

Special Issue on Virtual Rehabilitation: Guest Editors' Introduction

For many years we have been searching for the “VR killer app.” Virtual rehabilitation is the “kinder app,” as Skip Rizzo of the University of Southern California likes to say. This new domain of science uses virtual or augmented reality in rehabilitation training, for patient populations as varied as stroke survivors, those with cognitive disorders, athletes with sport injuries, or seniors suffering from arthritis. The benefits of virtual rehabilitation over conventional approaches include an interactive, motivating exercise environment, the ability to store patient data online and present them at a distance, the provision of objective recovery measures, and so on.

The articles included in this special issue of *Presence* dedicated to virtual rehabilitation are based on presentations at the International Workshop on Virtual Rehabilitation, which the guest editors chaired in fall 2003 at Rutgers University. There were many interesting papers, and a sense of pioneering science among the participants from 18 countries. The first article, based on the keynote address by Skip Rizzo and developed by Rizzo and Kim, is an overview of the virtual-rehabilitation field looking at strengths, weaknesses, opportunities, and threats, regardless of patient populations. In the second article, Rand and colleagues look at the suitability of particular VR platforms (video capture vs. HMD) in relation to the therapeutic goals. Their study concludes that both the technology as well as the patient's characteristics must be taken into consideration when seeking a suitable VR therapeutic application. This is followed by an article on the use of sensing and haptic gloves for VR training of chronic post-stroke patients' hand function, written by Adamovich and colleagues. The authors present a study of eight patients who have improved their hand range of motion, speed of motion, independence of finger motion, and grasping strength solely with VR therapy, years after their stroke. Just as interesting is the fourth article by Kuttuva, Burdea, Flint, and Craelius, in which amputees are trained to

control a virtual hand by using a sensing sleeve. Initial trials on two subjects were promising, showing that VR may be utilized by subjects with severe disabilities. Bauermann describes an fMRI study of healthy individuals navigating through virtual environments with a joystick or touch pad. He found that there was a significant correlation between the subjective task-difficulty rating and the intensity of bilateral brain-activation patterns. This finding is useful as a baseline when interpreting the neuroimaging of brain-injured patients.

Sondell and colleagues describe a study on user walking when tracked in an immersive VE. The environment was manipulated through unexpected events that were fall-inducing. The system was sensitive enough to capture the difference in gait among subjects as well as their specific fall-avoidance strategies. Such results are useful in order to prevent ankle injury and fracture during fall. In another study looking at ankle training, Deutsch et al. performed a usability evaluation of a VR telerehabilitation system. This study was done on the Rutgers Ankle haptic system, its VR gamelike training environment, the remote therapist's console, and the associated therapist manual. The remote monitoring system was subsequently tested on five therapists from different practice areas and varying levels of experience. In another telerehabilitation study, Holden, Dyar, Schwamm, and Bizzi present two case studies in which VR is used to improve arm motion in the home, while the therapist is located at a clinic. The simulations apply the principle of the “teaching” virtual object controlled by an expert, which the poststroke patient attempts to mimic.

This special issue ends with an article by Herbelin, Ponder, and Thalmann, that presents a practical approach for immersive VR training and therapy applications based on interactive storytelling. Their aim is to minimize the contradictions between control over the story required by trainer/therapist and interaction required by trainee/patient. These concepts and their practical realization are investigated in the context of

emergency-situation training and psychotherapeutic exposure.

We want to thank all the contributing authors for working diligently to produce this special issue, which we hope will entice the reader to contribute to the very active area of virtual rehabilitation research and development.

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