International Society *for* Virtual Rehabilitation

ISVR

NEWSLETTER

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Editorial

October 2017 Newsletter 11

Welcome to the October 2017 edition of the ISVR Newsletter. In this issue we recognize the achievements of leading figures in the field of Virtual Rehabilitation, and one up-and-coming investigator. Greg Burdea is the recipient of the prestigious IEEE 2017 Virtual Reality Career Award, while Emily Keshner has been honored for her outstanding service to the ICVR. Roberto Llorens is the winner of this year's ISVR Early Career Investigator Award.

Also in this issue, we review the recent successful ICVR in Montreal. The conference continues to grow fron strength to strength, with 181 participants from 25 countries this year. We have included extended summaries of the Best Paper and Best Poster conference awards in both the open and student categories.

The field of Virtual Rehabilitation continues to expand, with four recent books featured in this issue. These new books cover topics including cyberpsychology and technologies for inclusive well-being.

Belinda Lange, Kynan Eng and Sergi Bermudez i Badia, ISVR

UPCOMING EVENTS

European Congress of NeuroRehabilitation (ECNR)
October 25-27, 2017, Lausanne, Switzerland
http://www.efnr.org

American Society of Neurorehabilitation Annual Meeting
November 9- 10, 2017, Baltimore, USA
https://www.asnr.com

The United Kingdom Acquired Brain Injury Forum - UKABIF's 9th Annual Conference
November 13, 2017, London, UK
http://www.ukabif.org.uk

10th World Congress for NeuroRehabilitation (WCNR)
February 7-10, 2018, Mumbai, India
http://www.wcnr2018.in

12th International Society of Physical & Rehabilitation Medicine (ISPRM) World Congress
33rd Annual Congress of the French Society of Physical and Rehabilitation Medicine
July 8-12, 2018, Paris, France
http://www.isprm2018.com

12th International Conference on Disability Virtual Reality and Associated Technologies, In Collaboration with Interactive Technologies and Games
September 4-6, 2018 - Nottingham, England
http://www.icdvrat.org/

11th World Stroke Congress
October 17-20, 2018 - Montreal, Canada
http://www.world-stroke.org

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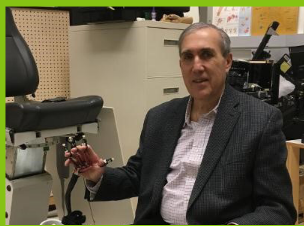

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2017 IEEE VIRTUAL REALITY CAREER AWARD

Greg Burdea

Greg Burdea is Professor of Electrical and Computer Engineering and Adjunct Professor of Biomedical Engineering at Rutgers - the State University of New Jersey. Burdea was born in Bucharest, Romania, where he received his B. Eng. degree as Valedictorian in 1980. Burdea was then offered a Fellowship at NYU where he graduated with a PhD degree in Applied Science – Robotics, under the advising of the famous Professors Martin Hoffert and Jacob Schwartz. In 1988 Burdea joined Rutgers Electrical and Computer Engineering Department, where he formed the Human-Machine Interface Laboratory and later the Tele-Rehabilitation Institute. It is in this research environment that Burdea invented the Rutgers Master glove as an interface allowing users to feel the compliance of virtual objects. The journal Presence (MIT Press) featured it in its 1992 Inaugural Issue. The Rutgers Master was subsequently used to rehabilitate patients post carpal tunnel surgery playing Rutgers custom VR games at Stanford University. This marked the start of a new science domain which Burdea coined "tele-rehabilitation" in 1990. This earned a Presidential citation as example of leading-edge, human-centered, federally funded research. In early 2000 Burdea's team was asked to join forces with Meredith Golomb MD, a pediatric neurosurgeon at Indiana University. A low-cost home rehabilitation system was created using Virtual Reality running on modified PlayStations, coupled with the 5DT DataGloves. This clinician-engineers team was able to give back hand function to teenagers with Cerebral Palsy living in rural Indiana, and training at home. It was the first time Virtual Reality proved a viable treatment for Cerebral Palsy where conventional medicine was unsuccessful. Burdea was also preoccupied by the inefficiencies of conventional therapy for stroke, TBI, or dementia. Current rehabilitation targets the motor, or the cognitive, or the emotive, but not the patient as a whole. Using Integrative Virtual Rehabilitation (a term he coined), Burdea was able to reverse mild cognitive impairments back to normal cognition in only 8 weeks of playing his custom serious games. Burdea was also able to improve a rare case of Primary Progressive Aphasia, which conventional Medicine considers incurable.

How long have you been in the field, and how do you think it has evolved since you started?

I've been in the field of Virtual Reality since the early 90s and in 1994 wrote the first textbook on VR technology. The field of Virtual Rehabilitation I named in 2002 together with Professor Daniel Thalmann. That year he organized the first conference dedicated to Virtual Rehabilitation.

What achievement have you been most pleased with in the course of your career so far?

I was very happy with my early work on haptic interfaces (the first force feedback glove - the Rutgers Master, and later the Rutgers Ankle). But I "found my place" doing integrative virtual rehabilitation research and development. As an engineer it was very gratifying to help advance some of the current health therapies. Especially the impact on people's lives.

What do you see as the most important trends in VR rehabilitation over the next 5-10 years?

I am a bit subjective here, but I do believe the most important trend is customized game-based training in the home. One example addresses the current limitations of chronic pain maintenance treatments. Clearly opioid medications are problematic (i.e. addictive and with diminished effect). Virtual rehabilitation for maintenance of people with chronic pain offers a medication-free alternative that I believe is the answer.

What advice would you give to young researchers wanting to get into VR rehabilitation?

