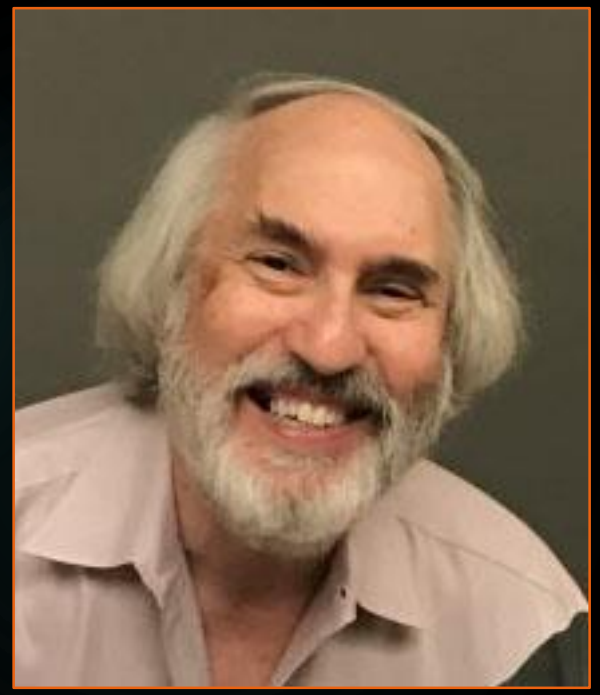
January 9, 2024

Introduction to Assistive Technology

ENGR110/210
Perspectives in Assistive Technology



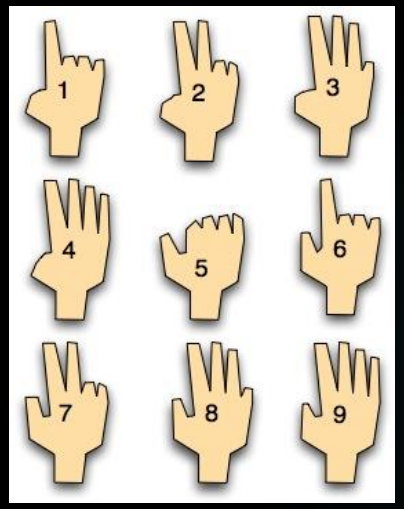
David L. Jaffe, MS

Instructor

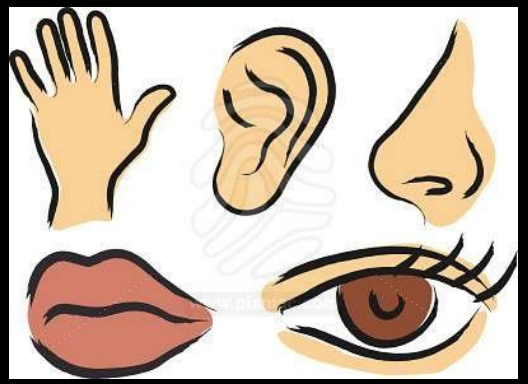
18

Years

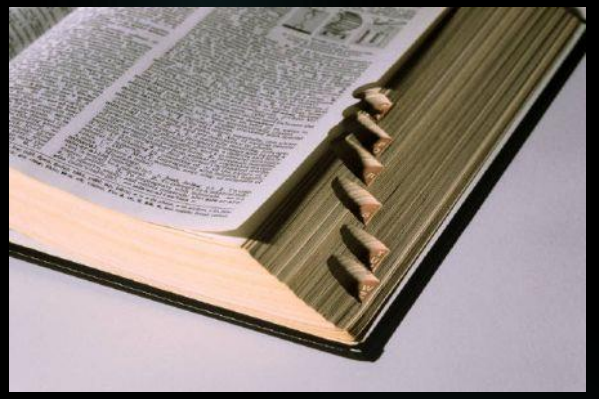
Introduction to Assistive Technology



- Definitions
- Broad overview
- What is a disability?
- Range of disabilities
- People involved - demographics and numbers
- Goal of rehabilitation
- Challenges of people with disabilities
- Perception of people with disabilities
- Examples of assistive technology products and devices
- Phraseology, semantics, and social correctness
- Last year's student projects



Definitions



- Disability
- Assistive Technology
- Rehabilitation
- Rehabilitation Engineering

Disability
Work-Based Definition

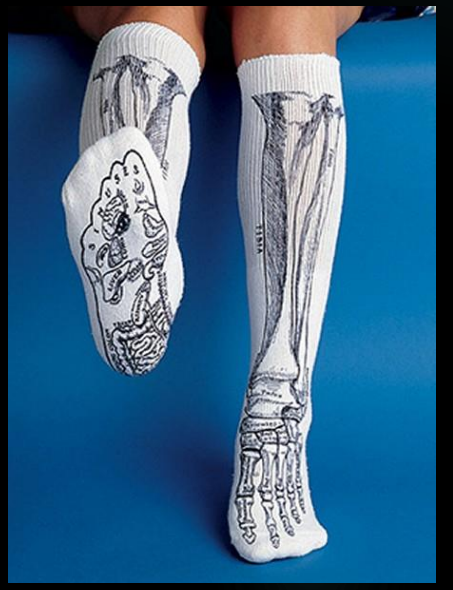
Persons with a disability are those who have a "health problem or condition which prevents them from working or which limits the kind or amount of work they can do".

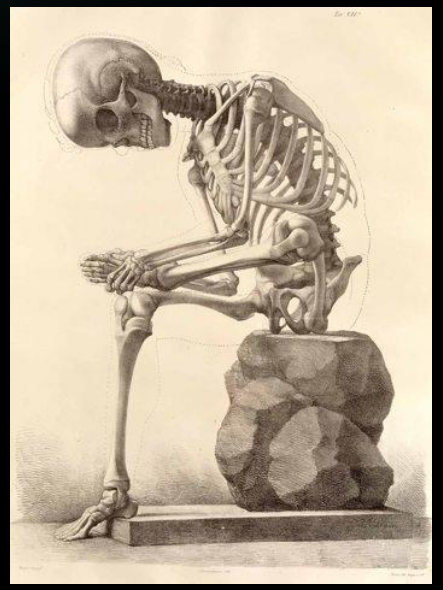
Current Population Survey

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".





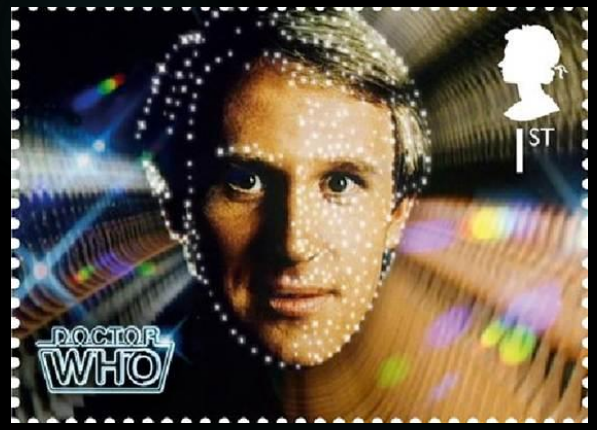
Disability
Activity-Based Definition

- 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 challenges, difficulties, problems 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.

- People with disabilities (and older adults) are healthy
- But 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 specialized health and rehabilitation services they need in many settings.

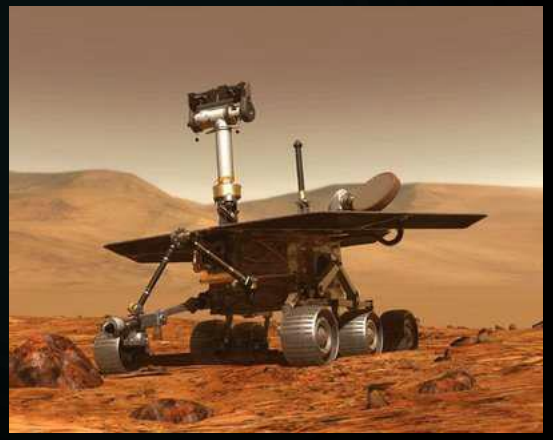
Disability
ADA Definition

Disability is defined as an 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 any 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



Situational 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

Lack of Opportunities

abused, butchered, chained, cremated, dehumanized, denied the right to vote, discriminated, disenfranchised, dragged, embittered life with hard labor, enslaved, evicted, falsely accused & convicted, forbidden to own land, forced to live in a ghetto, gassed, ignored, imprisoned, kidnapped, killed, lynched, murdered, overlooked, raped, repressed, restrained, segregated, shackled, shot, starved, sterilized, targeted, violated

