

RST

Where Rehabilitation,
Science and Technology
changes lives!

Department of Rehabilitation
Science and Technology

School of Health and
Rehabilitation Sciences



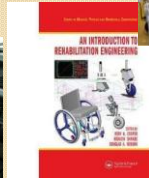
Rehabilitation Engineering in Clinical Practice

VA-PRC 7th Virtual Grand Rounds

Carmen DiGiovine, PhD, RET, ATP,
Ed Lopresti, PhD, ATP and
John Coltellaro, MS, ATP

Why are we here?

- Increase the overall awareness of Rehabilitation Engineering.
- Provide examples of Rehabilitation Engineering in service delivery.



Overview

- Introductions
- 3 case examples of Rehabilitation Engineers
- History of Rehabilitation Engineering
- Rehabilitation Engineering Today
- Case Studies of the application of Rehabilitation Engineering



Carmen P. DiGiovine

- RESNA Certified Assistive Technology Professional (ATP)
- RESNA Certified Rehabilitation Engineering Technologist (RET)
- University of Pittsburgh
 - PhD & MS in Bioengineering with a Certificate in Rehabilitation Engineering
- University of Illinois at Urbana-Champaign
 - BS in General Engineering



Experience

- Occupational Therapy Division, OSU
 - Assistant Professor
- Assistive Technology Center, OSUMC
 - Program Director and Rehabilitation Engineer
- 6 Degrees of Freedom, LLC
 - President and Rehabilitation Engineer
- Assistive Technology Unit, University of Illinois at Chicago (UIC)
 - Rehabilitation Engineer and Clinical Assistant Professor
- Human Engineering Lab, University of Pittsburgh
 - Research Associate



Standards and Professional Organizations

- Wheelchair Transportation Safety
 - Clinical Representative - ISO & ANSI/RESNA - Standards Development
- Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)
 - Chair - Professional Standards Board (PSB)
- National Spinal Cord Injury Association (NSCIA)
 - Executive Committee - Board of Directors



John Coltellaro

- RESNA Certified Assistive Technology Professional (ATP)
- California State University, Sacramento
 - MS in Biomedical Engineering with an emphasis on Rehabilitation Engineering
- California State University, Sacramento
 - BS in Electrical and Electronics Engineering
- Solano Community College, Fairfield
 - Associates of Science, Electronics Technician



Experience

- 2007-Present **University of Pittsburgh, Center for Assistive Technology**
Position: Rehabilitation Engineer
- 2007-Present **University of Pittsburgh, Dept. of Rehab Science & Tech**
Position: Adjunct Professor
- 1997-2007 **The Children's Institute, Pittsburgh, PA**
Position: Rehabilitation Engineer
- 1992-1997 **HEALTHSOUTH Rehabilitation Hospital, Monroeville, PA**
Position: Rehabilitation Engineer
- 1990-1992 **The Rehabilitation Institute, Pittsburgh, PA**
Position: Rehabilitation Engineering Specialist
- 1987-1990 **The Assistive Device Center, Sacramento, CA**
Position: Rehabilitation Engineering Assistant



US Air Force Veteran



Edmund F. LoPresti

- University of Pittsburgh
 - PhD in Bioengineering
- Carnegie Mellon University
 - BS in Electrical and Computer Engineering



Experience

- University of Pittsburgh
 - Adjunct Assistant Professor
- Hiram G. Andrews Center
 - Rehabilitation Engineering, Learning Technologies Program
- AT Sciences, LLC
 - President and Rehabilitation Engineer
- Koester Performance Research & Augmentech, Inc.
 - Assistive Technology Electronics & Software Development
- University of Pittsburgh
 - Research Fellow



Other (Standards or Professional Organization Activities)

- RESNA
 - Past Chair, Cognitive Disabilities Special Interest Group and Technology Transfer Special Interest Group
- Institute for Electrical and Electronics Engineering (IEEE)
 - Engineering in Medicine and Biology Society
- Association for Computing Machinery (ACM)
 - Accessible Computing Special Interest Group



Professional Organizations and Certifications

- Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)
 - www.resna.org
 - Mission: To improve the health and well-being of people with disabilities through technology.
- Certifications
 - Assistive Technology Professional (ATP)
 - Seating and Mobility Specialist (SMS)
 - Rehabilitation Engineering Technologist (RET)



Professional Organizations

- IEEE - Engineering in Medicine and Biology
 - www.embs.org
 - www.embs.org/docs/careerguide.pdf
- Biomedical Engineering Society
 - www.bmes.org



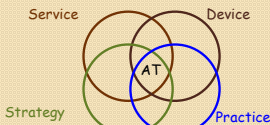
Questions

- What is Assistive Technology?
- What is Rehabilitation Technology?
- What is Engineering?
- What is Biomedical Engineering?
- What is Rehabilitation Engineering?
- What is Clinical Rehabilitation Engineering?