Do it if you are passionate about the field, get involved and persevere. Never give up. There are many rewards awaiting, and you can have a clear impact on future Medicine. Be creative and think outside the box. I wish you great success, because the field cannot grow without the young energetic researcher.

ICVR OUTSTANDING SERVICE AWARD

Emily A. Keshner

Dr. Emily A. Keshner is a Professor in the Department of Physical Therapy at Temple University. She received her Physical Therapy degree and her EdD degree in Movement Science at Columbia University. She was instrumental in identifying the role of the vestibular system in the organization of multisegmental balance as a post-doctoral fellow with Dr. Marjorie Woollacott at the University of Oregon and Dr. John Allum at the University of Basel, Switzerland. She then moved to the laboratory of Dr. Barry Peterson at Northwestern University where they published seminal papers on control dynamics of the head and neck. Dr. Keshner is Director of the Virtual Environment and Postural Orientation (VEPO) Laboratory at Temple University, which was developed for experimental and clinical testing of postural behavior within a simulated visual environment. She has always had an interdisciplinary approach to her research and has built a team of collaborators that include clinicians, computer scientists, and bioengineers. Her current research focuses on how the CNS computes conflicting sensory feedback demands to organize effective postural behavior. Studies are performed with multiple populations including healthy adults and those with balance problems and central nervous system disorders, such as vestibular deficit, stroke and cerebral palsy, to understand how control parameters change with age and dysfunction. The overall goal of this research is to develop treatment interventions that will effectively reduce instability and falls in aging and clinical populations. Her research has been funded by NIH and NSF. Dr. Keshner is an Associate Editor for both the Journal of NeuroEngineering and Rehabilitation and Transactions on Neural Systems and Rehabilitation Engineering. She has served as President for the International Society for Posture and Gait Research (ISPGR) and the International Society for Virtual Rehabilitation (ISVR) and is on the steering committee of ICVR since its inception.

How long have you been in the field, and how do you think it has evolved since you started?

I started collaborating with Dr. Robert Kenyon from the Electronic Visualization Laboratory, University of Illinois at Chicago in 1999 where they had first invented the CAVE. At that time, virtual reality was primarily being developed for realistic, real-time graphical renderings for industry and medical applications. We were unusual in that we were trying to identify how the control processes in human-machine interactions could be used to open a window into perceptual-motor control. The field has really evolved in its ability to produce more user-friendly technology. I think the greatest advance has been developing accessible software and affordable technology so we no longer expect that only engineers and computer scientists will use VR. Increasing the availability of VR has opened the field up to a much wider range of uses and will eventually make it an anticipated component of rehabilitation programs.

What achievement have you been most pleased with in the course of your career so far?

My career has taken many turns but as for my research, I think the work I've done with Drs. Neil Longridge and Art Mallinson at the University of British Columbia has been the most fulfilling. We combined their clinical expertise with patients who experience visually induced dizziness with my knowledge about the perceptual impact of VR to design a new intervention. These are people who have been struggling with dizziness and disorientation for a long time and no traditional treatments have worked for them. Our participants reported real changes after only one month of treatment so we are excited about moving forward with this research direction. This study was particularly exciting for me because it was informed by the results of both my basic science and clinical research endeavors. I had a real sense of accomplishment after seeing a direct application of the issues I've been investigating for much of my life.

What do you see as the most important trends in VR rehabilitation over the next 5-10 years?

I think we are definitely moving toward a time when rehabilitation

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programs will be personalized and performed in the home environment under the supervision of distant skilled professionals. There is tremendous potential for VR to become a wearable sensor device and to provide essential information during action. We are on the cusp of developing technology lightweight enough to be worn for longer periods and fast enough to deliver exploitable feedback. Holding us back, though, is that we still need to fully understand how the parameters of the technology impact the human performer. I see the trend of interprofessional teams as a major step forward in advancing VR as a research and intervention tool. Clinical scientists and users will demand that the developers deal with these questions in order to push the envelope of human performance.

What advice would you give to young researchers wanting to get into VR rehabilitation?

Working as a team means that we all have something unique to contribute. It is important to communicate with developers and share your research needs and goals, but I would caution young researchers to not allow the availability of commercial products shape their research. Respect your own knowledge base and let the data guide you. When we created ISVR it was with the hope that we would motivate industry to continuously interact and exchange ideas with the clinicians and scientists. Remain true to the scientific inquiry - virtual reality is a tool for addressing your research question. It is an amazingly robust tool as it can influence the human organism on every level – motor, movement and cognitive. But like any research tool, you need to fully understand how the technology impacts performance in order to effectively assess results and derive meaningful conclusions.

ISVR EARLY CAREER INVESTIGATOR AWARD

Roberto Llorens

Roberto Llorens graduated from the Universitat Politècnica de València (Valencia, Spain) in 2007 with a major in Telecommunications Engineering. He also earned a Masters in Technology, Communication Systems and Networks in 2011 and got a Doctorate Degree Cum Laude in 2014. His growing interest in applied science led to his association with the i3B Institute in January 2008, where he started working on virtual reality-based applications to neurorehabilitation after a brain injury. His clinical orientation motivated his association with the Neurorehabilitation Unit of NISA-Vithas Hospitals, where he started working as a Research Associate. Since then, he has been working as a bridge between research and clinical practice, leading a stable interdisciplinary research group. The Neurorehabilitation and Brain Research Group is focused on assessing and promoting the recovery of brain function after an injury and on examining the underlying mechanisms of different brain processes, and, in the recent years, on studying the technical and psychological basis of virtual reality and embodiment. Roberto combines the coordination of several research projects with teaching and supervision of undergraduate thesis projects, master's theses, and PhDs in the field of physical therapy, neuropsychology, occupational therapy, and engineering. Roberto Llorens is a board member of the International Society for Virtual Rehabilitation, a member of the Spanish Neurorehabilitation Society, co-chair of the International Conference on Recent Advances in Neurorehabilitation series, and co-founder of the Open Rehab Initiative.

