January 7, 2014

ENGR110/210
Perspectives in Assistive Technology

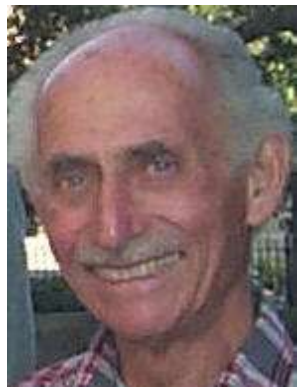
David L. Jaffe, MS

Margaret Mongare

Professor Drew Nelson

Proadpran P. Punyabukkana, PhD

Any questions so far?



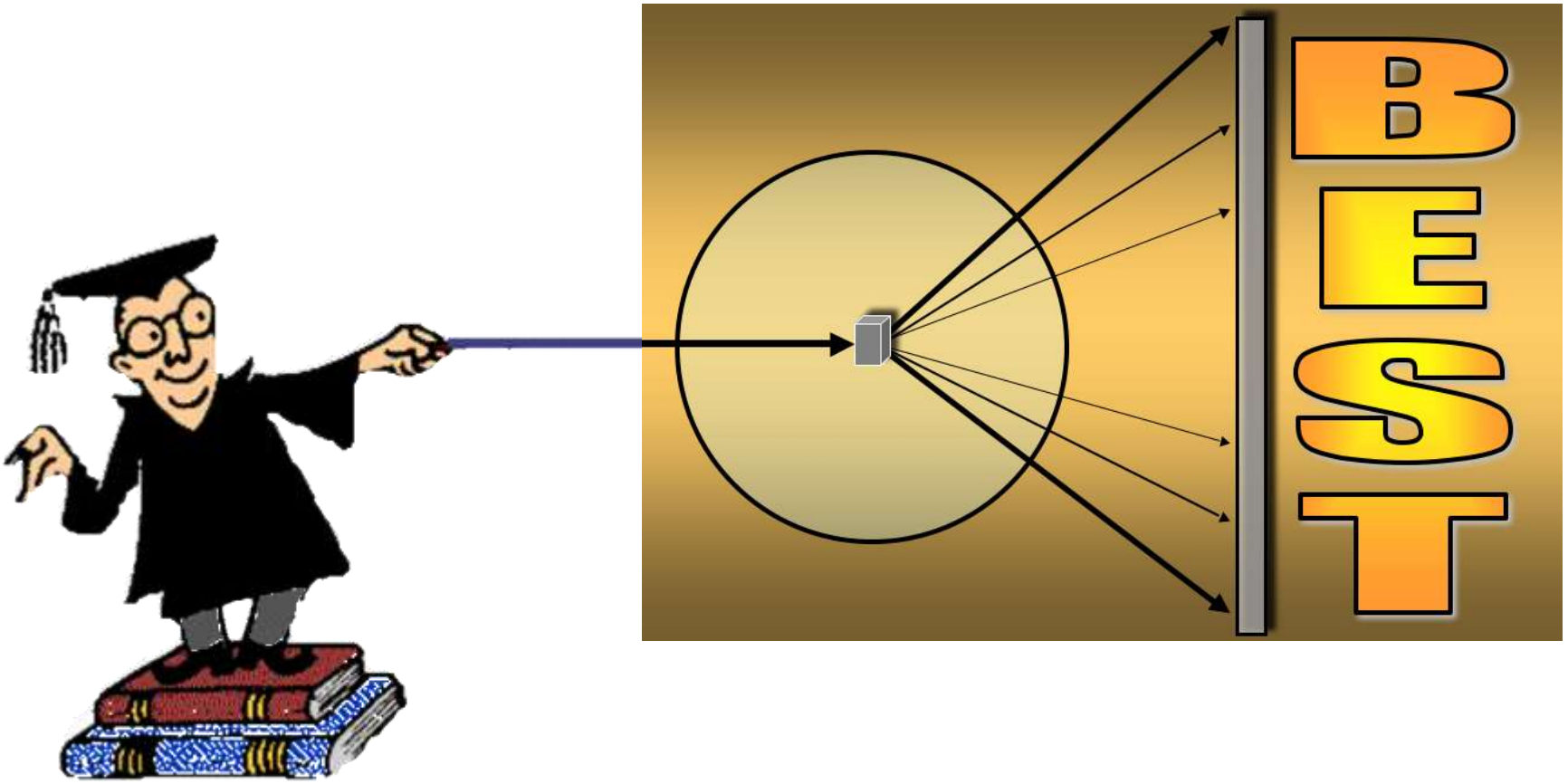
Homage to Prof Kane

“Have I made a good choice by enrolling in *Perspectives in Assistive Technology?*”

“Have I made a good choice by enrolling in *Perspectives in Assistive Technology?*”

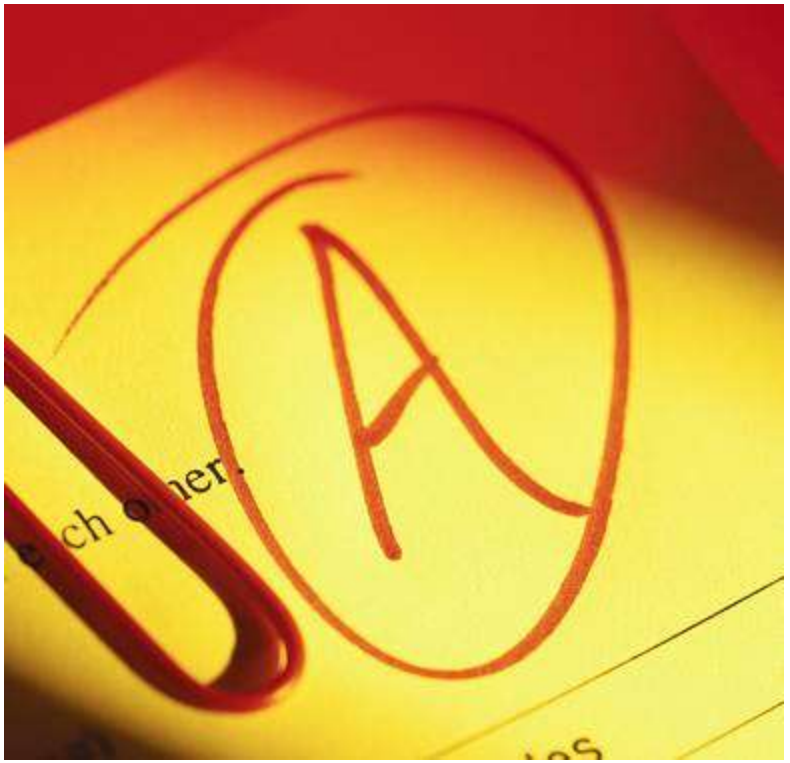
YES!

