International Society *for* Virtual Rehabilitation

ISVR

NEWSLETTER

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Editorial

As we prepare for the start of a new academic year, we swing into a new cycle of projects and activities. Our focus this summer was the organization of the International Conference of Virtual Rehabilitation, one of the major meetings sponsored by ISVR. The meeting was held in Valencia, Spain in conjunction with RehabWeek, which included the participation of two other societies ICRAN and INRS. It was co-chaired by Mariano Alcaniz Raya and Emily A. Keshner and included a large number of hard-working committee members. An important and recurrent event of the ICVR is the full-day of workshops organized before the meeting. This year, there was quite a bit of interest in the workshops with high levels of attendance, signaling the continuing need for and popularity of this learning format. You can find more information about the meeting on page 6 of the newsletter as well as summaries of the winning platform and poster presentations on pages 7 to 11.

In terms of ISVR news, as I announced during the ISVR annual general meeting, held during ICVR, we have created a new category of membership. Open to clinicians and users of VR technology including patients and their families, membership in the Society is free for the first year, and will be available at a reduced rate thereafter. We hope to encourage the formation of a 'community of practice' of individuals involved in using or developing VR for rehabilitation purposes, who can use resources available on our webpage for information sharing. General membership information can be found on page 5 of the newsletter.

Also, I am very excited to announce the establishment of the ISVR Early Career Investigator Award. Our awards committee including Belinda Lange, Greg Burdea and Tamar Weiss have worked hard on bringing this award to fruition. We hope that it will encourage young researchers in the field of virtual rehabilitation and provide a means of recognizing the accomplishments of promising upcoming scientists. Full details about the award and the nomination procedure can be found on page 13.

Finally, the newsletter includes our regular features of technology and clinical profiles, now in a new format. These provide a means by which we can showcase the work of people in our network. This newsletter features the work being done by one of our newest Board members, Philippe Archambault, at the Jewish Rehabilitation Hospital site of the Center for Interdisciplinary Research in Rehabilitation of Montreal in Quebec, Canada, as well as by Andrea Turolla at the Laboratory of Kinematics and Robotica, in the IRCCS San Camillo Hospital Foundation in Venice, Italy.

We are always looking for interesting news from our membership, so if you have something exciting to share, such as a meeting announcement or news from your clinic or lab, please pass it on to our newsletter team (see the email address on the bottom right of this page).

Mindy Levin President, ISVR

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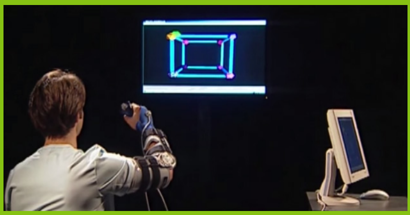

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TECHNOLOGY PROFILE

Jewish Rehabilitation Hospital

Philippe Archambault
Associate Professor; Chercheur régulier, C.R.I.R. (Centre de recherche interdisciplinaire en Réadaptation) du Montréal métropolitain in Quebec, Canada
http://www.mcgill.ca/spot/faculty/archambault

Where is your lab located?

Our laboratory is located in the Jewish Rehabilitation Hospital (JRH), Quebec, Canada. The JRH is affiliated with McGill University and is also part of the Interdisciplinary Research Center in Rehabilitation, a multisite research center. This places us in close proximity with clinicians and patients at multiple rehabilitation sites.

How did it start, how long has it been around?

The laboratory was founded in 2006. The idea was to develop the infrastructure to test the use of different technologies in rehabilitation. Since then, we have been working on rehabilitation robotics, virtual reality and the use of videogame-like systems for rehabilitation.

Who are the members?

We have a very collegial atmosphere at the JRH, with researchers and students being able to use the infrastructure of different labs according to their interests. We collaborate mainly with Drs Anouk Lamontagne, Joyce Fung and Mindy Levin.

What research interests does your lab have?

In terms of virtual reality, our main interest is the development and evaluation of a simulator for the training of power wheelchair skills. We have gone through many iterations following a user-centered design. The effectiveness of the wheelchair simulator in terms of improving driving skills is currently being tested in an RCT, involving an at home training program with new wheelchair users. We have also been evaluating the Jintronix system, a suite of applications for upper extremity rehabilitation. We are interested in robotic rehabilitation. We are currently comparing the same rehabilitation exercises in a real versus a virtual environment, to understand if they are equivalent.