How long have you been in the field, and how do you think it has evolved since you started?

I came to neurorehabilitation in 2010, after spending some years in medical imaging research. In these 7-8 years, I have seen firsthand how the field has grown in maturity, moving from small preliminary experiments that yielded promising but very preliminary results to much more rigorous randomized controlled trials that begin to corroborate those results. It is definitely a very young research field, but it begins to prove its power.

What achievement have you been most pleased with in the course of your career so far?

Although in the last years I have spent some time collaborating with other groups doing basic research, most of my research career has been markedly applied. Perhaps this evidences my work in the Polytechnic University of Valencia while being an associate researcher in the Neurorehabilitation Service of Vithas-NISA Hospitals. I am very happy and proud of having combined both worlds, leading research projects that have ended up being effective and usable tools that have been integrated into the clinical practice of our hospital network.

What do you see as the most important trends in VR rehabilitation over the next 5-10 years?

I think that we have been successful at providing customized auditory, visual, and proprioceptive stimulation and facilitating interaction to those with impaired motor and cognitive skills, but I think that in the following years we will be extending these features to include non-invasive brain stimulation and brain-computer interaction. This will lead us to more and more customized interventions and individuals.

What advice would you give to young researchers wanting to get into VR rehabilitation?

I would advise them to read whatever comes to their hands, to be critic, and to think out of the box. I would like them to use the technology as a means to promote rehabilitation, and not as an end in itself. Finally, I would strongly invite them to join the International Society for Virtual Rehabilitation. I have known some of the smartest people who are working on the field, and they have always been close and available.

ICVR 2017 Summary

ICVR 2017 took place in Montreal from June 19 to 22 and was a great success, with 181 participants from 25 countries! The event started with a day of workshops, attended by students, clinicians and researchers. Then, at the scientific conference, a total of 91 papers were presented, as either poster or platform presentations. Topics included VR applications for pediatrics, stroke, older adults, cognitive rehabilitation and many more. The proceedings are now available on IEEEXplore: http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8000694

Poster presentations took place at noon on two separate days. These were introduced at a rapid-fire session, where poster presenters had 1 minute and a single slide to describe their findings. The allowed time was very tightly moderated using a variety of songs and sound effects.

The eye-opening presentations by our keynote speakers greatly contributed to the overall success of ICVR 2017. Dr. Mel Slater, from the University of Barcelona, discussed virtual reality and body ownership. He provided examples from his work of how incarnating various VR avatars and observing the same event from different points of view can change behaviours, helping to diminish racial bias and gender harassment in social situations. Our second keynote, Dr. Judy Deutsch from Rutgers University, described her 17 years of work in the development of VR applications and technology to improve mobility and fitness for persons with neurologic conditions. She shared her thoughts on how to make ideas progress from the drawing board to a proof of concept; and eventually to the clinical environment and commercialization. Dr. Tiiu Poldma, from the University of Montreal, was our final keynote presenter. A researcher in interior design, Dr. Poldma presented perspectives about how the built environment interacts with persons with disabilities, and what issues arise. She presented evidence on how adapting physical environments through an understanding of the five senses contributes can improving capacity and autonomy for vulnerable populations.

Participants at ICVR 2017 also enjoyed several social events. The opening reception took place at McGill's Redpath museum of natural history, with its quaint collection of minerals, dinosaurs and one mummy. Students and post-docs were able to meet and discuss with researchers during a mentoring breakfast. The traditional ICVR banquet was held in a restaurant in the Old Port of Montreal, with views on the city and on the St-Lawrence river. Prizes and awards were presented at the closing ceremony, including prizes for best posters and best platform presentations, the ISVR Early Career Investigator Award to Dr. Roberto Llorens and the ISVR Career Award to Dr. Emily Keshner.

In closing, we would like to deeply thank all the ICVR committee members and volunteers who worked very hard for the success of the conference.

ICVR 2017: Best Student Poster (1st Prize)

Enhancing a beam+ Telepresence Robot for Remote Home Care Applications

Sébastien Laniel, Dominic Létourneau, Mathieu Labbé, François Grondin, François Michaud

The aging population is putting increasing pressure on health care systems in many developed countries, and maintaining quality of care while controlling costs becomes a major issue that needs to be addressed. With platforms now available at low cost, telepresence robots are one potential solution to provide remote care services to elders living in their homes. However, they need improved capabilities to make them more than simple "Skype on wheels" devices. To make telepresence robots suitable for remote home care applications, they must offer enhanced and robust functionalities such as autonomous navigation, artificial audition and vital sign monitoring. For the robot platform, we chose to use the beam+ robot because of its low cost (2,000 $US), its payload capability, and the possibility of interfacing it using a library [1]. The original robot comes with a 10" LCD screen, low power embedded computer, two wide angle cameras facing bottom and front, loudspeakers, four high quality microphones, WiFi network adapter and a recharging station. Motor control and power management is accomplished via an USB 2.0 controller in the robot's base. Its maximum speed is 0.8 m/s and the robot has two hours of autonomy. Fig. 1 illustrates the modified beam+ robot. We added a total of 2000 $US of hardware. We placed a XBOX One Kinect camera, a circular microphone array and the 8SoundsUSB [2] sound card using custom made aluminum brackets and acrylic support plates. We added an Intel Skull Canyon NUC6i7KYK (NUC) computer running Ubuntu 16.04 with Robot Operating Systems (ROS). We replaced the head computer's hard drive with a 128 GB mSATA drive along with ROS. Finally, an additional SWX HyperCore 98Wh VMount lithium-ion battery is installed on the robot's base. Coupled with DC-DC converters, the battery provides power to the microphone array, the Kinect and the NUC computer. The lithium-ion battery is recharged manually and separately. As the robot control architecture, we chose to use a Hybrid Behavior-Based Architecture (HBBA) [3] [4]. Basically, behavior-producing (or Behaviors) modules are used as independent and distributed modules that can be activated and configured according to what are referred to as the Intentions of the robot. They generate all of their commands based on percepts produced by Perception using data coming from the sensors of the robot. High-level goals are generated and monitored by Motivations, which generate Desires for the satisfaction or inhibition of Intentions. The Intention Workspace modules, monitors and arbitrates the Desires generated by Motivations based on a database of Strategies. Each Strategy describes how a specific class of Desire can be fulfilled on a specific robot platform, which includes activation of Behavior and Perception modules and transfer of parameters to these modules.

