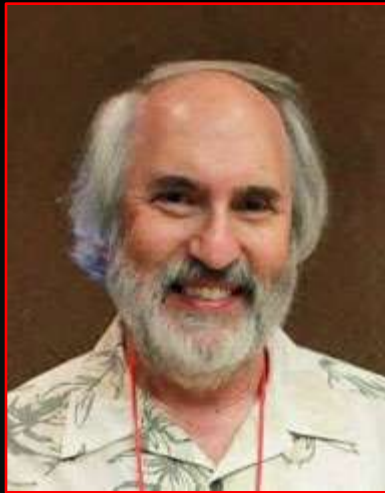


January 10, 2017



ENGR110/210

Perspectives in Assistive Technology



David L. Jaffe, MS
Instructor





Any questions so far?



Homage to Prof Kane

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

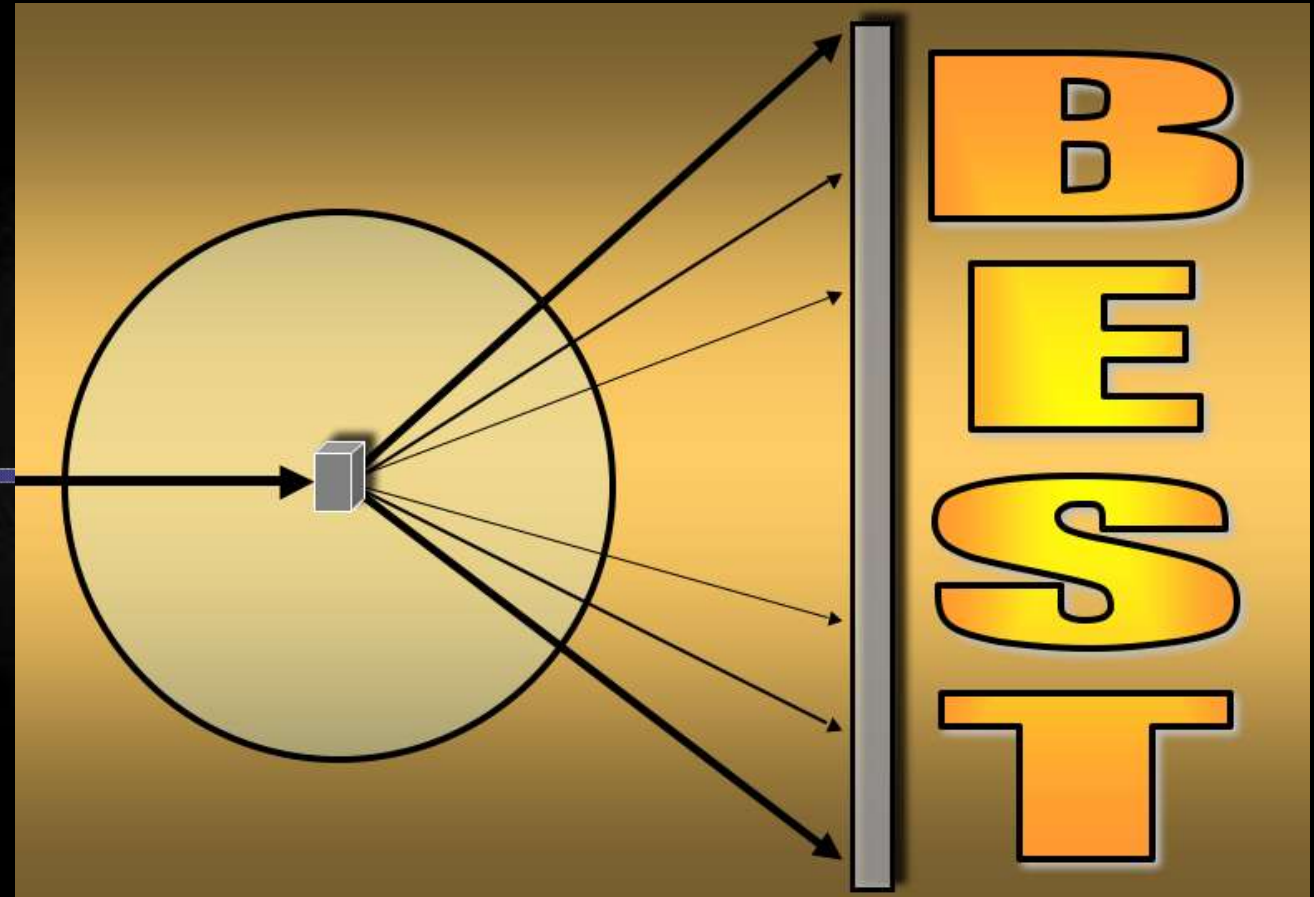


- First day of class
- New course
- New instructor

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



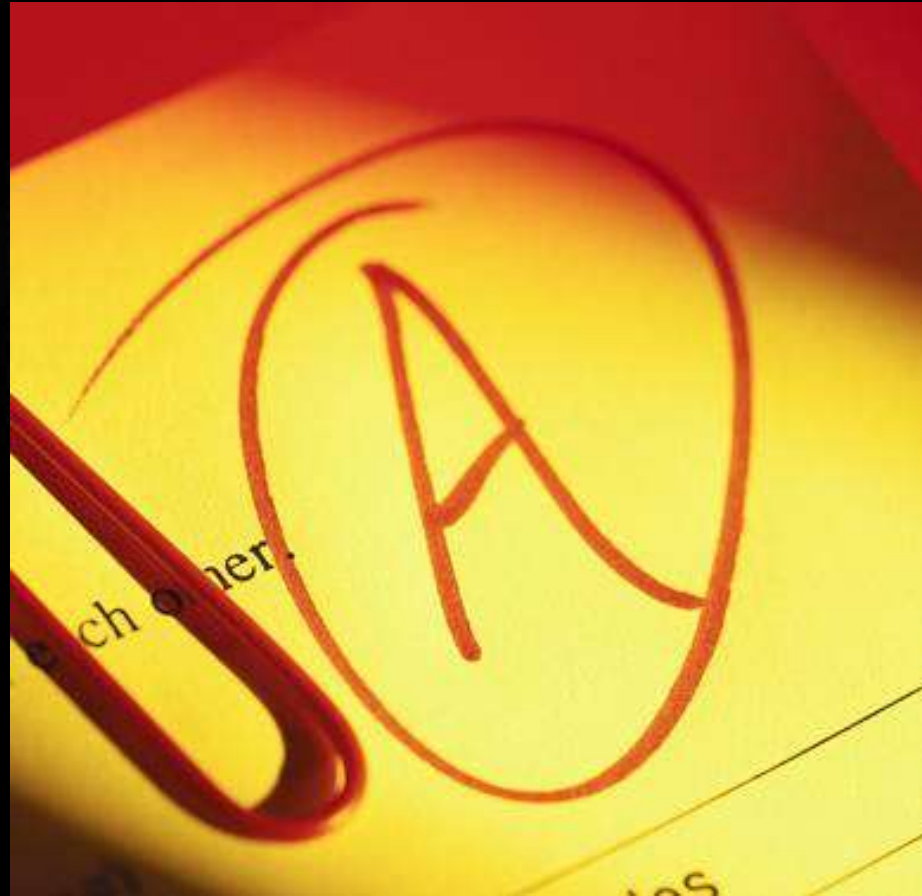
This is the best course I teach



This is the best assistive technology course at Stanford

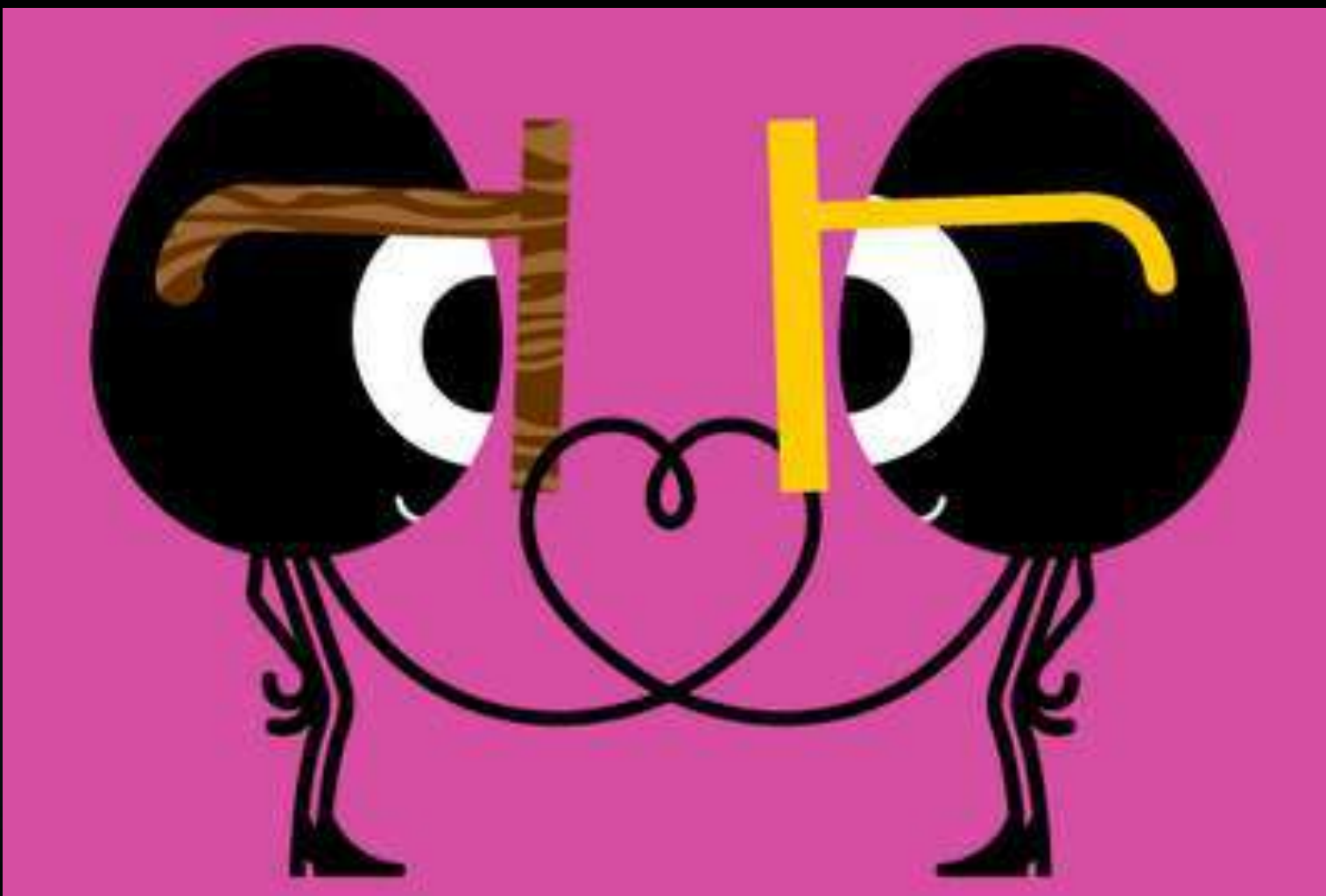


Everyone who has taken this course
has earned a very good grade



Not everyone gets an "A"

Meet your love connection



The fame and notoriety

The image shows the Stanford University homepage. At the top, there is a red navigation bar with the Stanford logo and the text "STANFORD UNIVERSITY". Below this, there are several menu items: "Home", "About", "Admissions", "Academics", "Research", and "Life On Campus". The main content area features a large banner image of a Stanford building. Below the banner, there are several sections: "EVENTS" with a list of upcoming events, "UNIVERSITY NEWS" with a featured article titled "Eclectic blend" and another titled "Analyzing land use", and "OR STANFORD.EDU" with a grid of links to various university resources. The layout is clean and professional, with a clear emphasis on news and events.

The image shows the Stanford Alumni website. At the top, there is a red navigation bar with the Stanford logo and the text "STANFORD ALUMNI". Below this, there is a large banner image of the Stanford Memorial Arch. The main content area features a "Welcome!" message with a search bar and a "Find an alum" button. Below this, there are several sections: "Alumni Center", "Alumni Network", "Career Services", "Clubs", "Discussion groups", "Diversity", "Events", "For students", "Lifelong learning", "The Loop", "Membership", "My Class", "Reunions", "Sierra Camp & Chalet", "Stanford links", "Stanford magazine", "Travel/Study", and "Volunteering". The layout is clean and professional, with a clear emphasis on alumni resources and community.



