January 10, 2012

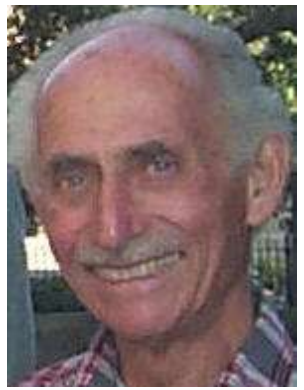
ENGR110/210
Perspectives in Assistive Technology

David L. Jaffe, MS

Professor Drew Nelson

John Thiemer

Any questions so far?



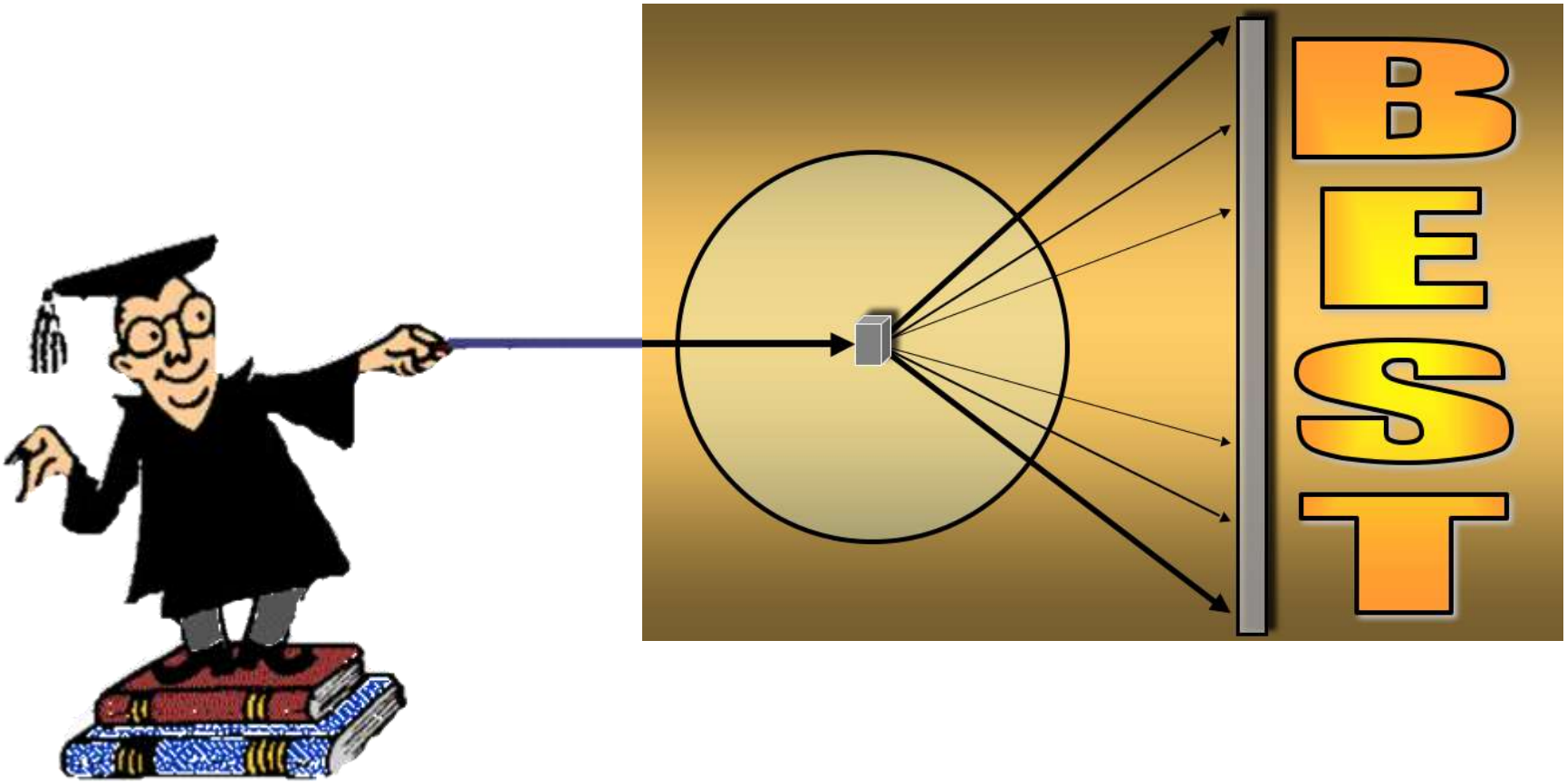
Homage to Prof Kane

Twelve Reasons to Enroll in *Perspectives in Assistive Technology*


Twelve Reasons to Enroll in *Perspectives in Assistive Technology*

12

It is the best course I teach

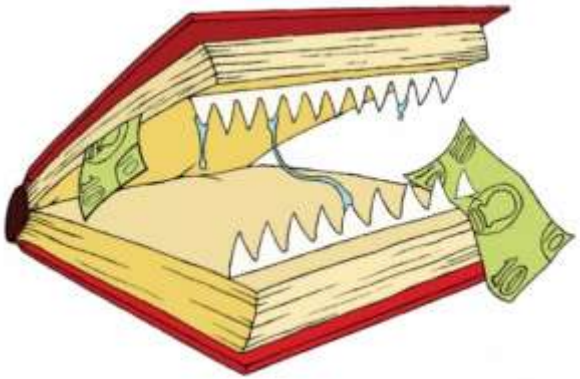


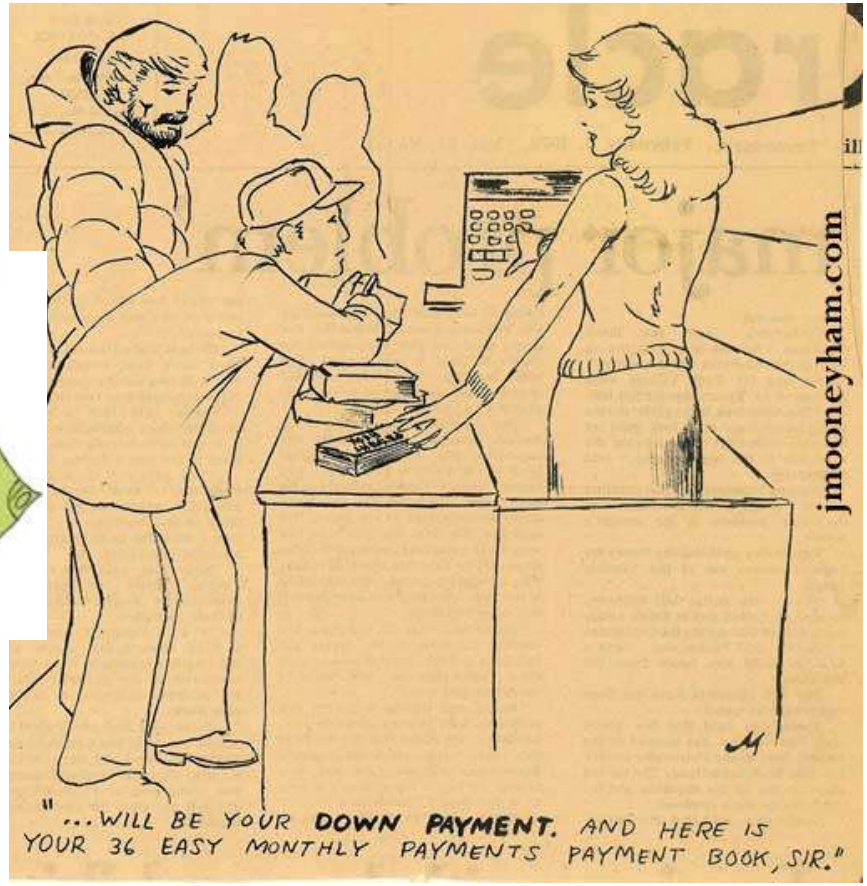
11

It is the best assistive technology course at Stanford

10

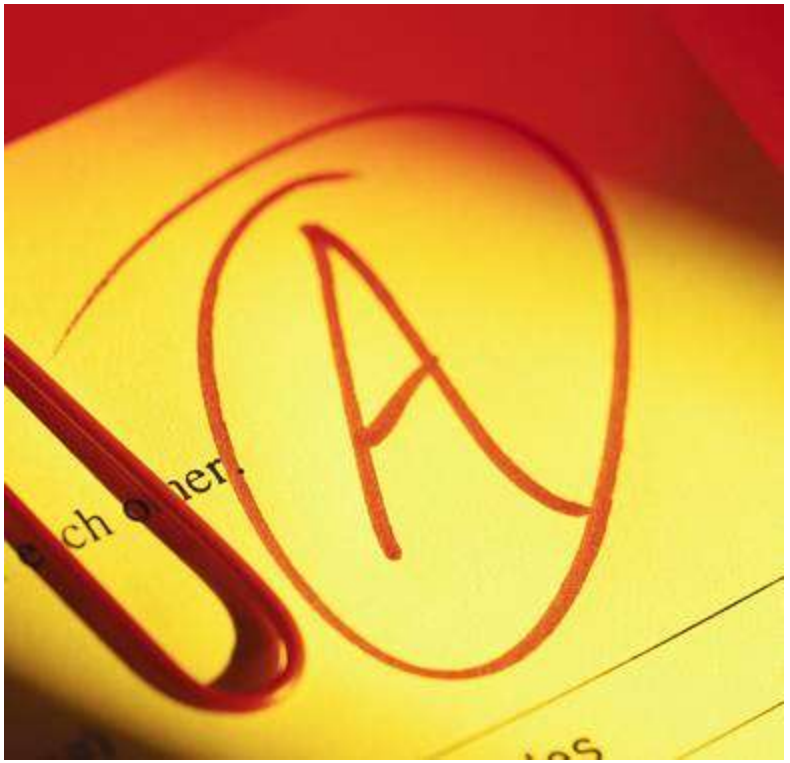
You don’t want to pay $200 for a textbook