Inclusive Definition of Disability

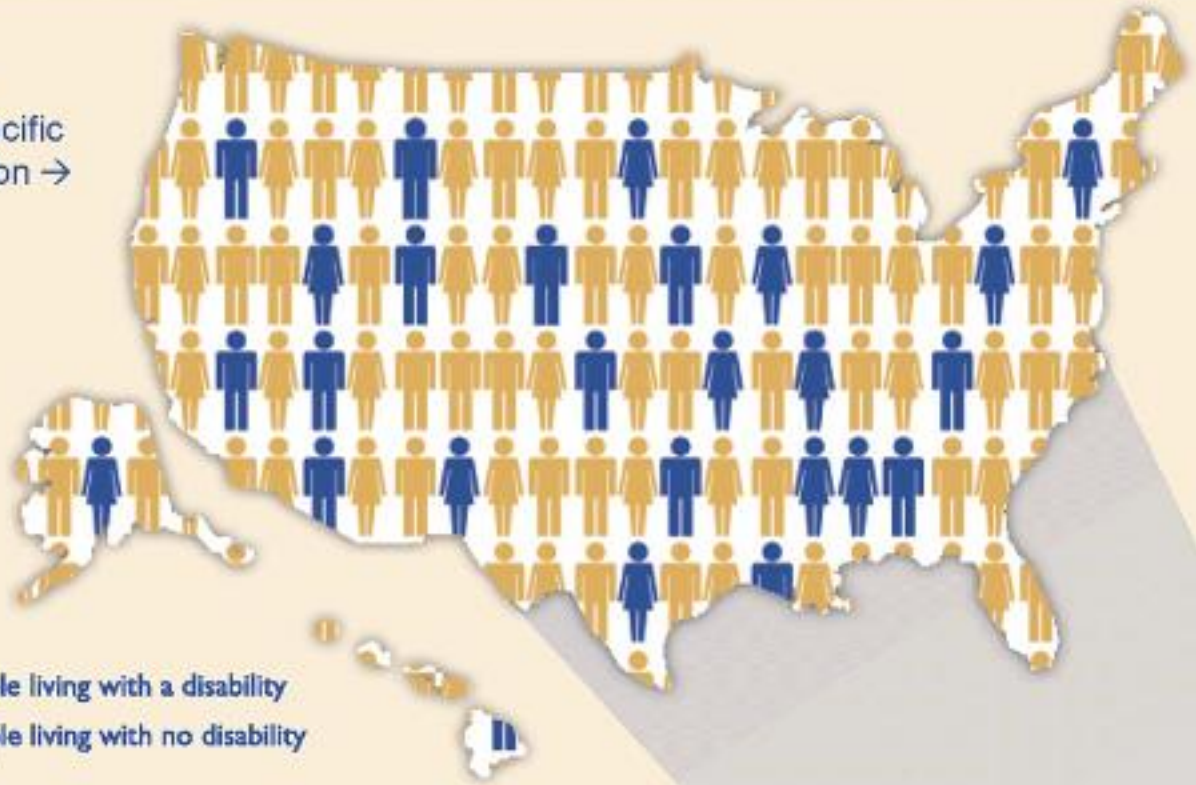
"Disability is a normal variation of the human condition." - Gregor Wolbring

Deep inside we're all the same - Styx

Biodiversity
Neurodiversity
Autism spectrum
Ability diversity

61 million adults in the United States live with a disability

Click for state-specific information →



26% (1 in 4) **of adults in the United States have some type of disability**

The percentage of people living with disabilities is highest in the South

Percentage of adults with functional disability types

13.7%

MOBILITY

Serious difficulty walking or climbing stairs

10.8%

COGNITION

Serious difficulty concentrating, remembering, or making decisions

6.8%

INDEPENDENT LIVING

Difficulty doing errands alone

5.9%

HEARING

Deafness or serious difficulty hearing

4.6%

VISION

Blindness or serious difficulty seeing

3.7%

SELF-CARE

Difficulty dressing or bathing

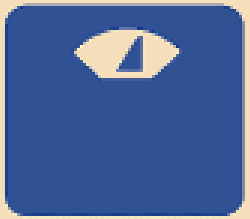
Disability is especially common in these groups:

2 in 5 adults age 65 years and older have a disability

1 in 4 women have a disability

2 in 5 Non-Hispanic American Indians/ Alaska Natives have a disability

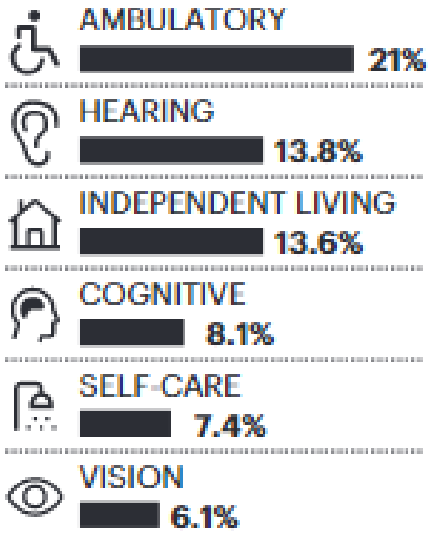
Adults living with disabilities are more likely to

	With Disabilities	Without Disabilities
 HAVE OBESITY	38.2%	26.2%
 SMOKE	28.2%	13.4%
 HAVE HEART DISEASE	11.5%	3.8%
 HAVE DIABETES	16.3%	7.2%

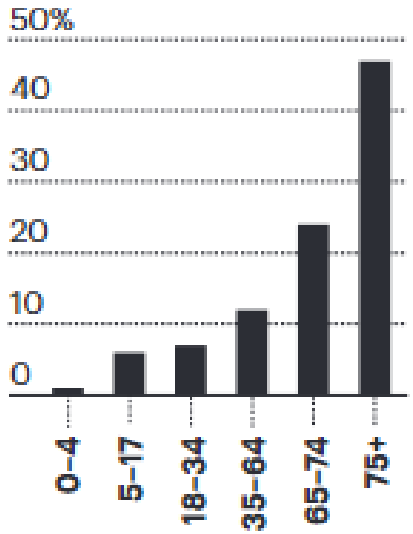
LIVING WITH DISABILITIES

A total of 41.1 million Americans—12.6 percent of the population—live with some sort of disability. They range from hearing and vision difficulties to difficulty in living independently. Disabilities increase by age, and nearly half of those 75 and above report having one of six disabilities measured by the U.S. Census Bureau.

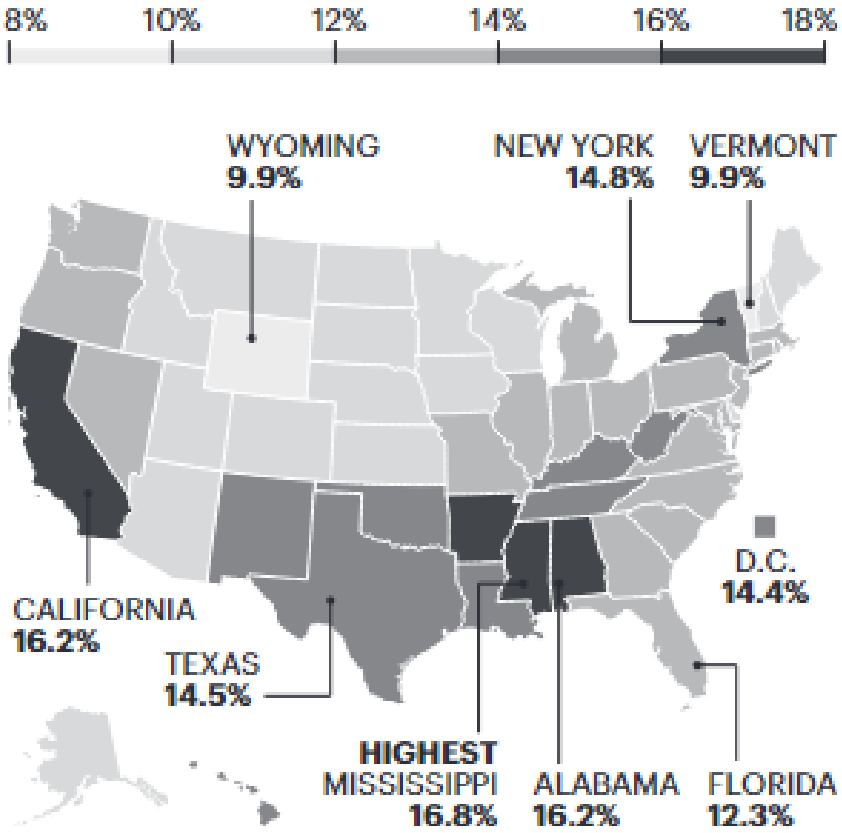
TYPE OF DISABILITY FOR THOSE 65 AND OLDER



PERCENTAGE WITH DISABILITY, BY AGE

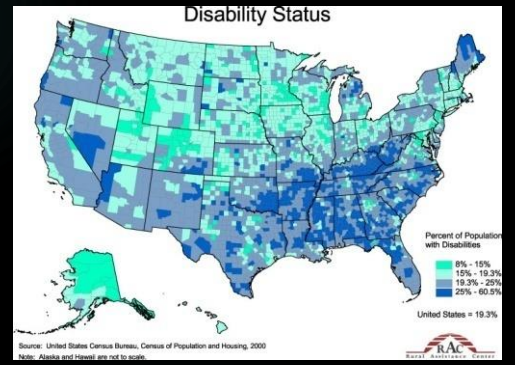


PERCENT OF THOSE 65 AND OLDER WHO HAVE AN INDEPENDENT LIVING DIFFICULTY



SOURCE: U.S. CENSUS BUREAU, AMERICAN COMMUNITY SURVEY, 5-YEAR ESTIMATES, 2021

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
- > 22 million are 65 or older
- 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
- > 12% (3000) of Stanford students are registered with OAE

Disability in the US

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

- Disabilities may 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 is a normal variation of the human condition.**

Disability Types

Which disabilities are most obvious?

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

Age-related Disabilities

- Macular Degeneration
- Sarcopenia
- Cognitive Decline
- Commercial Pilot Restrictions
- Driving Restrictions
- Presidential Age

Desires of People with Disabilities

- Regain wellness & function
- Perform tasks independently
- Experience a high quality of life
- Take full advantage of all opportunities
  - Educational
  - Vocational
  - Recreational
  - Activities of daily living

- Pursue happiness
- Freedom to 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!

