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
Did You Forget to Sign the Attendance Sheet on Tuesday?

Please see Dave after class
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
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.
• 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
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

<table>
<thead>
<tr>
<th>Description</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
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<tr>
<td>65+ US Population</td>
<td>40.3 M</td>
<td>54.7 M</td>
<td>71.4 M</td>
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<tr>
<td>65+ Manual Wheelchair Users</td>
<td>1.1 M</td>
<td>1.5 M</td>
<td>2.0 M</td>
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</table>
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)
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”
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.

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

<table>
<thead>
<tr>
<th>Modality</th>
<th>Acronym</th>
<th>Measures</th>
<th>Sensor</th>
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<tbody>
<tr>
<td>electrocardiograph</td>
<td>ECG/EKG</td>
<td>cardiac conduction, heart rate, HRV</td>
<td></td>
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<tr>
<td>electrodemograph</td>
<td>EDA, GSR, SC, SP</td>
<td>eccrine sweat gland activity</td>
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<tr>
<td>electromyograph</td>
<td>EEG</td>
<td>cortical post-synaptic potentials</td>
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<td>SEMG</td>
<td>muscle action potentials</td>
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<td>feedback thermometer</td>
<td>TEMP</td>
<td>peripheral blood flow</td>
<td></td>
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<tr>
<td>photoplethysmograph</td>
<td>PPG</td>
<td>peripheral blood flow, heart rate, HRV</td>
<td></td>
</tr>
<tr>
<td>pneumograph</td>
<td>RESP</td>
<td>abdominal/ chest movement, respiration rate</td>
<td></td>
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</tbody>
</table>
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
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.

RoTrike
The ultimate cross-over wheelchair.
RoTrike

Fully integrated power assist system for RoTrike.
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.
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

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

January 12, 2012
Except for some minor variations, little has been done to improve or enhance the basic cane function to overcome many of life's pitfalls.
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

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

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

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
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
"That's all folks!"
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.

On deck: Jan Clements
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.

On deck: Gerardo Capiel
Flat House Project

Riser is within 7-3/4" max. allowable

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 Jaffee

  – 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