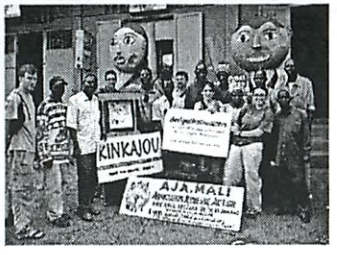

sketch model review
October 4, 2012. 7-9:30 PM

life is *not* a dress rehearsal

Rose Tremain, author



But first

Some logistics

Think ahead to the next milestone, wait for feedback (by mid Tuesday)

Peer review 1 is due 5 PM Wednesday

Team review A is due 5 PM Wednesday

2.009 Product engineering processes

Today

Review feedback learn and keep improving

Launchers! testing ideas

Feedback: sketch review

What's the point?

A motivational target, manage timeline, typical milestone

Summarize exploration of the design space

Buy in from real, tangible customer or expert

Identify additional challenges early, hear different viewpoints (more feedback over weekend)

Discover what you don't know

Practice early design exploration strategies and presentation techniques

Grading?

Learn, do it for real, and grades will take care of themselves

L13 Sketch Model Feedback + Challenge Instructions

10/5

Feedback: sketch model phase
Objectives

Develop a deeper understanding of the problem context
(e.g., market, benchmarking, patents)

Identify the top few user/purchaser needs

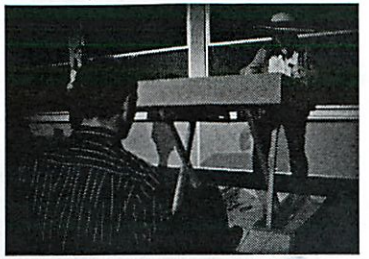
Preliminary exploration and feasibility assessment of ways to address needs, and to address key risks or unknowns

Feedback: sketch model phase
some good examples

memorable:

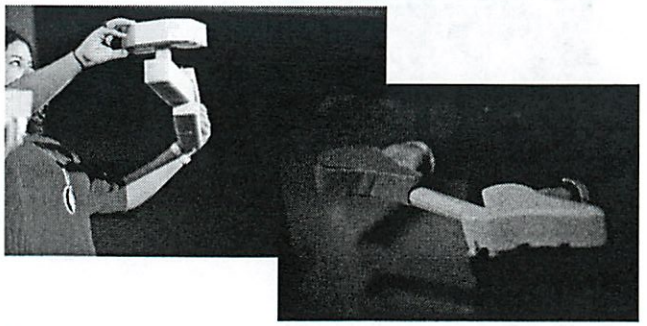
purple B: Knapack

silver b: sprout



blue a: quick rinse

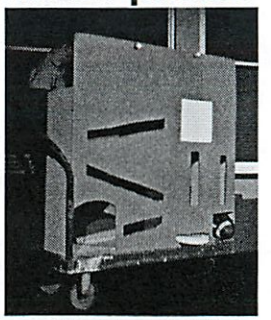
Feedback: sketch model phase
some good examples



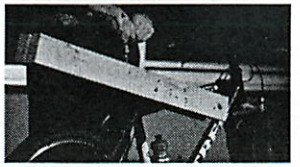
exploration with models: red b: duiseat

Feedback: sketch model phase
some good examples

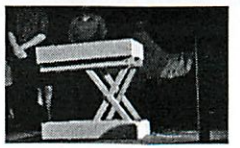
orange a: snap and snow



blue b: sportShare



honest:
red b: duiseat

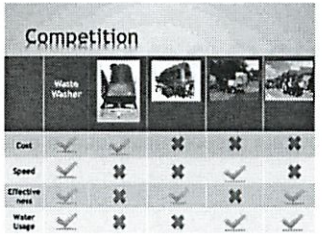


silver b: sprout

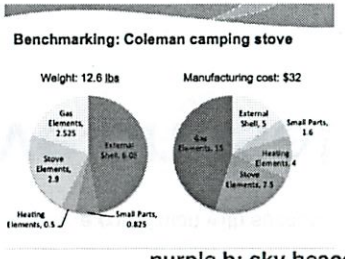
Feedback: sketch model phase

some good examples

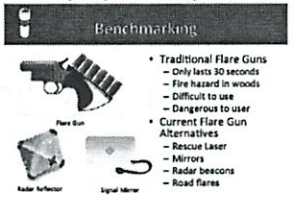
pink b: waste washer



orange b: flex ferno



purple b: sky beacon

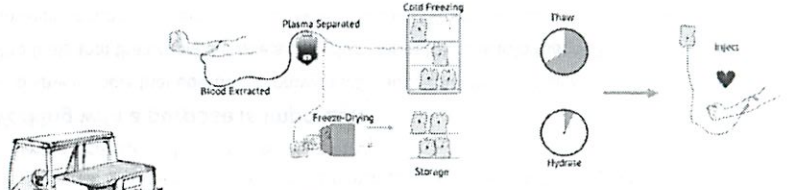


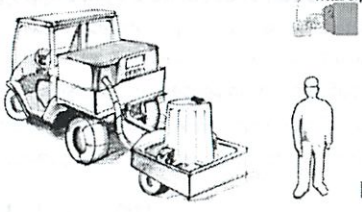
benchmarking:

Feedback: sketch model phase

some good examples

green b: blood plasma dryer





pink b: waste washer

product vision/user experience

Feedback: sketch model phase

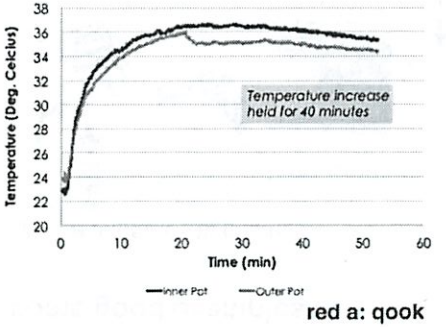
some good examples

pink b: parcel pro

user experience

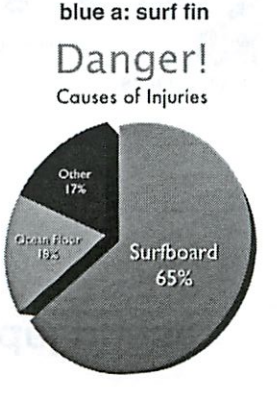
Feedback: sketch model phase

some good examples



red a: qook

blue a: surf fin

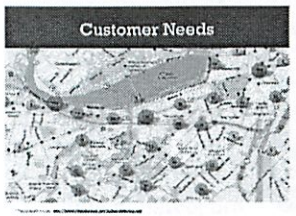


answer key questions:

Feedback: sketch model phase

some good examples

purple a: blindspotter



needs:

Customer needs

Compactible
Lightweight
Cleanable
Secure
Safe

orange b: flex ferno

silver b: sprout

Motivation

elderly susceptible to falls

33 % of seniors call gardening a hobby

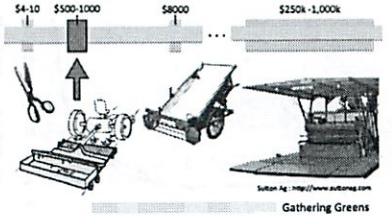
horticulture therapy

55,000 nursing homes and assisted living facilities nationwide (USA 2009)

Feedback: sketch model phase

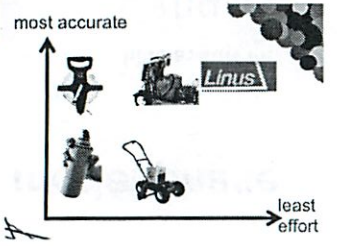
some good examples

yellow a: gathering greens



market:

silver b: linus



Constructive feedback

Put the following discussion in context

name a team characteristic that has negative correlation with success.

excessive praise!

Feedback: general

Reflection

Presentation design and practice is important:

Who saw presentations that showed signs of insufficient design or practice?

Who feels that their section did not design their presentation or practice enough?

(6 sections went over time, pick your core message and get it out, plan your physical setup. Several second presenters were left short)

Working with a purpose is important:

Who saw models that seemed to provide little additional information?

Who feels that their team's models provided little additional information?

(physical models that allow realistic testing or experiments are useful, form models need to be well resolved to be useful)

Sincere communication is important:

Who felt that, at times, some presentations oversold or stated opinions as fact?

Who feels that, at times, their team oversold or stated opinions as fact?

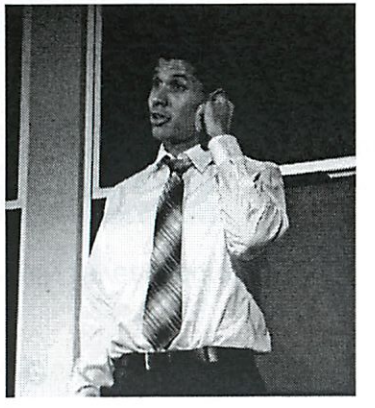
(opinion as assertion or fact are especially an issue in Q&A)

Feedback: general
Reflection

show up (~50% absent)
test on time with actual presenters
show design/idea/models up front
practice with the remote!
work with real users

Feedback: general
Reflection

avoid fidgeting



Feedback: general
Reflection

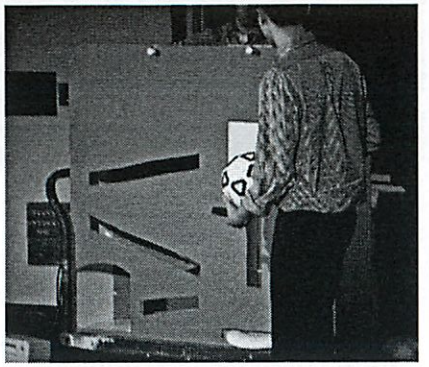
Keep a focal point

Feedback: general
Reflection

be respectful

Feedback: general
Reflection

engage the audience



Feedback: Presentation Ranking
Faculty consensus

2 hours of discussion.

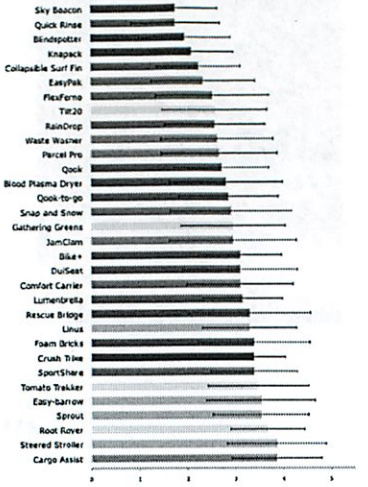
Use to reflect upon what worked well, what did not.

Not a grade.

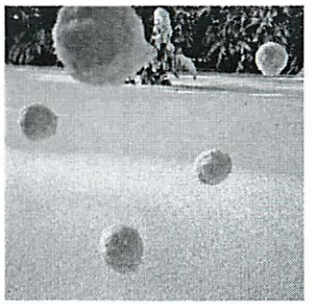
Mix of presentation, concept, research...effective models/ presentations can have big influence.

Ideas with lots of potential may have not ranked as highly do to mix of factors, and vice versa.

Idea-specific feedback over the next few days (important material for making decisions).



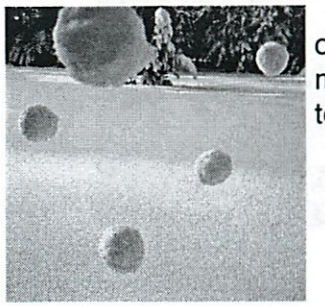
And finally
Launchers



Are you ready?

The challenge
Launchers!

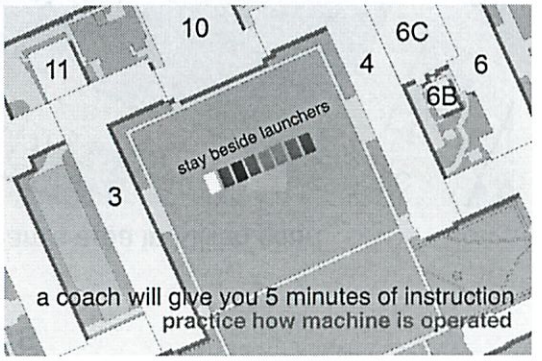
be the fastest team fully reveal your flag



or have the most spirited team

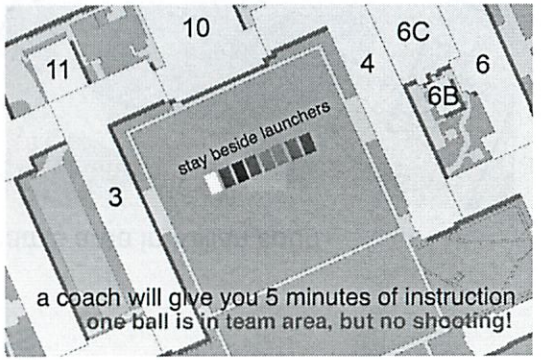
Logistics
Launchers!

go to your team's area in Killian court



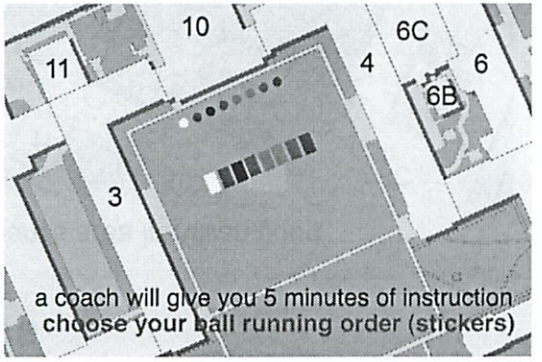
Logistics
Launchers!

go to your team's area in Killian court



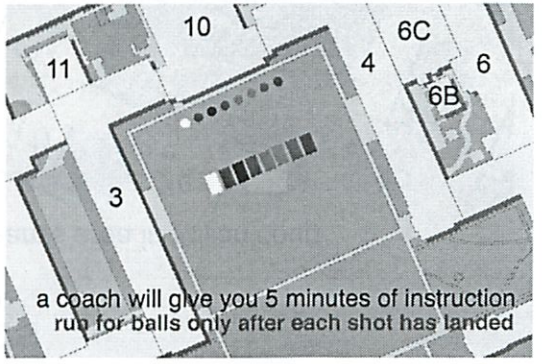
Logistics
Launchers!

go to your team's area in Killian court



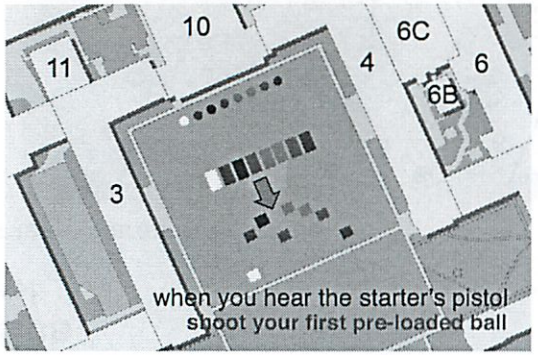
Logistics
Launchers!

go to your team's area in Killian court



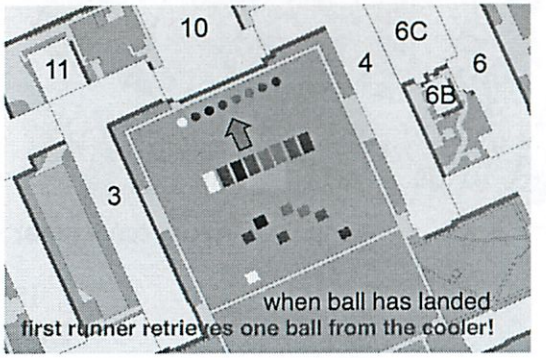
Logistics
Launchers!

go to your team's area in Killian court



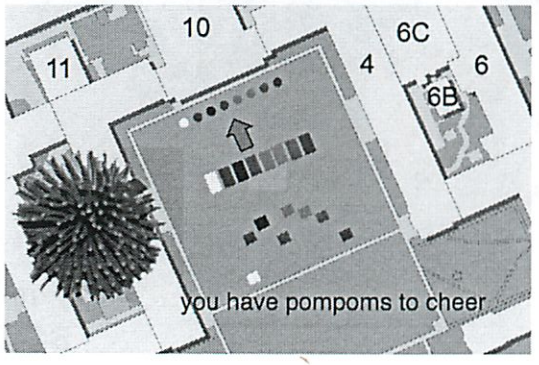
Logistics
Launchers!

go to your team's area in Killian court



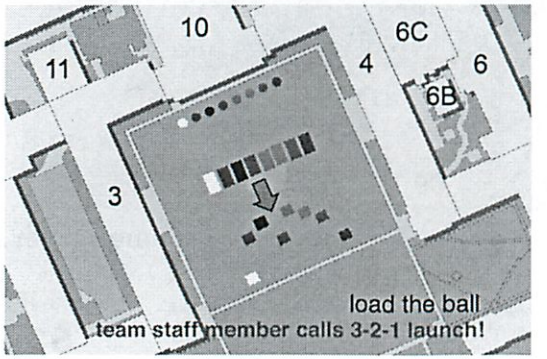
Logistics
Launchers!

go to your team's area in Killian court



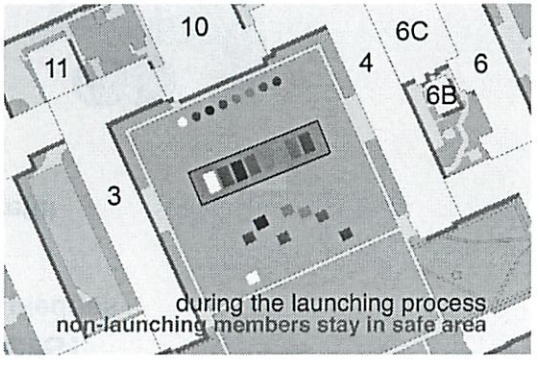
Logistics
Launchers!

go to your team's area in Killian court



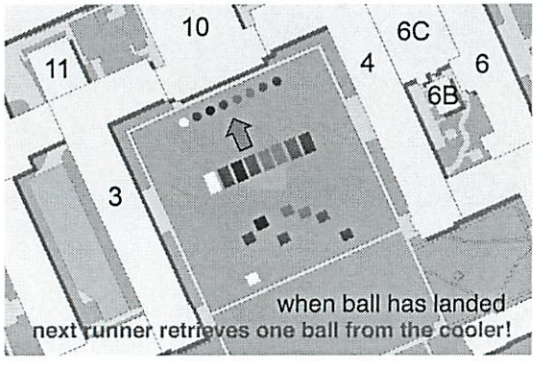
Logistics
Launchers!

go to your team's area in Killian court



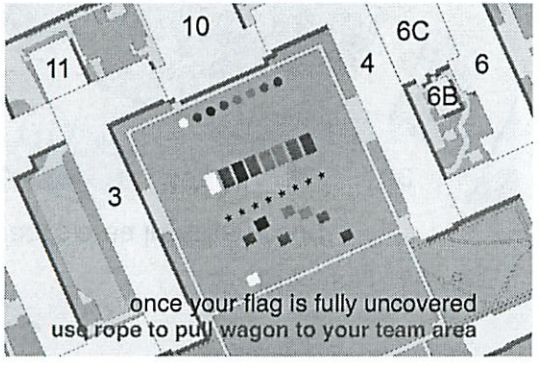
Logistics
Launchers!

go to your team's area in Killian court



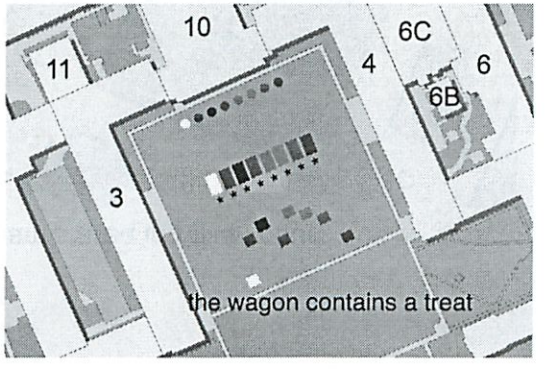
Logistics
Launchers!

go to your team's area in Killian court



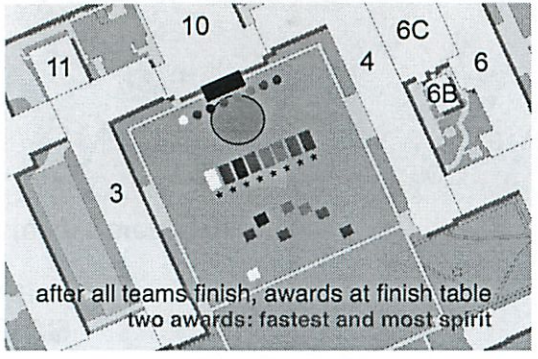
Logistics
Launchers!

go to your team's area in Killian court



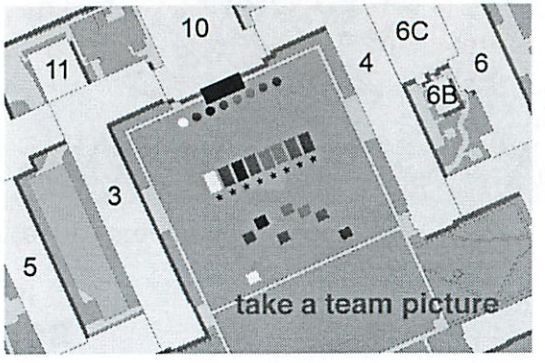
Logistics
Launchers!

go to your team's area in Killian court



Logistics
Launchers!

go to your team's area in Killian court



Launchers!
a couple of pledges

I will be careful

I *will* throw snowballs in Killian

2.009

Sketch Model Logistics:

before the review, review details, after the review

Before the review:
A computer projector will be available in the presentation room (34-101). If other AV equipment is needed by your section please let the course instructor know by 5 PM Tuesday.

All presentations will be pre-loaded onto a single presentation computer. A representative of each section **must load your section's presentation** onto the 2.009 presentation computer **between 2:30 and 5:30 PM**, and check that media are working correctly. You can schedule a time slot and a TA will be in the 2.009 computer area to meet you. You will not be able to make changes to your slides after this time. You can use either powerpoint, keynote, or pdf files for your presentations.

Work in the Pappalardo will stop at the usual 4:45 PM, but you will be able to have access to pickup materials until 6:30 PM.

The presentation room is booked from 5 PM. Presenters should test their slides in the room between 5:30 and 6:30. It is important that the actual presenters check the materials in the room.

Sketch models/presentation props should be in the hall outside of 34-101 prior to starting at 7:00 PM.

Green A
Green B
Red A
Red B
Purple A
Purple B
Silver A
Silver B
Orange A
Orange B
Yellow A
Yellow B
Pink A
Pink B
Blue A
Blue B

Review details:
The sketch model review will start at 7 PM sharp and finish by 9:30 PM on the date indicated in the course schedule. All students should plan on attending if possible, since seeing what the other sections are working on is an important part of the learning experience.

Each *entire section* (two sketch models together) will have **6 minutes for their presentation** followed by **2 minutes of questions**. Time limits will be adhered to strictly. Your section must merge material for the two concepts into a single presentation file. The presentations will also be video taped for the online feedback forms.

The presentation order is shown on the left.

The transition between sections will take place during the 2 minute question and answer period at the end of each presentation. The section answering questions should have members remove models and props while the next presenters bring materials into the room and setup AV materials.

After the review
You will return your section's sketch models to the Pappalardo lab immediately following the review.

Preliminary feedback will be provided in class on Friday and you will receive written comments by email over the weekend. Presentation videos and slides will be put on the results page so that instructors can provide more feedback than is possible during the short question period during the presentations. Three instructors will be assigned to provide additional feedback for your section.

Additionally, over the weekend we will be using a crowd sourcing platform to obtain feedback on ideas from real, potential users and purchases. These data will be compiled and provided to teams by Tuesday.

You may also arrange to view the presentation video with your team communication instructors for additional feedback about your presentation style.

Success factors

For 2.009 projects

Strong connection to user need

Potential for large impact/benefit

Contact with users or qualified representatives of user

Clear team vision for product

Appropriate scope

(substantive to engage/challenge team, not outrageously big)

Understanding of technology, context

Innovative, not inventive

Understand market, competition, and product demand

Work in Pappalardo lab, where you can get help

Ability to test

Demonstrable

10/5

2.009

Home > Peer review

Peer Review

The peer review contributes to a significant portion of your individual grade.

Performance reviews are commonplace in industry. Here, the goal of having anonymous reviews is to provide direct, peer feedback on your performance and contributions. This will help you improve over the course of the term. Additionally, we hope that during the review process you will also reflect upon your own contributions and thus gain experience in critically assessing your own efforts.

Peer reviews are conducted using online forms, and four peer reviews are scheduled throughout the term.

The first peer review is early in the term to provide initial feedback on performance within your section. The results of this survey are provided to students only. Instructors will not see the results.

The second peer review is roughly 1/2 way through the term (after the mockup review) and is also intended to provide feedback to section members. The results of the survey are provided to both students and instructors, but they are not used for grading. Information is provided to instructors in the event that there are problems that may need assistance to be resolved.

The third peer review is approximately 3/4 through the term and 1/2 way through the final prototyping stage. This review provides feedback from the entire team, not just your section. Again, instructors will also receive the information but it will not be used for grading.

The 4th peer review is completed after the final presentation. This review is used for grading purposes, and to provide your team-members feedback.

Before completing an online review, you will need to **read the detailed peer review instructions.**

2.009

Home > Peer review > Instructions

Peer Review Instructions

Preparation
Before completing the peer review, it is highly recommended that you familiarize yourself with your teammates efforts. A good approach is to review the design notebook highlights that have been posted on your team page. The notebook pages can also be accessed directly from the peer review forms.

Scenario
You are in charge of dispensing compensation for your team. Your budget is 1000 bonus points per team member and you are free to distribute this reward in anyway that you see fit. You are being asked to make a general decision on the performance of your peers. In addition to the bonus allocation, your comments are extremely important for adjusting team member behavior, so please spend some time and be constructive.

The on-line form
The online form is intended to make the review process easy and discreet. Each of your section or team members should be listed with a box for the amount you wish to give as his/her bonus (integer bonus points please). There is also a space for comments: what they should do less of, what they should keep the same, and what they should do more of.

Be sure to evaluate your own performance and allocate some of the bonus to yourself.

Review etiquette
Making thoughtful, honest comments is a very important contribution to your team's performance. You must make an award to each team member (including yourself) and if there is a reason to enter a very large or small number, please make sure to include appropriate comments... a zero with no comment is just mean, not constructive. The form will only allow submission when the bonuses total 1000x the number of members on your team. If you get an error message just adjust the numbers so they add up and try again.

Submission and distribution
Once you successfully submit your peer review, the results are automatically sorted and distributed accordingly, depending on which of the 4 peer reviews is being conducted. You always receive only the reviews that pertain to yourself. **Peer reviews are anonymous, your identity will never be revealed to those you are reviewing.**

I'm ready to **complete a peer review now**! Certificates are required.

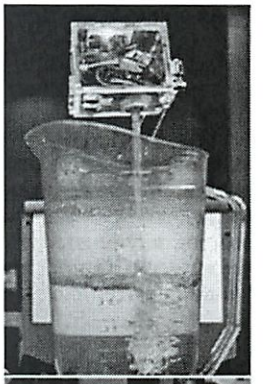
10/5

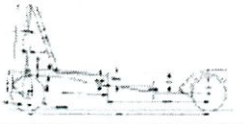
2.009

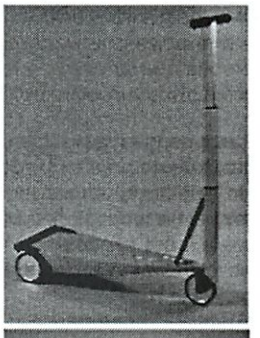
Home > Mockup Review

Mockup Review

background, key review elements, grading, logistics, results







Background
The review takes place during the evening on the date indicated in the class schedule.

The goal of the review is to inform classmates and instructors about the key challenges related to your section's leading design concept, and how these challenges will be resolved. If there are open issues this is a good opportunity to obtain input and suggestions before fully committing to detailed development. The mockup concepts will also be posted on a crowd-sourcing platform to obtain feedback from a large number of real, potential users.

You will use feedback from this review to decide which final concept will be pursued by your team for the technical review. The experience will also help you learn how to present technical challenges and solutions in a design review.

Examples of functional and visual mockups are on the right. You can also view mockups from other years in the gallery (select a project and then click on the mockups tab). The communication instructors have also prepared guidelines for effective mockup presentations.

Video of your presentations will be made available on the course web site.

Key review elements
The review is comprised of two components: a short, structured presentation to the entire class (slides only), and a less-structured question-and-answer session in the Pappalardo lab (working with the mockups). The presentation should focus on issues that are both potentially high-risk and critical to the concept.

Each section will present technical or visual mockups and drawings of their single concept, focusing on illustrating the overall concept, technical feasibility/operational principles of critical systems, preliminary product contract, and user/product interaction. The concept is typically an adaptation of one of the team's 4 concepts in the sketch model review, or a section might try a different product based upon what they have learned so far.

Grading
The mockup review contributes to a portion of your section-wide grade. All course instructors will participate in the review process but your lab instructors determine your grade.

Key grading criteria are:

- degree of resolution on critical issues/risks
- evolution of the design concept since the last review and your design process
- usefulness and effectiveness of the mockups and other models

Please review the detailed **presentation logistics** carefully.
See **results** of mockup review.

2.009

Home > Team review

Team Review

10/5

The team review is conducted twice during the course schedule (review A, review B). It is an on-line survey that is designed to help you proactively diagnose potential team issues that might ultimately compromise your project and learning experience. We also hope that the exercise will provide an example of how information can be gathered to improve a team's effectiveness.

The first team review will provide feedback on group dynamics within your lab section. The second team review will provide feedback for the entire team (two sections) as a whole.

Survey information will be compiled and provided in an anonymous form. Your team and system integrators should be able to use the information to improve the effectiveness of your team. Instructors will also be provided with the survey results.

Please **take me to the team review now**.

10/9

2.009

Lab #5: Week of October 8: Identify and resolving key risks

objective, preparation, what's due, activities

Main Lab Objective
Your section needs to pick one of its two ideas and identify a clear set of tasks for *addressing key risks* associated with the chosen concept.

Each section of your team will focus on furthering a design concept in preparation for the upcoming mockup review, as scheduled in the course syllabus.

Tuesday lab sections only:
Since Tuesday (October 9) is a student holiday, your team will need to find a way to make up what needs to happen this week for your project. The Pappalardo lab wil be open on Tuesday, and instructors will be available if your team elects to meet at your normal time. Otherwise, you may be able to arrange a time with your instructors.

lol - holiday
Come anyway

Advanced preparation for Lab #5
Individual:
Make sure that you understand the requirements for the mockup review.

Read and think about the sketch model review feedback that you received by email from instructors. All instructors assigned to give you feedback will have done so by noon on Tuesday.

Read and consider the summary of crowd-sourced feedback for you concept. This information is from real, potential users or purchasers.

For your section:
Your tool officer should organize a team area cleanup before your lab session, so that your workspace is in good shape for continuing work this week.

Given the limited amount of time, your section may want to decide what concept to pursue before your lab. Even if you decide in advance of lab, please be sure to wait for the detailed comments from instructors (via email through Tuesday noon) before making the decision. Also, follow a rational decision process as is described in the suggested lab activities. If desired, you may coordinate this decision as a complete team and work on different embodiment concepts for the same product idea, but it is very important to maintain two quite different options in case unanticipated problems are discovered during the mockup phase.

Note: if your team decides to pursue two concepts based on ideas that were proposed by one section, it may make sense to break the sections so that people with background information for each concept are working on each idea. This is permissible provided that the similar-sized groups work on each idea, and that you provide a list of team members working on each concept to your instructors and the course instructor. This is very important to avoid problems during the second peer review.

For the complete team:
System integrators should prepare an agenda for the lab and make sure that the name cards are setup on the table before the start of lab. If you think that you will need AV equipment, set this up in advance as well.

What's due
Design notebooks (physical/digital) and project timesheets are due this week.
Tuesday teams only: Due to the holiday, your physcial notebook will be reviewed next lab.
Online submissions are still due this week.

Please send an email to the course instructor indicating the concept that your section has chosen to pursue.

If your team web page (under the teams menu) does not yet have your final officer positions, please email this information to the course instructor.

Recommended Lab #5 Activities

As a complete team (both sections together):
It is recommended that you begin with your two sections together to reflect on your effort in the sketch model review and its outcome/feedback. Start in your team areas so that you may use your models to facilitate the discussion.

As a complete team OR as individual sections:
Begin with the standard meeting startup.

Discuss which of the team ideas are to be further pursued, or if a new approach needs to be considered (see comments in the preparation section). You may even need to keep two ideas temporarily alive within your section for further investigation. Use your sketch models, sketches, etc. to facilitate the discussion.

Carefully develop criteria to pick between the alternatives. **Don't just ask people what they like.** Consider roughly 6 relevant factors (you may want to considered some 2.009 project success factors have been observed over several years).

As individual sections:
Submit your physical design notebooks to your section instructor.

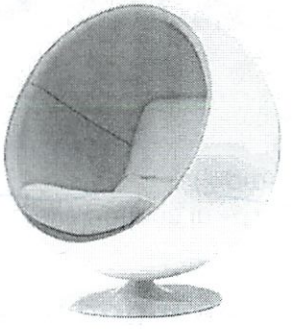
Once you have picked a concept, identify key risk factors that must be resolved by the mockup review. The goal at this stage is to fully address issues that could potentially prevent the concept from being successful. Some advice from the instructors may be needed in the risk identification process. Remember that you should not be trying to prototype the whole product for the mockup review—there is not enough time—concentrate on the most difficult, critical aspects/subsystems and resolve them well.

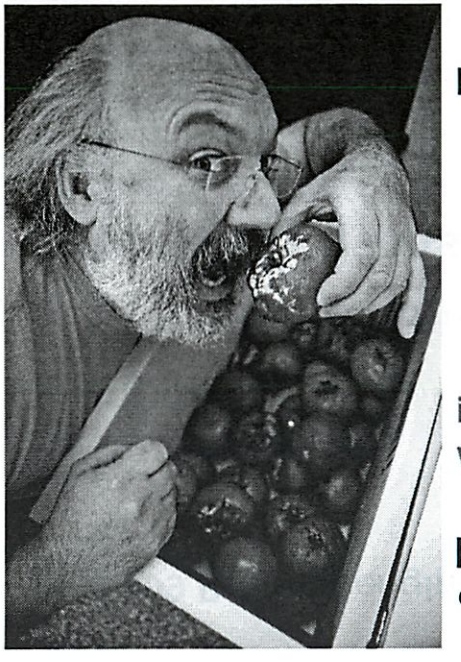
Divide your section into task forces to work on refining the concept and resolving key risks.

Use the remaining time to work.

2.009 Product engineering processes

a chair is to sit on





Pappalardo lab

if you are working with food...

please clean up!

otherwise it gets nasty fast

LH Mockups Customer Needs Human Use

2.009 Product engineering processes

today

mockups resolve key risks

form and human use product usability, vision

customer needs know your core proposition

but first!

Mixed class

Feedback from general population

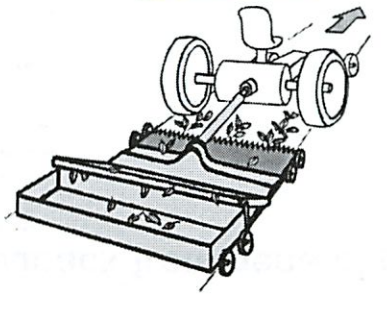
Survey

The product idea below may represent a new product opportunity. Please review the information about the product idea and then provide us with your feedback on the product idea.

Idea Name: salad green harvester

Need: small-sized specialty produce farms harvest salad greens by hand because large-scale automated equipment is too expensive

Proposed Solution: a $500-$1000, tractor-powered greens harvester



10/10

Feedback from general population
Survey

1. Do you think that products already exist that address this need/opportunity?

○ a good product/solution already exists (specify below)
○ there might be a good product/solution on the market (specify below)
○ I don't know of a product/solution already on the market

If you know of existing products/solutions, please name them and/or provide URLs for them below:

2. Are you a member of the target user/purchaser/audience for the product idea?
○ no, I am not a member of the target audience for this product idea
○ yes, I am a member of the target audience for the product idea and would not buy this product because (provide short reason below)

○ yes, I am a potential user/purchaser of the product idea and would pay up to $ ____ for it (specify whole dollar amounts).

3. Comments/Suggestions on the product idea:

Good q

Feedback from general population
Survey

Reviewer Information

A. What is your gender?

○ Male ○ Female

B. What is your age?

--Select--

C. Which of the following best describes your highest achieved education level?

--Select--

D. Which country are you living in now?

○ U.S.A.
○ Canada
○ India
○ Other: ____

Conditions:

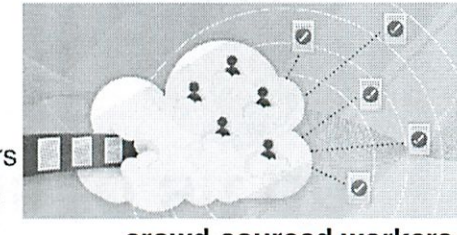
- No worker may evaluate the exact same concept more than once (even if it is available under different HITs).
- All questions must be answered to receive payment (e.g., if you answer that you know of a similar product idea, you must specify what it is).
- Answers must be consistent to receive payment.
- Payment will be made in three days. Do not ask for payment sooner.

Oh mech terms

Feedback from general population
Amazon mechanical turk

3199 evaluations in ~12 hours
(7 pm-7 am)

69% from US
59% with college
41% female
18-45 years old
406 unique reviewers
89-117 reviews/idea



crowd-sourced workers

$.25 per review
1:30 min average, 376 over 3 minutes
$9.00 per hour ← Oh not bad

2.009 Product engineering processes

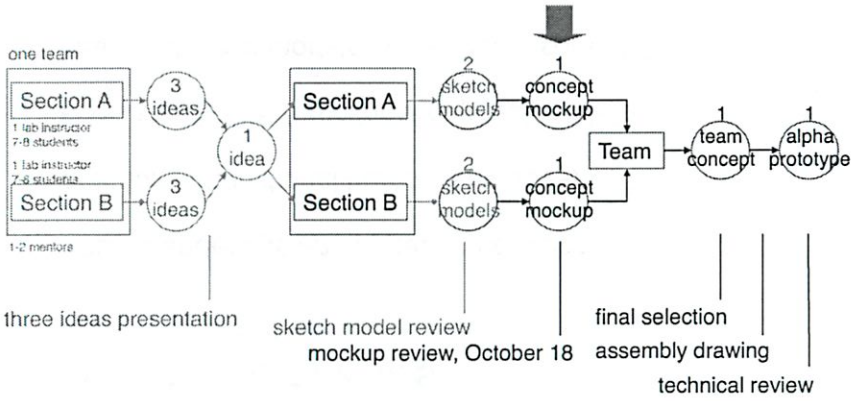
today

mockups resolve key risks

form and human use product usability, vision

customer needs know your core proposition

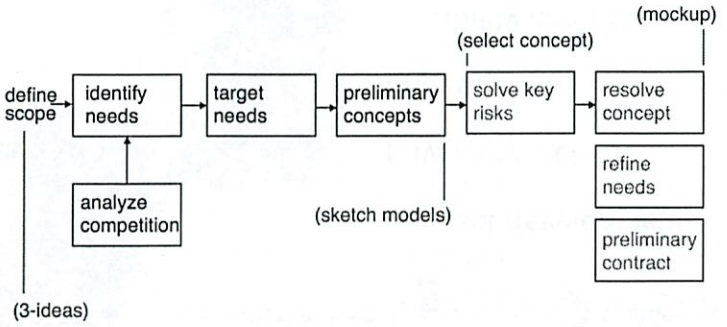
What's now?
workflow



Down-select: 4 to 2
project success factors

strong connection to user need
potential for impact/benefit
contact with users or qualified representatives of user
clear team vision for product
appropriate scope
(substantive to engage/challenge team, not outrageously big)
understanding of technology, context
innovative, not inventive
understand market, competition, and product demand
working in Pappalardo lab, where you can get help
ability to test
demonstrable

What's now?
textbook viewpoint



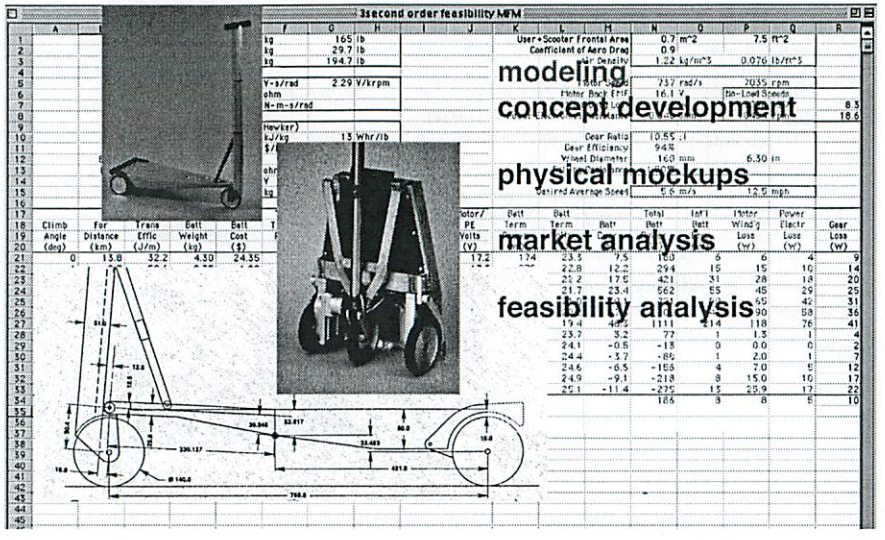
Mockup phase
what is a mockup?

engineering drawings or renderings, geometric models, spreadsheets, simulations, or physical models used to realistically **resolve fundamental issues and risks** associated with a concept

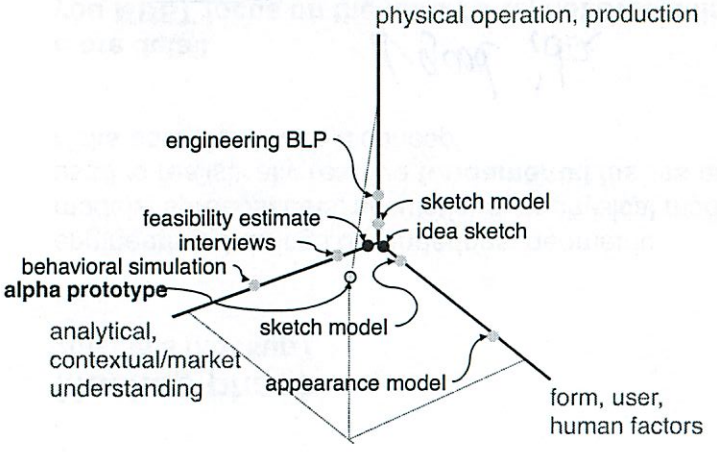
more detail
you MUST focus on the hard parts, not everything

user acceptance
product cost: how much can it be?

Mockup phase
activities



Mockup phase
decompose the problem



Types of mockups
along different axes

visual (renderings and appearance models)

ergonomic (functional human interfaces)

engineering BLP (functional physical models)

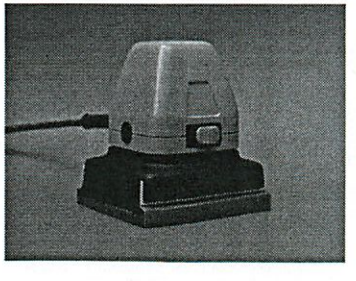
analytical (solid models, simulations, spreadsheets)

Visual mockups
look like the real thing

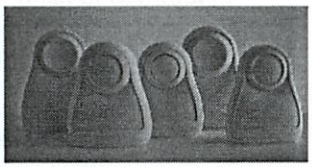
clearly illustrate what the product will look like

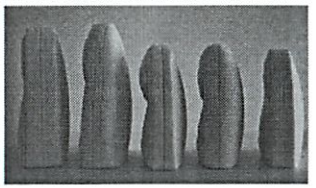
evaluate customer appeal and how the product will fit into its use environment

may be used in interviews or focus groups



Ergonomic mockups
test and validate human factors decisions





able to hold

Engineering BLPs
key operational principle

resolve key technical issues and functionality

test components

verify analytical models

Analytical mockups
predict how the product will behave

engineering analysis, CAD, CAE

economic analysis

2.009 Product engineering processes
today

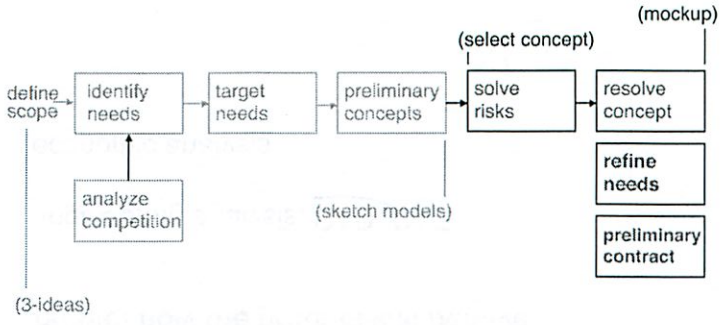
mockups resolve key risks

form and human use product usability, vision

customer needs know your core proposition

Preliminary contract

mockup review



Product contract

guiding document for key needs, core value proposition

Product Description: Portable electric device for lifting automobiles

Intended Customer: Back yard mechanics

Market: Automotive accessories

Customer Needs	Design Attributes	Engineering Specifications
Can be easily transported in and out of a house		
Is easily stored in the home and office		
Comfortable to carry		

Eliciting key needs

techniques

secondary research:

benchmarking

option generation:

observation: every customer compensation or adaptation is a potential product opportunity.

exploratory interviews: one-on-one sessions, where a respondent answers a set of pre-planned questions on a subject. The outcome is a long list of comments, some important, some not, that *need to be translated into customer needs.*

inappropriate: written surveys—too little context, poor for hidden needs

eliciting key needs

interview questions and prompts

Walk me through a typical session performing a task
What do you like about existing products?
What do you dislike about existing products?
What issues would you consider when purchasing?
What improvements would you make?

Eliciting key needs
interacting with the customer

go with the flow

use props (competitive products, related products)

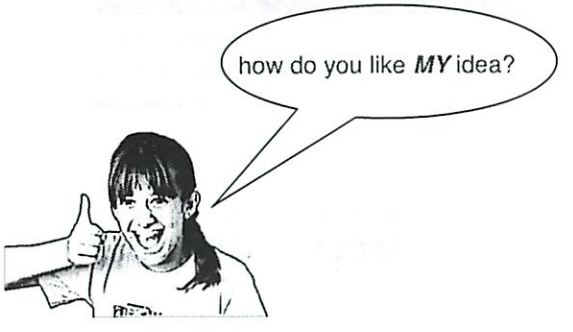
discourage technology speculation or detailed design

have customer demonstrate use whenever possible

watch carefully for unexpressed or non-verbal needs

Eliciting key needs
interacting with the customer

don't lead users to the answer that you want!

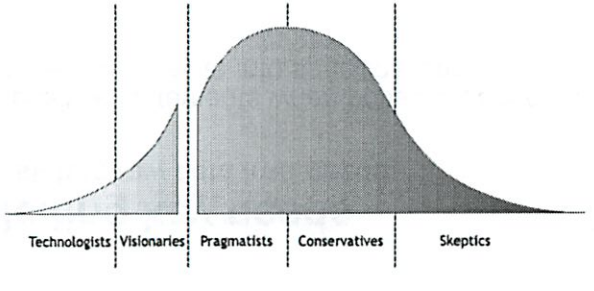


Eliciting key needs
who should be interviewed?

the target customer or user!

look for lead users (innovators and early adopters)

people who experience needs ahead of the marketplace, struggle with existing products, or invent their own solutions to meet needs



Eliciting key needs
translating raw data into needs

express needs in terms of what product has to do

guideline	customer data	need (correct)	need (incorrect)
what, not how	"put protective shields around battery contacts"	protect batteries from accidental shorting	cover battery contacts with sliding door

Eliciting key needs
translating raw data into needs

use positive statements when possible as they will be easier to translate into specifications

guideline	customer data	need (correct)	need (incorrect)
positive, not negative	"it does not matter if it's wet, I still need to do my work"	operates normally in the rain	is not disabled by the rain

Eliciting key needs
translating raw data into needs

express need with same specificity as the raw data to avoid losing or introducing information

guideline	customer data	need (correct)	need (incorrect)
same specificity	"I drop the product all the time"	product operates normally after repeated dropping	the product is rugged

↑ lol

Eliciting key needs
translating raw data into needs

avoid must and should, as these imply priority

guideline	customer data	need (correct)	need (incorrect)
do not prioritize	"I really hate it when the product dies without warning"	the product indicates power reserve	the product must indicate power reserve

Mockup review
Core 3-6 needs on product contract

Product Description: Portable electric device for lifting automobiles

Intended Customer: Back yard mechanics

Market: Automotive accessories

Customer Needs	Design Attributes	Engineering Specifications
Can be easily transported in and out of a house		
Is easily stored in the home and office		
Comfortable to carry		

design attributes and specifications: **Friday**

2.009 Product engineering processes

today

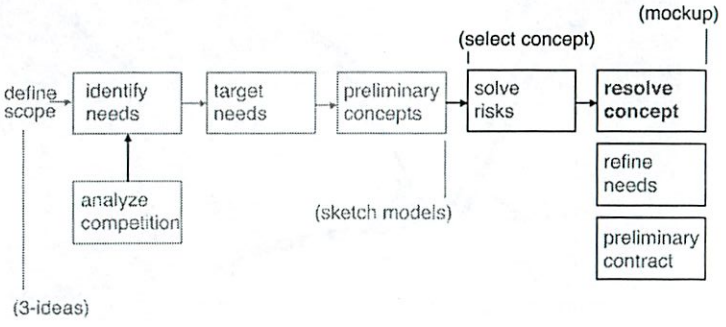
mockups resolve key risks

form and human use product usability, vision

customer needs know your core proposition

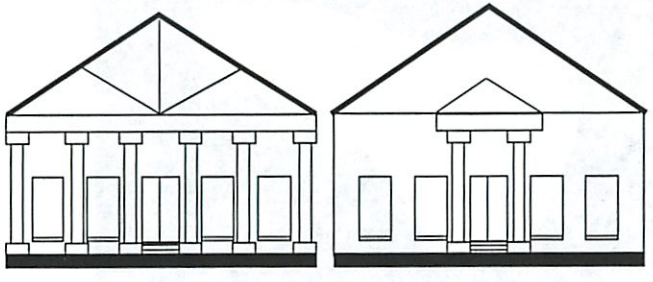
Resolve concept

mockup review



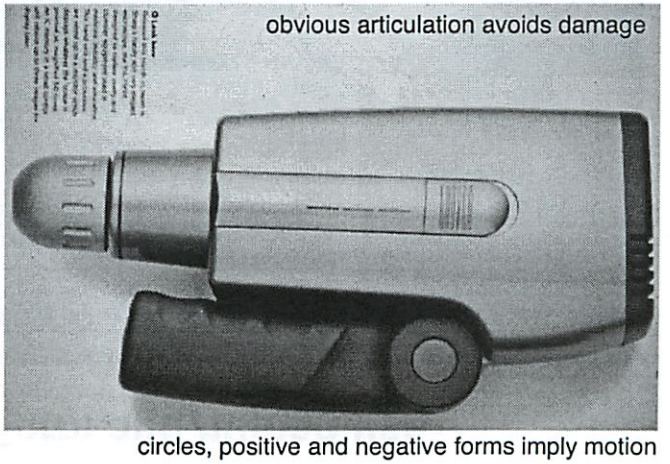
Form and human use

form follows function: Louis Sullivan



Form and human use

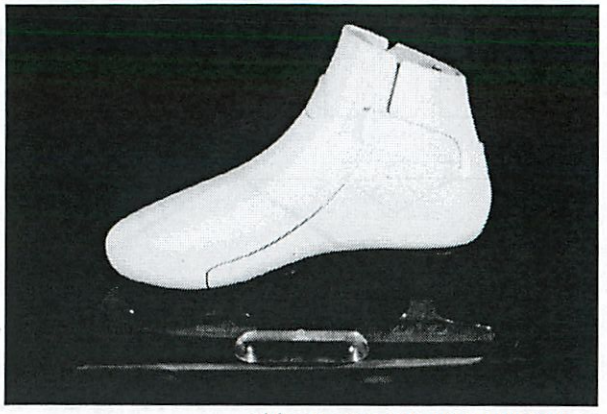
form follows function



circles, positive and negative forms imply motion

Form and human use

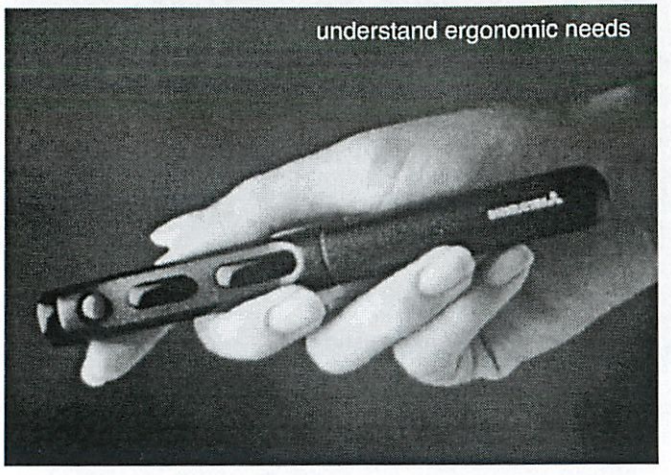
form follows function



objects separate on parting lines

Form and human use

form follows function

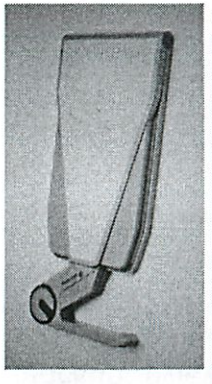


Form and human use

form follows function

Form and human use

form follows function



avoid mixed messages, arbitrary details

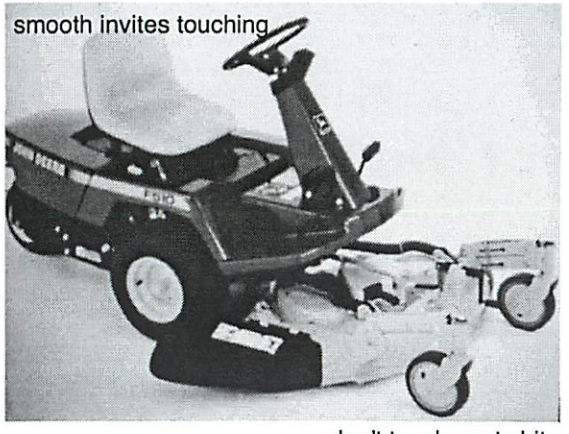
Form and human use

form follows function

black recedes, conceals

Form and human use

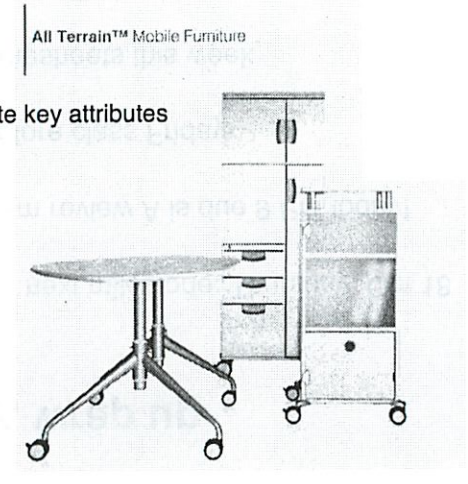
form follows function



don't touch nasty bits

Form and human use

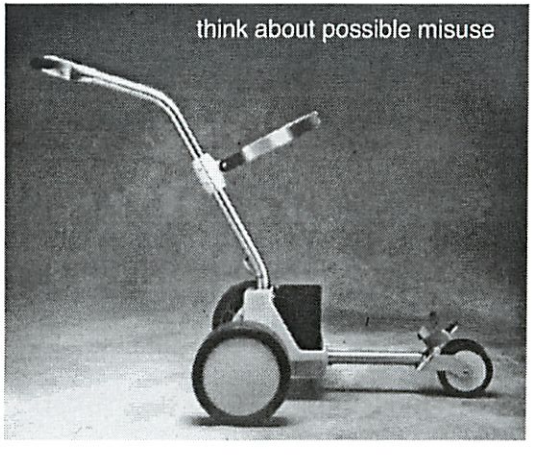
form follows function



communicate key attributes

Form and human use

form follows function



And finally, wrap up

Some logistics

think ahead to the next milestone: Thursday, Oct 18

peer review 1, team review A is due 9 PM today!

read chapter 5 before class Friday

notebooks and timesheets this week

I always wanted to be somebody… I should have been more specific

Lily Tomlin

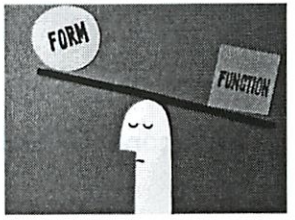
2.009 Product engineering processes

But first

a mini quiz!

name on index card
1 minute

form follows function means?



2.009 Product engineering processes

Today

Specifications defining success

And…

few reminders

team review results online
instructor review opens later today through 5 PM Mon.
bring laptops to class on Monday
read chapter 16 before class Monday
Pappalardo 1-5 Sat, team side only
full shop 6-9 Tuesday and Wednesday

Specifications

mockup review: preliminary product contract

Product Description: Portable electric device for lifting automobiles.

Intended Customers: Backyard mechanics.

Market: Automotive accessories.

Customer Need	Product Attribute(s)	Engineering Specification(s)
Can be easily transported in and out of a house.	Weight	Total weight less than 30 lbs.
Is easily stored in the home and office.	Size	Less than 14" x 14" x 14" in smallest configuration.
Can handle most repair situations.	Lifting capability	more than 15 cycles at 1" per second per charge for a 3000 lb. automobile.
Can be used on many uneven surfaces.	Stability	3000 lb vehicle raised 16 inches will not tip under 400 lb side loading. Base self-levels up to 1 inch discontinuities and 2% slopes in pavement.

Customer needs

Wednesday's class

extracting customer data

observation

one-on-one interviews

converting customer data to customer needs

what, not how
positive, not negative
same specificity
do not prioritize

Identifying attributes

map attributes to needs

Need \ Attribute	assemblability	usability	fault detection	wow factor
easy to setup	■			
safe		■	■	
special	■			■

house of quality

Once you have attributes

set specifications

translate the product attributes (customer needs) into quantitative design performance targets

quantify the core benefit of your product

define internal basis for measuring success

provide a basis for resolving trade-offs

keep the development effort focused

Setting specifications
definition

a precise description of *what* the product must do

customer need: easy to install
interpretation: average time to assemble is less than 60 seconds (Floyd)

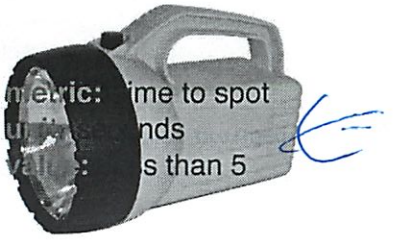
design attribute: assemblability
metric: time to assemble
unit: seconds
value: less than 60
owner: Floyd

specification
what it must do

Setting specifications
they are *NOT*...

descriptions of *how* to implement the product (embodiment)

customer need: easy to find
design attribute: visibility
metric: color
unit: rgb
value: 255, 255, 0 (yellow!)
owner: Floyd



Identifying appropriate metrics
measure the product attributes

metrics should be observable or analyzable properties/behaviors of the product

metrics should be quantifiable

include metrics used in the marketplace for benchmarking

Attributes and specifications
example: types of metric values

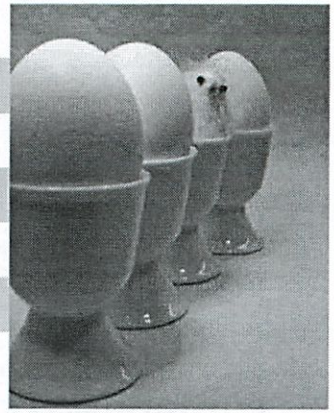
attribute	metric	unit	value
damage detection	defects visible	binary	yes/no
solidifies in heat	thermo-sets	binary	yes/no
household usability	curing temperature	Celsius	between 50 and 100
producability	manufacturing time	days	less than 21
food safe	FDA approved mat'ls.	binary	yes/no
Atkins-diet friendly	carbohydrate content	grams/product	less than 1

mini quiz! what product might meet these specifications?

Attributes and specifications

example: types of values

attribute	metric
damage detection	defects visible
solidifies in heat	thermo-sets
household usability	curing temperature
producability	manufacturing time
food safe	FDA approved mat'ls.
Atkins-diet friendly	carbohydrate content



Exercise

writing specifications

each section has a 'product' kit

develop specifications consistent with the product

assess specifications developed by another team

interpret specifications and identify products that meet them (and why)

present and critique specifications

Exercise

step 1: 10 minutes

develop specifications consistent with your fruit "product"
use attribute and specification forms provided (one extra copy of each)
write legibly, use black sharpie provided

attribute	metric	unit	value
damage detection	defects visible	binary	yes/no
solidifies in heat	thermo-sets	binary	yes/no
home usability	curing temperature	Celsius	between 50 and 100
producability	manufacturing time	days	less than 21
food safe	FDA approved mat'ls.	binary	yes/no
Atkins-diet friendly	carbohydrate content	grams/unit	less than 1

Exercise

step 2: 7 minutes

review another section's specification
i) use red sharpie to highlight questionable specifications
ii) identify products that fit the specification, using form provided

product is:	metric	unit	value
	visible defects	binary	yes/no
could be:	thermo-sets product description?	binary	yes/no
	setting temperature	Celsius	between 50 and 100
	manufacturing time	days	less than 21 seems long
	FDA approved mat'ls.	binary	yes/no
	carbohydrate content	grams/unit	less than 1

Exercise

step 3: 7 minutes

present and critique:

what products fit and why, discuss specification

critiqued a good specification?

critiqued a less good specification?

diameter of peach

The Homer

"The Homer" (also known as **"The Car Built for Homer"**) was a car designed by Homer when his half-brother, Herb, gave Homer a job at Powell Motors.

The Homer

Owner	Powell Motors
Maker	Powell Motors - designed by Homer
Use	Concept, designed for the "average" American
First Appearance	Oh Brother, Where Art Thou?

History

Thanks to Homer's dislike of the cars Herb's company was creating, Herb decided his company needed a new car that would appeal to the "average" American. Despite the many objections of Herb's employees, Herb encouraged Homer to follow his instincts in creating a car that American consumers would want to buy. Homer took charge of the project after Herb encouraged him to obey his gut when it came to what kind of car he wanted. Unfortunately, Homer's creation was such a monstrously strange car, it cost so much to develop, and had such a high price tag, that Herb's car company went out of business shortly after, with its building purchased by Komatsu Motors.

Features

- The Homer has two bubble domes; one in the front, while the one in the back is for quarreling kids, and comes with optional restraints and muzzles.
- According to Homer, the engine sound causes people to think "the world's coming to an end."
- There are three horns, as Homer claims that "you can never find a horn when you're mad." The three horns play the song "La Cucaracha."
- The car also features gigantic cupholders, which actually became a feature on many cars in the 1990s onward.
- The car has various outdated features such as bubble domes, shag carpeting, and tailfins. It also has a metal bowler as a hood ornament.

Non-Canon Appearances

The contents of this article or section are considered to be non-canon and therefore may not have actually happened/existed

In the video game The Simpsons Road Rage, The Homer is unlocked after all 10 missions are completed successfully. The vehicle is driven by Homer, but is harder to handle than his Pink Sedan, and is more of a trophy than an actually useful car like the Bandit and Hover Car. When selected before it is unlocked, Homer will be heard saying "And the sticker price for this car... is *$82,000?!*" along with an audible crowd gasp as the car is displayed.

In *The Simpsons: Hit and Run*, "The Homer" can be acquired by Apu from Homer at the Hospital parking lot in Level 5 for 500 coins. Required for completion of the "Eight is Too Much" mission. The horn plays "La Cucaracha."

Behind the Laughter

A toy was made of "The Homer", and the car was an unlockable in the videogames *The Simpsons Road Rage* and *The Simpsons: Hit and Run*.

The Homer in *The Simpsons: Hit and Run*

Added by Seu Madruga

Appearances

- *Episode* – "Oh Brother, Where Art Thou?"
- *Video game* – *The Simpsons: Hit and Run*
- *Video game* – *The Simpsons Road Rage*

Vehicles

Pink Sedan • Orange Station Wagon • Shorts Car • **The Homer** • Canyonero • School Bus • Blue Station Wagon • Geo Metro • Honor Roller • Lil' Bandit • Troy's DeLorean • Elec-Taurus • Duff Truck • Surveillance Van • Curator • Burns' Limo • Dr. Frink's Hover Car • Springfield Monorail • Pontiac Firebird • Homer's RV • WWII Jeep • Willie's Tractor • Book Burning Mobile • Gremlin • Stutz Bearcat • Plow King • Mr. Plow

Categories: Vehicles | Vehicles in Simpsons Hit & Run | Homer Simpson

Languages: Español

10/12

2.009

Home > Lab instructor review

Lab Instructor Review

The lab instructor review gives you an opportunity to give your lab instructor constructive feedback. The results of the review are provided to each individual lab instructor. The review is optional, your feedback is anonymous, and it will not affect grading.

The first lab instructor review is roughly 1 month into the course, and the second review is 3 weeks after the first. The goal of the second review is to provide instructors additional feedback so they can see how changes they have made were received.

The lab instructor review has the same format as the peer reviews, except you are reviewing your lab instructors rather than yourself and your classmates.

Take me to the lab instructor review form! ← darn when I tried to print

2.009
Product engineering processes

the *bad news* is time flies
the *good news* is that you're the pilot

Michael Altshuler

But first...

Some reminders

Read chapter 16 in the textbook (managing projects)

Instructor review closes 5 PM today

Mockup review:
key risks, 3 + 7, detailed logistics linked on home page

Clients welcome, just let me know

email me: special testing needs by Tuesday
current product names by 5 PM Wednesday

2.009 Product engineering processes

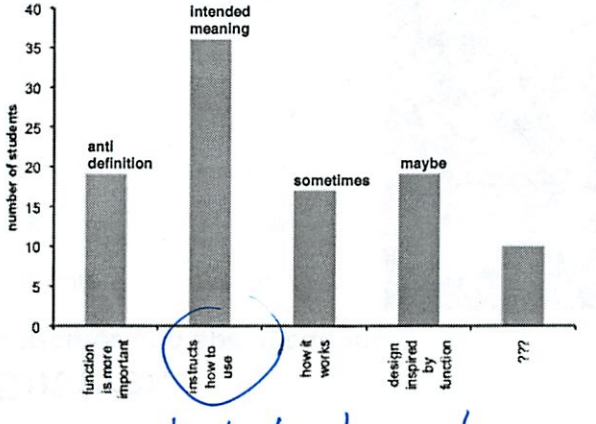
Today

time estimation resource budgeting
scheduling project management

L16
Scheduling + Time Estimation

But first...

mini quiz: form follows function means...



instructs how to use

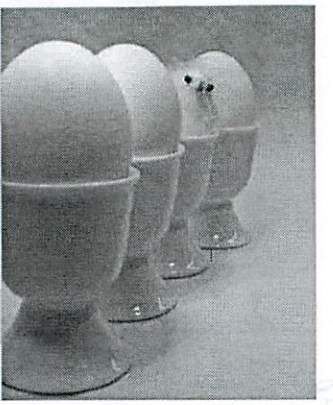
10/15

form is function

But first...

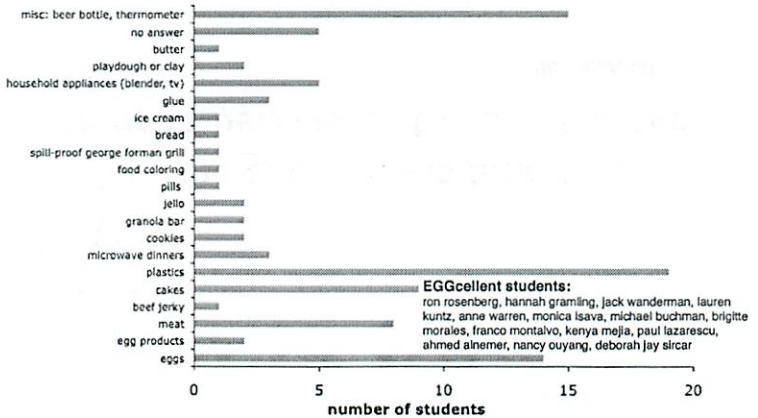
attributes and specifications

attribute	metric
detect damage	defects visible
solidifies using heat	thermo-sets
home usability	curing temperature
producabiity	manufacturing time
food safe	FDA approved mat'ls.
Atkins diet-friendly	carbohydrate content



Attributes and specifications

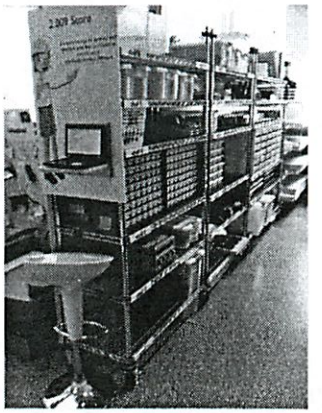
mini quiz: identifying the egg



writing good specifications is challenging
very important in development teams, especially in era of outsourcing

2.009 supply store

in Pappalardo lab



2.009 supply store
components for purchase (at cost) or loan

2.009 Supply Store

Welcome, David Wallace!

You are making purchases/rentals on behalf of Staff Team.

2.009 Supply Store Shopping Cart

Your current shopping cart is below.

Components to purchase:

Item Description	Quantity	Units	Unit Cost	Item Cost
Micro Gear Motor, 150:1	1	each	$15.95	$15.95
5/8"" hardwood dowel, 2' max length	3	ft.	$1.00	$3.00
			Total	$18.95

Equipment to borrow:

Item Description	Quantity	Units
12" quick grip bar clamp	2	each

Update shopping cart! Empty shopping cart! I'm done. Checkout!

2.009 supply store
~660 items: electronics, materials

2.009 Store

Welcome, David Wallace!

You are making purchases/borrowing on behalf of Staff Team.

Enter the quantity for items you are purchasing or borrowing

Expand All Collapse All

search online

- Electronics
  - Audio components (4)
  - Batteries (12)
  - Boards (3)
  - Capacitors (33)
  - Connectors (13)
  - Diodes (3)
  - Displays (5)
  - Fans (6)
  - Fuses and holders (8)
  - H Bridges (5)
  - Heat Shrink Tubing (35)
  - Heatsinks (2)
  - ICs (21)
  - Knobs (6)
  - LEDs (14)
  - Microcontrollers (3)
  - Motors (20)
  - Potentiometers (15)
  - Power supplies (8)
  - Relays (2)
  - Resistors (18)
  - Sensors (4)
  - Steering (21)

Browse Search Cart Returns More Logout

Information Schedule Teams Team manual Project Resources

or scan with phone

220 Ω Resistor 1003

2.009 supply store
billing process

add to cart and checkout

Item Description	Qty. Available	Quantity	Units	Unit Cost	Item Cost
1/2" Birch, 2'x4' max size	64	0	sq. ft.	$1.31	$0.00
3/4" Birch, 2'x4' max size	24	0	sq. ft.	$1.04	$0.00
3/4" Cabinet grade pine, 2'x4' max size	64	0	sq. ft.	$0.96	$0.00

Tools

Add items to shopping cart!

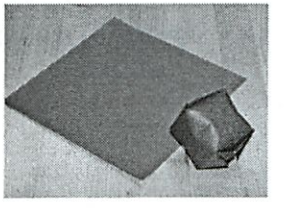
receipt emailed to you
process receipt in standard fashion
daily summary sent to financial officer
inventory management/resupply

Oh need to do std fashion

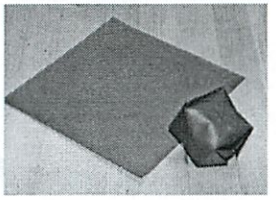
Time estimation
Origami ball experiment

put your name and time estimate on the handout
do not look at the back side of the page!

when I start timer, turn over the handout
make the ball
record your actual time (no fudging please)
go to course website
enter and submit data
hand in paper estimate



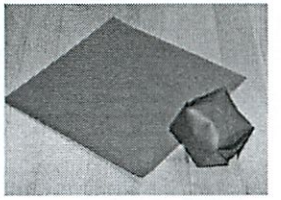
Time estimation
Experiment results



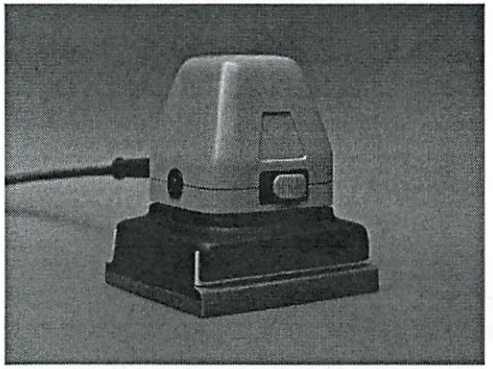
Time estimation
Take-home message

task time estimate = expected time x multiplier

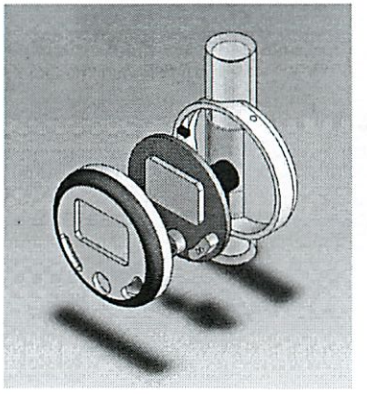
multiplier $f_{(\text{familiarity, complexity, process uncertainty})}$



Time estimation
Visual model: 9 hours

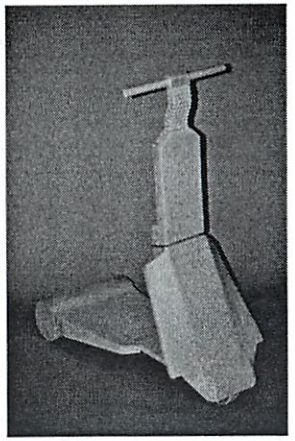


Time estimation
Preliminary solid model: 6 hours



Time estimation

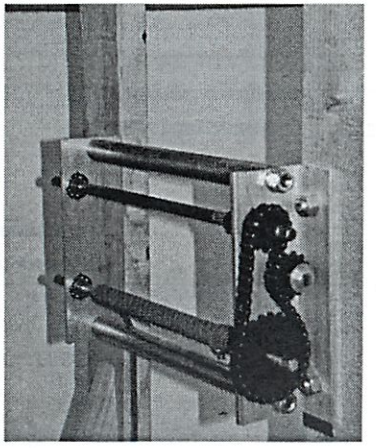
Sketch model: 2.5 hours



how to estimate how long it will take

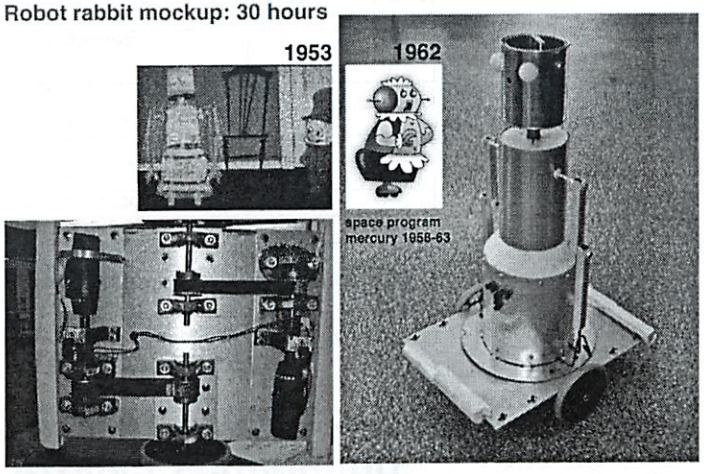
Time estimation

String dynamometer: 20 hours



Time estimation

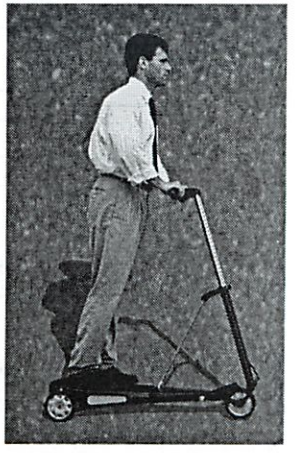
Robot rabbit mockup: 30 hours



Electric scooter

Electric scooter prototype: 110 hours fabrication + lead time

all examples: fabrication time only!



Project scheduling

Step 1: task list and milestones

by project (course/program)
by development phase (system integrators)

Mockup tasks	Estimated time
refine needs	2 days
refine benchmarking	1 days
refine concept	4 days
refine attributes	1 day
preliminary contract	1 day
resolve risk 1	4 days
resolve risk 2	4 days
Milestones	
team review	Oct. 17
mockup review	Oct. 18

why 4 days?
total: 17 days

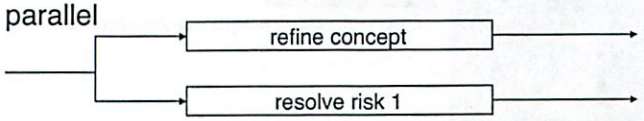
time to review: 4 days

Project scheduling

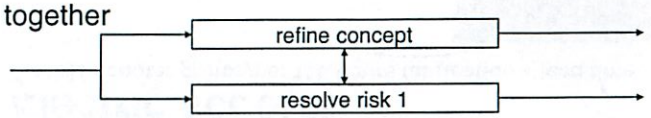
Step 2: task sequencing

sequential

parallel



together



Project scheduling

Step 2: sequence based upon interdependencies

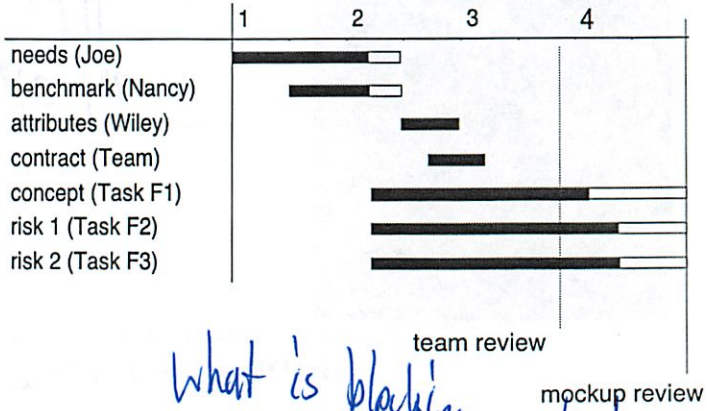
	refine needs	refine benchmarking	refine attributes	refine contract	refine concept	resolve risk 1	resolve risk 2
refine needs	X						
refine benchmarking		X					
refine attributes	X	X	X				
refine contract	X	X	X	X			
refine concept			X	X	X	X	
resolve risk 1					X	X	
resolve risk 2				X			X

need info (row)
provide info (col.)

Project scheduling

Step 3: Visualization

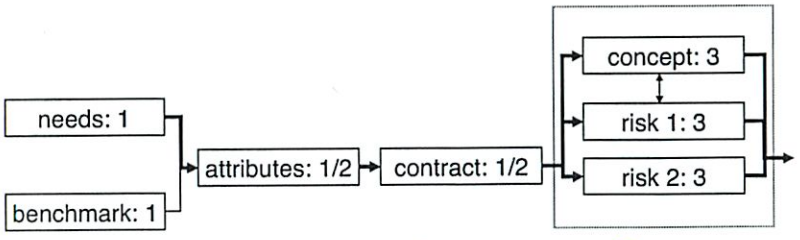
Gantt charts (tasks, resources, milestones)



what is blocking what
powerful tools (I need to get better at)

Project scheduling
Step 3: Visualization

Critical path
Pert charts (program evaluation and review technique)

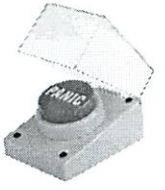


Min path through
Project is only as fast as crit path
only place can potentially add resources to speed up

Project scheduling
Managing a deadline crunch

start early
manage/change project scope
freeze decisions based on timeline
increase work load
outsource or engage additional resources

reallocate resources to critical path
(eliminate secondary items)
eliminate parts of critical path



Scheduling
Step 1: task list and milestones

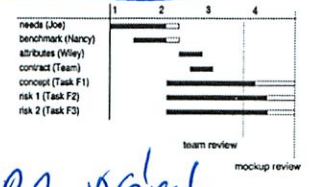
by project
by milestone
by sub-problem: risk 1 (weekly task forces)

Risk 1 tasks	Estimated time
brainstorm options	1/2 day
develop options	1 days
analyze options	1/2 day
design mockup	1 day
build mockup/test bed	2 1/2 days
run experiment and document	1 days
Milestones	
task force progress review	Oct. 16
team review	Oct. 17

Section schedule preparation
Gantt chart through mockup review (October 18)

list key milestones towards the review
list tasks and estimate completion times
sequence tasks based upon dependencies
allocate resources and draft a Gantt chart

system integrators draw Gantt chart on team white board
use schedules from now on



Usually only works if people totally focused on project

Wrap up

miscellaneous items

Gantt chart software will be linked on home page

instructor review open until 5 PM Today

10/16

Skipped

2.009

Lab #6: Week of October 15: Preparing for the mockup review

objective, preparation, what's due, activities

Main Lab Objective
Your section should focus on preparing for the upcoming mockup review, which is on Thursday evening. Your section should be resolving the most critical risks associated with the concept you selected last week. The goal is to have enough information to knowledgeably and confidently make your final project selection after the mockup review.

Teams that have meetings in the later part of the week should be further along in their preparations *prior to lab time* than teams that meet during the beginning of the week.

Advanced preparation for Lab #6
Individually:
Make sure that you understand the requirements for the mockup review and logistics for the presentation.

Be prepared to give a status report on the items you are responsible for at the start of lab.

For your section:
Make sure that your task forces are organized to prepare the different types of materials that needed to address the critical questions related to your concept.

Your section should also have an up-to-date Gantt chart and task dependency matrix (or similar visualization that clearly shows milestones, key tasks, and timing) in your team area.

For your team:
System integrators should prepare an agenda for the lab. Plan to have a meeting that allows a significant amount of time for working on tasks.

If you think that you will need AV equipment set this up in advance as well.

What's due
There are no formal deliverables in lab this week.

Recommended Lab #6 Activities
This lab should be focused on running a very efficient, short meeting so that there is time left to work on remaining tasks.

Close the meeting room divider so that the two sections can work separately.

As individual sections
Begin with the standard meeting startup.

Each task force should give a brief status report to the section, indicating what you have completed, what needs to be done, open issues that are of concern, and whether the assigned tasks are on-schedule. Using work-in-progress as props can facilitate this process.

Based on the reports, decide if resources need to be reallocated to different tasks or if new task forces need to be created.

Your team communication requirements mentors will be available in lab for presentation consultation.

Work!

Important notes: Once the mockup review is over, it is strongly recommended that your team waits until the next lab meeting before making your final concept selection.

The second peer review will be held at the end of the week.

2.009 Product engineering processes

"nothing is particularly hard if you divide it into small jobs"

Henry Ford

Mockup review

7:15-9:30 PM, Thursday October 18

key criteria

- degree of resolution on critical issues/risks
- appropriateness of mockups/models/simulations
- quality of the design concept

two components

- presentation to the entire class (3 min/section in 35-225, no models or questions)
- testing and questions in the Pappalardo lab (four 7 minute rotations)
- 2 minute video demonstration

detailed schedule online, linked to home page

2.009 Product engineering processes

today

logistics and pointers

mockup review

LL Mockup Review Points

Mockup review

issues to cover

what is the concept?

clear overall definition/vision for the product

scoping of major subsystems/technical elements

clear use life-cycle, human interface

10/17

Mockup review
issues to cover

key needs and preliminary contract
clear core product proposition
logical mapping between needs, product attributes, and specs
basis for estimated purchase price

Needs and attributes
mockup review: preliminary product contract

Product Description: Portable electric device for lifting automobiles.

Intended Customers: Backyard mechanics.

Market: Automotive accessories.

Customer Need	Product Attribute(s)	Engineering Specification(s)
Can be easily transported in and out of a house.	Weight	Total weight less than30 lbs.
Is easily stored in the home and office.	Size	Less than 14" x 14" x 14" in smallest configuration.
Can handle most repair situations.	Lifting capability	more than 15 cycles at 1" per second per charge for a 3000 lb. automobile.
Can be used on many uneven surfaces.	Stability	3000 lb vehicle raised 16 inches will not tip under 400 lb side loading. Base self-levels up to 1 inch discontinuities and 2% slopes in pavement.

Mockup review
issues to cover

key risks
major issues identified
feasibility demonstrated or disproven
lessons learned and identification of unresolved challenges

Mockup review
presentation

pointers
don't try to sell — communicate
design the presentation to be engaging
use 3 minutes to summarize the concept, contract, risks, findings
in the lab, let the content speak — few words
plan the content for your short mockup demonstration video
remember the longer-term goal — design a good new product

Mockup review
preparation

special locations

purple b: (sky beacon: parking lot, south end)
silver a: (keg mover: south Pappalardo foyer/stairwell)
orange b: (flex ferno, parking lot, north end)
blue b: (raindrop, parking lot, south end)
red b: (duoseat, north Pappalardo foyer)

have someone take notes during lab portion

Mockup review
preparation

before the review

Product names: today 5 PM

2:30-5:15 PM Thursday (schedule online)
load images onto presentation computer (Pappalardo)

4:45-6:45 PM: prepare team area

5:30-6:30 PM: AV test in 35-225

7:15 PM sharp: presentations start in 35-225

Should have attended

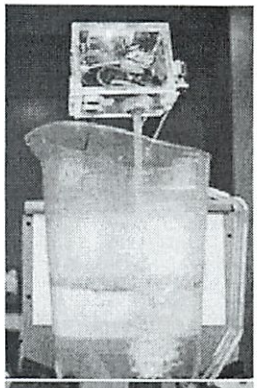
10/18

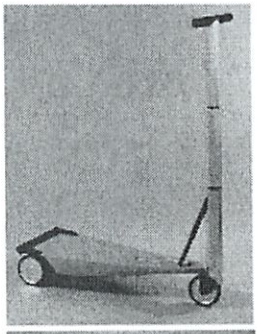
2.009

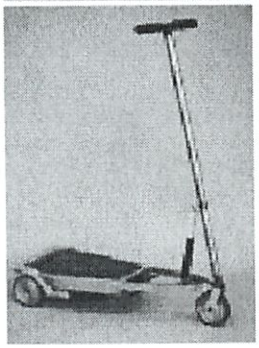
Home > Mockup Review

Mockup Review

background, key review elements, grading, logistics, results







Background
The review takes place during the evening on the date indicated in the class schedule.

The goal of the review is to inform classmates and instructors about the key challenges related to your section's leading design concept, and how these challenges will be resolved. If there are open issues this is a good opportunity to obtain input and suggestions before fully committing to detailed development. The mockup concepts will also be posted on a crowd-sourcing platform to obtain feedback from a large number of real, potential users.

You will use feedback from this review to decide which final concept will be pursued by your team for the technical review. The experience will also help you learn how to present technical challenges and solutions in a design review.

Examples of functional and visual mockups are on the right. You can also view mockups from other years in the gallery (select a project and then click on the mockups tab). The communication instructors have also prepared guidelines for effective mockup presentations.

Video of your presentations will be made available on the course web site.

Key review elements
The review is comprised of two components: a short, structured presentation to the entire class (slides only), and a less-structured question-and-answer session in the Pappalardo lab (working with the mockups). The presentation should focus on issues that are both potentially high-risk and critical to the concept.

Each section will present technical or visual mockups and drawings of their single concept, focusing on illustrating the overall concept, technical feasibility/operational principles of critical systems, preliminary product contract, and user/product interaction. The concept is typically an adaptation of one of the team's 4 concepts in the sketch model review, or a section might try a different product based upon what they have learned so far.

Grading
The mockup review contributes to a portion of your section-wide grade. All course instructors will participate in the review process but your lab instructors determine your grade.

Key grading criteria are:

- degree of resolution on critical issues/risks
- evolution of the design concept since the last review and your design process
- usefulness and effectiveness of the mockups and other models

Please review the detailed **presentation logistics** carefully.
See **results** of mockup review.

2.009

Mockup Review Logistics

before the review, review details, after the review

Before the review
Please email the course instructor your product name by no later than 5 PM Wednesday.

All presentations will be pre-loaded onto a single presentation computer: a representative of each section must show up in the Pappalardo lab at your section's scheduled time **between 2:30 and 5:15** to load your section's presentation onto the computer, and to check that media are working correctly. You will not be able to make changes to your slides after this time.

You may use either *powerpoint, keynote, or pdf files* for your presentations. If you are using powerpoint be sure that linked videos are exported as a package to the presentation computer. Keynote embeds all media files automatically.

Work in the Pappalardo will stop at the usual 4:45 PM, but you will be able to have access to setup your team area until 6:45 PM.

Presenters should test AV in the presentation room (35-225) between 5:30 and 6:30. It is important that the actual presenters check the materials in the room. Please ensure that all AV testing is finished before 6:30.

Make sure that your team area in Pappalardo lab is clean and your mockups are ready for demonstration and testing. If you need to demonstrate in an area other than your team space, please discuss with the course instructor before the end of Tuesday. Your will also be asked to do a two minute video demonstration/explanation using your mockups. Please plan and *practice for the video in advance.*

Review details
The mockup review will start at 7:15 PM sharp and finish by 9:30 PM on the date indicated in the course schedule. The review is divided into two parts, as described below.

Part 1: Structured presentation
During the first hour of the review each section will have 3 minutes to present critical questions and findings. Each section should have its own separate presentation fie.

The presentation order is shown on the right. A computer projector and a document camera will be available in the presentation room (35-225).

Present your product vision, critical risks, key findings, and remaining concerns. Be sure to include a preliminary product contract with your key 3-6 customer needs, product attributes, and specifications. Physical models will not be part of this structured presentation, and there will be no questions after each presentation. One minute will be allowed between presentations for transition.

All students should plan on attending the first portion of the presentations since seeing what the other sections are working on is an important part of the learning experience.

Silver B
Silver A
Blue B
Blue A
Red B
Red A
Yellow B
Yellow A
Green B
Green A
Orange B
Orange A
Purple B
Purple A
Pink B
Pink A

***Part 2: Informal testing and discussion*:**
After the formal presentations are complete, faculty will promptly move to the Pappalardo lab to experiment with your physical mockups and ask questions. Ten minutes will be allowed for the transition to the Pappalardo lab.

Instructors will be divided into 8 small groups and assigned to different sections. Every 7 minutes the instructors will switch to a different section according to the rotation schedule below. The rotation is structured to that you will have 7 minutes on, then 7 minutes off. In total, you will have four 7 minute question and answer sessions.

All students in your section do not need to participate in the Pappalardo lab portion of the review. There needs to be people to demonstrate and discuss the mockups, and at least one person to record notes during the feedback session. The notes should be distributed to your team.

Photographs and a two minute video explanation of your mockups will be taken during one of your breaks, as noted in the rotation.

rotation 1 rotation 2 rotation 3 rotation 4 rotation 5 rotation 6 rotation 7 rotation 8

silver A (stairwell, south end)	*wallace keating sevnic	**video**	duplessie schoenstein cobi		meeker nielsen tardiff		braunstein kokernak xingie	
silver B		wallace keating sevnic		duplessie schoenstein cobi	**video**	meeker nielsen tardiff		braunstein kokernak xingie
orange A	*duplessie schoenstein cobi		kim volaitis wood	**video**	wiesman winter te locknar		seering sutliff martins	
orange B (parking lot, north end)		duplessie schoenstein cobi		kim volaitis wood		wiesman winter te locknar	**video**	seering sutliff martins
red A	*braunstein kokernak xingie		seering sutliff martins		kim volaitis wood		wiesman winter te locknar	**video**
red B (Pappalardo, north foyer)		braunstein kokernak xingie		seering sutliff martins		kim volaitis wood	**video**	wiesman winter te locknar
purple A (parking lot, south end	*seering sutliff martins		hu devlin rogers		wallace keating sevnic		duplessie schoenstein cobi	**video**
purple B (parking lot, south end)	**video**	seering sutliff martins		hu devlin rogers		wallace keating sevnic		duplessie schoenstein cobi
yellow A	*kim volaitis wood		meeker nielsen tardiff	**video**	duplessie schoenstein cobi		hu devlin rogers	
yellow B		kim volaitis wood	**video**	meeker nielsen tardiff		duplessie schoenstein cobi		hu devlin rogers
blue A	*meeker nielsen tardiff		braunstein kokernak xingie		seering sutliff martins	**video**	kim volaitis wood	
blue B (parking lot, south end)	**video**	meeker nielsen tardiff		braunstein kokernak xingie		seering sutliff martins		kim volaitis wood
green A	*wiesman winter te locknar		wallace keating sevnic		hu devlin rogers	**video**	meeker nielsen tardiff	
green B		wiesman winter te locknar		wallace keating sevnic	**video**	hu devlin rogers		meeker nielsen tardiff
pink A	*hu devlin rogers	**video**	wiesman winter te locknar		braunstein kokernak xingie		wallace keating sevnic	
pink B		hu devlin rogers	**video**	wiesman winter te locknar		braunstein kokernak xingie		wallace keating sevnic

* review team captain

After the review

Preliminary feedback will be provided in class on Friday and you will receive written comments by email over the weekend. Presentation videos and slides will be put on the results page so that instructors can

provide more feedback than is possible during the short question period during the presentations. Three instructors will be assigned to provide additional feedback for your section. We will also ask you to complete a short form so that we can obtain crowds feedback via mechanical turk.

You may also arrange to view the presentation video with your team communication instructors for additional feedback about your presentation style.

8/01

blessed are the flexible,
for they shall not be bent out of shape
Michael McGriffy, MD


two-headed snake

But first!
A one minute mini quiz

write your name on index card

list the 4 components of a specification

write name of your mockup concept

write one well-formulated
need-attribute-specification for your concept

2.009 Product engineering processes
today

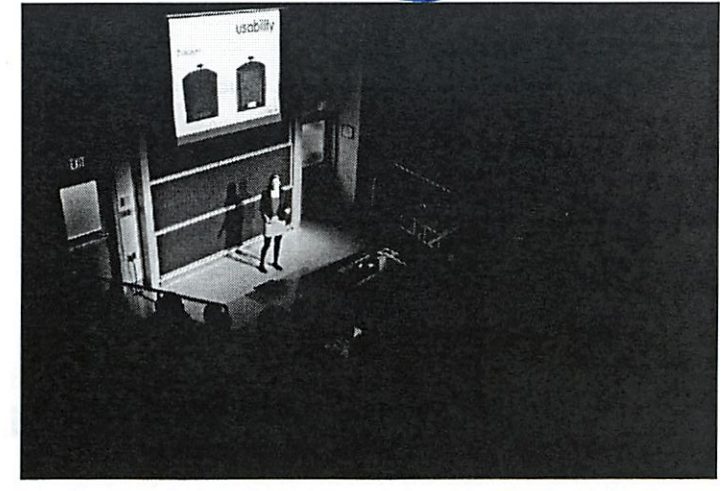
mockup feedback reflection

what's now assembly (October 30)

critique providing constructive feedback

ethics effective teamwork, professional responsibilities

Mockup review
good progress has been made



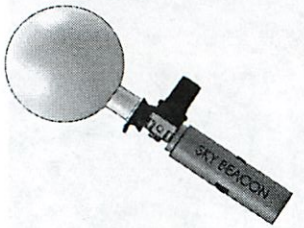
10/2010

Mockup review
setting the context

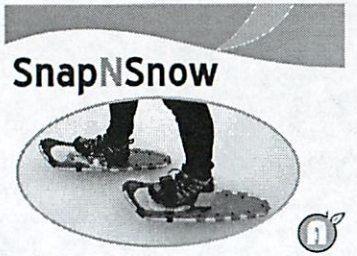
name a team characteristic that has negative correlation with success

excessive praise!

Feedback: mockup phase
Product vision



Purple B: sky beacon



Orange a: snapNsnow
mockup vs. product

Feedback: mockup phase

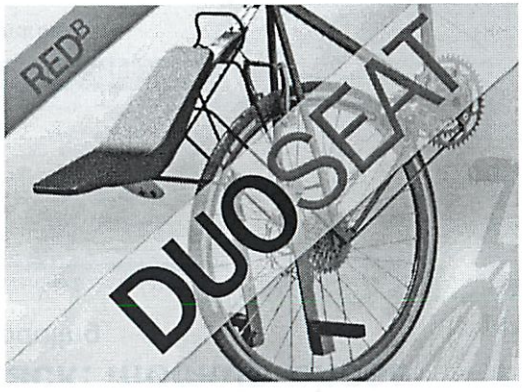
SnapNSnow is...

A universal, hands-free snowshoe interface that offers an easy on and off snowshoe experience with quick transitions to get you to your hot chocolate in record time.

the problem: moving a keg downstairs

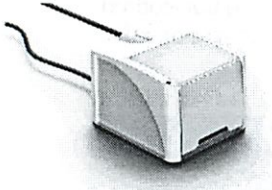
Feedback: mockup phase

Product vision



Feedback: mockup phase

Product vision (2010)



Blue B: happy egg

Pink B: flour pot

(watched some v.'deos
Skybeacon very cool!)

Tilt 20
is cool as well
Blindspotter

Feedback: mockup phase

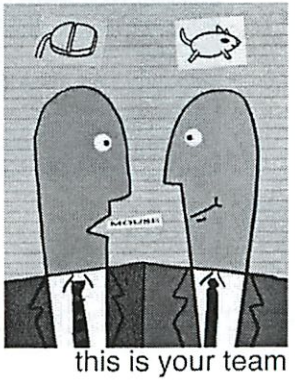
Product vision: most did not have one at all

Why care?

concept scoring

somewhat crazy

have one for decision



this is your team

Feedback: mockup phase

real user/product advocate

the market

in boston...

4000 clients
50 trucks
10 stops/day
10 keg/stop

1.4 million kegs annually

ABInBev

"I want this"

Feedback: mockup phase

real user/product advocate

Why care?

designing a shape shifter is hard, and frustrating

"I want this"
have one for decision

Feedback: mockup phase

real user/product advocate

PRODUCT DESCRIPTION:
DuoSeat is a bike seat attachment with foldable feet support which allows you to carry a passenger while you bike and has the dual functionality of carrying cargo as well!

INTENDED CUSTOMERS:
- young professionals 25-45y/o (commuters and urban dwellers)
- bikers in developing countries

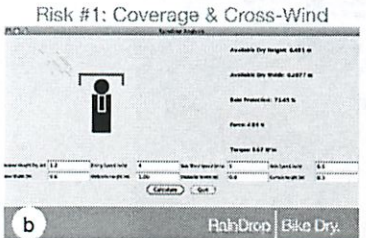
MARKET:
the bike accessories market (annual growth of 22%)

lol

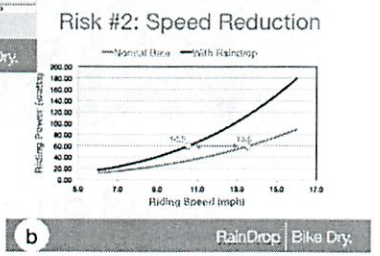
incongruity? OUR PRODUCT **VISION**

Feedback: mockup phase

use of modeling



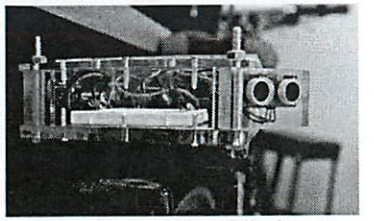
blue B: raindrop



Feedback: mockup phase

demonstrating function

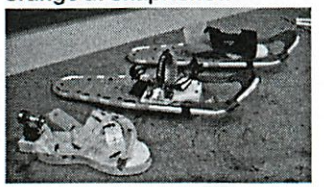
green a: bike+



purple a: blindspotter

orange a: snapNsnow

use to test your value proposition before your decision



Feedback: mockup phase

presentation slides

Product Contract

Customer Need	Attribute	Engineering Specification
Easy On	Attachment Time	Less than 10 seconds with minimal dexterity
Easy Off	Detachment Time	Less than 5 seconds with minimal dexterity
Indoor Safe	Bottom Surface	No floor-damaging protrusions beyond the sole of the shoe
Compatibility	Adjustable	Fits shoe sizes from Mens 4-12
Reliable retention	Strength, Stability	Maximum experimental lifting force from the leg: 300N
Resists snow-packing	Geometry, Materials	Minimum spacing of 1/2 inch between parts, minimal number of cavities
Wear resistant	Durability	Materials which won't rust, degrade, or crack in cold, wet conditions

Feedback: mockup phase

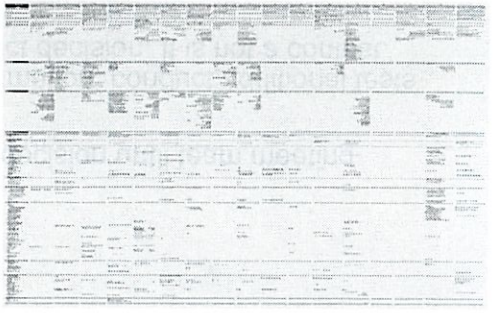
presentation slides

the problem?

readable

ways to present contract?

or vignette



Feedback: mockup phase

preparation and delivery

use the confidence monitor

presenters must test setup!

plotting takes time!

Feedback

review scoring:

there is information in the standard deviations

mockup

execution and testing only

2+ hours of discussion.

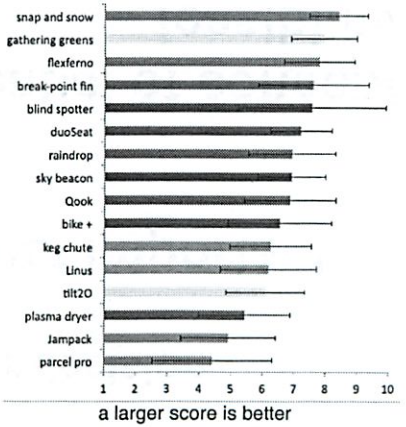
24 reviewers.

reflect on what lead to stronger or weaker impressions

not your grade.

not a product selection. It is a critical error to use the ratings this way!

rating captures a group impression influenced by many factors.

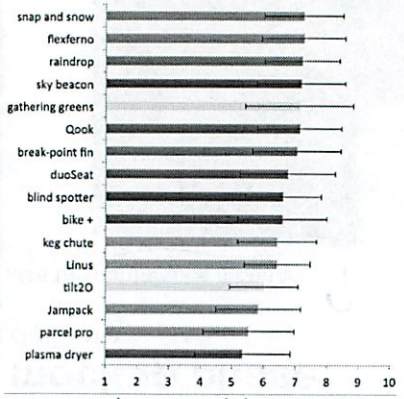


a larger score is better

Feedback
review scoring:

there is information in the standard deviations

mockup
analysis only (risks, contract)



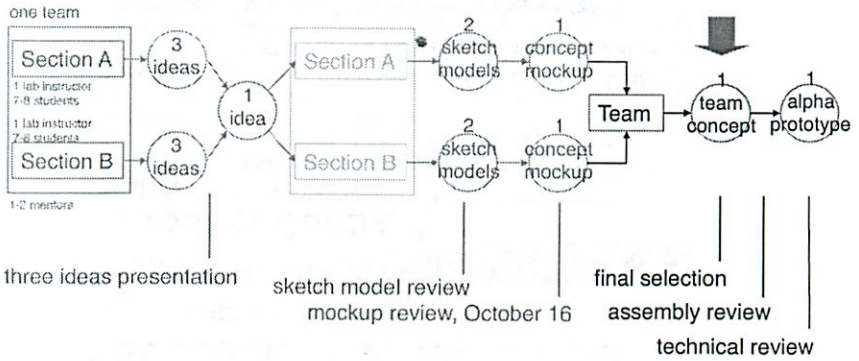
a larger score is better

making your decision

what's most important?

potential of concept
feasibility

What's now
workflow



What's now
the next few days

do not make product decision until team meeting

gather additional information, conduct additional tests for an *informed* product decision. It is not a contest.

reflect on feedback sent over the weekend.

prepare product summaries for the next lab!

mechanical turk: two questions, product vision/picture, short description, key needs
(email link to form today, needed 8 PM Saturday)

2.009 Product engineering processes

design critique

an important improvement and

decision-making mechanism

self critique, design review

Self critique

introspection is suspect

don't marry an idea

synthesis and deconstruction (analysis)

no aspect of the design is arbitrary

mental role-playing

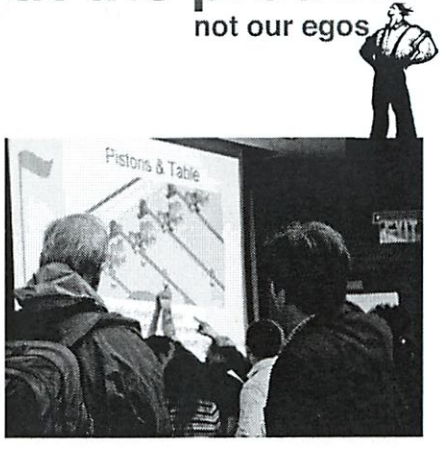
use time to develop distance

challenge yourself

Design review

it's about the product

not our egos



Role playing exercise

two design critique scenarios

Presenting in a critique

suggestions

present

listen

consider

decide and respond

Questioning in a critique

suggestions

ask

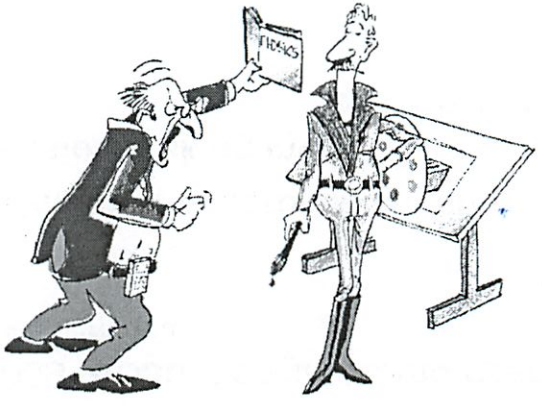
listen

consider

decide and respond if appropriate

Ego *vs.* ego

honest, respect viewpoints, avoid *my* and *your*



Engineering ethics

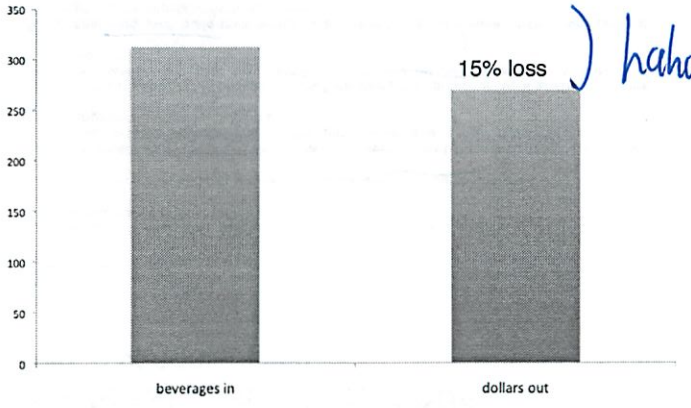
Functional teams, professional responsibilities

wait, wait—don't tell me!

bluff the listener

a) VisuaLAB's technology a hoax
b) Software piracy losses increasing
c) Engineering students less honest than humanities students

Engineering ethics
Functional teams, professional responsibilities



hahahha

Professional ethics code
most professions have one

even pirates had them!

Ye spoil taken from a captured ship is to be distributed in equal portion.
All ye who shall plot to desert, or having deserted shall be captured, shall have ye heads split open.

Engineering ethics
What is an ethic?

a code of behavior or conduct justified according to a reasoned value system

Engineering ethics
Value system?

what is good or bad, beneficial or deleterious, according to some set of criteria (measure of worth)

personal:

- resources such as energy should be purposefully used, regardless of monetary value
- return policies should be used in good faith only

professional (ASME):

- "engineers uphold and advance the integrity, honor, and dignity of the engineering profession by using their knowledge and skill for the enhancement of human welfare ... striving to increase the competence and prestige of the engineering profession."

societal:

- balance between privacy and security
- entitlement to health care

value systems change over time

Engineering ethics
values *vs.* preferences

preference: *like or dislike*

I enjoy cheese with apple pie *vs.* cheese is an appropriate side dish for apple pie

This is a good design but I would never use it

It was a good decision to buy the camera even though I did not want to buy a camera

Professional ethics code
part 1: principles

ASME:

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

I. using their knowledge and skill for the enhancement of human welfare;

II. being honest and impartial, and serving with fidelity the public, their employers and clients; and

III. striving to increase the competence and prestige of the engineering profession.

Professional ethics code
part 2: canons (laws)

ASME:

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in the areas of their competence.
3. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional and ethical development of those engineers under their supervision.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest or the appearance of conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall associate only with reputable persons or organizations.
7. Engineers shall issue public statements only in an objective and truthful manner.
8. Engineers shall consider environmental impact in the performance of their professional duties.

Engineering ethics
words indicating that you need to check your code...

"no one will ever know..."

"everyone does it."

"we can hide it."

"destroy that document."

"this will destroy the competition."

"no one will get hurt."

"well, maybe just this once..."

"we didn't have this conversation."

"it doesn't matter how it gets done as long as it gets done."

"if they are that stupid, they deserve to get hurt."

from Lockheed Martin

Engineering ethics

When in doubt ask ...

are my actions legal?
what would my professional society think?
am I being fair and honest?
will my action stand the test of time?
how will I feel about myself afterwards?
how will it look in the newspaper?
will I sleep soundly tonight?
what would I tell my child to do?
how would I feel if my family, friends, and neighbors knew what I was doing?

Ethical problem solving

Design a useful code of conduct for your team

principles and laws: your team's guiding values for how to work with each other.

draft a code of ethics
(start now by collecting idea from the entire team)
up to 8 canons
submit an electronic version (Word) by 10 AM Monday (2009cr@mit.edu)
you will receive feedback by Monday 5 PM
final edited versions due noon Tuesday (drwallac)

And finally

reminders...

peer review opens today, due Monday
notebooks and timesheets next week
think about what you need to do to make a good decision

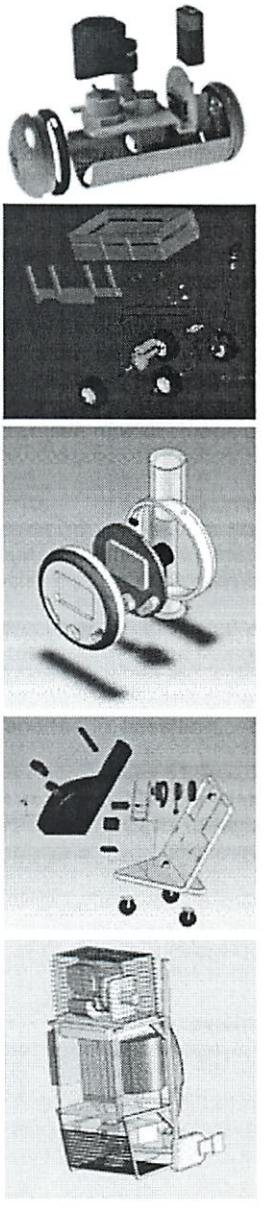
10/20

2.009

Home > Assembly and product contract

Assembly & Product Contract

background, key elements, grading, logistics and schedule, results



Background
The assembly review is an important step on the way to success in your technical review.

The goal of the assembly milestone is to help your team develop a clear, detailed, and shared view of your overall product. The lack of a good assembly model very often leads to many errors and a high degree of stress as the technical review approaches. However, even while the team is working on the assembly model it is critical to continue exploring design options and performing physical tests for high risk aspects of the design.

The in-class review is intended to provide design feedback. Examples from prior years are on the right. You can also view assemblies from other years in the gallery (select a project and then the assembly tab). If you compare the assembly model to the technical review or final presentation gallery entry, you can see how dramatic changes may be based upon input from the assembly review.

Key elements
There are two primary deliverables for this review: an assembly model for your team's design (including a list of who-modeled-what), and a product contract document. See the submission logistics for specifics.

The product contract will be used as a baseline to evaluate the performance of your prototype during the technical review.

There are two deadlines. The date of the electronic submission of your materials, and the in-class presentations.

Grading
The review contributes to a portion of your shared team-wide grade and all course instructors will participate in the evaluation during an in-class review. Your assembly grade will be the average of the scores assigned by the reviewers.

The electronic assembly model will be evaluated based upon completeness and quality of design details. *Each team member will need to model at least one part of the assembly!*

The product contract will be evaluated based upon relevance and correctness of needs, attributes, and specifications.

2.009

Product Contract Example

A product contract or design specification is a document that defines the product design task and measures by which success of the design will be judged. The contract defines expectations for the alpha prototype. A simple partial example of a product contract is provided below. There are also examples in the course textbook.

Product Description: Portable electric device for lifting automobiles.

Intended Customers: Backyard mechanics.

Market: Automotive accessories.

Customer Need	Product Attribute(s)	Engineering Specification(s)
Can be easily transported in and out of a house.	Weight	Total weight less than30 lbs.
Is easily stored in the home and office.	Size	Less than 14" x 14" x 14" in smallest configuration.
Can handle most repair situations.	Lifting capability	more than 15 cycles at 1" per second per charge for a 3000 lb. automobile.
Can be used on many uneven surfaces.	Stability	3000 lb vehicle raised 16 inches will not tip under 400 lb side loading. Base self-levels up to 1 inch discontinuities and 2% slopes in pavement.

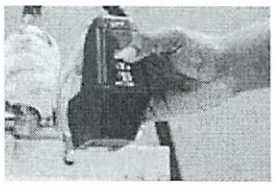
10/20

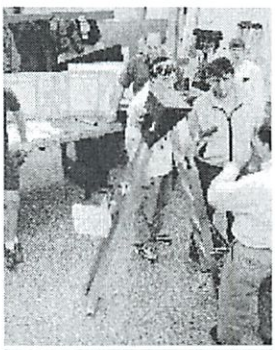
2.009

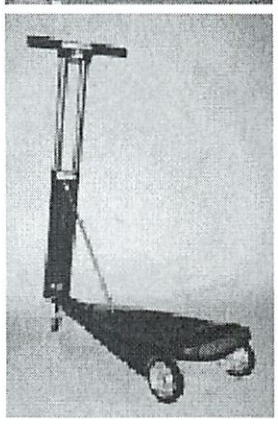
Home > Technical review

Technical Review

background, review elements, grading, logistics, results







Background
The goal of the technical review is to inform instructors about the state of your functional, final prototype and to obtain critical feedback. This feedback will help you prioritize improvements for the final presentation. The exercise will help you learn how to factually present a product prototype to colleagues in a professional working context and obtain design feedback.

The review will be held during the evening, as indicated in the class schedule. Examples from prior technical reviews are on the right. You can also view projects from other years in the gallery (select a project and the click on the technical review tab). The communication instructors have also prepared some useful guidelines for effective technical review demonstrations.

Key review elements
The review is an informal, interactive prototype demonstration. Think of it as a mostly show (demonstration), not tell, presentation. Be ready to have reviewers using your prototype.

Instructors will work in teams so that you will demonstrate for 15 minutes, have 15 minutes off, and then demonstrate again to a different pair of instructors. In total you will have four 15 minute demo sessions.

Grading
The review contributes to a portion of your shared team-wide grade and all course instructors will participate in the review process.

This is a technical design review, so important aspects that will be considered include:

- Mechanical design details
- Human factors/form/aesthetics
- System integration
- Details/prototype execution/manufacturing
- Performance quality/safety/reliability

Instructors and mentors will attend the review and will meet immediately following to discuss each prototype, but your team instructors will determine your final grade.

2.009

Technical Review Logistics

Before the review, the review, after the review

Before the review
If a special location or other arrangements are needed to demonstrate your prototype, please let the course instructor know no later than **Friday evening** before of the review.

You should have a large poster that clearly highlights critical functional specifications (from your product contract). Be prepared to let instructors use your prototype.

During the evening, your team will also be asked to give a 5 minute demonstration to be video taped for the website. Your team should *plan this demonstration in advance* of the review.

Work on the machine shop side of the lab will cease at 4:45 PM, but you will have shop access through to 7 PM.

The review
The review will be in the Pappalardo lab from 7-8:30 PM on the date indicated in the course schedule.

Instructors will divide into 4 small groups and be assigned to different teams. Every 15 minutes the instructors will switch to a different team according to the schedule below. The rotation will be structured so that you will have 15 minutes on, then 15 minutes off. In total, you will have four 15 minute review sessions.

There needs to be space to let instructors use the prototypes, so students not involved in the review need to avoid crowding the team workspace. There should be team members present to demonstrate/answer questions and at least one person to record notes during the review.

A 5 minute video of you demonstrating your prototype will be taken during one of your breaks.

More details will be available shortly before the review.

After the review
Notes recorded during the review should be disseminated to the team for consideration when prioritizing improvements before the final presentation. Additionally, your review materials and video will be posted on the course website, and you will receive written feedback from at least 3 course staff.

2.009

10/22

(5 min late)

Miniquiz: 2 words to avoid doing a design critique

Specs

attribute

rain protection

metric

what is right comparison

how measure?

dry area ratio?

Setup time vs collapsability

Size vs Collabsed side

Should be < not exact

Aerodynamics vs speed loss

Speed loss @ 17mph

Or drag coefficient ratio

Could actually improve!

(2)

Ethics

all 3 were true

Product Architecture

decompose into 4 functional areas
know the interfaces b/w the sections

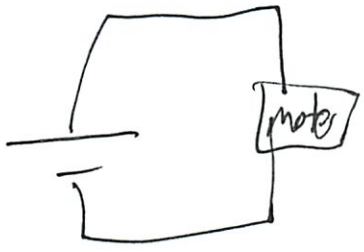
get a framework for product
Can organize your team around that
integrated vs modular

Set of tools all use same batteries

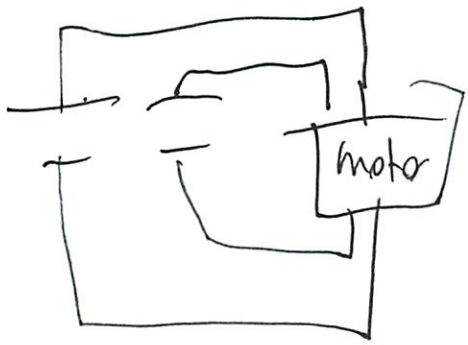
Reverse engineering exercise
how is dill working

(3)

Half



Full



That's not it
Should be able to solve this
Need more EE knowledge

But how show second that can't power on own
↳ something in motor
like a transformer or something
↳ which I don't know about

(4)

Voltage can combine

idk

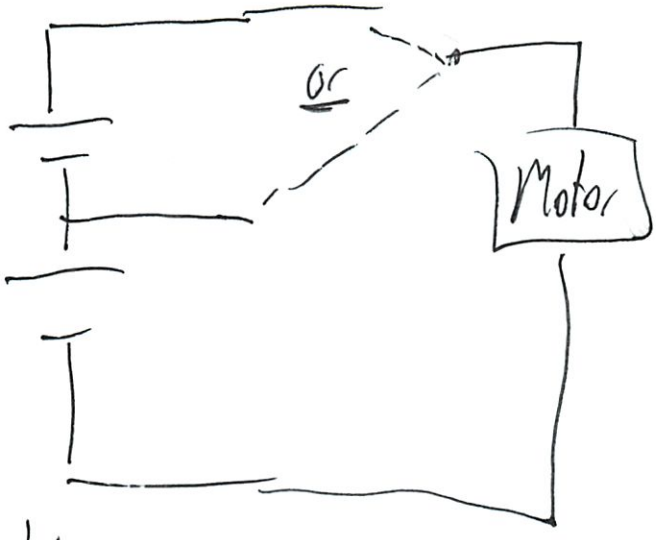
I've forgotten many of these ugs

intuitive feel: light bulb experiment

[redacted]

2 batteries in series

So



I think

Cheap

series always restricted by lowest

lowering power

so don't get my max torque

(5)

Reciprocating saw

Very similar motor

Some other parts the same

Differ motion

Detail sander

Same clip, battery connector

Same motor

Slightly diff mechanism

→ Modular architecture

functions well contained

Clear interfaces

low packing density

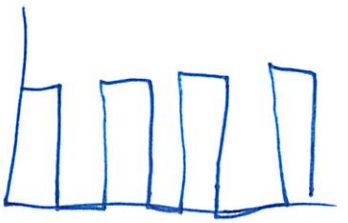
high volume, commodity elements

(6)

Another drill:

better speed control

- potentiometer – yes, but inefficient
- or turn on/off DC to regulate voltage



Much more packed

planetary gear box

Integral architecture

tightly packed

Components adapted for app product

Compare

weight | 1, 2 - same similar

but much more dense

(1)

Charge time 12 the bette drill takes $\frac{1}{5}$ the time much more specific designed charge

power/weight 2.5

purchase price ~8-10

pretty typical

2x price = 10x in cost

- Gearbox
- harder to assemble
- parts
- more custom parts
- amortize engineering cost
- markup / margin

(8)

Modular w/ same motor

User interacts w/ modularity

Can invest a lot more into the 1 part

design life → 20 hrs

but who buys it

how much will they use it?

is it a good use of resources?

gives more people access

uses less resources for something w/ little use

Can only use 1 at a time

lot of work if using 1 at a time

if main part breaks → everything breaks

standard ergonomics

(9)

Modular

less expensive
economies of scale
Caise to decompose
platform for new changes
more customizable
maintenance eaiser?

Cons

performance
jack of all fates, master of none

Integral

performance
Can optimize

Choice defines your products/biz model

(10)

Sony is a lot of modular combo

Swatch car

originally could very body panels easily

performance sucks

1998

+W

(shipping)

2.009 Product Engineering Processes

it's not just about doing...

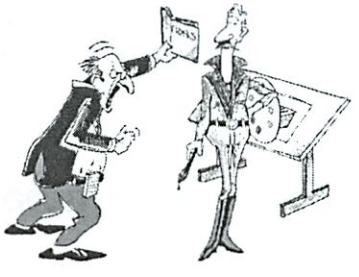
it's about thinking about what you are doing

But first...

A mini quiz

Put your name on the index card

List two words you should avoid when referring a design during a critique.



2.009 Product engineering processes

Today

Product architecture structure the problem

Professional ethics codes of conduct

(attached)

UA Product Architecture

Product architecture

Definition

The organization or chunking of the product's functional elements, and the definition of the interfaces between these elements.

(functional and physical decomposition)

10/22

Product architecture
Purpose

The architecture and product specifications together define the structure/framework of the product.

The architecture is an important vehicle for organizing and focusing team activities.

Chapter 9

Product architectures
Two fundamental types

Modular

Integral

Product architecture 1
Hand power tools

Several different tools for same customer segment

Reverse engineering exercise

Blank piece of paper, name on top of page

Draw the circuit for the drill

Collect papers after 4 minutes

Please DO NOT look at your neighbor's work

Product architecture 1
Hand power tools

Several different tools for same customer segment

Modular product architecture

- Modules are functionally self contained
- Component interfaces well defined
- Low packing density
- High volume, commodity elements

Product architecture 2
Hand power tools

Individual tool designed for a specific market

Integrated product architecture
- components designed or adapted for the specific product
- geometric or functional relationships tightly coupled

Product architecture
Drill performance comparisons

Characteristic	Integral Modular
weight	1.2 (2.0 with batteries)
charge time	0.2
power/weight	2.5
purchase price	~8-10

Product architecture 3
Hand power tools

Several different tools for same customer segment

Modular architecture
Advantages

Task allocation and out-sourcing

Economies of scale

Reuse/standardization for developing new products

Maintenance

Adaptation/mass customization (combinatorial design)

Integrated architectures

Advantages

Performance: modularity can mean performance sacrifices especially when performance is f(size, shape, mass)

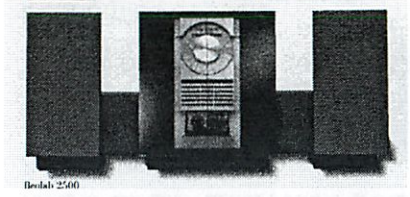
It is easier to optimize overall system with an integrated architecture

Product architecture decision

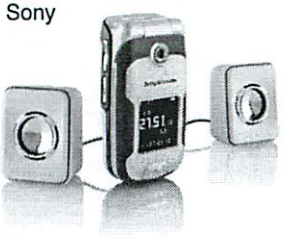
Key role in defining what the product can be

Apple

Bang and Olufsen



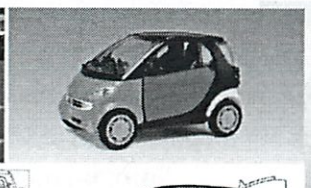
Sony

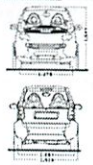


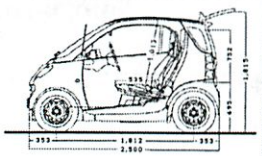
often linked with corporate identity

Product architecture

Innovation through a new architecture







first sold in?
1998

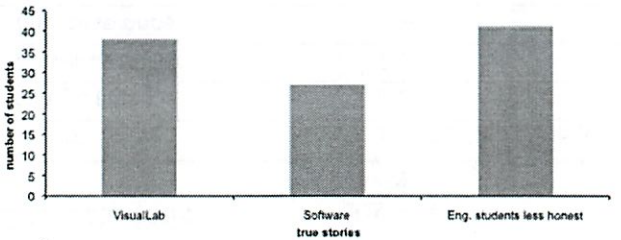
change color and style for 'price of evening dress'
$10,000
~1800 lb.
0-37 mph in 6 seconds, ~80 mph max.
40 mpg combined

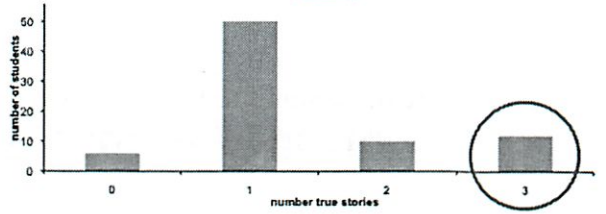
swatch
OFFICIAL TIMEKEEPER

DAIMLERCHRYSLER

Professional Ethics

Wait wait, don't tell me: bluff the listener





Engineering ethics
What is an ethic?

a code of behavior or conduct justified according to a reasoned value system

Engineering ethics
Value system?

what is good or bad, beneficial or deleterious, according to some set of criteria (measure of worth)

personal:

- resources such as energy should be purposefully used, regardless of monetary value
- return policies should be used in good faith only

professional (ASME):

- "engineers uphold and advance the integrity, honor, and dignity of the engineering profession by using their knowledge and skill for the enhancement of human welfare ... striving to increase the competence and prestige of the engineering profession."

societal:

- balance between privacy and security
- entitlement to health care

value systems change over time

Engineering ethics
values *vs.* preferences

preference: *like or dislike*

I enjoy cheese with apple pie *vs.* cheese is an appropriate side dish for apple pie

This is a good design but I would never use it

It was a good decision to buy the camera even though I did not want to buy a camera

Professional ethics code
part 1: principles

ASME:

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

I. using their knowledge and skill for the enhancement of human welfare;

II. being honest and impartial, and serving with fidelity the public, their employers and clients; and

III. striving to increase the competence and prestige of the engineering profession.

Professional ethics code
part 2: canons (laws)

ASME:

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in the areas of their competence.
3. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional and ethical development of those engineers under their supervision.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest or the appearance of conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall associate only with reputable persons or organizations.
7. Engineers shall issue public statements only in an objective and truthful manner.
8. Engineers shall consider environmental impact in the performance of their professional duties.

Engineering ethics
words indicating that you need to check your code...

"no one will ever know..."

"everyone does it."

"we can hide it."

"destroy that document."

"this will destroy the competition."

"no one will get hurt."

"well, maybe just this once..."

"we didn't have this conversation."

"it doesn't matter how it gets done as long as it gets done."

"if they are that stupid, they deserve to get hurt."

from Lockheed Martin

Engineering ethics
When in doubt ask ...

are my actions legal?
what would my professional society think?
am I being fair and honest?
how will I feel about myself afterwards?
how will it look in the newspaper?
what would I tell my child to do?
how would I feel if my family, friends, and neighbors knew what I was doing?

Ethical problem solving
Design a useful code of conduct for your team

principles and laws: your team's guiding values for how to work with each other.

divide into your teams
draft a code of ethics
up to 8 canons
submit an electronic version (Word) by 5 PM Wednesday (2009cr)
you will receive feedback by Thursday at 5 PM
final edited versions due 5 PM Friday (drwallac)

Finally

reminders

Peer review 2, due today at 5 PM

Codes of conduct (draft Wednesday 5 PM, final Friday 5 PM

Assembly 5 PM Nov. 1, (red, green, blue, yellow)
Assembly 5 PM Nov. 3, (pink, orange, purple, silver)

In-class presentations Nov. 2, 4

Technical review with alpha prototypes, Nov. 21

10/23

2.009

Lab #7: Week of October 22: Making the decision

objective, preparation, what's due, activities

Main Lab Objective
The main goal of the lab this week is to determine which concept will be pursued for the remainder of the term. Once this decision is made, the team should organize, allocate resources, and begin working towards the assembly review and the technical review.

It is important to have your full team and your instructors participate in the concept selection process, so it is strongly recommended that you wait until this week's lab meeting before making a decision. If you feel that you cannot wait until your lab before making a decision, please make arrangements with your instructors so that they can participate in the decision meeting.

Advanced preparation for Lab #7

Individual:
Read the assembly model (October 30 (red, green, blue, yellow) or November 1 (pink, orange, purple, silver), 5 PM) and technical review (November 19) descriptions so that you are familiar with the upcoming milestones.

As a section:
If possible, meet with your section to discuss the mockup review. What worked well? What did not? How will you do better next time? If there are additional issues that should be be looked into before deciding on your project direction, work on them prior to the lab meeting.

Prepare a short summary presentation about *your opposite section's concept*, highlighting strengths, weaknesses, and open issues. Be sure to work with the opposite section and have their aggreement on the key points of your summary presentation.

As a team:
System integrators from both sections should meet to form an agenda and devise a rational decision process with relevant criteria for choosing the team concept.

What's due
Design notebook and timesheets are due in lab this this week.

Your team code of ethics is due at the start of this week (see the course home page)

Email the course instructor your final project direction after the lab.

Recommended Lab #7 Activities
In all remaining labs the two sections will work together. Make a point of intermixing the seating so that sections are not polarized on opposite sides of the room. Decide if the name cards are needed.

Begin with the standard meeting startup.

Submit your design notebooks.

Spend roughly 10 minutes in total to present the short concept summaries prepared before lab, reviewing the team's two ideas and feedback from the mockup presentation. Your instructors will discuss your mockup review grades.

System integrators should discuss the decision process they have developed, and revisions should be made based upon input from the team. If the sections are different in size, be sure that your decision process is perceived to be fair. It should not be possible for one section to simply out-vote the other. You want to make the best choice regardless of who has worked on an idea.

A Pugh chart or similar rational process should be used to help elucidate and compare the strengths and weaknesses of the concepts relative to your team's project criteria. Think carefuly about risks associated with your product concepts.

Negotiate the product definition for the final alpha prototype. Focus on the common goal of having the best-possible successful project, and in making a timely decision so that your team can move on to the next steps. You should make a choice on the basis of what is the best option, not on an emotional level. Be willing to change your mind as new information becomes available.

It is hoped that this experience will help you prepare for times when, as a project manager, you will need to make critical decisions from a set of alternatives. Be thorough but do not belabor the process —begin by checking to see if there is consensus.

Be sensitive to team dynamics and focus on the merits of the concepts, not ownership of the ideas. For example, make statements like: the idea has significant technical risk *rather than* your idea has significant technical risk; the widget idea fulfills an important need *rather than* my widget idea fulfills an important need. Paying attention to how things are said can make a significant difference.

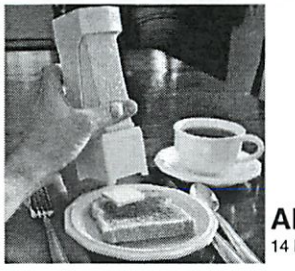
Once a decision is made, celebrate team buy-in symbolically with a YoWup! (**view the instructions** (certs required) and an actual board meeting YoWup) This is derived from a Japanese tejime symbolic gesture symbolizing that all team members fully support the decision and are committed to advancing the project in its chosen direction. To perform the ritual, the team stands, chants *Yo Wup!* and simultaneously claps on the *Wup*. Creative interpretation of the chant is encouraged. If the chant is not sufficiently enthusiastic it should be repeated, or the team needs to further reflect on the decision.

Make a plan for the team's next steps (assembly and technical review) and allocate responsibilities. Think carefully about the best way to bring all team members up to speed on the chosen concept.

Divide tasks and assign responsibility for design issues that need to be addressed. Make sure that there is a clear plan of how the product contract and assembly model will be prepared for the deadline next week. Remember that the in-class assembly presentations are Wednesday and Friday *next week*.

Don't forget to pickup your reviewed notebook before leaving lab.

2.009 Product Engineering Processes



Albert Einstein
14 March 1879 – 18 April 1955

any intelligent fool can make things bigger
and more complex

it takes a touch of genius
to move in the opposite direction

2.009 Product engineering processes

today

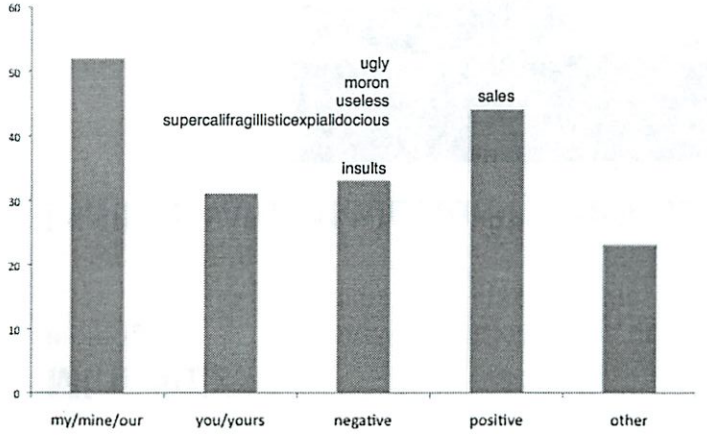
design for assembly

making things easier for yourself

2.70 Design for Assembly

But first...

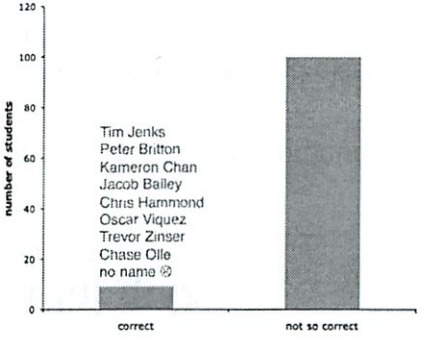
words to avoid in a critique

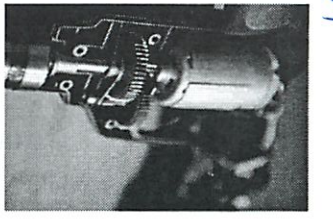


Mini quiz

drill reverse engineering

circuits with the desired behavior...



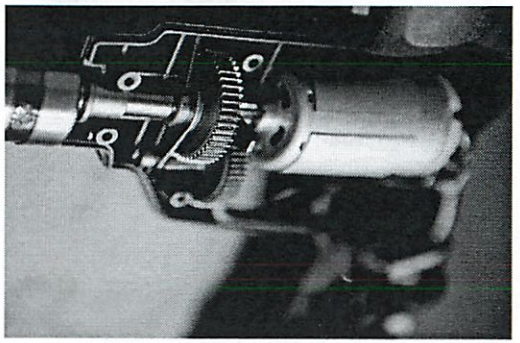


a chair is to sit on...
curiosity and design

10/24

Mini quiz
a pledge

I will remain intellectually curious



Mini quiz
another one!

identify two types of product architectures

list one advantage and disadvantage of each architecture

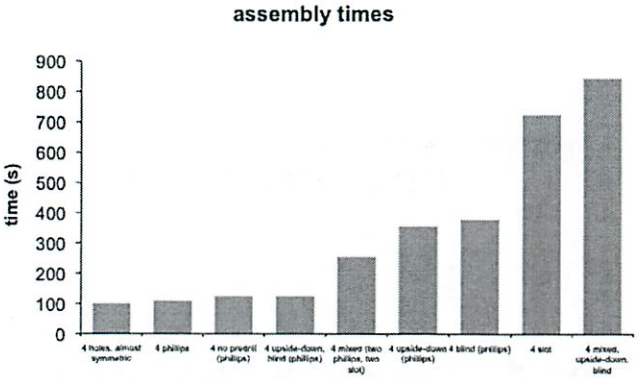
what is an ethic?

what does *form follows function* mean?

design for assembly

so what?

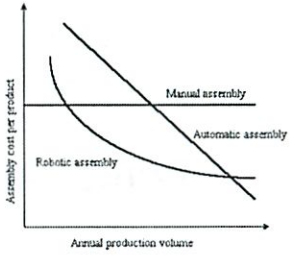
Design for assembly
screw 4 fasteners, exercise



Design for assembly
why care?

thinking about it will save you time, and now is the time to think about it

typically consider things like production volume, part count, capital investment, per product cost, and payback period when deciding how to assemble



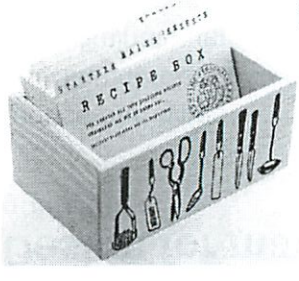
Design for assembly
manual assembly

manual almost always chosen method for low volume (few thousand per year)

human assembly with simple, low cost fixtures
- low initial capital outlay compared to automated systems
- high flexibility and adaptability
- assembly cost stays the same regardless of volume
- can be error prone

Design for manual assembly
overall procedure

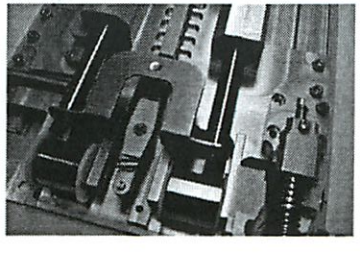
i) for each part, decide if it is really necessary



ii) if a part is necessary…
design it so that it is easy to assemble

Design for manual assembly
guidelines

reduce part count
- is there relative motion during use?
- is a different material needed?
- does it need to separate for assembly, maintenance or end-of-life? (debugging)
- will it be difficult to make?



Design for manual assembly
guidelines

reduce part types
- standardize fasteners (Robertson, Phillips, Allen)
- eliminate unnecessary product features
- avoid wiring harnesses, connecting cables

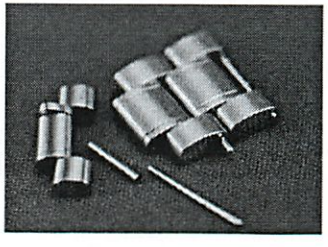
Design for manual assembly
guidelines

eliminate adjustments (design to fit):

judgment and decisions during assembly take time and lower reliability
- avoid joining parts if they can be made from one piece
- use locating pins or features (e.g., for bolted elements)

Design for manual assembly
guidelines

design parts to be self locating/aligning
- parts that do not have to be held in place during assembly (e.g., spot face)
- use chamfers or tapers to guide parts into one and other
- avoid multiple surfaces that need to be aligned simultaneously
- let gravity work for you



Design for manual assembly
guidelines

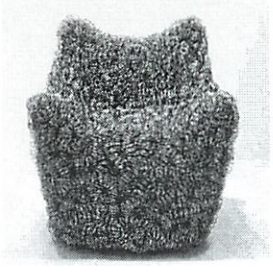
consider access

- provide adequate space for hands, tools, and post assembly operations (lubricating, debugging, batteries)
- ensure that there is a direct line of sight for mating surfaces during each assembly step
- adopt a single assembly direction (e.g., vertical stack)

Design for manual assembly
guidelines

make parts easy to handle

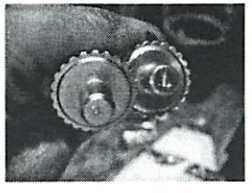
- avoid heavy, sharp, fragile, awkward parts
- avoid parts that require special tools for griping or insertion (e.g., e-clips)
- avoid flexible parts
- avoid parts that tangle easily (e.g., open-end springs)



Design for manual assembly
guidelines

design parts so they can only be installed correctly

- make parts fully symmetric
- make parts clearly asymmetric
- make it obvious if parts are not correctly aligned (no almost fits)
- add features to block incorrect assembly (e.g., memory chips)
- provide registration marks
- avoid flexible parts since they almost always can be installed incorrectly



Last
some reminders

Class Friday: consulting

Solidworks topdown design: Friday at 5

read about the assembly review

11 PM Tuesday: red, blue, yellow, green
5 PM Thursday: pink, orange, purple, silver

10/30

2.009

Lab #8: Week of October 29: Clarifying the system vision

objective, preparation, what's due, activities

Main Lab Objective
The main goal of this week's lab is to make sure that a single, clear vision for the product is taking shape, and to ensure that things are coming together for the assembly model and product contract presentations on Wednesday and Friday this week. If you happen to have lab after your presentation, your focus should be on further refining the product after receiving feedback.

The assembly materials need to be first submitted by 11 PM Tuesday (red, green, blue, and yellow teams) or 5 PM Thursday (pink, orange, purple, and silver teams). However, you should continue to refine your design up until your in-class presentation—if you have updated materials you may resubmit them up until the time of your in-class presentation..

Even though you will be concentrating on the overall assembly model, you will also still need to be *doing mockups, tests and experiments at the same* to time validate design details or resolve outstanding risks. Don't forget that while the having a clear product vision and architecture defined through the assembly is vital, the end goal is a successful product prototype.

The technical review is coming fast (November 19), so critical parts should be ordered within one to two weeks to ensure that they are received on-time.

Advanced preparation for Lab #8
individual:
Your task force should prepare a short, well organized, status report for the tasks that you have been working on.

As a team:
Financial officers should prepare a budget status report for the team.

Options for product configuration and overall form should be prepared *in full scale* using 2 or 3 dimensional media. If the models are in an electronic format, they should be printed on paper, ***full scale***, so that they can be pinned up for discussion and editing during the lab meeting.

System integrators from both sections should meet to form an agenda and update the project schedule (Gantt Chart), covering tasks through to the technical review (see the scheduling lecture).

If AV equipment is needed, the system integrators should set this up prior to the start of lab.

What's due
The assembly review materials are due 5 PM Tuesday (red, green, blue, yellow) or 5 PM Thursday (pink, orange, purple, silver).

Your team will be presenting during class either Wednesday or Friday depending upon your submission day (above).

Recommended Lab #8 Activities
Begin with the standard meeting startup.

Financial officers should give a short budget update to the team.

System integrators should present an updated project schedule through to the technical review. Input should be obtained from section instructors and team members.

Review the current status of the design. This should include reports from different task forces. Review your product contract to ensure that all are on the same page.

Discuss the overall product configuration and form options using the printouts prepared before class. Consider changes as appropriate and make sure that there is consensus about the direction of the product.

Spend as much of the lab time as is possible working. Time is short. Remember that lead times on ordered parts can be substantial. Some task forces might be working on specfic mockups or tests while others work out details of the product assembly and architecture.

Lab instructors may want to meet individually with each task force to review progress and help

with design issues.

2009

10/3

Canadian candy

Right level of detail

Gestation period of chicken = time for tech review

processes are like each other

unrecognizable at first

but comes together quickly

Time to discuss projects

Red Ooh

"Cook"

portable flameless food heater

Same as MREs

(I like what they came up w/)

fuel coverages

(2)

Vacuum sealed so can't accidently stat

add from top

Some variants

Green / Bike

Bike navigation system

vibrates handlebars

Arduino + Google Maps

(much more SW project)

(motors will not be enough

(very HW-focused people)

handle bars vs wrist bands

complicated scheme for sharp / slight left right

1, 2, or 3 vibrations

(3)

Blue/Raindrop

Collapsable rain shield for bike

tent attachment mechanism

Safe when wind

air beam w/ ~~pump~~ pump

- pretty big

getting stolen?

what if you crash?

more torque from wind

Yellow/Gathering Greens

harvest salads

- lots of work now

Small farms

adjust blade holders

want rollers to adjust to road

(4)

Collect w/ leaf blower system

need 2 people

both push

gas power hedge trimmer

(this does not seem very professional)

2009

11/2

Simplicity does not precede complexity, but follows it

Orange/Flex Fenn

Compactable, lightweight, elegant

hex one → unrolls

stacks → pulls out

(what's the obsession w/ Product Contracts)

Nose missing

Still greece?

wind protection

Purple/Sky Beacon

Blimp shape

So not blown off course

Good industry contacts

(2)

lots of plans!

Modules to refill

<u>keg Carrier</u> Team silver

now a sled

~~tr~~ treads w/ a dashpot

winch design

(how is winch base staying steady?)

<u>Waste Washer</u> Pink

(~~sketch~~ showing img)

Cleaning trash ~~can~~ can clean (

(wait how is this diff then the company one

Pressure washer clean

(why just target MIT)

10/31
11/2

2.009

Home > Assembly and product contract > Results

Assembly & Product Contract Results

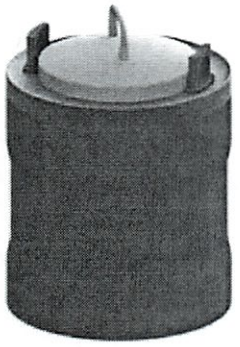
Click on a team name to view their work or, go to the Wednesday or Friday presentations.
Click on any image to see a larger version.

pink **green** **blue** **yellow** **red** **orange** **purple** **silver**

Wednesday presentations

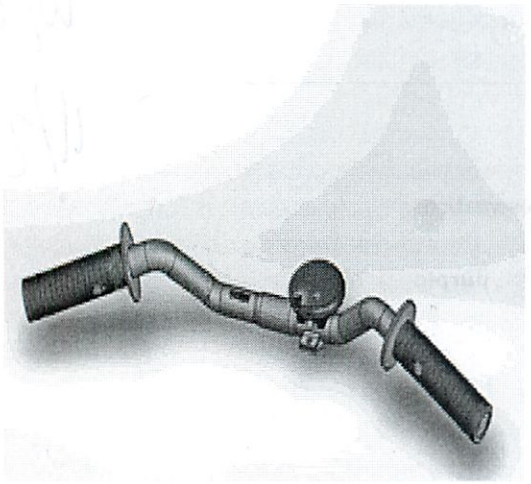
Red

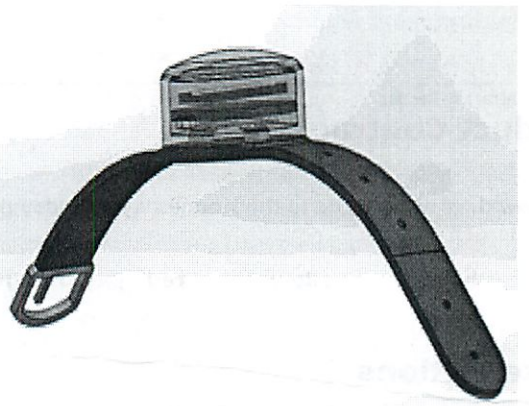
Presentation slides [pdf]
Review video [.mov]
Product contract [pdf]
CAD files [.zip]
All documents
click on images to see larger versions



Green

Presentation slides [pdf]
Review video [.mov]
Overall schematic [pdf]
User interface [pdf]
Infographic—wristband [pdf]
Infographic—handlebars [pdf]
App flow chart [pdf]
Product contract [pdf]
CAD files [.zip]
All documents
click on images to see larger versions





Blue

Presentation slides [pdf]
Review video [.mov]
Product contract [pdf]
All documents (including CAD files)
click on images to see larger versions

airbeam

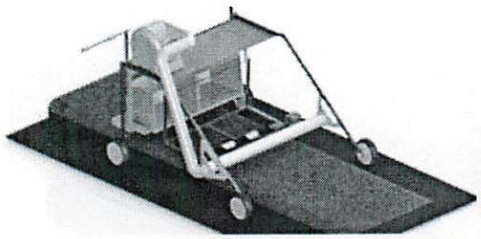
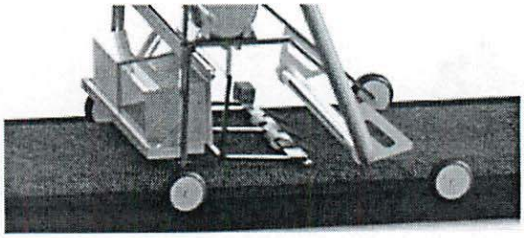
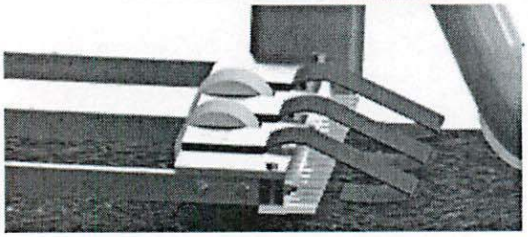
car roof


telescoping

tent pole

Yellow

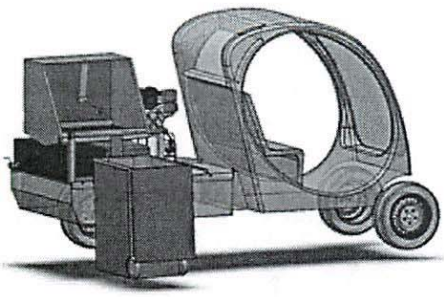
Presentation slides [pdf]
Review video [.pdf]
Product contract [pdf]
CAD files [.zip]
All documents
click on images to see larger versions

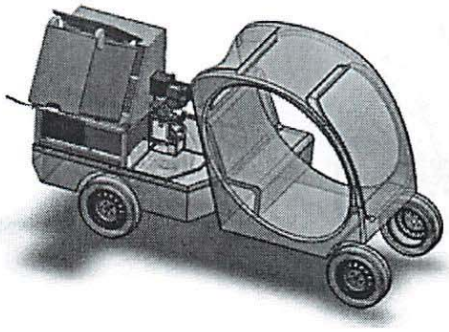




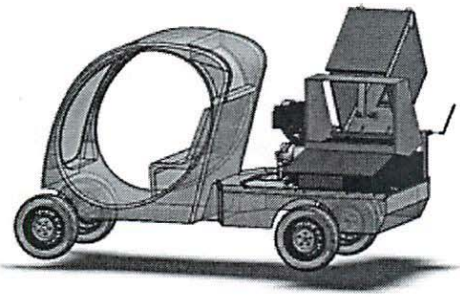
Friday presentations

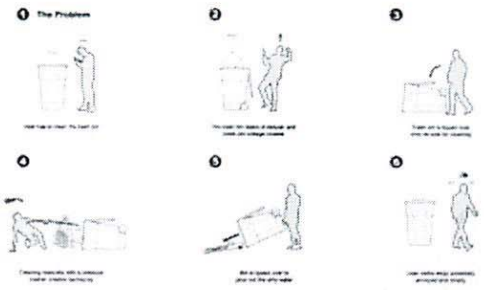
Pink

Presentation slides [pdf]
Review video [mov]
Product contract [pdf]
CAD files [.zip]
All documents
click on images to see larger versions



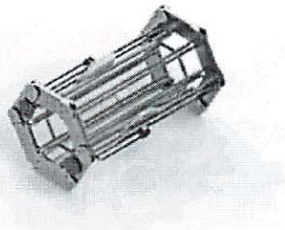


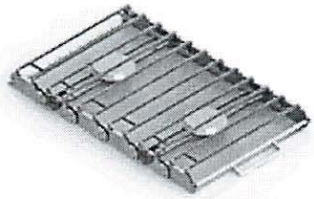


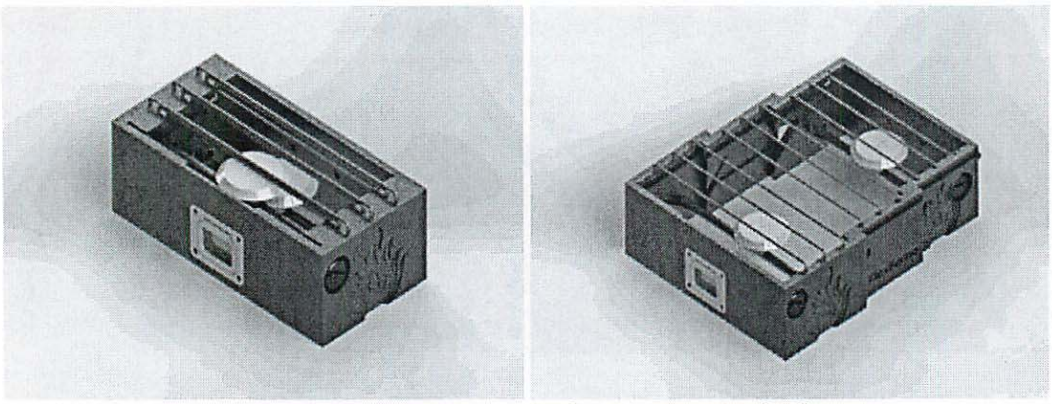


Orange

Presentation slides [pdf]
Review video [mov]
Product contract [pdf]
CAD files [.zip]
All documents
click on images to see larger versions



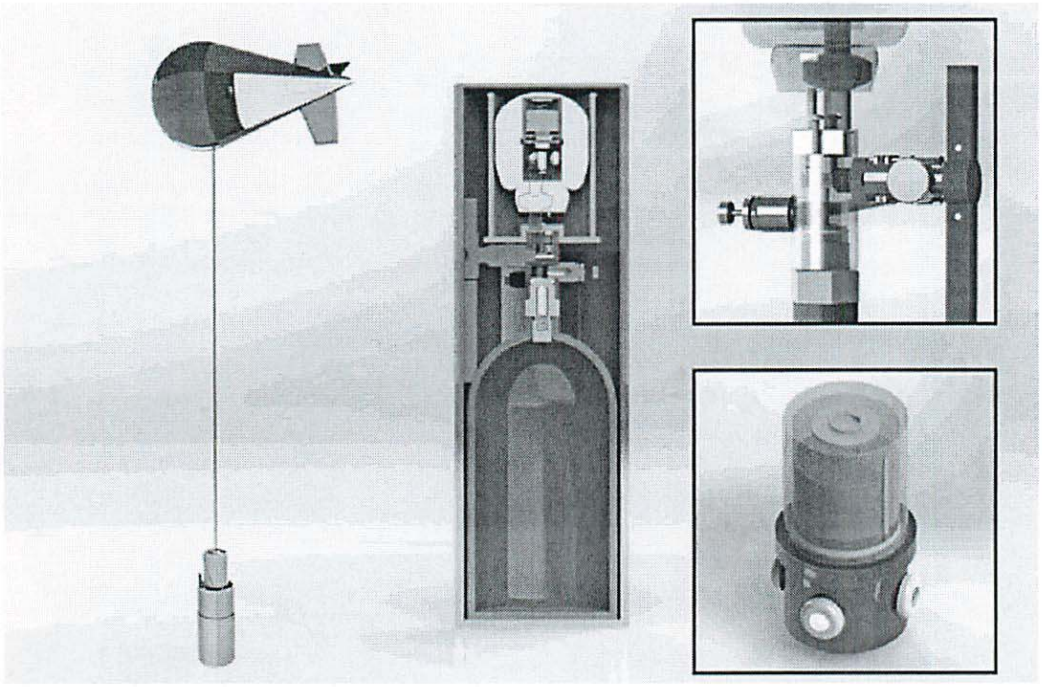




stackFerno animation [avi]

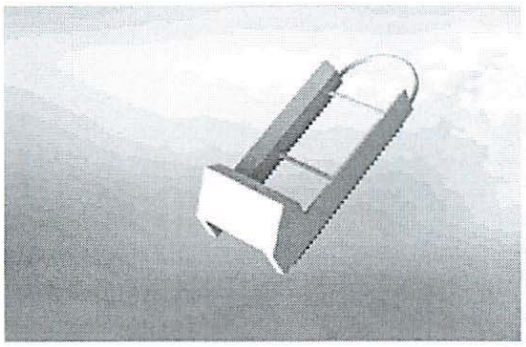
Purple

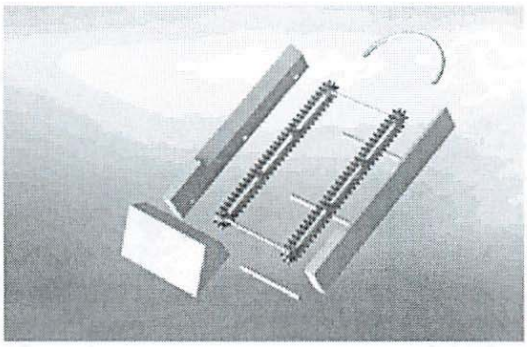
Presentation slides [pdf]
Review video [mov]
Product contract [pdf]
Circuit design [.pdf]
CAD files [.zip]
All documents
click on images to see larger versions



Silver

Presentation slides [pdf]
Review video [mov]
Product contract [pdf]
CAD files (sled) [.zip]
CAD files (sprocket) [.zip]
All documents
click on images to see larger versions





2.009 Product engineering processes

the only thing worse than no help is unreliable help

winners of the contest:

safety at work...

(didn't attend)

Safety

your product, yourself, your team

inherent part of a product's design. Not an add on
(like product architecture, usability, product form)

stop if you are too tired, stressed, distracted, feeling unwell, or have skipped meals

ask if you are unsure...

if you see something you are uneasy about...

(25 Technical Review + Debrief)

5th place

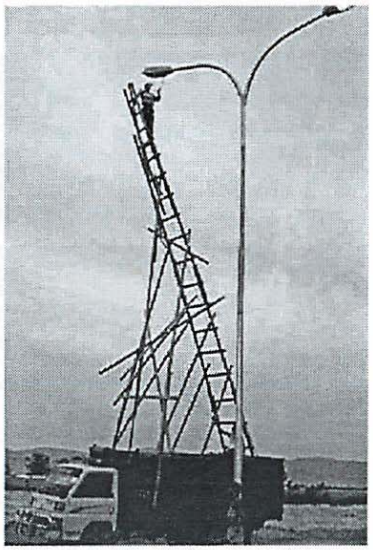
11/15

4th place

3rd place

2nd place

and the winner…



A look ahead
upcoming items

evening lab hours for this week are posted on website

costing tutorial 7 PM tonight, Pappalardo south conference, 2 people per team

ID consultations Thursday 6-10 PM. Team area. 30 minute sessions—see schedule on website (of interest)

consulting class on Wednesday

2.009 Product engineering processes
today

technical review pointers

debugging a systematic approach to the art

Alpha prototype
the "first" complete prototype: looks right, works right

your first version of the alpha prototype will not work well

technical review is November 19

typically, teams redesign and rebuild before final
(you must get close enough to know what the issues are)

Technical review
how to think about it?

all show, no tell
be prepared to let reviewers use the prototype

Technical review in 14 days...
examples

work in parallel
keep meetings short
communicate
design, don't hack
ask
enjoy engineering

Technical review
intent

demonstrate/test functional alpha prototype and discuss remaining areas for improvement

assess operation of the product in relation to the product contract

assess the prototype from many viewpoints and prioritize areas for improvement

Technical review
focus

operation

- meets contract
- ease of use
- robustness
- quality of experience (sounds good, feels good)
- safety

details

- mechanical design
- interface/human factors
- form and aesthetics
- electronics design
- system integration
- assembly and manufacturability
- prototype execution

and now...
a design-for-assembly quiz

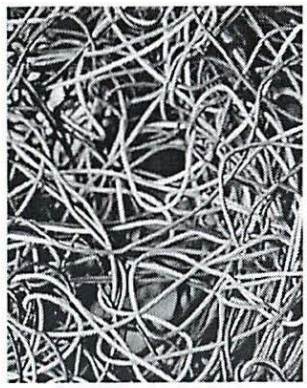
analyze the platen lift assembly and answer the questions on the handout

no talking or sharing answers

read the instructions, but don't look at assembly (on back) until instructed

get as much done as you can in 7 minutes

Debugging
a systematic approach



if it is not tested
it does not work

Debugging

seeing:
expect the **unexpected**

Debugging process
(fault diagnostics)

wishing will not make a fault go away

symptoms that mysteriously disappear are not problems solved

debugging requires careful systematic thinking, tackling probable causes in a strategic order

goal: a 5 step process to follow when trying to diagnose and fix a problem

Debugging
step 1

when something goes wrong ...

- stop, observe, and think
- *document* the circumstances
  - how was the device being used leading to the failure?
  - who observed the problem?
  - had something been changed?
  - describe the environmental circumstances
  - describe the faulty behavior
    What, When, Where, How big?
- form a clear symptom statement (object—defect form)

Debugging
example symptom statement

object—defect

- Good
  - the product made a popping sound, emitted a flash of light and smoke
- Bad
  - the product shorted out

Debugging
step 2

identify and recruit the people needed to solve the problem

- who are the best people to tackle the problem? Are you the right person? System integrators should be able to help in this process

- provide your detailed notes and symptom statement to the individual or task force that will address the problem (wiki)

- don't be afraid to think about it

Debugging
step 3

carefully review data and develop an interim plan

- are the initial data sufficient to localize the problem?
  If no, gather more information (often through careful exploration and observation)
  - is a new drawing/diagram needed?
  - is their too much clutter to observe the problem?

- can the problem be isolated or provisions be made so that other team members can continue to work?
  - what else needs to happen?

Debugging
step 4

define and verify possible causes

- develop hypotheses about what is causing the problem
- carefully evaluate each hypothesis against the existing data. Eliminate improbable causes
- prioritize remaining probable cause hypotheses, trading off ease of verification with confidence in hypothesis
- systematically test each hypothesis by isolating its probable cause and performing appropriate experiments or measurements

Debugging
step 4

remember

there may be more than one cause behind the defect!

Debugging
step 5

once the cause has been identified...

- generate ideas for *permanent* correction of the problem
- select most promising solution and, if appropriate, perform simple sketch model or mockup level tests to verify that it will work
- implement the solution
- carefully verify that the solution has eliminated the fault. Be sure that tests emulate the initial failure conditions

Debugging
step 6

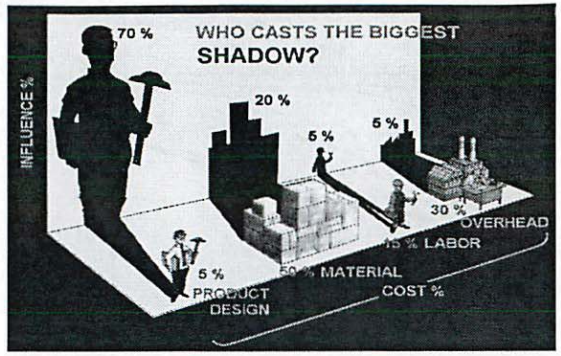
inform team members that the fault has been corrected, summarizing the fault (object—defect), the cause(s), and the solution(s).

Everything You Always Wanted To know About Product Cost but Were Afraid to Ask .....

In product costing no one cares what your prototype cost.
Unless you spent more than your allotted $6000. dollars.

They want to know what your product costs in production AND how much profit you plan to make.

Some Facts About Product Cost



Source: Ford Motor Company

General rule of thumb you have locked in 70 – 95 % of your product cost after you have completed 5% of the product design

Product Cost

Product Cost

Product Cost Equals =

Material Cost + Assembly Labor + Profit

Material cost =parts, scrap, maybe amortized tooling to make parts.

Assembly labor = All labor to get it out the door to the customer manufacturing, assembly, testing, packaging,

Profit = $$$ left over after you pay all the bills

11/5

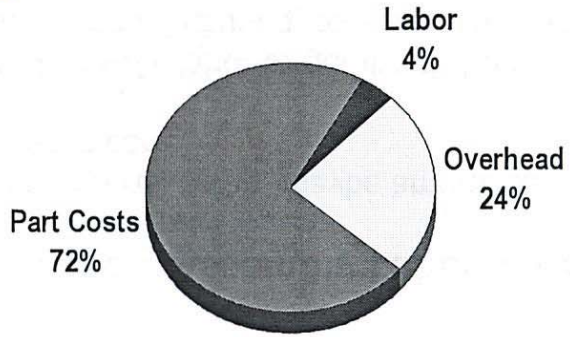
Product Cost

All the Bills include:

- Salary for your team about $100,000/ engineer including benefits
- Rental Space for offices, lab areas
- Manufacturing areas, tools assembly fixtures .....
- Equipment office, computers, Xerox machines .....
- Heat, lights ..... If not included in rent
- Inventory of raw and finished materials
- Phones, internet,
- Marketing
- Product Liability insurance

But to name a few

Typical Product Cost Breakdown



Source : The True Cost of Oversea Manufacturing June 2004 N. Dewhurst & D. Meeker

Product Cost mini quiz

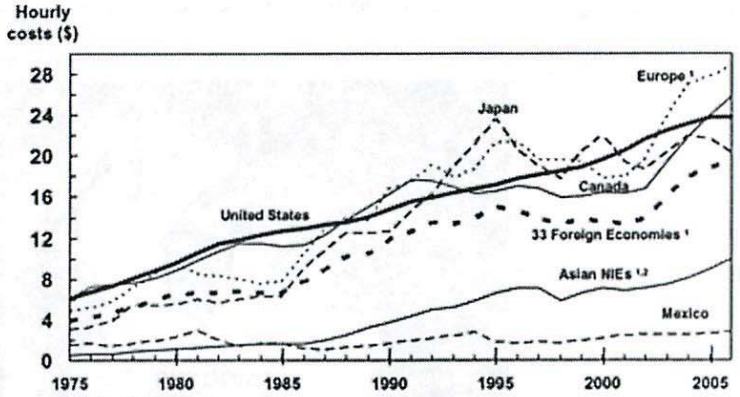
What do Materials Cost ?

- Copper $/lb _____
- Aluminum $/lb. _____
- Magnesium $/lb _____
- