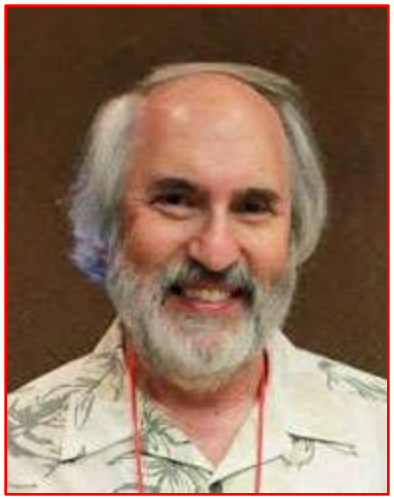
January 5, 2016

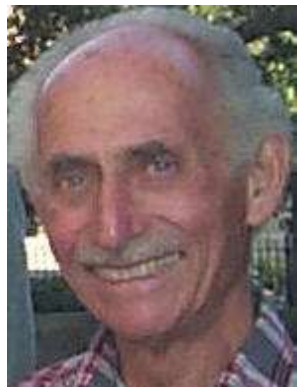
ENGR110/210
Perspectives in Assistive Technology



David L. Jaffe, MS
Instructor

CELEBRATING 10 YEARS

Any questions so far?

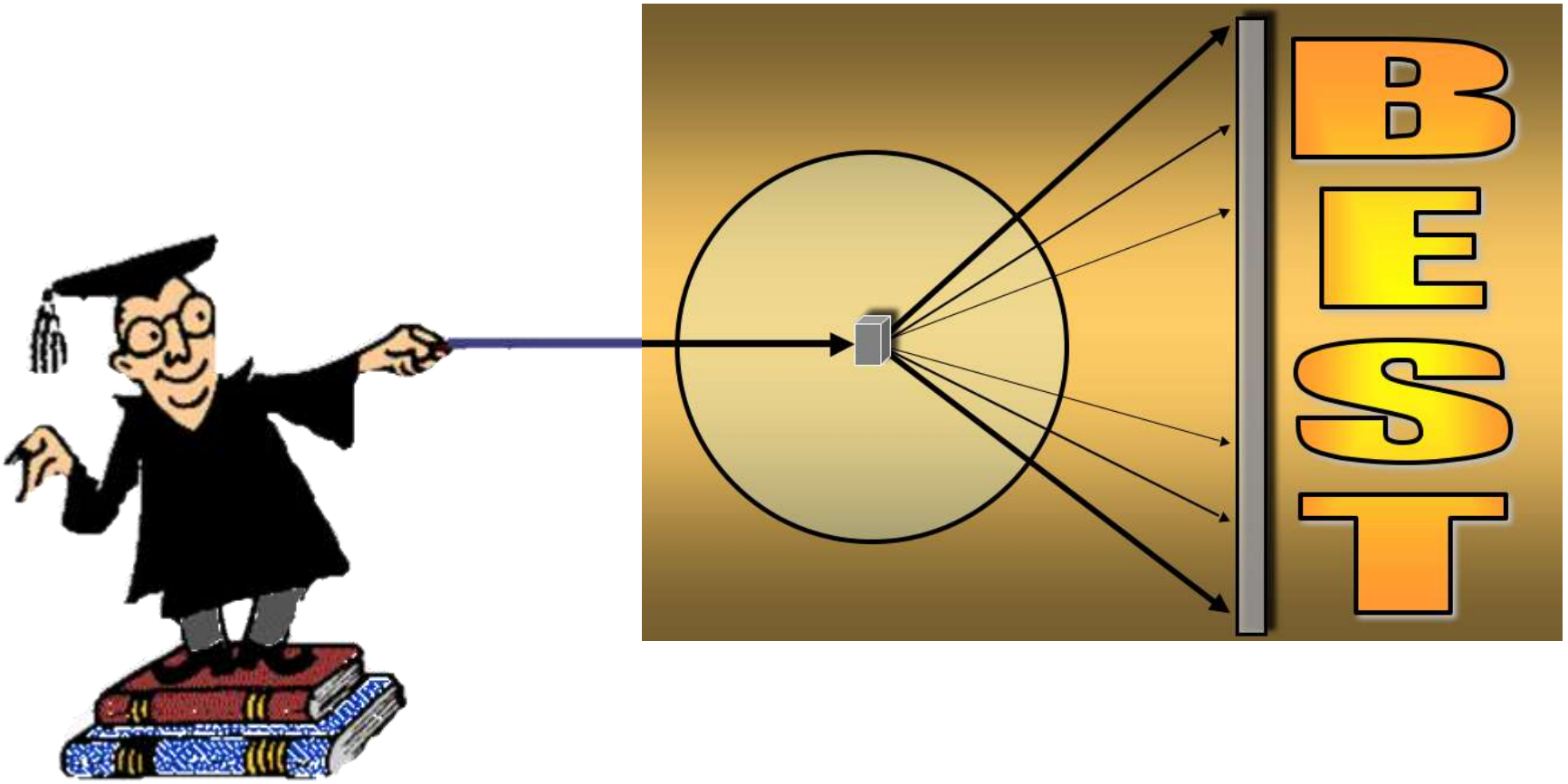


Homage to Prof Kane

“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?*"

