

Art and Science of Creating Intuitive Devices



Shirley Ryan
Abilitylab.

Northwestern
University

JANUARY 19, 2023 – ONLINE COURSE



COURSE DESCRIPTION

In the field of rehabilitation, devices that restore function and ability after a trauma or a debilitating medical condition can offer a lifeline to individuals and families. However, creating devices that mimic natural human movement and responses, restore sensation, and aid in daily tasks can fall short in their usability, aesthetic appeal or often have a large learning curve. How do we create tools that achieve these functional goals, yet are so well designed that people can easily adopt them without these barriers? This course will discuss human-centered design and how it's applied to rehabilitation devices including prosthetics, wheelchairs and exoskeletons. Attendees will learn more about user interfaces and how human-centered design principles can be applied to create more intuitive devices. The day will end with a commercial panel of industry experts who will discuss their approach to design for the commercial market.

WHO SHOULD ATTEND

Engineers, Data Scientists, Physical Therapists, Physical Therapist Assistants, Occupational Therapists, Occupational Therapy Assistants, Nurses, and Physicians

LEARNER OUTCOMES

Upon completion of this course, participants will be able to:

- Compare the pros and cons of design elements that have been deployed in rehabilitation devices over time
- Identify key principles of user-centered design that can be applied to the development process for rehabilitation devices

SUCCESSFUL COMPLETION

To successfully complete this course, you will need to attend the live activity, attest to your attendance and complete an evaluation at its conclusion through the Academy Learning Portal.

ABOUT C-STAR

The Center for Smart Use of Technologies to Assess Real World Outcomes (C-STAR) is one of six national resource centers comprising the Medical Rehabilitation Research Resource network (MR3) of the National Institutes of Health.

C-STAR is a joint grant between Northwestern University and Shirley Ryan AbilityLab, conceived out of a need to equip investigators with the skills and know-how to accurately employ technologies to measure and interpret data relevant to sensorimotor and cognitive function in the lab, clinic and real world. Our mission is to connect researchers with the right tools to develop and accurately assess technologies in the field of rehabilitation science. Leveraging the collective experience of clinicians, scientists, engineers and patients, our center provides the expertise, instruction and mentorship to empower researchers on the meaningful use of the vast array of technologies that are readily available but notoriously difficult to implement consistently across diverse patient populations.

COURSE CHAIR



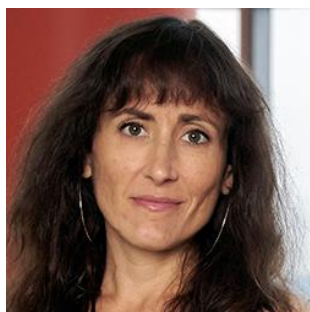
Levi Hargrove PhD

Scientific Chair of The Regenstein Foundation Center for Bionic Medicine and of the Neural Engineering for Prosthetics and Orthotics Laboratory, Shirley Ryan AbilityLab; Associate Professor, Feinberg School of Medicine and McCormick School of Engineering, Northwestern University

A major goal of Dr. Hargrove's research is to develop clinically realizable myoelectric control systems that can be made available to persons with limb loss in the near future.

His research addresses all levels of amputation and has been published in the Journal of the American Medical Association and the New England Journal of Medicine and has multiple patents. Key projects include the development of advanced and adaptive control systems for prosthetic legs, improving control of robotic hand prostheses, and intramuscular EMG signal processing. In 2012, Dr. Hargrove co-founded Coapt, a company to transition advanced rehabilitation technologies from the research lab to patients' homes.

COURSE FACULTY



Brenna Argall, PhD

***Associate Professor of Computer Science
Associate Professor of Mechanical Engineering
Associate Professor of Physical Medicine and Rehabilitation
Northwestern University***

Dr. Argall is an associate professor of Mechanical Engineering, Computer Science, and Physical Medicine & Rehabilitation at Northwestern University. She is director of the assistive & rehabilitation robotics laboratory (argallab) at the Shirley Ryan AbilityLab (formerly the Rehabilitation Institute of Chicago). The mission of the argallab is to advance human ability by leveraging robotics autonomy. Argall is a 2016 recipient of the NSF CAREER award and was named one of the 40 under 40 by Crain's Chicago Business. Her Ph.D. in Robotics (2009) was received from the Robotics Institute at Carnegie Mellon University, as well as her B.S. in Mathematics (2002). Prior to joining Northwestern and RIC, she was a postdoctoral fellow (2009-2011) at the École Polytechnique Fédérale de Lausanne (EPFL), and prior to graduate school, she held a Computational Biology position at the National Institutes of Health (NIH). More recently, she was a visiting fellow at the Wyss Center for Bio and Neuroengineering in Geneva, Switzerland (2019).



Arun Jayaraman, PT, Ph.D.

***Director, Max Näder Center for Rehabilitation Technologies & Outcomes Research;
Director & Business Development Officer, Office of Translational Research, Associate Professor of PM&R, Medical Social Science, PTHMS, Northwestern University***

Dr. Arun Jayaraman's work primarily focuses on developing and executing both investigator-initiated and industry-sponsored research in prosthetics, orthotics, rehabilitation robotics, and other assistive and adaptive technologies to treat physical impairments. He conducts all of his outcomes research using advanced wearable patient monitoring wireless sensors and novel machine learning techniques, in addition to the traditional performance-based and patient-reported outcome measures. He collaborates both nationally and internationally with many academic and industrial organizations and is internationally recognized in the field of rehabilitation robotics.



James Patton, PhD

Senior Research Scientist

Professor, Bioengineering, University of Illinois at Chicago

Dr. Patton's research focuses on computational modeling of biomechanics, the neural control of actions, motor learning, and neuro-rehabilitation. He specializes in robotic manipulators and human machine-interactions to try to answer some of these questions. Dr. Patton is interested in leveraging our knowledge of how the brain acquires, organizes and executes motor behaviors to solve problems not only in rehabilitation but in other endeavors that present challenges to the neuromotor system.



Amy Schwartz, PhD

Adjunct Professor, Northwestern University

Principal, Empathic Innovation, LLC

For over 30 years, Dr. Amy Schwartz has used her training as a cognitive psychologist to humanize technology and has applied her expertise in human-centered design across a wide range of challenges. She is a Human Centric Design Thought Leader at Battelle Memorial Institute where she focuses on medical devices and healthcare, helping Battelle realize their strengths in blending creativity and technical rigor. Amy spent 20 years at the design innovation consultancy IDEO, where she founded the design research group in the Chicago studio, served as the global design lead for the IDEO health practice, and led the design research for some of IDEO's most innovative and successful designs including the award-winning Lifeport Kidney Transporter (which won the IDSA Design of the Decade award and is in the permanent collection of New York's Museum of Modern Art), Medtronic StealthStation surgical navigation system, Bayer Contour glucose meters, and Sherwin Williams' ColorSnap in-store color selection system. She has worked with a wide variety of clients from startups, to industry giants like Baxter, Eli Lilly, and Ford as well as clients in the governmental and public sectors. Amy excels in helping clients and design teams frame problems in new ways to inspire innovative design solutions.



Jacob Segil, Ph.D.

Research Assistant Professor, Mechanical Engineering Department

College of Engineering and Applied Science

University of Colorado Boulder

Dr Segil directs the Artificial Limb Laboratory where their research mission is to enable the embodiment of artificial devices by providing physiologically appropriate somatosensory feedback. Using neural interfaces, biomechatronic devices and machine learning, they strive to blur the lines between human and machine by eliciting perceptions of the natural body using artificial devices. He received a B.S. in Mechanical Engineering from the University of Illinois Urbana-Champaign (2008), a M.S. in Mechanical Engineering (2012) and a Ph.D. in Mechanical Engineering (2014) from the University of Colorado Boulder. He is a Research Assistant Professor in Mechanical Engineering at the University of Colorado Boulder and a Biomedical Engineer in the Rocky Mountain Regional VA Medical Center.



Katherine Strausser, Ph.D.

Technology Lead for Exoskeletons at Ekso Bionics

Dr Strausser holds a Bachelor's degree from Carnegie Mellon University and a Master's and PhD from the University of California, Berkeley. She was one of three primary inventors of Ekso, an electro-mechanical lower extremity exoskeleton for medical applications. Ekso and its derivatives including the EksoNR have helped thousands of patients recover from neurological injuries and disorders through advanced rehabilitation technology. Dr. Strausser is currently the Technology Lead for Exoskeletons at Ekso Bionics, where she

continues to lead development of new and novel exoskeleton devices and controls strategies, with a special focus on the interaction of the users with the device.

AGENDA – JANUARY 19, 2023 (IN US CENTRAL TIME)

8:45 am	Welcome & Course Introduction
9:00 am	Applying Human-Centered Design to Create Better User Interfaces Amy Schwartz, Ph.D.
10:00 am	A History of Design in Rehabilitation Levi Hargrove Ph.D.
10:45 am	Break
11:00 am	Human Autonomy through Robotics Autonomy Brenna Argall, Ph.D.
11:45 am	User Interfaces in Exoskeletons Homayoon Kazerooni, Ph.D.
12:30 pm	Lunch Break
1:30 pm	Can Robots Help Understand What's Therapy? James Patton
2:15 pm	User Interfaces in Rehabilitation Devices: A Commercial Perspective Panel Moderator: Levi Hargrove Ph.D. Jacob Segil, Ph.D., Katherine Strausser, Ph.D.
3:30 pm	Course Wrap-Up

LOCATION

The program will be held online. All programming will be shared through an online meeting platform, Zoom, and the Academy Learning Portal.

TECHNOLOGY REQUIREMENTS

To participate, you will need access to a computer with an internet connection. High-speed broadband access (LAN, Cable or DSL) is highly recommended.

- Internet connection: broadband wired or wireless (3G or better)
- Web browser:
 - Apple Safari: Latest stable version
 - Google Chrome: Latest stable version
 - Mozilla Firefox: Latest stable version
 - Microsoft Edge: Latest stable version
- JavaScript and Cookies enabled
- Speaker or headset to listen to audio files and participate in Zoom calls

- Do NOT use Internet Explorer, as it is not supported.

ACCESSIBILITY

Please contact the Academy if you require special accommodations for this course.

CONTINUING EDUCATION CREDIT

Occupational Therapy



The Shirley Ryan AbilityLab is an AOTA Approved Provider of professional development. Course approval ID# 5903. This distance learning interactive course is offered at .575 CEUs [intermediate, Foundational Knowledge]. AOTA does not endorse specific course content, products, or clinical procedures.

Physicians



The Rehabilitation Institute of Chicago DBA Shirley Ryan AbilityLab is accredited by the Illinois State Medical Society (ISMS) to provide continuing medical education for physicians.

The Rehabilitation Institute of Chicago DBA Shirley Ryan AbilityLab designates this live activity for a maximum of **5.5 AMA PRA Category 1 Credit(s)™**. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Physical Therapy

This course has been approved by the Illinois Physical Therapy Board for 5.5 Contact Hours Approval #216-000069

The Shirley Ryan AbilityLab is recognized by the New York State Education Department's State Board for Physical Therapy as an approved provider of physical therapy and physical therapist assistant continuing education. This three-day course has been approved for 5.5 Contact Hours.

The following states require continuing education units with no state-specific approval: CT, IA, and WA

REGISTRATION INFORMATION:

Register online at <https://www.sralab.org/academy>

If you have any questions, please contact Academy@sralab.org

FACULTY AND PLANNING COMMITTEE DISCLOSURES:

Course Director's and Planning Committee Members' Disclosure Information:

Rebecca Bagdy, MBA

Has nothing to disclose.

Ronald Cotton, MD, Ph.D.

Has nothing to disclose.

Levi Hargrove, Ph.D.

Coapt, LLC, Intellectual Property Rights Ownership Interest.

Melissa Kolski, PT, DPT

Has nothing to disclose.

Speakers, Moderators and Panelists' Disclosure Information:

Brenna Argall, Ph.D.

Has nothing to disclose.

Arun Jayaraman, PT, Ph.D.

Has nothing to disclose.

James Patton, Ph.D.

Financial relationship with and HDT Robotics (Royalty). NONFINANCIAL DISCLOSURES: Patton is named IP (patent) of a robotic device that he consulted on the design of -- the burt robot from Barrett Medical. There is no current financial arrangement.

Amy Schwartz, Ph.D.

Has nothing to disclose.

Jacob Segil, Ph.D.

Financial relationship with Point Designs LLC, receives a salary, IP and patent, Infinite Biomedical Technology receives a consulting, IP, royalty and patent. Receives a salary and IP from Ekso Bionics.

Katherine Strausser, Ph.D.