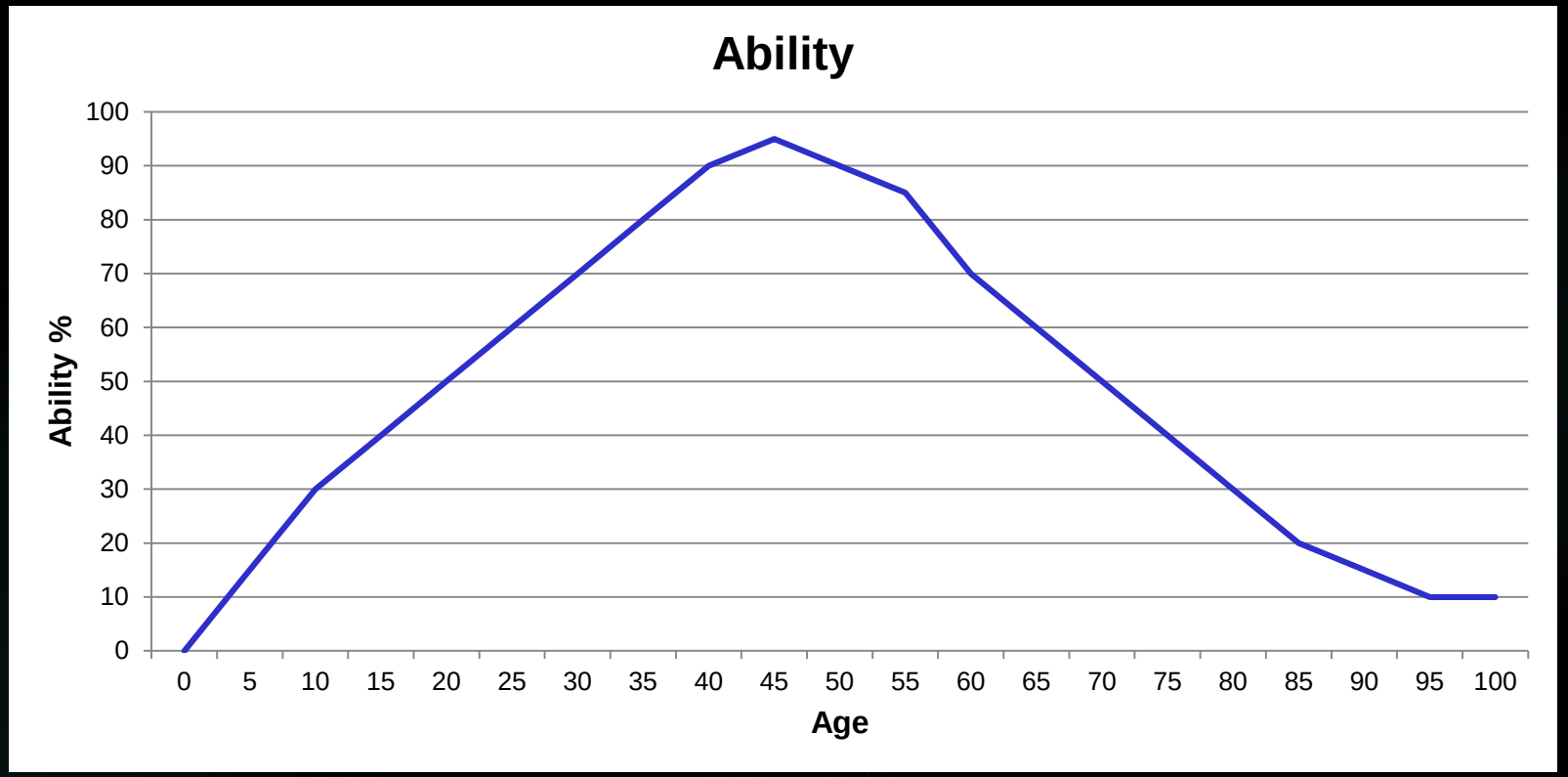
If you're over 24 years of age you've already reached your peak in terms of your cognitive performance - and perhaps physical performance

Simon Fraser University

Ability

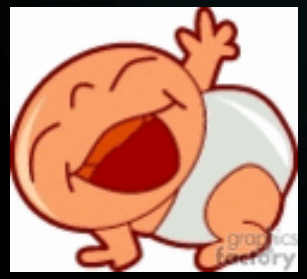
Ability = Having the talents and opportunities to contribute to society

A DisAbility View of Life

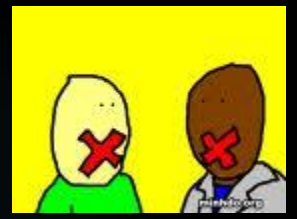


Life events:

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



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

UK - The People & The Royals
US - The People & The Celebrities (?)

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.

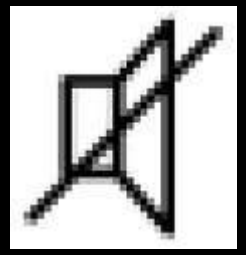
The basic idea is to impose a sentence structure that names the person first and the condition second, ie "people with disabilities" rather than "disabled people", in order to emphasize that "they are people first". Because English syntax normally places adjectives before nouns, it becomes necessary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

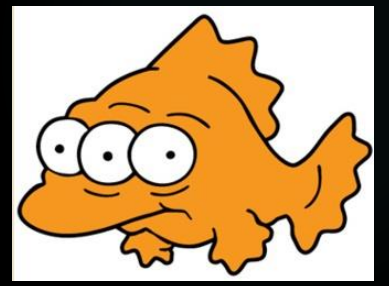
Social and Political Correctness

- 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
  - "Lost battle with … "



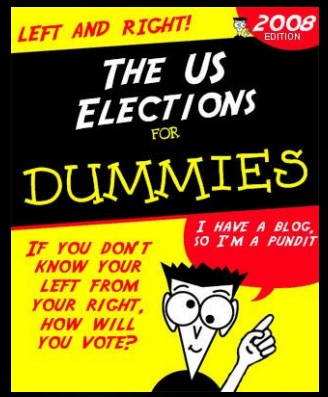
Medical & Common Use

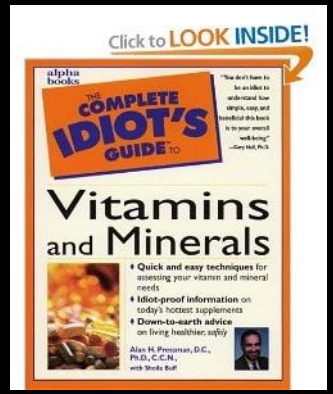
- Crippled, Retarded, Deaf & Dumb, Lame
- Mute, Moron, Imbecile, Idiot, Spastic
- Persistent vegetative state
  Unresponsive wakefulness syndrome