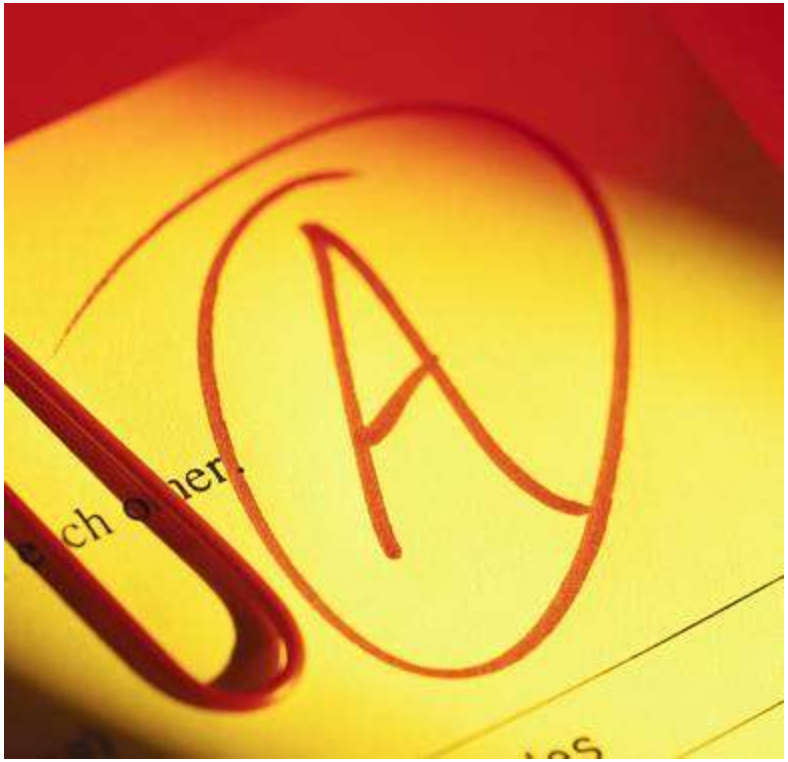
It is the best course I teach



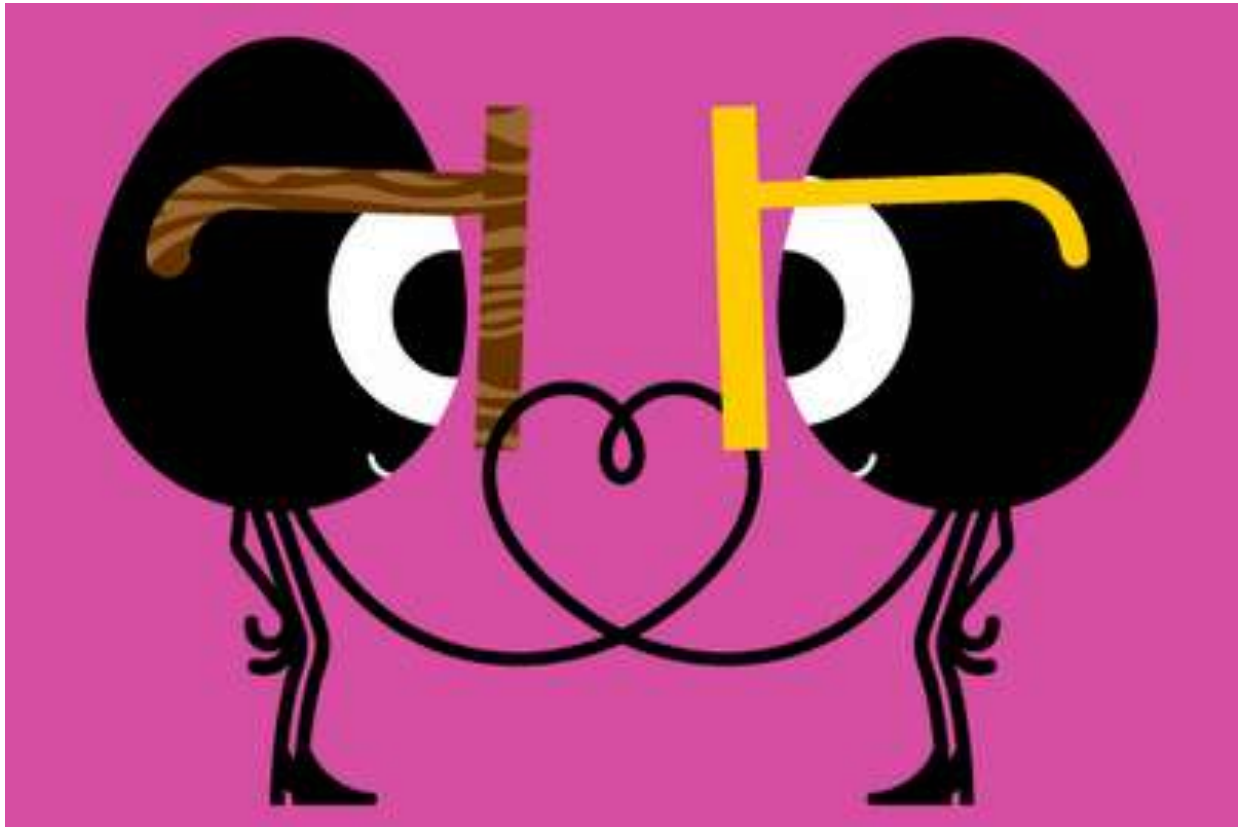
It is the best assistive technology course at Stanford

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

Not everyone gets an “A”



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

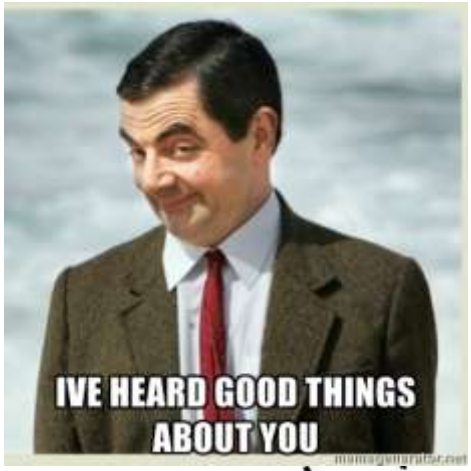
You want to know if your Stanford education and skills can benefit others

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 (Sam Jaffe)
from Ben Casey

Mr. Jaffe, my father

My title is not Professor and I don’t have a PhD or MD

David A. Jaffe

David L. Jaffe, MS
Course Lecturer

“Partly Sunny”

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, BIOE141A, 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

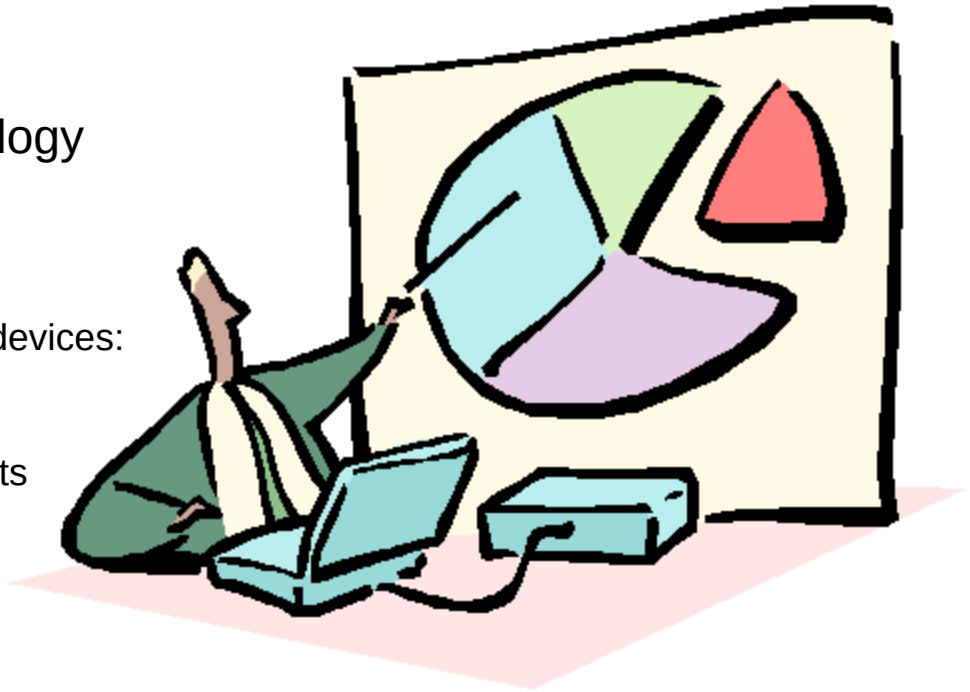
FORTH INTEREST GROUP

fig

Course Organizer & Instructor

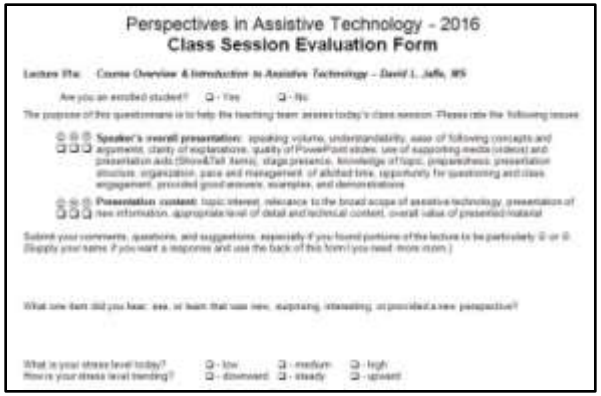
Today's Agenda

- 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
- Administrative items:
  - Student sign-up form
  - Sign in:
    - Students - attendance
    - Community members - signup



Perspectives in Assistive Technology - 2016
Class Session Evaluation Form

Lecture Title: *Course Overview & Introduction to Assistive Technology – David L. Jaffe, MS*

Are you an enrolled student? ❑ - Yes ❑ - No

The purpose of this questionnaire is to help the teaching team assess today's class session. Please rate the following issues:

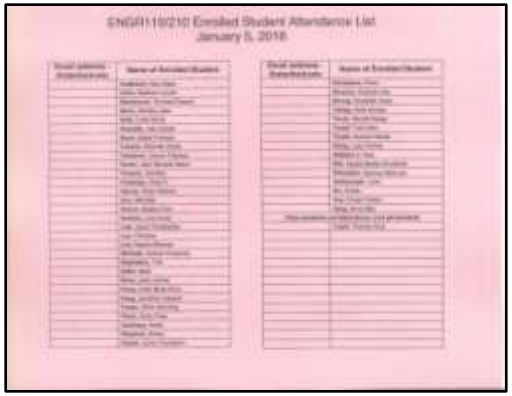
❑❑❑ **Speaker's overall presentation:** speaking volume, understandability, ease of following concepts and arguments, clarity of explanations, quality of PowerPoint slides, use of supporting media (videos) and presentation aids (Show&Tell items), stage presence, knowledge of topic, preparedness, presentation structure, organization, pace and management of allotted time, opportunity for questioning and class engagement, provided good answers, examples, and demonstrations

❑❑❑ **Presentation content:** topic interest, relevance to the broad scope of assistive technology, presentation of new information, appropriate level of detail and technical content, overall value of presented material

Submit your comments, questions, and suggestions, especially if you found portions of the lecture to be particularly ☺ or ☹ (Supply your name if you want a response and use the back of this form if you need more room.)

What one item did you hear, see, or learn that was new, surprising, interesting, or provided a new perspective?

What is your stress level today? ❑ - low ❑ - medium ❑ - high
How is your stress level trending? ❑ - downward ❑ - steady ❑ - upward



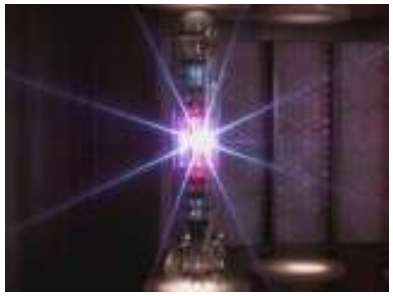
ENGR110/210 Enrolled Student Attendance List
January 5, 2016

2016 ENGR110/210 Enrolled Student Signup Sheet

Name
Email

ENGR110/210 Community Member Signup List
Winter Quarter 2016

Who are these students and why are they smiling?



