

January 12, 2012

ENGR110/210

Perspectives in Assistive Technology



David L. Jaffe, MS



Professor Drew Nelson

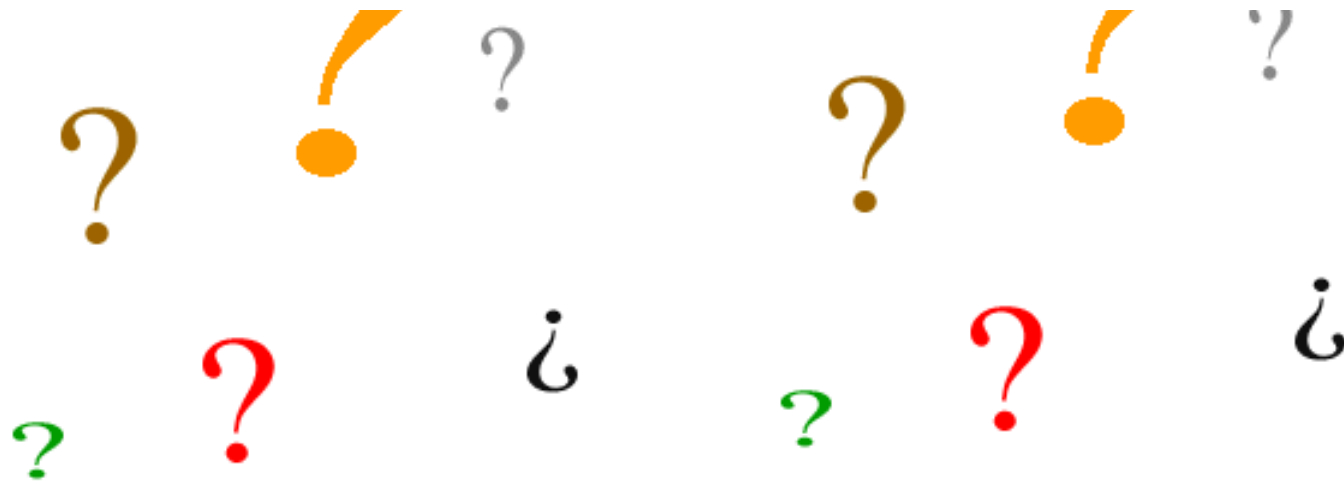


John Thiemer

Questions?



Who's here from out of town?



Did You Miss Tuesday's Lecture?

- Pick up handouts:
 - Student Team Candidate Projects
 - Assignment One
 - Enrolled Student Signup Sheet
- Review lecture audio and slides on course website <http://engr110.stanford.edu/lecture01a.html>
- Email me a 1 – 2 page summary of the lecture including your thoughts
- Upon receipt of your summary, I will credit you with “attending” this mandatory lecture

Who are they?



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



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

Project Pitches & Team Formation

Agenda

1. Introduction of Course Resource People
2. Overview of Room 36 Resources
3. Considerations for Team Formation and Project Selection
4. Project Selection & Team Formation
5. Project Pitches
6. Open Question Time and Random Access

Course Resource People



Deborah E. Kenney, MS, OTR/L

Douglas F. Schwandt, MS



Sakti Srivastava, MBBS, MS

Mark Felling, EE, MBA



Gary M. Berke, MS, CP, FAAOP

Overview of Room 36 Resources



Marlo Dreissigacker Kohn



PRL

PRODUCT REALIZATION LAB

36

R O O M



PURPOSE

Make something!

Get your concepts out into the physical world through hands-on prototyping and exploration.

Room 36 is a subset of the

Product Realization Lab (PRL) and can be used both separately from and along with the full PRL resources.



RESOURCES – TOOLS

- Tools:
 - laser cutter
 - 3D printer
 - electronics prototyping equipment, tools, and supplies
 - band saw
 - scroll saw
 - drill press
 - heat forming tools for plastic
 - vinyl cutter (and heat transfer press for applying vinyl to fabric)
 - sewing machines
 - X-Acto cutting surfaces and tools
 - hand tools such as wrenches, pliers, saws, and drills





RESOURCES – MATERIALS

- Materials:
 - foam core
 - cardboard
 - wood
 - plastics
 - fabric
 - foam
- Bins of interesting materials are available for inspiration and use, and additional materials are available for purchase.
- Claim a project bin to store your materials and projects!