Jerry Mahoney

Knucklehead Smiff

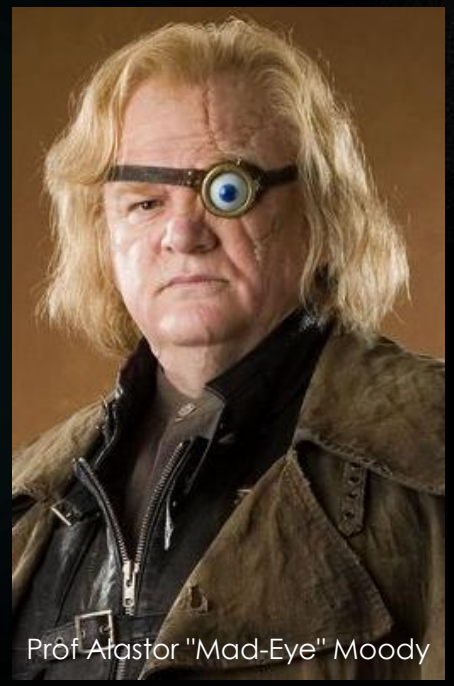




Portrayal of People with Disabilities

Quasimodo

Joseph Merrick



Prof Alastor "Mad-Eye" Moody

Gary Busey

Dr. Strangelove

Famous People with Disabilities

Dalek

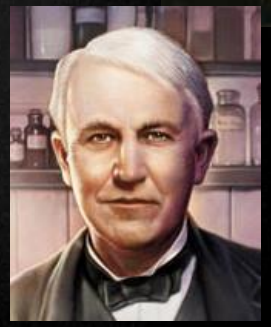
New Inductees - 2017

Brian Stowe

Malala

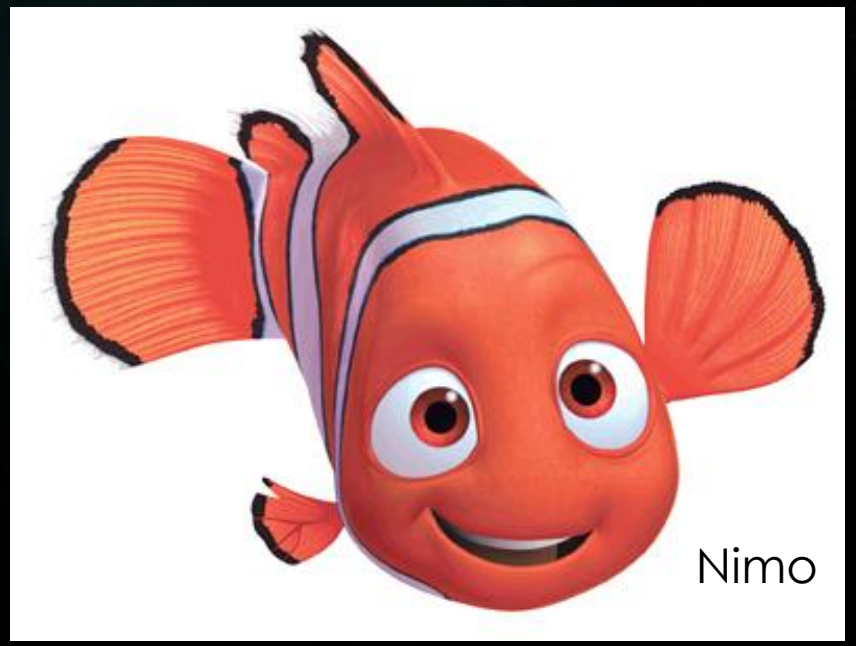
Richard III

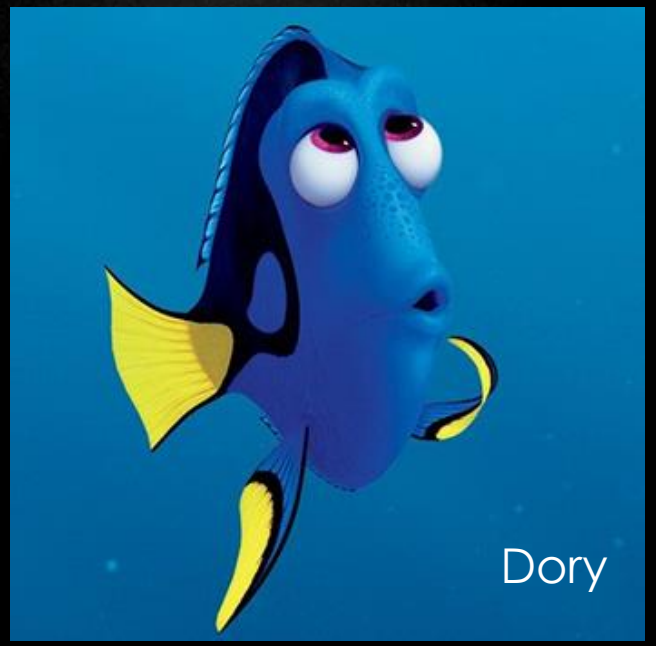
Temple Grandin



Tracy Morgan

New Inductees - 2018





Characters on Big Band Theory

New Inductees - 2019

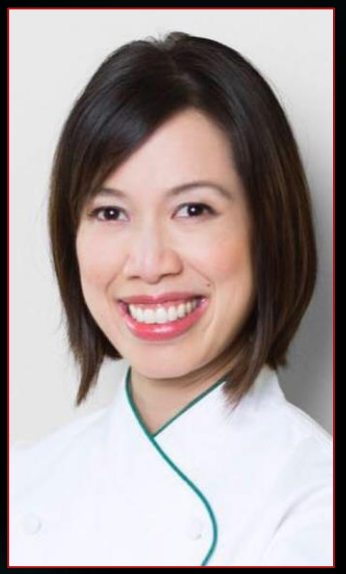







Della Duck

Adam Savage



Christine Ha

New Inductees - 2020

Bruce Springsteen

Linda Ronstadt

New Inductees - 2022

Elon Musk - Asperger's Syndrome
“I’m actually making history tonight as the first person with Asperger’s to host ‘SNL'. Or at least the first to admit it. So I won’t make a lot of eye contact with the cast tonight. But don’t worry, I’m pretty good at running ‘human’ in emulation mode.”

Greta Thunberg - Asperger's syndrome, OCD
“I was diagnosed with Asperger's syndrome, OCD, and selective mutism. That basically means I only speak when I think it's necessary. Now is one of those moments."

New Inductees - 2022

Jesse Jackson - Parkinson's Disease

Amanda Grayson, Spock's Mother - Human
In a Star Trek movie, a group of Vulcan administrators called Spock "disadvantaged" because he had a human mother.

New Inductees - 2022

Selma Blair - living with Multiple Sclerosis

Jacques-Yves Cousteau - paralysis on his right side
If it weren't for a severe car accident that left him paralyzed on much of his right side, Jacques-Yves Cousteau would not have been swimming incessantly off southern France to recuperate.

New Inductees - 2022

Gavin Newsome - Dyslexia

Maya - Little person on The Simpsons
Maya is a beautiful woman whom Moe met over the Internet. She's a little person, standing at about three feet tall. Moe talked of arranging to have a risky height-reduction surgery to literally "knock himself down to her size", but she convinced him not to. She then left Moe because she was put off by his willingness to try something so crazy, and also because she wanted to be with a man who was truly comfortable with her size. Moe's seeking the surgery, therefore, showed Maya that he wasn't the right man for her.

New Inductees - 2022

Josh Miele - Vision Impairment - 2021 MacArthur Fellow
Joshua Miele is a blind adaptive technology designer developing devices to enable blind and visually impaired (BVI) people to use technologies that pervade our lives. Miele's graduate work focused on psychoacoustics (the science of sound perception) and directional aspects of hearing. More recently, he is creating effective and affordable solutions to everyday problems blind people face, particularly access to digital information.

Joe Biden - Stuttering

New Inductees - 2023

Christina Applegate - MS

Harriet Tubman - Head Injury

Selma Blair - MS

Roberta Flack - ALS

New Inductees - 2023

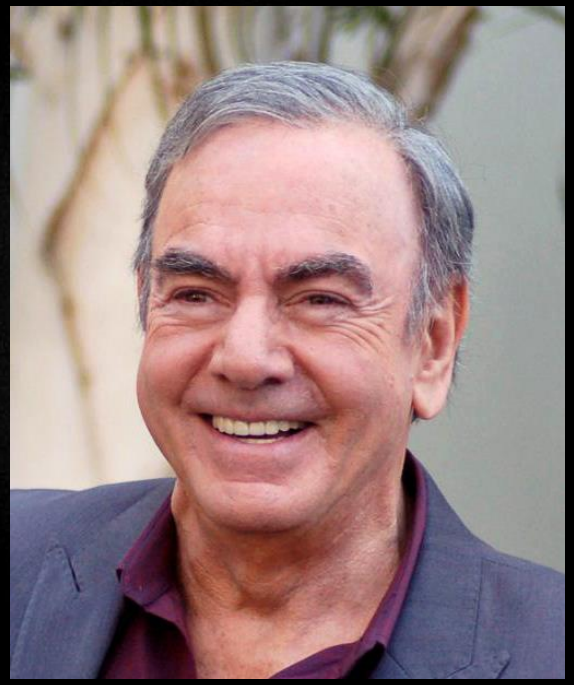
Selina Gomez - Bipolar Disorder

Michael J. Fox - Parkinson's Disease

Danica Patrick - Breast Implant Illness

New Inductees - 2023

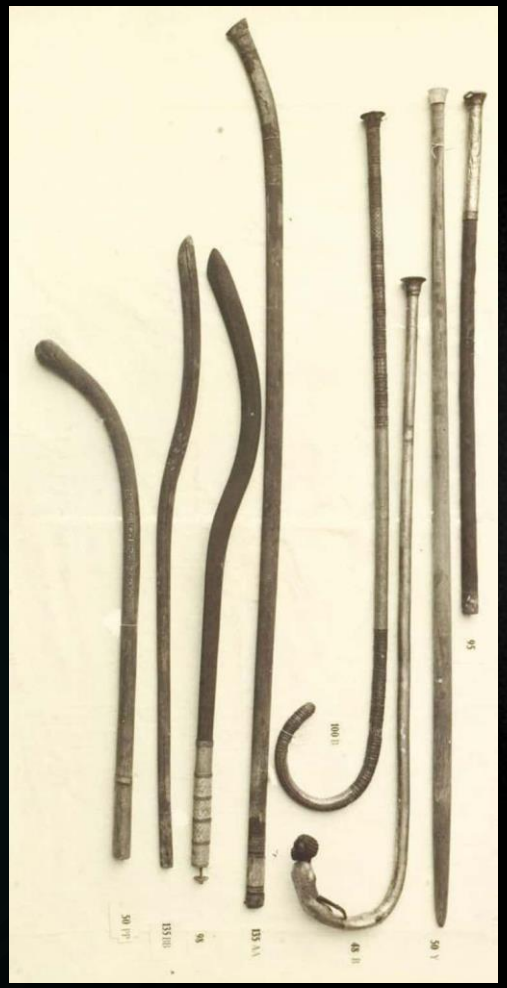
Celine Dion - Stiff Person Syndrome

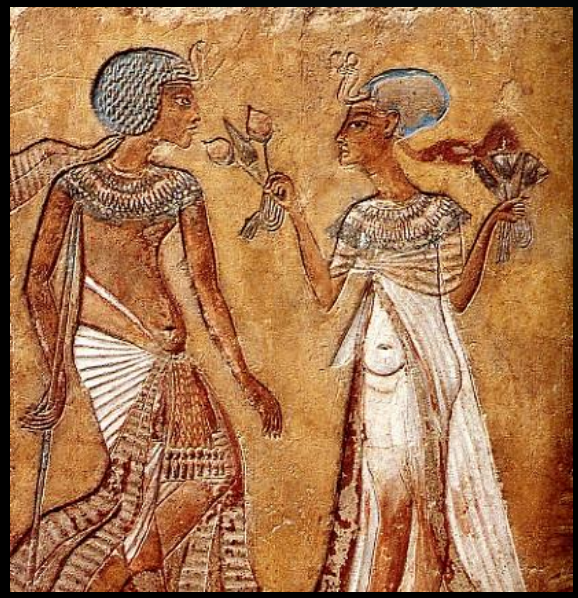


Neil Diamond - Parkinson's Disease

Ozzy Osborne - Parkinson's Disease

New Inductees - 2023



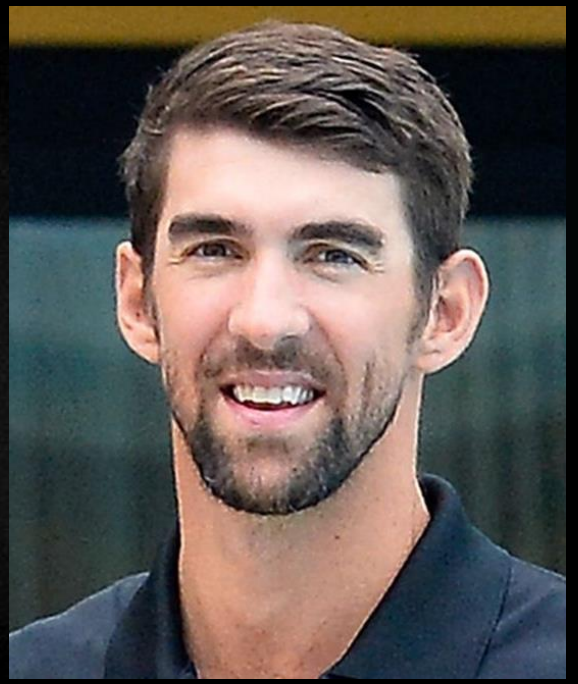


Tutankhamun (born c 1341 BCE) was physically disabled with a deformity of his left foot along with bone necrosis that required the use of a cane, several of which were found in his tomb. He had other health issues including scoliosis and had contracted several strains of malaria.