The Genesis Device

Class Genesis

The Rock Group Genesis

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

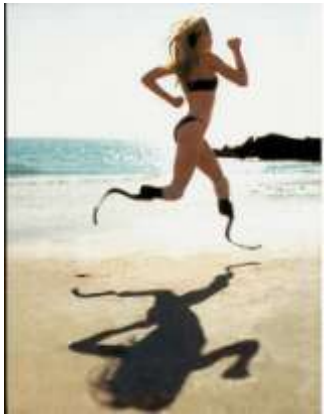
Star Trek Genesis Project

Course Objectives

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

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 kind of course are you expecting?

- Love to study; do homework and problem sets; take quizzes, exams, and finals?
- Relish going through a course text book chapter by chapter?
- Anticipate hearing the professor's voice for the entire quarter?
- Excited about learning something without an obvious practical application or that you will just forget next quarter?
- Ok with spending $$$ on an expensive textbook?
- Want to further improve your ability to study and take exams?
- Enjoy taking notes and smelling a highlighter?

What this Course isn't

- Not a d.school course
- Not a course in Design Thinking or Product Design
- Not just about good ideas and using Post-it notes
- Not about starting a company
- Not about commercializing a device or product
- Not about business or marketing or manufacturing
- Projects typically 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)
- Approved for HumBio Program
- Approved for Learning, Design and Technology (LDT) in the Graduate School of Education
- 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

"Save the World"?
- or -
"Change the World"?

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 three facility tours, a movie screening, 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

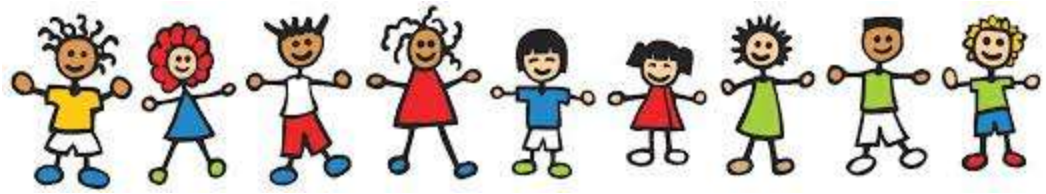
For those working on a project:

- 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

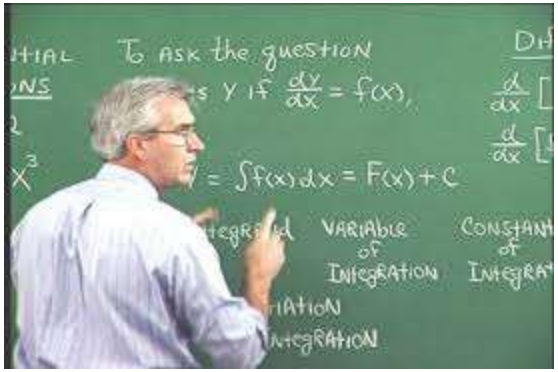
How does this course fit into your life and education?

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



Are These Your Expectations?

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



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

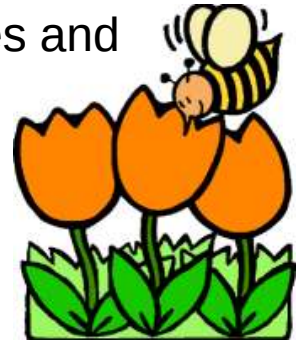
The only equation you may see

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, or
    - engage in an aftermarket functionality / usability design
    - consider a project from the Candidate Individual Project List



Credit Options

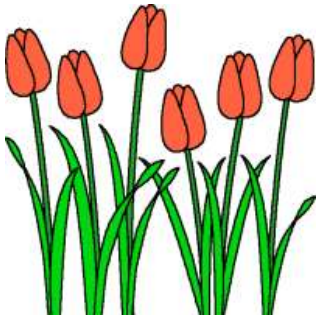
3-unit options:

– 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

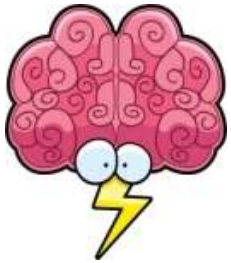
- Your team can be excused from one lecture to work on your project

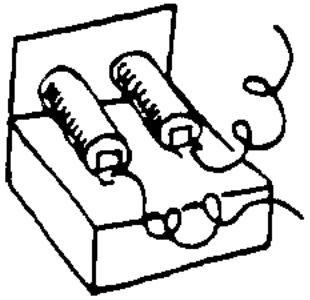


Project Activities

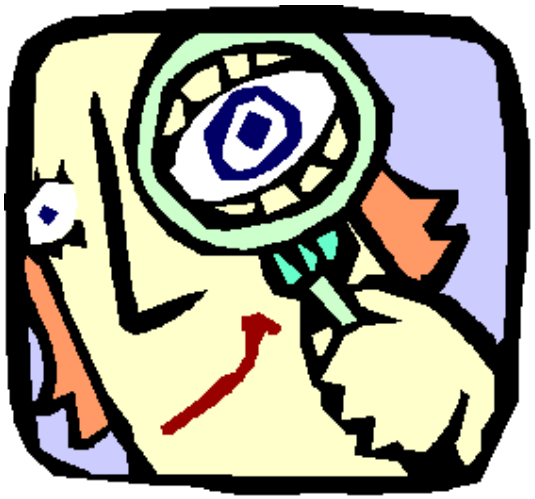
For those working on a **team** project:

- 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, analyze, and iterate 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

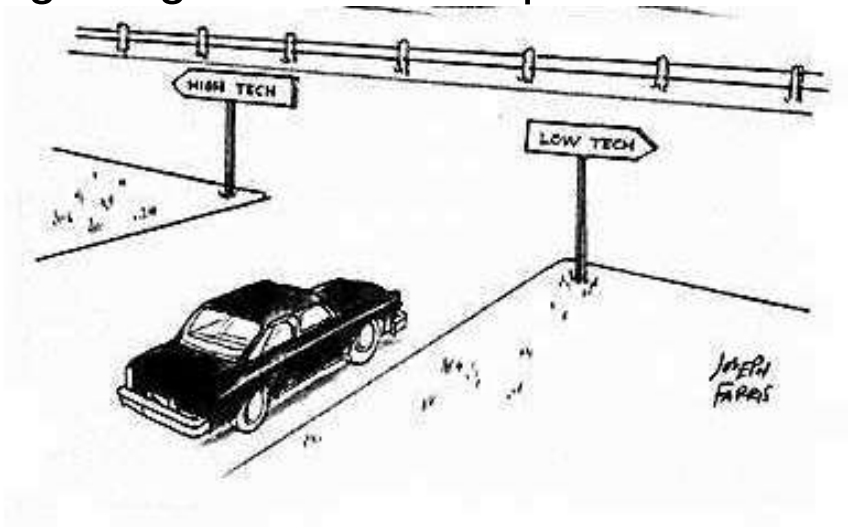




Projects

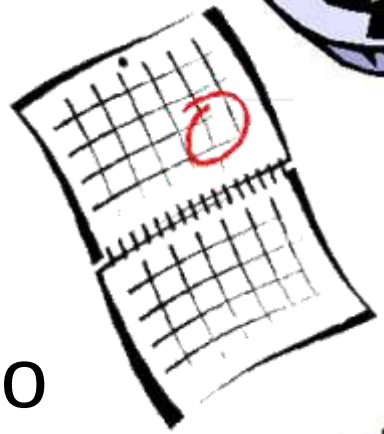


- “Building people” not projects – Prof Larry Leifer
- “Problem first” or “Technology first”
- 8-week prototypes
- Need not be ready-to-market
- Low tech solutions are ok
- Solution benefitting one person is ok
- Experiencing the design process and getting it to work are priorities



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

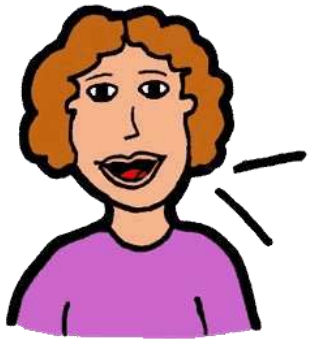
If you have enrolled for <u>three units</u>, you may want to consider taking the course for <u>one unit</u> or <u>waiting until next year</u> if:

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

Take it twice!

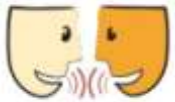
For those working on a **team** project:

- 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

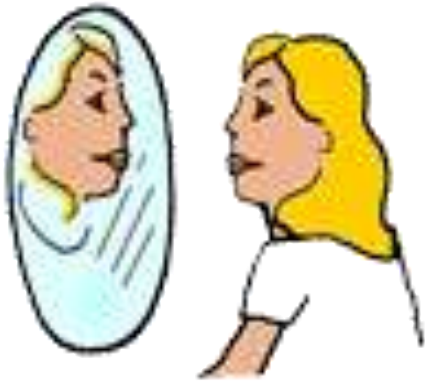
Grading

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

- Mid-term Report & Presentation 20%
- 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 20%
- 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.