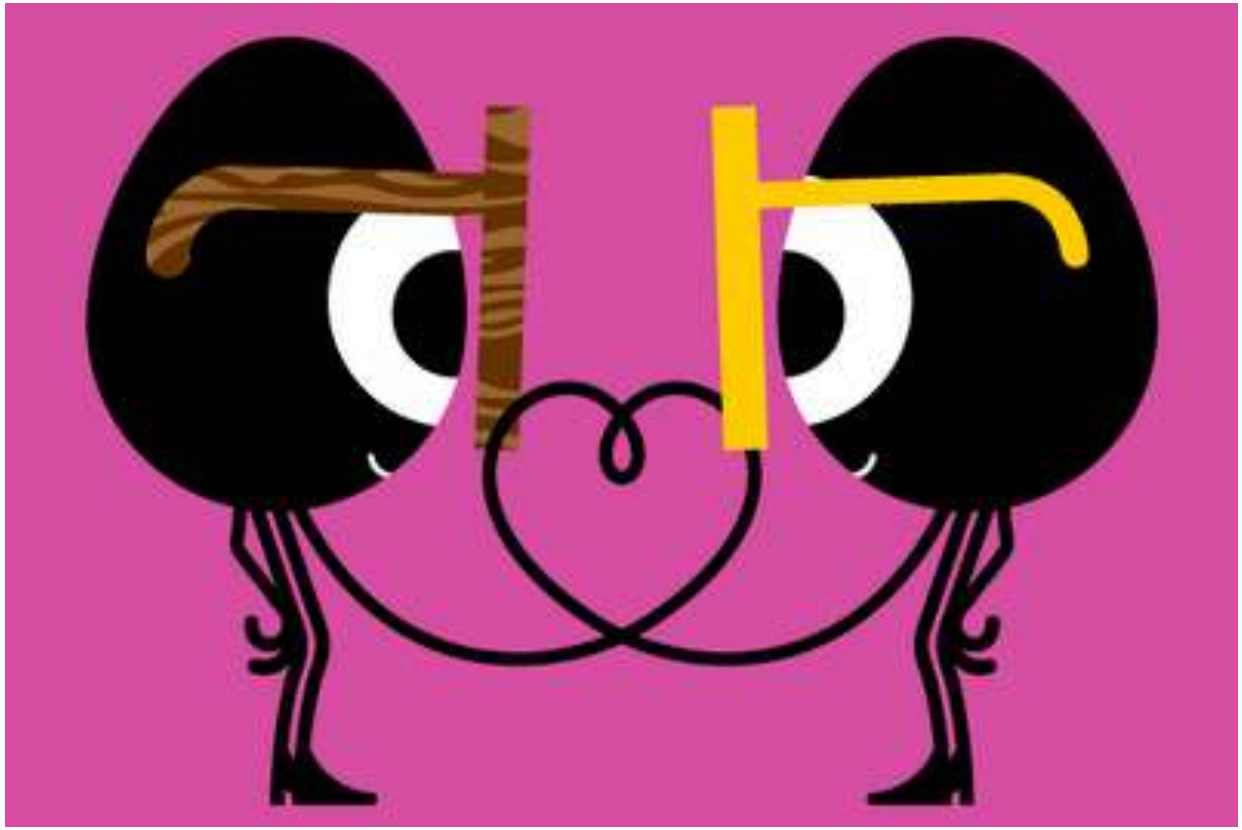
9

Everyone who has taken the course has earned a very good grade



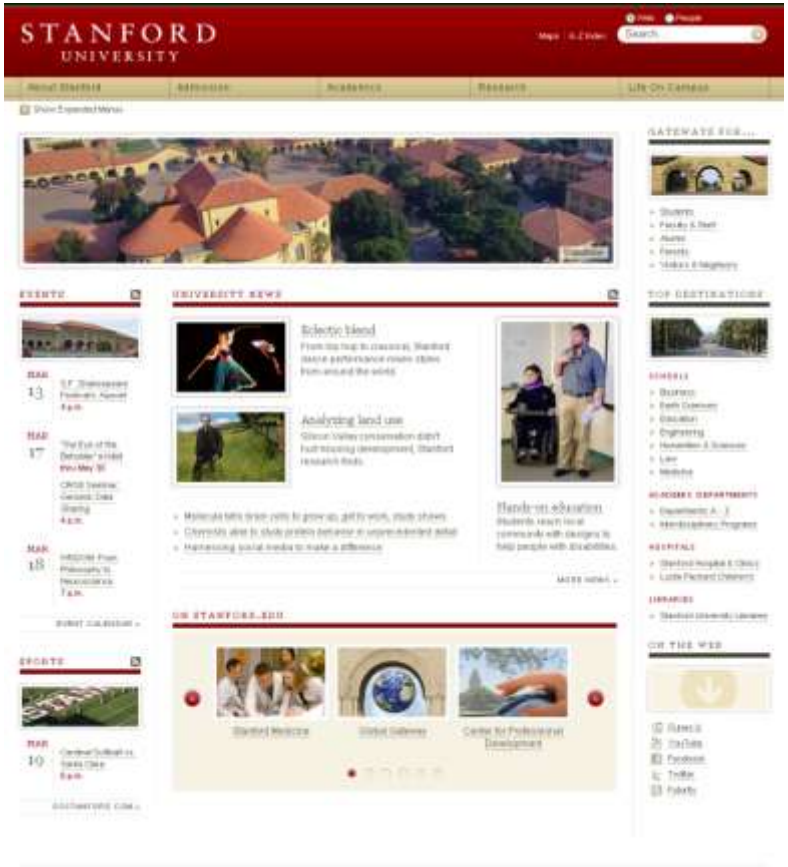
8

To meet your love connection

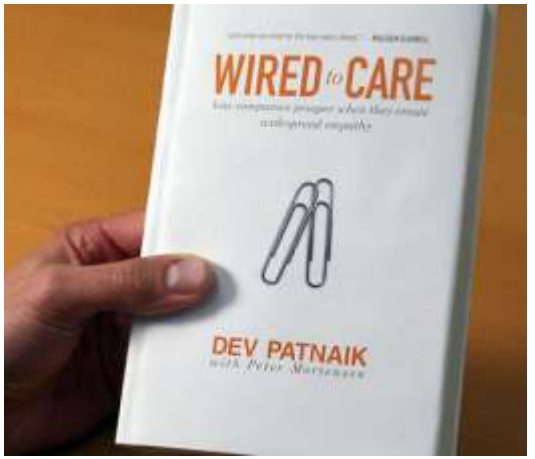


7

The fame and notoriety



6



You are compelled to do it:

Top motivational factors for engineering students are behavioral, psychological, social good, and financial. Center for the Advancement of Engineering Education

Service Learning

Local Community

Factors recent graduates rate most important in choosing their first job

1. Opportunity for advancement
2. **Opportunity to benefit society**
3. Salary
4. Hours required
5. Travel time to/from work
6. Health benefits
7. Vacation time
8. Bonuses
9. 401(k) matching
10. Relocation opportunity
11. Tuition reimbursement
12. Pension plan
13. Stock options

class

Factors that influence your job satisfaction most

1. The challenges that accompany the design of new products
2. Researching potential design solutions
3. **Opportunity to design products that can benefit society**
4. The compensation you receive for the work you do
5. The recognition you get from others for the work you do
6. Working in team situations with peers
7. The pleasures (and pressures) associated with solving design problems
8. Working independently of others

Faces of the Engineering Lifecycle - link
From: Electronic Design - 10/20/2011 - page 28 - 45
By: Jay McSherry

The biggest innovations of our time will likely be those that help address humanity's needs, rather than those that simply create the most profit. Good ideas come from doing things differently, exploring new territory, and taking risks.

Six Amazing Science Projects that are Changing the World - link
From: ThomasNet News - 09/27/2011
By: David R. Butcher

5

You want to know if your Stanford education and skills can benefit others

4

The job opportunities

3

You have heard good things about the course

2

You want to take something completely different

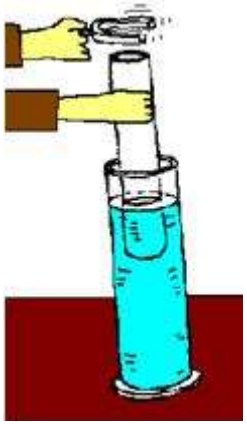
And the **Number One** Reason to enroll in *Perspectives in Assistive Technology*

1

You want to get a head start on ME113

Twelve Reasons to Enroll in *Perspectives in Assistive Technology*

12. It is the best course I teach
11. It is the best assistive technology course at Stanford
10. You don't want to pay $200 for a textbook
9. Everyone who has taken the course earned a very good grade
8. To meet your love connection
7. The fame and notoriety
6. You are compelled to do it
5. You want to know if your Stanford education and skills can benefit others
4. The job opportunities
3. You have heard good things about the course
2. You want to take something completely different
1. You want to get a head start on ME113



Call Me “Dave”

“Professor” from Gilligan’s Island

Dr. Zorba from Ben Casey

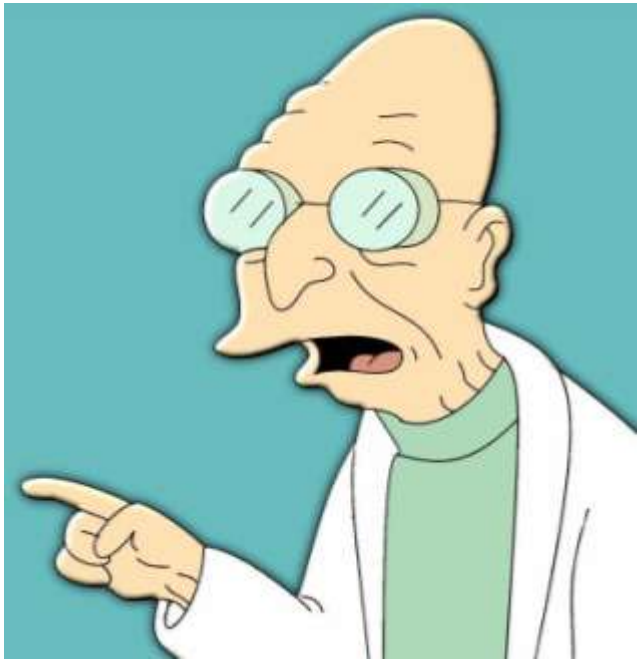
Mr. Jaffe, my father

I am not a professor and I don’t have a PhD or MD

David L. Jaffe, MS

Not a Professor

Professor Frink
Simpsons



Professor Farnsworth
Futurama

Course Organizer & Instructor

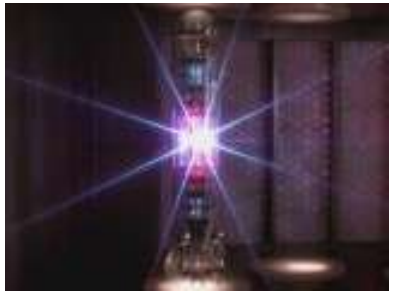
Today's Agenda

- Welcome to the Course
- Course Outline
- Introduction to Assistive Technology
- Student Project Preview
  - Prior Years' Student Projects
  - Project Suggestions for this Quarter

to the Class

- Welcome students and community
- Senior Faculty: Professor Drew Nelson
- Student Peer Liaison: John Thiemer
- Administrative items
  - Time conflicts
  - Sign-up form
  - Sign in
    - Students - attendance
    - Community members - signup

Who are these people and why are they smiling?



