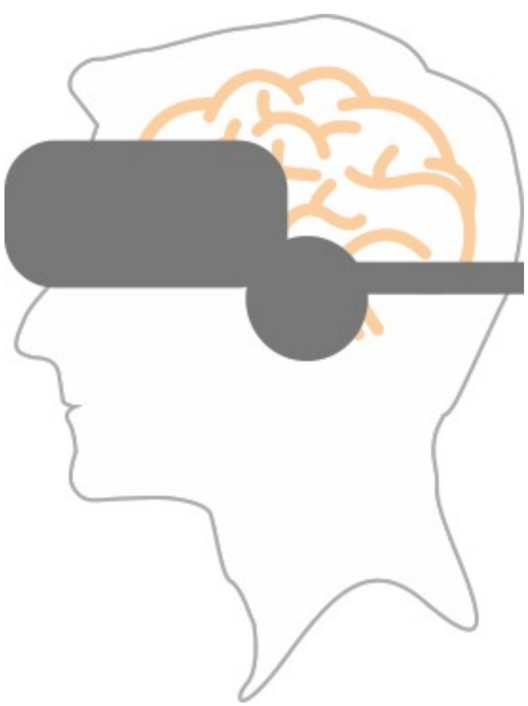
1ST ANNUAL USC

VR FOR HEALTH SYMPOSIUM



1540 Alcazar St.

Los Angeles, CA 90089
smartvr.usc.edu

Schedule of Events

REGISTRATION & BREAKFAST **(Sullivan Center)** — 8:00 AM

WELCOME — 9:00 AM

ICE BREAKER — 9:20 AM

Break **(Move to G37)** — 9:50 AM

PRESENTATION SESSION 1 **(CHP G37)** — 10:00 AM

James Finley 10:00AM - 10:20AM
Design and Development of Virtual Reality Interventions for Locomotion

Tyler Ard 10:20AM – 10:40AM
Neuroscientific Data Visualization in Virtual Reality

Carolee Winstein 10:40AM - 11:00AM
Virtual Reality for Neurorehabilitation: Fun and Games, or Is There More

KEYNOTE LECTURE **(CHP G37)** — 11:00AM

Skip Rizzo 11:00AM – 12:00PM
Is Clinical Virtual Reality Ready for Primetime?

LUNCH (CHP Patio) — 12:00 PM

PRESENTATION SESSION 2 **(CHP G37)** — 1:00 PM

Arno Hartholt 1:00PM – 1:20PM
Virtual Humans for Clinical Care

Dominique Duncan 1:20PM - 1:40PM
Correcting Segmentation Errors in Neuroimaging Data Using Virtual Reality

Sook-Lei Liew 1:40PM - 2:00PM
Virtual Reality for Stroke Rehabilitation

Vangelis Lympouridis 2:00PM - 2:20PM
Virtual Reality and Pain Management

Judy Pa 2:20PM - 2:40PM
Targeting Physical and Cognitive Activity in a VR Environment to Combat Age-related Disease

Break — 2:40 PM

Talks/Demo — 2:50 PM
Murat Burme, Dominique Duncan, Brian Cohn, Tyler Ard, James Finley (5 min each)

Poster Session **(Outside Lawn)** — 3:20 PM

Questions & Discussion **(CHP G37)** — 4:30 PM

Happy Hour **(The Edmondson)** — 5:00 PM

James Finley

Design and Development of Virtual Reality Interventions for Locomotion

Recent advances in consumer-level virtual reality (VR) have opened the door for the development of low-cost, fully-immersive systems for interactive mobility training. The promise of VR for improving mobility lies in its ability to mimic real-world challenges such as obstacles and crowds, provides systematic control over the environment, and provide augmented performance feedback to guide learning. However, creating effective training systems requires an understanding of how multisensory feedback provided in VR is integrated with ongoing locomotor commands and how the practice of locomotor skills in VR transfers to the real world. I will share recent work from our lab exploring sensorimotor integration and locomotor skill learning in virtual reality, and conclude with a description of how we use this information to develop interactive mobility training experiences for people with Parkinson's disease.