Wheelchair simulator in virtual supermarket environment

Tell us about some of the technologies you use

The wheelchair simulator was designed by our lab with extensive feedback from expert clinicians and wheelchair users. The goal was to develop an application that could be easily used at home or in the clinic. Therefore, we have designed an application that runs on Unity Pro and is interfaced with a USB joystick. We have also worked at integrating affordable controllers, such as the Sixense motion controller in order to allow for hand reaching movements in the simulator. The Jintronix system is built around the Kinect 2 (Windows version). This company has designed a suite of applications involving either unilateral or bilateral arm movements. For our robotic rehabilitation projects, we use the Haptic Master, a 3D endpoint robot.

What makes your approach unique?

An important goal in our lab is to develop and evaluate technology that is affordable, that can be potentially used in the clinic or at home. Thus we try to target computer-based solutions and applications employing devices that are commercially available, or soon will be. In our development, we also try to involve clinicians and patients as soon as possible, in order to understand the needs and to test early applications.

Is the technology available for general use?

We are planning to release the power wheelchair simulator once the RCT data collection is completed. The Jintronix system can be purchased from the company.

Laboratory of Kinematics and Robotics

Andrea Turolla
Laboratory of Kinematics and Robotics, IRCCS San Camillo Hospital Foundation, Venice, Italy
http://www.ospedalesancamillo.net/ricerca/laboratori-e-centri-di-ricerca/cinematica-e-robotica

Where is your lab located?

Laboratory of Kinematics and Robotics is located at IRCCS San Camillo Hospital Foundation (Venice, Italy).

How did it start, how long has it been around?

The Lab was established by Dr. Lamberto Piron in 1998 after his placement as senior scientist at the Bizzi Lab in the Department of Brain and Cognitive Science at McGovern Institute for Brain Research at MIT (Cambridge, MA, US). After his death in January 2011, the activities have been continued by his staff.

Who are the members?

The Lab is coordinated by Andrea Turolla, Michela Agostini and Paolo Tonin. The current permanent staff is composed of 9 Physical Therapists (Mahmoud Alhelou, Alfonc Baba, Francesca Baldan, Carmine Berlingieri, Francesco Dipalma, Pawel Kiper, Claudia Longhi, Salvatore Pernice, Andrea Polli, Giorgia Pregnolato) and 2 Engineers (Marialuisa Bullo, Antonio D'Andrea).

What research interests does your lab have?

The core research interests of the Lab are in the field of translational neuroscience for rehabilitation of neurological diseases and deal with: clinical effect of VR, task-oriented and motor imagery modalities for recovery of upper and lower limb after stroke; characterisation of muscle synergies in neurological diseases; motor control and neuroplasticity in pathologies of the CNS; rehabilitation robotics for the hand and upper limb; telerehabilitation applications for motor and speech impairments; telemonitoring of degenerative diseases; detection of intention to move in biological signals (e.g. sEMG) for controlling rehabilitation devices.

Laboratory of Kinematics and Robotics Team

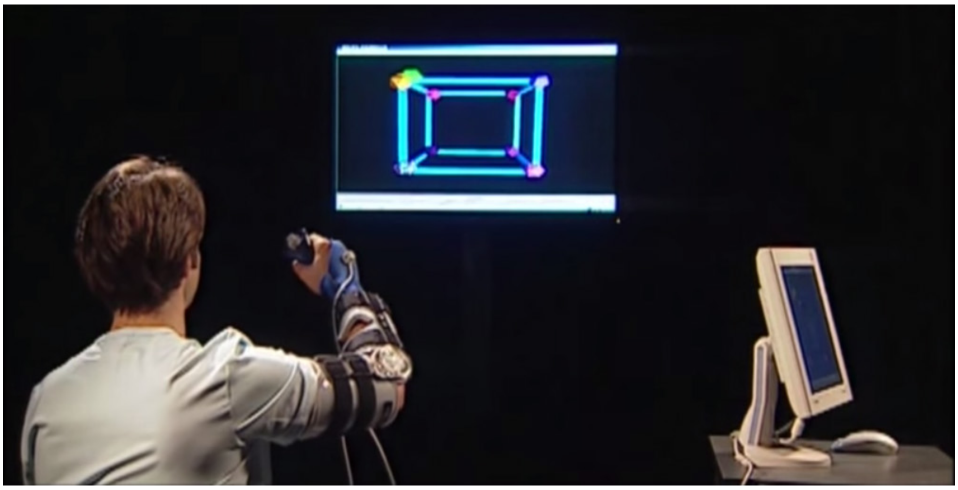
Tell us about some of the technologies you use

The Lab is currently equipped with following commercial devices: VRRS-EVO® and VRRS-TR® (Khymeia Group, Ltd. Noventa Padovana. Italy), for VR rehabilitation and tele-rehabilitation; AMADEO® and PABLO® (Tyromotion GmbH. Graz. Austria) for rehabilitation of the hand. Moreover, we are evaluating haptic-exoskeleton robot prototypes controlled by sEMG signals acquired online from patients' muscles for hand and shoulder rehabilitation. When the muscular activation reaches a threshold level, the robots translate this intention of movement into effective movements assisted by devices.

