HERL Newsletter
News from the Human Engineering Research Laboratories Vol 14, No 2 · December 2015

The ADA at 25

We've come a long way, but more work is needed

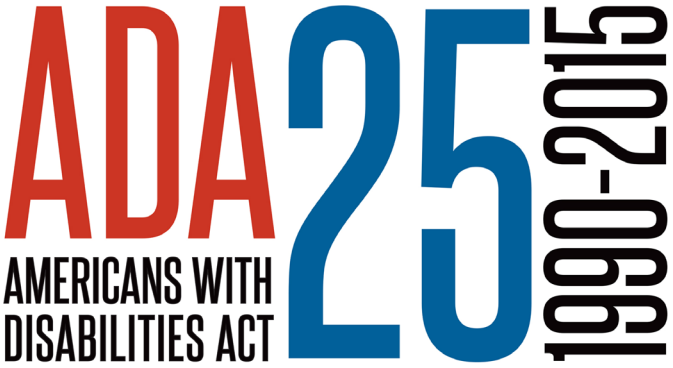
The 25th anniversary of the landmark Americans With Disabilities Act (ADA) was celebrated this year. The ADA was signed into law by President George H.W. Bush on July 26, 1990, and was the culmination of years of effort by disability and civil rights activists. The ADA prohibits discrimination against people with disabilities and upholds their rights to equally participate in the community and the workforce by addressing five key areas: employment; state and local government facilities and services; public accommodations; telecommunications; and transportation.

"Thanks to the ADA, the places that comprise our shared American life — schools, workplaces, movie theaters, courthouses, buses, baseball stadiums, national parks — they truly belong to everyone," stated President Barack Obama during a commemorative event in July. He also noted that more work needs to be done, especially addressing employment. "We all know too many people with disabilities are still unemployed — even though they can work, even though they want to work, even though they have so much to contribute," Obama said.

The Human Engineering Research Laboratories stands with groups around the country to celebrate this historic anniversary. We commit ourselves to do our part in ensuring opportunities for people with disabilities are available today and in the future.

For more information on the ADA and the ADA anniversary, see these websites:

The ADA Legacy Project: http://adalegacy.org/
Information and Technical Help: http://www.ada.gov/
U.S. Government Tools: https://www.disability.gov/
National Organization on Disability: http://nod.org/



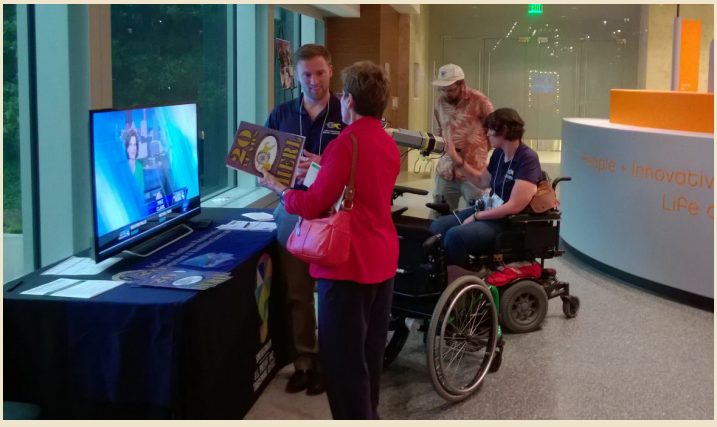
HERL Demonstrates Innovation at the Smithsonian Institution

Recently patented HERL projects were featured at the National Museum of American History's Innovation Festival in Washington, D.C. on September 26 and 27, 2015.

The event was a collaboration between the Smithsonian Institution and the United States Patent and Trademark Office, and showcased patented technologies and intellectual property systems. Thirteen organizations, including HERL, were selected to participate as exemplary examples of innovation.

HERL's presentation featured the Personal Mobility and Manipulation Appliance (PerMMA) and the Mobility Enhancement Robotic Wheelchair (MEBot). MEBot is a specialized wheelchair that climbs curbs and navigates challenging terrains such as ice or other slippery surfaces. PerMMA is a wheelchair that offers two-armed coordinated manipulation controlled locally, by a partner over the Internet, or a combination of the two.

Visitors were able to perform hands-on activities, watch demonstrations, talk with inventors, and learn about the patent process. Read the press release at http://is.gd/innovationfestival.