It is the best course I teach

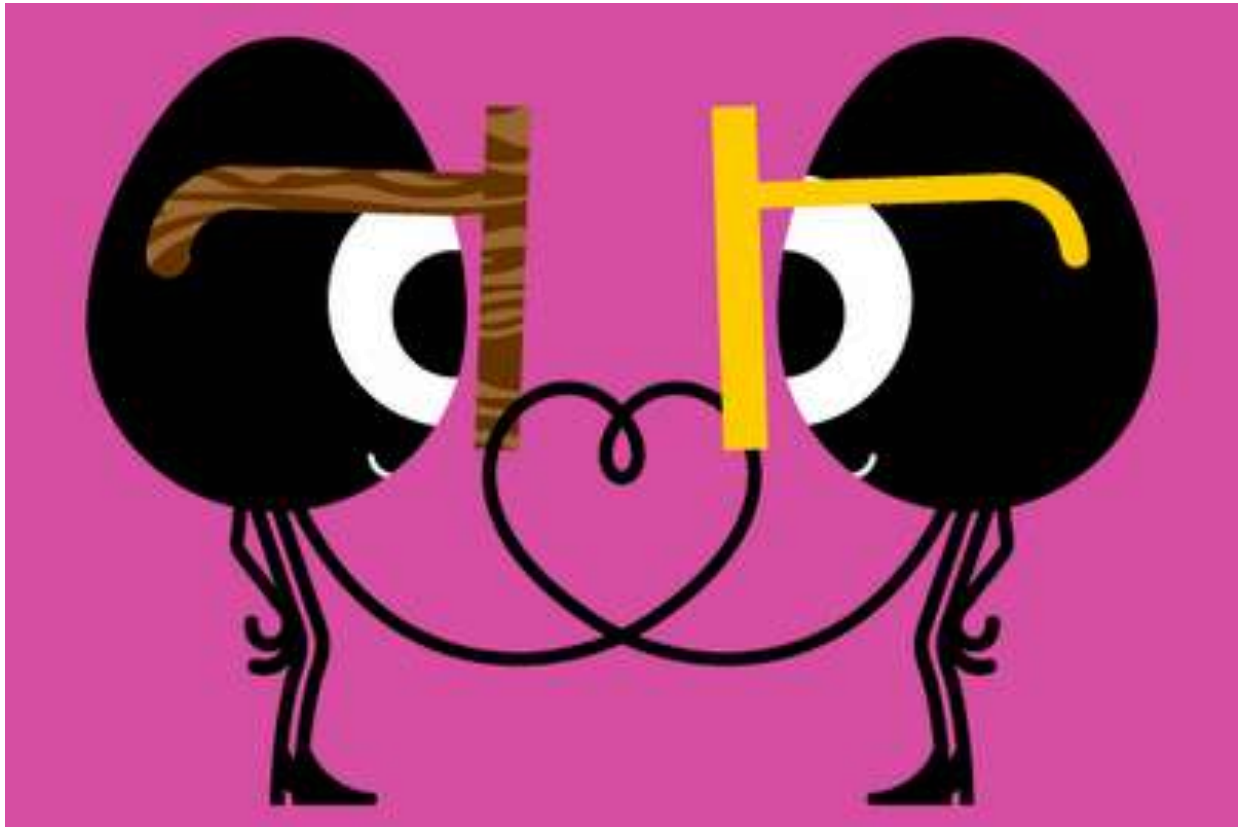


It is the best assistive technology course at Stanford

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



Meet your love connection



The fame and notoriety

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

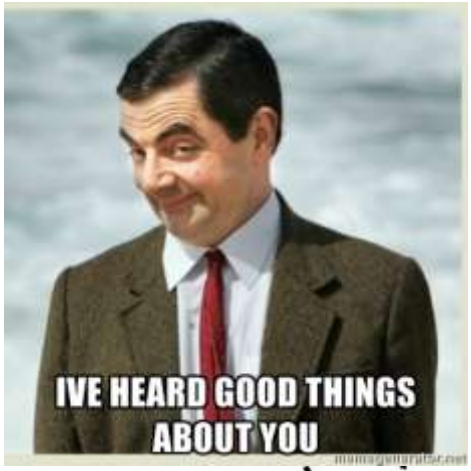
You want to know if your Stanford education and skills can benefit others

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

The job opportunities

You have heard good things about the course



You want to take something completely different

Call Me “Dave”

“Professor” from Gilligan’s Island

Dr. David 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
Course Lecturer

More about Me

- Education:
  - University of Michigan – BS in EE
  - Northwestern University – MS in BME

- Employment:
  - Hines VA Hospital
  - VA Palo Alto Health Care System – RR&D

- Stanford:
  - ME218, ME113, ME294, assistive technology projects

My Passions

- Inspired by “Watch Mr Wizard”
- Early home computer adopter – 1975
- Forth programming language devotee, embedded systems
- Teaching human aspects of technology and engineering

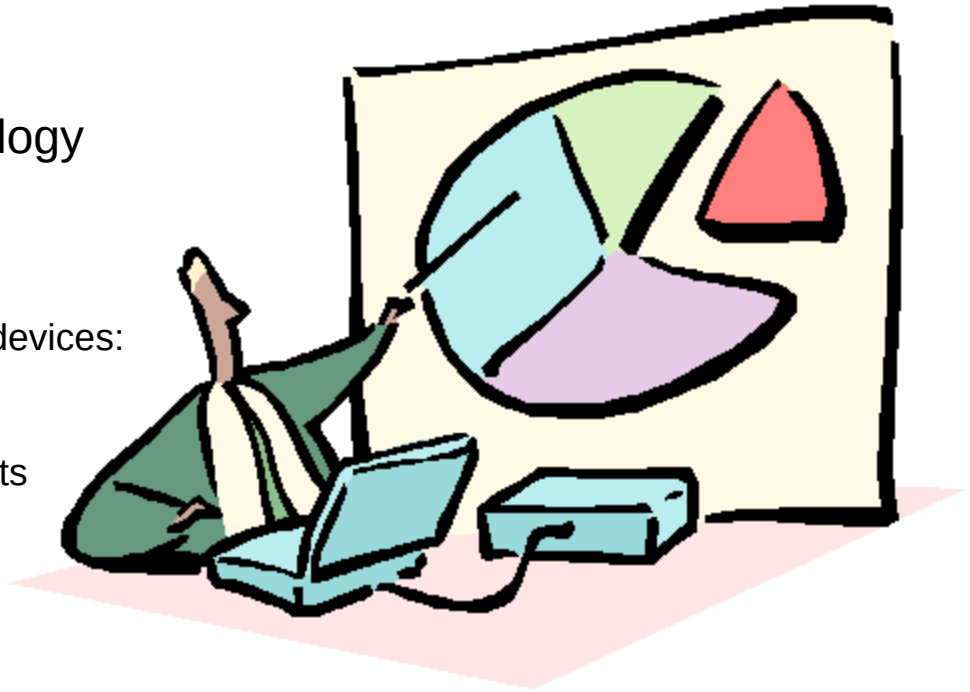
FORTH INTEREST GROUP

fig

Course Organizer & Instructor

Today's Agenda

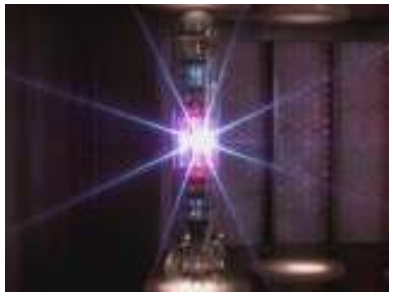
- Welcome to the Course
- Course description
- Introduction to Assistive Technology
  - What is Assistive Technology?
    - Definition
    - Population numbers
  - Assistive Technology research and devices:
    - DJ projects at VA
    - Existing devices and products
    - Past and candidate student projects
    - New technology
  - Successes and Failures
- Student Project Preview
  - Prior Years' Student Projects
  - Project Suggestions for this Quarter



to the Class

- Welcome students and community
- Senior Faculty: Professor Drew Nelson
- Teaching Assistant: Margaret Mongare
- Visiting Assistant Professor: Proadpran P. Punyabukkana
- Administrative items:
  - Student sign-up form
  - Sign in:
    - Students - attendance
    - Community members - signup

Who are these people and why are they smiling?