RESOURCES – COACHING

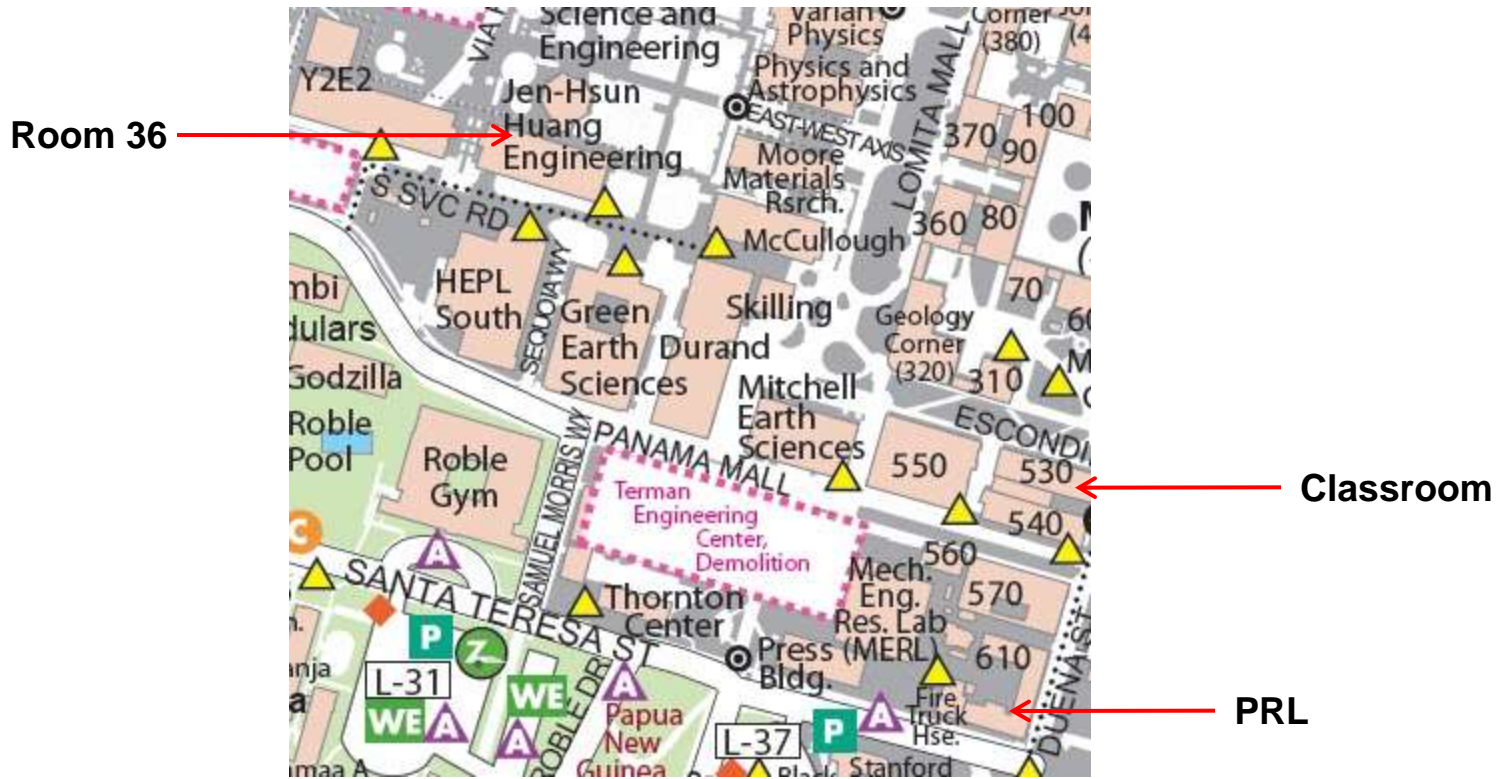
- Teaching assistants are available during all open hours for design and building coaching.





LOCATION

- Room 36 is located on the lower level of the Huang Engineering Center





GETTING STARTED

- Sign up on **Webshop** (<http://webshop.stanford.edu>)
- Attend a 15 minute safety and lab orientation in Room 36 (available during posted times listed on Webshop)
- Pay fee: 1 qtr (\$40) or 2 qtrs (\$70)
 - Day passes are available for \$10
 - Use of Room 36 is included in active PRL passes
- Hours (generally): Mon-Sat 1pm-5, 7pm-11
- **Email Marlo at marlod@stanford.edu with any additional questions**

Project Selection & Team Formation

- For those working on **team** projects:
 - Send me your top 3 project interests
 - Inform me of team members (no more than teams of 3)
 - Name your team
 - Name your project
 - Name your device
- For those working on **individual** projects:
 - Research an assistive technology topic
 - Work on a paper design of an assistive technology device
 - Create a work of art

Considerations for Team Formation and Project Selection (1/2)

Project preference

- All team members should have a desire to work on the same project.

Undergraduate / graduate student

- It would be best if all team members were either undergraduate or graduate students as this makes it easier to continue projects into the Spring Quarter.

Desire to continue project work into Spring Quarter

- Ideally, all team members should commit to continue their project work into the Spring Quarter.

Considerations for Team Formation and Project Selection *(2/2)*

Team's engineering skill set

- Match the team's expertise with the project needs.

Personality

- There should be a compatible mix of personalities in the team.

Other courses

- Can you spend the time working on a team project? Courses like ME218 and ME310 are very demanding.