Current Research Abstracts

Daveler B, Salatin B, Grindle GG, Candiotti J, Wang H, Cooper RA, Participatory design and validation of mobility enhancement robotic wheelchair, *Journal of Rehabilitation Research and Development*, pp. 739-750, Vol. 52, No. 6, 2015.

SUMMARY: Design of a mobility enhancement wheelchair was shaped with input from wheelchair users.

The design of the mobility enhancement robotic wheelchair (MEBot) was based on input from electric powered wheelchair (EPW) users regarding the conditions they encounter when driving in both indoor and outdoor environments that may affect their safety and result in them becoming immobilized, tipping over, or falling out of their wheelchair. Phase I involved conducting a participatory design study to understand the conditions and barriers EPW users found to be difficult to drive in/over. Phase II consisted of creating a computer-aided design (CAD) prototype EPW to provide indoor and outdoor mobility that addressed these conditions with advanced applications. Phase III involved demonstrating the advanced applications and gathering feedback from end users about the likelihood they would use the advanced applications. The CAD prototype incorporated advanced applications, including self-leveling, curb climbing, and traction control, that addressed the challenging conditions and barriers discussed with EPW users (n = 31) during the participatory design study. Feedback on the CAD design and applications in phase III from end users (n = 12) showed a majority would use self-leveling (83%), traction control (83%), and curb climbing (75%). The overall design of MEBot received positive feedback from EPW users. However, these opinions will need to be reevaluated through user trials as the design advances.

Hiremath SV, Chen W, Wang W, Foldes S, Yang Y, Tyler-Kabara EC, Collinger JL, Boninger ML, Brain Computer Interface Learning for Systems Based on Electrocorticography and Intracortical Microelectrode Arrays, *Frontiers in Integrative Neuroscience*, Vol. 9, No. 40, June 2015.

SUMMARY: A review of the various approaches to the generation of cortical activity (BCI learning).

A brain-computer interface (BCI) system transforms neural activity into control signals for external devices in real time. A BCI user needs to learn to generate specific cortical activity patterns to control external devices effectively. We call this process BCI learning, and it often requires significant effort and time. Therefore, it is important to study this process and develop novel and efficient approaches to accelerate BCI learning. This article reviews major approaches that have been used for BCI learning, including computer-assisted learning, co-adaptive learning, operant conditioning, and sensory feedback. We focus on BCIs based on electrocorticography and intracortical microelectrode arrays for restoring motor function. This article also explores the possibility of brain modulation techniques in promoting BCI learning, such as electrical cortical stimulation, transcranial magnetic stimulation, and optogenetics. Furthermore, as proposed by recent BCI studies, we suggest that BCI learning is in many ways analogous to motor and cognitive skill learning, and therefore skill learning should be a useful metaphor to model BCI learning.

Dicianno BE, Parmento B, Fairman AD, Crytzer T, Yu DX, Pramana IW, Coughenour D, Petrazzi A, Perspectives on the Evolution of Mobile (mHealth) Technologies and Application to Rehabilitation, *Physical Therapy Journal*, pp. 397-405, Vol. 95, No. 6, June 2015.

SUMMARY: The evolution of mobile health technologies and their applications.

Individuals with chronic conditions and disabilities who are vulnerable to secondary complications often require complex habilitative and rehabilitative services to prevent and treat these complications. This paper reviews the evolution of mHealth technologies and presents insights as to how this evolution informed our development of a novile mHealth system, iMHere, and other technologies, including those used by the Veterans Administration. We will explain the novel applications of mHealth for rehabilitation and specifically physical therapy. Perspectives on the roles of Rehabilitation professionals in the delivery of healthcare using mHealth systems are included. We will discuss challenges to mHealth including regulatory and funding issues. This article also describes how mHealth can be used to improve patient satisfaction and delivery of care and to promote health and wellness.

Kankipati P, Boninger ML, Gagnon D, Cooper RA, Koontz AM, Upper limb joint kinetics of three sitting pivot wheelchair transfer techniques in individuals with spinal cord injury, *Journal of Spinal Cord Medicine*, pp. 485-497, Vol. 38, No. 4, July 2015.

SUMMARY: Reviewed three transfer techniques and analyzed upper extremity joint kinetics for each.

