“Design for Independence from Disability”

(E/ME105)

A collaboration between
The California Institute of Technology
Rancho Los Amigos National Rehabilitation Center
Art Center College of Design

Winter Quarter 2015
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<th>Name</th>
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Today’s Agenda

• Welcome!

• Introduction of Instructors
  – Pasadena
    • Ken Pickar
    • Nate Allen
    TA Alex Hartz
  – Rancho Los Amigos
    • Phil Requejo
    • Andy Lin
Today

Introduction: What the class is about (And what it’s not)

- Trip to Rancho
- Class notes
- Student’s introduction: Who I am? Why am I taking the class
Professor Ken Pickar
TA  Alex Hartz

Classroom 3 BBB

E-mail
Ken Pickar  Pickar@caltech.edu
Alex Hartz ahartz@calech.edu

Office  244 KeithSpalding

Phone  (626) 395 4185  (Ken)

Website http://www.pickar.caltech.edu/

Admin Asst  Leslie Rico (626) 395 3389

Availability:  Anytime but no set hours (best to e-mail first)
We will have informal team reviews of progress to date periodically
Rancho Los Amigos

Dr Philip Requejo
E-mail prequejo@verizon.net

Andrew Lin, MS
E-mail alin@dhs.lacounty.gov

Availability:
Art Canter College of Design

Nathan Allen
E-mail nathanallen@gmail.com
My Classes

- **Product Development/Technology Management Courses**
  - E/ME 105  Product design
  - E 102 a,b  Entrepreneurship (Q1,3)
  - E/ME 103  Management of Technology (Q3)

- **Other Resources**
  - Caltech Engineers for a Sustainable World
    http:www.its.caltech.edu/~esw
  - Caltech Entrepreneur’s Club
    http:www.its.caltech.edu/~eclub
  - Tech Coast Angel Meetings (techcoastangels.com)
  - Pasadena Angels
Evolution of This Class

1. Anything Products

2. Developing World Guatemala

3. Developing World India

4. Freedom from Disability (LA)
Ken Pickar’s background

• PhD Low Temperature Physics
• Bell Labs
• GE Corporate R&D
• AlliedSignal (Honeywell)
• Caltech 1998-
• Tech Coast Angels 1998-
• Board of Directors: 3 public companies, start-ups, Los Angeles Regional FoodBank
Rancho Los Amigos National Rehabilitation Center (RLANRC), www.rancho.org, is a Los Angeles County public hospital offering Spinal Injury, Traumatic Brain Injury, Stroke, General Neurological Conditions, Gerontology and Reconstructive rehabilitation and services.

RLANRC treats approximately 3,000 inpatients annually and sees over 63,000 outpatients. The majority of people served by RLANRC qualifies for Medi-Cal (Medicaid) and comes from a racial/ethnic minority group; the racial/ethnic breakdown is 55% Hispanic, 16% Asian, 9% black and 20% non-Hispanic, Caucasian.

As RLANRC 's mission is to provide each patient with superior medical and rehabilitation services in a culturally sensitive environment, many individuals who have been served at RLANRC throughout the years chose to live close to the facility as it offers them continuity of care, long after their initial hospitalization. Individuals with disabilities have become involved with the institution as consumers, mentors, volunteers and workers enabling newly injured individuals to better transition to the community.
Philip S. Requejo, PhD

- BSEE, PhD Biomechanics and Kinesiology
- Director, Rehabilitation Engineering Department and Associate Director of Pathokinesiology Laboratory.
- Co-Director of a Rehabilitation Engineering Research Centers – Spinal Cord Injury and Aging with Disability.
- Adjunct Associate Professor – Biomedical Engineering, Biokinesiology and Physical Therapy Biology, University of Southern California

THE ART & SCIENCE OF REHABILITATION
Andy E. Lin, MS

- Rehabilitation Engineer and Technology Specialist at Center for Applied Rehabilitation at Rancho Los Amigos National Rehabilitation Center
- 20 years of experience in designing and evaluating tech for people with disabilities
- Director of Emerging Technology Lab
  - Researching ways which new technologies (Virtual Reality, 3D printing, Google Glass and wearable tech) can be utilized by patients at Rancho
Nate Allen
Alex Hartz