3-Minute Project Pitches

- **Educational Activities for Children with Disabilities** - Greg Brown, RAFT
- **Application of NeuroSky's Brain-Computer Interface** - Tansy Brooke, NeuroSky
- **Electric Scoop Bowl & Wireless Treat Dispenser** - Henry Evans
- **Virtual Community Project , Elderly Drivers at the Wheel Project , and Household Tasks Project** - Marta Gaia Zanchi, Medinnovo
- **Customize the Wheelchair Project** - Jennifer Smith
- **Sailboat Seating Project** - Fernanda Castelo
- **Sirott Speech Feedback Project** - Tracey J. Baldwin, Kaiser Permanente
- **Low Cost Transfer Device** - Chris and Michael Bayne, ROTA Mobility
- **Rain Protector Project** - Aubrie Lee
- **Accessible Restaurant Menu Project** - Nicole B. Torcolini
- **Friendly Cane Project** - Don Frank & Rosenna Yau, Stanford
- **Adjustable Seating System Project** - Liz Hamill
- **Piano Pedal Project** - Zack Wentz
- **Projects suggested by Berke Prosthetics / Orthotics** - Gary M. Berke
- **Projects suggested by Sunrise of Palo Alto** - Jan Clements
- **Flat House Project & Shower / Bathtub / Sink / Toilet Cleaning Project** - Jack Moorman
- **Projects suggested by Benetech** – Gerardo Capiel
- **Dog Leash Project** - Deborah Davis (video)
- **Other projects** - Dave

Projects Not Pitched

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

Project Pitches

- **Educational Activities for Children with Disabilities** - Greg Brown, RAFT
- Investigate and develop new educational activities appropriate for children with disabilities. This may include mechanical and/or computer software solutions that will provide interactive access for these learners.

On deck: Tansy Brooke, NeuroSky

Project Pitches

- **Application of NeuroSky's Brain-Computer Interface** - Tansy Brooke, NeuroSky
- Explore an application for a person with a disability using the MindSet brain-computer interface product. Examples include the control of household appliances (lights, TV, music system), operation of Bluetooth devices (iPhone), construction of an on-screen keyboard, and design of a communication system for non-vocal users with limited manipulation skills.

On deck: Henry Evans

Project Pitches

- **Electric Scoop Bowl & Wireless Treat Dispenser - Henry Evans**
- **Bowl:** Explore solutions that would bring the food back to where the user could reach it.
- **Dispenser:** Explore a design for a simple wireless treat dispenser that it would operate by a switch or a wireless signal.

On deck: Marta Gaia Zanchi, Medinnovo

Scoop Bowl

Overview: Scoop bowls are ubiquitous for people with disabilities who have limited hand and arm function.

Problem: When Henry scoops, most of the yogurt gets pushed aside where he can't reach it.

Challenge: Redesign a scoop bowl so this is not a problem.



Wireless Dog Treat Dispenser

Problem: Many wheelchair users with severe disabilities have service animals, but have no way to reward them.



Challenge: Design a wireless dog treat dispenser which attaches to the wheelchair and is activated by:



- voice
- cheek-mounted bluetooth EMG
- a laser mounted on glasses
- a Dynavox with headtracker
- some other mechanism that does not require use of the hands.



Project Pitches

- **Virtual Community Project , Elderly Drivers at the Wheel Project , and Household Tasks Project - Marta Gaia Zanchi, Medinnovo**
- See handout or website

On deck: Jennifer Smith

Project Pitches

- **Customize the Wheelchair Project** - Jennifer Smith
- Explore ways to add a personal aesthetic to wheelchairs.

On deck: Fernanda Castelo

SMITHWORKS™

**more positive, empowering design aesthetics
for users of wheelchairs**

Introduction + Project Proposal

January 2012

Jennifer Smith, Founder

Target Users: The Numbers

Most generally, users of manual wheelchairs

- Approximately 2 million people in the US

More specifically, 65+ users of manual wheelchairs

- 65+ population driving growth in mobility aids market
- Use of manual wheelchairs by 65+ is 9X that of <65

Description	2010	2020	2030
65+ US Population	40.3 M	54.7 M	71.4 M
65+ Manual Wheelchair Users	1.1 M	1.5 M	2.0 M

Target Users: Brand Preferences

Consumer “Mood Board”

- Some brands this demographic considers good/premium
- 7-10K Baby Boomers per day turning 65, starting in Jan 2011 (born 1946-1964)



WILLIAMS-SONOMA



orbit baby™



ESTÉE LAUDER

Consumer Problem

Lack of Design for Aesthetic Preferences

- Majority of designs haven't changed substantively in decades, look geriatric, and lack individuality → add insult to injury

PRODUCT PERCEPTIONS (FOCUS GROUP FEEDBACK)

“geriatric” “fear” “tragic” “institutional” “like a hospital”
“deterioration” “dependent” “undignified” “old & tired”



Consumer Problem

Little Opportunity to Extend Personal Aesthetics

- Whereas choice of clothes, shoes, and accessories are made daily, users of wheelchairs have to “wear” the same equipment everyday and for every different kind of occasion

Which one of these is not like the others?