Study design: Repeated measures design.
Objective: This study compared the upper extremity (UE) joint kinetics between three transfer techniques.
Setting: Research laboratory.
Methods: Twenty individuals with spinal cord injury performed three transfer techniques from their wheelchair to a level tub bench. Two of the techniques involved a head–hips method with leading hand position close (HH-I) and far (HH-A) from the body, and the third technique with the trunk upright (TU) and hand far from body. Motion analysis equipment recorded upper body movements and force sensors recorded their hand and feet reaction forces during the transfers.
Results: Several significant differences were found between HH-A and HH-I and TU and HH-I transfers indicating that hand placement was a key factor influencing the UE joint kinetics. Peak resultant hand, elbow, and shoulder joint forces were significantly higher for the HH-A and TU techniques at the trailing arm ($P < 0.036$) and lower at the leading arm ($P < 0.021$), compared to the HH-I technique.
Conclusion: Always trailing with the same arm if using HH-A or TU could predispose that arm to overuse related pain and injuries. Technique training should focus on initial hand placement close to the body followed by the amount of trunk flexion needed to facilitate movement.

Current Research Abstracts

Dicianno BE, Mahajan H, Cooper RA, Advanced Joystick Algorithms for Computer Access Tasks, *Physical Medicine and Rehabilitation*, pp. 555-561, Vol. 7, No. 6, June 2015.

SUMMARY: Compared two joysticks - isometric and movement-sensing - and two correction algorithms.

Objective: To compare two correction algorithms and two joysticks (a conventional movement-sensing joystick and a custom-designed isometric joystick) in computer access tasks.

Design: Repeated-measures, within-subject.

Setting: National Veterans Wheelchair Games.

Participants: Fifteen participants with various diagnoses including multiple sclerosis, spinal cord injury, traumatic brain injury, Wilson disease, and Parkinson disease.

Methods: A computer access test scenario was used to evaluate the effects of applying proportional integral derivative (PID)–based and least means–based algorithms to suppress unintentional cursor motions by users with upper extremity spasticity.

Main Outcome Measures: Trial completion time, reaction time, and trajectory-based measures: movement offset, movement variability, and percentage of out-of-path motion on test tracks.

Results: The quantitative outcome measures showed a high correlation with clinical measures for spasticity and functional independence. On small test tracks, compared to when no correction algorithms were used, both algorithms performed equally well in suppressing unintentional cursor motions. On longer test tracks, participants navigated most accurately while using the PID algorithm. Participants moved the cursor more accurately using the isometric joystick compared to the movement-sensing joystick, with only a slight increase in the task completion times.

Conclusions: The joysticks and the advanced correction algorithms show promise for use in wide-ranging applications as control interfaces.

Toosi KK, Hogaboom NS, Oyster ML, Computer keyboarding biomechanics and acute changes in median nerve indicative of Carpal Tunnel Syndrome, *Clinical Biomechanics*, pp. 546-550, Vol. 30, No. 6, July 2015.

SUMMARY: Determined that continuous keyboarding can cause changes to the median nerve.

Background: Carpal tunnel syndrome is a common and costly peripheral neuropathy. Occupations requiring repetitive, forceful motions of the hand and wrist may play a role in the development of carpal tunnel syndrome. Computer keyboarding is one such task, and has been associated with upper-extremity musculoskeletal disorder development. The purpose of this study was to determine whether continuous keyboarding can cause acute changes in the median nerve and whether these changes correlate with wrist biomechanics during keyboarding.

Methods: A convenience sample of 37 healthy individuals performed a 60-minute typing task. Ultrasound images were collected at baseline, after 30 and 60 min of typing, then after 30 min of rest. Kinematic data were collected during the typing task. Variables of interest were median nerve cross-sectional area, flattening ratio, and swelling ratio at the pisiform; subject characteristics (age, gender, BMI, wrist circumference, typing speed) and wrist joint angles.

Findings: Cross-sectional area and swelling ratio increased after 30 and 60 min of typing, and then decreased to baseline after 30 min of rest. Peak ulnar deviation contributed to changes in cross-sectional area after 30 min of typing.

Interpretation: Results from this study confirmed a typing task causes changes in the median nerve, and changes are influenced by level of ulnar deviation. Furthermore, changes in the median nerve are present until cessation of the activity. While it is unclear if these changes lead to long-term symptoms or nerve injury, their existence adds to the evidence of a possible link between carpal tunnel syndrome and keyboarding.

