Fischer, H., Stubblefield, K. (2007) **Hand rehabilitation following stroke: A pilot study of assisted finger extension training in a virtual environment.** *Topics in Stroke Rehabilitation, 14(1), 1-12.* NARIC Accession Number: J52074. Project Number: H133E020724.
Abstract: Study examined whether repetitive practice with finger extension assistance in a virtual environment could improve hand function in stroke survivors with chronic upper-extremity hemiparesis. Participants received six weeks of training in reach-to-grasp of virtual and actual objects after being randomly assigned to one of three groups: finger extension assistance provided by cable orthosis, assistance provided by pneumatic orthosis, or no assistance provided. Hand performance was evaluated before, after, and 1 month after training using the Wolf Motor Function Test (WMFT), the Box and Blocks Test (BBT), the upper extremity Fugl-Meyer (FM) test, and the Rancho Los Amigos Functional Test of the Hemiparetic Upper Extremity (RLA). Biomechanical assessments included grip strength, extension range of motion and velocity, spasticity, and isometric strength. Participants in all three groups demonstrated a significant decrease in time to perform functional tasks as measured with the WMFT, an increase in the number of blocks successfully grasped and released during the BBT, and an increase for the FM score. There were no changes in time to complete tasks on the RLA or any of the biomechanical measures. Assistance of extension did not have a significant effect in this study.

Schultheis, M., Rebimbas, J. (2007) **Examining the usability of a virtual reality driving simulator.** *Assistive Technology, 19(1), 1-8.* NARIC Accession Number: J53456. Project Number: H133G000073.
Abstract: Study examined aspects of usability in a virtual reality driver rehabilitation (VR-DR) system among 20 individuals with traumatic brain injury (TBI), 13 with stroke, and 21 healthy control subjects. The VR-DR is a computer-based system that uses a head-mounted display unit to visually present a virtual environment through which users can drive using a commercially available steering wheel and foot pedal. In addition to visual feedback, the VR-DR provides auditory and tactile feedback and allows the presentation of different driving challenges. All participants were administered the VR-DR and completed the VR-DR User Feedback Questionnaire. To examine group differences, a one-way analysis of variance was performed, comparing the user feedback total score between the three groups. Results indicated that the healthy control group reported significantly more favorable VR-DR ratings than both the TBI group and the stroke group. A standard multiple regression analysis revealed that age was the only significant participant factor that contributed to the differences in user feedback ratings. Finally, consistent across the three groups, as users' discomfort increased, the likelihood of simulation sickness increased.

Fager, S., Beukelman, D. (2006) **Use of safe-laser access technology to increase head movement in persons with severe motor impairment: A series of case reports.** *Augmentative and Alternative Communication, 22(3), 222-229.* NARIC Accession Number: J51610. Project Number: H133E030018.
Abstract: Article describes the use of safe-laser technology to increase head movement in 6 individuals with locked-in syndrome due to brainstem stroke. When invited to participate in the study, none of the subjects were able to speak and none were able to use an augmentative and alternative communication (AAC) device. All subjects communicated using eye movements, eye blinks, dependent scanning strategies with eye movement signals, or eye linking. Following intervention with the safe-laser access technology, 3 of the 6 participants developed head movement sufficient to control AAC technology.

Kahn, L., Lum, P. (2006) **Robot-assisted movement training for the stroke-impaired arm: Does it matter what the robot does?** *Journal of Rehabilitation Research and Development (JRRD) (formerly the Bulletin of Prosthetics Research), 43(5), 619-631.* NARIC Accession Number: J51742. Project Number: H133E020724; H133G980052.
Abstract: Article examines the role of applied robotic forces in improving arm motor function following stroke by comparing results from studies involving the Assisted Rehabilitation and Measurement (ARM) Guide and the Mirror Image Movement Enabler (MIME) robotic trainers. The key finding was that subjects who participated in non-robotic therapy (unassisted reaching in the ARM Guide study or conventional rehabilitation therapy in the MIME study) and subjects who received active assistance from the ARM Guide did not improve their reach extent. Only subjects who received movement training with the MIME improved their reach extent. The results suggest that requiring the subject to generate specific patterns of force before allowing movement is more effective than mechanically completing the movements for the subject.

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RehabWire
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NARIC National Rehabilitation Information Center

NIDRR Grantees on the Cutting Edge

RRTC on Enhancing the Functional and Employment Outcomes of Individuals Who Experience a Stroke *Rehabilitation Institute Research Corporation* (H133B080031) led by Elliot J. Roth, MD. Theresa San Agustin, MD, Project Officer.
Abstract: As new and better stroke treatments have become available, the number of stroke survivors living in the community has increased. Therefore, not only is there a need for further research on promising new interventions that promote health and function, but also a growing need for interventions that can be delivered in home and community settings. This project studies rehabilitation interventions and assessments focused on improved mobility and secondary conditions that have been designed with the intent of promoting efficient function in the workplace or at home. It also looks at the barriers and facilitators for return-to-work from the perspective of stroke survivors who are seeking employment. The RRTC research projects include: (1) a study of the effectiveness of stretching as hand therapy for sub-acute hemiparesis; (2) development of a low-cost, non-mechanized gait retraining device; (3) testing a self-management approach to community living, participation, and employment; (4) examining the barriers and enablers for return-to-work from the perspective of the of the individual who experienced the stroke; and (5) development of a return-to-work vocational assessment using virtual reality technology.
Find out more at: www.rrtc-stroke.org

Consortium for Assistive Technology Outcomes Research (CATOR) II *Duke University* (H133A060062) led by Frank DeRuyter, PhD. Shelley Reeves, Project Officer.
Abstract: The Consortium for Assistive Technology Outcomes Research (CATOR-II) enhances understanding of the impact of assistive technology (AT) on the lives of people with disabilities by conducting a research project that systematically applies state-of-the-science measures of AT interventions, outcomes, and data collections mechanisms. The purpose of this project is to improve the AT field's ability to measure the impact of AT on the lives of people with mobility disabilities, with the potential to supplement or supplant the

According to the National Stroke Association, stroke is the third leading cause of death in the US. It is the most common cause of adult disability in the US. One of the most common myths of stroke recovery is that a stroke survivor may improve for a few months, but recovery is limited to those early efforts. The technology funded by NIDRR assists stroke survivors in their recovery throughout their lifespan.

Please note: These abstracts have been modified. Full, unedited abstracts, as well as any available REHABDATA citations, are available at naric.com.

Thousands of additional resources on these topics are available from NARIC's resource pages at www.naric.com/public

One of NIDRR's research priorities is Technology for Access and Function. This includes technology developed for the rehabilitation process as well as assistive technology.

instruments and techniques available to researchers, service providers, and policy makers. Drawing on the advanced measures emanating from co-occuring projects, researchers use an experimentally controlled design to examine the conditions under which a change in assistance strategy, induced by a mobility AT intervention, enhances the functional performance, well-being, and device satisfaction of stroke survivors and decreases the assistance being received from cohabitating caregivers.
Find out more at: www.AToutcomes.com

Virtual Reality-Based Assessment Tool for Spatial Neglect Following Stroke *Assaf Y. Dvorkin, PhD* (H133F080010) led by Assaf Y. Dvorkin, PhD. A. Cate Miller, PhD, Project Officer.
Abstract: This project investigates the possibilities of robotics and virtual reality technology in spatial neglect following stroke. A haptic/graphic virtual reality system (VRROOM) is developed and used in assessing and quantifying perceptual performance and overall movement quality. The data provides therapists and physicians with a more precise quantitative description of a patient's sensory and motor deficits in different spatial dimensions and provides a rational basis for improving current neuropsychological assessment measures.

Virtual Reality Assessment and Treatment of Hemispatial Neglect *Albert Einstein Healthcare Network* (H133G060086) led by Laurel Buxbaum, PsyD. Leslie J. Caplan, PhD, Project Officer.
Abstract: The goal of this project is to address previous limitations in the assessment and treatment of neglect through the use of virtual reality (VR) technology. Hemispatial neglect, a failure to attend to and/or act on objects on the side of space opposite a brain lesion, is a common and persistent consequence of stroke, occurring in approximately 45 percent of the nearly 2 million Americans who have suffered a right hemisphere cerebral vascular accident. The neglect syndrome is associated with impairments in a wide range of activities of daily living, with significant consequences for functional independence. This project capitalizes on a number of VR's useful assets, including simulation of the spatial and cognitive demands of real world environments, quantification of aspects of performance, ready control of the experimental task, and ease of administration. The major aims are: (1) to develop and validate a VR navigation task measuring lateralized attention (the VRLAT), an extension of a sensitive VR task developed previously; (2) to perform clinical trials assessing the short-term efficacy of two VR-based treatments for neglect that induce different types of mismatch between proprioceptive and visual information, using the VRLAT as one of the measures of treatment response; and (3) to perform clinical trails of the two treatments focused on generalization and maintenance of gains with a longer course of treatment.

A Low-Cost Portable/Wearable Device for Intelligent Stretching and Movement Training of Hypertonic Forearm in Stroke with Outcome Evaluation *RehabTek, LLC* (H133S080076) led by Yupeng Ren. Delores Watkins, Project Officer.
Abstract: This project develops a wearable/portable robotic device, IntelliStretch, to perform therapeutic rehabilitation of the arm with the following three integrated steps: (1) stretching a spastic/stiff joint to its extreme position under intelligent control to loosen the stiff joint, (2) voluntary movement training using virtual reality games interfaced with assistance/resistance control when needed, and (3) quantitative outcome evaluation. IntelliStretch is first modified for wearable design to improve portability and functionality. Second, in order to motivate/facilitate patients in motor-function recovery, voluntary movement training by playing virtual reality games is added. Finally, the outcome of the robotic treatment is evaluated quantitatively in terms of the biomechanical and neuromuscular properties of the joint. The IntelliStretch device facilitates the delivery of healthcare services to remote locations, such as patients' homes and local clinics, and, thus enables an increased number of patients to receive effective treatment and outcome evaluation conveniently while enjoying the games.

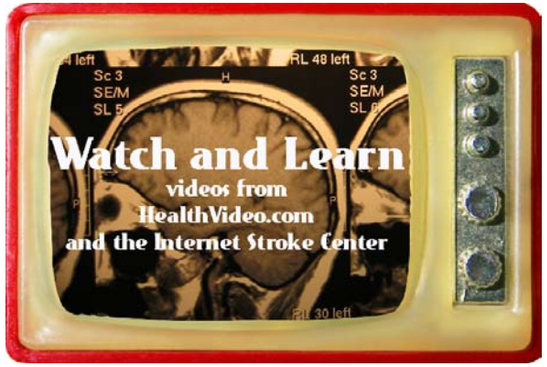

Photo Credits: Susanne Becker, Germany, and Aaron Balogh, Hungary

The Internet Stroke Center and HealthVideos.com have developed a series of videos that discuss life after stroke, including the basics of rehabilitation, new therapies, long term rehabilitation, and rehab from a personal perspective. Gather around the monitor and watch at www.strokecenter.org/patients/living.htm

Where Can I Find More?

A quick keyword search is all you need to connect to a wealth of disability and rehabilitation research. NARIC's databases hold more than 75,000 resources. Visit www.naric.com/research to search for literature, current and past research projects, and organizations and agencies in the US and abroad.

The Cochrane Library

The Cochrane Collaboration lists 64 "technology assessments" for stroke. This is in addition to the protocols and reviews from the Stroke Group. Reviews currently in the editorial process include constraint induced therapy, rehabilitation in long term care, and orthotic device use after stroke. Visit www.thecochranelibrary.org and click By Review Group to browse by topic.

Current Literature - *Selections from REHABDATA*

Roth, E., Lovell, L. (2008) **Design of products and environments for people with stroke.** *Topics in Stroke Rehabilitation, 15(2), 73-176.* NARIC Accession Number: R08931. Project Number: H133B031127.
Abstract: This journal issue contains articles that reflect the topics presented at the State of the Science Conference on Strategic Development of Products and Environments for People with Strokes. Topics include: the Chicago perspective on design for the disabled, creating engaging experiences for rehabilitation, the role of people with disabilities in the design process, the design of a progressive building constructed by an independent living center, a new model for universities and companies to work together to meet the needs of 50+ consumers, developing more desirable products for stroke survivors, designing an accessible waterfront park, designing the experience of health care, and the design and development of a robotic overground gait and balance therapy device. In addition, several articles illustrate the products and process of design for stroke survivors conducted in an undergraduate engineering design class at Northwestern University. Individual articles are available for document delivery under accession numbers J54320 through J54335, J54997, and J55003.

Reinkensmeyer, D., Housman, S. (2007) **"If I can't do it once, why do it a hundred times?": Connecting volition to movement success in a virtual environment motivates people to exercise the arm after stroke.** *In Proceedings of the Virtual Rehabilitation 2007 Conference; Venice, Italy; Sept. 27-29, 2007, 44-48.* NARIC Accession Number: O17099. Project Number: H133E020724; H133E020732.
Abstract: Article presents the results of a follow-up survey conducted with subjects who participated in a study in which they reported a preference for a new passive arm orthosis training system called Therapy Wilmington Robotic Exoskeleton (T-WREX), compared to conventional self-directed tabletop exercises to improve arm movement and hand function after stroke. T-WREX has 4 main features: (1) a passive, gravity-balance arm support that allows a wide range of arm motion; (2) a hand grip sensor that detects even trace amounts of grasp; (3) virtual reality exercises that simulate activities of daily living; and (4) software that provides feedback about task performance. Results suggest that subjects preferred T-WREX because it is more interesting, and because it allowed them to be more successful with their movement