Consumer Problem

Consumer Product Innovations Trending to Individuality, Customization, & Design → But Not in Mobility Aids



The Solution: Product Requirements

Project Aim

- Explore ways to add a personal aesthetic to wheelchairs
- Aspiration: more positive, empowering design aesthetics

Specifications

- No altering or permanent damage to wheelchair structure
- Easily changed and cleaned by the user
- Works on a number of popular/standard wheelchairs covered by insurance and Medicare
- Consider different user personas and aesthetic points of view (e.g. refined/elegant, modern/contemporary, premium/luxury, smart/sporty, male/female, age of the user, etc.)

The Solution: Product Requirements

Specifications (cont'd)

- Consider different usage occasions (e.g. in-home, outdoors, dinner party, tailgater, etc.)
- Consider fabrics, metal finishes, color, patterns, light, texture, and text elements

Design Suggestions

- Some sort of “kit” that transforms the look-and-feel of the wheelchair to cleaner, more modern lines
- “Slipcovers”
- “Hubcaps”

The Solution: Skills

Skills Needed

- Mechanical Engineering
- Product Design / Industrial Design & Engineering
- Textile / Fabric Engineering a plus

Resources/Expertise from Me

- Business Background: MBA + Marketing/Strategy experience
- Passion and Time
- Disability

Project Pitches

- **Sailboat Seating Project** - Fernanda Castelo
- Explore a seating design for a sailor with quadriplegia that is adjustable, comfortable, functional, and secure.

[weblink](#)

On deck: Tracey J. Baldwin, Kaiser Permanente

Project Pitches

- **Sirott Speech Feedback Project** - Tracey J. Baldwin, Kaiser Permanente
- Design a voice-activated feedback device that provides a means of maintaining a proper speaking volume for people with Parkinson's Disease.

On deck: Chris and Michael Bayne, ROTA Mobility

Parkinson's Disease Biofeedback Device

- Voice activated background noise
Detected by a laryngeal microphone and activated when vocal volume is low (below 70dB) (requires in ear bud for patient to hear noise)
- Display of speaker's volume and pitch
- Feedback available in visual / auditory / kinesthetic display (with ability to set threshold targets)

iPhone iPad app



Laryngeal microphone



Respiratory sensors

- Monitors abdominal / chest movement and respiration rate

Modality	Acronym	Measures	Sensor
electrocardiograph	ECG/EKG	cardiac conduction, heart rate, HRV	
electrodermograph	EDA, GSR, SC, SP	eccrine sweat gland activity	
electroencephalograph	EEG	cortical postsynaptic potentials	
electromyograph	SEMG	muscle action potentials	
feedback thermometer	TEMP	peripheral blood flow	
photoplethysmograph	PPG	peripheral blood flow, heart rate, HRV	
pneumograph	RESP	abdominal/ chest movement, respiration rate	