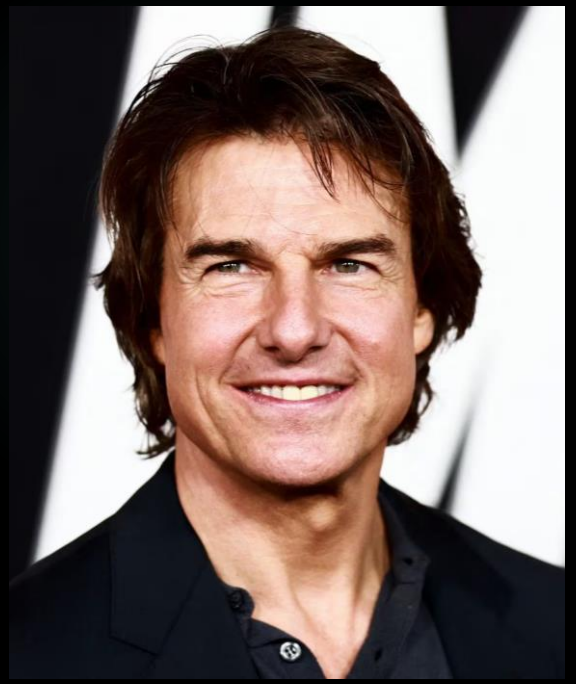
New Inductees - 2024

Bruce Willis - Dementia

Justin Timberlake - ADHD



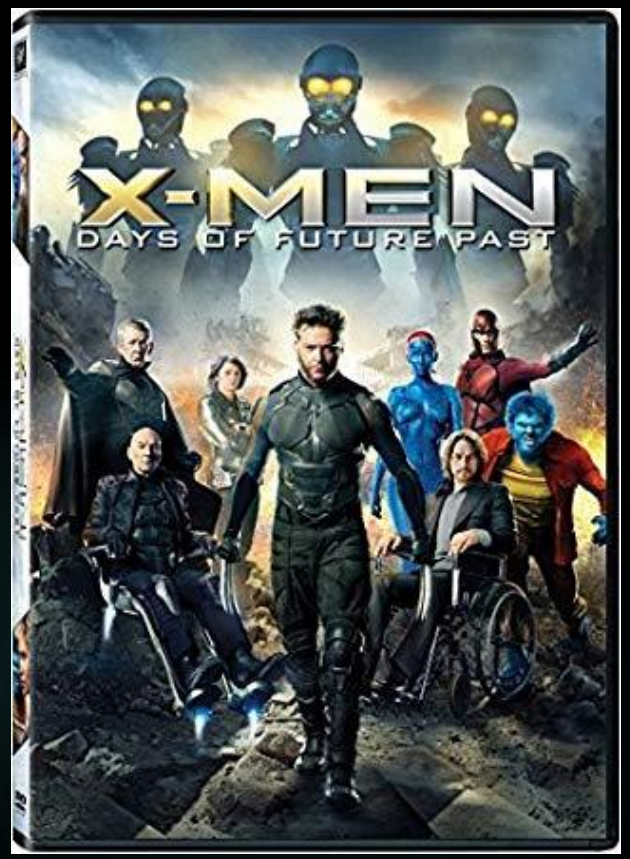
Michael Phelps - ADHD



Tom Cruise - Dyslexia

A Superhero with a Disability

Superheros with a Disability



Robert Van Etten

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

Bob

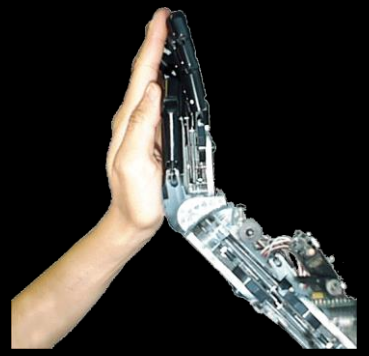
Device Definition of Assistive Technology

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:
  - Devices, services, and policies that benefit people with disabilities
  - Institutions and facilities where the work takes place
  - The process that makes them available to people with disabilities.
- An AT device is one that has a diagnostic, functional, adaptive, or rehabilitative benefit.
- An AT service provides various resources.
- AT policies, laws, and legislation that mandates the provision of devices and services
- Engineers employ an AT process to specify, design, develop, test, and bring to market new devices.

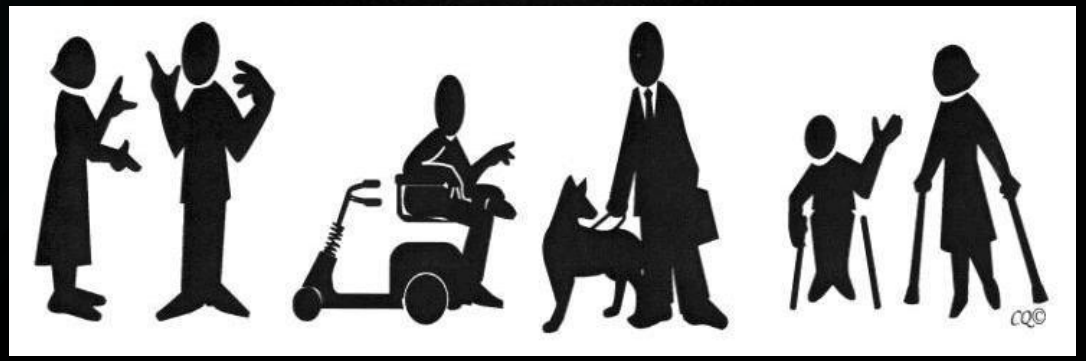


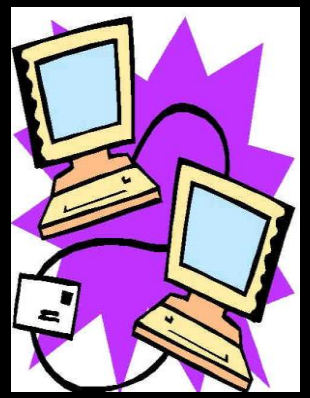
Assistive Technology

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

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.

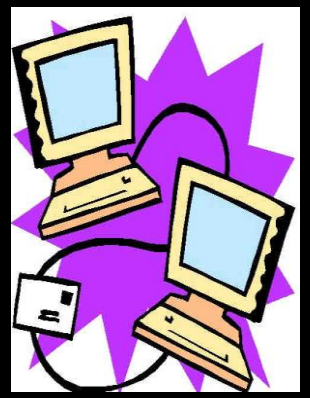




Assistive Technology

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



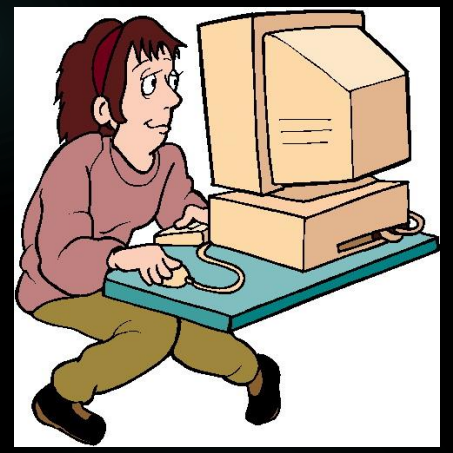
Assistive Technology

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

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

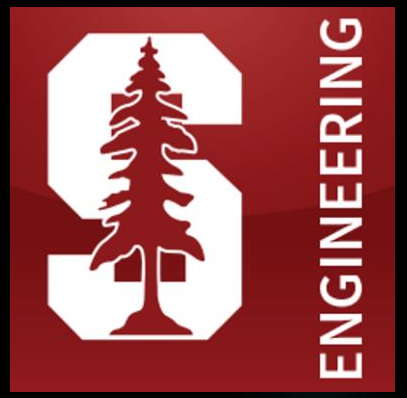
This leads me to conclude that:

Everything is Assistive Technology!



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

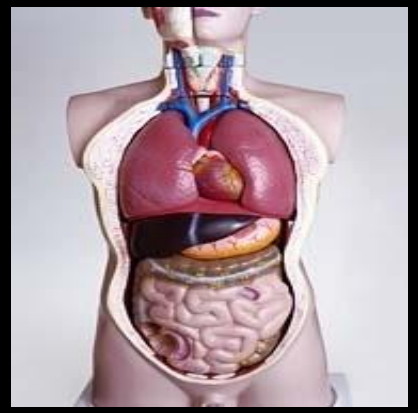
> The universe seems neither benign nor hostile, merely indifferent to the concerns of such **puny creatures** as we are.
> Carl Sagan



Assistive Technology Workers

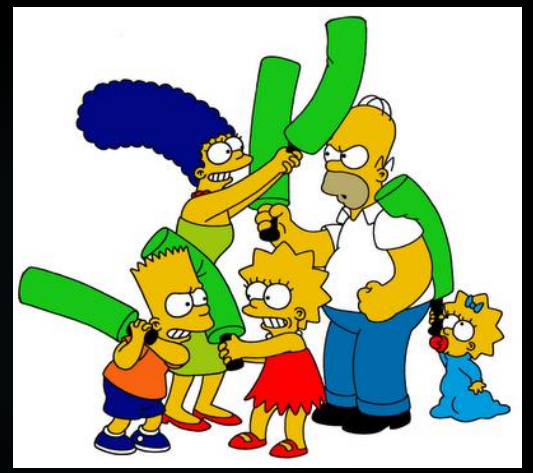
Health care professionals (not just engineers) are involved in evaluating the need for AT devices; working on research, design, and development teams; prescribing, fitting, and supplying them; and assessing their benefit.