Class Genesis

- How this course came about
- Why it is being offered

Course Goals 1/2

- Expose students to the engineering, medical, and social issues facing engineers, researchers, entrepreneurs, clinicians, seniors, and individuals with disabilities in the design, development, and use of assistive technology

- Engage students in a team-based project experience that exercises team working skills and applies an engineering design process to tackle difficulties experienced by individuals with disabilities and seniors

- Provide an opportunity for students to interact with users of assistive technology in the local community along with health care professionals, coaches, and project partners

Course Goals 2/2

- Enhance students' communication skills, with specific emphasis on in-class discussions, report writing, and presentations

- Encourage students to use their engineering skills and design expertise to help individuals with disabilities and seniors increase their independence and improve their quality of life

- Provide information to the greater Stanford community

What this Course <u>isn't</u>

- Not about starting a company
- Not about commercializing a device or product
- Not about business or manufacturing
- Projects not with big companies or in other countries
- No finals, exams, or quizzes
- No books to buy or required reading
- No problem sets
- No boring lectures

"Not that there is anything wrong with that"

What this Course <u>is</u>

- Technology and people
- Assistive Technology in its many forms
- Engineering design-development process:
  - Problem identification
  - Brainstorming
  - Prototyping
  - Testing
  - Communicating
- Working with a team
- Partnering with local community

Course Credentials

- Certified Service Learning Course
- Approved course for ME undergraduate degree
  (*Handbook for Undergraduate Engineering Programs 2010-2011, page 308, note 7*)
- Can be approved as an elective for the MS degree in ME by a faculty advisor
- Approved for the Program in Science, Technology & Society (STS) - included on the BS Major STS Core list in Social Scientific Perspectives area of the Disciplinary Analyses section (3 credit option)
- Listed as one of two "**Save the World**" Winter Quarter courses on *The Unofficial Stanford Blog*

STANFORD ENGINEERING

« Pasadena-Bound? A Government We Deserve? The Meaning of Tuesday's Elections »

TUSB 2011 Winter Course Guide: spice up your courseload!

Posted by Kristi at November 3, 2010 1:10AM

Stanford: land of sunshine-y studying all year round

It's that time of year again! Not sure what winter classes to take? No worries; check out TUSB's course primer. Whether you're looking to satisfy a GER, find profound inspiration, or just take a fun class for **kicks**, we've got you covered.

If there's anything we missed, don't hesitate to mention it in the comments – we appreciate your feedback. Additionally, you can check out past years' course guides **here**. **Enjoy**!

Save the World: cool classes that give you Haas Center credit

- **EESS 105**: **Food and Community for a Sustainable Future** – from garden development to food dispersal to the needy
- **ENGR 110**: **Perspectives in Assistive Technology** – team-based projects for the disabled

Welcome to the Farm

Burst the Bubble: field trip-based

search

Search

The Unofficial Stanford Blog

Like 730

announcements:

The Procrastination Nation photo contest is over! Watch for the post with the winning entries.

popular this week

» Big Game Tickets Available
» A time to be thankful...
» Overheard at Stanford...

a word from our sponsors

recent comments

» C.J. on This Week in Stanford 11/7/10-11/13/10

Course Structure

- A twice-weekly lectures exploring perspectives in the design and use of assistive technology by engineers, designers, entrepreneurs, clinicians, and persons with disabilities – and three facility tours

- Opportunities for thought and discussion
- An experience that includes problem identification, need-finding, brainstorming, design, fabrication, testing, and reporting - benefitting individuals in the local community

Student Experience

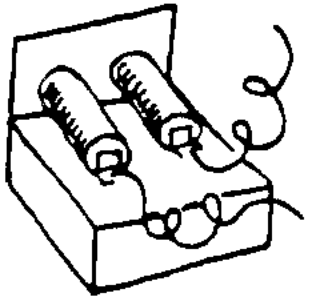
- Gain an appreciation for the social, medical, and technical challenges in developing assistive technologies

- Learn about assistive technology concepts, design strategies, ethical issues, and intellectual property rights

For those working on a project:

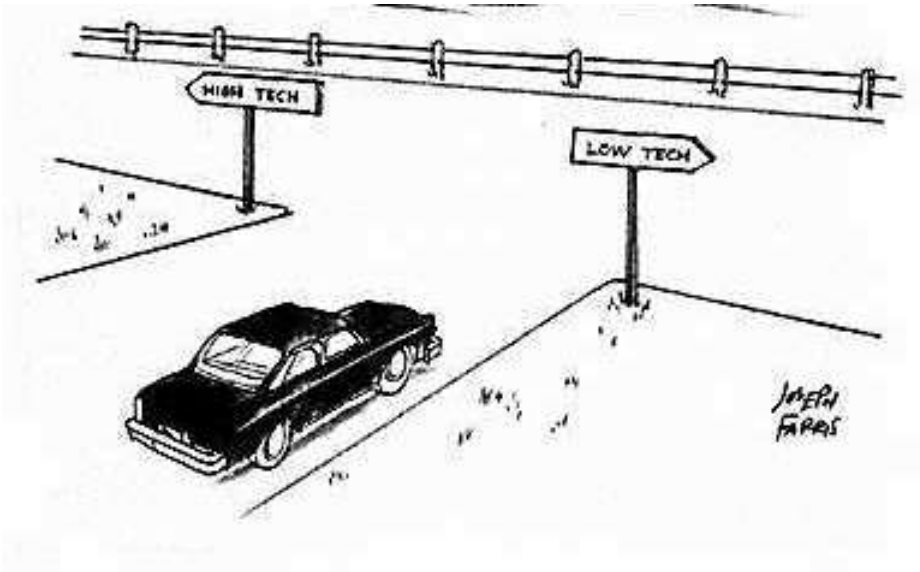
- Engage in a comprehensive design experience that includes working with real users of assistive technology to identify problems, prototype solutions, perform device testing, practice iterative design, and communicate results

- Employ engineering and design skills to help people with disabilities increase their independence and improve their quality of life



Projects

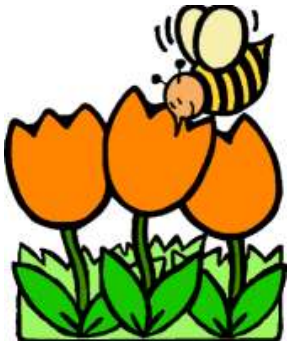
- Need not be impressive
- Low tech is ok
- Experiencing the design process and getting it to work are priorities



Credit Options

1-unit options:

- **No letter grade (Pass/NC)**
  - attend **at least 10** ENGR110/210 lectures (including this one)
  - no participation in a project
- **Letter grade**
  - attend **at least 10** ENGR110/210 lectures (including this one)
  - individual project: interview an individual with disabilities and
    - research an assistive technology topic,
    - paper design of an assistive technology device, or
    - create of a work of art

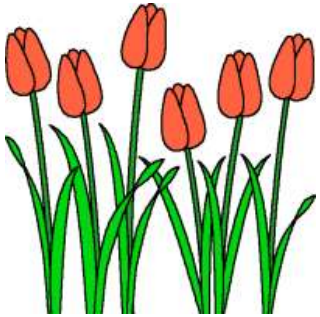


Credit Options

3-unit options:

- attend ENGR110/210 lectures, participate in a team project, continue with ME113 (with your entire team) or CS194 in the Spring Quarter
- attend ENGR110/210 lectures, participate in a team project, continue with independent study credit in the Spring Quarter
- attend ENGR110/210 lectures, participate in a team project, no project continuation in the Spring Quarter

- Your team can be excused from no more than two lectures to work on your project



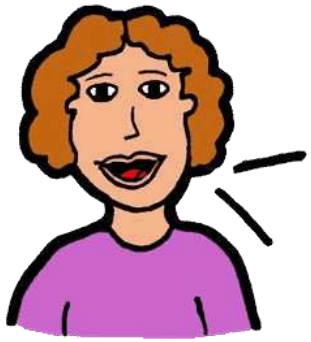
Project Activities

For those working on a **team** project:

- Review project suggestion offerings
- Select a project
- Form a team
- Investigate project needs with an individual with a disability
- Evaluate the needs to further define the problem
- Gather relevant background information for the project, including any prior design approaches and commercial products
- Brainstorm, evaluate, and choose a design concept
- Prototype, fabricate, test, and assess the design
- Present team's design - giving background, criteria, initial concepts from brainstorming, selected design candidate, and any prototyping, fabrication, and testing
- Submit mid-term and final reports and reflect on experience

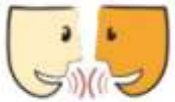
For those working on a **team** project:

- Submit and present team **Mid-term Report**
- Communicate team's project progress
- Submit and present team **Final Report**
- Reflect individually on your personal project experience



For those working on an **individual** project:

- Meet with Dave to agree on project
- Communicate your project progress



- Submit and present **Individual Final Report**
- Reflect on your personal project experience

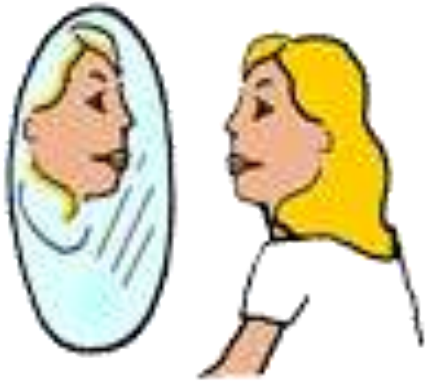
Grading

For those working on a **team** project:

- Mid-term Report & Presentation 30%
- Final Report 30%
- Final Presentation 30%
- Individual Reflection 10%
- Participation 10%

Participation includes actively listening, posing questions to speakers, engaging in class discussions, verbalizing thoughts & analyses, and communicating project progress.

