Design Challenges in Assistive Technology

Doug Schwandt

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Perspectives in Assistive Technology
Outline...

- Design Process
- Project Examples:
  - Handbike/Sunburst – arm-powered bikes
  - Inter-Limb Resistance – space exercise
  - Kine-Assist – robot assist for physical therapy
- Perspective
Design Process

- Need (create one if necessary; be passionate)
- State-of-the-Art (it may already exist)
- Conceptual Design (this is the fun phase)
- Select Preferred Concept (tools/intuition)
- Detail Design/Analysis (don’t give up!)
- Working Prototypes (make it work, sleep deprivation)
- Testing (does it really work?)
- Final Device (deliver something)
- Documentation (you’ll build on it; share the credit)
- Technology Transfer (get it out there!)
Handbike Arm-Powered Bicycle

Features

- Arm-Powered Bike for People with Lower Limb Disability
- Adjustable Side-Wheels up for Two-Wheeling and Fasten Down for Transfer
- Multiple Gears
- Folding Crank Tower for Easy Access
- Steer to Balance

Applications

- Recreation, Transportation, Competition, Exercise

Commercialization

- Recreational Mobility Inc. (1983-1984)
- Mobility Engineering, Inc. (1996 - present) www.mobilityeng.com

Principal Designer:
Doug Schwandt, MS

Bicycle Frame Builders/Designers:
Keith Bontrager
Gary Hale
Peter Johnson
Tim Paterek
Chris Schwandt

Other Significant Design Contributions:
Gordon Abraham, MS
Jim Anderson, JEM
Peter Axelson, MS
Phil Barkan, PhD
Irv Housinger
Larry Leifer, PhD
Candy Mintz, PhD
Fred Tatch
Features

- Arm/Foot-Powered Bike for Able-Bodied and Disabled to Share
- Separate Gearing for Recumbent Front Rider
- Upright Rider in Back Steers
- Not Only for Disabled Riders
- Easy to Communicate and See Ahead

Applications

- Recreation, Transportation, Competition, Exercise

Collaboration

- British Columbia Provincial Program for 1981 International Year of the Disabled Program thru Univ BC

Unrelated Commercialization

- CounterPoint Conveyance, Inc.
  - Jim Weaver
- Viewpoint Tandem
  - Bilenky’s Cycle Works Ltd. ViewPoint
Inter-Limb Resistance Exercise Device

NASA-VA Collaboration:
- Space Exercise (NASA)
- Rehab Exercise Potential (VA)

Investigators:
Scott Parazynski, MD (Astronaut)
Alan Hargens, PhD

Design/Fabrication:
Doug Schwandt, MS
Jim Anderson, JEM
Donna Hooker (JSC Contractor)
Maurice LeBlanc, MS CPO
Lin Liang, PhD
Russ Hays

NASA-VA Collaboration:
- Space Exercise (NASA)
- Rehab Exercise Potential (VA)

Tests On-Board NASA's KC-135 Parabolic Flight Microgravity Simulator

On-Board STS-66 space shuttle launch

Jim machines ILR flight hardware

Space Physiology Laboratory, NASA Ames Research Center
http://spacephysiology.arc.nasa.gov/
KineAssist™ -- Assistive Device for Physical Therapy

Features

- Assist clinicians in gait & balance training, in a functional context.
- Challenge clients to their maximum limits without increasing the risk of falls.
- Maintain consistency with current practice and infrastructure.
- Allow more therapy, by minimizing set up time.
- Will be used during transition, standing balance, ambulation and dynamic balance therapy.

www.chicagopt.com
Perspective

• Involve the client throughout the design process!
• Use the tools (SolidWorks, Skype, Internet, etc.).
• Review your notes and continue to learn.
• Work in a team – stay flexible - consult the experts.
• “Don’t bite off too much.”
• “Mt. Everest is climbed one step at a time.”
• “Never enough time to do it right – always enough time to do it over again.”
• “No quick and dirty – the quick is soon forgotten, and the dirty lives on and on.”
• Quotes mostly from Jim Anderson, Journeyman Experimental Machinist, champion rehab machinist.
Windsurfing Wheelchair
Jim Anderson, Dave Jaffe and Doug Schwandt with Ralph.