Follow-on Activities in ME113 or CS194 or Independent Study or SURI

- 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
- Assistive robotics

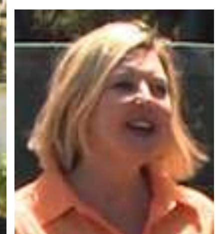
- Video theater
- Everything is a prototype / AT
- In the news
- What would MLK say about AT?
- Suffering & Need
- Ethical dilemmas

Guest Lecturers









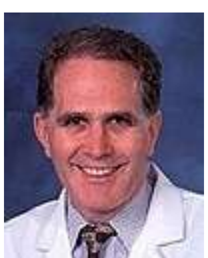






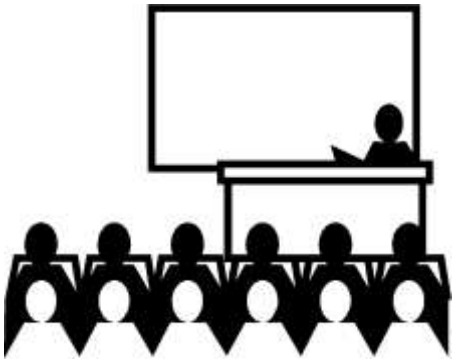










Lecture Titles 1 of 2

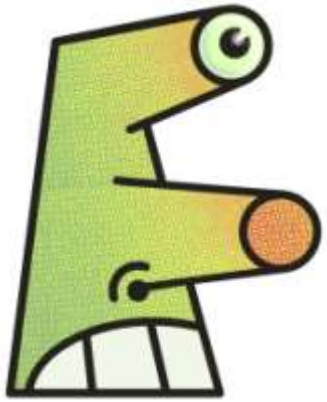
- Course Overview & Introduction to Assistive Technology
- Project Pitches & Team Formation
- Need Finding and Context Discovery for Assistive Technologies
- Bridging the Gap between Consumers and Products in Rehabilitation Medicine
- Perspectives of Stanford Students with a Disability
- Issues of Human Interface Design in Prosthetics
- A Personal and Historical Perspective on Creative Thinking and Design with a Focus on Seniors
- Designing Beyond the Norm to Meet the Needs of All People
- Tour of VA Palo Alto Spinal Cord Injury & Brain Injury Services
- Assistive Technology Faire
- Tour of Motion & Gait Analysis Lab (Menlo Park)

Lecture Titles 2 of 2

- The Design and Control of Exoskeletons for Rehabilitation
- Field Trip to Magical Bridge Playground (Palo Alto)
- Perspectives on Bringing New Assistive Technology Products to Market
- Aesthetics Matter in Assistive Technologies
- From Idea to Market: Eatwell, Assistive Tableware for Persons with Cognitive Impairments
- Movie Screening: Fixed
- Wheelchair Fabrication in Developing Countries

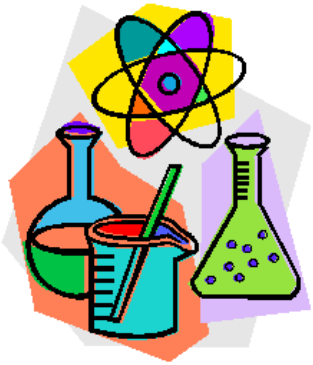
Lectures

- Lecture topics are chosen for their interest, but may not relate to specific projects
- Some class sessions may run overtime - students will be given an opportunity to leave at 5:50pm

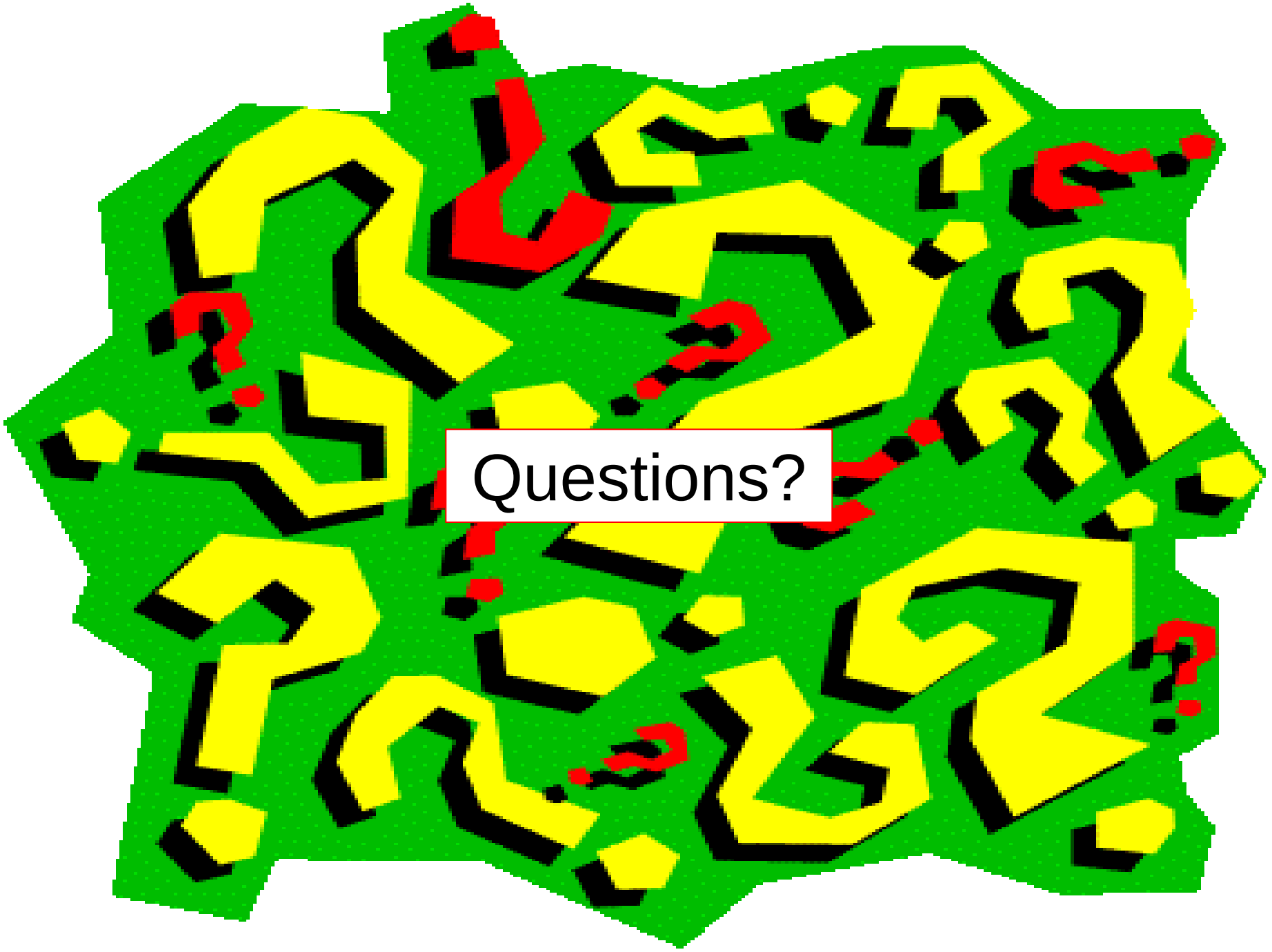


Technology Tidbits

- New products
- Research and development
- Interesting articles



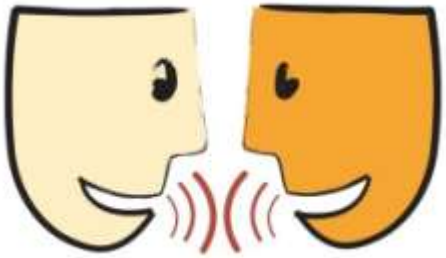
Tell Your Friends


Questions?

Short Break

Break Activities

- Attendance sheet
- 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

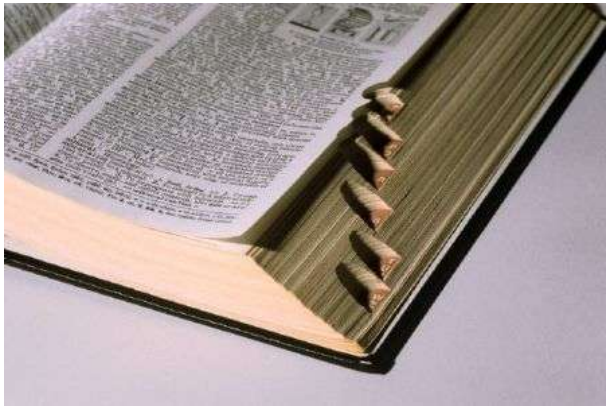
- Definitions
- Broad overview
- What is a disability?
- Range of disabilities

- 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
- Perspectives in Assistive Technology – course and projects

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

ADA Definition

Disability is defined as a individual's physical or mental impairment that substantially limits one or more major life activities

ADA 25
AMERICANS WITH DISABILITIES ACT
1990-2015

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

More Inclusive Definition

Disability = any situation that prevents an individual from taking full advantage of one's talents and life's opportunities including circumstances such as political system, socio-economic status, etc

Disability in the US

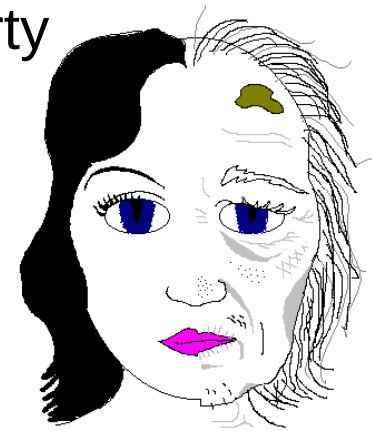
- 71.4 million citizens have activity limitations, ~ 23% of 308 million
  - Reports cite 32 to 78 million (over 1 billion worldwide – 15%)
- 24.1 million individuals have a severe disability
- 11 million children have a disability
- 25% of health care costs relate to disability
- Disability is the largest 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
- >20% of Stanford students are registered with OAE (2015)

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 education and 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

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

A Positive View

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

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

Students!

Is this fair?

Downloadable Skills

Can you fly a B-212 Helicopter?

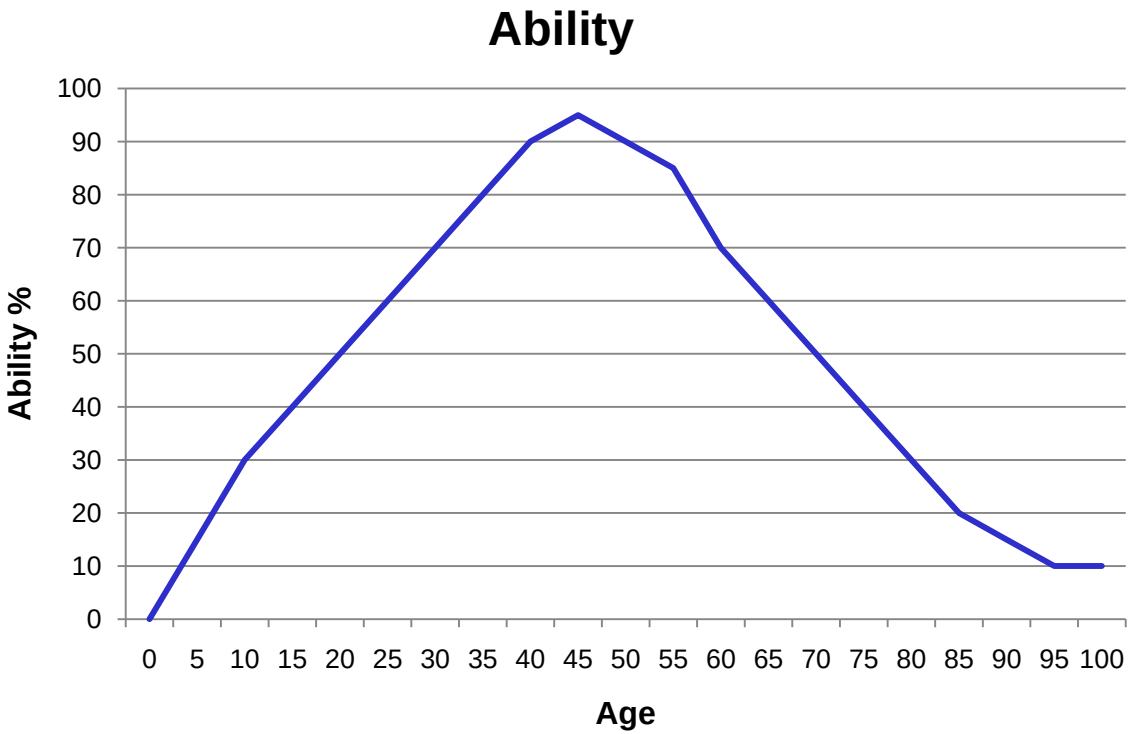
Matrix

Over the Hill at 24

If you're over 24 years of age you've already reached your peak in terms of your cognitive motor performance – and perhaps physical performance

Simon Fraser University

A Disability View of Life



Life events:

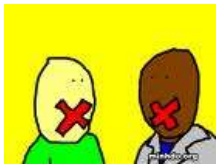
- Birth
- Walking
- Talking
- Bowel control
- Writing
- Dressing
- Balancing
- Coordination
- **Education**
- Driving
- **Financial**
- Marriage
- Children
- Job
- **Physical**
- Benefit society
- Legacy
- Retirement

Ability

Ability = Having the talents and opportunities to contribute to society

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

What is your secondary attribute?

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

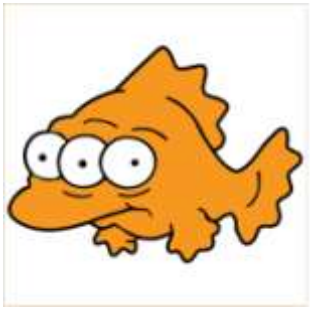
A trio of rodent-Americans
who are experiencing severe visual impairments

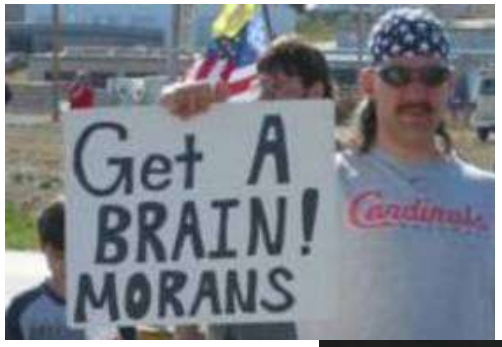
Social and Political Correctness

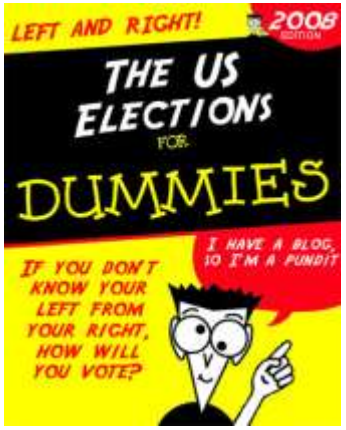
- Shorthand terms:
  - Para, Quad
- Derogatory terms:
  - Gimp, Crip, Spaz, Retard
- Use of terms:
  - “Patient”, “User”, “Subject”, “Consumer”
  - “Suffering from”, “Afflicted with”, “Confined to”, “Victim of”
  - “Diagnosed with”, “Living with”, “Survivor of”, “Recovering from”
  - “Inspiring” – lack of expectation

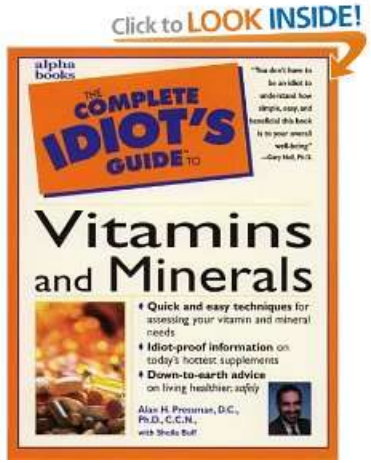
Medical & Common Use

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









Portrayal of People with Disabilities

Professor Alastor
"Mad-Eye" Moody

Famous People with Disabilities

New Inductees

Malala

Brian Stowe

Richard III

Temple Grandin

Tracy Morgan

Robert Van Etten

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

Bob

Blue Man Group

Some people purposely create a unique appearance

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.”

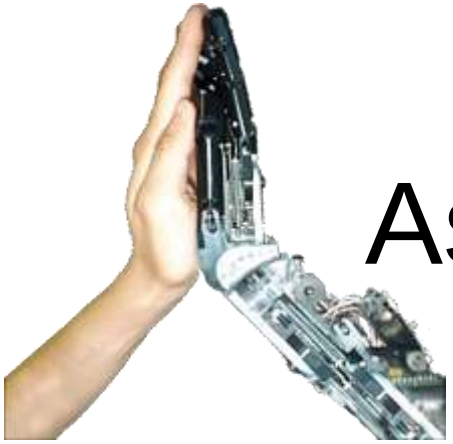
South Carolina Assistive Technology Program - link

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.

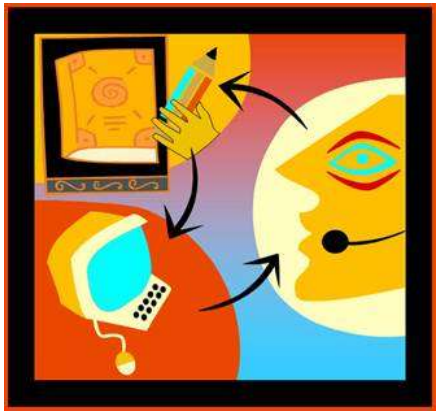
- An AT device is one that has a diagnostic, functional, adaptive, or rehabilitative benefit.