Yang Y, Koontz AM, Chen C, Fang W, Chang J, Effect of a Wheelie Training Method With the Front Wheels on a Ramp in Novice Able-Bodied Participants: A Randomized Controlled Trial, *Assistive Technology*, pp. 121-127, Vol. 27, No. 2, 2015.

SUMMARY: Front-wheel ramp balancing training appears to effect retention rate of wheelie skills positively.

The objective of this study was to determine if wheelie training that begins with learning how to balance with the front wheels on a ramp would increase the success rate, reduce the training time, and improve retention rates. A randomized controlled trial design was used to evaluate the effectiveness of wheelie training on a ramp setting (ramp group, n = 26) and conventional training (conventional group, n = 26). The main outcome measures were success rates in achieving wheelie competence, training time, and the retention rate in 7 and 30 days respectively. The results showed that the success rate for each training group both reached 100%. The mean training times for the conventional group and the ramp group were 86.0 ± 35.7 and 76.0 ± 25.8 minutes. Training time was not significantly affected by the training method ($p = 0.23$), but it was affected by gender, with women requiring an average of 92.0 ± 31.4 minutes in comparison with 70.0 ± 27.5 minutes for men ($p = 0.01$). The skill retention rate after 7 and 30 days was 100% for both groups. Neither success rate nor training time for wheelie skill acquisition by learners were improved by learning wheelie balance on a ramp. However, a high retention rate of wheelie skills for both training groups was found, which implies that success can be achieved by training on a ramp used in this study.

State of the Science Symposium:
Advances in Military and Veteran Health Research from Post-911 Conflicts For Wounded, Injured, and Ill Veterans

The State of the Science Symposium on Advances in Military and Veteran Health Research for Wounded, Injured, and Ill Veterans was held in Sanford Auditorium at the Uniformed Services University of the Health Sciences in Bethesda, Maryland on October 23, 2015.

Dr. Jack Tsao, Director of Traumatic Brain Injury Programs for the US Navy Bureau of Medicine and Surgery, started the symposium off with a presentation of the treatment of phantom limb pain after major limb loss, and also discussed promising advancements in the treatment of phantom limb pain with the use of mirrors.

Next, **Dr. Seth Messinger**, Director of Qualitative Research for the Center for Rehabilitation Sciences Research at the Uniformed Services University of the Health Sciences, discussed social barriers to successful reintegration and the initial results of a study comparing the social reintegration experiences of two groups of patients in an effort to better understand social reintegration in general as well as with the added challenge of mild traumatic brain injury.

After a break, symposium co-director **Dr. Rory Cooper** presented an update of assistive technology currently being developed at the Human Engineering Research Laboratories.

Dr. Eric Schoomaker, retired Lieutenant General and former Surgeon General of the U.S. Army, presented a discussion on advances in Military Medicine.

Following lunch - generously provided via a grant from that Paralyzed Veterans of America - a talk entitled "Lower Limb Orthoses: Prescription and Rehabilitation to Restore Lower Limb Function" was presented by **Dr. Jason Wilken**, director of the Military Performance Laboratory at the Center for the Intrepid, which discussed advances in lower limb function in the Center for the Intrepid Gait Lab.

Caregiving was the topic of the next presentation by **Dr. Lynda Davis**, a subject matter expert on Military, Veteran, Family (MVF), Caregiver & Survivor support through successful, sustainable services who is currently working with the Department of Defense in the area of Tragedy Assistance Program for Survivors (TAPS).

Following the afternoon break, **Dr. Louis French**, the Deputy Director for Operations at the National Intrepid Center of Excellence, spoke on advances in neuropsychology since 911, including current policy on screening and treatment for TBI on the battlefield and at home. He also gave updates on the federal panels and workgroups on TBI in the military, including the Army Surgeon General's Taskforce on TBI, whose report provided the foundation for the structure of TBI screening and treatment that is currently in place in the DoD.

Symposium co-director **Dr. Paul Pasquina** finished up the presentations for the day with a discussion entitled "Post-911 Rehabilitation and Amputee Care." Afterward, the course directors made closing remarks and the symposium was dismissed at 1600.

Videos, presentations, and photos from this symposium are available, along with biographies of all speakers, on the HERL website at **http://herl.pitt.edu/post-911-advances**. You can also browse symposia dating back to 2011 at **http://herl.pitt.edu/education-outreach/symposia**.