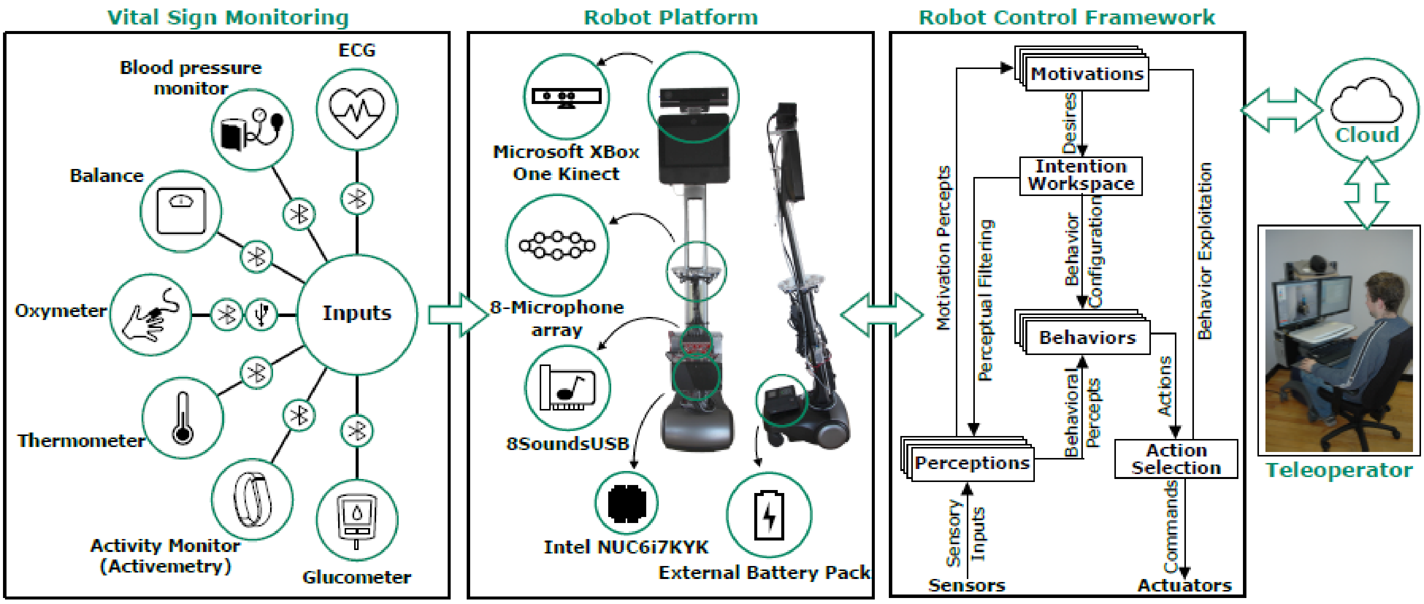

Figure 1: Enhancing a beam+ Telepresence Robot for Remote Home Care Applications

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This makes this robot control architecture highly reusable and versatile, isolating what is specific to a robot platform into Perception and Behavior modules. The two Perception modules integrated are Real-Time Appearance-Based Mapping (RTAB-Map) [5] and ManyEars [2].

RTAB-Map is the open source library used for 3D mapping and autonomous navigation in the home environments using the Kinect camera. Such capability should help minimize cognitive load by allowing the robot to move autonomously to specific locations and by providing a 3D representation of the home.

ManyEars is the open source library performing sound sources localization, tracking and separation. It is used to filter and separate sound sources to focus the robot's attention only on speech, and ignore ambient noise. Using separated audio streams can also help maintain a conversation in noisy environments.

A low-cost USB dongle is installed on the robot to acquire vital signs from different kinds of battery-powered Bluetooth Low Energy sensors. To integrate vital sign monitoring with videoconferencing and robot telepresence control, a telecommunication framework is designed to provide secure bidirectional multipoint communication of audio streams, multi video feed streaming (e.g., general view of the scene and a close-up view of a region of interest; a navigation camera and a videoconference camera on a mobile robot) and data (e.g., vital signs, commands and states of the robot) from the same telecommunication station.

We currently have an operational prototype of our enhanced beam+ platform. Before validating its use in remote home care applications, we are following a user-centred design approach involving clinicians, seniors and caregivers. Once the scenarios are identified, the robot control architecture will be adapted accordingly and rigorously tested before being deployed in a senior residence for trials.