Masking modes

- Ambient background noise
(people talking, restaurant, etc)
- White noise

Environmental noise

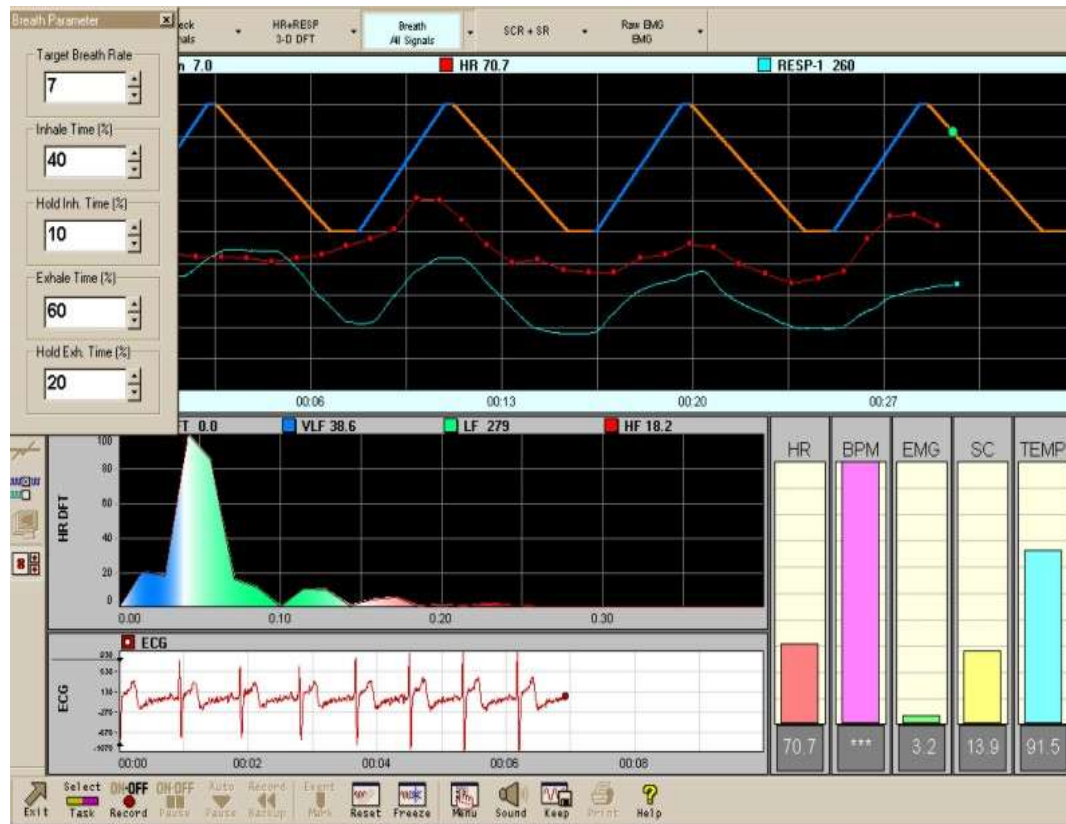
Computer interface

- Biofeedback device interfaces with the clinician's office based computer



Display Options – pitch, volume

- Colored lights, tones, vibration, bar graph



Project Pitches

- **Low Cost Transfer Device** - Chris and Michael Bayne, ROTA Mobility
- Explore designs for a low cost transfer device for a wheelchair user.

On deck: Aubrie Lee



Introduction + R&D Project Proposals



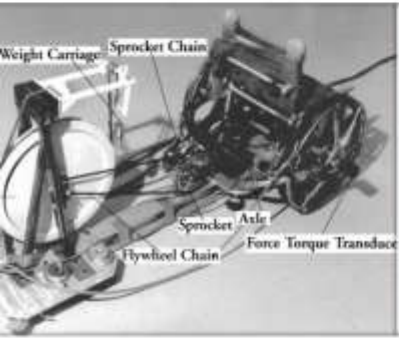
Hard



Pain



Health



RoChair & RoTrike

The most efficient and ergonomic rides for those who can't walk.



RoChair

The world's most advanced manual wheelchair.

< 2010 prototype shown >



RoTrike

The ultimate cross-over wheelchair.

< 2010 prototype shown >

RoTrike

Fully integrated power assist system for RoTrike.



Specified
Sourced
Integrated
Tested





RoChair



RoTrike PA



What's next



RoScooter

A lightweight, foldable, manual scooter at an unbelievable price.



ROTA Wheel Sets

Twist-lock hub, quick-release axle, lightweight rim, and premium tire.
A universal-fit 24-26" wheel set all included.



Slide removed per request of Rota

Slide removed per request of Rota

ROTA Lift

A manually operated transfer device.



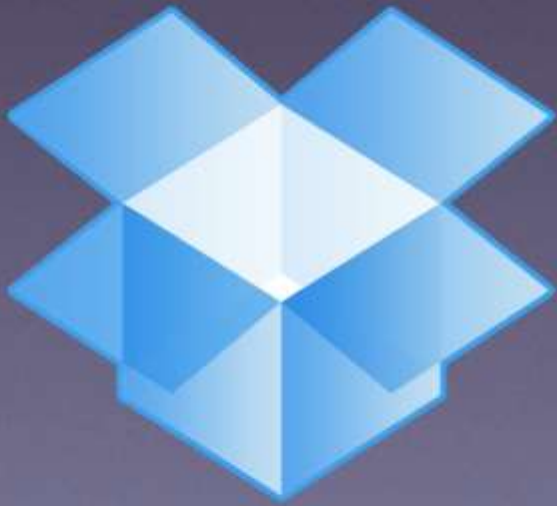


Stanford

ROTA Factory

ROTA HQ







Michael



Suki



Chris







Amrik



[Follow](#) @rotamobility

See us at the Abilities Expo San Jose, CA Booth 328 Nov. 18-20 25 days ago

<p>Buy a ROTA Just \$4,980 all included.</p> 	<p>Medical Institutions Request a ROTA clinic.</p> 	<p>We're recruiting Wheelchair riders, engineers and salespeople.</p> 	<p>Help Fund Research Improve the lives of people living with disabilities.</p> 
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rotamobility.com

Project Pitches

- **Rain Protector Project** - Aubrie Lee
- Explore solutions to provide rain protection for a Stanford student who uses a scooter to get around campus.

On deck: Nicole B. Torcolini

Project Pitches

- **Accessible Restaurant Menu Project** - Nicole B. Torcolini
- Create an accessible database of restaurant menus that can be accessed via a website or a mobile application.

On deck: Don Frank & Rosenna Yau, Stanford

Project Pitches

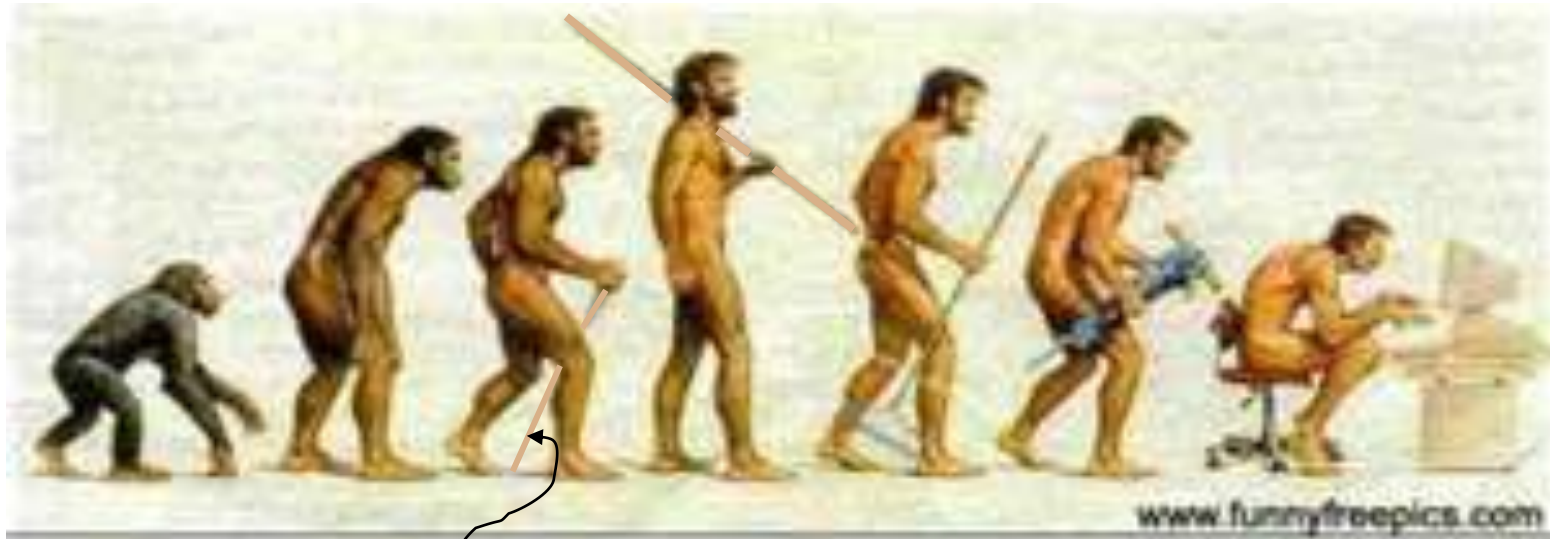
- **Friendly Cane Project** - Don Frank & Rosenna Yau, Stanford
- Explore designs for a light weight cane that can accommodate the weight of its user and easily retract and extend with one hand.

On deck: Liz Hamill

Friendly Creative Cane Project

Project Contact – Rosenna Yau - rosenna.yau@stanford.edu

Don Frank - nodknarf@hotmail.com



Note

With people throughout the world still using the cane, (starting as shown during our third stage of development), it's still used with little or no changes to configuration, safety, cost factor, and most importantly ease of use.

Friendly Creative Cane Project

Through engineering curiosity, imagination, skill set, visions and meeting person's needs, many, many inventions have evolved.



Di Vinci's concept to Boeing's 747



Abacus to Computers



Wagons to Sports Cars



**One Room School
to
Stanford's
Engineering Library**



Friendly Creative Cane Project



Except for some minor variations,
little has been done to improve or
enhance the basic cane function to
overcome many of life's pitfalls



Personal Convenience Variations Over Time



Gun
Sword

Brandy
Capsules

Multiple
Feet

Friendly Creative Cane Project

I've been a full Cane user (cane'ite) since 2007 due to arthritic knees, total knee replacement surgery and most recently spinal surgery. The "Pitfalls" and every day "Challenges" are "Cane-a-dates" for disaster.

Entering/Exiting Cars, Airplanes and Theater/Church rows

Using Cane while moving down rows of seats, by passengers carry on, peoples feet
Stowing Cane as passenger while attaching seat belt, or climbing into rear seat



Car Airplane Theaters

Limited ease of use in different scenarios

Difficult to hand out candy canes "One Handed" plus distributing presents
Storing Cane from being a trip hazard as people rush to get a drink at a game



Stadium Chow Line Santa

Difficultly in accomplishing required and special tasks

Most buildings are User Friendly and not all fun rides can be used by everyone
During Pool Class, showing 'Hands On" techniques requires use of both hands



Restrooms Carnival Ride Pool

Subtle environmental hazards, uneven surfaces, wet surfaces

Slipping or falling can happen when the Cane's tip skids on wet surface
Sudden change of weight shift as Cane drops in a pot hole or uneven area



Pot Holes Wet Floors Stairs

Friendly Creative Cane Project



STOUT DESIGNED CANE (To the Tune of “Stout-Hearted Men”)

**Give us a Cane, a Stout-Hearted cane;
Designed by students of Stanford Engineering School.**

**Start by considering material that’s strong yet so light;
With functions, easy to use in all conditions, both day night.**

**Start with today's Cane, the basic standard Cane;
Consider “Pitfalls” of every day use, to make it better.**

**Shoulder to shoulder, consider everything bolder and bolder;
Brainstorm, conceptualize, let your design ideas roam free.**

**Cane users throughout the world would forever be in your debt;
Your newly designed Cane would be “Nobel” worthy, we bet.**



**Thanks For Your Consideration
Rosenna & Don**

January 12, 2012



January 12, 2012

Project Pitches

- **Adjustable Seating System Project - Liz Hamill**
- Explore lightweight, portable, adjustable seating solutions for a woman who experiences chronic pelvic pain and associated chronic lower back pain.