HERL in the Media, 2015

Local ABC station **WTAE** and CBS station **KDKA** both did news reports featuring HERL and its work with Veterans in 2015.

HERL was in the spotlight in several Internet videos this year:

- The first, produced by **Department of Veterans Affairs VISN-4**, focused on new capabilities in 3D printing. HERL's 3D printers make use of technology so advanced that they can literally print anything that can be created on a computer, using plastic, metal, or rubber. HERL is using this advanced 3D printing technology for the benefit of Veterans – to find out how, go to *http://www.visn4.va.gov/herl-3d-printing.asp*.

- The second, on YouTube at *https://www.youtube.com/watch?v=Rh-6kS-bwQs*, featured members of the University of Pittsburgh's Student Disability Advocacy group - a number of whom are also researchers at HERL - in a video entry for the **I Want to Work PA** campaign. The Goal of I Want to Work PA is to ensure young adults with disabilities get the employment opportunities they rightfully deserve so they can live full, independent lives.

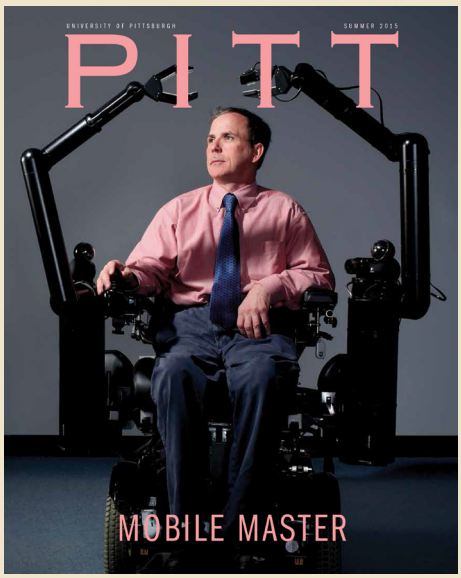
- Finally, HERL director Dr. Rory Cooper was featured in a video direct from the **National Veterans Wheelchair Games** in Dallas, discussing adaptive technology advances and how they are used to help Veterans and all people with disabilities; find it at *https://www.youtube.com/watch?v=mqpzqeK5ga0*.

Time Magazine's video producers visited Pittsburgh in mid-July 2015 for a video on the city of Pittsburgh's ongoing renaissance (which can be found at *http://time.com/pittsburgh/*), and HERL was one of the laboratories they visited. The producers were so impressed with HERL's work that they decided to make a separate video solely about us. The video about HERL is at *http://time.com/3975280/robotics-disabled/*.

HERL Director Dr. Rory Cooper was featured in an article in September issue of the **American Society for Engineering Education**'s magazine, PRISM: *http://www.asee-prism.org/up-close-sep/*.

Recently patented HERL projects were featured at the **National Museum of American History**'s Innovation Festival in Washington, D.C. on September 26 and 27, 2015. The event is was a collaboration between the Smithsonian Institution and the United States Patent and Trademark Office, and will showcased patented technologies and intellectual property systems. Thirteen organizations, including HERL, were selected to participate as exemplary examples of innovation. You can learn more about the festival or read the official press release on the National Museum of American History's website at *http://americanhistory.si.edu/*.

The Human Engineering Research Laboratories and HERL Director Dr. Rory Cooper were the cover story for the Summer 2015 issue of **Pitt Magazine**. Access the article at *http://www.pittmag.pitt.edu/*.



Dr. Cooper was also interviewed for an article released November 25 by international news bureau **Reuters** headlined "Wheelchair users more likely to die in car crashes." The article can be viewed at *http://www.reuters.com/article/2015/11/25/us-health-wheelchairs-traffic-safety-idUSKBN0TE2R320151125*.

In November, Dr. Rory Cooper was interviewed by sports network **ESPN** about prosthetics and other recent advances in assistive technology and what it will mean for the sports world. Read the article at *http://espn.go.com/nba/story/_/page/Veteran-NBA151111/how-advanced-prosthetics-impact-future-sports*.

Meet an Alum: EunKyoung Hong

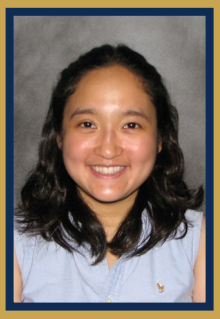
EunKyoung Hong earned her PhD in Rehabilitation Science at the University of Pittsburgh where she completed her dissertation work in the Human Engineering Research Laboratories. She defended her dissertation, "Improving the comfort of manual wheelchair back supports," on March 16, 2015.

The studies she completed for her dissertation focused on the investigation and development of manual wheelchair back supports to improve comfort. Although she has worked in various research areas, she is particularly interested in designing and manufacturing consumer-centered devices for people with disabilities to influence the clinical effectiveness of these devices and improve the quality of life of those who use them. In accordance with her interest, her dissertation work focused on improving the comfort of manual wheelchair backrests. An adjustable backrest design with a rigid shell backrest was designed and developed. It has since been patented.

Even as a child growing up in Korea, EunKyoung could see the almost insurmountable barriers that separated people with disabilities from mainstream society. Her interaction with people with disabilities motivated her to study rehabilitation science technology in college, with an emphasis on special education for children with disabilities. Through practical teaching and volunteer activities in special schools, she came to recognize and understand the needs of children with disabilities. Upon finishing her undergraduate education, she decided to pursue a degree in a more advanced country, motivated by her desire to ultimately design better fitting and more personalized wheelchairs or assistive technology devices for those with disabilities. This, of course, led her to HERL.

In July of 2015, she joined the VA RR&D National Center of Excellence for the Medical Consequences of Spinal Cord Injury at the James J. Peters VA Medical Center in the Bronx, New York to extend her knowledge to allow her to offer more opportunities for people with disabilities.

She currently lives in Northern New Jersey. While not working or studying, she is busy with housework and taking care of her three munchkins.



Attention Alums! Join HERL's Facebook Alum Group

To all HERL Alums and former HERL faculty, staff, and students: You're invited to join the new HERL Alum Facebook group!

Just go to *https://www.facebook.com/groups/herlalums* and request membership - it's that easy!

HERL Promotes Four in New Executive Structure

Following Dr. Brad Dicianno's promotion to Medical Director in January 2015, the Executive Staff of HERL has now also been expanded and its positions have been redeveloped. The new positions are as follows:

Associate Director for Research: Alicia Koontz, PhD, RET
Coordinates research and research grants.

Associate Director for Product Innovation and Translation: Jon Pearlman, PhD
Coordinates product development, patents, and licensing.

Assistant Director for Clinical and Regulatory Affairs: Annmare Kelleher, MS OTR/L ATP CCRC
Coordinates clinical activities and oversees research reviews

Assistant Director for Engineering: Garret Grindle, MS
Oversees the Prototyping and Testing Laboratories and machine shop

Dr. Rory Cooper and Dr. Michael Boninger remain Director and Senior Associate Medical Director, respectively.

2015 HERL Journal Articles

Wodlinger B, Downey J, Tyler-Kabara E, Schwartz A, Boninger ML, Collinger JL, Ten-Dimensional Anthropomorphic Arm Control in a Human Brain-Machine Interface: Difficulties, Solutions, and Limitations, *Journal of Neural Engineering*, 14 pages, Article ID 016011, Vol. 12, No. 1, 2015.

Hausmann LRM, Myaskovsky L, Niyonkuru C, Oyster ML, Switzer GE, Burkitt KH, Fine MJ, Gao S, Boninger ML, Examining implicit bias of physicians who care for individuals with spinal cord injury: a pilot study and future directions, *Journal of Spinal Cord Medicine*, pp. 102-110, Vol. 38, No. 1, January 2015.

Crytzer TM, Dicianno BE, Robertson RJ, Cheng YT, Validity of a Wheelchair Perceived Exertion Scale (Wheel Scale) for Arm Ergometry Exercise in People with Spina Bifida, *Perceptual and Motor Skills*, pp. 304-322, Vol. 120, No. 1, February 2015.

Sindall P, Lenton J, Cooper RA, Tolfrey K, Goosey-Tolfrey V, Data logger device applicability for wheelchair tennis court movement, *Journal of Sports Sciences*, pp. 527-533, Vol. 33, No. 5, 2015.

Ding D, Rodriguez SP, Cooper RA, Riviere CN, Improving Target Acquisition for Computer Users with Athetosis, *Assistive Technology*, pp. 52-58, Vol. 27, No. 1, 2015.