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ICVR 2017: Best Student Poster (2nd Prize)

Pilot Project: Feasibility of High-intensity active video game with COPD patients. Tools for home rehabilitation

Andrée-Anne Parent and Alain-Steve Comtois

The objective was to observe the feasibility of using motion capture devices safely and easily with this population. Furthermore, the project attempted to observe if quadriceps tissue oxygenation (TOq) could be used as an intensity marker during exergames training sessions for the home rehabilitation phase. 14 patients with moderate to severe COPD (8 men, aged 69±6 years and 6 women, aged 74±6 years, FEV1/VC=43.8±15.2% and %FEV1 predicted= 44.0±14.8) were recruited. The participants were invited to play 4 mini-game sessions from an exergame platform (Shape-Up, Ubisoft Divertissement, Montreal) that uses a motion capture device (Kinect). The ventilation and oxygen uptake were all collected with a portable metabolic analyzer (MetaMax, Cortex, Germany). The TOq (MOXY, Fortiori Design LLC, USA) was taken only on 3 participants. The main exercise instruction given to participants was to do as much they could. Exercises (exergames) began with a running game (Stationary knee lifting), were the participant raised their knees as high as they were comfortable and repeating as many times as they could. Followed by a boxing game (Target punching), where the participant had to punch the highest number of targets that appeared randomly. The core twisting exercise was to twist their core in order to navigate around obstacles in the game, and lastly, a squat game (Chair sit to stand), where the instructions were to sit on a chair and stand up. A TOq ratio was created as follows: ((R - L)/R) X 100, where R is the baseline value at rest, and L the lower value recorded during the mini-game. This percentage was compared to the peak METs recorded during the mini-game sessions using a linear regression analysis. The peak METS and peak ventilation reached, respectively, for Stationary knee lifting 4.2±1.5 METS, 33.5±8.2 L/min; Target punching 3.7±1.2 METS, 31.8±9.8 L/min; Core twisting 3.3±1.1 METS, 29.2±9.9 L/min and, Chair sit to stand 4.4±1.1 METS, 36.8±11.1 L/min. The TOq ratio as a function of mini-game intensity (METs), Figure 1, indicates a significant correlation (p=0.004) with a coefficient of determination of r2=0.56. The participants enjoyed the mini-games and mentioned a high interest to have it home based. However, four participants out of 14 did not feel confident with the technology if they had to use it alone.

The main finding of this study is the feasibility, where participants succeeded to interact with the mini-games platform and had an exercise response that showed a high intensity effort for this population. Previous studies [1,2] observed an 80% peak work rate related to around 3.4 METS and a VE around 33-36 L/min. These values can be reached with the Chair sit to stand (Squat me to the Moon) with the exergame used in this study. Furthermore, most of the participants reached breathlessness tolerance during exergames, and in fact, caused some participants to end sooner the exergame bout, possibly indicating maximal effort. Participants were interested to use the exergames at home due to enjoyment. However, some of them were not confident to navigate the setup menus by themselves if they would be alone at home. Furthermore, the medical crew would appreciate telemedicine biomonitoring parameters, such as saturation, heart rate and effort perception during a tele-rehabilitation program. However, the TOq ratio needs further investigation before it can be used as an exercise intensity parameter. In conclusion, the current pilot-project suggests that exergames are enjoyable and provide feasible high intensity exercise as a hospital and home based pulmonary rehabilitation platform. As well, further investigation in the role of home based exergame programs need to be completed in order to observe long term benefits.

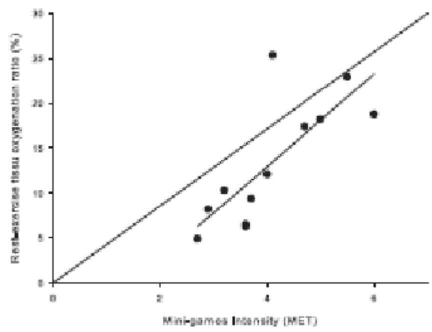

Figure 1: Relationship between the TOq ratio and peak METS during mini-game sessions (n=3)

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Gait adaptation to conflictive visual flow in virtual environments