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

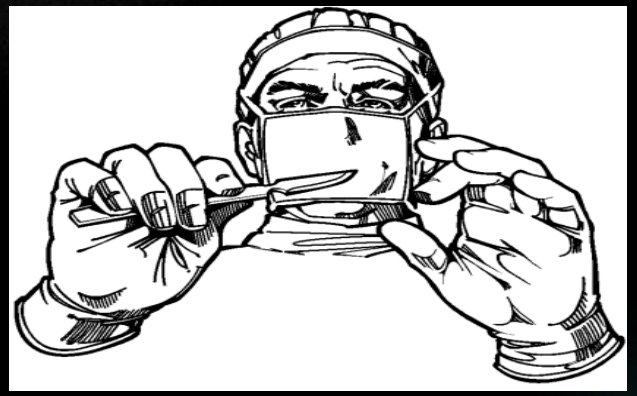


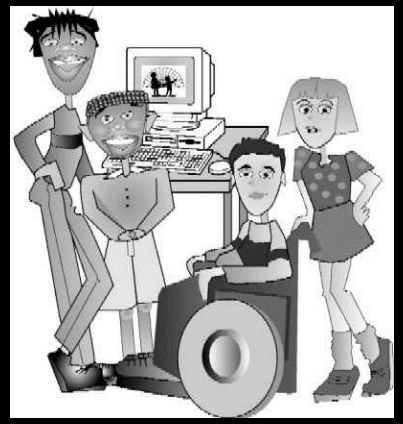
Rehabilitation

- Medical model: Restoration of function caused by disability - through surgery, medication, therapy, and/or retraining - "fix broken people"



- More inclusive model: Includes Assistive Technology

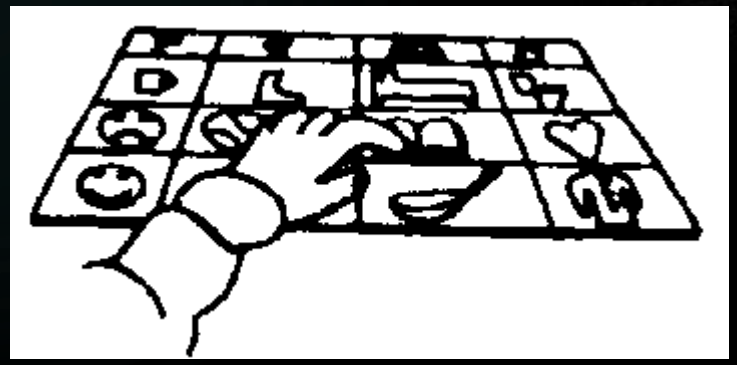




Goals

- Goal of Rehabilitation
  - Restore function and wellness

- 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

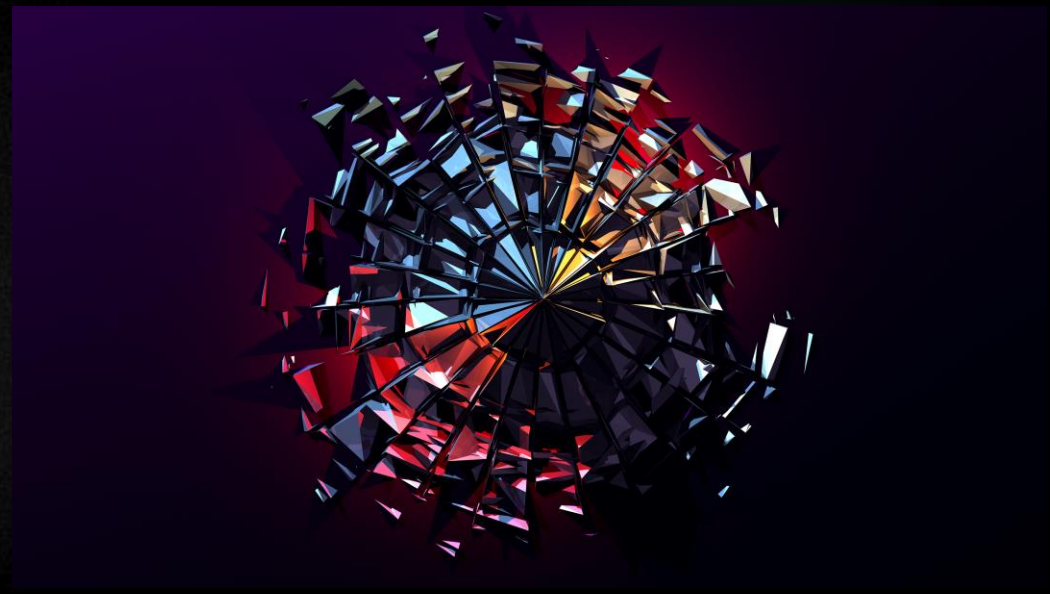
Rehabilitation Engineering

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 **non**-homogeneous group in the US is wheelchair users (several million)

- **Every consumer has a unique personality, challenges, circumstances, goals, 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**

Universal Design

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

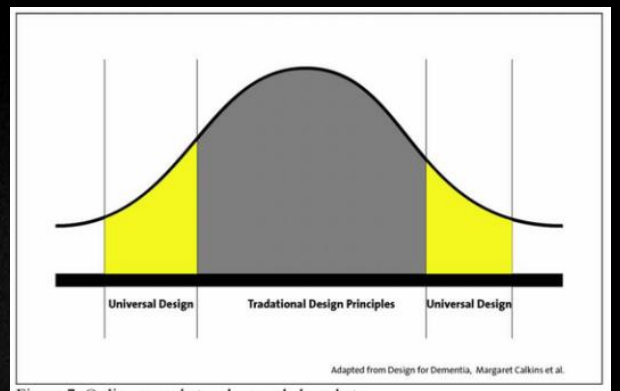


Figure 7: Ordinary market and expanded market

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.

Meyer Library

Terman Fountain

Universal Design Examples

The Problems with Ramps Blended into Stairs

Ed Roberts Campus

We have the solution for you!

Individual Design

- Individuals with disabilities and older adults may have personal challenges that can only be addressed by a custom solution
- The specific challenge, personal preference, and coolness direct prototype design in the course
- Examples:
  - Wheelchair seating
  - Prosthetic fittings
  - Wheelchair laptrays
  - Devices to aid with activities of daily living

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

3D 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."

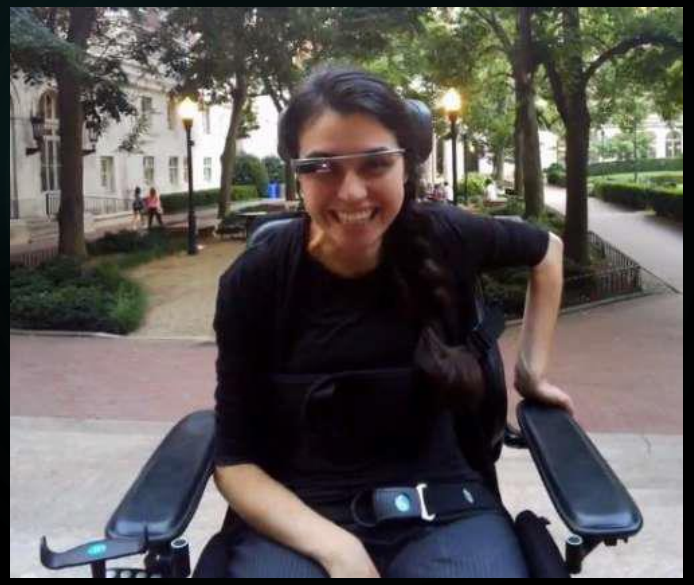
Robot Bed / Wheelchair

"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 a powered wheelchair. A single caregiver assists during the transformation process, significantly reducing the burden on staff."

Panasonic

Google Glass

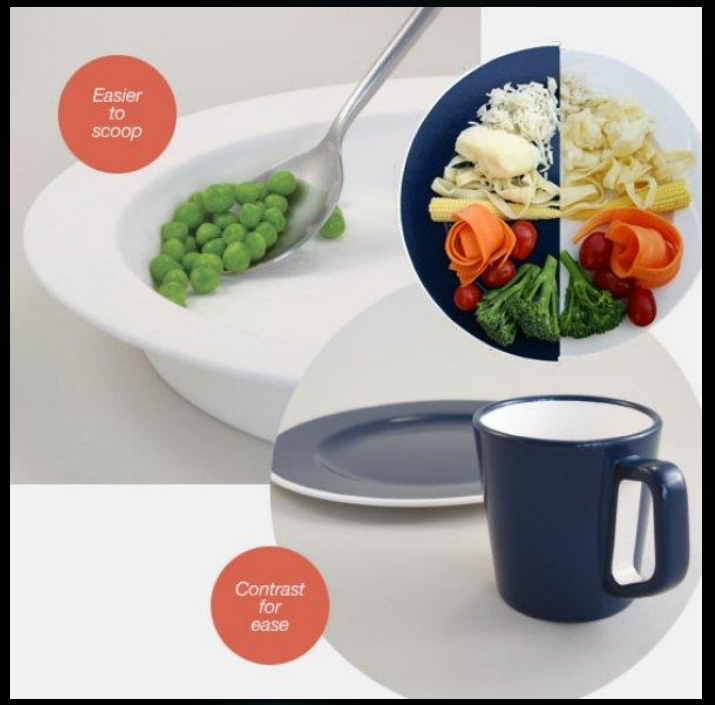
Tammie Lou Van Sant of Santa Cruz is a quadriplegic. She has wanted to take pictures for years and now is able to do it independently using Google Glass - with a nod, swipe, or verbal command.