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

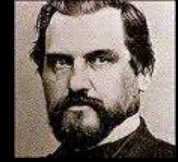


Service Learning



Local Community

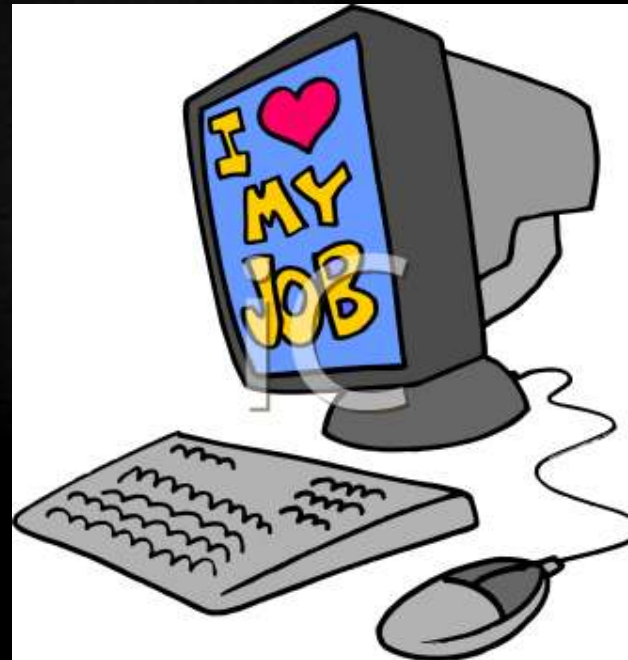
You want to know if your Stanford education and skills can benefit others



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



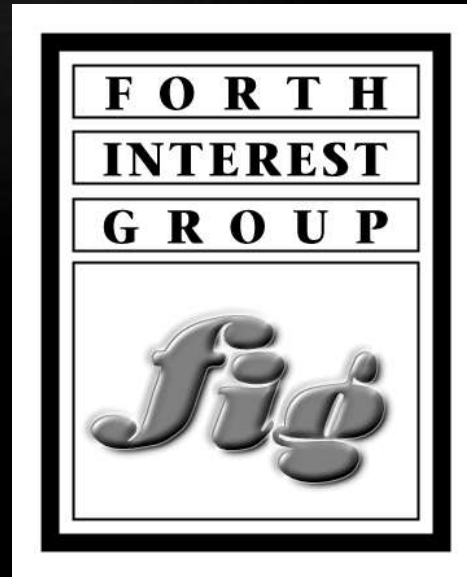
- Stanford:

- ME113, ME218, ME294, BioE141, 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



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



Who are these students and why are they smiling?



Class Genesis

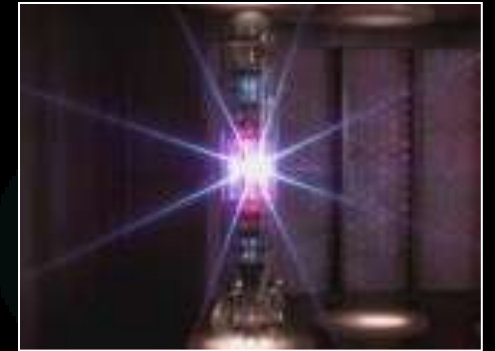


- ▶ How this course came about
- ▶ Why is it being offered

Star Trek Genesis Project



The Genesis Planet



The Genesis Device



The Rock Group Genesis

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
- ▶ **Practice leadership & organization**



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
- ▶ **Leadership & Organization**



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**?

**Expectations are
premeditated
resentments.**

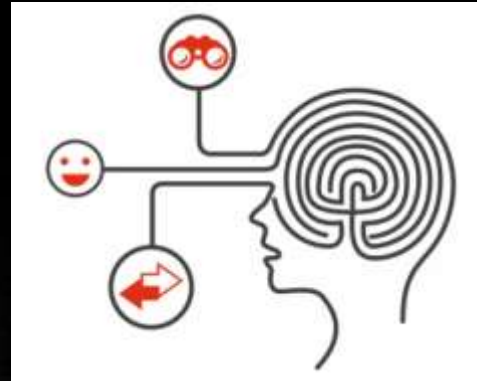
- Alcoholics Anonymous

DANGER

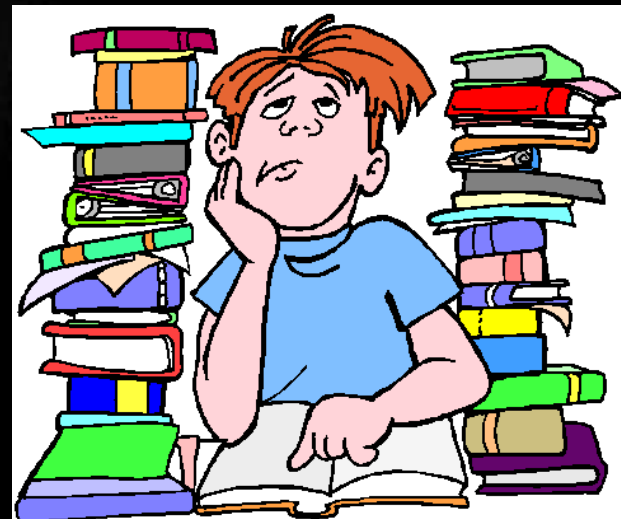
EXPECTATIONS

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:
 - ▶ Understanding the problem
 - ▶ Brainstorming
 - ▶ Prototyping, testing
 - ▶ Refining, iterating
 - ▶ Communicating
- ▶ Working with a team
- ▶ Partnering with local community
- ▶ Previewing your professional life



Course Credentials



- ▶ Certified Service Learning Course [**Cardinal Course**] (Haas Center for Public Service)
- ▶ 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*



THE UNOFFICIAL STANFORD BLOG

the blog events features about us sign up free stuff



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

TUSB 2011 Winter Course Guide: spice up your courseload!

Posted by **Erin** on November 2, 2010 1:50AM



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!**

Shake Your Groove Thing: what

better way to **shake off** the winter doldrums (literally) than with some fun dance classes? Here's a small sampling of the Dance Department's awesome offerings.

- **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

Burst the Bubble: field trip-based



Welcome to the Farm

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

“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 film 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**



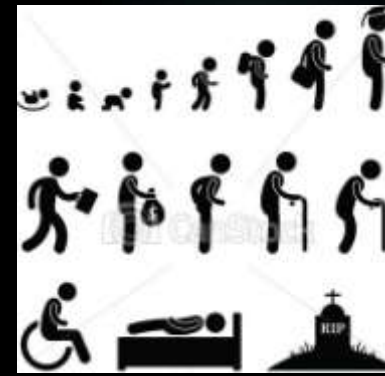
For students working on a project:



- ▶ 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

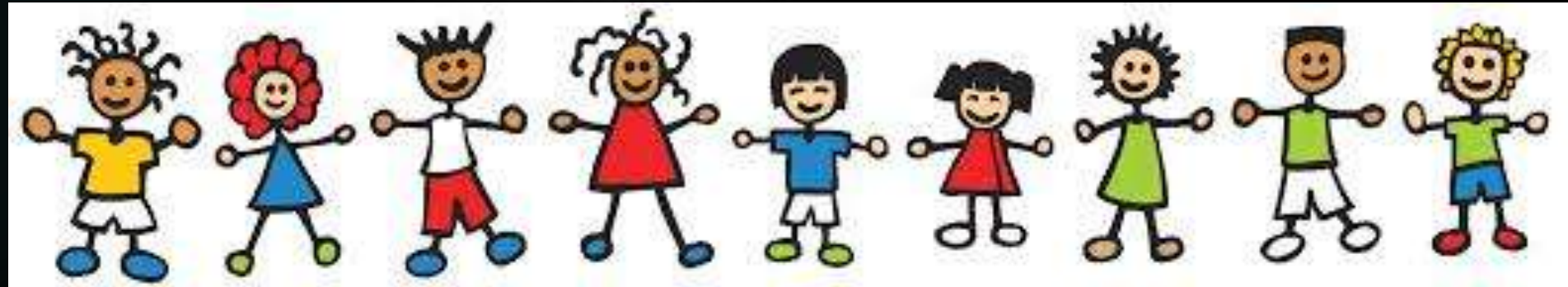


Your Experience



How does this course fit into your life and education?

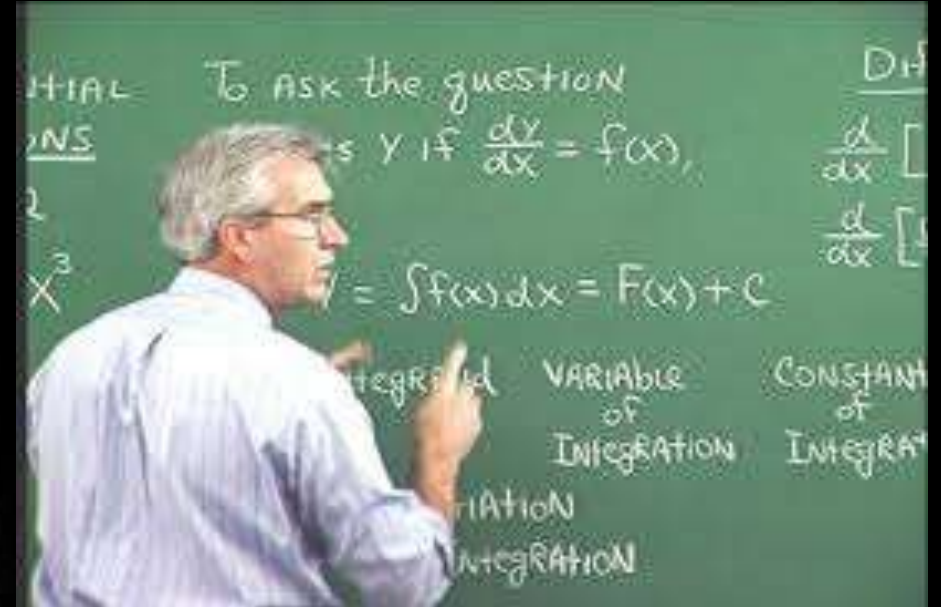
- ▶ not reliving past experiences
- ▶ not just another course
- ▶ previewing your future professional life



Are These Your Expectations?



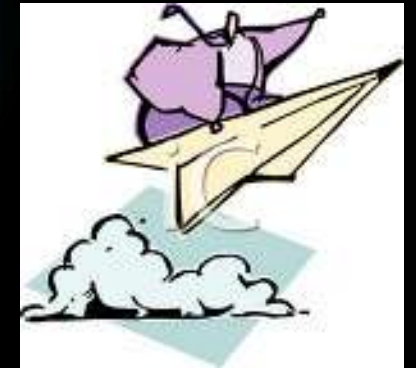
- ▶ Equations, derivations, proofs
- ▶ Chapter-by-chapter
- ▶ Disability-by-disability



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

The only equation you may see

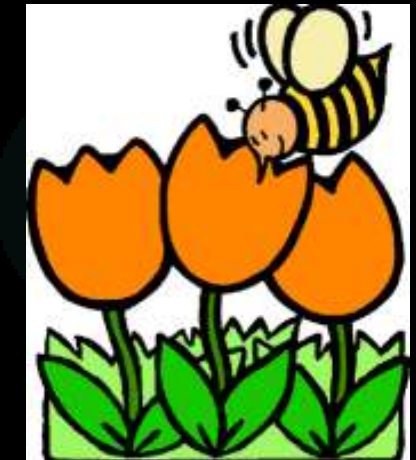
Credit Options



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



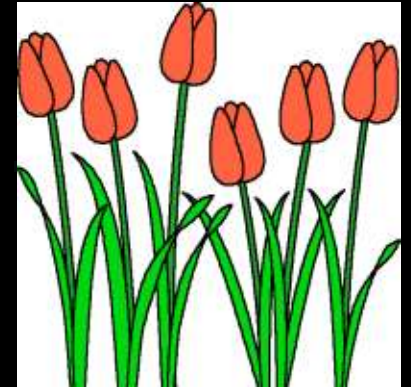
Credit Options



3-unit options:



- ▶ attend ENGR110/210 lectures, participate in a **team project**, no project continuation in the Spring Quarter
- ▶ attend ENGR110/210 lectures, participate in a **team project**, continue with **independent study** (ME191) effort in the Spring Quarter (with approval of your faculty advisor)
- ▶ attend ENGR110/210 lectures, participate in a **team project**, (optionally continue with ME113 (with your entire team) or CS194 in the Spring Quarter)
- ▶ Your team can be excused from one lecture to work on your project

