HUMAN ENGINEERING RESEARCH LABORATORIES

HERL Quarterly Newsletter

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LETTER FROM THE EDITOR

INSIDE THIS ISSUE:

This summer has been a busy and productive time at the Human Engineering Research Laboratories. HERL faculty and students attended the annual Rehabilitation Engineering Society of North America (RESNA) conference in Minneapolis, MN from June 27-July 1st, 2002. The last edition of the newsletter featured abstracts from HERL's five RESNA student award winning papers. There are additional articles on HERL research presented at RESNA featured inside this edition of the newsletter. In other RESNA conference news, the society honored HERL director Dr. Rory Cooper with the mentor and fellow awards this year. (See "Meet the Investigator" on page 5 for more details).

The HERL Research Team at the National Veterans Wheelchair Games in Cleveland in July.

Several HERL investigators, clinicians, and students traveled to Cleveland after the RESNA conference to attend the 2002 National Veterans Wheelchair Games. About 80 athletes participated in HERL research studies at the games. Dr. Cooper also competed and won four gold medals in the Masters' divisions of the slalom event and the 100, 800, and 1500 meter track events. He also competed in the Handcycling event using an armcycle he built with HERL Technical Staff Bill Ammer, John Duncan, Emily Zipfel and Mark McCartney, and HERL students Beth Kaminski, Lam Mays, Jeremy Puhlman & Eliana Chaves.

HERL Technical Staff & Students built the armcycle that Dr. Cooper raced with at the games.

The 2002 HERL Summer Students. *Back row, from left*: Seth Ammer, Katie Fronczak, Sara Gross, Alex Cheng, Garrett Grindle. *Front row, from left:* Jeremy Puhlman, Lam Mays, Alexis Ulerich, Martha Loehr, Stephanie Martin

The 2002 HERL summer students contributed tremendously to our research and information dissemination efforts this year. These high school students and undergraduates from the University of Pittsburgh and Carnegie Mellon University were an integral part of completing projects that kept HERL such an unstoppable force during our busy summer months. This year's summer interns were an exceptional help, especially with the National Veterans Wheelchair Games and the HERL Quarterly Newsletter.

The public's reaction to our quarterly newsletter remains positive. Our mailing list is up to 650+ from 500 since the last edition was published in June. We are currently working on posting the HERL quarterly newsletter online at HERL's website: www.herlpitt.org. We have also contacted many local agencies, encouraging them to submit articles or event announcements for publication.

We hope you enjoy this latest edition of the HERL quarterly newsletter. The Winter issue will be out December 1st...see you then!

Editor, HERL Quarterly Newsletter

CURRENT RESEARCH ABSTRACTS

Impact of Pushrim Activated Power Assist Wheelchairs on Mobility Among People with Tetraplegia

Rory A. Cooper, PhD; Michael L. Boninger, MD; David Algood, BS; Rosemarie Cooper, MPT, ATP

Purpose of the Work. Using one's arms to push a manual wheelchair can result in injuries, the need for surgery, and potential loss of independent mobility. The purpose of this study is to evaluate the effectiveness of Yamaha's JWII Pushrim Activated Power Assist Wheelchair (PAPAW) among manual wheelchair users with tetraplegia.

Subjects/Procedures. The study consists of three phases. For Phase I, the amount of energy required to push a manual wheelchair will be compared to a PAPAW. In Phase II, wheelchair users will evaluate the PAPAW over an Activities of Daily Living (ADL) course to determine its usability and acceptability. In Phase III, participants will take a PAPAW home with them for two weeks, and certain activities will be monitored. Full-time manual wheelchair users with tetraplegia (those with spinal cord injuries at the cervical level or above) are being recruited to participate in the study. Currently, fifteen subjects have completed all of the testing for Phase I.

Results. As initial testing reveals, a PAPAW operates much like a traditional manual wheelchair but requires less effort to propel.

Relevance to Wheelchair Users. PAPAWs can be particularly useful for elderly wheelchair users with tetraplegia, because upper extremity weakness is typically found in this population. PAPAWs have the potential to reduce stress on upper extremities during wheelchair propulsion, reduce metabolic energy expenditure, improve function during daily activities, and improve mobility and participation within one's community.

S. David Algood, B.S.

Development and Reliability Testing of A Clinical Rationale Measure of Seating and Wheeled Mobility Prescription

Laura Cohen PT, ATP; Shirley Fitzgerald PhD; Elaine Trefler MEd, OTR/L, FAOTA, ATP; Michael Boninger MD; Michael McCue PhD, CRC

Laura Cohen, PT, ATP

Purpose of this work: Experienced and/or specially-educated physical therapists (PT's) and occupational therapists (OT's) trained to provide seating and wheeled mobility prescription can be hard to find. In order to pursue research that investigates the most effective way to improve competency and proficiency of professionals, a tool is required. This study was done to develop and report reliability test results of a new measure, the Clinical Rationale Assessment Prescription (CRAP).

Development & Evaluation: The development of this testing and scoring method was completed over two separate trials. The first trial included a group of 20 physical therapist (PT) and occupational therapist (OT) students about to enter the field. The second trial involved 89 PT and OT professionals with varying levels of experience in seating and wheeled mobility prescription. Subjects were shown a video of an "expert" clinician performing a seating and wheeled mobility evaluation and asked to document their thought process and rationale for an equipment prescription.

Results: The CRAP was found to have poor reliability and lack the precision and sensitivity to detect true measurement differences between professionals.

Relevance to Wheelchair Users: In order to provide quality seating and wheeled mobility equipment to wheelchair users, targeted professional training is needed to maximize the consumer/technology match. In order to pursue research that measures clinical competency a measurement tool is needed. Future work will involve development of a new rationale measure with a subsequent clinical trial.

CURRENT RESEARCH ABSTRACTS

Use of the Independence™ 3000 IBOT™ Transporter at Home and in the Community

Rory A. Cooper, PhD; Michael Boninger, MD; Rosemarie Cooper, MPT; Annmarie Dobson, OTR/L

Purpose of the Work. The INDEPENDENCE™ 3000 IBOT™ Transporter (IBOT) is an advanced wheeled mobility device that is capable of negotiating over uneven terrain, inclines, and curbs. In addition, an adjustable seat height enables the user to be eye level with a person standing or walking. The purpose of this study was to gain experience with the IBOT at home and in the community using ten unimpaired non-wheelchair users and four experienced wheelchair users.

Subjects/Procedures. This study is based upon observations by trained clinicians, data recorded from a computerized data-logger, and reports from each expert. The ten unimpaired non-wheelchair users, 6 males and 4 females, mean (SD) age was 41.5 (13.4) at the time of the study. The four experienced participants were male manual wheelchair users with traumatic spinal cord injuries ranging from the T7 to L1 levels. The experienced participant's mean (SD) age was 45 (2.9) at the time of the study. The unimpaired non-wheelchair user and experienced wheelchair user participants used the IBOT as their primary mobility device for three days and one week, respectively. **Results:** The subjects used the IBOT to perform a variety of activities including holding eye-level discussions with colleagues and shopping by balancing on two wheels, going up and down steep ramps, traversing outdoor surfaces (e.g., grass, dirt trails) and climbing curbs. The balance and four-wheel drive functions were helpful and worked well. The IBOT required attention to control in standard function. The seat height was too high for most tables and wheelchairs and it was challenging to use the IBOT in the bathroom. The IBOT is a functional mobility device, its greatest strengths are outdoors and in circumstances where there is space to use balance function.

Relevance to Wheelchair Users. The IBOT has the potential to provide greater functional ability by allowing wheelchair users access to areas and activities that are currently inaccessible.

Annmarie Dobson, OTR/L

Disturbances Induced by Wheelchair Casters When Driving Backwards

Dan Ding, Ph.D., Rory A. Cooper, Ph.D.; Songfeng Guo, Ph.D.; Thomas A. Corfman, M.S.

Purpose of this work: Many users of electrical-powered wheelchairs (EPWs) are challenged when driving the wheelchair backwards, especially in confined areas. It is reported that twenty-five percent of tips and falls occurred while the EPW driven backwards. The study of this paper was to investigate the disturbances induced by three caster orientations at the start of backwards driving at three different speeds and thus examine patterns for developing improved controls.

Dan Ding, Ph.D.

Methods: In order to characterize the reverse stability, 3-D ground reaction forces and moments acting on the left and right casters at the start of backwards driving were collected by two AMTI force plates positioned directly underneath the right and left casters. The test protocol included three caster orientations at the start of backwards driving, i.e. P, Q and U, and three driving speeds, i.e. fast (1m/s), medium (0.5m/s) and slow (0.25m/s). Three trials for each caster orientation were performed at each driving speed. A total of 27 trials were collected and analyzed.

Results: The results of this study indicate that caster disturbances are lower when both caster wheels orient straight backward at the start of reverse driving with lower peak force and moment values and smooth ensemble force and moment curves.

Relevance to Wheelchair Users: In order to provide safe seating and wheeled mobility equipment to people who use power chairs, it is important to characterize the disturbances induced during reverse driving. Future work will be conducted on testing more wheelchairs and eventually lead to the development of control algorithms to dampen or eradicate the reverse instability.

RECENT HERL PUBLICATIONS

Cooper RA, DiGiovine CP, Boninger ML, Shimada SD, Koontz, AM, and Baldwin MA, Filter Frequency Selection for Manual Wheelchair Biomechanics, **Journal of Rehabilitation Research and Development**, Vol. 39, No. 3, pp. 323-336, May/June 2002.

Souza AL, Shimada SD, Biomechanical Analysis of the Knee During the Powerclean, **Journal of Strength and Conditioning Research**, pp. 290-297, Vol. 16, No. 2, May 2002.

Boninger ML, Souza AL, Cooper RA, Fitzgerald SG, Koontz AM, Fay BT, Propulsion Patterns and Pushrim Biomechanics in Manual Wheelchair Propulsion, **Archives of Physical Medicine and Rehabilitation**, pp. 718-723, Vol. 83, No. 5, May 2002.

Collins D, Cooper R, Cooper RA, Schmeler M, Strengthening Justification for Assistive Technology with Research Findings: A Case Study, **RESNA News**, p. 1, Spring 2002.

HERL IN THE MEDIA

University Times, May 2, 2002, Page 14: People of the Times: Michael L. Boninger

Pitt Campaign Chronicle, May 20, 2002, Page 2: Awards and Honors: Michael L. Boninger

Pitt Campaign Chronicle, May 28, 2002, Page 4: An Environment of Opportunity

Paraplegia News, Vol. 56, No. 5, May 2002, Page 55-57: SCRF: 25 Years of Progress

Pitt Magazine, June 2002, Page 4: Wheeling and Dealing

CURRENT EVENTS

The Family Advocacy Network of **United Cerebral Palsy** and **the Children's Institute** are proud to sponsor the 2002 **Assistive Technology Fair** on **Wed. Sept. 4** from 1pm-9pm at the UCP Pittsburgh Community Service Center. The fair will feature the leading vendors of all types of assistive technology in the Pittsburgh area. HERL will have a table at the fair...we hope to see you there! The fair is free to all visitors. Contact UCP Pittsburgh at 412-683-7100 for more details.

UCP Pittsburgh will also be holding their **10th Annual Community Hero Awards Dinner** on **Wed. Sept. 25** from 5-9:45pm at the Pittsburgh Hilton and Towers. HERL will also have a table at this event. For more information, please contact Marci Sloan at 412-683-7100 ext. 337.

The **HOPE Network Healthsports Cycling Program** provides children and adults who have a physical disability an opportunity to participate in recreational/fitness oriented activities. The HOPE Network will be visiting the following Rail-to-Trails locations in Western Pennsylvania:
***Saturday, September 21, 2002**: Montour Trail
***Saturday, October 12, 2002**: Ohiopyle
***Saturday, October 26, 2002**: Mon-Yough (Little Boston Trail)
The HOPE Network also has some hand-cranked bicycles available for use. For more information on this event, please contact the HOPE network Healthsports Coordinator, Richard Bender, at (412) 828-1300 x7321.

If you know of a current event that you would like to post in the HERL Quarterly Newsletter, please contact Christine Heiner at (412) 365-4854 or by e-mail at heinercm@pitt.edu

The HOPE Network is also sponsoring **Pennsylvania's first ever Women's Wheelchair Basketball team.** The team, which will be called the "Steel City Starz", is seeking women with impairments to lower extremities that prevent them from playing on a collegiate or recreational team. Participants to not need to be a wheelchair user, but must use a chair to play. If you are a lady interested in playing and want more information, contact Leah Tazza at (412) 580-9986 or via e-mail at peyton1997@msn.com or Norah Schneider at (724) 794-5062. The STARZ will begin practicing this fall and enter competition during the 2002-2003 basketball season.

MEET THE INVESTIGATOR: RORY A. COOPER, PH.D.

Rory A. Cooper, Ph.D. earned his B.S. and M.Eng degrees in electrical engineering from California Polytechnic State University, San Luis Obispo in 1985 and 1986, respectively. He received his Ph.D. degree in electrical and computer engineering with a concentration in bioengineering from University of California at Santa Barbara in 1989.

Dr. Cooper joined the University of Pittsburgh's Department of Rehabilitation Science and Technology as an Associate Professor in the winter of 1993. Shortly after his arrival, he started up the Human Engineering Research Laboratories, an engineering/clinical lab dedicated to designing and improving assistive technology devices, at the VA Pittsburgh Healthcare System. Dr. Cooper has since become professor and chair of the Department of Rehabilitation Science and Technology and VA Senior Research Career Scientist of the Center of Excellence for Wheelchairs and Related Technology, a VA Rehabilitation Research and Development Center. He is also a professor in the Departments of Physical Medicine and Rehabilitation and Orthopaedic Surgery at the University of Pittsburgh Medical Center Health System and the University of Pittsburgh Departments of Bioengineering and Mechanical Engineering.

Dr. Cooper has authored or co-authored more than 100 peer-reviewed journal publications. He is the author of two books: "Rehabilitation Engineering Applied to Mobility and Manipulation" and "Wheelchair Selection and Configuration". Dr. Cooper also serves on the editorial boards of several prominent peer-reviewed journals in the fields of rehabilitation and bioengineering, such as the VA's *Journal of Rehabilitation Research and Development* and the *Journal of Spinal Cord Medicine*.

HERL director Rory Cooper received the RESNA mentor and elected fellow award; he will receive the Olin E. Teague award this September.

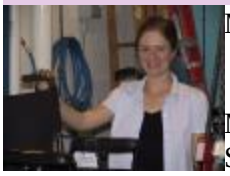
Dr. Cooper is a member of the RESNA/ANSI and ISO Wheelchair Standards Committees, and IEEE-EMBS Medical Device Standards Committee. He is also a member of the United States Health Care Finance Administration – Medicare Advisory Committee, the National Advisory Board on Medical Rehabilitation Research, National Institute of Child Health and Human Development, and the United States Secretary of Veterans Affairs Prosthetics and Special Disability Programs Advisory Committee.

Dr. Cooper has recently been elected as the President-elect of the Rehabilitation Engineering Society of North America (RESNA) for a two-year term beginning on August 1, 2002. RESNA also bestowed two prominent awards to Dr. Cooper at this year's RESNA conference: the mentor award, for "counseling and nurturing others in rehabilitation and assistive technology", and the elected fellow award, which is the highest honor that RESNA gives.

Dr. Cooper was also recently notified that he has been selected to receive the prestigious Olin E. Teague award, the highest award offered by the U.S. Department of Veterans Affairs. Dr. Cooper will receive the Olin E. Teague award at a ceremony to be held on September 18th at the Cannon House Office Building in Washington, D.C.

Article written by Christine Heiner

GRADUATING HERL STUDENTS



Megan Vitek

Master of Science, Rehabilitation Science and Technology

Thesis: Reliability, Repairability, Durability and Value of Power Wheelchairs

Sailesh Panchang

Master of Science, Rehabilitation Science and Technology

Thesis: Assessing Web Page Usability for Users of Text to Speech Assistive Technology

Andrew Rentschler

Master of Science, Bioengineering

Thesis: Analysis of the ANSI/ RESNA Wheelchair Standards: A Comparison Study of Five Different Electric Powered Wheelchairs

FEATURED HERL STUDENT: DIANE COLLINS

Diane Collins earned her bachelor's degree in occupational therapy from Wayne State University in Detroit in 1981. She also holds a Masters of Arts in Management from Webster University in Myrtle Beach. Diane came to the University of Pittsburgh in 1999 on a UCLID fellowship to pursue a doctorate in Rehabilitation Science and Technology. She came to the Human Engineering Research Laboratories in June of 2000 to complete her Ph.D. studies.

Diane's works with Dr. Shirley Fitzgerald to examine how service dogs can assist wheelchair users both functionally and psychologically. Since she has 18 years of experience as an occupational therapist, Diane has always found it rewarding to adapt tasks and environments so that people with disabilities can tackle obstacles in their daily lives. Through her doctoral work, her interests have expanded beyond the clinical setting to include experimental research in assistive technology.

Diane was recently awarded a Pre-Doctoral Associated Health Rehabilitation Research Fellowship from the U.S. Department of Veterans Affairs. This grant will allow her to combine and compare Dr. Fitzgerald's two service dog studies. Diane plans to graduate from the University of Pittsburgh in April of 2003 and join the VA as a research scientist.

article written by Christine Heiner

Influence of Wheelchair Service Dogs on Human Assistance Needs in Basic and Instrumental Activities of Daily Living

Diane M. Collins, MA, OTR/L, Shirley G. Fitzgerald, PhD,
Margo B. Holm, PhD, OTR/L, Natalie Sachs-Ericcson, PhD.

Purpose of the Work: Research has found individuals partnered with wheelchair service dogs (SDs) to be less reliant on human assistance compared to similar individuals without service dogs. However, studies differed as to the amount by which need for assistance was reduced. Therefore, a nine-month, case/control, longitudinal study examining the influence of wheelchair SDs on need for human assistance was conducted.

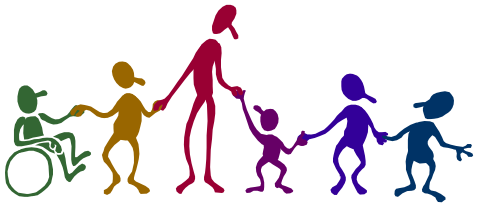
Subjects/Procedures: Cases included 14 individuals partnered with SDs, and controls were 19 individuals on a waiting-list to receive a SD with a service dog organization. Baseline data was collected when participants entered the study, and was obtained prior to receipt of SD for those in the SD group. Questionnaires were used to collect data, and included questions regarding sociodemographics, healthcare utilization, ADL and IADL, and psychological characteristics. Data on hours of human assistance utilized were obtained at baseline, 3-months, and 9-months from enrollment data.

Results: Two trends were found in the data, though they were not significant. First, hours of human assistance utilized for instrumental activities of daily living (IADL) tended to remain stable in the SD group, while an upward trend was noted for the control (waiting-list) group. Second, though the number of monthly healthcare appointments at nine-months was more than twice that of controls, the SD group's need for assistance in transportation to healthcare appointments declined, while the control group's need increased.

Relevance to Wheelchair Users: Wheelchair service dogs may mediate loss of function for people who use wheelchairs in instrumental activities of daily living and transportation needs.

AGENCY SPOTLIGHT: UNITED CEREBRAL PALSY

In 1948, the Leonard Goldenson and Jack Hausman families joined forces to improve the quality of life for people with cerebral palsy and other disabilities. Their goal was for these people and their families to have a network of support and feel involved in the community. Due to the innovative vision of two families, hundreds of people came together to form the United Cerebral Palsy (UCP) national organization in 1949.



The faces of UCP have changed, but the goal has remained the same. In the 90's, the UCP adopted a set of principles declaring that every effort would be made "to affect positively the quality of life for persons with cerebral palsy and also others with severe disabilities and multiple service needs and the families of both; and to prevent cerebral palsy and minimize its effects." Today, their mission "is to advance the independence, productivity, and full citizenship of people with cerebral palsy and other disabilities."

The Pittsburgh UCP chapter was founded in 1951 to serve Allegheny County, and actively advocates the UCP message throughout the community. Dr. Al Condeluci, who has over 28 years of service at UCP of Pittsburgh, is the organization's executive director. UCP Pittsburgh has progressed from a small, Children's Hospital clinical affiliate into a prominent rehabilitation agency in the county. UCP Pittsburgh has three divisions: UCP Parent Corporation, the UCP Foundation, and Community Living and Support Services (CLASS). Through CLASS, UCP of Pittsburgh serves more than 200 people with all kinds of disabilities every day. UCP Pittsburgh offers a large number of progressive services including attendant care, residential services, community skills training, vocational programs, outreach, and advocacy.

HERL has been involved with UCP of Pittsburgh for about 7 years. Dr. Rory Cooper has served on UCP of Pittsburgh's board of directors since 1996. Our lab also attends many annual UCP of Pittsburgh events such as their Assistive Technology vendor fair and their Annual Community Hero Awards Dinner.

More information about UCP of Pittsburgh is available is available on their wesbite, www.ucppittsburgh.org. They may also be reached by E-mail at info@ucppittsburgh.org or phone at (412) 683-7100 (TTY: (412) 683-6166). UCP of Pittsburgh also distributes a newsletter, "The Voice", three times a year. To subscribe to "The Voice", call or e-mail UCP of Pittsburgh.

Article written by Alexis Ulerich and Christine Heiner

RESEARCH PARTICIPANT SPOTLIGHT: SHANNON FRANKS

Shannon Franks became involved with the Human Engineering Research Laboratories in 1999 when he traveled from New Jersey to participate in one of our research studies. That summer, he came back to HERL to complete a summer student internship.

Shannon Franks

Shannon graduated from Northland College in 2001 with a degree in Environmental Science. He is currently thinking about attending graduate school to study remote sensing technology.

Shannon has kept in contact with HERL for potential research involvement since his internship in 1999. He spends a lot of time traveling and has stopped by HERL in Pittsburgh to participate in research studies during several of his trips in the last few years. Shannon also enjoys many outdoor activities such as rock climbing, biking, kayaking, and skiing.

Article written by Christine Heiner

Human Engineering Research Laboratories

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University of Pittsburgh Model Center on Spinal Cord Injury

Rory A. Cooper, Ph.D.
Director

Michael L. Boninger, M.D.
Medical Director

Shirley G. Fitzgerald, Ph.D.
Associate Director of Research, VA R&D Center of Excellence for Wheelchair and Related Technology

Visit our website!
www.herlpitt.org

Interested in Participating in a HERL Research Study?

Studies at our laboratories involve participants who utilize manual or power wheelchairs as a means for mobility. The majority of our studies involve a visit to the Human Engineering Research Laboratories located at the VAMC- Highland Drive, however, some of our studies are survey based and do not involve travel to the VAMC. We welcome you to contact the Clinical Coordinators at HERL in order to provide you with study information and study participation options. We look forward to hearing from you.

If you're interested in participating in a HERL Research Study, contact our clinical coordinators Rosemarie Cooper or Annmarie Dobson at (412) 365-4850.