The Genesis Device

Class Genesis

The Rock Group Genesis

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

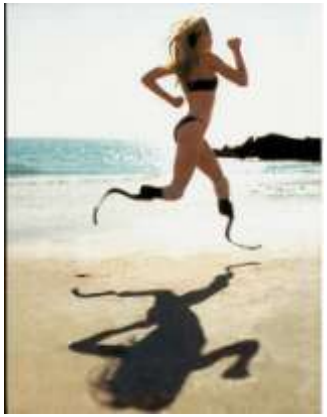
Star Trek Genesis Project

Course Objectives

Gain additional engineering confidence in applying your knowledge and skills to address real problems

Focus on critical thinking and communication skills, working as a team, and interacting with individuals in the local community

Learn about the design, development, and use of technology that benefits people with disabilities and older adults



Skills Exercised

- Independent & critical thinking
- Analysis
- Problem-solving

- Working in a team
- Working in the community
- Public service

- Service-learning
- Designing, fabricating, testing, analyzing, iterating
- Communicating: reports, presentations, class participation

What this Course isn't

- Not just about ideas and Post-it notes
- Not about starting a company
- Not about commercializing a device or product
- Not about business or marketing or manufacturing
- Projects not with big companies or in foreign countries
- No finals, exams, or quizzes
- No books to buy - some reading
- No problem sets
- No boring lectures

"Not that there is anything wrong with that"

What this Course is

- 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
- Previewing your professional life

Course Credentials

- Certified Service Learning Course (Haas Center)
- 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

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

TUSB 2011 Winter Course Guide: spice up your courseload!

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

How many people do you have to save?

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 two facility tours – and an assistive technology faire

- Opportunities for thought, reflection, and discussion

- A design 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 interaction of people with technology

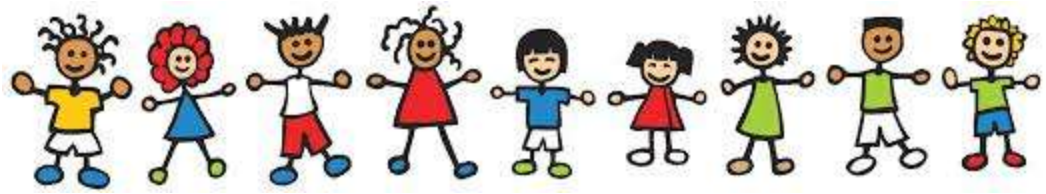
For those working on a project:

- 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

Your Experience

How does this course fit into your life and education?

- not reliving past experience
- not just another course
- previewing your future professional life



Your Expectations

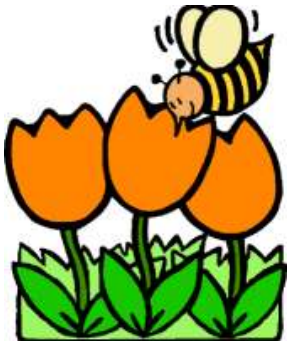
- Equations, derivations, proofs
- Chapter-by-chapter
- Disability-by-disability

$$e^{i\pi} == -1$$

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,
    - create of a work of art,
    - engage in an aftermarket aesthetic design
    - engage in an aftermarket functionality / usability design



Credit Options

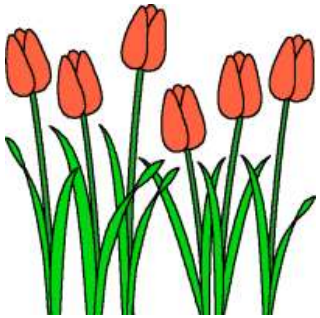
3-unit options:

– 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 <u>independent study</u> effort in the Spring Quarter (with approval of your faculty advisor)

– attend ENGR110/210 lectures, participate in a team project, <u>no</u> project continuation in the Spring Quarter

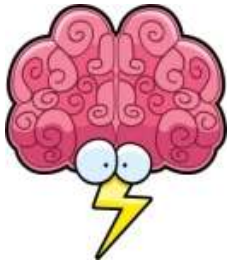
- Your team can be excused from one lecture to work on your project

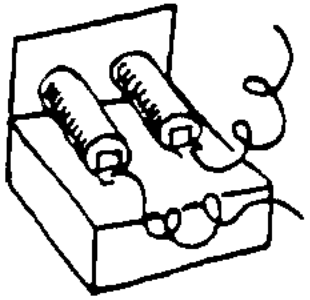


Project Activities

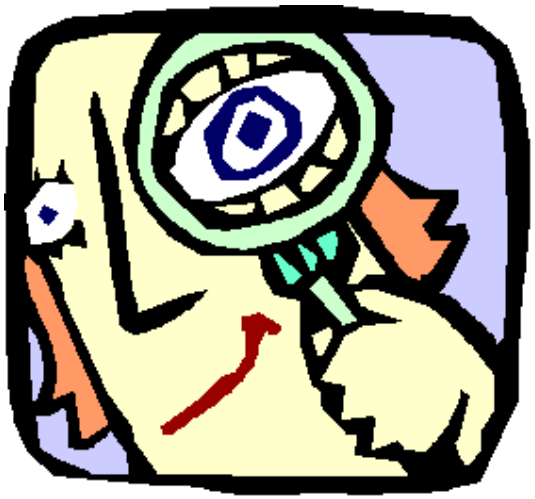
For those working on a **team** project:

- 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

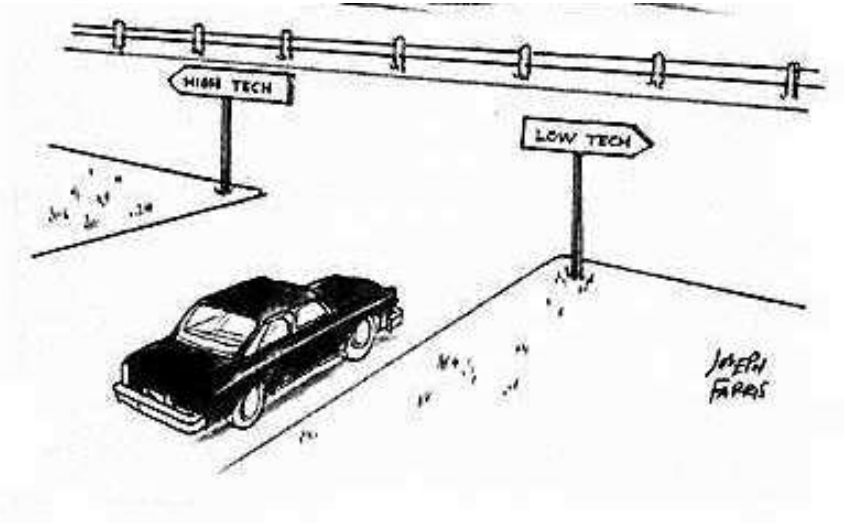




Projects

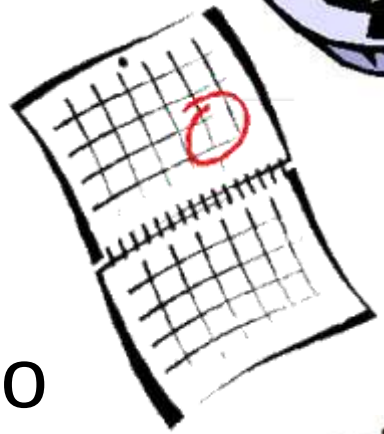


- “Building people” not projects – Prof Larry Leifer
- Problem first or Technology first
- 8-week prototypes
- Need not be ready-to-market
- Low tech solutions are ok
- Experiencing the design process and getting it to work are priorities



Your Project Team is Like a Company or Start-Up

- Team members
- Resources
- Deadlines
- Budget
- People to please / report to
- Problem to address
- Goal



