and motor rehab, as an attempt to offer a holistic approach that encapsulates the interdependency of motor and cognitive functionalities. The common ground of all these approaches is that they try to reduce costs and time, by working with off-the-shelf software and hardware that offer top-notch graphic and interaction quality.

Rehab is all about repetition, repetition, repetition, motivation, and feedback. Only with an almost endless repetition of the impaired functionality it is possible to totally, or partially, regain the lost function. But whereas repetition is not much of a problem for computers, in fact they are quite good at it, human beings are not that keen on repeating the same process over and over again, especially if it causes any pain or discomfort, as happens with rehab exercises. One strategy to overcome this problem is to keep the patients motivated so that they can endure the boring and repetitive process of executing the same exercise repeatedly. Another strategy is to keep the patients up to date with the success or failure of their actions, while executing the exercises. Feedback is, therefore, paramount to keep the patients in the loop of their performance.

The feedback (and monitoring) theme played a major role in REHAB 14. A majority of the papers published in this book are about ways of getting data out of the

performance of the rehab exercise, so as to be used by the therapists and the patients alike. The widespread use of sensors and motion capture devices, alongside VR, helps to improve the performance through the collection and assessment of data from the exercise while it is ongoing, delivering better insight into the outcomes of the therapy.

The rest of the studies presented at REHAB 14 comprised work reporting on some of the latest advances in motor rehab. Several studies of gait and of upper limb rehab illustrate how technologies are being applied in this context. These studies reflect the mainstream use of VR for rehab purposes.

The rest of the studies were split into areas that are now emerging as clients of ICT-based rehab. Several studies of the use of VR to stimulate cognitive functioning are now available opening new possibilities for the use of VR in the context of rehab. Also, reports on the contribution of ICT on speech and navigational problems were discussed.

These examples of the studies that got podium time at Rehab 14 illustrate the overall tendency of ICT-based rehab solutions. Nevertheless, some groups are looking for additional opportunities. For example, avatars are being investigated to be used as surrogates of clinicians to help assist patients when caregivers are not around, or to train clinicians with virtual IA-enabled patients. Another trend is to couple the existing platforms with pervasive and continuous monitor valences, which are able to collect ongoing data from the patient's physiology and behavioral status. This trend also includes the use of mobile systems so that the assessment can be made anytime and anywhere.

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