What makes your approach unique?

Our technological approaches (i.e. VR, robotics, telerehabilitation) are based on portable high-fidelity tracking technologies, allowing specific control of the interaction with the external environment. Moreover, real-time multi-sensory feedback is provided to patients, enhancing the amount of coherent information exploitable to improve clinical outcomes. The graphic

(continued from page 3)



interfaces for users are designed like unique environments, fully touch controllable, with very simple icons flowchart for both clinician and patient, allowing fast setup (up to 5 minutes) and limited technical assistance. All the hardware for our VR approach can be controlled by the same software environment, fully self-explanatory and the high-fidelity precision of sensors embedded makes standard and reliable reports automatically available, as soon as the therapy is completed. Our approach can be controlled by gesture, as well as by biological signals detecting the intention to move (e.g. sEMG).

Is the technology available for general use?

Our current VR approach for the treatment of motor impairments has been implemented as standard care at IRCCS San Camillo Hospital Foundation. The treatment is provided by means of the certified medical device VRRS® (Khymeia Group, Ltd. Noventa Padovana. Italy) and the clinical VR pathway has been translated to hospital staff, being fully managed by health-professionals, without any assistance from the lab.

Do you collaborate with other research groups and clinics?

The Lab is currently collaborating with the following partners, within funded schemes: Department of Brain and Cognitive Science at McGovern Institute for Brain Research at MIT (Cambridge, MA, US); Department of Neurorehabilitation Engineering, University Medical Center at Georg-August University (Goettingen. Germany); Ottobock GmbH (Duderstadt. Germany); FERROBOTICS GmbH (Linz. Austria); Tyromotion GmbH (Graz. Austria); Khymeia Group (Noventa Padovana. Italy); Biomedical Technology Department and Laboratory for Clinical Research on Walking and Balance (LARICE), IRCCS "S.Maria Nascente" Fondazione Don Gnocchi (Milan. Italy); Department of Management and Engineering, University of Padova (Italy); "Mario Negri" Institute for Pharmacological Research (Milan. Italy).

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 or student) entitles the member to receive a reduced registration at ISVR sponsored conferences and affiliated meetings (see webpages for more details). There is also a special category of membership for clinicians and users of VR.

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.

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

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 upcomming 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.

UPCOMING EVENTS

Rehab2015 - ICTs for improving Patient Rehabilitation Research Techniques
October 12, 2015, Lisbon, Portugal
http://rehabworkshop.org/

The International Conference on Paediatric Acquired Brain Injury
Supporting Young People and Their Families to Maximise Good Outcomes and Quality of Life
September 16-18, 2015, Liverpool, UK
http://goo.gl/9emafl

The Eleventh World Congress on Brain Injury
March 25, 2016, The Hague, The Netherlands
http://www.internationalbrain.org/news/savedateeleventhworldcongress2016/

International Congress of Physiotherapy 2016 - Biomedical Engineering & Physiotherapy
January 30, 2016, Brussels, Belgium
http://mpsevents.be/icp2016/

11th International Conference on Disability, Virtual Reality and Associated Technologies
September 20-22, 2016, **Los Angeles**, USA
Pre-Conference Workshop on Pain Management September 19, 2016
http://www.icdvrat.org/

Rehab Week 2015 (June 9 - 12, 2015)

Mariano Alcañiz Raya, General Conference Chair ICVR 2015

Rehab Week 2015 was held in Valencia, Spain, from June 9-12, 2015. This conference was co-organised by the Institute LabHuman of the Polytechnic University of Valencia (Spain), the Neurorehabilitation Service of Hospitales Nisa (Spain) and the company Hocoma (Switzerland). As for the previous successful Rehab Week 2011 in Zurich, we again adopted a strategy of combining three international conferences in the field of rehabilitation science and engineering. These three conferences (Conference on Recent Advances in Neurorehabilitation - ICRAN, International Neurorehabilitation Symposium – INRS and International Conference on Virtual Rehabilitation - ICVR) joined forces for a week of intensive cross-disciplinary knowledge transfer.