Project Team Identification

- Team name
- Team logo / icon
- Project name
- Device name
- Catch phrase

project name

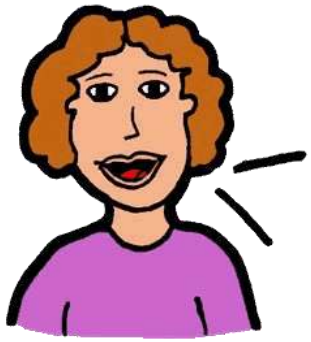
Why you may want to

If you have enrolled for <u>three units</u>, you may want to consider taking the course for <u>one unit</u> or <u>waiting until next year</u> if:

1. You are a freshman or sophomore, or
2. If you have limited fabrication experience, or
3. If you are already taking a project course, or
4. If you have to miss lectures or tours

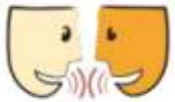
For those working on a **team** project:

- 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

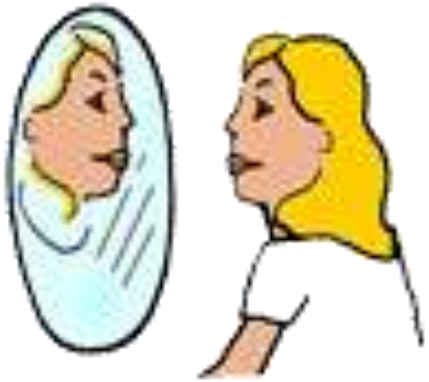
Grading

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?
- The Upside of Failure!
- Antique technology
- New technology
- AT device review
- Famous people with disabilities

- Video theater
- Everything is a prototype / AT
- In the news
- What would MLK say about AT?


Guest Lecturers











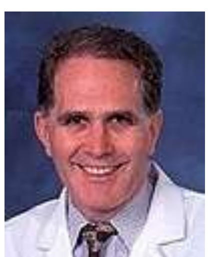






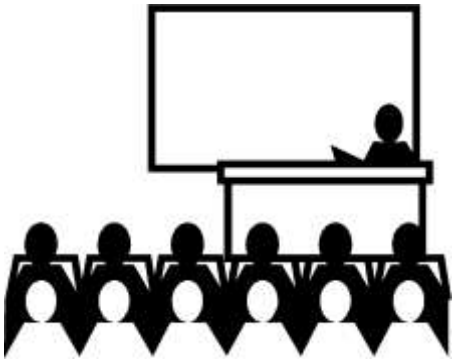










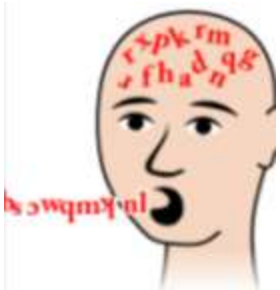


Lecture Titles 1 of 2

- Course Overview & Introduction to Assistive Technology
- Project Pitches & Team Formation
- Need Finding for Assistive Technologies
- The Transdisciplinary Team: Bridging the Gap between Consumers and Products in Rehabilitation Medicine
- Perspectives of Stanford Students with a Disability
- The Design and Control of Exoskeletons for Rehabilitation
- International Perspectives
- A Tale of Two Wheelchairs
- Rehabilitation and Assistive Robotics
- Prosthetics
- Assistive Technology Faire

Lecture Titles 2 of 2

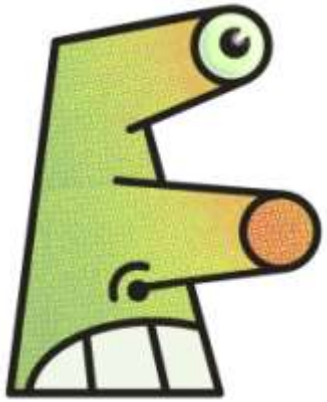
- Assistive Technology Faire
- What Kind of Assistive Technology Do You Need if You Break Your Neck? & Assistive Technologies: The Benefits for Returnees – Tour of VA Palo Alto Spinal Cord Injury & Brain Injury Services
- Assistive Technology Opportunities in Autism
- Tour of Motion & Gait Analysis Lab (Menlo Park)
- Designing Beyond the Norm to Meet the Needs of All People
- Aesthetics Matter in Assistive Technologies
- Starting an Assistive Technology Company
- Wheelchair Fabrication in Developing Countries



Lectures

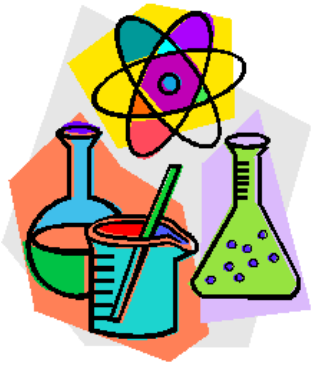
- Lecture topics are chosen for their interest, but may not relate to specific projects

- Some class sessions may run overtime, so students are given an opportunity to leave at 5:30pm