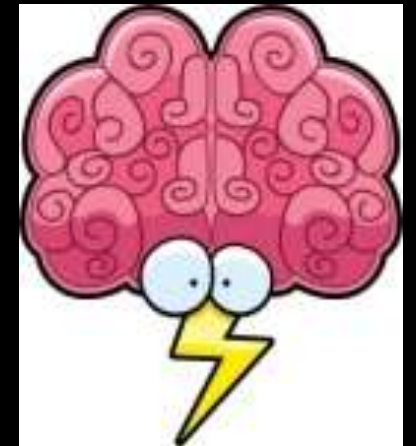


Project Activities

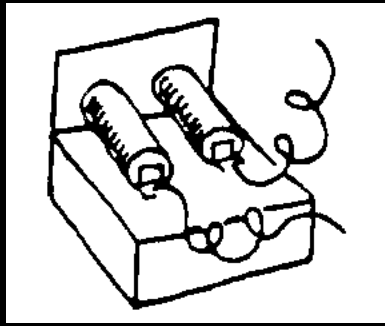


For those working on a **team project**:

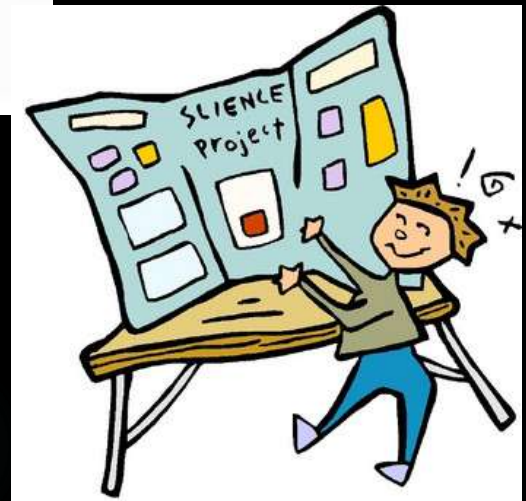
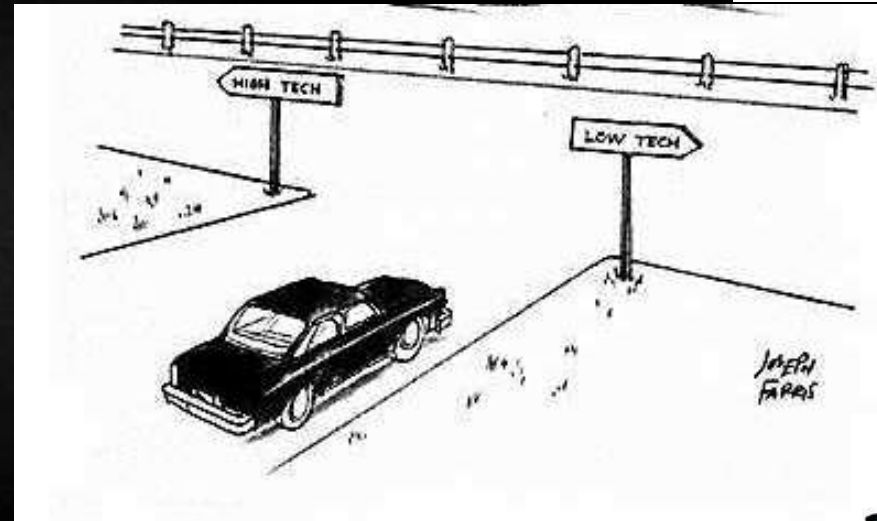
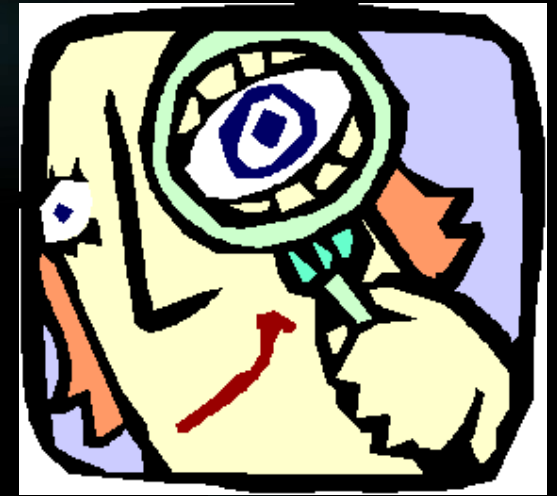
- ▶ Review candidate team project descriptions & pitches
- ▶ Select a project
- ▶ Form a team
- ▶ Investigate **project problem** with an individual with a disability
- ▶ Evaluate the situation to further **understand the problem**
- ▶ **Gather relevant background information** for the project, including 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

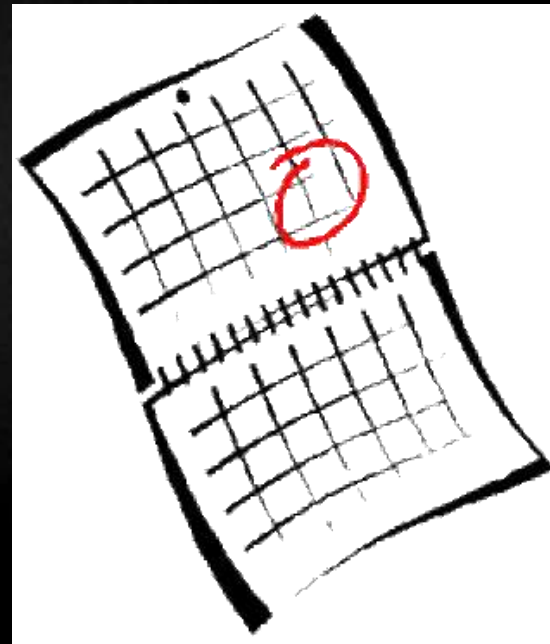


- ▶ “Building people” not projects – Prof Larry Leifer
- ▶ “Problem first” or “Technology first”
- ▶ 8-week prototypes
- ▶ Need not be ready-to-market
- ▶ Low tech solutions are ok
- ▶ Solution benefitting one person is ok
- ▶ Experiencing the design process and getting it to work are priorities



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



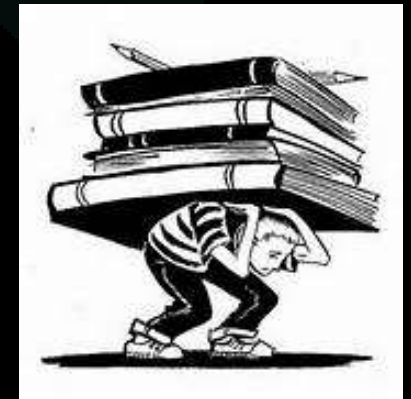
Why you may want to



If you have enrolled for three units, you may want to consider taking the course for one unit or waiting until next year 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!

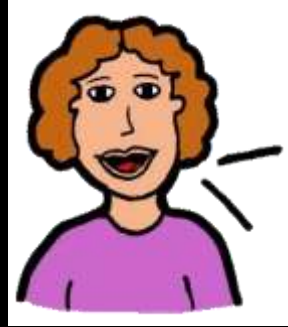


Assignments



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

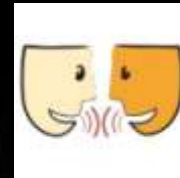


Assignments



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.



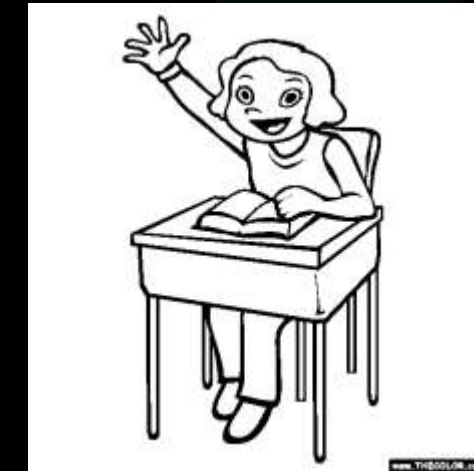
Grading



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.

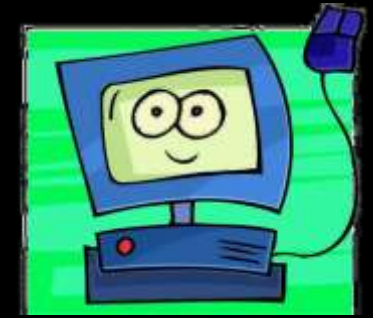


Optional Follow-on Activities: ME113 or CS194 or Independent Study or SURI

- ▶ 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

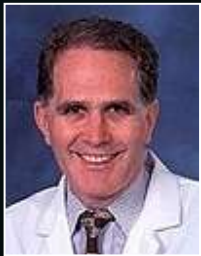


- ▶ Who is Disabled?
- ▶ The Upside of Failure!
- ▶ Antique technology
- ▶ New technology
- ▶ AT device review
- ▶ Famous people with disabilities
- ▶ Assistive robotics

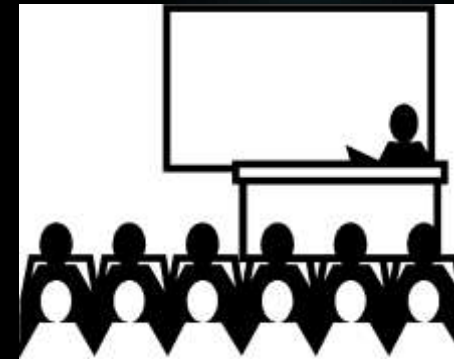
- Video theater
- Everything is a prototype / AT
- In the news
- What would MLK say about AT?
- Suffering & Need
- Ethical dilemmas
- Marketing terms
- Accessibility



Guest Lecturers



Lecture Titles 1 of 2



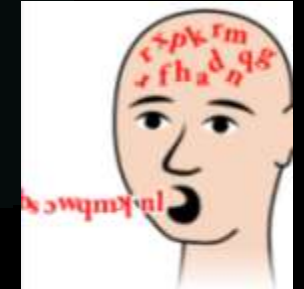
- ▶ Course Overview & Introduction to Assistive Technology
- ▶ Project Pitches & Team Formation
- ▶ Needfinding and Assistive Technologies
- ▶ Bridging the Gap between Consumers and Products in Rehabilitation Medicine
- ▶ Perspectives of Stanford Students with a Disability
- ▶ Issues of Human Interface Design in Prosthetics
- ▶ The Design and Control of Exoskeletons for Rehabilitation
- ▶ Tour of Magical Bridge Playground (Palo Alto)
- ▶ Designing Beyond the Norm to Meet the Needs of All People
- ▶ Tour of VA Palo Alto Spinal Cord Injury and Brain Injury Services (Palo Alto)



Lecture Titles 2 of 2



- ▶ Assistive Technologies: The Benefits for Returnees
- ▶ Humanistic Intelligence and HARCAD for Assistive Technologies
- ▶ Collaboration: From User-based Design to Co-design
- ▶ Aesthetics Matter in Assistive Technologies
- ▶ Assistive Technology Faire
- ▶ Tour of Motion & Gait Analysis Lab (Menlo Park)
- ▶ Role of Aesthetics in the Design of Assistive Technology Devices
- ▶ Movie Screening
- ▶ Wheelchair Fabrication in Developing Countries



Lectures

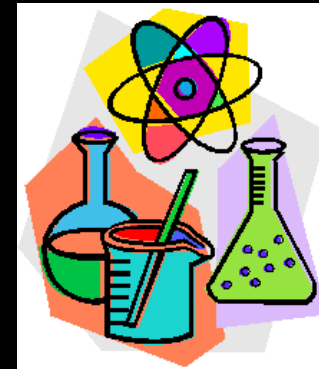
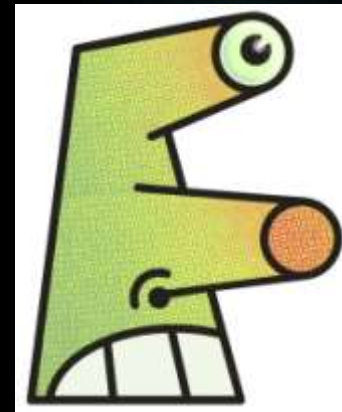
- ▶ Lecture topics are chosen for their interest, but may not relate to specific projects
- ▶ Some class sessions may run overtime - students will be given an opportunity to leave at 5:50pm