• Senior, Applied Physics
• TA for E 102b (Entrepreneurial Development)
• Product/Business evaluation at HVF Labs
• Software engineering at Vision Technologies

• Email: ahartz@caltech.edu
• Phone: 443-797-7174
Purpose of Course

• To aid people with disabilities become independent through understanding of Engineering, Human and Business contexts
• To study how product development is accomplished and to actually design a product through the early design stages
• To develop (interdisciplinary) team skills
My classes are all business related but this mixture does not plow new ground at Caltech. . .
(Robert) Millikan said . . . that he had observed that a good many Caltech graduates were going into Industry and . . .
Old Caltech Tradition

(Robert) Millikan said . . . that he had observed that a good many Caltech graduates were going into Industry and . . . they ought to know something about that.
Not the Purpose

• Formal Methods
  – Instead- Semi-quantitative, qualitative Analysis
• Product optimization algorithms
• To study the medical causes of disability
• To learn how to start a company
• Biggest challenge of class
• What to leave out
What are we doing this year?

• Formed alliance between Rancho, Caltech and Art Center
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• Trip(s) to Rancho
What are we doing this year?

- Formed alliance between Rancho, Caltech and Art Center
- Trip(s) to Rancho
- Project Generation and Choice
What are we doing this year?

• Formed alliance between Rancho, Caltech and Art Center

• Trip(s) to Rancho

• Project Generation and Choice

• Team Formation
What are we doing this year?

• Lectures
  – Formal Engineering concepts
  – People who touch the product
What are we doing this year?

• Lectures
  – Formal Engineering concepts
  – People who touch the product

• Design Product to early prototype stage
What are we doing this year?

• Lectures
  – Formal Engineering concepts
  – People who touch the product

• Design Product to early prototype stage

• Consider Independent study in Spring (and summer?) to bring prototype to useful stage and transfer to Mfg
How will students interact?

• Lectures will be at Caltech

• Students must attend (on-time attendance for full lecture required)

• Each team will meet separately at least once per week to work on HW assignment

• Team Communication. Suggest you use e-mail, Wiki and Skype, Google docs, etc. Means are up to you.
Supplementary Reading and Lectures

– Each student writes 1-2 pages on 2 of the Guest Lectures or readings.
  • What did you learn?
  • How can you apply your learning to your project?
Supplementary Reading and Lectures

– Each student writes 1-2 pages on 2 of the Guest Lectures or readings.
  • What did you learn?
  • How can you apply your learning to your project?
– The results will be folded into the “participation” grade which includes Class discussion
Class Attendance Expectations

• Lectures (PowerPoint) will be posted on website after the class

• You must attend lectures- PowerPoint bullets don’t contain
  – Background
  – Discussion
  – Q and A
  – Context

• All the students in the Class need “to be on the same page”
Class Attendance Expectations

• If you must unavoidably miss class, please e-mail in advance
• Computers/phones off (no multi-tasking)

Decide whether you want to make commitment!
Team expectations

• You must fully participate
• No free rides
• Caltech Honor Code applies
• Teams will self-regulate and problems which do not resolve after discussion will be shared with TA and Instructors
Readings

• We are compiling a list of readings. They are designed to provoke thought. They don’t necessarily reflect the opinion of the instructor.