Goldberg M, Cooper RA, Milleville M, Barry A, Sporner ML, Ensuring Success for Veterans with Disabilities in STEM Degree Programs: Recommendations from a Workshop and Case Study of an Evidence-Based Transition Program, *Journal of STEM Education*, pp. 16-24, Vol. 16, No. 1, 2015.

Popchak A, Burnett T, Weber N, Boninger ML, Factors Related to Injury in Youth and Adolescent Baseball Pitching, with an eye Toward Prevention, *American Journal of Physical Medicine and Rehabilitation*, pp. 395-409, Vol. 94, No. 5, May 2015.

Dicianno BE, Parmento B, Fairman AD, Crytzer T, Yu DX, Pramana IW, Coughenour D, Petrazzi A, Perspectives on the Evolution of Mobile (mHealth) Technologies and Application to Rehabilitation, *Physical Therapy Journal*, pp. 397-405, Vol. 95, No. 6, June 2015.

Dicianno BE, Mahajan H, Cooper RA, Advanced Joystick Algorithms for Computer Access Tasks, *Physical Medicine and Rehabilitation*, pp. 555-561, Vol. 7, No. 6, June 2015.

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Yang Y, Koontz AM, Chen C, Fang W, Chang J, Effect of a Wheelie Training Method With the Front Wheels on a Ramp in Novice Able-Bodied Participants: A Randomized Controlled Trial, *Assistive Technology*, pp. 121-127, Vol. 27, No. 2, 2015.

Kankipati P, Boninger ML, Gagnon D, Cooper RA, Koontz AM, Upper limb joint kinetics of three sitting pivot wheelchair transfer techniques in individuals with spinal cord injury, *Journal of Spinal Cord Medicine*, pp. 485-497, Vol. 38, No. 4, July 2015.

Dicianno BE, Lieberman J, Schmeler MR, Souza AESP, Cooper RM, Lange M, Liu H, Jan Y, Rehabilitation Engineering and Assistive Technology Society of North America's Position on the Application of Tilt, Recline, and Elevating Legrests for Wheelchairs Literature Update, *Assistive Technology*, pp. 193-198, Vol. 27, No. 3, Fall 2015.

Daveler B, Salatin B, Grindle GG, Candiotti J, Wang H, Cooper RA, Participatory design and validation of mobility enhancement robotic wheelchair, *Journal of Rehabilitation Research and Development*, pp. 739-750, Vol. 52, No. 6, 2015.

Worobey L, Lin Y, Koontz AM, Boninger ML, Ultrasound to Evaluate Scapular Movement among Manual Wheelchair Users and Healthy Controls, *Topics in Spinal Cord Injury Rehabilitation*, pp. 303-312, Vo. 21, No. 4, Fall 2015.

Lin Y, Boninger ML, Day KA, Koontz AM, Ultrasonographic Measurement of the Acromiohumeral Distance in Spinal Cord Injury: Reliability and Effects of Shoulder Positioning, *Journal of Spinal Cord Medicine*, pp. 700-708, Vol. 38, No. 6, November 2015.

Human Engineering Research Laboratories

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University of Pittsburgh
School of Health & Rehabilitation Sciences
School of Medicine

University of Pittsburgh
NIDILRR Model Center on Spinal Cord Injury

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We need Pittsburgh-area volunteers for research studies!

We're currently recruiting for the following studies - and more!

- An Ergonomic Comparison of Wheelchairs
- Effects of Wheelchair Seat Position and Footprint Length on Ramp Propulsion Biomechanics
- Voice-controlled Intelligent Assistive Robotic Manipulation Assistance
- Participatory Evaluation of Assistive Technologies

Check http://herl.pitt.edu/volunteer *for current studies.*

ARE YOU INTERESTED IN ASSISTIVE TECHNOLOGY RESEARCH?

The Human Engineering Research Laboratories (HERL) is recruiting individuals interested in participating in research studies for the ASSISTIVE TECHNOLOGY REGISTRY.

If you would like to be notified of research studies related to assistive technology for which you may be eligible to participate, contact The Human Engineering Research Laboratories and join the Assistive Technology Registry.

This is an informational resource and notification of a study does not obligate you to participate. You do not need to be located in, nor are you required to travel to, Pittsburgh in order to participate in research studies.

If you are at least 18 years of age, and use assistive technology (e.g. wheelchair, scooter, prosthesis, etc) please contact a Clinical Coordinator at (412) 822-3700 or herlregistry@shrs.pitt.edu.

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