Technology Tidbits

Weekly Readings

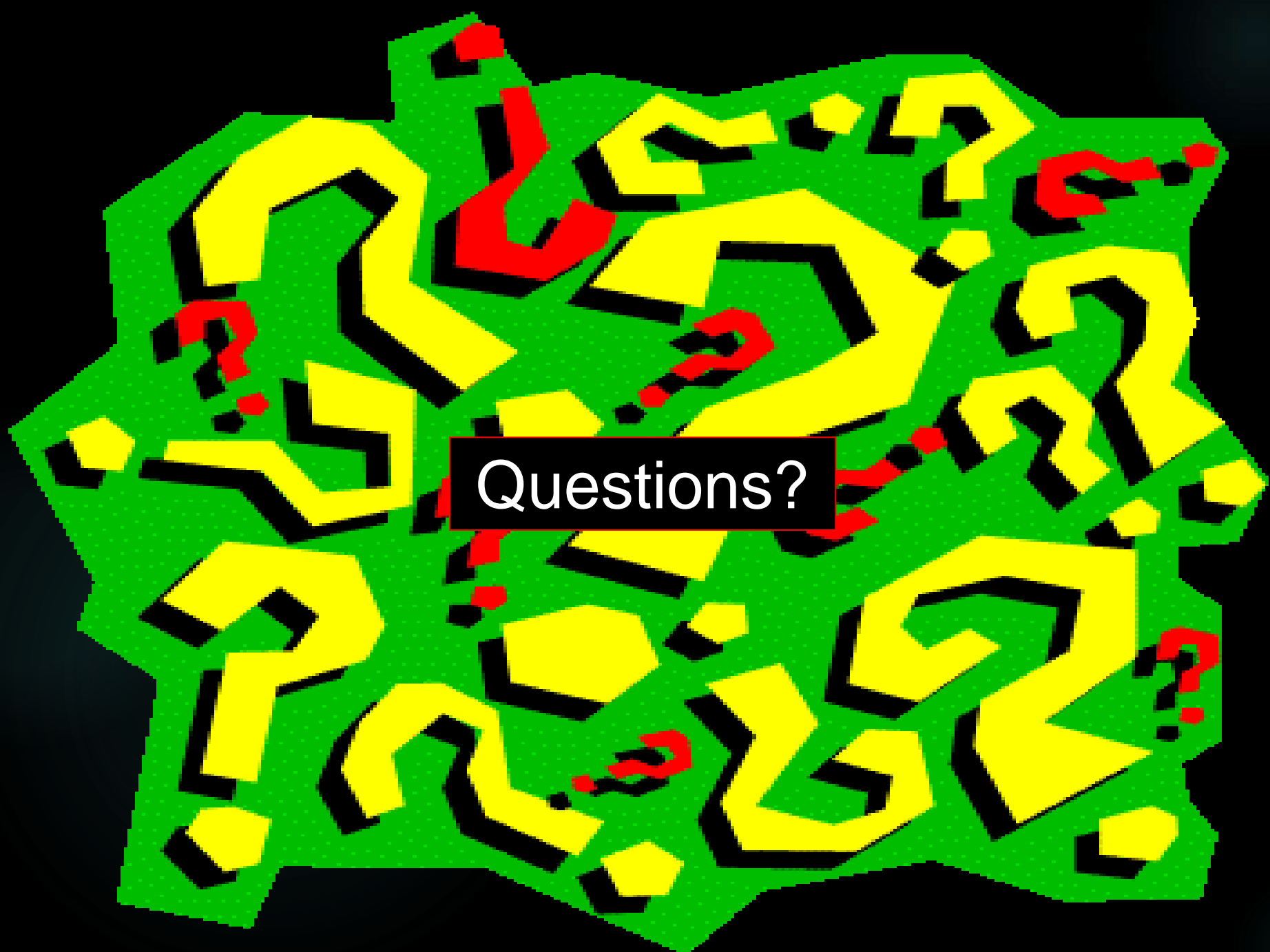
- ▶ New products
- ▶ R&D
- ▶ Interesting articles



Tell Your Friends



Openings for 1 credit options: seminar or individual project, **not 3 credit team projects**



Questions?

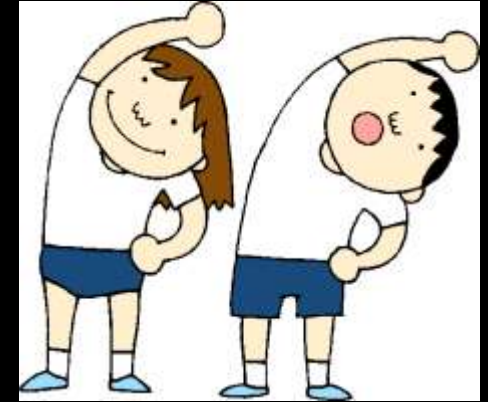
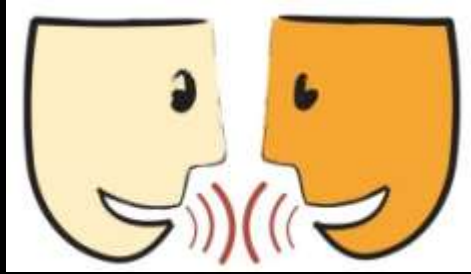


Short Break



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

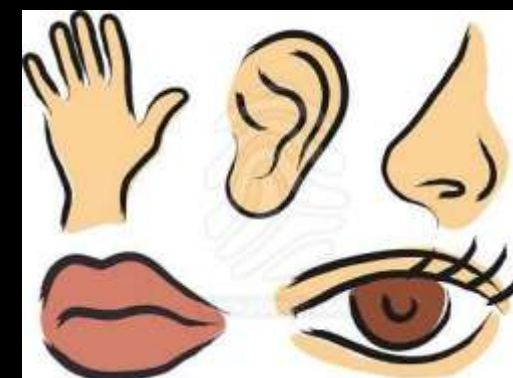
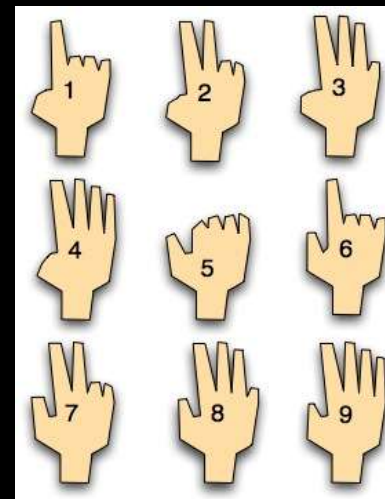




Introduction to Assistive Technology



- ▶ 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 - student 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 **percent disabled** 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 performing 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





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 is 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 globally - 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, gender, 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!



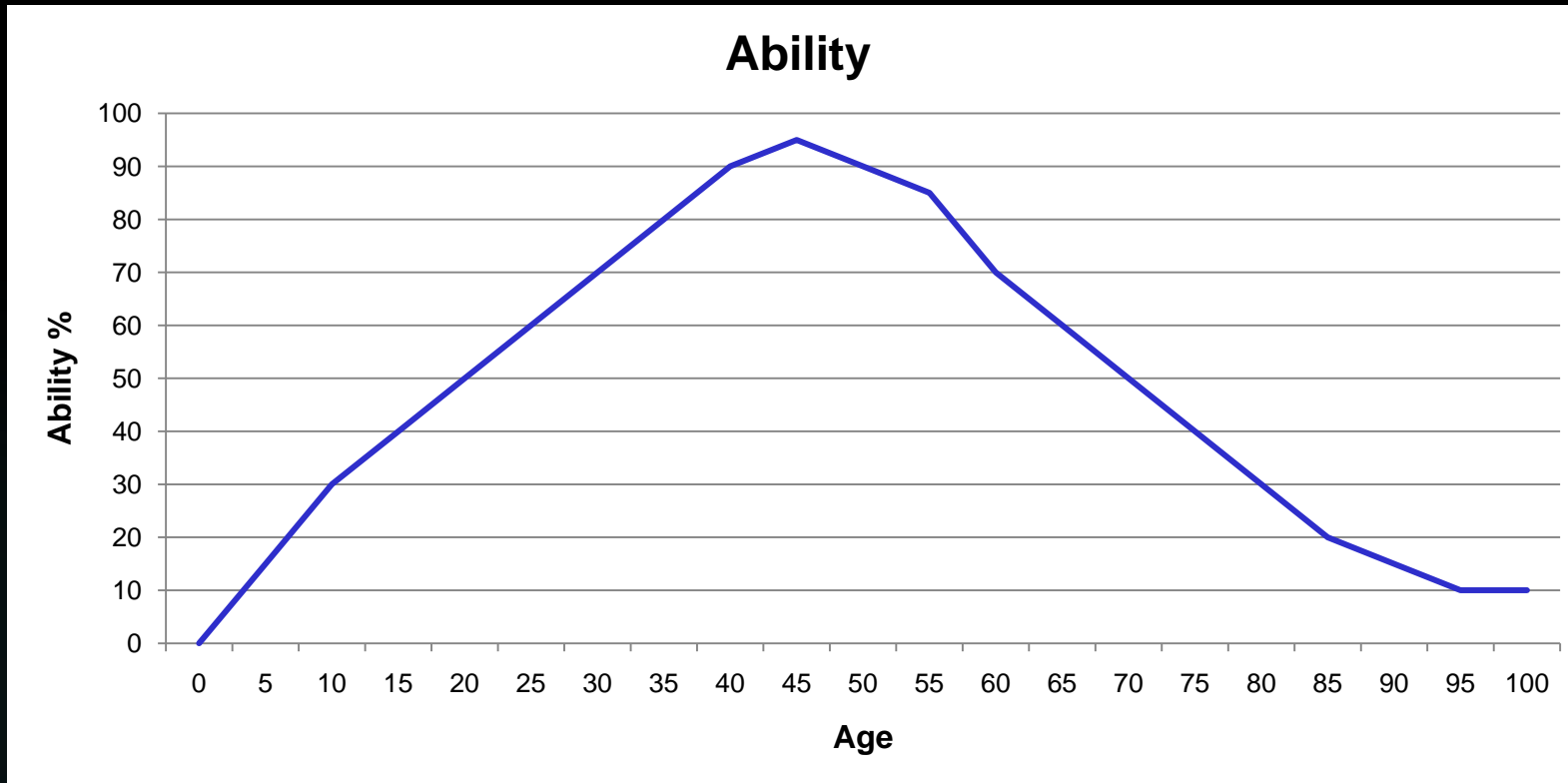
If you're over 24 years of age you've already reached your peak in terms of your cognitive motor performance - and perhaps physical performance

OVER THE HILL

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

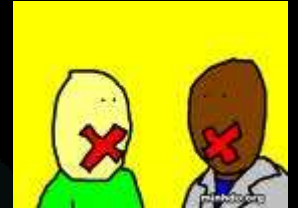
Ability



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

▶ NOT: The Blind (?), the Disabled, the Deaf



Exclusive

The
People



The
Disabled



Inclusive

US Constitution



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, 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?

