An overview of a USC Rehabilitation Engineering Research Center: The use of virtual reality for a range of motor impairments

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Abstract— This paper describes the use of Virtual Reality in four projects within a Rehabilitation Engineering Research Center at the University of Southern California. The Research Center aims to develop and assess a range of technologies for people aging with and into a disability. One of the deliverables of this Center will be the development of a Virtual Rehabilitation Toolkit, a series of Virtual Reality video based games for use with a range of impairments for a variety of disabilities including spinal cord injury, traumatic brain injury, stroke, Parkinson's disease, and cerebral palsy.

Keywords- aging; disability; virtual reality; rehabilitation

The National Institute on Disability and Rehabilitation Research (NIDRR) provides leadership and support for a comprehensive program of research related to improving the lives of individuals with disabilities from birth through adulthood. NIDRR supports the development of Rehabilitation Engineering Research Centers (RERC) to plan and conduct research leading to new scientific knowledge, advanced technology and new or improved methods, procedures and devices to benefit people with disabilities at individual and systems levels. The RERC, lead by Dr. Carolee Winstein, entitled Optimizing Participation through Technology (OPTT) was awarded in 2008 to researchers (http://www.isi.edu/research/rerc/), at the University of Southern California with a focus on optimizing participation in persons aging with and into disability.

The OPTT-RERC has a series of important questions to investigate regarding aging with and into disability. The use of VR technology to design games with very specific focus to augment traditional rehabilitation interventions will play a part across a range of the projects. The development of
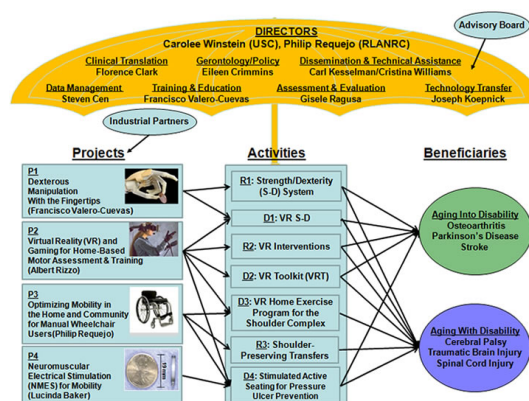

Figure 1. Administrative Structure of the OPTT-RERC

the virtual rehabilitation toolkit will involve a participatory action research through a series of focus groups, iterative game design and development, pilot and usability testing, followed by testing of the virtual rehabilitation toolkit in clinic-based and home-based settings.

The OPTT-RERC will integrate advanced technologies to address key problems of rehabilitation for the express purpose of improving functional performance across and within six aging with and into disability benefactor groups: cerebral stroke, spinal cord injury, cerebral palsy, Parkinson's disease, osteoarthritis, and traumatic brain injury. The OPTT-RERC will coordinate a comprehensive combination of research and development activities employing four technological domains across four primary project areas: dynamic dexterous manipulation systems; Virtual Reality and gaming; wheeled mobility and exercise systems; and implantable micro-stimulator form of neuromuscular electrical stimulation (NMES).