The congress featured extensive, cross-disciplinary interaction and focused on the challenges and benefits of combining different new technologies. Valencia Rehab Week provided a pivotal platform for scientists, clinicians and engineers to share their experiences, expand their knowledge in the field of neurological rehabilitation, and discuss key issues around the fusion of new technologies to enhance clinical outcomes. In the coming years, we will see a revolution in the field of neurological rehabilitation thanks to the joint work of clinicians and scientists whose ties we intend to strengthen with the help of conferences such as this. During this week, the attendees shared novel ideas and progress made in this field through paper presentations, panel discussions, keynote speeches and through the participation of various satellite workshops associated with the main conference.

During Rehab Week, several internationally renowned keynote speakers, over 20 invited platform speakers and more than 490 clinicians, scientists, therapists and engineers focused on neurological rehabilitation and the use of new technologies. The topic of the conference was "Fusion of New Technologies to Enhance Clinical Outcome". The various aspects of this subject were debated in numerous workshops and lectures by speakers and participants from 42 countries. 106 submitted posters complemented the scientific program of the Rehab Week 2015 with a wide spectrum of topics and interesting new aspects. We also had 23 exhibitors that presented their latest commercial innovations in the field.

This year, the list of keynote speakers was: Prof. Olaf Blanke (Swiss Federal Institute of Technology, Lausanne, Switzerland); Prof. Michael Boninger (University of Pittsburgh Medical Center, USA); Prof. Roger Gassert (Swiss Federal Institute of Technology, Zürich, Switzerland); Prof. Michael Gazzaniga (University of California, Santa Barbara, CA, USA); Prof. John Krakauer (Johns Hopkins University, Baltimore, MD, USA); Prof. Michael Merzenich, (University of California, San Francisco, CA, USA); Prof. Paul Verschure (University Pompeu Fabra, Barcelona, Spain) and Prof. Nick Ward (University College London, UK).

Without the dedication of the many people involved in organizing RehabWeek 2015, it would not be possible to make it the success that it was. The organizers wish to express their gratitude to the main sponsors of the conference, to the ISVR (Best student paper and Best student poster), Bright Cloud International Corporation (Best paper) and MotekForce Link (Best poster) for sponsoring these awards. We are also truly in debt to many others who made behind-the-scenes contributions for making RehabWeek 2015 another success.

rehabweek valencia '15 · INRS 2015 · ICRAN2015 · ICVR 2015

ICVR 2015: Bright Cloud International Corporation Best Paper

From Theoretical Analysis to Clinical Assessment and Intervention: Three Interactive Motor Skills in a Virtual Environment

Dagmar Sternad - Department of Biology, Electrical and Computer Engineering, and Physics, Northeastern University

Virtual rehabilitation has used commercial technologies to administer motivating games at low cost for therapeutic intervention and remote activity monitoring. Despite successful outcomes, the mechanisms underlying positive effects in recovery have remained elusive. More evidence-based approaches are needed for the design of rehabilitative tasks that permit rigorous assessment of performance. Robotic rehabilitation, on the other hand, has capitalized on insights in basic neuroscience, but to date these applications have been confined to simple reaching tasks. An extension to more complex and more engaging task based on scientific underpinnings would be desirable.

In the context of her basic neuroscience research, Dagmar Sternad and her research group has aimed to create richer experimental test beds that go beyond reaching without compromising scientific rigor. To date, she has developed three tasks using virtual reality to address theoretically-motivated questions about motor control while including gaming aspects: the throwing task skittles, a task mimicking carrying a cup of coffee, and bouncing a ball. All three paradigms capture specific control demands and afford mathematical modeling of the task that is then rendered in a virtual environment. Thereby, the task permits a range of experimental manipulations and affords high-fidelity measurement for precise quantitative assessment. Notably, the insights into basic motor control questions present the foundation for the design of targeted interventions.

In the first task, inspired by tetherball or skittles, the subject throws a ball that is suspended from a pole, like a pendulum, to hit a target skittle on the opposite side of the pole. Accurate throwing requires a controlled hand trajectory combined with opening the hand for ball release at exactly the right position and velocity. The scientifically interesting aspect is that the task has redundancy: a variety of strategies lead to successful performance. Analysis of how initial variability changes with practice to exploit the set of successful solutions offers insights into the learning process. A first experiment showed that children with dystonia, handicapped by extremely high variability, transformed their trial-to-trial variability to exploit the space of solutions offered by the redundant task. A companion study (virtually) decreased their performance variability and unmasked their ability to control their movements and improve their mean score. A second experimental task imitated the control demands of carrying a cup of coffee, a dynamically complex object, where the sloshing liquid requires continuous adjustments to avoid spilling the coffee. Capitalizing on a simplified mechanical model, Sternad and her group examined safety margins and showed that older adults have a smaller safety margins than young individuals. However, with appropriate practice older adults can learn and approach control performance. The third task involves rhythmic movements to bounce a ball with a racket. Again, a simple physical model of this task revealed that this system displays dynamic stability, a feature that offers a smart solution for the performer, as errors die out by themselves and need not be corrected. A series of experiments demonstrated how humans learn to exploit the dynamics of the system, probably to avoid excessive information processing. An intervention study showed how a subtle manipulation in the virtual set-up could guide performers to dynamically stable performance.