On deck: Zack Wentz

Project Pitches

- **Piano Pedal Project - Zack Wentz**
- Explore designs that would enable a Menlo Atherton high school student with paralysis to operate the sustain foot pedal on his electronic music keyboard.

On deck: Gary M. Berke

Project Pitches

- **Projects suggested by Berke Prosthetics / Orthotics - Gary M. Berke**
- **Stockings:** Explore designs for a simple device that will assist individuals in rolling on or pulling up their compression stockings.
- **Aids:** Design an aid that provides increased independence for a male user with a bilateral traumatic trans-radial (below the elbow) amputation in toileting and showering.

Gary M. Berke MS, CP, FAAOP
Adjunct Clinical Instructor,
Department of Orthopaedic Surgery

Private Practitioner
Redwood City, CA







- No-Hands attachment for the shower to allow for cleaning of private areas, back, neck and the washing of hair.
- The limitations of this project are that this device must be durable, reliable, relatively inexpensive, and waterproof.

Project Pitches

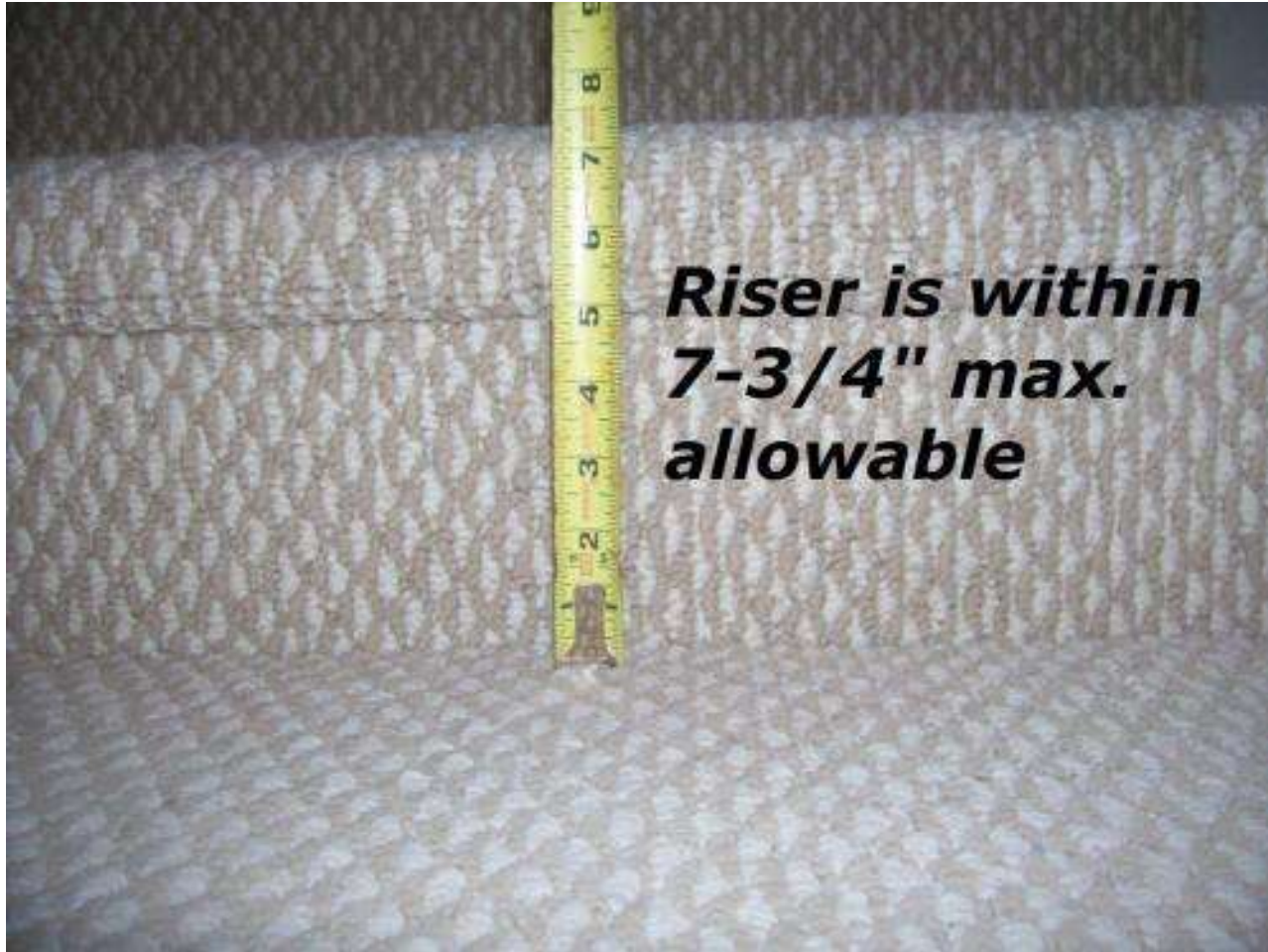
- **Projects suggested by Sunrise of Palo Alto -
Jan Clements**
- See handout or website