- 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.



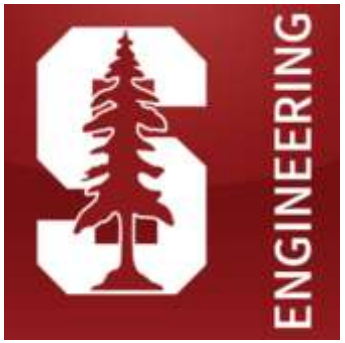
Assistive Technology

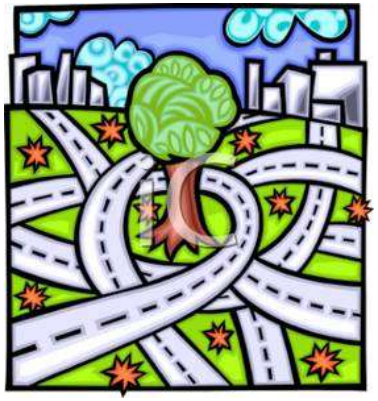
AT devices provide greater independence, increased opportunities for participation, and an improved quality of life for everyone by enabling us to perform tasks that we were formerly unable to accomplish (or had great difficulty accomplishing, or required assistance) through enhanced or alternate methods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

Everything is Assistive Technology!

The universe seems neither benign nor hostile, merely indifferent to the concerns of such **puny creatures** as we are. Carl Sagan

- Technology
- Transportation
- Institutions
- Organized government
- Networks: TV, Radio, Internet, Highway, Electricity, News, Gas, Food, Commerce, Money, Entertainment, Sports, Computers





Assistive Technology

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

- Computers, IoT
- Robotics & Mechatronics
- Nanotechnology
- Medical technologies
- Wearable devices

Assistive Technology

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

- Computers, IoT
- Robotics & Mechatronics
- Nanotechnology
- Medical technologies
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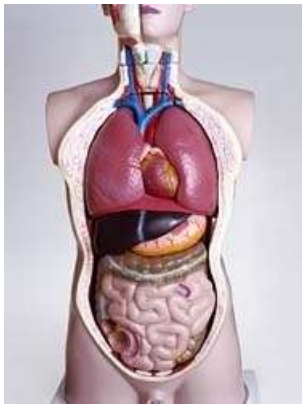
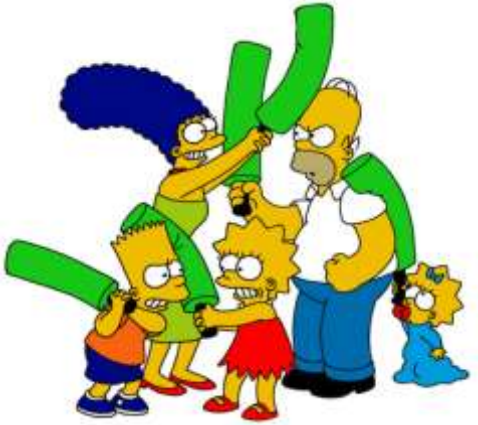
Assistive Technology Workers

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



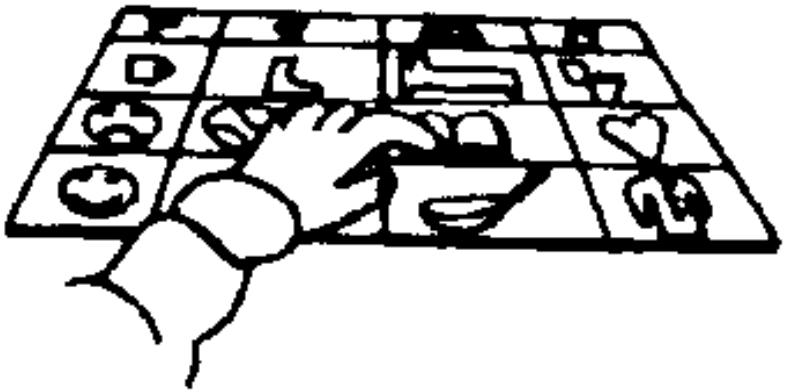
- **Medical model**: Restoration of function caused by disability – through surgery, medication, therapy, and/or retraining

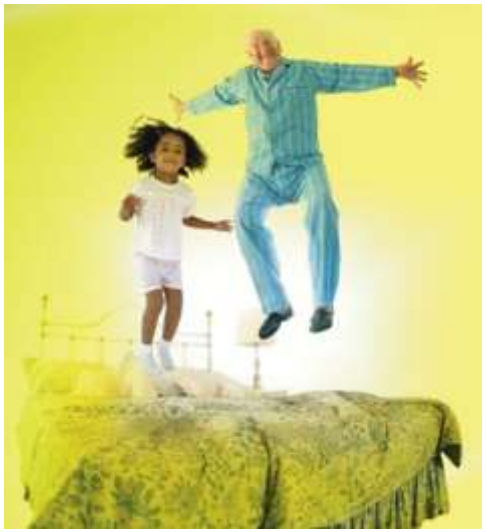
- **More inclusive model**: Includes Assistive Technology

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

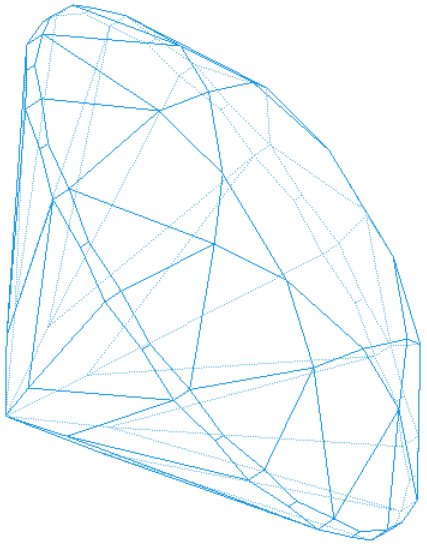
Rehabilitation Engineering

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 (over 1 billion)
- Largest homogeneous group in the US is wheelchair users (several million)
- **Every consumer has unique needs, desires, and aesthetic preferences**
- **Lack of a well-defined mass market means that companies serving individuals with disabilities are small and their products are expensive**

What is Universal Design?

Universal Design

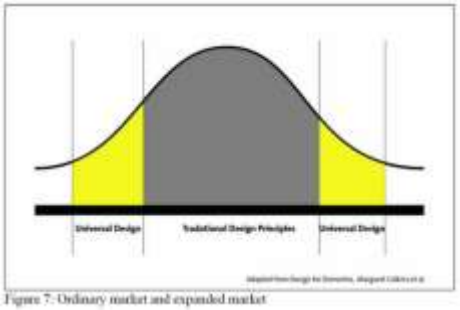


Figure 7: Ordinary market and expanded market

Universal design (often called **inclusive design**) refers to a design strategy meant to produce buildings, products, and environments that are inherently accessible to the greatest number of individuals including older adults, people without disabilities, and people with disabilities.

The term "universal design" was coined by the architect Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life.

Universal Design Examples

Ed Roberts Campus

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.

Example Assistive Technology Devices

Bionic Hand
Luke Arm
Prosthetic Arm Design
Bionic Eye
Joint Implants
Personal Robot
Brain Computer Interface
3-D Printing
Cyborg Beast
Google Glass
Bionic Pets
Essential Tremor
Ralph Fingerspelling Hand
Bionic Fingers
Terminator Arm
iBot Wheelchair
Cochlear Implants
Advanced Prosthetics
Exoskeleton
Mind-controlled Limbs
Project Daniel
Robot Bed / Wheelchair
Designs for People with Dementia
Steampunk Wheelchair
Head Control Wheelchair

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

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

3-D Printing

“Officially launched in January 2012, Robohand creates affordable mechanical prosthetics through the use of 3D printers. Not only that, but it has made its designs open source, so that anyone with access to such printers can print out fingers, hands and now arms as well.”

Project Daniel

“A company called Not Impossible Labs has come up with one of the best uses for 3D printer technology we've ever heard of: printing low-cost prosthetic arms for people, mainly children, who have lost limbs in the war-torn country of Sudan.”

Cyborg Beast

“Jeremy Simon from 3D universe was able to create a 3D-printed hand that he calls the Cyborg Beast. It's a completely mechanical device made from ABS plastic with a series of flexible cords that allow it to act like a real hand. It turned out so well that the patient says he prefers it for day-to-day use.”

Robot Bed / Wheelchair

"A bed that transforms directly into a wheelchair. The mattress is split in half, with one side remaining firmly in place when the other half is separated to form the body of the chair. A patient simply needs to move over a few inches to one side, and with a few adjustments they'll be sitting upright in an powered wheelchair. A single caregiver assists during the transformation process, significantly reducing the burden on staff."