Desiderio Cano, Rivka Inzelberg, Gabriel Zeilig, Meir Plotnik

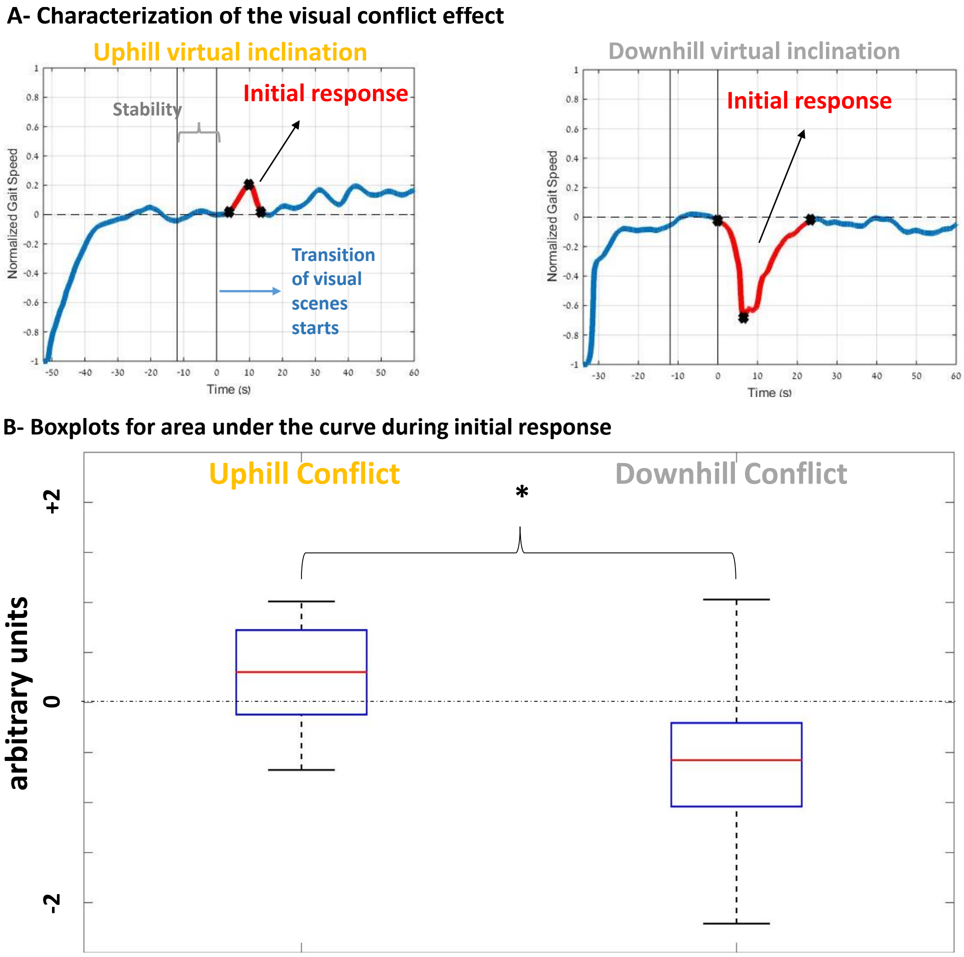

Figure 1: Gait adaptations to virtual inclinations during level walking. **A)** Characterization of the effect during uphill and downhill virtual inclinations. The two vertical lines (stability) represent the period of steady-state velocity (SSV), which is determined by a real-time algorithm monitoring walking speed. Right after this period, transition of visual scenes starts. Initial response is marked in red in both plots. Black dots represent the beginning, peak and end of initial response in each plot. Left plot: representative figure from a single participant depicting normalized (to SSV) walking speed during the uphill virtual inclination. Right plot: representative figure from a single participant showing normalized (to SSV) walking speed of the downhill virtual inclination. **B)** Magnitude of the effect measured by area under the curve during uphill and downhill conflict (or virtual inclination). Positive and negative values reflect, respectively, an increase and decrease in walking speed. * :p < 0.05 in the comparison between uphill and downhill conflict, and between each condition and zero, performed by at-test.

Walking speed (WS) relies on multiple sensory inputs such as vision and proprioception. Virtual reality (VR) facilitates the investigation of the mechanisms underlying this sensorimotor integration. Studies suggest that the manipulation of VR-generated visual feedback may modulate WS and promote postural adjustments [1, 2]. However, very little is known about the effect of manipulating proprioceptive feedback, as for example, by introducing a "virtual inclination" during level walking. One model for how individuals select (preferred) WS in a virtual environment posits that there are two main mechanisms involved [3]. In the first mechanism, called direct optimization, preference is given to walking patterns that minimize energy expenditure and metabolic cost, and the second mechanism, indirect prediction (IP), suggests that our nervous system has pre-programmed gait patterns based on accumulated experience that may be quickly activated under certain tasks or environmental conditions (e.g., slippery ice, inclined surfaces). A third mechanism included in the model, sensory reweighting (SR), suggests that following incongruence between two or more sensory inputs, there will be a recalibration of each sensory system leading to a gradual return to preferred WS. The aims of our study were first, to examine gait adaptation following incongruent virtual inclinations during level walking and second, to test the hypothesis that the mechanisms of IP and SR govern adaptations of WS following virtual inclinations.

We recruited 25 young healthy participants (14 female, age: 28±4 years), and experiments were conducted in a large fully immersive VR system, the CAREN High End (Motek Medical, The Netherlands). The CAREN system has a moveable platform synchronized with a visual scene (one-lane road) projected on a 360° dome shaped-screen (Fig. 2 & 3). Participants walked on a self-paced, level treadmill (TM) embedded in the platform [4]. Concurrently, a motion capture system (Vicon, Oxford, UK) recorded the movements of the participant. Here, we report on 2 walking conditions (out of 9 randomly presented): 1. uphill conflict, and 2. downhill conflict, in which, after reaching steady-state velocity, the virtual road switched to uphill (+10°) or downhill (-10°), respectively. Note that the actual TM platform did not change in either of these conditions (only

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the virtual inclination of the road changed). We assessed WS, joint angles (knee, elbow, pelvic girdle) and spatiotemporal gait parameters (step and stride length as well as stance time).

Uphill virtual inclinations (uphill conflict) increased WS, while downhill virtual inclinations (downhill conflict) decreased WS ($p<0.05$, Fig. 1). The initial response occurred by 10 seconds in both conditions, and adjustments occurred by 20 seconds. During the initial response, spatiotemporal parameters followed changes in WS (e.g., stride length longer in uphill conflict) and pelvic girdle angles were larger in uphill conflict, suggesting an increase in mobility of the pelvic girdle (data not shown). Additionally, our results support the interpretation that selection of WS following virtual inclinations relies on the mechanisms of IP and SR. The former might be related to the rapid initial response and the latter to the gradual return to preferred WS. We speculate that this gradual return occurs when the nervous system "realizes" that there is discordant visual feedback and seeks to "correct" WS.

Our results suggest that virtual inclinations may modulate WS without actual TM inclination. Specifically, we found an early effect; however, we are continuing to analyze the later period for possible late-effects (i.e.>20 seconds). Additionally, we are currently analyzing data from the remaining experimental conditions. This paradigm of virtual inclinations might be suitable for integration within clinical protocols of VR-based gait rehabilitation.