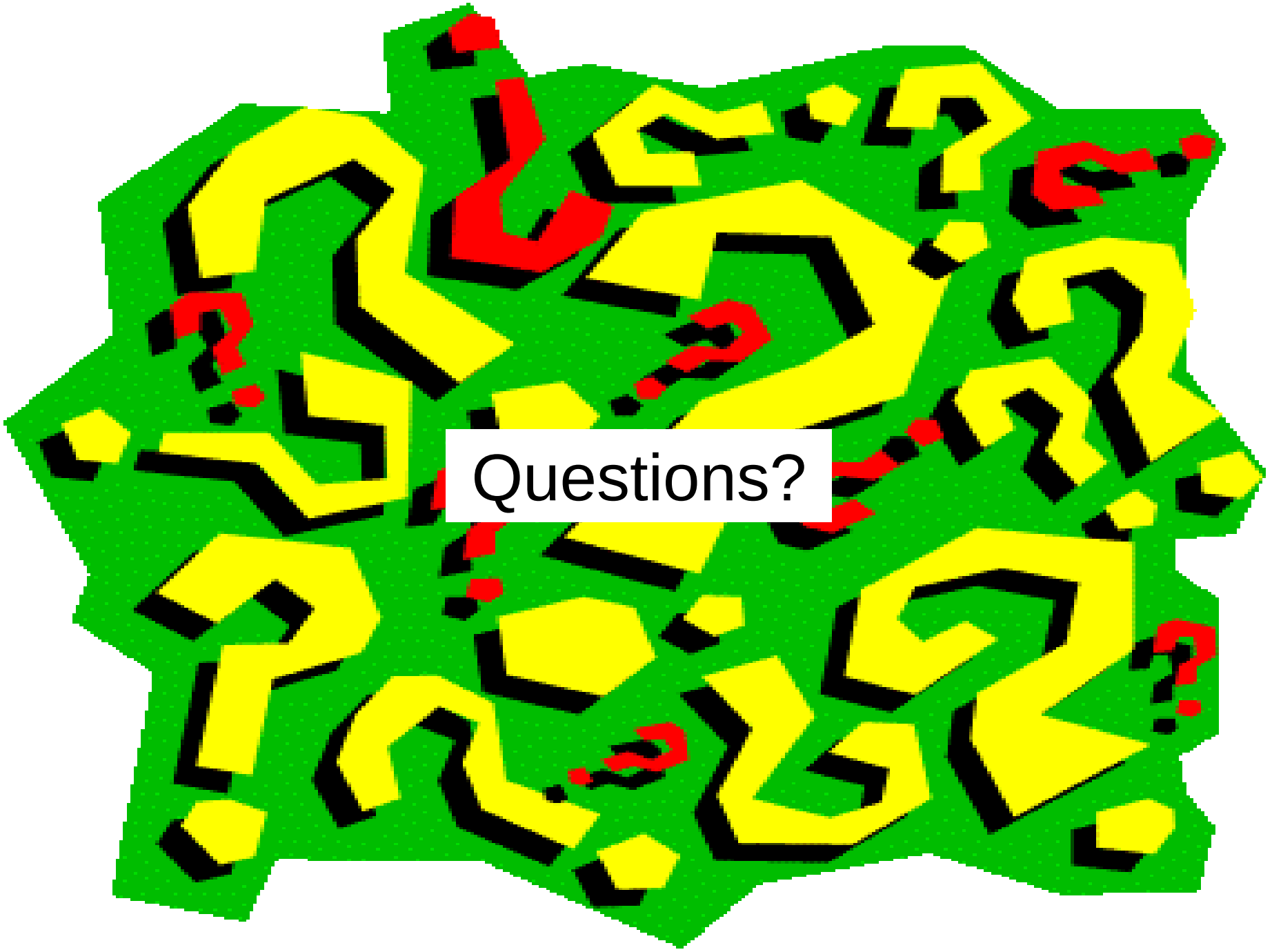


Technology Tidbits

- New products
- Research and development
- Interesting articles



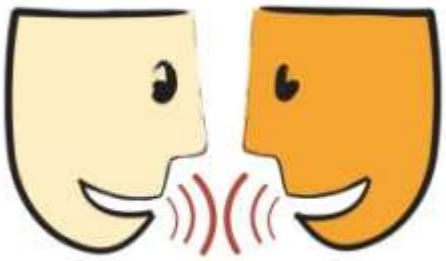
Tell Your Friends


Questions?

Short Break

Break Activities

- Stand up and stretch
- Take a bio-break
- Text message
- Web-surf
- Respond to email
- Talk with classmates
- Reflect on what was presented in class



Short Break

Introduction to Assistive Technology

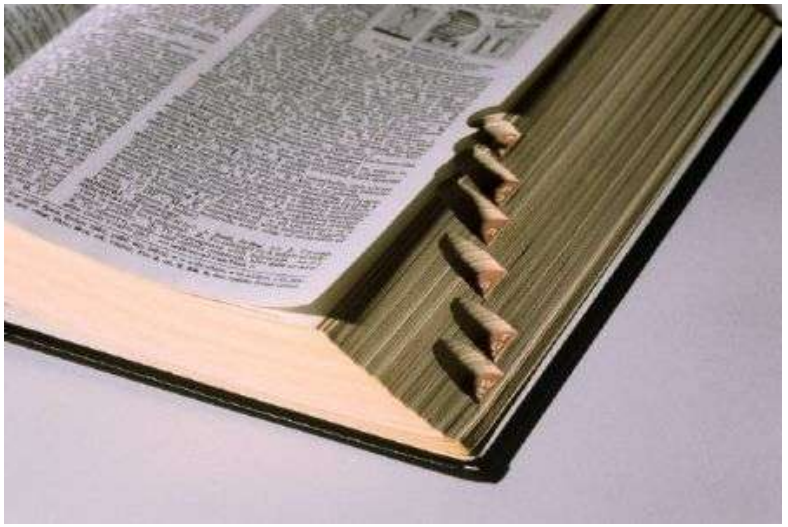
- Definitions
- Broad overview
- What is a disability?
- Range of disabilities

- 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

This material may be familiar to ME294 students.

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

WHO says

“Disability” is an umbrella term covering impairments, activity limitations, and participation restrictions.

- an **impairment** is a problem in body function or structure
- an **activity limitation** is a difficulty encountered by an individual in executing a task or action
- a **participation restriction** is a problem experienced by an individual in involvement in life situations.

WHO says

“Disability” is not just a health problem.

It is a complex phenomenon, reflecting the interaction between **features of a person’s body** and **features of the society** in which he or she lives.

Overcoming the difficulties faced by people with disabilities requires interventions to remove **environmental** and **social barriers**.

WHO says

People with disabilities have the same health needs as non-disabled people – for immunization, cancer screening, etc.

- They also may experience a narrower margin of health, both because of **poverty and social exclusion**, and also because they may be **vulnerable to secondary health conditions**, such as pressure sores or urinary tract infections.

- Evidence suggests that people with disabilities face **barriers in accessing the health and rehabilitation services** they need in many settings.

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

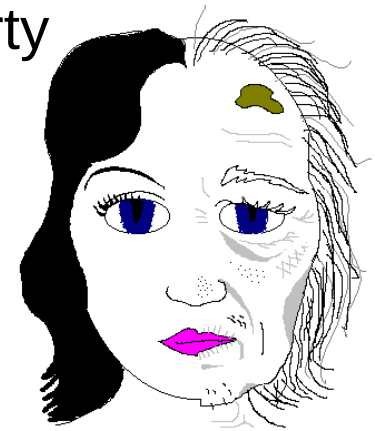
- 71.4 million citizens have activity limitations, ~ 23% of 308 million
  - Reports cite 32 to 78 million (over 1 billion worldwide – 15%)
- 24.1 million individuals have a severe disability
- 11 million children have a disability
- 25% of health care costs relate to disability
- Disability is the largest 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
- 15% of Stanford students are registered with OAE

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 - 27.8% working-age individuals with disability live in poverty



- 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

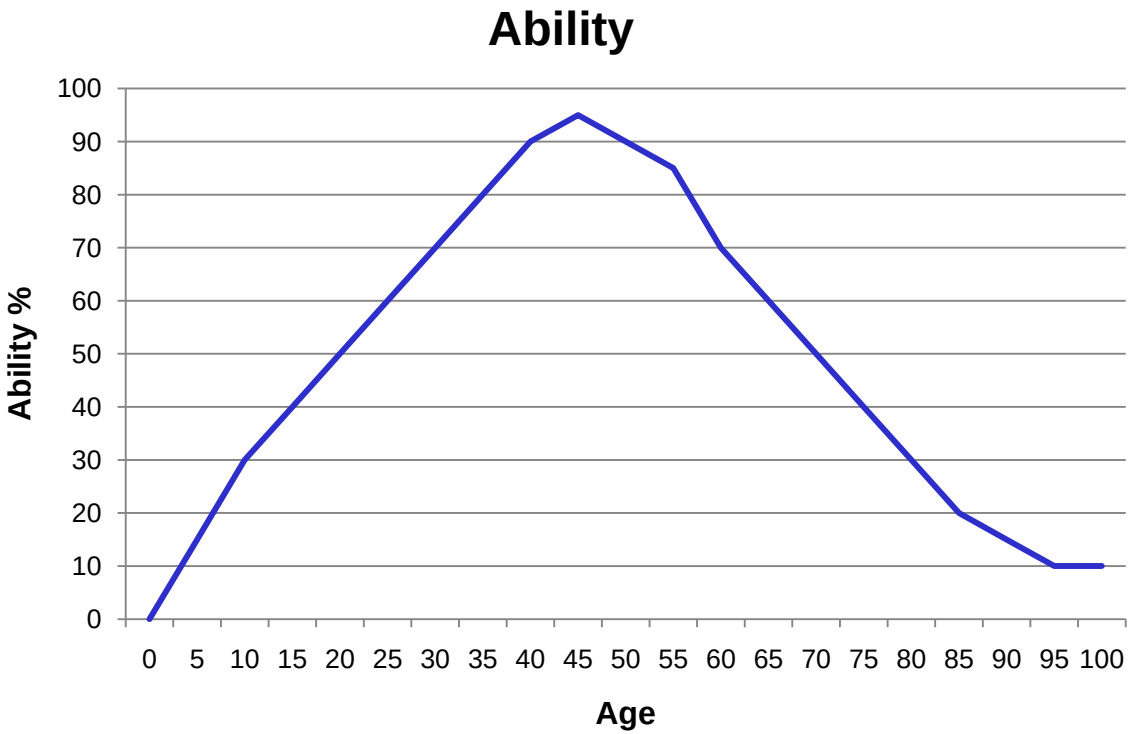
There is a large group of individuals who spend 12 to 25 years in institutions before they can contribute significantly to society

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

Students!

Is this fair?

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

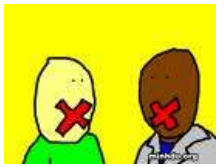
- Pursue happiness
- Integrate into society (or be a part of their own group or be an individual)

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

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 rodent-Americans
who are experiencing severe visual impairments

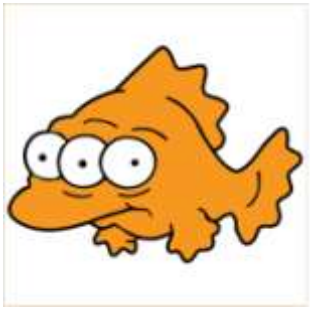
Social and Political Correctness

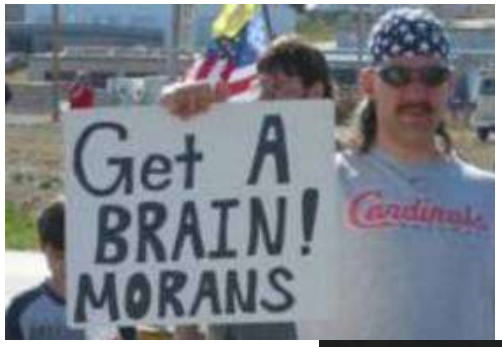
- Shorthand terms:
  - Para, Quad
- Derogatory terms:
  - Gimp, Crip, Spaz, Retard

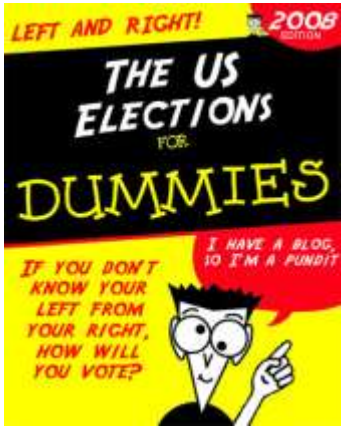
- Use of terms:
  - “Patient”, “User”, “Subject”, “Consumer”
  - “Suffering from”, “Afflicted with”, “Confined to”, “Victim of”
  - “Diagnosed with”, “Living with”, “Survivor of”, “Recovering from”

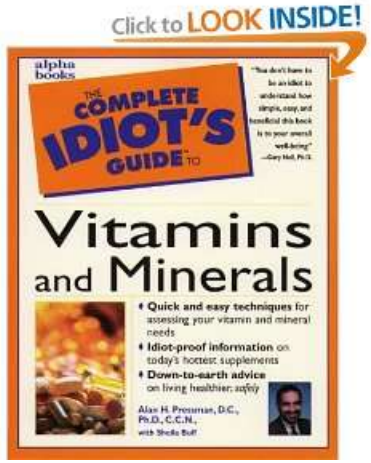
Medical & Common Use

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









Portrayal of People with Disabilities

Professor Alastor
"Mad-Eye" Moody

Robert Van Etten

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

Bob

Blue Man Group

Device Definition of Assistive Technology

The Technology Related Assistance Act of 1988 (P.L. 101-407) and the Assistive Technology Act of 1998 (P.L. 105-394) provide a standard definition of assistive technology as “any item, piece of equipment, or product, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities.”

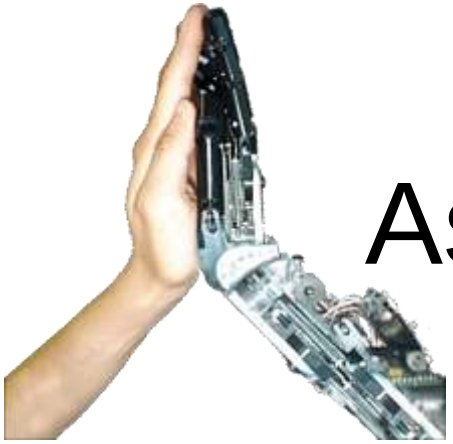
South Carolina Assistive Technology Program - link

My Definition of 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.

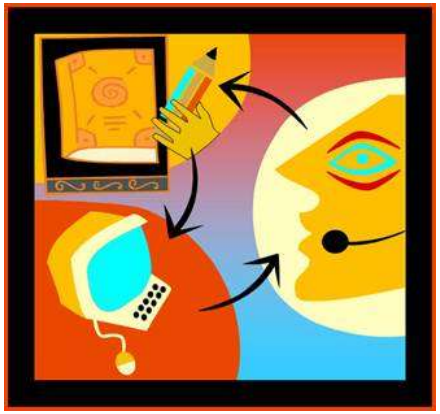
- An AT device is one that has a diagnostic, functional, adaptive, or rehabilitative benefit.

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



Assistive Technology

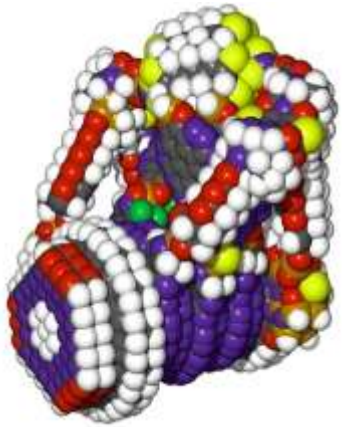
AT devices provide greater independence, increased opportunities for participation, and an improved quality of life for people with disabilities by enabling them to perform tasks that they were formerly unable to accomplish (or had great difficulty accomplishing, or required assistance) through enhanced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

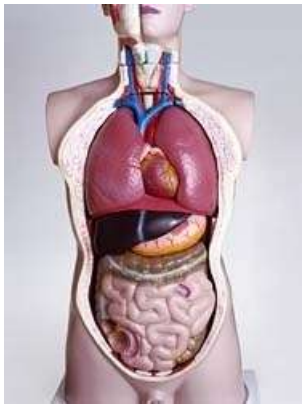
- Computers
- Robotics & mechatronics
- Nanotechnology
- Medical technologies



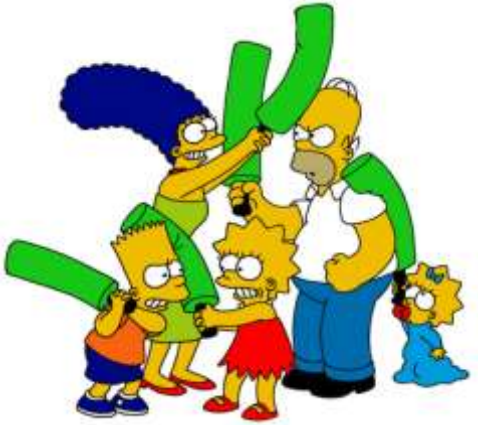
Assistive Technology Workers

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



Rehabilitation



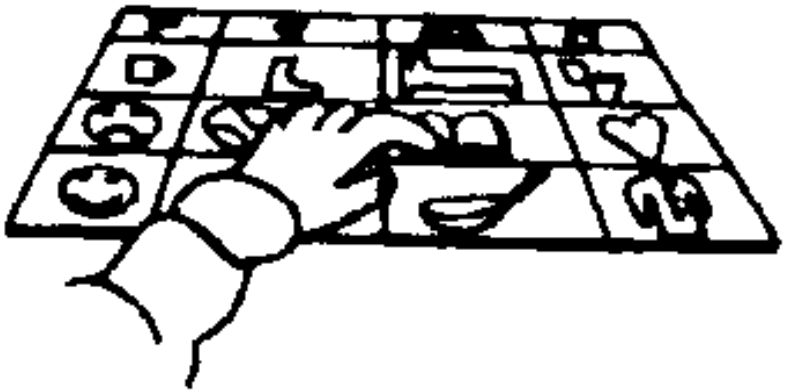
- **Medical model**: Restoration of function caused by disability – through surgery, medication, therapy, and/or retraining