These three tasks highlight how theoretical analysis carves out informative variables that go beyond simple error measures and present sensitive measures of motor control. Hence, these three paradigms exemplify how a theory-driven approach can create experimental platforms that permit basic scientific insights, but also afford a seamless transition to clinical assessment and targeted interventions.

ICVR 2015: ISVR Best Student Paper

Visualisation of 2D kinematic data from bimanual control of a commercial gaming system used in post-stroke rehabilitation

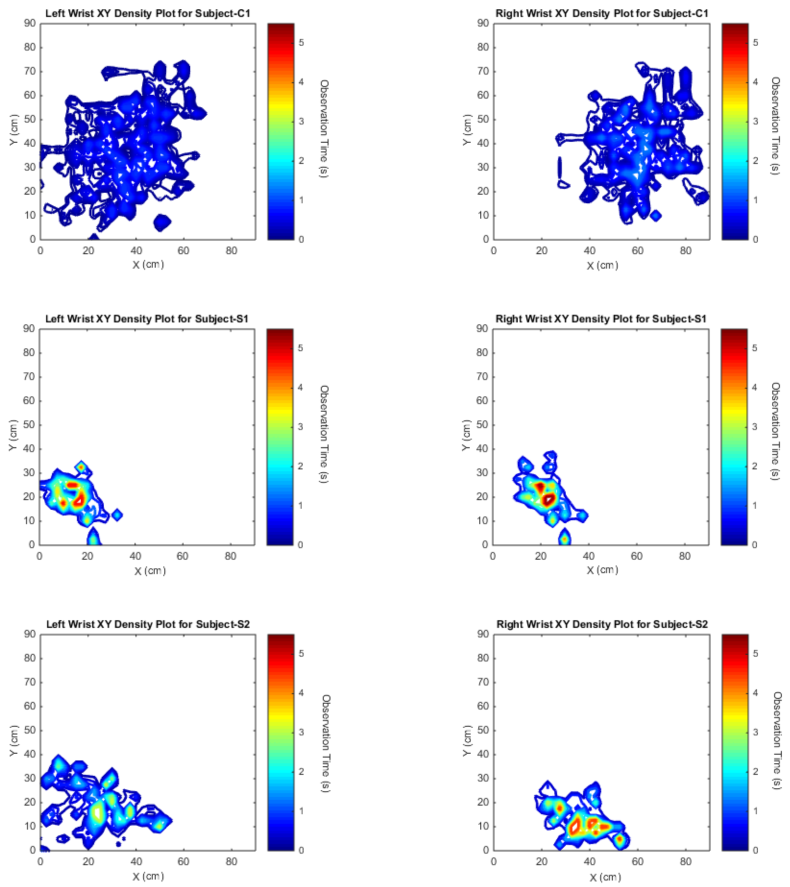
Bulmaro V. Benavides, Navid Shirzad, Chai-Ting Hung, Stephanie Glegg, Erin Reeds, Machiel Van der Loos - Robotics for Rehabilitation Exercise and Assessment in Collaborative Healthcare Lab, University of British Columbia

The FEATHERS (Functional Engagement in Assisted Therapy through Exercise Robotics) Project aims to provide an engaging solution for physical therapy by combining bilateral movement therapy with a social media platform and computer games. The target users are adults with stroke and adolescents with cerebral palsy or acquired brain injury involving hemiparesis.

The FEATHERS system consists of three main components: FEATHERS Motion, a software application that allows the user to control the computer cursor using bilateral upper-body movements; an adapted motion tracking system (Sony PlayStation® Move controllers and Eye Camera) that records the kinematics data of the users; and FEATHERS Play, a Facebook© application that links to numerous online games and serves as an online community for users, i.e., rehabilitation professionals and therapy clients.

In the FEATHERS system, real-time software implements a “Visual Symmetry” mode that requires the users to move both hands at the same time in the same direction to control the computer cursor. If the user fails to move both hands in symmetry, the computer cursor will not move. Specifically, the displacements of both hands are compared at every time step to ensure that the hand motion with the least movement in the user’s frontal plane is mapped into cursor motion. This mapping mode was implemented to promote bimanual motion in the absence of therapist supervision, which prevents users from compensating by only using their unaffected arm to operate the system.