• You are invited to contribute interesting, appropriate readings to our list
Text

• The Textbook, “Product Design and Development” Ulrich and Eppinger, Fifth edition, is recommended but not required. We will have 5 copies on reserve.
  – I will not have time in class to lecture on all of it
  – The Textbook readings will be very useful in building your product
Some supplementary materials

• Steven Hawking documentary
  http://www.pbs.org/program/hawking/.
Mentorship and Shop Assistance

• Please contact John Van Deusen
  – ME Shop
  – 024 Spalding Laboratory
  – 626 395 4120
Presentation Format

• There will be continuous 10 min scheduled student HW presentations throughout the quarter
Presentation Format

Some advice
Presentation Format

Some advice

– Don’t wing it, Don’t ramble, Rehearse
Presentation Format

Some advice
– Don’t wing it, Don’t ramble, Rehearse
– Rotate amongst team members
Presentation Format

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- Don’t wing it, Don’t ramble, Rehearse
- Rotate amongst team members
- Don’t talk to the screen, don’t declaim
Presentation Format

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- Rotate amongst team members
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- 10 minute time time enforced
Presentation Format

Some advice

– Don’t wing it, Don’t ramble, Rehearse
– Rotate amongst team members
– Don’t talk to the screen, don’t declaim
– 10 minute time time enforced
– We can video if desired
Presentation Format

• E-mail PDF copies of presentation and accompanying paper by noon the day of your presentation

Most Important: All Teams must do all assignments whether they present or not!
Syllabus Team Highlights (cf website)

<table>
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<tr>
<th>Step</th>
<th>Deadlines</th>
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<td>1. Form a team</td>
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<td>2. Choose a project</td>
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<td>3. Project approval</td>
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<td>4. Architecture Approval</td>
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<td>5. Midterm Presentation</td>
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<td>6. Final presentations</td>
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Final gala presentation

• Best paper contest
  -$1000 to pursue project
• Invited Guests
• Poster session with prototypes
• Video
Rehabilitation Engineering and Assistive Technology Society of North America 2015 Conference  June 10-14 2015  Denver, Colorado

Student Design Competition
Rehabilitation Engineering and Assistive Technology Society of North America 2015 Conference June 10-14 2015 Denver, Colorado

Student Design Competition

• *Showcase creative and innovative assistive technology designs that help people with disabilities function more independently.*
Student Design Competition

• *Showcase creative and innovative assistive technology designs that help people with disabilities function more independently.*

• *Student teams represent a wide variety of disciplines including mechanical, electrical, and biomedical engineering; computer information science; architecture; and physical and occupational therapy.*
Rehabilitation Engineering and Assistive Technology Society of North America 2015 Conference  June 10-14 2015  Denver, Colorado

• Semifinalist teams receive all-expense paid trip to Conference for final judging.
Rehabilitation Engineering and Assistive Technology Society of North America 2015 Conference June 10-14 2015 Denver, Colorado

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• Student Design Competition deadlines for RESNA 2015 are:
  – April 3, 2015: Registration deadline
  – April 17, 2015: Submission deadline
Grading

• Grade or P/F (but whole team must be the same status)

• 20% HW, 20% Midterm, 30% Final Term Paper, 20% class participation, 10% Team contributor

• All grades are designed to assess knowledge of the design process, insight into market, and ingenuity/ appropriateness in Design
What is the Course about??

• Engineering
  – Concept development
  – Design for X (Anticipatory design practices)
  – Prototyping

• Understanding customer
  – Without understanding of “customer” failure is guaranteed
Design for “X”

- Market
- Human Factors
- Manufacturing
- Distribution
- Cost
- Reliability
- Sustainability (life cycle)
- Maintainability
- Testability
Example Manufacturing

• The objective is to take steps to eventually build and distribute useful products.

•
Example Manufacturing

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• Manufacturers as lecturers and resources to advise on project designs.
Example Manufacturing

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• Manufacturers as lecturers and resources to advise on project designs.

• Idea is to design something in class which someone can make.
Form a Team

• There will be 6-8 teams
Form a Team

• There will be 6-8 teams
• Suggest teams of 4-5 (tops).
Form a Team

• There will be 6-8 teams
• Suggest teams of 4-5 (tops).
• On each team
  – One Art Center student on each team
  – Some Bases for choice of Team
    • Common recognition of attractiveness of the problem
    • Compatibility
    • Diversity
    • Dependability
Form a Team

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• On each team
  – One Art Center student on each team
  – Some Bases for choice of Team
    • Common recognition of attractiveness of the problem
    • Compatibility
    • Diversity
    • Dependability
• Choose carefully- *but decisions are reversible*
Team Projects