“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 Blaszczuk

Designs for People with Dementia

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



Winner of Stanford Center on Longevity First Design Challenge

Bionic Pets

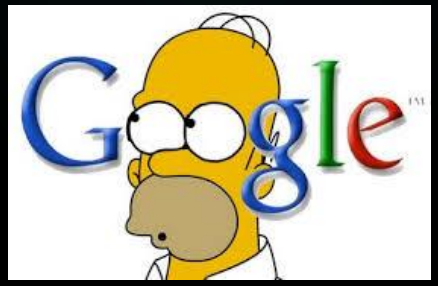
"Sometimes individual animals need our help. Left disabled without fins, flippers, beaks, or tails because of disease, accidents, or even human cruelty, these unfortunate creatures need what amounts to a miracle if they are to survive. Luckily for them, sometimes miracles do happen. Amazing prosthetics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

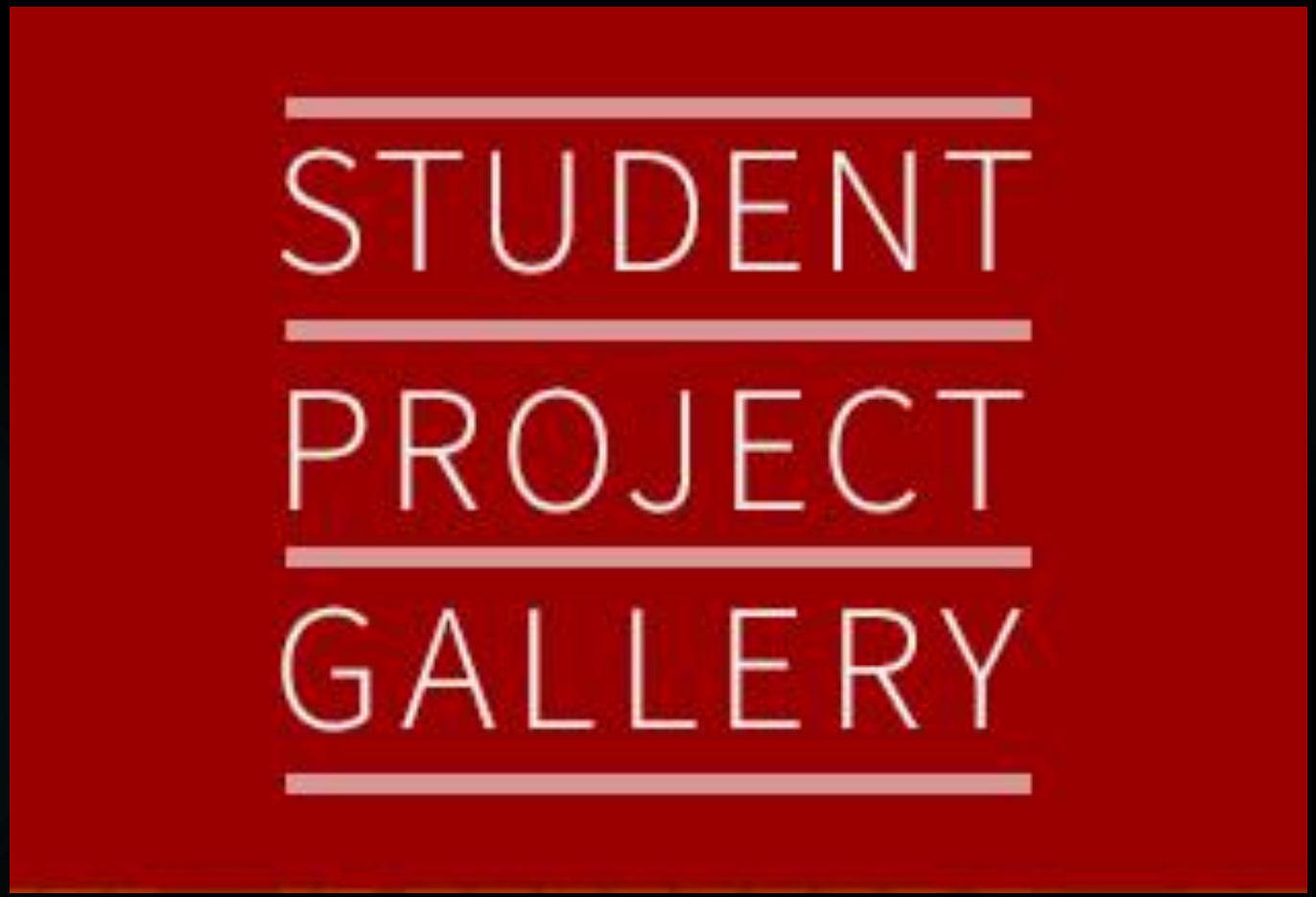
- Johnson & Johnson Independence Technology
- Toyota Research Institute
- Mobius Mobility

Web link

Alexis Wheelchair

Whill Wheelchair

Student Projects from 2023



Team and Individual Projects - 2023

ENGR110/210 – Perspectives in Assistive Technology
Winter Quarter Course

- Ten-week course conducted in-person, in classroom
- Seven teams of four students and two teams of three students
- Two individual projects
- Four students just attended lectures, no project involvement
- Forty students enrolled
- Fabrication projects addressed challenges experienced by people with disabilities and older adults in the "local" community
- Deliverables included presentations, reports, and individual reflections

Accessible and Inclusive Playground Attractions

Explore designs to create new play and educational experiences incorporating multiple senses, actions, and outcomes for all playground users and visitors, especially those with visual impairments and diminished fine motor skills.

Water Bowl for Danny's Service Dog Korey

Explore designs that would enable a wheelchair user with CP to independently care for his service dog's hydration needs.

iPhone Project with Danny

Explore designs that would enable Danny to independently use his iPhone.

Accessible and Inclusive Playground Attractions

Explore designs to create new play and educational experiences incorporating multiple senses, actions, and outcomes for all playground users and visitors, especially those with visual impairments and diminished fine motor skills.

Leash Project for Danny and Korey

Explore ways to make it easier for Danny to operate his wheelchair and control Korey.

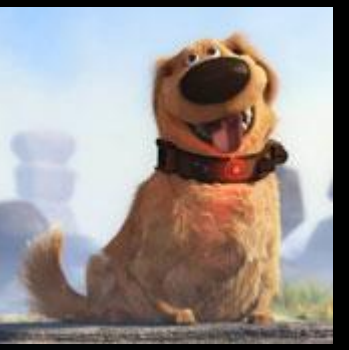
Aesthetic Prosthetic Leg Project for Mary

"I would like to have the ability to 'dress up' my prosthetic leg through coverings to match my outfit. I envision having a cool sleek cover to provide structure under a pant leg and protection to my prosthetic on a daily basis."

Bass Reduction Project for Cat

Explore designs that would enable Cat to enjoy concerts more despite nerve damage to her shin.

Communication Aid for Nathan



Explore designs for a device that would communicate service dog etiquette by "speaking for Nathan", informing people that he is "on the job" and not available to be petted or engage in human-canine conversation.

Mobile Laptop & iPad Computer Support for Abby

Explore solutions that would enable Abby to securely and comfortably use her computer devices while away from a desk.

Candidate Student Projects

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

Team Project Offerings

This year's candidate team projects:

- Projects with Abby, Kinematic / Kinesthetic, Olenka, Gary, Danny & Stanford & Kiara
- Projects suggested by Dave
- Student-defined projects

- **Bring your laptop on Thursday**

Individual Project Offerings

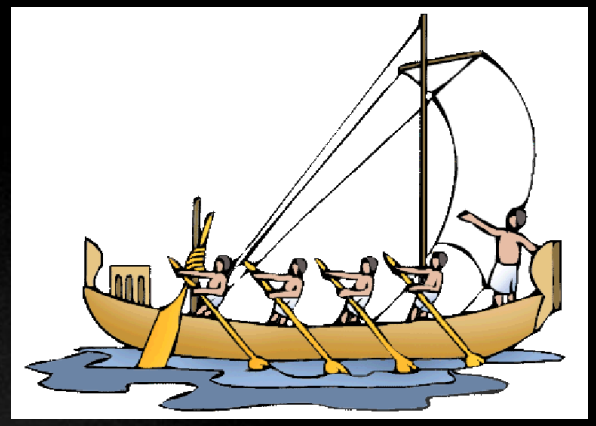
This year's candidate individual projects:

- Report on an advance in assistive technology
- Report on a disability-related topic
- Report on a local disability or aging organization
- Pursue a paper or CAD design
- Pursue an "appearance model"
- Create a work of art
- Engage in an aftermarket aesthetic design
- Engage in an aftermarket functionality / usability design
- Student-defined projects

Project Pitches & Team Formation

Dave's suggested projects:

- Creative Expression
- Designing Your Afterlife
- Tactile Art



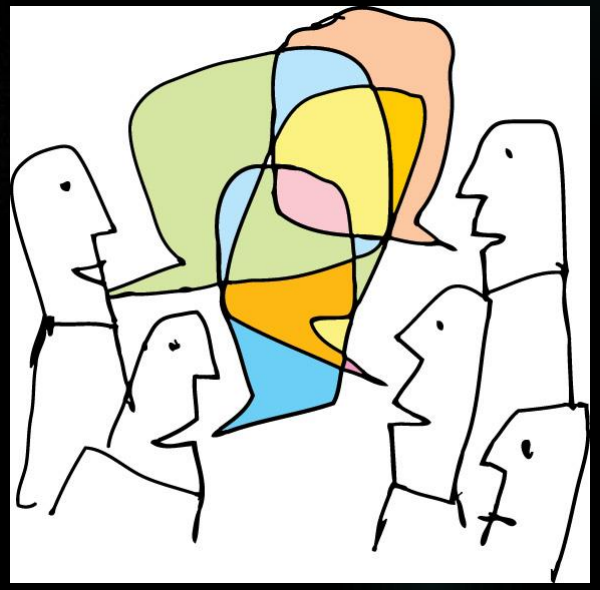
Student Project Resource People

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



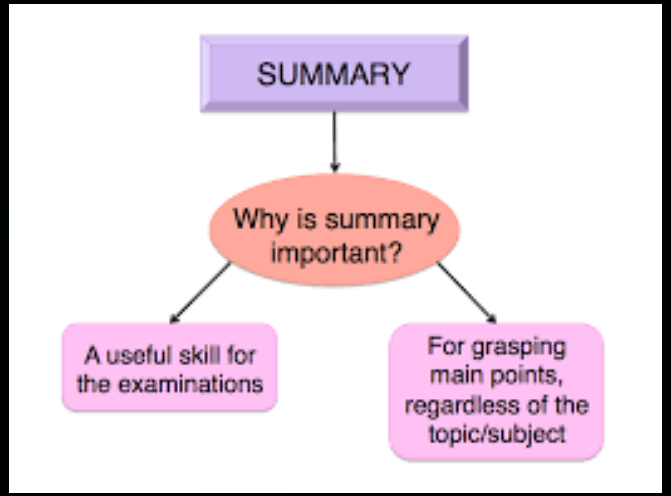

Other Involved People

- Project suggestors
- Individuals with disabilities
- Community members attending lectures