What is Assistive Technology?

- Services, devices, strategies and practices that are conceived and applied to increase, maintain or improve functional capabilities of individuals with disabilities.



Cook and Polgar (2008)



Assistive Technology

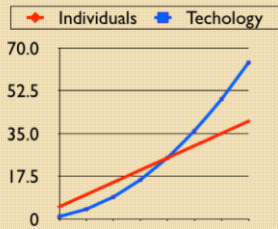


Rehabilitation Technology

- Services, Devices, Strategies and Practices associated with the assessment, implementation, training, and follow-up process.



Rationale

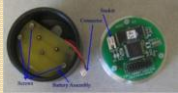


- Increasing number of individuals with a disability
- Increasing utilization of Assistive Technology and Rehabilitation Technology
- Processes and infrastructure are not keeping pace with increasing number of individuals with disabilities and increasing number of technologies



Rehabilitation Engineering

- Application of science and technology to improve the quality of life of individuals with disabilities



Hobson and Trefler (2000)
Reswick (1983)



History of Rehabilitation Engineering

- Pole as a walking aid – Egyptian stele circa 1500 BC
- Medieval armorers were the first rehabilitation engineers and prosthetists
- Modern era began in 1960s and 1970s
 - Creation of 3 research centers in Canada as a result of “Thalidomide tragedy” – 1960s
 - Program for “Rehabilitation Engineering Centers of Excellence” – 1970s
 - Rehabilitation act of 1973
 - Department of Veteran Affairs



Cooper, Ohnabe and Hobson (2007)



History of Rehabilitation Engineering

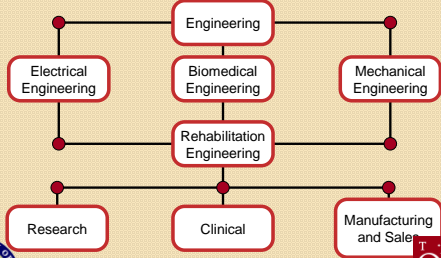
- 1980's and 1990's
 - RESNA formation
 - Increased role for Rehabilitation Engineering in service delivery
- 2000s
 - Transition of service delivery role from design and fabrication to integration, customization, performance analysis and outcome measures
 - Continue design and fabrication role in research and development sector which includes manufacturing and research



Cooper, Ohnabe and Hobson (2007)



Clinical Rehabilitation Engineering - Today



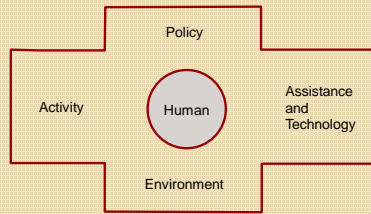
What makes the CRE Unique?

- Design and Fabrication
- Customization
- Technology Integration
- Performance Analysis
- Outcome Measures

Key to future success!



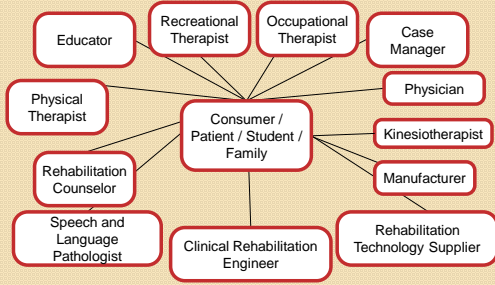
Conceptual model for CRE practice? PHAATE Model



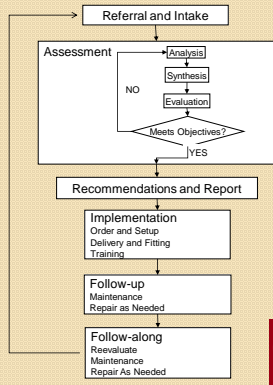
Cooper, Ohnabe, Hobson (2007)