Animal First



A trio of rodent-Americans
with severe visual impairments



Social and Political Correctness



- ▶ Shorthand terms:

- ▶ Para, Quad

- ▶ Derogatory terms:

- ▶ Gimp, Crip, Spaz, Retard

- ▶ Use of terms:

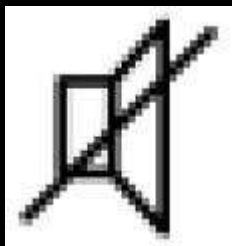
- ▶ “Patient”, “User”, “Subject”, “Consumer”

- ▶ “Suffering from”, “Afflicted with”, “Confined to”, “Victim of”

- ▶ “Diagnosed with”, “Living with”, “Survivor of”, “Recovering from”

- ▶ “Inspiring” - lack of expectation

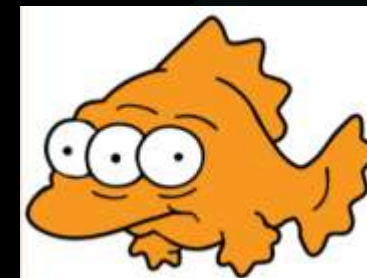




Medical & Common Use



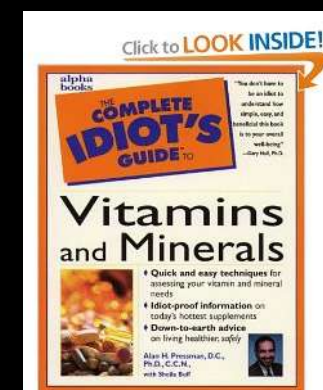
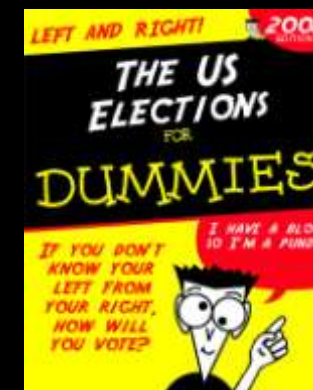
- ▶ Crippled, Retarded, Deaf & Dumb, Lame
- ▶ Mute, Moron, Imbecile, Idiot, Spastic
- ▶ Persistent vegetative state



Jerry Mahoney



Knucklehead Smiff





Portrayal of People with Disabilities



Prof Alastor "Mad-Eye" Moody



Famous People with Disabilities





New Inductees

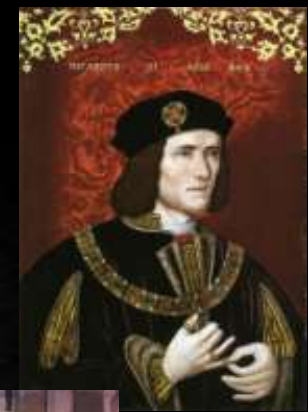
Brian Stowe



Malala



Richard III



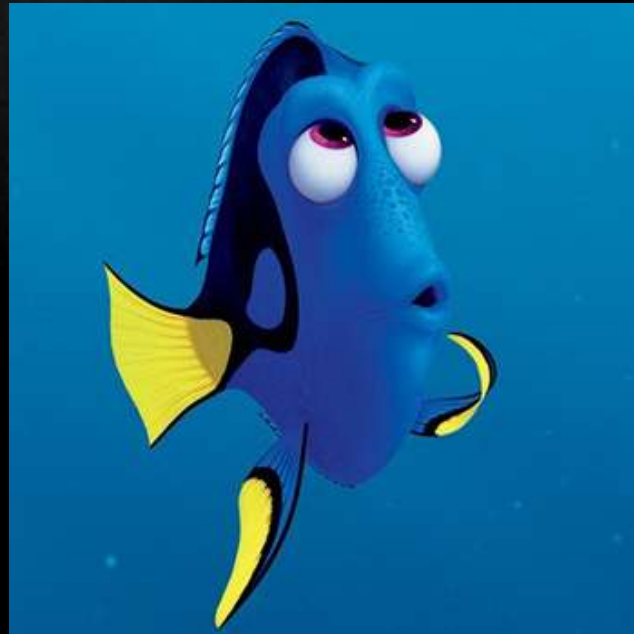
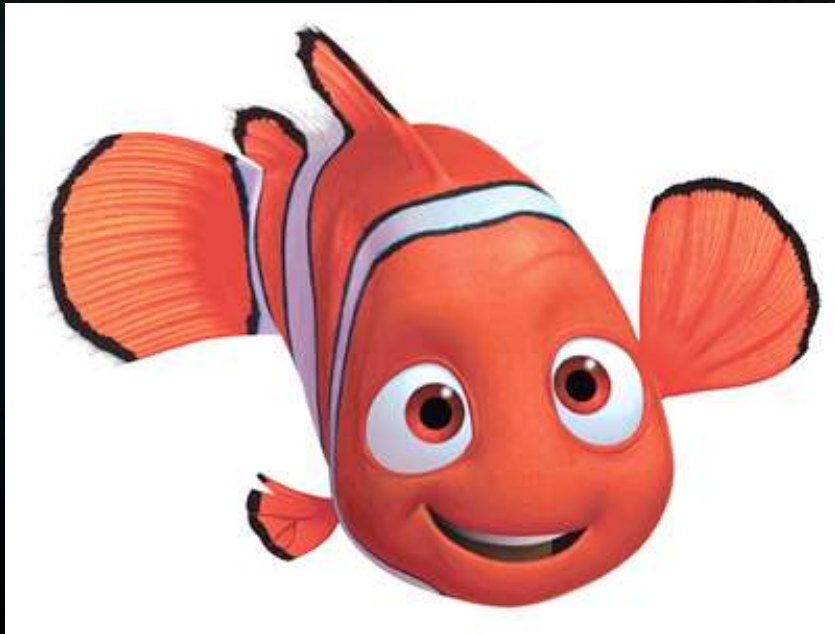
Temple Grandin



Tracy Morgan



A Few Recent Ones



Robert Van Etten



- ▶ Dwarf
- ▶ Midget
- ▶ Shorty
- ▶ Little person
- ▶ Munchkin
- ▶ Elf
- ▶ Height challenged
- ▶ Scooter-guy
- ▶ Something else?



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.

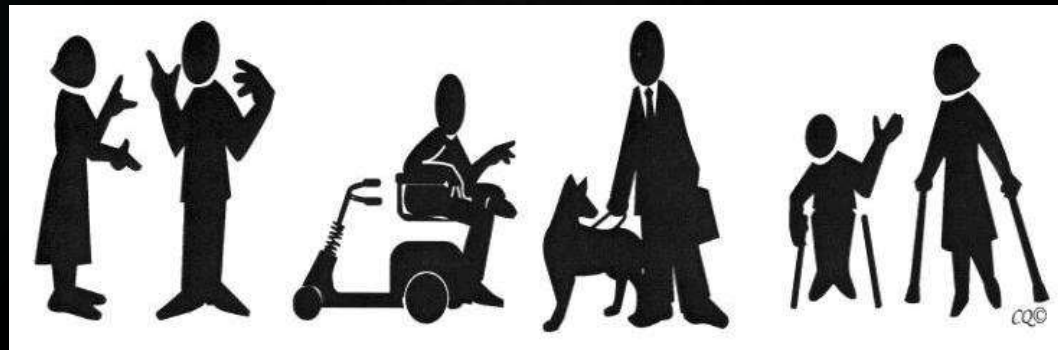




Assistive Technology



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.





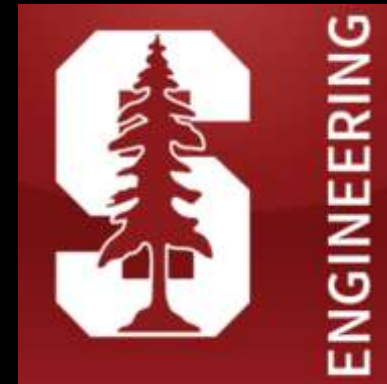
Everything is Assistive Technology!

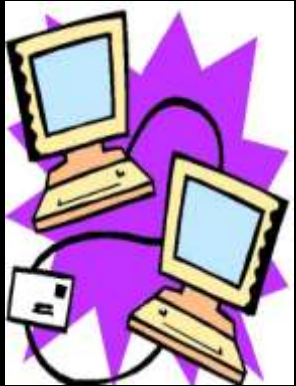


- ▶ Technology
- ▶ Transportation
- ▶ Institutions
- ▶ Organized government
- ▶ Networks: TV, Radio, Internet, Highway, Electricity, News, Gas, Food, Commerce, Money, Entertainment, Sports, Computers



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





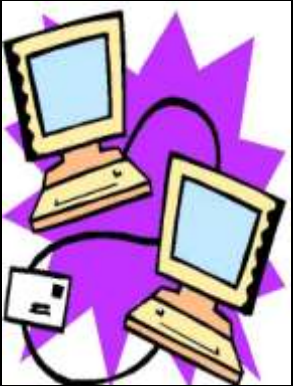
Assistive Technology



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
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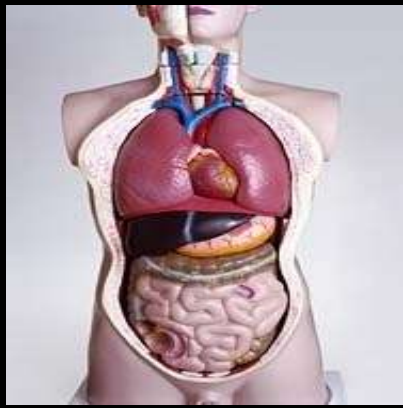
Assistive Technology Workers



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

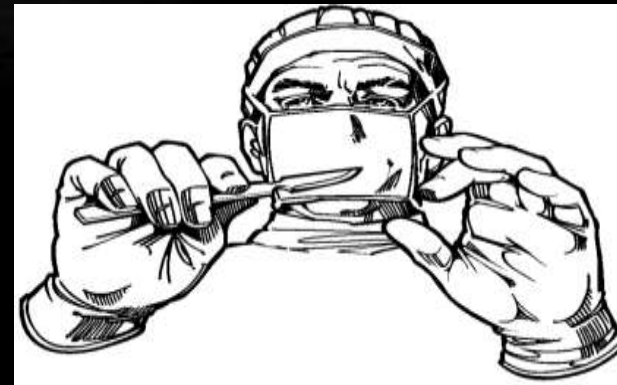
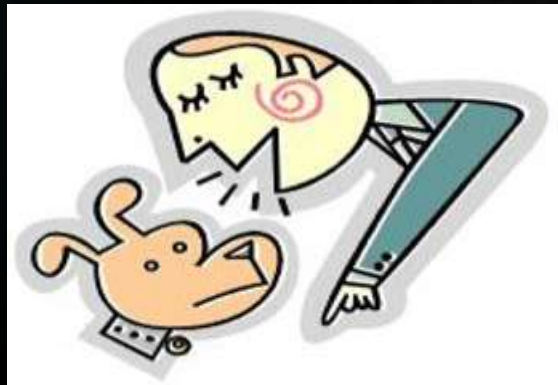
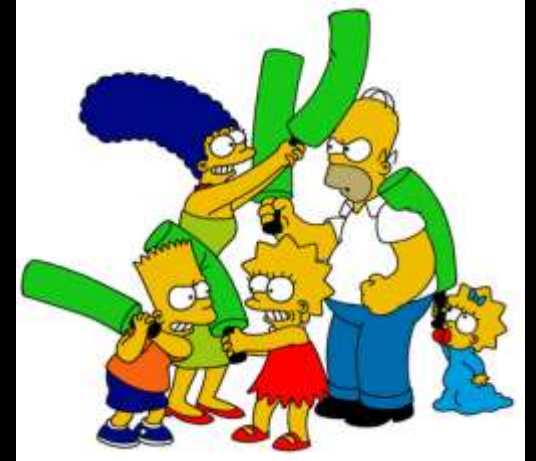




Rehabilitation



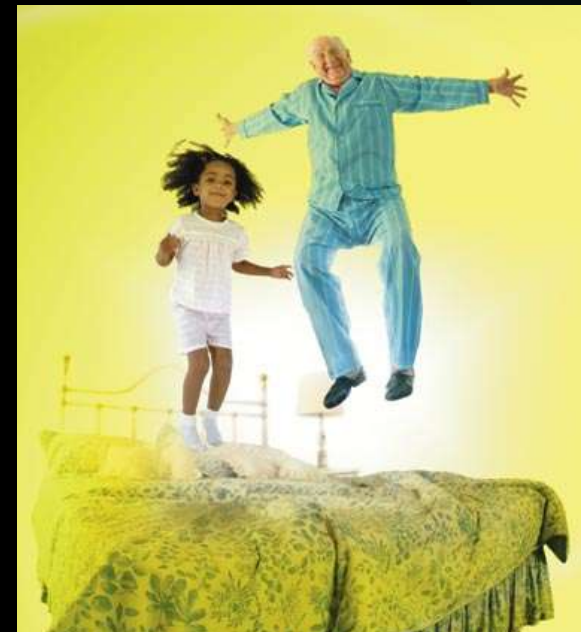
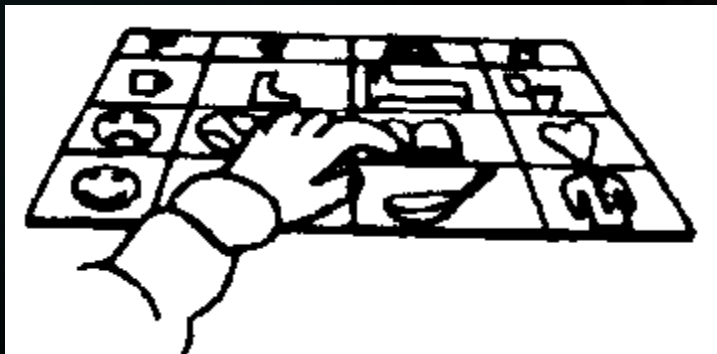
- ▶ Medical model: Restoration of function caused by disability – through surgery, medication, therapy, and/or retraining
- ▶ More inclusive model: Includes Assistive Technology





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:

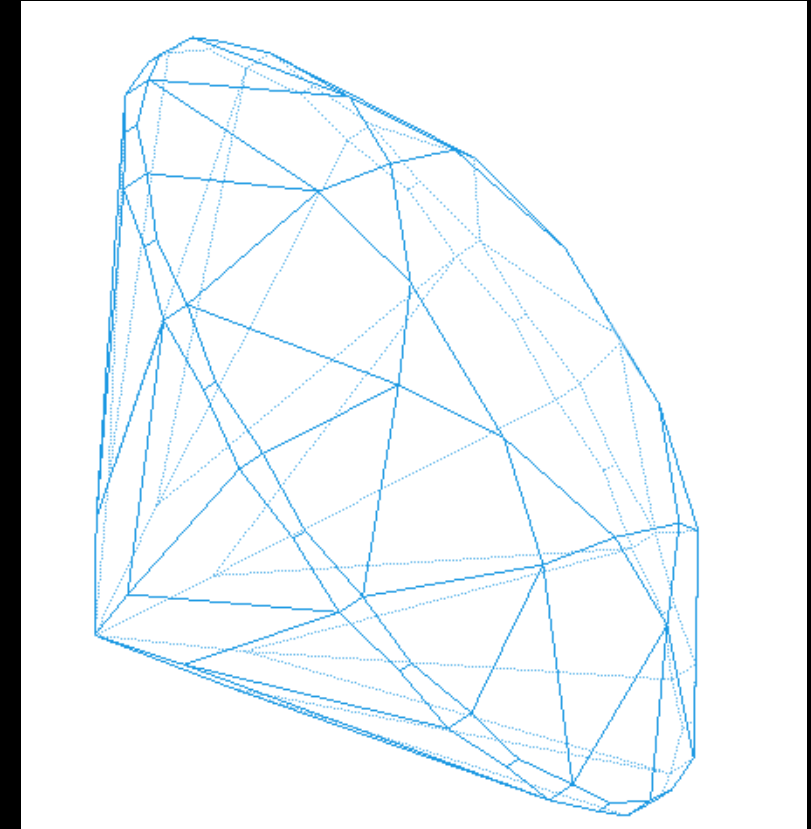
- ▶ Device Design
- ▶ Research & Development
- ▶ Technology Transfer
- ▶ Marketing
- ▶ Provision
- ▶ Education & Training



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



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

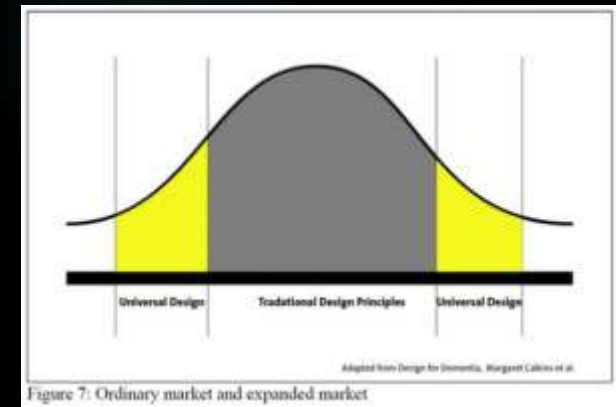


- ▶ Many people with a disability – in US and world-wide (over 1 billion)
- ▶ Largest homogeneous group in the US is wheelchair users (several million)
- ▶ **Every consumer has unique needs, desires, and aesthetic preferences**
- ▶ **The lack of a well-defined mass market means that companies serving individuals with disabilities and older adults are small and their products are expensive**



What is Universal Design?

Universal Design



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](#)

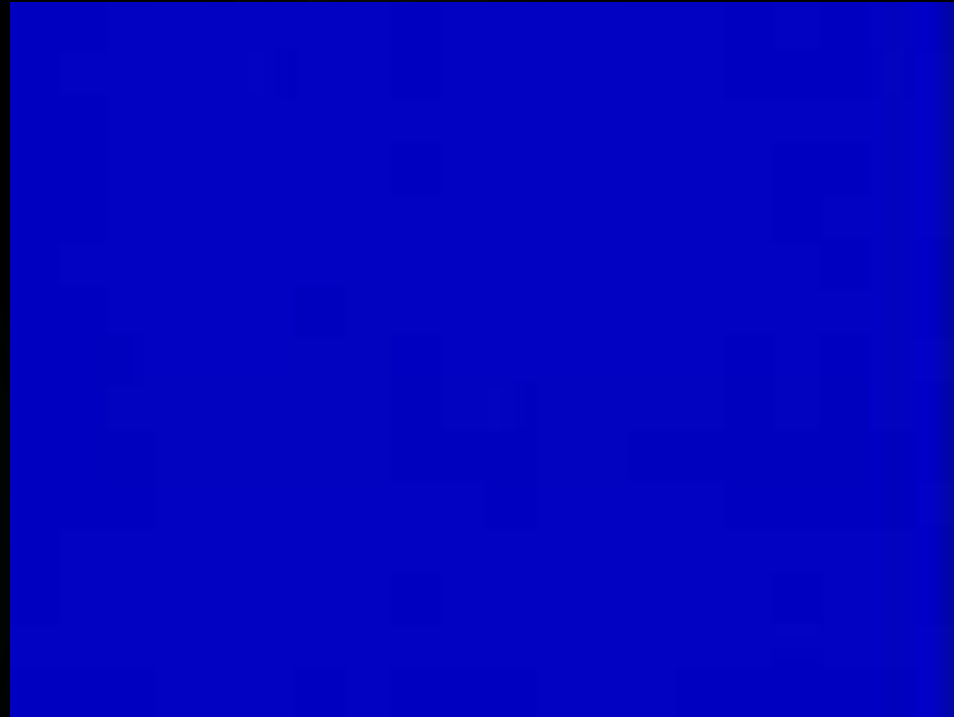
Ralph Fingerspelling Hand



- ▶ 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

Bionics
Terminator Arm Fingers
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
Whill 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.”

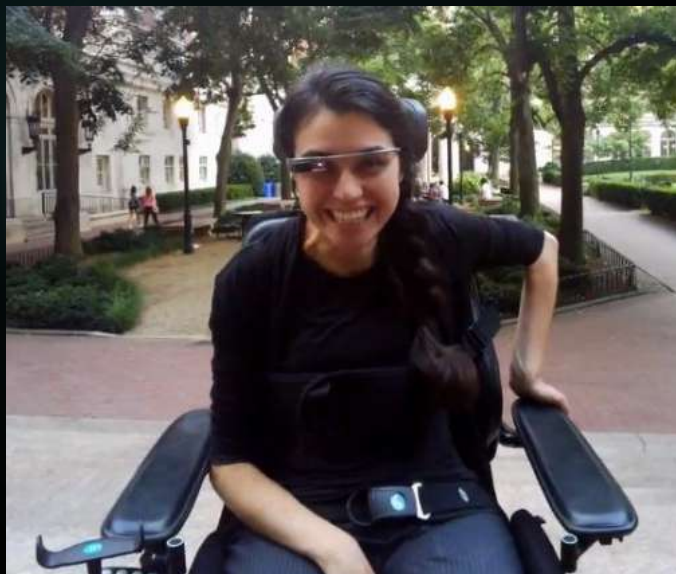
Panasonic



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 Blaszcuk

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



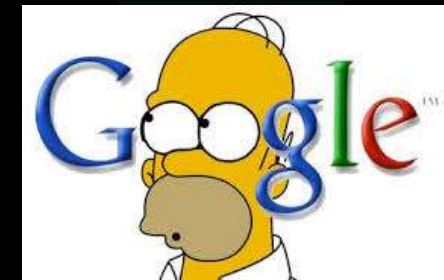
“Sometimes individual animals need our help. Left disabled without fins, flippers, beaks, or tails because of disease, accidents, or even human cruelty, these unfortunate creatures need what amounts to a miracle if they are to survive. Luckily for them, sometimes miracles do happen. Amazing prosthetics 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.**”