Bed Mode | Shown with the back rest up | The wheelchair separated from the bed

Panasonic

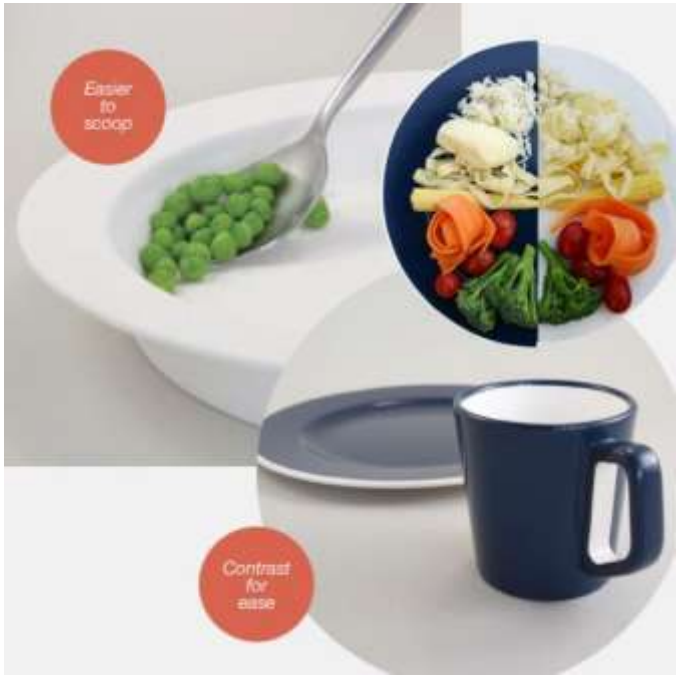
Google Glass

Tammie Lou Van Sant of Santa Cruz is a quadriplegic. She has wanted to take pictures for years and now is able to do it independently using Google Glass – with a nod, swipe, or verbal command.

“I am a New Yorker, a law student, a quadriplegic. With Google Glass I could finally capture my life on my own. I would show the world how to thrive with physical limitations in the most interesting city on the planet. With Glass, paralysis doesn’t have to be paralyzing.” Alex Blaszczuk

Designs for People with Dementia

“A re-thinking of a table setting specifically tailored to help those with cognitive impairment eat without assistance.”



Winner of Stanford Center on Longevity Design Challenge

Bionic Pets

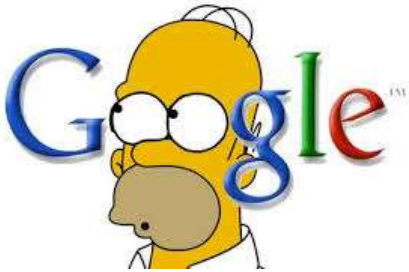
“Sometimes individual animals need our help. Left disabled without fins, flippers, beaks, or tails because of disease, accidents, or even human cruelty, these unfortunate creatures need what amounts to a miracle if they are to survive. Luckily for them, sometimes miracles do happen. Amazing prosthetics made possible by the latest engineering and technology are able to provide just what they need, and scientists are finding that innovations created in the process are benefiting both animals and humans.”

PBS Nature

Steampunk Wheelchair

“Help us construct a retro-futuristic Steampunk Wheelchair for a 14 year old boy with Muscular Dystrophy. We want to modify a wheelchair to take it from ‘functional’ to ‘awesome’ to will help him gain confidence in his interactions by changing the focus of the conversation and expressing his uniqueness and individuality through his mobility device.”

Essential Tremor



“A motion sensor and a tiny computer in Liftware’s rechargeable base work together to analyze movement frequencies and distinguish unintentional tremor from intentional movements like bringing the spoon to your mouth. Based on that feedback, the utensil attachment compensates for the involuntary motion; if the tremor sends the base stabilizer to the left, the spoon head will adjust to the right.”

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.

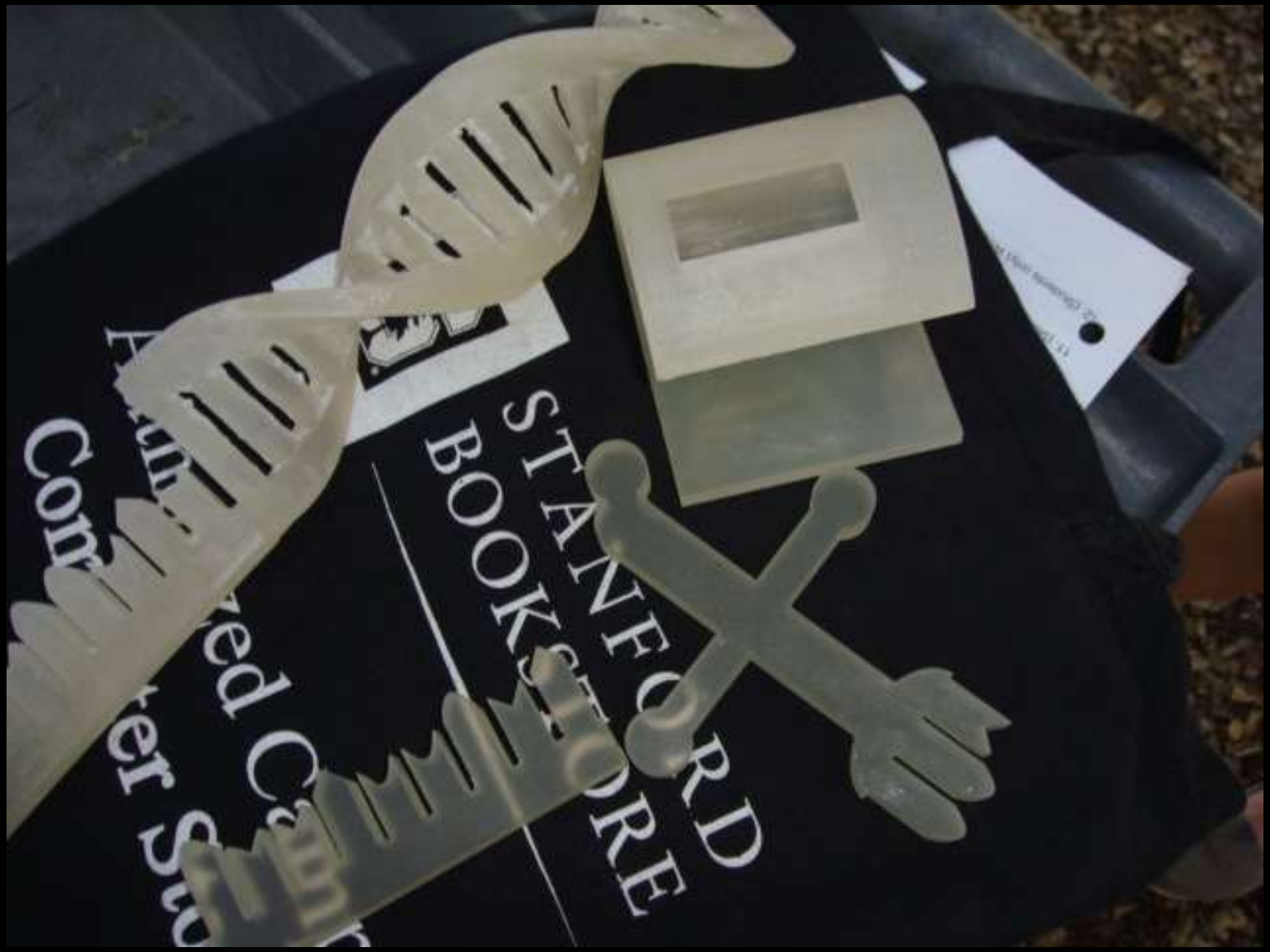
- The **4-Wheel Function** enables the user to climb curbs as high as five inches and to travel over a variety of uneven terrain, such as sand, gravel, grass, thick carpet and other surfaces.