Grading



For those working on an **individual** project:

- Progress Reports 30%
- Report 30%
- Presentation 30%
- Individual Reflection 10%
- Participation 10%

Participation includes actively listening, posing questions to speakers, engaging in class discussions, verbalizing thoughts & analyses, and communicating project progress.

Spring Quarter Activities in ME113 or CS194

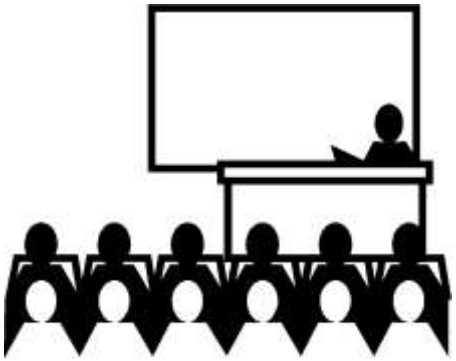
- Continue brainstorming additional design approaches
- Evaluate the approaches and select one to pursue
- Prepare an updated design proposal
- Perform detailed design and analysis
- Prepare a midway report
- Build a first cut prototype to demonstrate design feasibility
- Test the prototype and get feedback from users
- Redesign as necessary
- Construct a second, improved prototype
- Pursue re-testing and get feedback
- Prepare a final report documenting the results of a project and suggesting steps to further develop the design

Discussion Topics

- Who is Disabled?
- Failure
- Antique technology
- New technology
- Is this funny?
- Words & labels

- Are you old?
- Fun with ethics
- Video theater
- What teams are you on?
- Secret of the universe
- In the news

Guest Lecturers

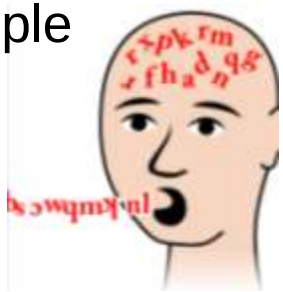


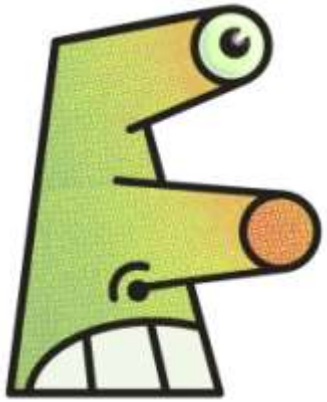
Lecture Titles 1 of 2

- Course Overview & Introduction to Assistive Technology
- Team Formation & Project Pitches
- Design Thinking and Innovation for Assistive Technologies
- The Transdisciplinary Team: Bridging the Gap between Consumers and Products in Rehabilitation Medicine
- Design Challenges in Assistive Technology
- Rehabilitation Robotics
- Assistive Technology in Patient Care: Anti-Gravity Treadmill in Rehabilitation and Training
- Perspective of Stanford Students with a Disability
- Service Learning - Engaged Scholarship

Lecture Titles 2 of 2

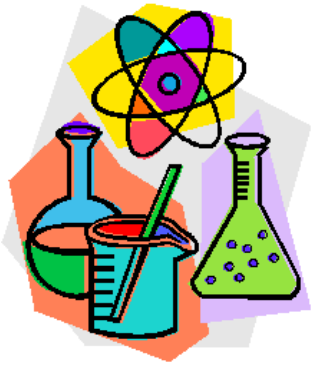
- Tour of Willow Garage (Menlo Park)
- Designing Inclusive User Experiences
- Designing Beyond the Norm to Meet the Needs of All People
- Teri Adams' Lecture – Title Forthcoming
- Tour of Motion & Gait Analysis Lab (Menlo Park)
- Practical and Appropriate Technology Solutions
- What Kind of Assistive Technology Do You Need if You Break your Neck? & Assistive Technologies: The Benefits for Returnees – Tour of Palo Alto VA Spinal Cord Injury
- Wheelchair Fabrication in Developing Countries



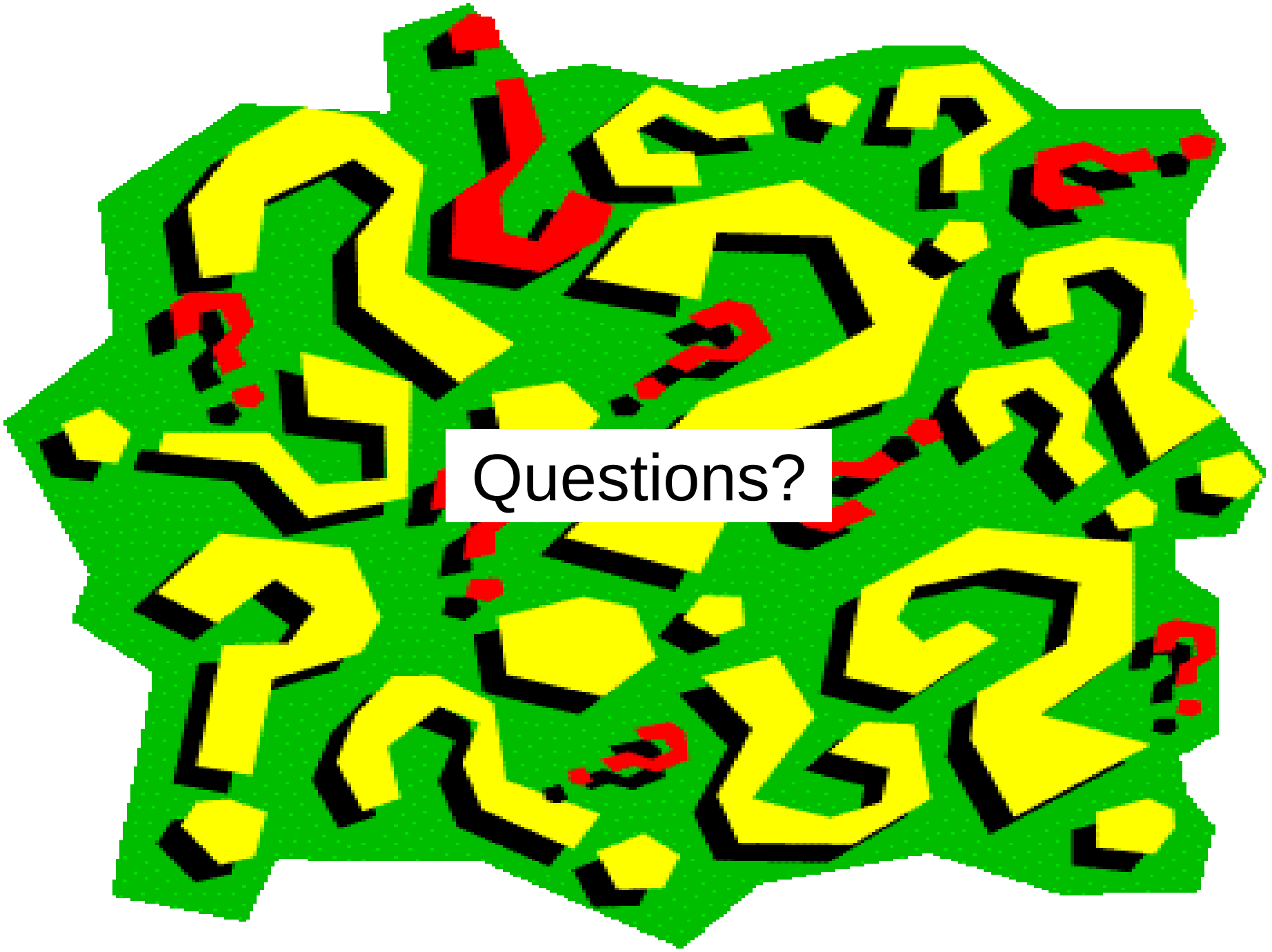


Technology Tidbits

- New products
- Research and development
- Interesting articles



Tell Your Friends


Questions?

Short Break

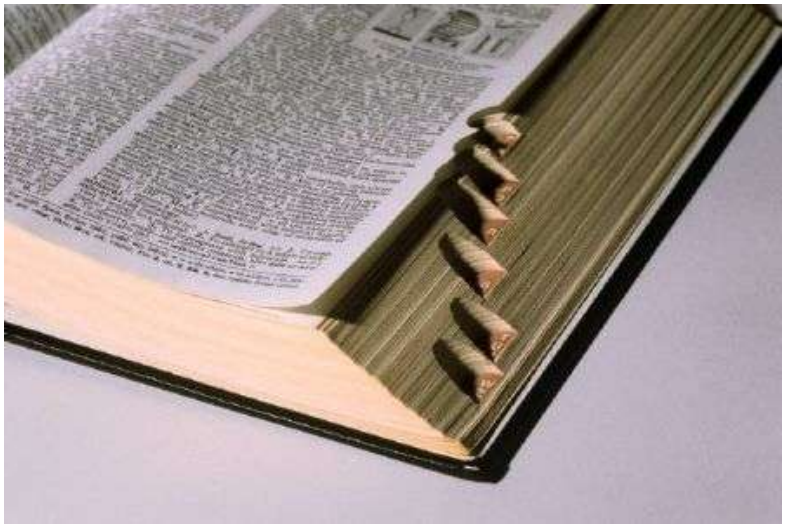
Introduction to Assistive Technology

- Definitions
- Broad overview
- What is a disability?
- Range of disabilities

- People involved - demographics and numbers
- Goal of rehabilitation
- Needs of people with disabilities
- Perception of people with disabilities

- Examples of assistive technology products and devices
- Phraseology, semantics, and social correctness

Definitions



- Disability
- Assistive Technology
- Rehabilitation
- Rehabilitation Engineering

Disability

Work-Based Definition

Persons with a disability are those who have a "health problem or condition which prevents them from working or which limits the kind or amount of work they can do".