Key to Success - Consumer Centered



AT Service Delivery Process: A Dynamic Process



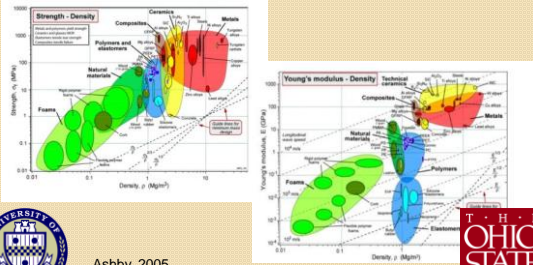
Adapted from Cook and Polgar (2008)



The Clinical Relevance of Rehabilitation Engineering



Strength and Modulus of Engineering Materials



Ashby, 2005
www.grantadesign.com/ashbycharts.htm



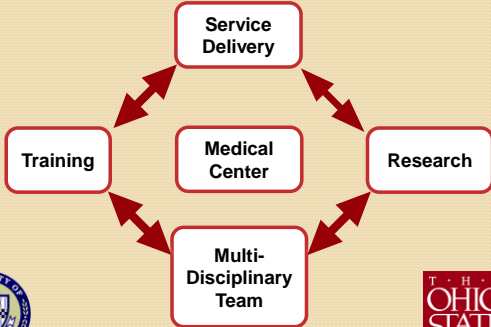
Significance



- Weight
- Strength
- Flex



Framework

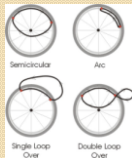


Case Example - Manual Wheelchair Propulsion Analysis

- Research Tool (Instrumentation)
- Clinical Tool (Rehabilitation Technology)
- Process (Clinical Practice Guidelines)



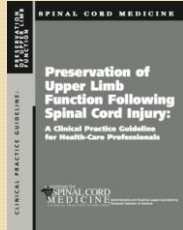
Clinical SmartWheel



Clinical Practice Guidelines and Evidence-based Practice

- Processes and Protocols
- Analysis Met
- Business Mo

Cowan et. al. 2008



www.dva.org 2005



Rehabilitation Engineering: Technology Integration Specialists Across the Continuum

- Personalized Health Care
- Technology Integration
 - Primary - Customization and Integration
 - Secondary - Design, Modification and Fabrication
- Evidence-Based Practice
 - Rehabilitation Technology
 - Performance Analysis
- AT Outcome Measurement
- Development, Transfer and Application
- Tele-Rehabilitation
- Community Integration



Rehabilitation Engineering in Practice



Case Study: Jim

- Traumatic Brain Injury
 - 22 year old male
 - 8 years post-injury
 - Power wheelchair user; types w/ right index finger
 - Difficulty with memory, reading
- Needs:
 - Keyboard, mouse alternatives
 - Alternatives to paper for reading, writing; assistance with cognitive task of reading
 - Assistance with keeping appointments, managing assignments

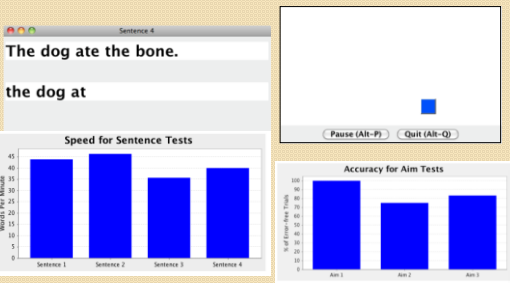
Keyboard: Exploring Alternatives



Mouse: Exploring Alternatives



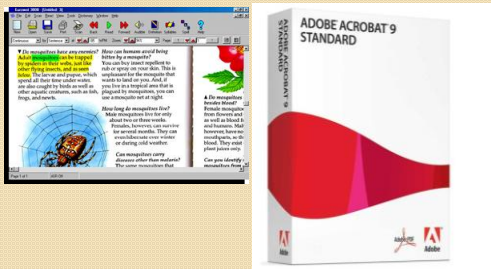
Computer Access: Evaluating Alternatives



Literacy & Paper Alternatives: Exploring Needs

- Burns & Roe Informal Reading Inventory
 - Compares reading comprehension when client reads silently, client reads aloud, and client listens to passage read aloud
 - Indicates potential for comprehension improvement with text-to-speech software

Literacy & Paper Alternatives: Evaluating Solutions



Literacy & Paper Alternatives: Evaluating Outcomes

- Nelson-Denny Reading Test
 - Compare speed and accuracy with and without text-to-speech