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
- ▶ Toyota



**I AM NOT
DISABLED** I JUST
**REALLY LIKE
WHEELCHAIRS!**



Alexis Wheelchair



Whill Wheelchair



Student Projects from 2016





Brace for Impact

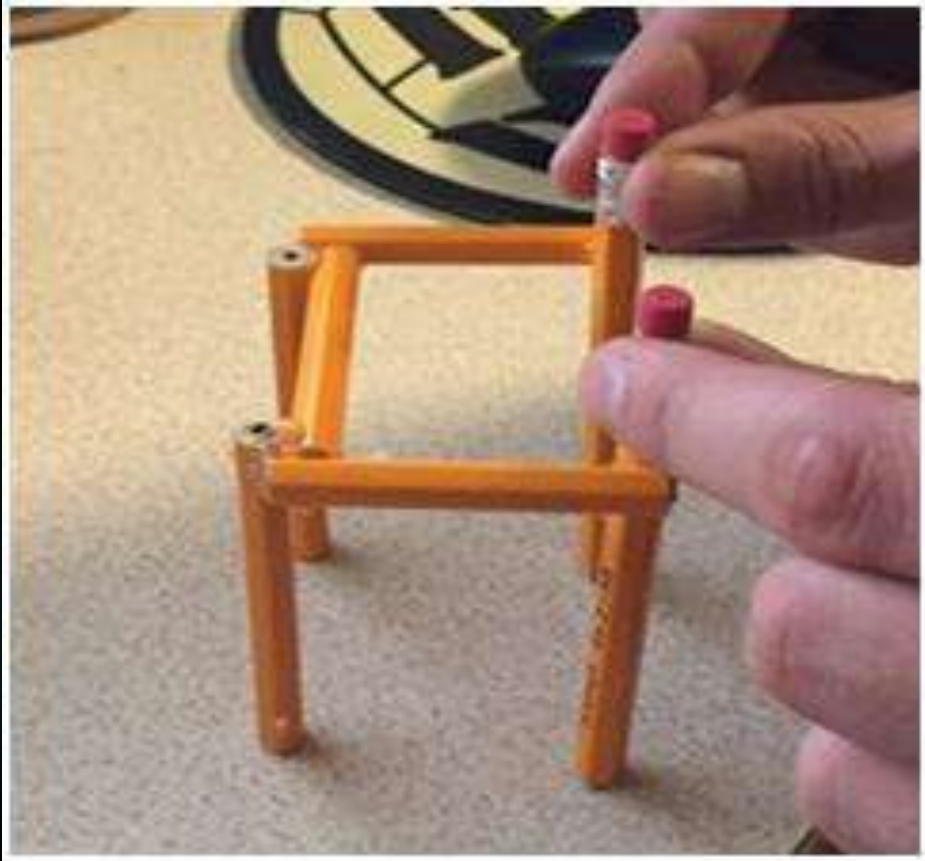




Engineering Empathy



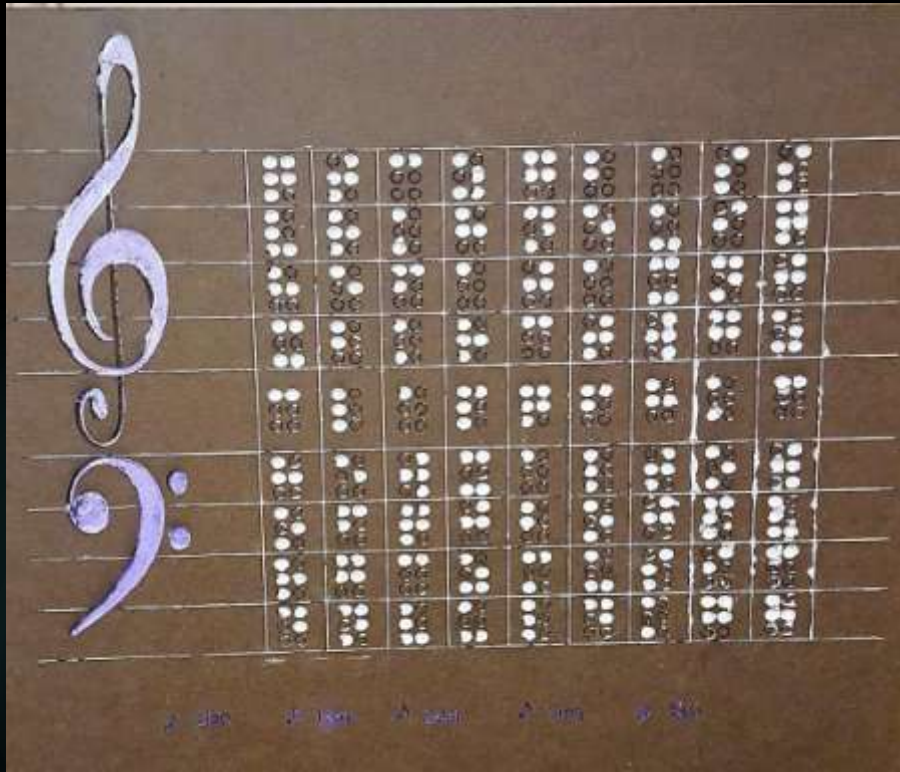
Fairing Well



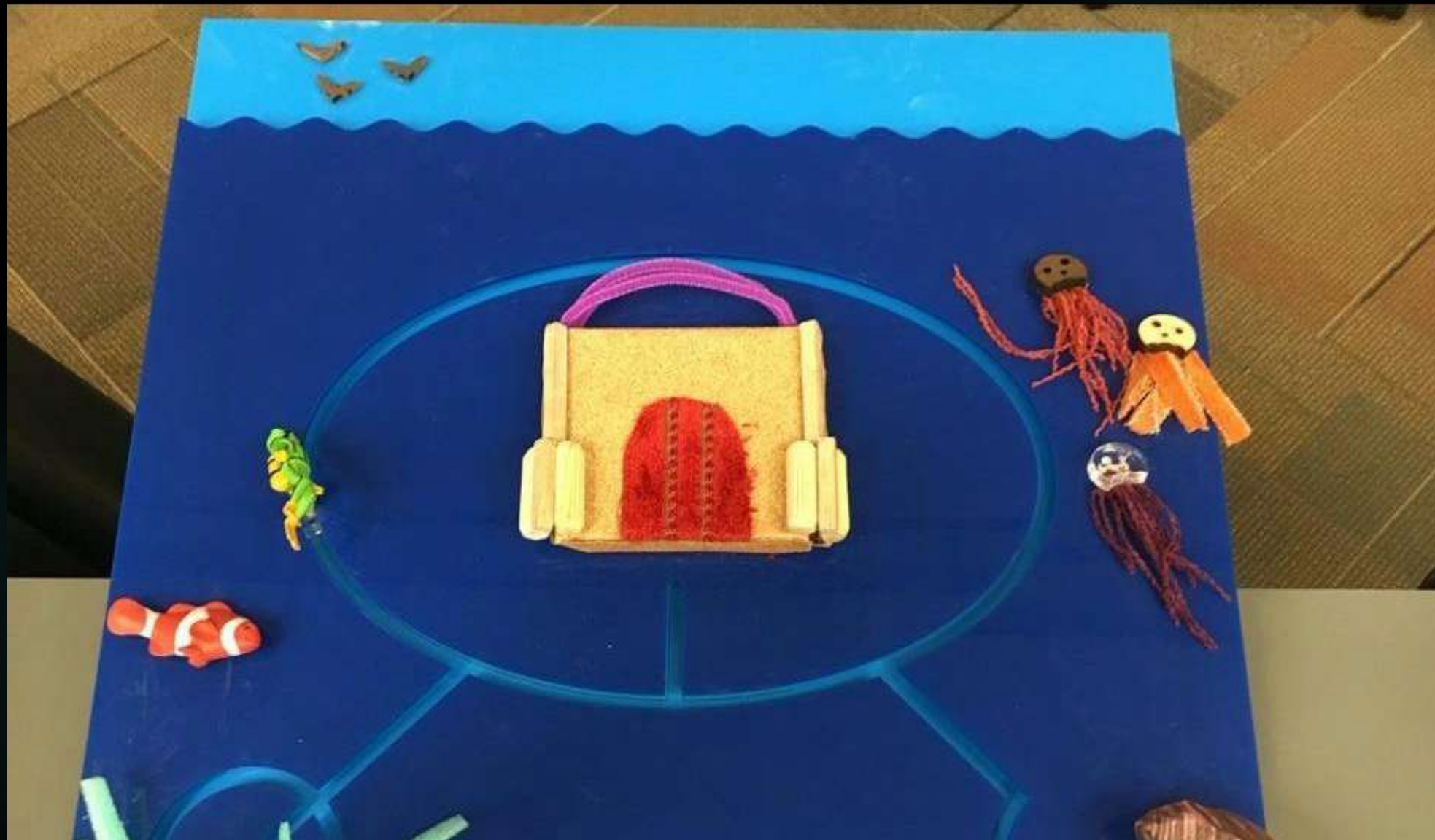
Low cost prototyping materials



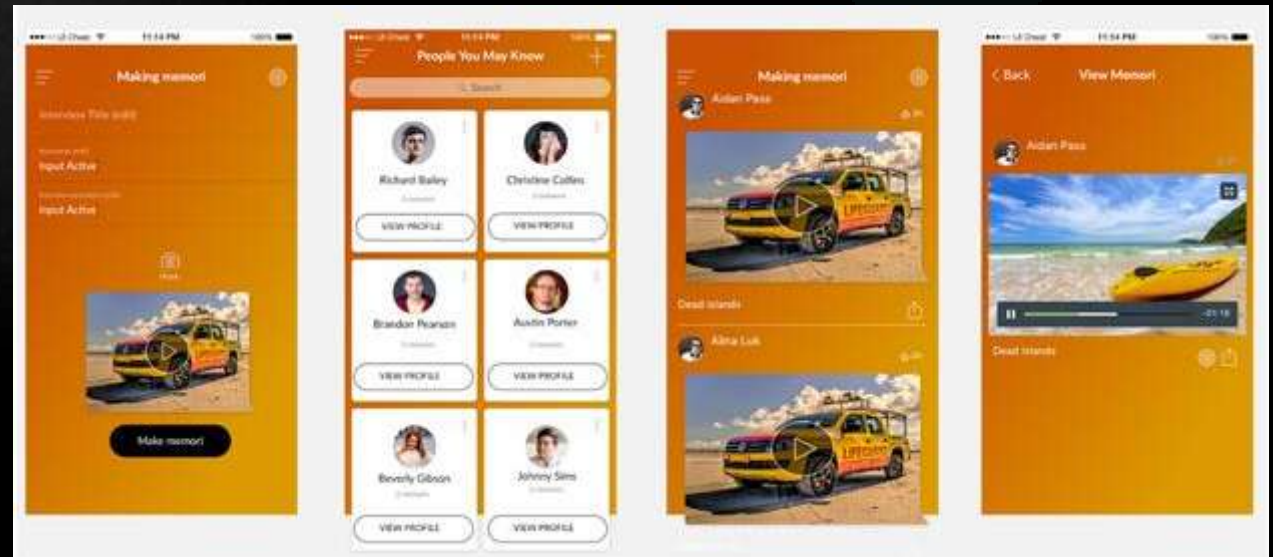
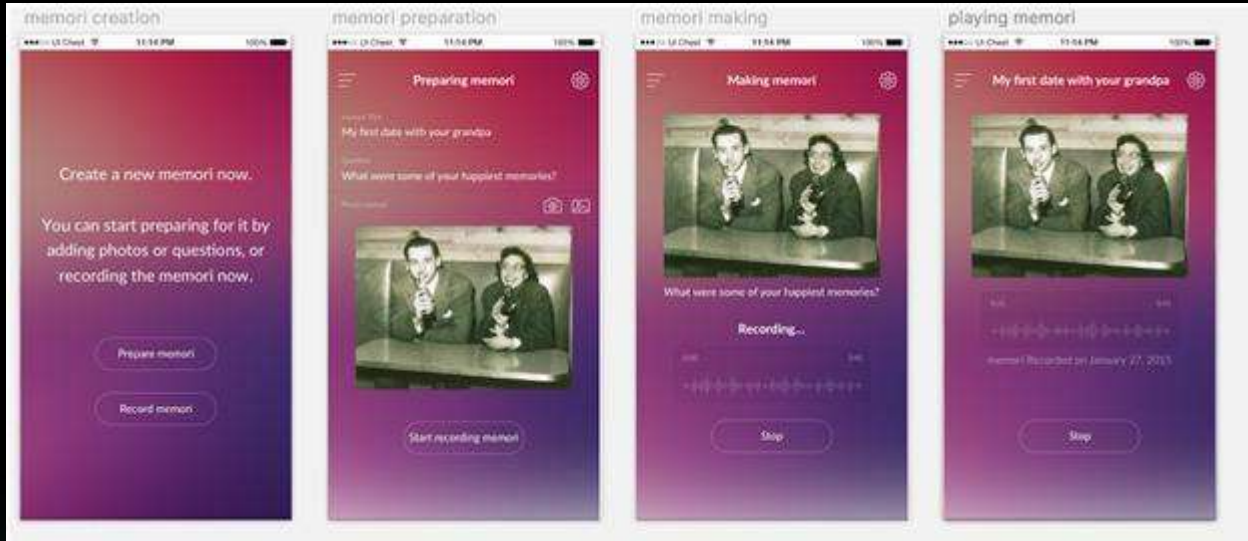
Game Plan



Magic Makers



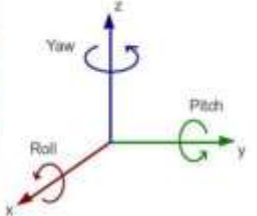
Magicians



Memori



One More Mile



Sachi-on-the-Ko



Swift Engineering



Team Supreme



Walkabout



Guest Lectures, Tours, Faire from 2016





Lecture 01a – Course Overview & Introduction to Assistive Technology



Lecture 01b – Project Pitches



Lecture 02a – Needfinding and Context Discovery for Assistive Technologies



Lecture 02b – Bridging the Gap between Consumers and Products in Rehabilitation Medicine



Lecture 03a – Perspectives of Stanford Students with a Disability



Lecture 03b – Issues of Human Interface Design



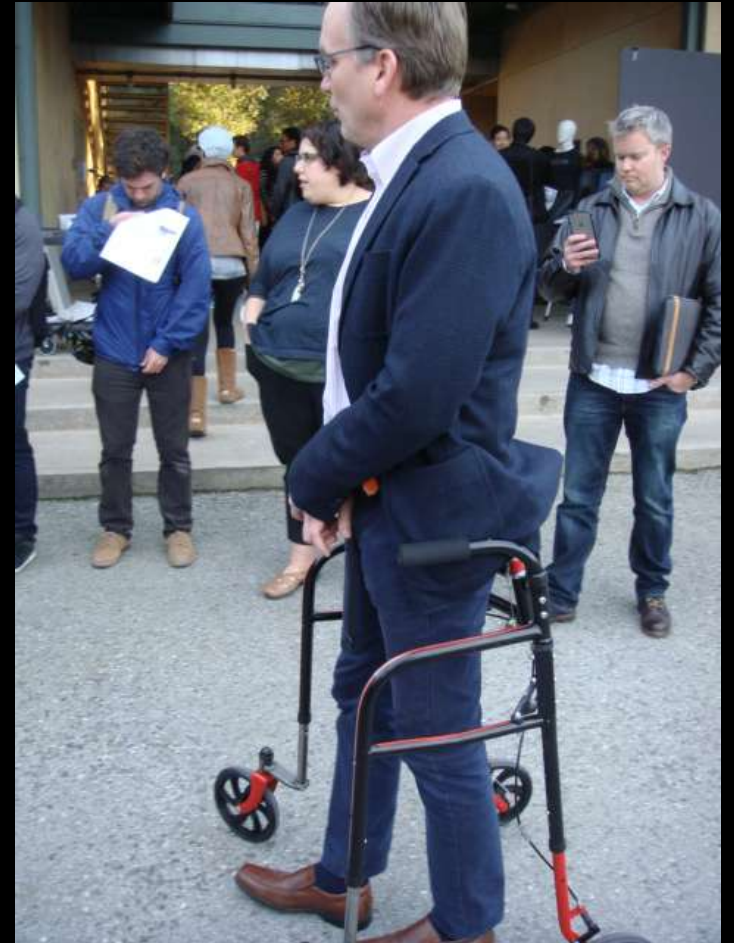
Lecture 04a – A Personal and Historical Perspective on Creative Thinking and Design with a Focus on Seniors