Current Population Survey

Cornell University Disability Statistics

Disability

Anatomically-Based Definition

The Department of Veterans Affairs uses a <u>percent disabled</u> definition partially based upon loss of use of limbs, etc that “interferes with normal life functions”.

Disability

Activity-Based Definition

- Disability is defined in terms of limitations in a person's activities due to a health condition or impairment.

- Activities is a broad enough term to include working, doing housework, taking care of personal and household needs, and other age-appropriate activities. - National Health Interview Survey

- UCSF Disability Statistics Center

Disability

Opportunity-Based Definition

Disability is defined as a health condition or impairment that prevents an individual from taking full advantage of life's opportunities such as education, vocation, recreation, and activities of daily living

Disability in the US

- 71.4 million citizens have activity limitations, ~ 23% of 308 million
  - Reports cite 32 to 78 million (100 - 650 million worldwide)
- 24.1 million individuals have a severe disability
- 11 million children have a disability
- 25% of health care costs relate to disability
- Disability is the largest minority group
- 15 million are 65 or older (7 million more by 2015)
- 10 million people with vision impairments
  - 1.3 million are legally blind (37 million blind globally)
- 24 million people with hearing impairments
  - 2 million are deaf
- 1 million wheelchair users
- 6 million people have developmental disabilities
- Less than 5% are born with their disability

Disability in the US

- Disability rates vary by age, sex, race, ethnicity, state of residence, and economic status

- Disabilities result in a reduced chance for employment

- Disability is associated with differences in income

- As the nation ages, the number of people experiencing limitations will certainly increase.

Disability Types

Which disabilities are most obvious?

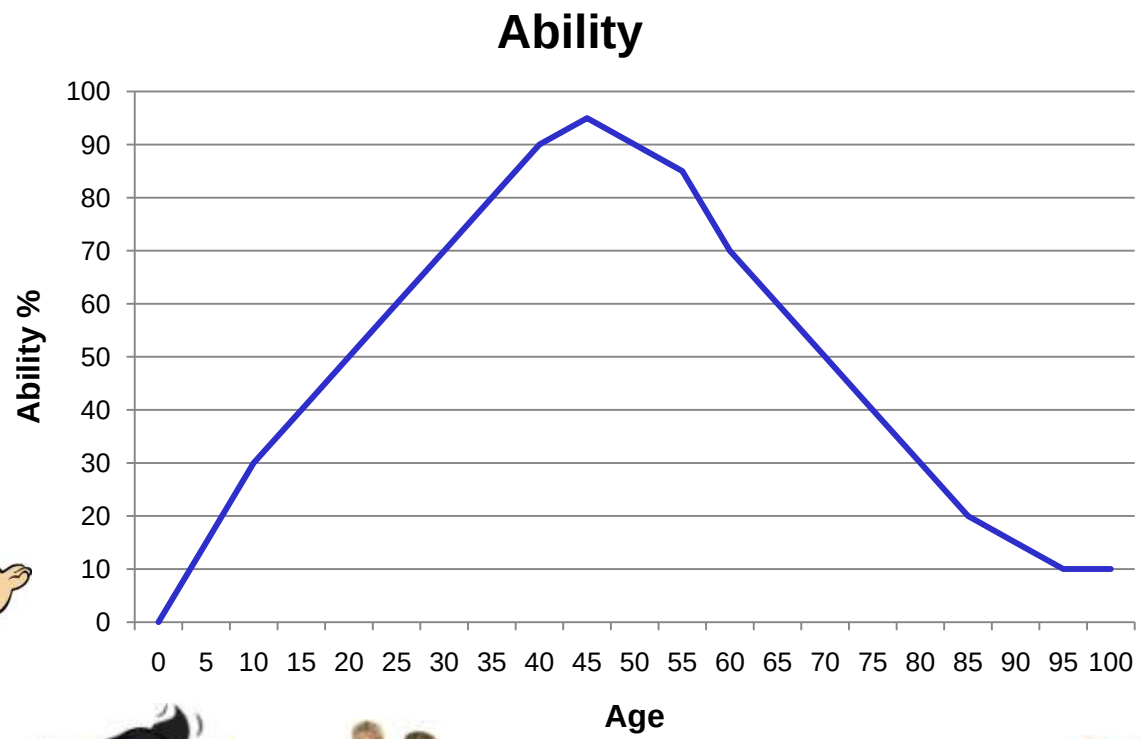
- Congenital / Acquired
- Physical
  - Sensory
  - Functional
- Psychological / neurological

There is a group of individuals who are so impaired that they spend 12 to 25 years in institutions before they can contribute significantly to society

There is a group of individuals who are so impaired that they spend 12 to 25 years in institutions before they can contribute significantly to society

Students!

A Disability View of Life



Life events:

- Birth
- Walking
- Talking
- Bowel control
- Writing
- Dressing
- Balancing
- Coordination
- **Education**
- Driving
- **Financial**
- Marriage
- Children
- Job
- **Physical**
- Benefit society
- Legacy
- Retirement

Needs / Desires of People with Disabilities

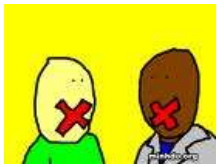
- Regain wellness & function
- Perform tasks independently
- Improve quality of life
- Take full advantage of all opportunities
  - Educational
  - Vocational
  - Recreational
  - Activities of daily living
- Pursue happiness
- Integrate into society

Perceptions of Disabilities

- In the US:
  - A diminishing stigma
  - Mainstreaming
  - ADA
- In other countries:
  - Taken care of, but often hidden away
  - Pursuit of a technology solution is a priority

Social and Political Correctness

- Put the person rather than the condition first:
  - Individuals or people with a disability



- Focus on capabilities rather than disabilities
  - Wheelchair user

- Refer to the person rather than the disability group – be inclusive
  - **<u>NOT</u>**: The Blind, the Disabled, the Deaf
  - (More about this later)

Exclusive

The People

The Disabled

Inclusive

People

People with disabilities

People First

People-first language aims to avoid perceived and subconscious dehumanization when discussing people with disabilities, as such forming an aspect of disability etiquette.

The basic idea is to impose a sentence structure that names the person first and the condition second, ie "people with disabilities" rather than "disabled people", in order to emphasize that "they are people first". Because English syntax normally places adjectives before nouns, it becomes necessary to insert relative clauses, replacing, eg, "asthmatic person" with "a person who has asthma."

The speaker is thus expected to internalize the idea of a disability as a secondary attribute, not a characteristic of a person's identity. Critics of this rationale point out that the unnatural sentence structure draws even more attention to the disability than using unmarked English syntax, producing an additional "focus on disability in an ungainly new way“.

Wikipedia

Animal First

Three blind mice, three blind mice,
See how they run, see how they run,
They all ran after the farmer's wife,
Who cut off their tails with a carving knife,
Did you ever see such a thing in your life,
As three blind mice?

Three Blind Mice

Animal First

A trio of visually impaired rodent-Americans

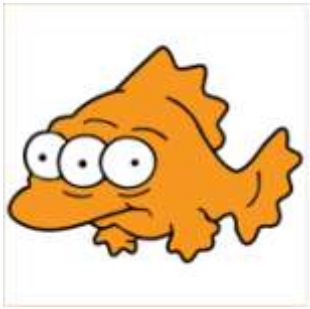
Social and Political Correctness

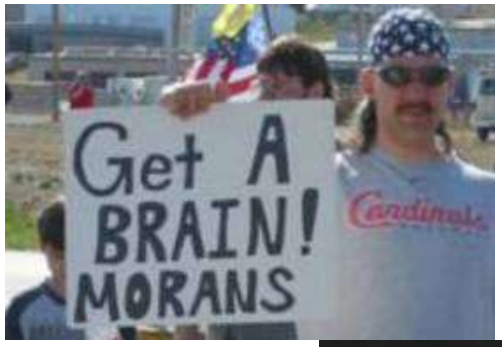
- Shorthand terms:
  - Para, Quad
- Derogatory terms:
  - Gimp, Crip, Spaz, Retard

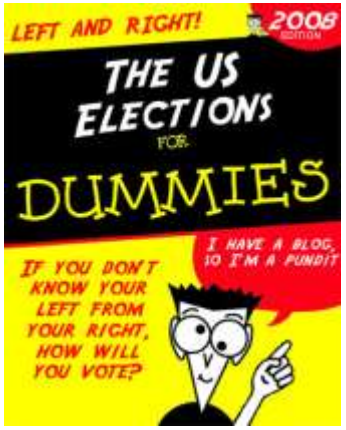
- Use of terms:
  - “Patient”, “User”, “Subject”, “Consumer”
  - “Suffering from”, “Afflicted with”, “Confined to”, “Victim of”
  - “Diagnosed with”, “Living with”, “Survivor of”, “Recovering from”

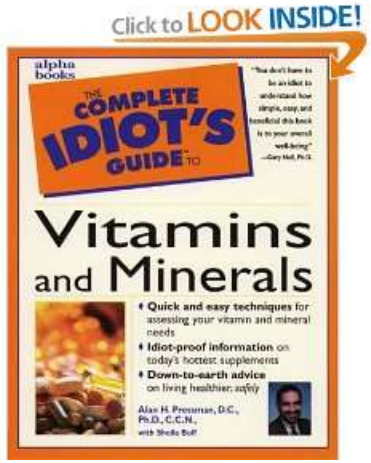
Medical & Common Use

- Crippled, Retarded, Deaf & Dumb, Lame
- Mute, Moron, Imbecile, Idiot, Spastic
- Persistent vegetative state









Portrayal of People with Disabilities

Robert Van Etten

- Dwarf
- Midget
- Shorty
- Little person
- Munchkin
- Elf
- Height challenged
- Scooter-guy

Bob

Yell if you are paying attention

Blue Man Group

Assistive Technology

- Assistive Technology (AT) is a generic term that includes both:
  - devices that benefit people with disabilities and
  - the process that makes these devices available to people with disabilities.