Memory: Matching Technology



Memory: Matching Technology



Case Study:

C4-C5 Level Spinal Cord Injury

Returning to Work as a Graphics
Designer

WINMINI KEYBOARD

WinMini Keyboard is a small keyboard measuring 2.25" x 4.5" x 1". It is available in QWERTY or Frequency of use layout. The keyboard surface is very sensitive with membrane keys that are less than .5" square and are closely spaced for easy access. Auditory feedback is provided when a key is pressed. The WinMini also has a Mouse Mode Key, which allows you to move the mouse in all directions and have access to right and left click, double click and drag functions. The keyboard's response rate, key repeat rate and mouse tracking speed are all adjustable.

WinMini\$ 749.00
Platform: PC
Connection: AT/PS2 and Serial
Layout: QWERTY or Frequency of Use
WinMini Keyboard\$ 65.00



WTVIK3

Peritek America's WTVIK3 comes with over 50 different keyboards, available in 22 languages. The keyboards can be customized to contain any keys you want, moved anywhere on the screen and re-sized. Included is word prediction, abbreviation expansion, spell selection and scanning. Scrolling lets you use a pointing device or a switch to select keys. It supports automatic, step or direct scanning.

WTVIK3\$ 350.00
Platform: WIN



Invisacors® Infrared Module with Mouse Emulation

Simplicity is the Key!

Infrared IR Control

- ✓ Windows
- ✓ MSN Messenger
- ✓ Power
- ✓ 1000+ Windows Applications
- ✓ Microsoft Office
- ✓ Internet Explorer

Infrared Module with Mouse Emulation

How to Operate

How to customize using software

How to Install





Sony Memory Stick® Digital Voice Recorder



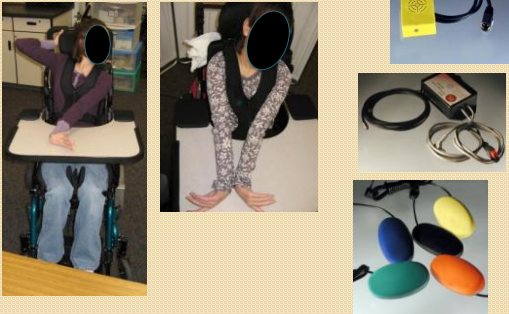
Dragon Dictate for Mac
Simply Smarter Speech Recognition



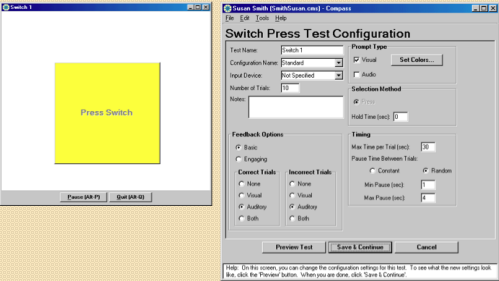
Case Study:Aurora

- History
 - High School Student
 - Cerebral Palsy: Cognitive and Physical Impairments
 - Uses Manual Wheelchair with Caregiver Propulsion
 - Difficulty with accessing computer/communication device/EADLs
- Needs:
 - Integrated method for accessing environment

Anatomical Site, Movement, Interface Control, Mounting



Evaluate: Switch Activation and Set-up



Performance Measurement

	Correct Trials	Avg Trial (s)	Avg. Press (s)	Avg. Release (s)
Head Right	5/5	8.5	7.8	0.64
Head Left	5/5	9.0	8.5	0.57
Head Right - Embedded	4/5	17.4	11.1	6.32
Right Hand	2/5	19.4	15.6	3.8
Right Finger	4/5	11.2	8.6	2.5

Implementation = Integration and Training

- Communication Device
- Computer Access
- Infrared Devices



Case Study: Linda

- History
 - Neurofibromatosis
 - Hemipelvectomy
 - Uses Manual Wheelchair and Power Wheelchair
 - Unable to sit for prolonged periods of time
- Needs:
 - Improved postural support
 - Increased comfort
 - Ability to utilize both power and manual wheelchair (AND not OR)

Analysis

- Photographs
- Pressure Mapping
- Propulsion Analysis
- Wheelchair Skills Program



Evaluate



Implementation and Integration



Implementation and Integration



Thank You.....



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