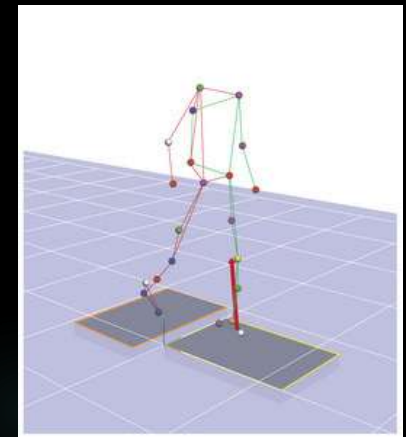
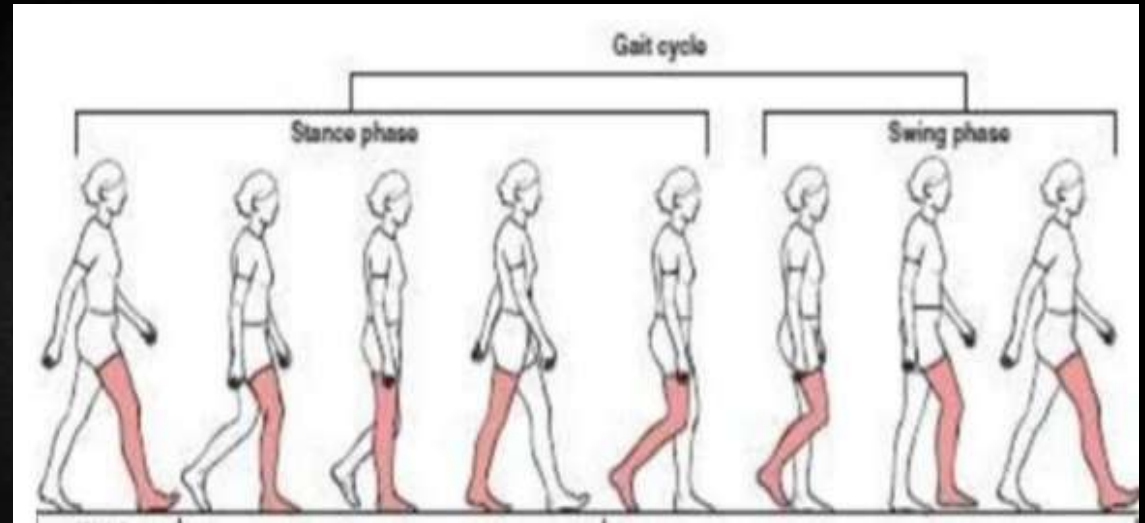
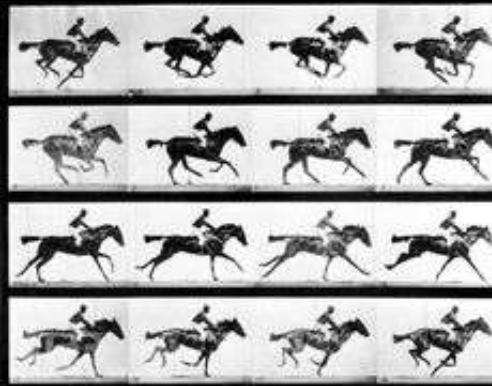
Lecture 04b – Designing Beyond the Norm to Meet the Needs of All People



Lecture 05a – Tour of VA Palo Alto Spinal Cord Injury and Brain Injury Services



Lecture 05b – Assistive Technology Faire



Lecture 06a – Tour of Motion & Gait Analysis Lab



Lecture 06b – Mid-term Student Team Project Presentations



Lecture 07a – The Design and Control of Exoskeletons for Rehabilitation



Lecture 07b – Field Trip to the Magical Bridge Playground



Lecture 08a – Perspective on Bringing New Assistive Technology Products to Market



Lecture 08b – Aesthetics Matter in Assistive Technologies & From Idea to Market



Lecture 09a – Film Screening



Lecture 09b – Wheelchair Fabrication in Developing Countries



Lecture 10a – Final Student Team Project Presentations



Design Group Happy Hour & Student Project Demonstrations
Thursday, March 10th at 5pm
 No rain – outside Thornton Center adjacent to Gibbon's Grove
 Rain – in the Thornton Center breezeway and in Classroom 110

Please stop by to check out the efforts of twelve student teams from ENGR110/210 - *Perspectives in Assistive Technology* - who have been addressing challenges experienced by individuals with disabilities or older adults by working to understand, research, brainstorm, design, fabricate, and test prototype devices or software to meet the identified problems.

Teams and Projects:

- Team Magicians - Magical Bridge Playground Project
- Fairing Well - Aesthetic Brace Faking Project
- Magic Makers - Magical Bridge Playground Project
- Swift Engineering - Aesthetic Brace Faking Project
- Team Memori - Designing Your Afterlife
- Walkabout - Improved Walker Project
- Team Supreme - Power for Veterans Project
- Game Plan - Improved Walker Project
- Brace for Impact - Knee Brace Project
- Engineering Empathy - Support System to Destigmatize Mental Health in the Black Community
- Sachi-on-the-Ro - iPhone and Me Project
- One More Mile - Jogging and Running Aid for the Blind and Visually Impaired



Lecture 10b – Project Demonstrations

Candidate Team Student Projects



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

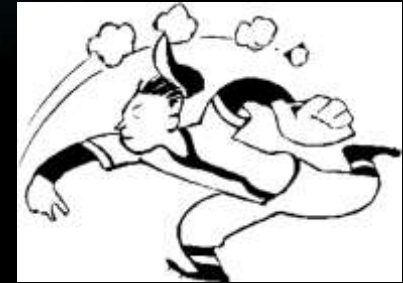


Team Project Offerings



New projects suggested this year:

- ▶ Pickup Sticks Project - pitched by June
- ▶ Add-a-Sock Project - pitched by Gary
- ▶ Grip Sense Project - pitched by Gary
- ▶ Hybrid Body-Powered Harness Project - pitched by Gary
- ▶ Get a Grip Project - pitched by Dave
- ▶ Dance Therapy Project - pitched by Amy
- ▶ Paddle Project - pitched by Dainuri
- ▶ Orthotic Rebound Shock - pitched by Max by video
- ▶ Hand Grasp Project - pitched by Debbie (?)
- ▶ Plugs for Molly - pitched by Molly by video



Team Project Offerings



Projects suggested in previous years:

- ▶ Art Tools Project - pitched by Gautam
- ▶ Wheelchair Backup Alert - pitched by Dave
- ▶ Project employing the Leap Motion Controller - pitched by Dave
- ▶ Enhanced bed control for veterans with spinal cord injury - pitched by Dave
- ▶ Enhanced access to touch screen devices - pitched by Dave
- ▶ Magical Bridge Playground Project - pitched by Olenka, Jill, and Jay
- ▶ Customize Abby's Scooter Project - pitched by Abby
- ▶ Deane's project suggestions - pitched by Dave
- ▶ Authoring Grade School Lessons on Disability and/or Assistive Technology - by video

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

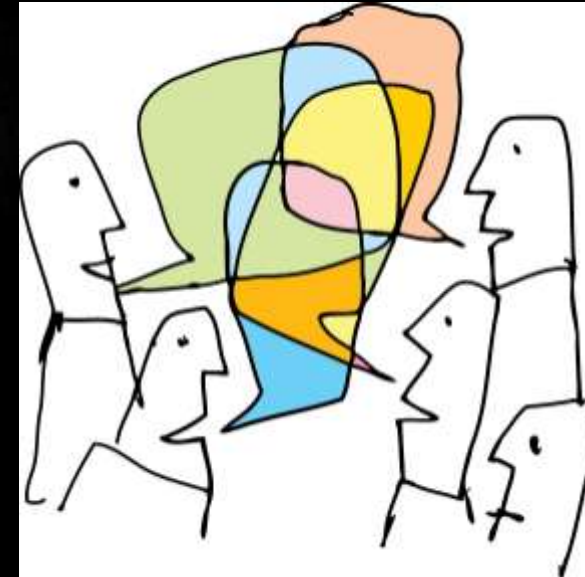


Twenty PRL Teaching Assistants!



Other Involved People

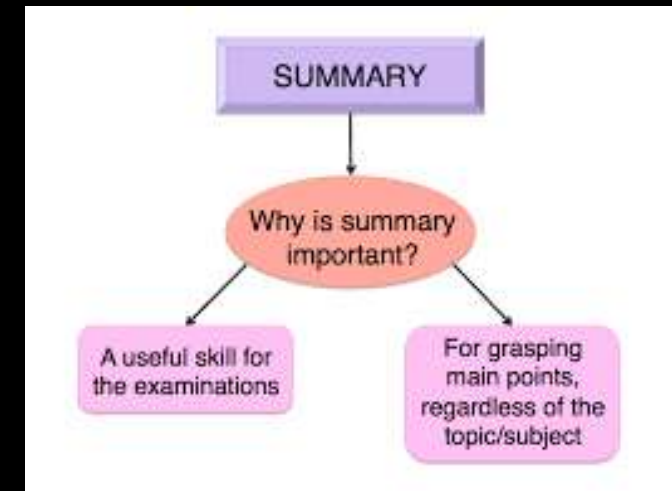
- ▶ Those who suggested projects
- ▶ Individuals with disabilities
- ▶ Community participants attending lectures



THE EXECUTIVE SUMMARY



- ▶ 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



- ▶ Websites:

- ▶ <http://engr110.stanford.edu>
- ▶ <http://me113.stanford.edu>
- ▶ <http://cs194.stanford.edu>

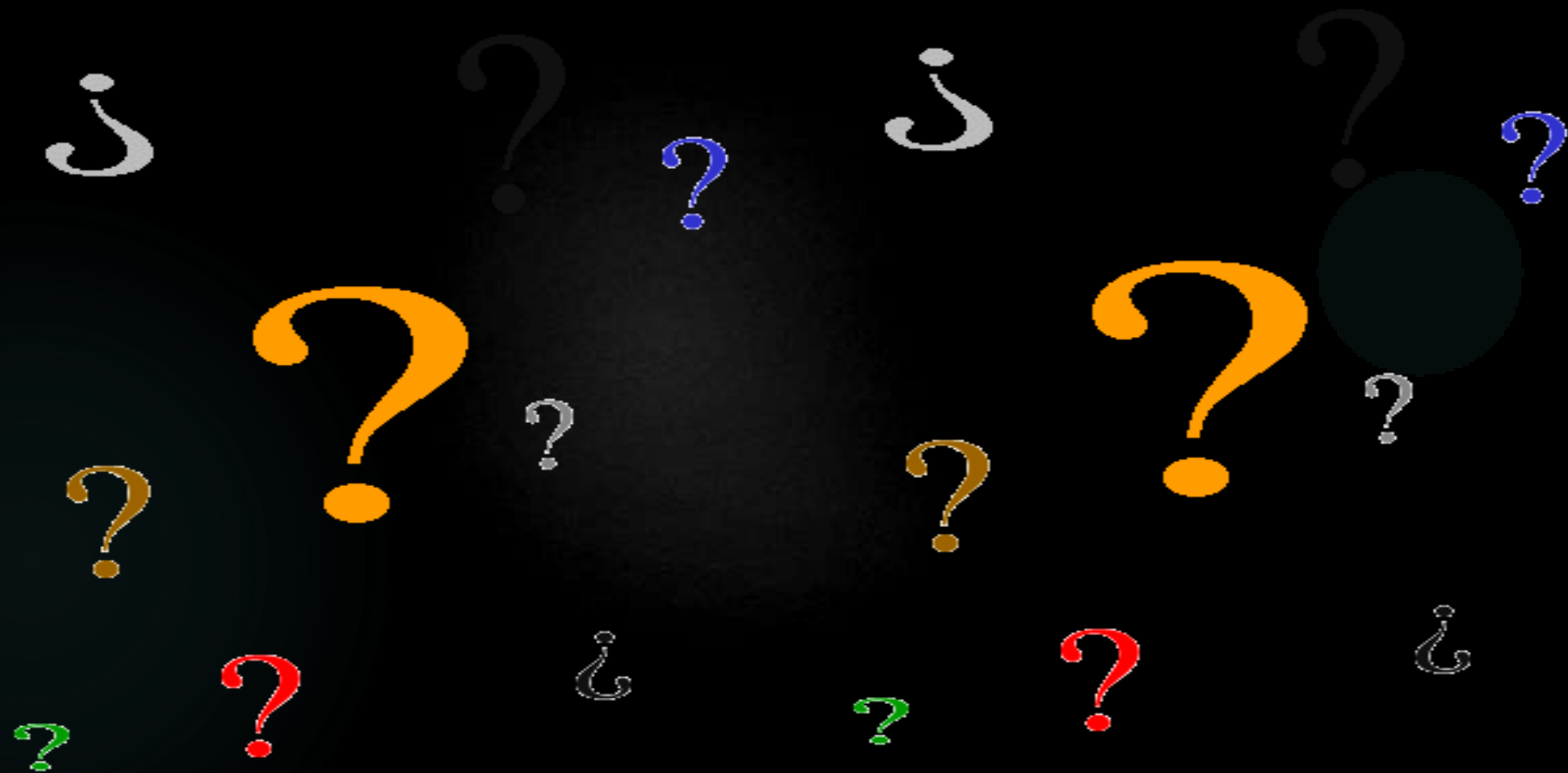


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Questions?



Adjourn



class dismissed