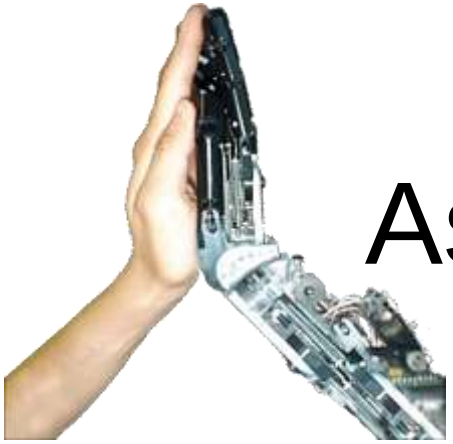
- An AT device is one that has a diagnostic, functional, adaptive, or rehabilitative benefit.

- Engineers employ an AT process to specify, design, develop, test, and bring to market new devices.

Assistive Technology

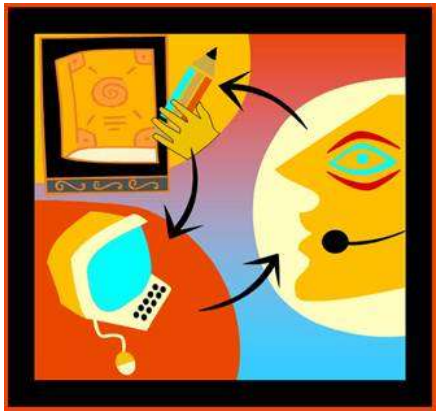
Health care professionals (not just engineers) are involved in evaluating the need for AT devices; working on research, design, and development teams; prescribing, fitting, and supplying them; and assessing their benefit.

- Physicians
- Clinicians
- Therapists
- Suppliers
- Policy makers
- Educators



Assistive Technology

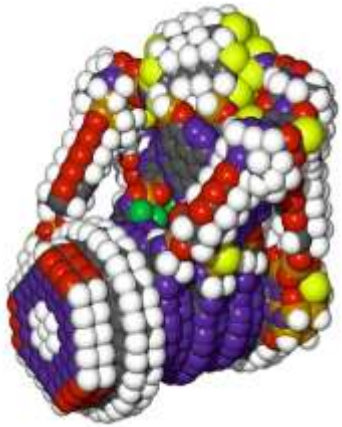
AT devices provide greater independence, increased opportunities for participation, and an improved quality of life for people with disabilities by enabling them to perform tasks that they were formerly unable to accomplish (or had great difficulty accomplishing, or required assistance) through enhanced or alternate methods of interacting with the world around them.

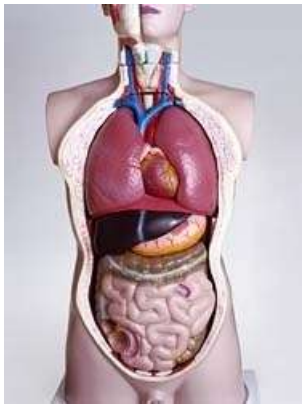


Assistive Technology

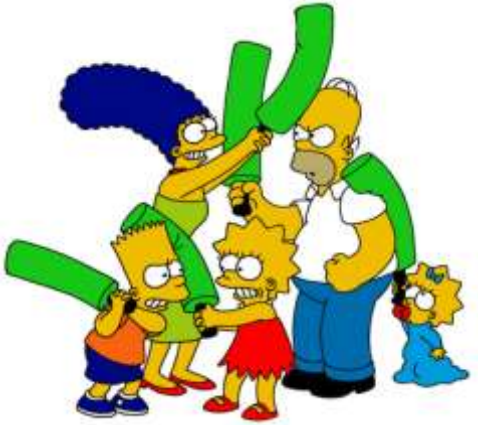
New AT devices incorporating novel designs and emerging technologies have the potential to further improve the lives of people with disabilities.

- Computers
- Robotics & mechatronics
- Nanotechnology
- Medical technologies





Rehabilitation



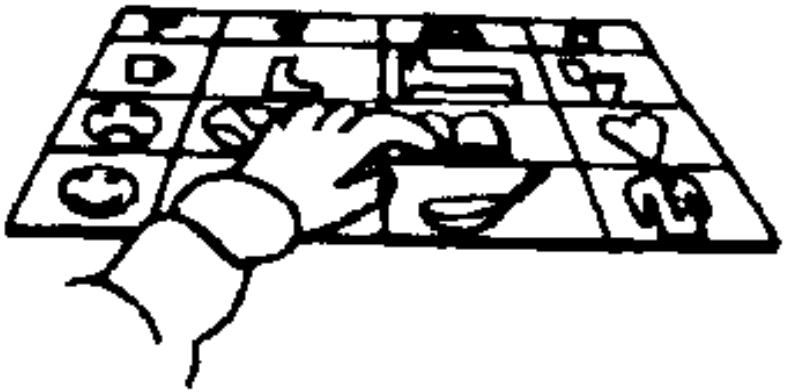
- **Medical model**: Restoration of function caused by disability – through surgery, medication, therapy, and/or retraining

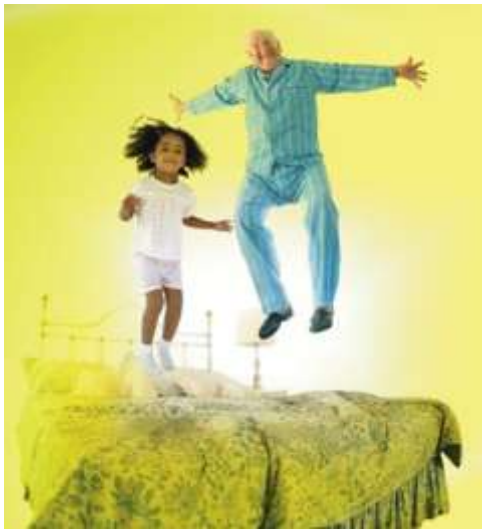
- **More inclusive model**: Includes Assistive Technology

Goals

- Goal of Rehabilitation
  - Restore function

- Goals of Assistive Technology
  - Increase independence
  - Improve quality of life





Rehabilitation Engineering

Rehab Engineers assist people who have a functional impairment by engaging in one or more of these activities:

- Device Design
- Research & Development
- Technology Transfer
- Marketing
- Provision
- Education & Training

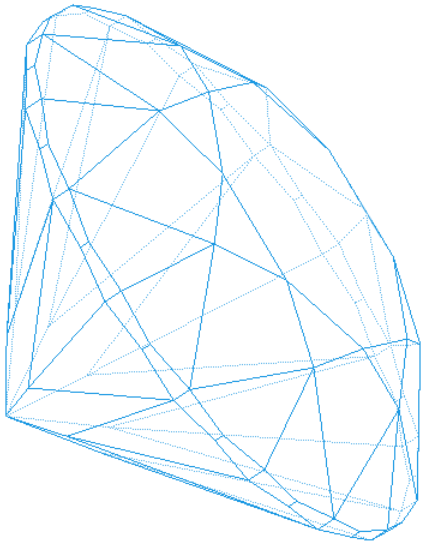
Rehabilitation Technology

The term "rehabilitation technology" refers to the systematic application of technologies, engineering methodologies, or scientific principles to meet the needs of and address the barriers confronted by individuals with disabilities in areas which include education, rehabilitation, employment, transportation, independent living, and recreation. The term includes rehabilitation engineering, assistive technology devices, and assistive technology services.

Rehab Act

Facets of Rehabilitation Engineering

- Personal Transportation (vehicles and assistive driving)
- Augmentative & Alternative Communication
- Dysphagia: Eating, Swallowing, Saliva Control
- Quantitative Assessment
- Technology Transfer
- Sensory Loss & Technology
- Wheeled Mobility & Seating
- Electrical Stimulation
- Computer Applications
- Rural Rehabilitation
- Assistive Robotics & Mechatronics
- Job Accommodation
- Gerontology - Technology for Successful Aging
- International Appropriate Technology
- Universal Access



RESNA SIGs

Assistive Technology Market

- Many people with a disability – in US and world-wide
- Every consumer has unique needs and desires
- Largest homogeneous group in the US is wheelchair users
- **Lack of a well-defined mass market means that companies serving individuals with disabilities are small and their products are expensive**

Example Assistive Technology Devices

- Projects I worked on at the VA RR&D Center
- Commercial devices and research projects
- Technologies that have made an impact

Head Control Interface

- Features
  - –2 degrees of freedom
  - –real-time operation
  - –non-contact interface
  - –front or rear sensing
  - –mouse or joystick substitute
- Applications
  - –control of mobility (electric wheelchair) contrast with voice control alternative
  - –control of cursor position with hands on keyboard
  - –demonstrated robot control

Head Control Interface Video

YouTube link

Ralph Fingerspelling Hand

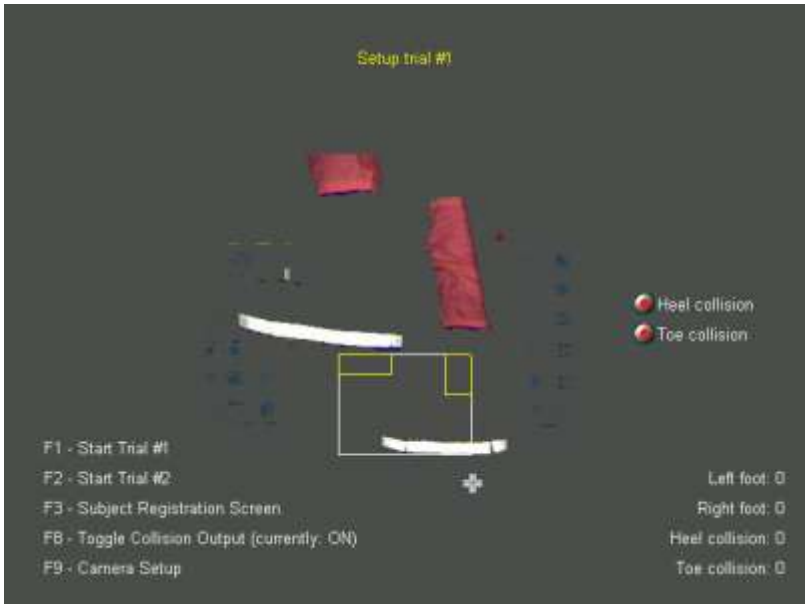
- **Ralph** offers individuals who are deaf-blind improved access to computers and communication devices in addition to person-to-person conversations.
- Enhancements of this design include better intelligibility, smaller size, and the ability to optimize hand positions.