In our work, we present the kinematic data analysis of one healthy control and two stroke participants using the FEATHERS system as a feasibility study, and describe the potential utility of these analyses for therapists monitoring game-based home treatment programs.



Density plots of the left and right hand positions of each participant. C1 was a healthy adult and S1 (left side weakness) and S2 (right side weakness) were stroke survivors. Contour lines summarize the minimum observed time of the area they surround in the collected position data.

The collected data were recorded during one game session, and movement distribution analysis was performed to create density plots of each participant’s hand motion in the frontal plane. These plots represent the natural way each participant distributes his or her motion in each of the position (Fig. 1), velocity, and acceleration domains. In this paper, we present how summarizing such motion distributions in density plots can help therapists gain better insight into the impairments and motion tendencies of their clients. In addition, the participants’ active range of motion was calculated to analyze the preferred offset between the hands, which provided information about the compensatory strategies employed.

Kinematic analysis of upper limb motion can now include not only absolute range-of-motion progression over time in multiple directions, but also relative movement parameters of the two arms engaged in a single task. The analysis presented in this work has led to several different anatomically and neurologically relevant visualizations of task space coverage in position, velocity and acceleration, and has shown clear differences between one healthy control and two post-stroke participants. Functional and spatial differences can be described numerically and graphically, providing therapists with the ability to track performance changes over time, and to evaluate the movement-specific and directional differences demonstrated by their clients over time.

OPCM Model Application on a 3D Simulator for Powered Wheelchair

Hicham Zatla, Amine Hadj-Abdelkader, Yann Morère, Guy Bourhis - Laboratoire d'Automatique de Tlemcen (LAT), Université de Tlemcen

Our aim is to develop analysis methods for powered wheelchair (PW) driving from data recorded during experiments on the PW simulator ViEW (Virtual Electric Wheelchair) [1]. This simulator was designed as a fully-software application, without a hardware platform, to allow for large-scale use. Many indoor and outdoor driving environments were developed at the request of rehabilitation centers for different purposes. Some of them are used for driving training of children with motor disability and include situations with gradually increasing challenges. Other environments are used for driving performance assessment. For these both objectives, there is a need to define performance indicators which may be used to assess the person's abilities in the PW driving task. We define these indicators using mathematical models of the human-wheelchair system. Among the numerous models described in the literature for car or plane piloting, some of them may be used for the human-wheelchair system. The main issue in using these models is parameter identification. It was generally achieved by setting empirical values which allowed the convergence of the model-computed trajectory to the experimentally recorded trajectories. However, these values would not provide any indication of the driving quality of the user. Hence, before using a particular model, we need to define methods for correctly identifying its parameters. At ICVR 2015 we presented the Optimal Preview Control Model, OPCM, introduced by [2]. The OPCM is a continuous-time state-space model made of three parts: a system model, a trajectory description and numerical integrators, all combined into a global model for which an optimal control law is computed. The system model is deduced from the dynamic model of the PW by choosing the states as the wheel displacements and instantaneous velocities. The trajectory description is expressed in a standard form. Its state vector contains elements of the reference trajectory. The number of these elements depends on the visible distance of the user, i.e. how far he is able to see in front of him. Thus, the trajectory model will hold more or less values depending on the length of the user's visible distance since this distance changes continuously during driving. To measure this visible distance, we performed experiments using an eye tracker for many users through a series of experiments. The visible distance ("preview time") is the only parameter in this model. We noticed in the first results that the OPCM generates trajectories close to the experimental ones when the visible distance is above 0.5 m. However, when this distance comes down or when the user looks away, the model trajectories drop out. This occurred in 25% of the cases. Since the OPCM was used for trajectory following tasks, we presume that the users were mostly performing this behavior when driving. It remains to show that in the divergence cases, the users were performing other kinds of behaviors (obstacle avoidance, tracking error compensation, etc.). For this purpose, we will try out other models. Our final goal is to be able to provide an indication of driving behavior and to extract relevant information about driving performance.

[1] Y. Morere, G. Bourhis, K. Cosnuau, G. Guilmois, E. Blangy, E. Rumilly, "ViEW, a wheelchair simulator for driving analysis", ICVR2015, Valencia, Spain, 9-12 juin 2015.

[2] R. S. Sharp and V. Valtetsiotis, "Optimal preview car steering control," in ICTAM: selected papers from the 20th International Congres [sic] of Theoretical and Applied Mechanics held in Chicago, 28 August-1 September 2000, 2001, vol. 35, pp. 101–117.