Tyler Ard

Neuroscientific Data Visualization in Virtual Reality

Visualization is a critical component of neuroimaging, with numerous programs, techniques, and approaches specifically designed to maximize data comprehension. Such considerable time and effort has been allocated to data visualization because it is not only a tool to quickly perceive data, but it can often make a crucial difference in misinterpreting a result, or even misdiagnosing a patient. Unfortunately, nearly all of the ways we view neuroscience data is through a 2D screen, which is inherently limited when viewing 3D data. However, with the recent commercialization and popularization of VR, we can surpass these limitations and begin viewing neuroimaging data in its natural 3D space. To begin exploring 3D data visualization, we've created Neuro Imaging in Virtual Reality (NIVR), a platform which integrates visualization techniques such as volumetric raymarching, particle clouds and near-field rendering into a real-time VR environment. This avenue offers promise to be the next generation of how we view, comprehend and diagnose data.

Carolee Winstein

Virtual Reality for Neurorehabilitation: Fun and Games, or Is There More

I will briefly review the accomplishments of the VR and Gaming for Home-based Motor Assessment and Training, a core project hosted by our Rehabilitation Engineering Research Center (RERC), Optimizing Participation through Technology for Successful Aging with Disability (2008-2013). I will follow this by providing an update regarding progress since the RERC effort and outline the challenges and opportunities for advancing the field. I will conclude by offering some thoughts on how to move forward strategically while avoiding some common pitfalls along the way.

Skip Rizzo

Is Clinical Virtual Reality Ready for Primetime?

Since the mid-1990s, a significant scientific literature has evolved regarding the outcomes from the use of what we now refer to as Clinical Virtual Reality (VR). This use of VR simulation technology has produced encouraging results when applied to address cognitive, psychological, motor, and functional impairments across a wide range of clinical health conditions. This presentation addresses the question, "Is Clinical VR Ready for Primetime?" After a brief description of the various forms of VR technology, I will discuss the trajectory of Clinical VR over the last 20 years and summarize the basic assets that VR offers for creating clinical applications. The discussion then addresses the question of readiness in terms of the theoretical basis for Clinical VR assets, the research to date, the pragmatic factors regarding availability, usability, and costs of Clinical VR content/systems, and the ethical issues for the safe use of VR with clinical populations. While there is still much research needed to advance the science in this area, I will make the case that Clinical VR applications will become indispensable tools in the toolbox of healthcare researchers and practitioners and will only grow in relevance and popularity in the near future.

Arno Hartholt

Virtual Humans for Clinical Care

Arno Hartholt is the Director of Research and Development Integration at the University of Southern California Institute for Creative Technologies where he leads the virtual human integration and central asset production & pipeline group. He is responsible for much of the technology, art, and processes related to virtual humans and related systems, in particular at the interchange between research and industry capabilities. He has a leading role on a wide variety of research prototypes and applications, ranging from medical education to military training and treatment. Hartholt is the Co-Lead of Bravemind, a clinical, interactive, virtual reality based exposure therapy tool used to assess and treat post-traumatic stress in service members. Other collaborations include online virtual humans for service members and medical students, and virtual role-players that help train US Army and Navy officers. Many of the ICT virtual human capabilities are freely available to the academic research community and US Military through the Virtual Human Toolkit (https://vhtoolkit.ict.usc.edu). Hartholt studied computer science at the University of Twente in the Netherlands where he got his Master's degree. He worked at several IT companies, from large multi-nationals to early start-ups, before accepting a position at ICT.