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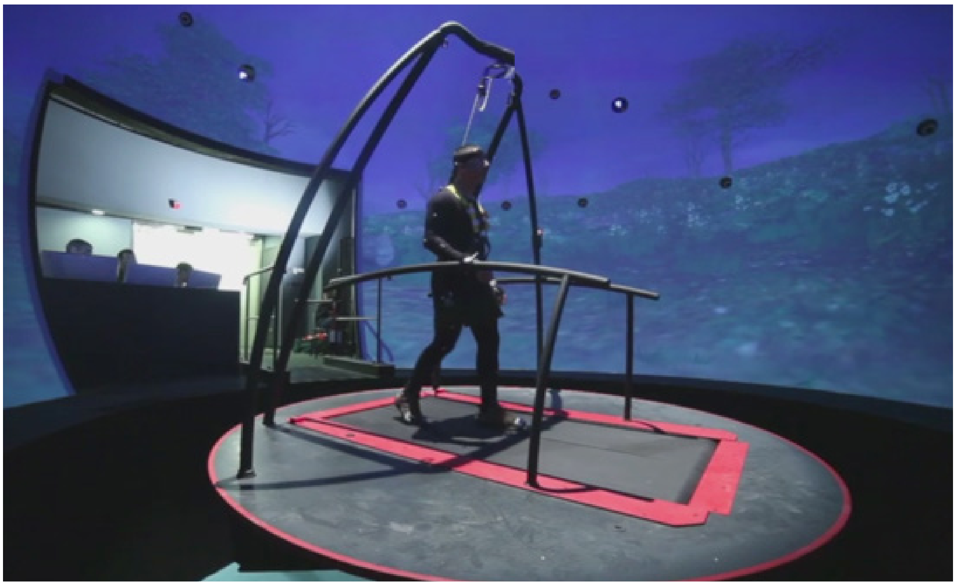

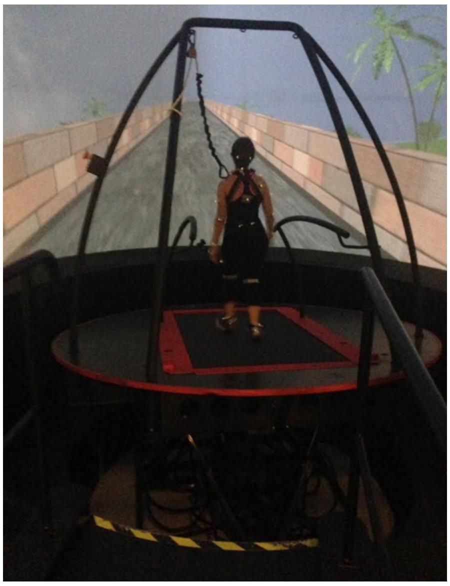

Figures 2 & 3: CAREN virtual reality system

Is children's motor learning of a postural reaching task enhanced by practice in a virtual environment?

Danielle E. Levac and Bojan B. Jovanovic

Figures 1 & 2: Virtual and physical environments

To support the use of virtual environments (VEs) in pediatric rehabilitation, greater understanding of the extent and mechanisms by which practice in a VE might facilitate motor learning as compared to practice in a physical environment (PE) is required. One proposed mechanism is via enhanced user engagement and/or motivation, which may directly influence the quality of motor memory consolidation. The objectives of this study were to a) compare children's motor learning of the same novel postural reaching task in a VE versus a PE; b) evaluate differences in engagement and motivation between the two practice environments; and c) explore the relationships between practice environment, engagement, motivation, and motor learning.

Thirty-two typically developing children aged 7-13 years were randomized to acquire a novel postural reaching skill in either a 2D flat-screen VE (Fig. 1) or a PE (Fig. 2). Children were instructed to use the visual information on the screen (VE) or board (PE) to determine how to weight-shift to move their body, without moving their feet, to a specific location in order to 'unlock' a target appearing on the projection screen (VE) or lighting up on the board (PE) and then 'touch' the target with their wand as quickly as possible. Skin conductance level (SCL) was measured on the non-task hand during practice. Following acquisition, children completed a language-modified User Engagement Scale (UES) and the Pediatric Motivation Inventory (PMOT). Participants returned 1-7 days later for retention (same environment) and transfer (opposite environment) tests.

Children who practiced in the VE demonstrated greater retention, as evidenced by higher mean scores on the retention test ($t[30] = -3.72$, $p = 0.001$, partial eta squared 0.28). Children who practiced in the PE demonstrated greater transfer to the opposite environment as compared to those who practiced in the VE ($t[30] = 2.05$, $p = 0.001$, partial eta squared = 0.238). There were no significant differences in UES total or subscale scores between the 2 groups. PMOT total motivation scores differed significantly between groups, favoring the VE ($t[30]= 2.49$, $p = 0.018$, partial eta squared = 0.154). There were no significant differences in SCL peak count or peaks per minute between groups. There was no relationship between engagement, motivation, and retention or transfer performance.

Findings suggest that retention but not transfer of a new motor skill may be facilitated by practice in a VE. This may be due to unique task demands in each environment. Children were more motivated to succeed in the VE and were engaged in the task in both environments, suggesting that both constructs should be measured in subsequent studies and that VE aesthetics alone may not be a key 'active ingredient' of children's engagement. Subsequent research will more objectively quantify neurophysiological correlates of engagement and motivation, explore additional tasks, include populations with neurological impairments and compare 3D vs 2D VE displays.

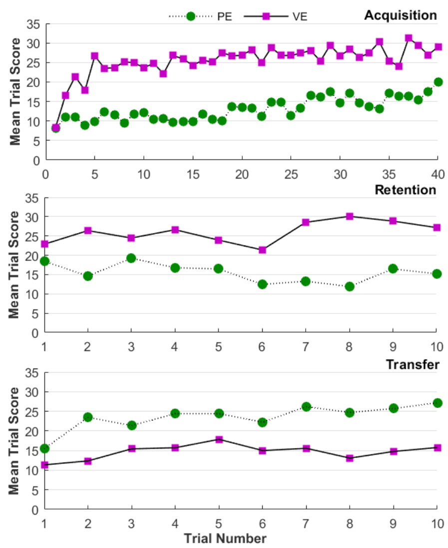

Figure 3: Average score per trial during Acquisition, Retention and Transfer for each group

ISVR Society News

The website at http://www.isvr.org acts as a portal for information about the society. We are keen to to enhance the community aspects of the site as well as to to make it the first port of call for people wanting to know what is going on in the field of virtual rehabilitation and its associated technologies and disciplines. Please do visit the site and let us know details of any upcoming events or conferences or news items you would like us to feature on the site. We intend to add further features in the coming year including member profiles; a directory of journals who publish virtual rehabilitation related work; and a list of Masters and PhD level theses completed or currently being undertaken in the field. As well as sending us details of events and news for display, we would welcome suggestions from members about what else they would like to see on the site, or ideas for how we can further develop the virtual rehabilitation community through it.