Using a 3D hand motion controller in a virtual power wheelchair simulator for navigation-reaching

Gordon Tao, Philippe Archambault - School of Physical & Occupational Therapy, McGill University; Interdisciplinary Research Center in Rehabilitation, Jewish Rehabilitation Hospital

Reaching for objects, along with manoeuvrability within confined spaces, is a key factor in powered wheelchair (PW) mobility, i.e. the ability to overcome the physical and social obstacles of daily activities [1]. Advanced task-related training involving combined navigation and reaching is often not possible in rehabilitation centers as access to training for PWs is already limited [2,3]. Virtual reality (VR) simulators offer a feasible alternative for rehabilitation training either at home or in a clinical setting. Objective: The purpose of this study was to evaluate a low-cost magnetic-based hand motion controller, the Razer Hydra (Sixsense, USA) as an interface for reaching tasks within the McGill Immersive Wheelchair (miWe) simulator. Methods: We determined concordance of total task time, reaching time, number of joystick movements, and number of reaching movements between simulator (VR) and the real world (RW) in three navigation-reaching tasks: parking at a desk and moving a book from the desktop into a drawer, calling and entering an elevator, and opening a door. Twelve experienced PW users performed each task 5 times in both VR and RW. Data was collected in using a joystick logger, ceiling mounted camera, and from the simulator directly. We performed task analysis to identify and compare key task behaviours. Concordance between VR and RW of key behaviours was determined using Cohen's Kappa coefficient. The Igroup Sense of Presence questionnaire was used to measure sense of presence in VR [4].

Results: Total task time, reaching time, joystick movements, and reaching movements were significantly longer and more numerous in VR than in RW, except in the door task where all but the reaching time were concordant. Task analysis revealed greater ($p<0.05$) relative risk of collisions and reaching errors in VR. The greater rate of errors, together with the longer task times and greater number of movements indicate that participants had, overall, greater difficulty performing tasks in VR than in RW. Of 22 identified navigation and reaching behaviours, 15 showed moderate to excellent ($\kappa > 0.4$, Cohen's Kappa) agreement between VR and RW. Participants tended to adopt concordant strategies when making choices regarding navigation and reaching, e.g. where to park. However, discordant behaviours tended to be skill-related, e.g. smooth driving. Our results suggest that, while participants may have experienced greater difficulty in VR compared to RW, they still performed both route finding and task planning in similar ways. Compared to a previous version of the miWe simulator without hand motion controls, the sense of presence was equivalent or higher. Conlusions: Task performance showed poorer kinematic performance in VR than RW. However, participants generally used similar strategies between VR and RW to accomplish each task. The reaching interface utilizing the Razer Hydra for navigate-to-reach tasks represents a promising addition to the miWe training simulator. However, the difficulty of the tasks should be optimized to elicit realistic kinematic performances.

[1] Holliday P, Mihailidis A, Rolfson R, Fernie G. Understanding and measuring powered wheelchair mobility and manoeuvrability. Part I. Reach in confined spaces. Disabil Rehabil 2005;27(16):939-949.
[2] Kaye HS, Kang T, LaPlante MP. Mobility device use in the United States. National Institute on Disability and Rehabilitation Research, US Department of Education; 2000.
[3] McNeil JM. Census Bureau. 1997.
[4] Schubert T, Friedmann F, Regenbrecht H. The experience of presence: Factor analytic insights. Presence 2001;10(3):266-281.

ICVR 2015: RehabWeek Best Student Poster

The role of feedback on cognitive motor learning in children with Cerebral Palsy: a protocol

Maxime Robert, Krithika Sambasivan, Rhona Guberek, Mindy Levin

Introduction:

Children with cerebral palsy (CP) have impaired upper limb movement because of deficits in motor control including abnormal muscle tone and limited isolated joint movement. These deficits can impact the development of typical reaching patterns. Rehabilitation interventions aim to reduce the difficulties for children when performing reaching tasks and to prioritize retention of learned motor variables. One way to optimize motor retention is to provide specific feedback to the learner. However, evidence of the effectiveness of the provision of extrinsic feedback for improvement and retention of upper limb kinematics in children with CP is scarce. Thus, the aim of this research is to determine which frequency of feedback can be recommended by clinicians to improve motor performance and movement quality of upper limb reaching movement in children with CP. We use a virtual environment to deliver the feedback in order to facilitate the manipulation of extrinsic feedback and the motivation to practice.