On deck: Jack Moorman

Project Pitches

- **Flat House Project** - Jack Moorman
- Explore and design solutions that can be retrofitted to current housing for entering and leaving a house, one step up or down on a single floor, and the multi-step problem of stairs.

Flat House Project



Standard stair riser

Flat House Project



Inside step height – 5 inches

Flat House Project



Outside step height – 3.5 inches

Flat House Project



Outside step height – 5 inches

Flat House Project



Outside step heights – 5 inches and 8 inches

Project Pitches

- **Shower / Bathtub / Sink / Toilet Cleaning Project** - Jack Moorman
- Explore and design solutions for cleaning problems for a senior with disabilities.

Shower / Bathtub / Sink / Toilet Cleaning Project

- User is required to:
 - Bend over (shower floor)
 - Reach in an awkward manner (behind toilet)
 - Smell and inhale noxious fumes (cleaners)
 - Lean out supported by one hand (clean tub)
 - Get close to work surface (poor eyesight)
 - Take a high step with leg (clean tub)
 - Reach high over head (shower walls and ceiling)
 - Pressure weak wrists (scrubbing)
 - Get up from a low seat (cleaning floors)
 - Sanitize cleaning tools (toilet bowl brush)
 - Remove mold (difficult work)
 - Notice drips and leaks (hearing and eyesight issues)
 - Access to cleaning tools and supplies (high or low storage)

Project Pitches

- **Projects suggested by Benetech – Gerardo Capiel**
- Image Analysis and Classification
- Image Sampler and Finder
- PDF to RTF Conversion
- Graphing Calculator that Produces SVGs for Use as Tactile Images
- Making Route66 More "Switch Friendly"
- Making the Bookshare Android Reader More "Switch Friendly"

On deck: Deborah Davis video

Project Pitches

- **Image Analysis and Classification**
- The goal is to develop an application which can analyze graphical images and determine what types of image they are (photographs, drawings, charts, etc.) and further categorize them so that a human describer can focus on the task of creating the image descriptions.

Project Pitches

- **Image Sampler and Finder**
- The goal is to develop a tool that automates the comparison of an image that needs to be described with other images in the repository and find similar images. With these proposed matches people annotating the images can repurpose the text, thus expediting the image description process.

Project Pitches

- **PDF to RTF File Conversion**
- The goal is to analyze/debug an existing, open-source conversion tool that would convert these PDF files into RTF, from which Benetech's Bookshare system then would be able to convert the files to DAISY format. Once the materials are defined in DAISY, then Bookshare members can have access to these materials on any of their AT devices. As a proof-of-concept for this project, the materials from the Perspectives in Assistive Technology course could be converted and made available through Bookshare.

Project Pitches

- **Graphing Calculator that Produces SVGs for Use as Tactile Images**
- One of the initiatives of the DIAGRAM Center is to be able to offer accessible images that can be described dynamically by text-to-speech (TTS) software or printed as a tactile graphic, based on the function and parameters that are fed to an open source graphing calculator module. Through the use of a dynamic template, minimal or no human intervention is required to describe the graphed function.

Project Pitches

- **Making Route66 More “Switch Friendly”**
- The goal is to identify areas and functions within Route66 where switches could be introduced to enable readers to take advantage of movements to control the flow and usage of this reading tool.

Project Pitches

- **Making the Bookshare Android Reader More “Switch Friendly”**
- The goal is to identify areas and functions within the Bookshare for Android where switches could be introduced to enable readers to take advantage of movements to control the flow and usage of this reading tool.

Project Pitches

- **Dog Leash Project** - Deborah Davis ([video](#))
- Explore designs for a dog leash system that will be easy for users to attach to their wheelchairs independently, prevent the leash from being caught under the wheelchair, and avoid being tipped over by a strong dog.

On deck: Dave

Project Pitches

- **Software projects suggested by Project: Possibility – [link](#)**
- Project: Possibility goal: create and support innovative software projects that are empowering for the software developers who implement them and for the persons with disabilities who use them.

Projects Not Pitched

See the handout or website for these project descriptions

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

Project Pitches

- **Other projects – Dave Jaffe**
 - Accessible interfaces for commonly used devices
 - Online multi-site tele-video games for seniors
 - Projects listed in NSF guide
 - Student-defined projects (with Dave's approval)

Tuesday, Jan 17th



Gayle Curtis – Design Consultant
**Need Finding for Assistive
Technologies**

Open Question Time and Random Access