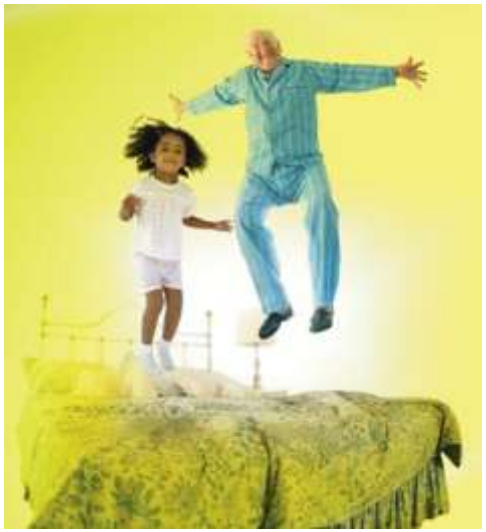
- **More inclusive model**: Includes Assistive Technology

Goals

- Goal of Rehabilitation
  - Restore function

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





Scientific Definition of Rehabilitation Engineering

Rehabilitation Engineering may be defined as a total approach to rehabilitation that combines medicine, engineering, and related sciences to improve the quality of life of persons with disabilities.

How and when did the rehabilitation engineering center program come into being? – James R. Reswick, ScD, DE – NIDRR - link

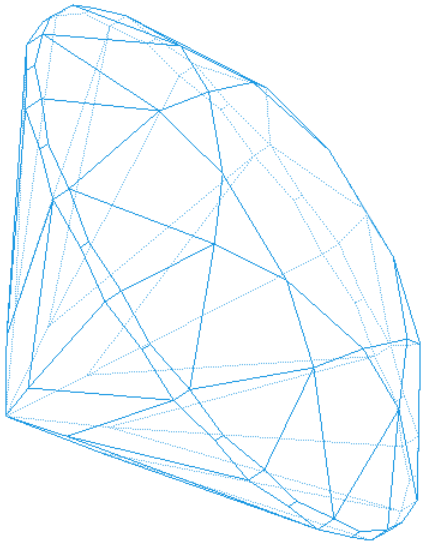
Rehabilitation Engineering

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

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

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

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

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

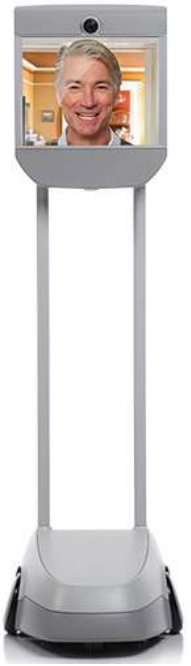
- Noninvasive – picks up surface EEGs
- Determines 6 mental states – concentration / meditation
- Detects blinks
- Controls computer games
- Open API for other applications

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
- $400,000



PR2 - Willow Garage

Advanced Prosthetics

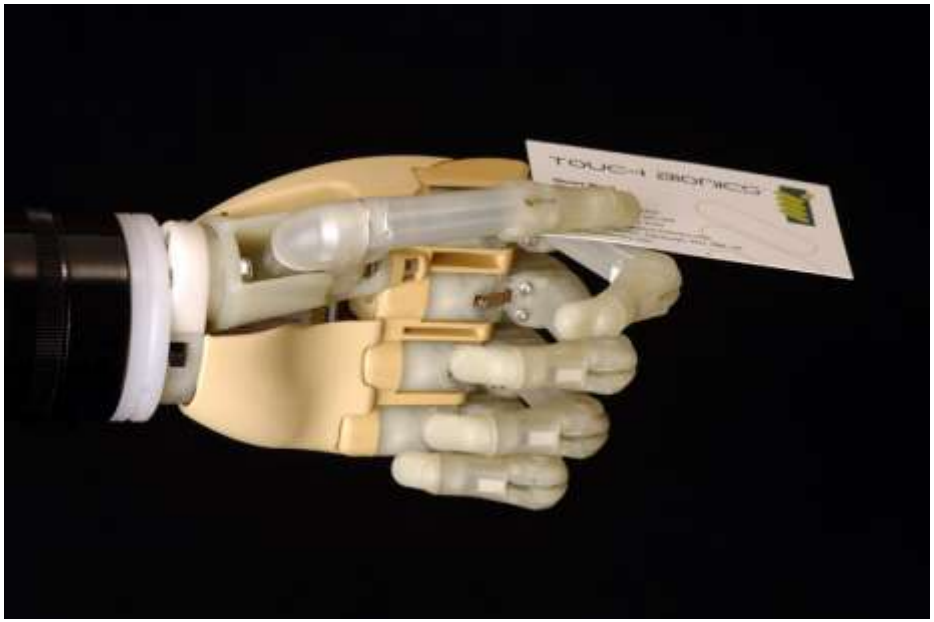
The **Proprio Foot** is a $30,000 device that uses artificial intelligence, sensors, and microprocessors to adjust automatically to the user's gait as well as to surface angles. It's capable of remembering exactly how its owner walked up a flight of stairs or down a hill, and can be trained to respond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

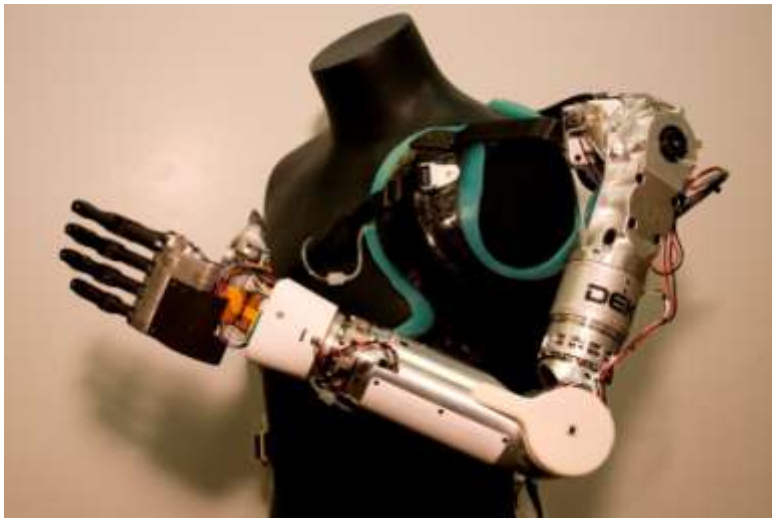
- Each finger is a standalone functional unit
- Myo-electric or pressure sensitive sensor signals open and close fingers
- Robotic or life-like cosmetic coverings available

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



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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

Dean Kamen

Dean Kamen - is an American entrepreneur and inventor from New Hampshire. He first developed the iBot, a standing, balancing, stair-climbing wheelchair. But he is best known for inventing the Segway, an electric, self-balancing human transporter with a sophisticated, computer-controlled gyroscopic stabilization and control system. Kamen's company, DEKA, received funding from DARPA to work on a brain-controlled prosthetic arm called the Luke Arm.

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

Gordon Bell

Gordon Bell – is a principal researcher in the Microsoft Research Silicon Valley Laboratory, working in the San Francisco Laboratory. His interests include extreme lifelogging, digital lives, preserving everything in cyberspace, and cloud computing as a new computer class and platform.

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

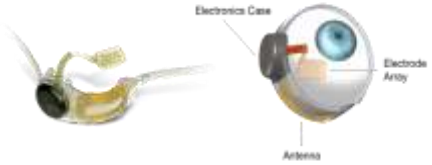
weblink

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



Mind-controlled Limbs

Humans can now move robotic limbs using only their thoughts and, in some cases, even get sensory feedback from their robotic hands.