Methods:

Thirty-three children with CP will participate in this study if they have movement difficulties in at least one arm and are aged between 8 and 17 years old. Prior to participating in an upper limb training intervention, they will undergo clinical assessment of arm sensorimotor impairment (tactile thresholds, touch and proprioception levels, passive joint range of motion), motor function (Melbourne test) as

well as levels of participation in everyday activities and motivation. The arm and trunk kinematics of a standardized reach-to-grasp task of an object placed at 3 different distances will also be assessed before and after the intervention to identify if changes in upper limb movement patterns used for reaching change due to practice. After initial clinical and kinematic testing, children will be grouped into triads by age and then randomly allocated to one of three training groups: no additional feedback, continuous feedback or faded feedback. Additional feedback consists of knowledge of results about movement precision and velocity and knowledge of performance about the use of compensatory trunk movements.
The training intervention consists of four practice sessions over one week and includes repetitive reaching using the Jintronix virtual reality system. A total of 450 reaching trials per session will be performed. The intervention includes the use of four distinct games in which two games involve unilateral arm movement and two games involve bilateral arm movement. Primary outcome measures are upper limb reaching patterns characterizes by performance level variables (endpoint trajectory straightness, smoothness and velocity) as well as movement quality variables (shoulder, wrist and elbow range of motion, trunk displacement).

Discussion:

Findings from this research will provide crucial information about the optimal schedule of delivery of feedback for motor learning and lead to better functional outcomes of the upper limb in children with CP. This study is being conducted in the Sensorimotor Control and Rehabilitation Laboratory of Dr. Mindy F. Levin, located at the Jewish Rehabilitation Site of the Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal. Mr Maxime Robert is a doctoral candidate in the Integrated Program in Neuroscience at McGill University in Montreal, Canada.

RJHRV - French Scientific Day on Disability and Virtual Reality (April 7, 2015)

Evelyne Klinger Research director at ESIEA and Scientific Chair of JHRV

The French Scientific Day on Disability and Virtual Reality (JHRV) was held on April 7th 2015 at ESIEA – Laval. The JHRV was organized by the National French Research Institute on Disability (IFRH) and ESIEA Graduate School of Engineering in partnership with the International Society for Virtual Rehabilitation (ISVR), the French Physical Medicine and Rehabilitation Society (SOFMER), the French Association of Occupational Therapists (ANFE) and the French Association for Virtual Reality (AFRV). JHRV was an opportunity for meetings and exchanges between therapists and researchers from various disciplines. The meeting was open to people outside the IFRH who are interested in the applications of Virtual Reality and Digital technologies to the fields of Health and Disability. Discussions were organized around two themes 1) Cross views on Cognition and Sensorymotor skills and 2) What does Virtual Reality bring to participation in real life? 150 people attended JHRV with a large participation of occupational therapists, researchers, clinicians and students. JHRV encouraged discussion about the interconnections between sensorimotor dialog and cognitive representations, stimulated reflection on sensorimotor learning, provided an overview of twenty years of use of Virtual Reality in psychotherapy, concretely explained the integration of Virtual Reality in the practices of occupational therapists, but also highlighted the need for close engineer / therapist collaboration in the modelling of daily life for therapeutic purposes.

AFRV

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ANFE ASSOCIATION NATIONALE FRANÇAISE DES ERGOTHERAPEUTES

SOFMER Société Française de Médecine Physique et de Réadaptation

FR H Institut Fédératif de Recherche sur le HANDICAP

ISVR Early Career Investigator Award

Call for Nominations

We are pleased to announce the creation of the ISVR Early Career Investigator Award. The purpose of this award is to recognize and acknowledge outstanding contributions by early career scientists whose research relates to virtual rehabilitation. The recipient will be awarded a certificate, free registration at an upcoming ICDVRAT or ICVR conference and be asked to present their research as a platform paper at that conference. A runner-up will also be awarded a certificate.

Eligibility criteria

- Have completed doctoral level studies no more than seven years prior to nomination
- Be a member in good standing of the ISVR
- Be engaged in and have published peer reviewed innovative research in the field of virtual rehabilitation

Evaluation criteria

- Number and quality of publications
- Type and amount of research community service (committees, panels, reviewing, etc.)
- Type and amount of public outreach activities, including knowledge translation activities evidence of clinical impact: teaching, standards setting, technology transfer

Individuals may be nominated by an ISVR member or be self-nominated. Applicants should provide:

- Short biography (maximum 500 words)
- Full CV
- Description of key research innovation and impact on the field of virtual rehabilitation (maximum 2 pages)

Nominations should be submitted to awards@isvr.org by January 1, 2016. The award will be presented at ICDVRAT in September 2016.