Dominique Duncan

Correcting Segmentation Errors in Neuroimaging Data using Virtual Reality

Segmentation of MRI is a critical part of the workflow process before researchers can further analyze neuroimaging data. The goal of segmentation is to algorithmically divide MRI voxels into brain or non-brain tissues, specific tissue types, including gray and white matter, or specific neural structures, e.g. hippocampus. Manual segmentation is time consuming to learn and complete, requires considerable expertise in neuroanatomy and MR, and can lead to inter-variability and intra-variability if consistent protocols are not followed. Thus, automatic segmentation software has been developed to process images more quickly with greater consistency, however, no segmentation software is perfectly accurate, and manual correction by visually inspecting the segmentation errors is required. We present a novel method of performing this task using virtual reality with a new software, Virtual Brain Segmenter (VBS). User testing has shown the potential benefits of our tool as a more efficient, intuitive, and engaging alternative compared with the current method of correcting segmentation errors. Accurate segmentation could have far-reaching benefits in neuroscience, spanning from research in development and cognitive processes to degenerative diseases, such as Alzheimer's disease, autism spectrum disorder, and epilepsy.

Sook-Lei Liew

Virtual Reality for Stroke Rehabilitation

Stroke is a leading cause of adult long-term disability, and many stroke survivors do not regain full functional abilities. Our lab explores how embodiment and immersion in virtual reality can be used to encourage learning and recovery following stroke. In this talk, I will focus on a brain computer interface we developed called REINVENT, which allows individuals to control a virtual avatar using motor-related brain activity and which provides closed-loop neurofeedback to promote brain recovery. I will discuss research in both healthy individuals and individuals after stroke, as well as the development, feasibility, and utility of using head-mounted virtual reality to encourage stroke recovery.

Vangelis Lympouridis

Virtual Reality and Pain Management

appliedVR uses mobile VR technology combined with biofeedback, game mechanics, and storytelling to provide chronic pain patients with fun, interactive breathing and mindfulness exercises, and to teach them how to have more control over their pain. In addition we have developed an acute pain platform that is utilized by 220+ hospitals around the country. This talk will discuss the similarities and differences of treating pain in VR and address some technical, creative and business challenges.

Judy Pa

Targeting Physical and Cognitive Activity in a VR Environment to Combat Age-related Disease

Alzheimer's disease is the most common cause of cognitive impairment in older adults and affects 36 million people worldwide. Results from several large pharmacological trials have been sobering with no effective treatments for halting, slowing, or preventing the Alzheimer's disease. Exercise has emerged as an exciting, lifestyle intervention to help remediate cognitive loss or delay onset of dementia. However, to fully leverage exercise benefits in this at-risk population, training the brain to learn and engage in a cognitively-stimulating environment may be key to effective therapies. In this talk, Dr. Pa will introduce NeuroRiderVR, a new physical+cognitive VR training research program at USC's Health Sciences campus.

Poster Session

1. **Patrick Bender**: Butterfly Lovers: Design Rationale of a Cooperative Virtual Reality Game for Promoting Compassion in Multigenerational Families
2. **Brian Cohn**: Quantifying and Attenuating Pathologic Tremor in Virtual Reality
3. **Ashwin Sakhare**: Nuts and Bolts: Designing a fully integrated VR bike
4. **Ashwin Sakhare**: Combined cognitive and physical activity in VR to promote brain health
5. **Julia Juliano**: Embodiment Improves Performance on an Immersive Brain Computer Interface in Head-mounted Virtual Reality
6. **Aram Kim**: Predicting Retention of Locomotor Skill Learning in Virtual Reality and Subsequent Transfer to Over-ground Walking
7. **Octavio Marin Pardo**: Flexible Architecture for EMG acquisition for a Virtual Reality-Based Brain Computer Interface
8. **Kate Spitzley**: Feasibility of Using the HTC VIVE System for Collection of Kinematic Data
9. **Thanos Vourvopoulos**: REINVENT 3.0: Multimodal Virtual-Reality and Brain-Computer Interfacing for Stroke Rehabilitation

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