Please mail webdec@isvr.org with any information/ideas using ISVR INFO in the subject header.

Membership information

Membership of ISVR is open to all qualified individual persons, organizations, or other entities interested in the field of virtual rehabilitation and/or tele-rehabilitation. Membership (regular, student or clinician) entitles the member to receive reduced registrations at ISVR sponsored conferences and affiliated meetings (see webpages for more details). There is also an active ISVR facebook page, which is another source of useful information, currently with 1148 members.

Call for Contributed Articles

- If you are a technology expert in virtual rehabilitation or you have experience in the clinical use of virtual rehabilitation technologies, and would like to be featured in an upcoming ISVR newsletter issue
- If you would like to submit a contributed article relevant to the ISVR community
- If you have any news, summaries of recent conferences or events, announcements, upcoming events or publications

We are looking forward to your contribution! Please contact us at newsletter@isvr.org.

International Society for Virtual Rehabilitation

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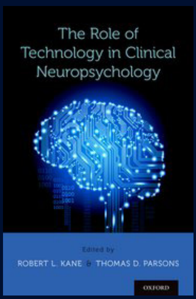
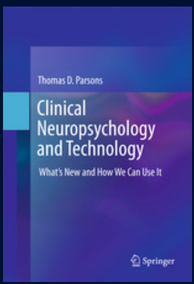
RECENT BOOKS ON VIRTUAL REHABILITATION



The Role of Technology in Clinical Neuropsychology

Robert L. Kane and Thomas D. Parsons, April 2017
https://global.oup.com/academic/product/the-role-of-technology-in-clinical-neuropsychology-9780190234737?cc=us&lang=en&

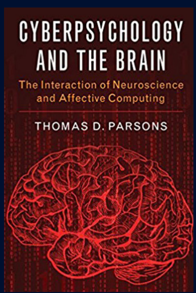
- Presents novel ideas and cutting-edge research that explore present and future uses of technology.
- Includes numerous, full color images and charts of virtual reality environments, neuroimaging, and data analytics.
- Provides information on various virtual reality-based neuropsychological assessments.
- Discusses how advanced technologies may enhance test data for neuroinformatics.
- Outlines prospects for a future computational neuropsychology.



Clinical Neuropsychology and Technology

Thomas D. Parsons, 2016
http://www.springer.com/gp/book/9783319310732

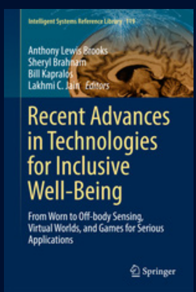
This ambitious and accessible guide reviews innovative technologies enhancing the field of neuropsychological testing. Starting with the premise that standard batteries—some nearly a century old—lag behind in our era of neuroimaging, genomic studies, psychophysiology, and informatics, it presents digital measures offering more efficient administration, more accurate data, and wider clinical applications. Ecological validity and evidence-based science are key themes in these advances, from virtual environments and assessment of social cognition to the shift toward situational reliability and away from lab-created constructs. These chapters also demonstrate how high-tech assessment tools can complement or supplement traditional pencil-and-paper measures without replacing them outright.



Cyberpsychology and the Brain: The Interaction of Neuroscience and Affective Computing

Thomas D. Parsons, 2017
https://www.amazon.com/Cyberpsychology-Brain-Interaction-Neuroscience-Affective/dp/1107477573

Cyberpsychology is a relatively new discipline that is growing at an alarming rate. While a number of cyberpsychology-related journals and books have emerged, none directly address the neuroscience behind it. This book proposes a framework for integrating neuroscience and cyberpsychology for the study of social, cognitive, and affective processes, and the neural systems that support them. A brain-based cyberpsychology can be understood as a branch of psychology that studies the neurocognitive, affective, and social aspects of humans interacting with technology, as well as the affective computing aspects of humans interacting with computational devices or systems. As such, a cyberpsychologist working from a brain-based cyberpsychological framework studies both the ways in which persons make use of devices and the neurocognitive processes, motivations, intentions, behavioural outcomes, and effects of online and offline uses of technology. Cyberpsychology and the Brain brings researchers into the vanguard of cyberpsychology and brain research. How technology can transform test data into information useful across specialties.



Recent Advances in Technologies for Inclusive Well-Being

Brooks, A.L., Brahnam, S., Kapralos, B., Jain, L.C., 2017
http://www.springer.com/gp/book/9783319498775

This book presents current innovative, alternative and creative approaches that challenge traditional mechanisms in and across disciplines and industries targeting societal impact. A common thread throughout the book is human-centered, uni and multi-modal strategies across the range of human technologies, including sensing and stimuli; virtual and augmented worlds; games for serious applications; accessibility; digital-ethics and more. Focusing on engaging, meaningful, and motivating activities that at the same time offer systemic information on human condition, performance and progress, the book is of interest to anyone seeking to gain insights into the field, be they students, teachers, practicing professionals, consultants, or family representatives. By offering a wider perspective, it addresses the need for a core text that evokes and provokes, engages and demands and stimulates and satisfies.