Origin
–Ideas you bring yourself to class
Team Projects

Origin
– Ideas you bring yourself to class
– Ideas presented by Rancho during visit
Team Projects

Origin
– Ideas you bring yourself to class
– Ideas presented by Rancho during visit
– Your own observations at Rancho. These will be seen on Thurs.
Team Projects

Origin
– Ideas you bring yourself to class
– Ideas presented by Rancho during visit
– Your own observations at Rancho. These will be seen on Thurs.
– We will email the ideas to you on Friday
Team Projects

Origin

– Over the week-end you will have the opportunity to choose your first, second and third choices.
Team Projects

Origin
– Over the weekend you will have the opportunity to choose your first, second and third choices
– Teams chosen to give you one of your choices
Team Projects

Origin
– Over the week-end you will have the opportunity to choose your first, second and third choices
– Teams chosen to give you one of your choices
– If ideas turn out to be non-viable they can be changed
Summary: Formation of Teams

- Read through problem statements
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
• Consider rules of the road
  – Is it interesting to you?
Summary: Formation of Teams

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  – Is it interesting to you?
  – Is it doable?
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• Read through problem statements
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  – Is it interesting to you?
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  – Does it matter?
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  – Is it interesting to you?
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  – Does it matter?
• Choices are reversible
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
• Consider rules of the road
  – Is it interesting to you?
  – Is it doable?
  – Does it matter?
• Choices are reversible

*There will be some “adjustments” by the management*
Trip to Rancho Thursday

• **Time 2:30 to 5:00 PM**
  
  Here are directions to CART: 710 South Exit Imperial Hwy EAST and head to Old River School Road. Make a left turn, and immediately make a right turn into the Rancho campus. You can park in the structure to your left. When you walk out of the parking structure, you'll see a sign pointing to Information. Follow the sign, and you'll see a building to your left with columns near the entrance. This is the CART building. The campus map is attached. The address is 7601 E. Imperial Hwy, Downey, CA 90242. However, if you put this into a GPS it will give you varying directions to certain points on campus. The above directions will direct you exactly where you will need to go.

• **Rides?**
Mentors

• Objective would be to have each team mentored by someone with the particular disability the team is addressing.
Ideas for Projects
Finally, Why I like Product Design

• Affects all people in the world
  – Changes and improves people’s lives
  – A strong determinant in national standards of living

• Fundamentally drives our economic system by
  – Providing the link between what people need and want (marketing) and what an enterprise can make (production).
  – Providing the link between new knowledge on what is possible (research) and new useful objects (product)

• Is highly creative
  – The output never existed before

• Is highly complex
  – Involves the linked contributions of many different skills
Why I like Product Design

• Is highly evolving
Why I like Product Design

• Is highly evolving
  – learns from the past
Why I like Product Design

• Is highly evolving
  – learns from the past
  – anticipates (and sometimes brings about) the future
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• Is highly evolving
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  – highly timing dependant
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• Can be esthetically pleasing
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  – the product
Why I like Product Design

• Is highly evolving
  – learns from the past
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  – highly timing dependant

• Can be esthetically pleasing
  – the product
  – sometimes the process
Why I like Product Design to help people be independent of disabilities
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- Ultimate human objective- to help other people- and we will meet some of these people
Why I like Product Design to help people be independent of disabilities

• Ultimate human objective- to help other people- and we will meet some of these people
• Could help ourselves (WIIFM!)
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• Need is obvious - look at present devices and say, “I could do it better than that!”
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• Ultimate human objective- to help other people- and we will meet some of these people
• Could help ourselves (WIIFM!)
• Complexity of challenge
• Need is obvious- look at present devices and say, “I could do it better than that!”
• Growing area
  – Aging population
  – Significant investment in Medical
• OK, Let's get to know each other. . .
Introductions

- Caltech and Art Center Students
  - Who are you?
  - What are you studying?
  - What are your reasons for taking the Course?
  - One interesting thing about yourself