Ralph Video

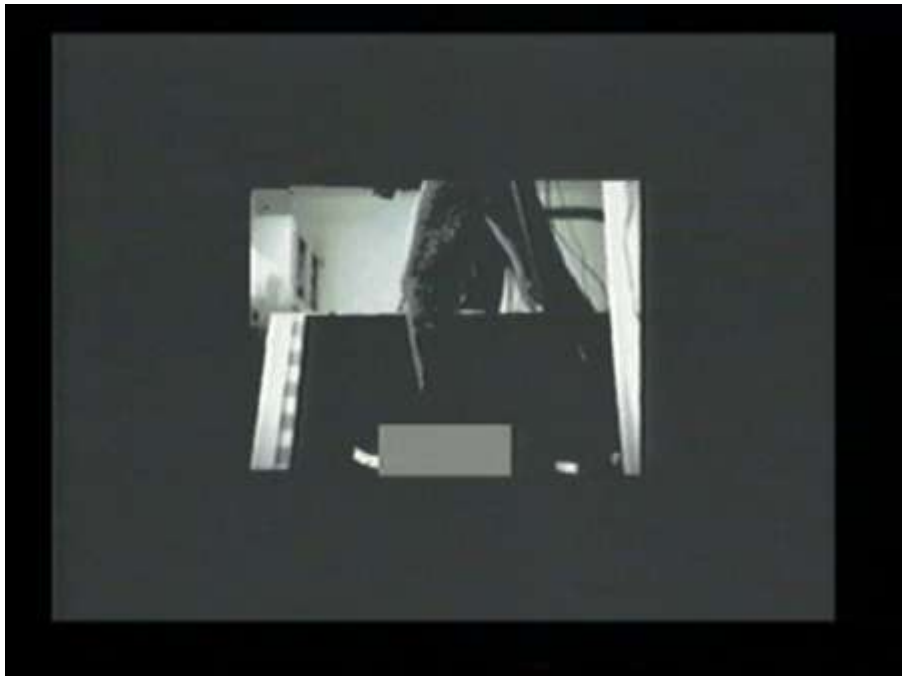
YouTube link

Virtual Reality

- Features
  - –treadmill-based training aid
  - –step over virtual obstacles
  - –harness prevents falling
  - –computer senses “collisions”
- Applications
  - –safe training aid for clinic
  - –range of motion, coordination, balance



Virtual Reality Video



YouTube link

Driving Simulator

- The goal of this project was to evaluate the potential of a high quality computer-based driving simulator to accurately assess and improve the driving ability of veterans with Stroke and Traumatic Brain Injury (TBI).
- Create realistic driving scenarios to address specific cognitive, visual, and motor deficits in a safe setting
- Compare driving performance with traditional “behind-the-wheel” assessment and training

DriveSafety Model 550C 3-Channel Simulator with Saturn car cab.

Brain Computer Interface

- Noninvasive – picks up surface EEGs
- Determines 6 mental states – concentration / meditation
- Detects blinks
- Controls computer games
- Open API for other applications

NeuroSky's MindSet

$200

Personal Robot 2

- Two-armed mobile robot
- Vision system
- Ethernet connectivity
- Grasps and handles physical objects
- Human-controlled or autonomous operation
- Applications for persons with disabilities and seniors

PR2 - Willow Garage

Advanced Prosthetics

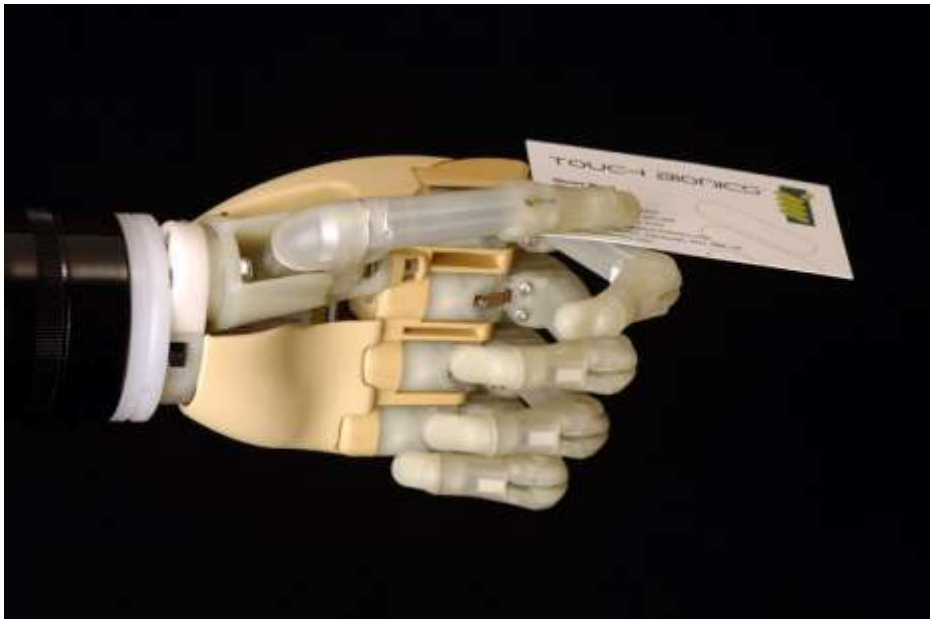
The **Proprio Foot** is a $30,000 device that uses artificial intelligence, sensors, and microprocessors to adjust automatically to the user's gait as well as to surface angles. It's capable of remembering exactly how its owner walked up a flight of stairs or down a hill, and can be trained to respond differently.

weblink

Bionic Hand

- Individually powered digits
- Myoelectric signal input to open and close fingers
- Cosmetic covering available

weblink



i-LIMB Hand – a fully articulating and commercially available prosthetic hand

Bionic Fingers

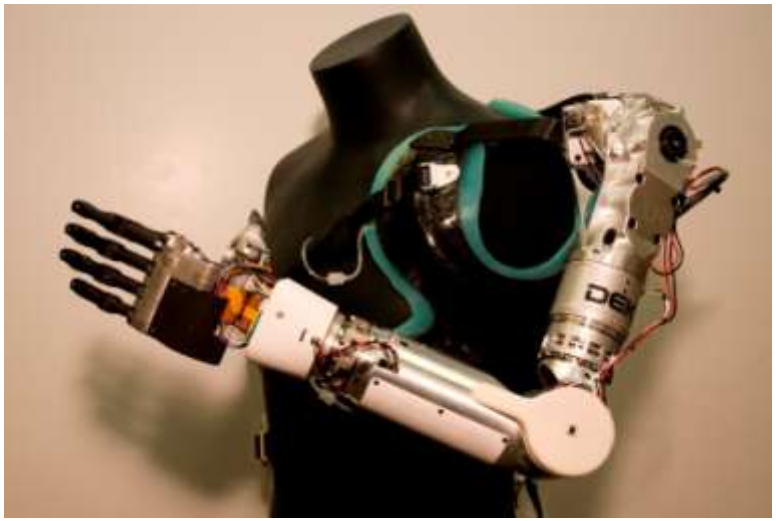
- Each finger is a standalone functional unit
- Myo-electric or pressure sensitive sensor signals open and close fingers
- Robotic or life-like cosmetic coverings available

ProDigits – motor-powered prosthetic for those with missing fingers

weblink

Luke Arm

- Designed by Dean Kamen and others
- Funded by DARPA - $30 million
- Brain-controlled
- Mechanical hand and arm



weblink

Mobility for Small Children

- Provides mobility to children who are unable to fully explore the world on their own
- Employs obstacle sensors

UD1 - University of Delaware

weblink

PowerKnee

- The **PowerKnee** is an active orthotic device. It provides active assistance, resistance, and rehabilitation of knee function for those with impaired mobility and is constructed with patented actuator technology, an embedded computer system, sensors, and a software control system. The result is a transparently activated, sensor-driven device which greatly enhances mobility and rehabilitation.

- The photo at the right is the prototype FlexCVA attached to a knee brace. Future versions will reduce the size and allow the entire device to fit under loose-fitting clothing.

weblink

Tibion – Moffett Field

iBot Wheelchair

- The **Balance Function** elevates the user to move around at eye level and to reach high places independently. In this function, the front wheels rotate up and over the back wheels, while the user remains seated at an elevated position.

- The **Stair Function** enables the user to safely climb up and down stairs, with or without assistance, giving them access to previously inaccessible places.

- The **4-Wheel Function** enables the user to climb curbs as high as five inches and to travel over a variety of uneven terrain, such as sand, gravel, grass, thick carpet and other surfaces.

- Johnson & Johnson Independence Technology

weblink

Lokomat Walking Retrainer

- The Hocoma **Lokomat** Robotic Ambulation System for body weight supported treadmill training is an effective therapy for persons with spinal cord injuries.

- Research indicates that spinal and cortical nervous systems have the ability to recall the walking process from repeated walking therapy.

weblink

Intel Reader

- Camera, computer, optical character recognition software, text-to-speech device for people with low vision, blindness, or reading-related disabilities
- Plays pre-recorded and mp3 content
- Zoom screen display

$1500 – one pound

weblink

Hand Mentor

- Interactive training environment for wrist and finger function improvement
- Employs a computer game
- Provides visual feedback of force, position, and emg

weblink

$10,000

Tracking Shoes

- GPS tracks wear's location
- Marketed to protect individuals with Alzheimer's Disease from wandering away

weblink

$300

SenseCam

- Device automatically takes photos
- Photos are reviewed (re-lived) to improve cognitive function of individuals with Alzheimer's Disease
- Gordon Bell – Microsoft

£299

weblink

Ekso Bionics Exoskeleton

- Returns walking to patients with spinal cord injury
- Hip and knee motors are computer controlled, providing walking motion
- Approved as a rehab therapy device

$100,000

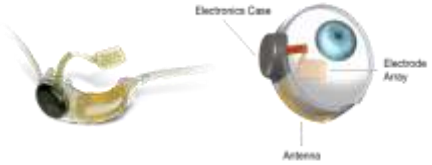
weblink

Bionic Eye

- Camera in glasses captures image
- Visual processor on belt converts image to 60 pixel black & white image
- Transponders in glasses send signal wirelessly to antennas around eyeball
- Signal activates 60 electrode array on retina

weblink

Argus II Retinal Prosthesis System
by Second Sight Medical Products



Page Turner

Microcontroller-based prototype page turner allowed a man with ALS, a neuromuscular disorder, to independently read a book. (ME113)

Caitlin Donhowe

Aid for Donning an Artificial Leg

A motorized device with wireless remote control that made it easier for an individual with a below-knee amputation to don an artificial leg.

Barrett Heyneman

Linus Park

Haley Kim

Aid for Donning an Artificial Leg

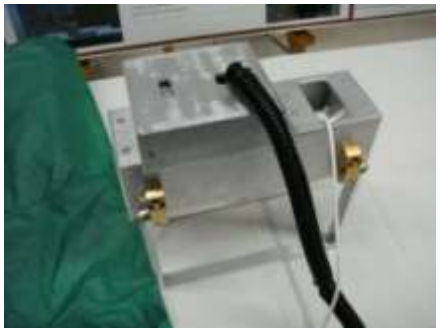
An improved device that made it easier for an individual with a below-knee amputation to don an artificial leg (ME113)

Jaime Jimenez

Wande Olabisi

Darnell Brooks

Angelo Szychowski



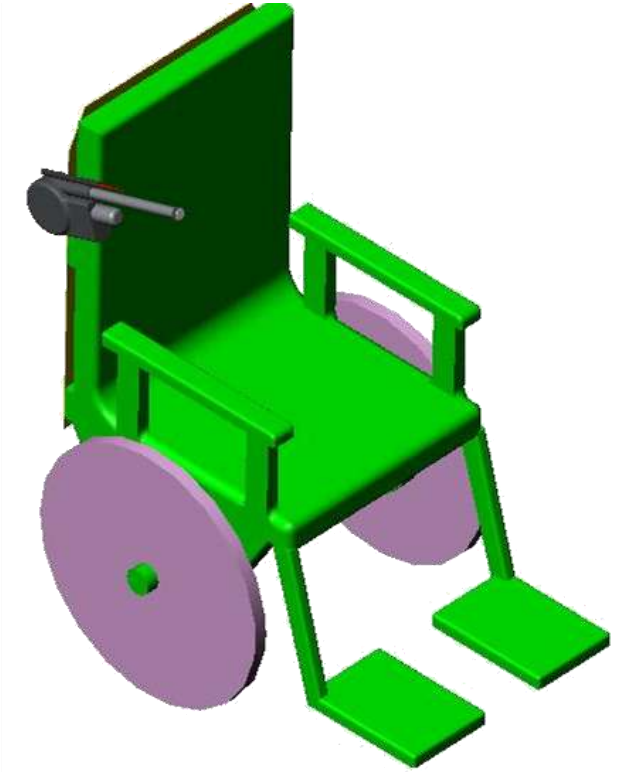
Pediatric Gait Project

The design team, **Lets Get Physical**, developed a physical therapy motivational device for use by children with Cerebral Palsy who are learning to walk. Combining innovative audio effects with a fun, portable design, the device encouraged users to keep walking outside physical therapy classes. (ENGR110 & ME113)

Nydia Cardenas
Whitney King
Roseanne Warren
Obinna Emenike

ElevAid

The **ElevAid** team addressed the need of a Stanford student who uses a powered wheelchair to access the elevator call button and to press the button corresponding to the floor desired.



Kevin Aberdeen

John Alabi

Kent Anderson

David Quintero

Opening Doors

Opening Doors addressed the need for a device that would assist wheelchair users in opening doors, specifically in the task of pulling.

Ana Pena
Subhanu Samarajiva
Shannon McClintock
Susan Nourse

Sonification of Movement

Sonification of Movement is a device that made physical exercises more engaging for stroke survivors who need to practice arm movement. The device translates arm movement into musical sounds, and can be customized to help the user practice different types of motion.

Eric Corona & Clare Kasemset

Handi-Cart

The **Handi-Cart** project allowed wheelchair users to use a shopping cart independently and easily.

Christine Appleby

Melissa Martinez

Xin Xie

iPhone Dialer for Individuals with Visual Impairments

The **iPhone Dialer** is a simple eyes-free dialing program which does away with absolute button location and which substitutes sound and vibration for the lack of tactile feedback.

Isaac Penny

Steerable Surfboard for a Surfer with Quadriplegia

The **Steerable Surfboard** project developed a prototype design with a fin-based steering system controlled by means of a forward-mounted joystick for a surfer with quadriplegia. (ME113)

Natasha Prats

Dharma Tamm

Ashley Pete

Kyle Imatani

Showering Aid for Persons with Below Knee Amputations

The **RISE** project developed an aid that provided below-knee amputees confidence, comfort, and balance while showering. (ME113)

Clay Heins

Durell Coleman

Karen Nesbitt

Pamon Forouhar

Kane's Canes

This project explored designs for a cane-type device that provided balance, stability, and support while standing, walking, and negotiating stairs without the disadvantages of a traditional walker. An existing prototype was enhanced by adding or improving three features: 1) creating an adjustable angle between the forearm segment and the bottom member, 2) adding a mechanism for varying the height of the bottom member, and 3) providing better forearm rests.

Harpreet K. Sangha

Recharging Vest

This project redesigned the Medtronic recharging vest to enhance its recharging efficiency and ease of use by patients who have an implanted rechargeable deep brain stimulator. The team identified three objectives to pursue for the improved vest design: 1) it should be very easy to put on and to position, 2) it should be comfortable to wear without feeling restricted or confined, even while moving around, and 3) it should be easy to custom fit to the user, ensuring the proper alignment of the implanted stimulator with the recharging unit. The final design addresses all three of these objectives: easy to put on, comfortable to wear, and individually customizable.

Dara Roberts & Reid Miller

Cardi-Row Exercise Machine

This project designed an exercise machine for veterans with disabilities that safely and easily varied the exercise resistance and accommodated various wheelchair types and sizes.

Darnell Brooks

Huong Xuan Phan

Thomas Waggoner

Hybrid Drive for RoTrike

This project developed a hybrid (manual and electric) add-on electric motor drive for the RoTrike, a 3-wheeled lever-drive wheelchair.

Marcus Albonico

Stephen Hibbs

Kevin Ting

Project Ideas

- Listed in handout – Thursday is “Pitch Day”
- Projects listed in the NSF guidebook
- Student-defined projects
- Software projects suggested by Project: Possibility

- Other projects:
  - Accessible interfaces for:
    - iPods and MP3 players
    - Cell phones
    - Game consoles
    - Remote controls

Project Pitches & Team Formation

- Educational Activities for Children with Disabilities
- Application of NeuroSky's Brain-Computer Interface
- Electric Scoop Bowl & Wireless Treat Dispenser
- Virtual Community Project , Elderly Drivers at the Wheel Project, and Household Tasks Project
- Customize the Wheelchair Project
- Sailboat Seating Project
- Sirott Speech Feedback Project
- Low Cost Transfer Device
- Rain Protector Project
- Accessible Restaurant Menu Project
- Friendly Cane Project
- Adjustable Seating System Project
- Piano Pedal Project
- Prosthetics & Orthotics Projects suggested by Gary Berke
- Dog Leash Project
- Projects suggested by Sunrise of Palo Alto
- Projects suggested by Benetech
- Flat House Project & Shower / Bathtub / Sink / Toilet Cleaning Project

Project Pitches & Team Formation

These projects will not be pitched in person:

- Project suggested by Eskaton
- Projects for veterans with traumatic brain injury
- Projects for veterans with spinal cord injury
- Projects for persons recovering from stroke
- Projects suggested by Parents Helping Parents

- Other project ideas – Dave

Student Project Resource People

- Debbie Kenney – Occupational Therapist
- Doug Schwandt – Mechanical Engineer
- Sakti Srivastava – ME294 Instructor
- Mark Felling – Assistive Technology provider and user
- Gary M. Berke – Director of Prosthetics





Other Involved People

- Those who suggested projects
- Individuals with disabilities
- Community participants attending lectures

Contact Information

- Websites:
  - http://engr110.stanford.edu
  - http://me113.stanford.edu
  - http://cs194.stanford.edu

- Telephone numbers and email addresses:
  - Dave Jaffe – 650/892-4464
    - dljaffe@stanford.edu
  - Drew Nelson – 650/723-2123
    - dnelson@stanford.edu
  - John Thiemer
    - jthiemer@stanford.edu

Questions?

Adjourn