THE
EXECUTIVE
SUMMARY

- Flexible course focusing on building confidence and enhancing professional skills
- Lectures, projects, field trip, assistive technology faire, mid-term & final presentations and reports, project demonstration
- Opportunities for in-class participation and reflection
- 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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  - http://engr110.stanford.edu
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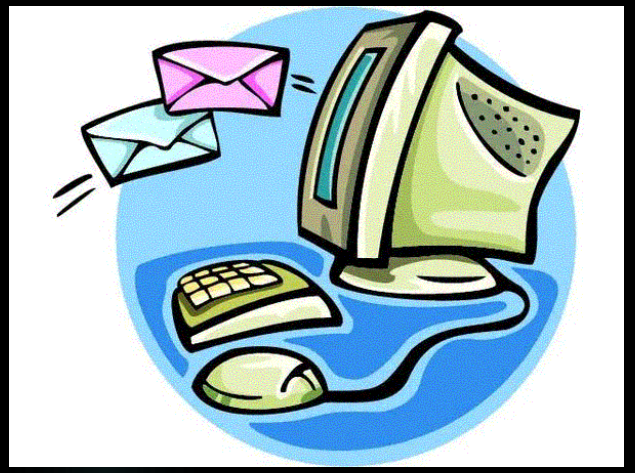
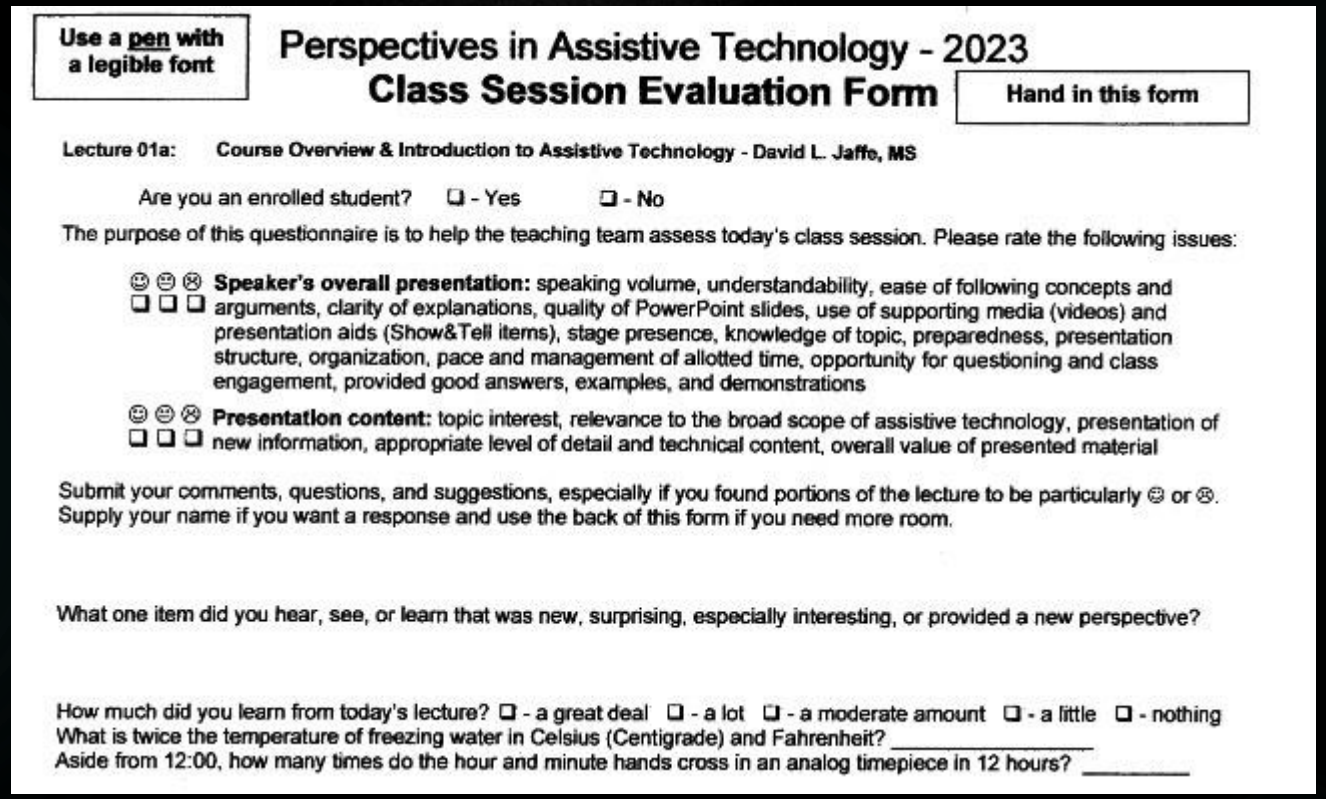


Fill out printed Class Session Evaluation Form



Use a pen with a legible font

Perspectives in Assistive Technology - 2023
Class Session Evaluation Form

Hand in this form

Lecture 01a: **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

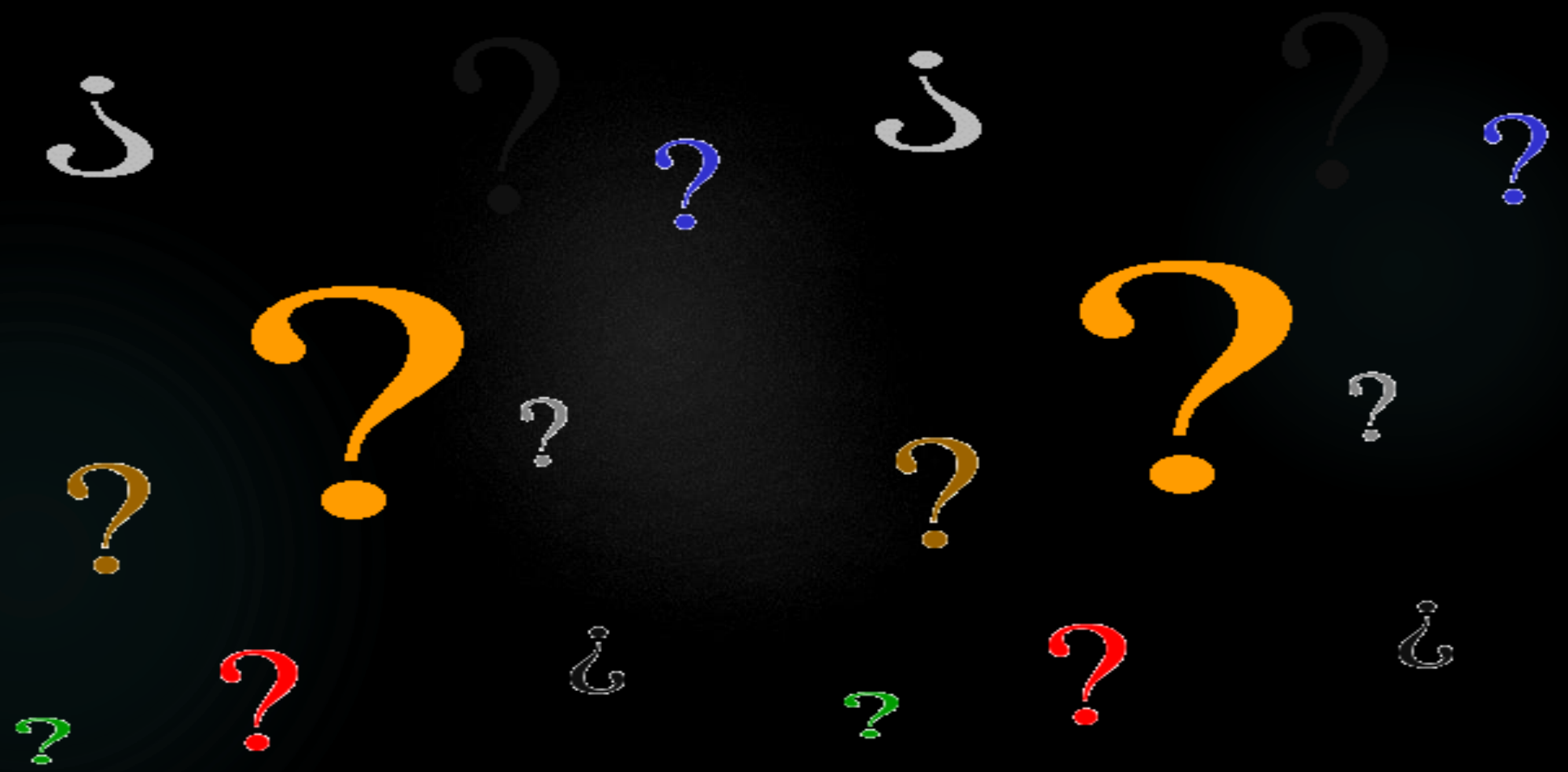
☺ ☺ ☹ ❑ ❑ ❑ **Presentation content:** topic interest, relevance to the broad scope of assistive technology, presentation of new information, appropriate level of detail and technical content, overall value of presented material

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, especially interesting, or provided a new perspective?

How much did you learn from today's lecture? ❑ - a great deal ❑ - a lot ❑ - a moderate amount ❑ - a little ❑ - nothing
What is twice the temperature of freezing water in Celsius (Centigrade) and Fahrenheit? _____
Aside from 12:00, how many times do the hour and minute hands cross in an analog timepiece in 12 hours? _____

Questions?



Adjourn