- Johnson & Johnson Independence Technology

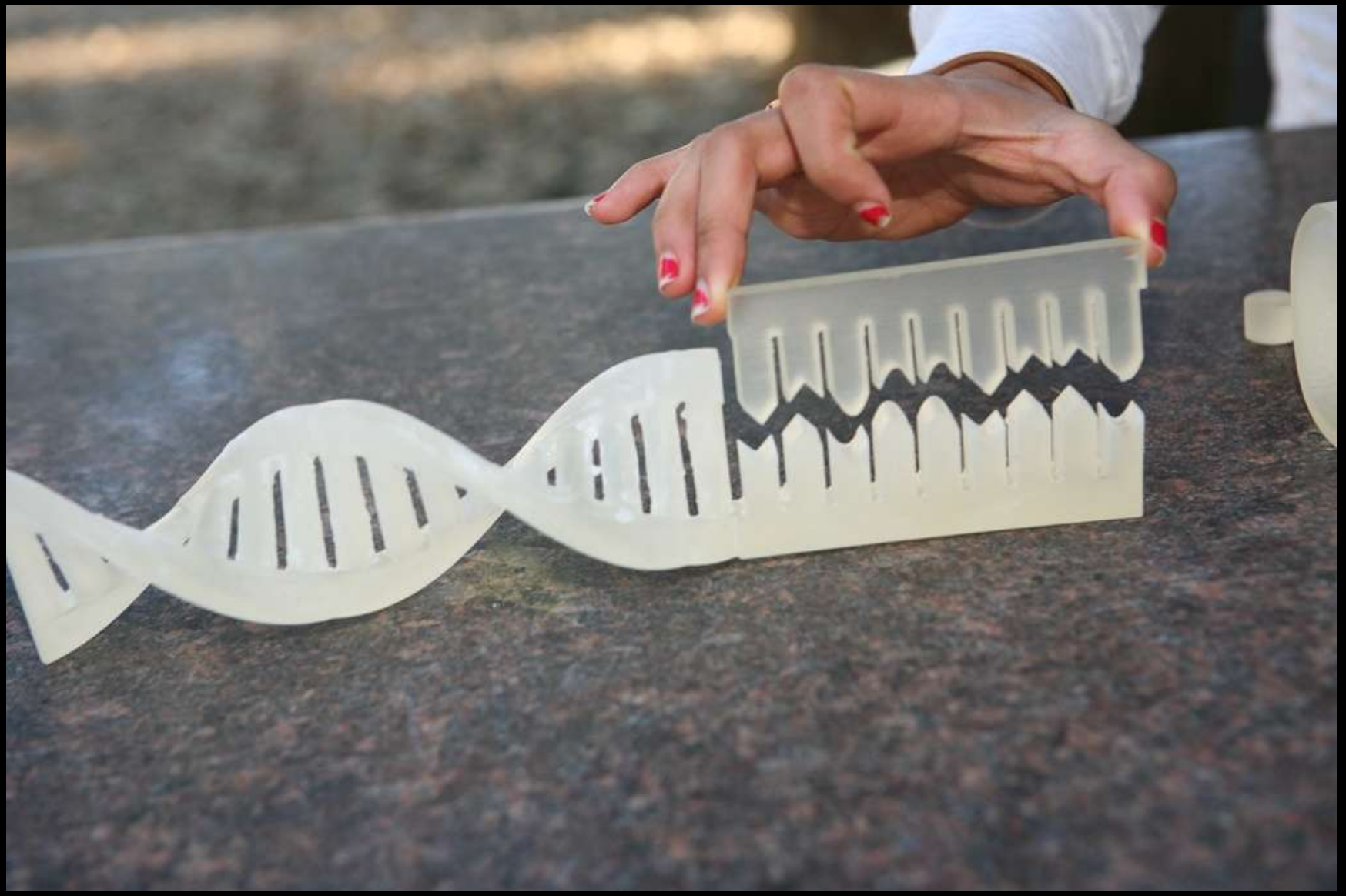
weblink

Student Projects

Matt - EEGrasper



Team Walrus! 3D printed a DNA teaching tool for blind students



Team Walrus! 3D printed a DNA teaching tool for blind students

Testing the prototype with Kartik

Ladidi fabricated a storage solution for her sister

Chase and Alex designed a prosthetic attachment for a triathlete

Austin built an interactive lap tray for his sister

Elizabeth designed a custom bag for a wheelchair user

Student Projects from 2015

LED Zeppelin – Enhanced Visibility Project

Dukes of Hazard – Improved Hand Controls

Dukes of Hazard – Improved Hand Controls

Team Smith – Tactile Map

Team Smith – Tactile Map

Far East Entertainment – Therapy Game for Stroke Survivors

Kanhika & Jenny – Rhombus Rumbles

Guest Lectures, Tours, Faire
2014

Ralf Hotchkiss of Whirlwind Wheelchairs

Evan at the Motion & Gait Analysis Lab

Julie at Palo Alto VA

Eyegaze product at Palo Alto VA’ s Assistive Technology Lab

Henry Evans telepresent at the Assistive Technology Faire

Whill wheelchair at the Assistive Technology Faire

Checking out a prosthetic leg after class

Panel of Stanford students with disabilities

Debbie Kenney and panel of community stroke survivors

Assistive Technology products

“Pitch Day” – Magical Bridge Playground Project

Students practicing brainstorming

Guest Lectures, Tours, Faire
2015

“Pitching” a student team project

June Fisher, an advocate of assistive technology for older adults

Students practice the first step in the design process – getting to know the user

Debbie with stroke survivors

Panel of Stanford students with a disability

Fernanda demonstrating the Ekso-Bionics exo-skeleton

Olenka guides the class through the Magical Bridge Playground

Peter, of Beneficial Designs, talks about accessible sport designs

Allison presents robot research for therapeutic applications

Gary focuses on prosthetic and orthotic design

An afternoon at the VA Palo Alto Assistive Technology Lab

Janhavi assesses a recumbent bicycle at the VA

Erich presents his project's mid-term progress

Alessia tries out a lever drive scooter at the Faire

Katelyn demonstrates retro-reflectivity

Jules discusses aesthetic design of assistive technology devices

Sha designed tableware for people with cognitive impairments

Movie screening of Fixed & Stumped

Ralf demonstrates the requirement for wheelchair ruggedness

“Far East Entertainment” team bask in their project’s success

Molly, a long-time community member

Candidate Team Student Projects

- Solicited from community
- Suggested by Dave
- Student-defined projects

Project Pitches & Team Formation

These projects will be pitched by their suggestors on “Pitch Day”:

- Power for Veterans Project - Jenny Kiratli (by video)
- Authoring Grade School Lessons on Disability and/or Assistive Technology - Maria Barrera
- Support System to Destigmatize Mental Heath in the Black Community - Lynne Sneed
- Knee Brace Project - Gary M. Berke
- Art Tools Project - Wendy Kuehnl & Roger Young
- Aesthetic Brace Fairing Project - Max Conserva
- Educational Design Kit for Children with Disabilities - Greg Brown
- iPhone and Me Project - Sachiko & Paul Berry
- Customize Abby's Scooter Project - Abigayl Tamara
- Horseback Riding at Home Project - Molly Hale
- Jogging and Running Aid for the Blind and Visually Impaired - Brian Higgins
- Project employing the Leap Motion Controller - Elizabeth Ruscitto & Cade Peterson (participation unconfirmed)
- Magical Bridge Playground Project - Olenka Villarreal

Project Pitches & Team Formation

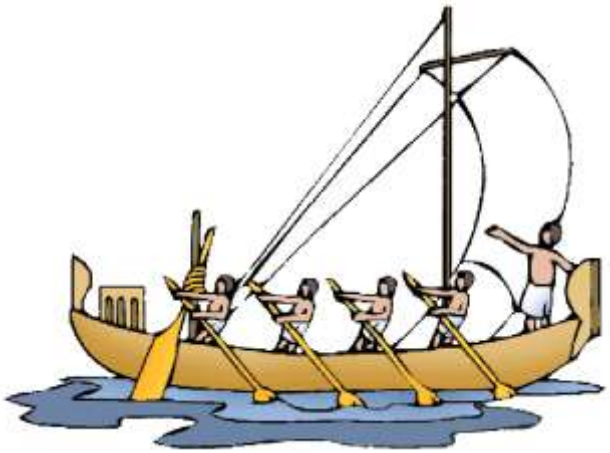
These projects were suggested by others, but will be pitched by Dave:

- Walking Stick Project – Dave for Barbara Beskind
- Improved Walker Project – Dave for Barbara Beskind
- Wheelchair Backup Alert – Dave for Karen Parecki
- Enhanced access to touch screen devices – Dave for Deane Denney
- Enhanced bed controls for veterans with spinal cord injury – Dave for Deane Denney

Project Pitches & Team Formation

Dave’ s suggested projects:

- Creative Expression
- Designing Your Afterlife
- Student-defined projects



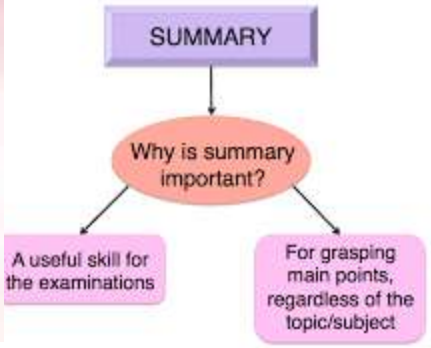
Student Project Resource People

- Debbie Kenney – Occupational Therapist
- Doug Schwandt – Mechanical Engineer Consultant
- Gary M. Berke – Director of Prosthetics
- Jules Sherman – Designer & Entrepreneur

Eighteen PRL Teaching Assistants!

Other Involved People

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



- Flexible course focusing on confidence and enhancing professional skills
- Lectures, projects, field trips, movie screenings, faire, mid-term & final presentations and reports, project demonstration
- Opportunities for in-class participation
- Lots of assistive technology products, research, student projects, and remaining challenges
- Assistive technology benefits everyone
- Everything is assistive technology!

Contact Information

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Questions?


class dismissed