60 Minutes

Student Projects

Page Turner

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

Caitlin Donhowe

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

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

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

Student Projects from 2012

- Accessible Eateries
- Belle
- Customobility
- Piano Pedal
- Friendly Cane
- ROTAbrake
- Transfer-Mations
- Spin a Story

Accessible Eateries

drinks

fresh orange juice	$ 3.25	sodas coke, diet coke, and sprite	$ 2.25
apple juice	$ 2.25	lorina lemonades	$ 2.95
hot lips organic soda	$ 3.25	guaraná brazilian soda	$ 2.75
iced tea		san pellegrino 250	$ 2.95
organic mango indica (from sri lanka)	$ 2.85	san pellegrino 500	$ 3.95
organic los andes black (from guatemala)	$ 2.85	perrier	$ 3.00
arnold palmer	$ 2.75	orangina	$ 2.50
fresh squeezed lemonade	$ 2.50	sparkling apple juice	$ 2.25
fresh organic mint lemonade	$ 3.25	italian sodas kiwi, caramel, strawberry, and more	$ 2.95
hot apple cider	$ 3.00		

breakfast

(served all day)

scrambled eggs & omelettes

served with baguette and fresh fruit
(egg white only add $1.50)

two eggs scrambled or omelette (plain)	$ 7.75
with your choice of cheese	$ 8.25
with black forest ham & cheese	$ 8.95
with tomatoes, onions & mushrooms	$ 8.95
with goat cheese, sundried tomatoes & chives	$ 9.75
with black olives, spinach & feta cheese	$ 9.50
with smoked salmon, cream cheese & chives	$ 9.95
with asparagus, broccoli & mozzarella	$ 9.75
with avocado, onion, cheddar cheese, bell peppers & sour cream	$ 9.75
design your own with up to four ingredients	$10.95
fried eggs *any style with baguette and fruit*	$ 7.75
poached eggs *any style with baguette and fruit*	$ 7.75
side order of bacon / or one egg	$ 3.50

granola, etc

granola (kingslake & crane premium blend)	$ 6.95
with white yogurt or fruit	$ 8.45
with white yogurt and fruit	$ 8.95
plain white yogurt (with fruit add $ 1.50)	$ 4.95
fruit bowl (with yogurt add $ 1.50)	$ 6.25
irish oatmeal	$ 6.95

coupa specialties

perico platter *served with a venezuelan arepa* scrambled eggs with sautéed tomatoes, onions & sweet peppers	$ 9.95
breakfast arepa with scrambled eggs, gouda cheese & bacon	$ 7.95
breakfast crepe lightly scrambled eggs with dutch gouda cheese	$ 8.50
eggs, black forest ham & cheese sandwich	$ 9.95
vegetable frittata	$ 8.95
black forest ham frittata	$ 8.95
blt croissant (bacon, lettuce & tomatoes)	$ 7.95
blt & egg croissant	$ 8.95
bagel & cream cheese	$ 2.50
bagel or english muffin sandwich with scrambled eggs, tomatoes, bacon & cheddar che	$ 7.95

pancakes, waffles & french toast

traditional buttermilk pancakes or waffles	$ 7.50
with fresh bananas	$ 8.25
with fresh strawberries & bananas	$ 8.95
with nutella	$ 8.50
with dulce de leche	$ 8.50
with chocolate chips	$ 8.95
JP's with fresh strawberries, bananas & nutella	$ 9.50
french toast made with organic challah bread	$ 7.95

from the coupa bakery

croissant	$ 2.50	assorted scones	$ 2.75
almond croissant	$ 2.75	biscotti (almond, chocolate or pecan)	$ 1.95
ham & cheese croissant	$ 3.75	sugar shortbread	$ 2.25
pain au chocolate	$ 2.75	brownie	$ 4.50
apple chausson	$ 2.75	lunette	$ 2.75
blueberry or bran muffin	$ 2.50	baklava	$ 2.75
bear claw	$ 2.50	apple cranberry tart	$ 5.95
palmier	$ 2.50	assorted mini muffins	$ 2.00
almondine	$ 4.50	danish blueberry or cinnamon-raisin	$ 2.50
freshly baked cookies	$ 1.95	raspberry pop tart	$ 2.95

Nicole Torcolini

Belle

Jules Sherman

ROTAbrake

Tyler Haydell, Jai Sajnani, and Mark Murphy

Student Projects from 2013

- Social Development Program for Students with Autism
- Monkey Bar Prosthetic Project
- Dressing Aids
- Flat House Project
- Neurosky Project
- Inhaler Appearance Project
- Wheelchair Wheel Washer
- Sock Donning Project

Social Development Program for Students with Autism

Explore applications that create an engaging method for students to build appropriate social emotional recognition.

Beth Shields & Kevin McCabe

Monkey Bar Prosthetic Project

Explore designs for a device for a child with a missing hand or arm that would allow him/her to play on the monkey bars.

Sane Cassidy & Tal Fix

Dressing Aids

Explore designs for anyone with an upper extremity impairment to help them button their pants and shirt.

Kelly Nguyen, Raymond Liou & Nathaniel Wynn

Flat House Project

Explore and design a solution that can be retrofitted to current housing for the multi-step problem of stairs.

Will Tucker, Matt Rios & Tommy Fraychineaud

Neurosky Project

Explore an application for a person with a disability using the NeuroSky brain-computer interface product.

Andrew Logan

Inhaler Appearance Project

Explore designs for inhalers that would improve their appearance, including making them more discreet.

Kezia Alfred

Wheelchair Wheel Washer

Explore designs to remove dirt from the wheels of a powered or manual wheelchair or walker.

Sean Pacheco

Sock Donning Aid

Explore a new design for a sock donning aid that can be used with one hand.

Anna Evans, Richard Lui & Wade Hatton

Candidate Student Projects

- 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

These projects will be pitched by their suggestors:

- Magical Bridge Playground Project
- Educational Activities for Children with Disabilities
- Project employing the Microsoft Kinect Controller
- Projects suggested by Berke Prosthetics / Orthotics
- Asthma Control Project
- Enhanced access to voting
- Balance Buddy & Moxie Mobile
- Wheelchair Adaptor for the ROTA Mobility RoWheel
- Accessible Stroller for a Wheelchair-Using Parent
- Dog Leash Project
- Wheelchair Adaptation for Easy Transfers
- 3D Printing of Tactile Graphics / Objects for Teaching Blind Students
- Projects for persons recovering from stroke
- Project employing the Leap Motion Controller

Project Pitches & Team Formation

These projects were suggested by others, but will be pitched by Dave:

- Project employing inexpensive voice-recognition technology
- Pooper scooper for canine companions of wheelchair users
- Wheelchair backup alert
- Handbike Leg Positioning Project
- Microphone Comfort and Appearance Project
- Enhanced bed control for veterans with spinal cord injury
- Enhanced access to touch-screen devices
- Guide Robot for the Blind
- Projects suggested by Adam Kumar
- Walker for Stroke Survivors
- Customize the Wheelchair Project
- Wireless Treat Dispenser
- Shower / Bathtub / Sink / Toilet Cleaning Project
- Projects for veterans with spinal cord injury

Project Pitches & Team Formation

Dave’ s suggested projects:

- Creative Expression
- Designing Your Afterlife
- Other project ideas including:
  - Student-defined projects
  - Software projects suggested by Project: Possibility

Student Project Resource People

- Debbie Kenney – Occupational Therapist
- Doug Schwandt – Mechanical Engineer Consultant
- Mark Felling – Assistive Technology provider and user
- Gary M. Berke – Director of Prosthetics
- Jules Sherman – Designer & Entrepreneur

Other Involved People

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

Contact Information

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Questions?


class dismissed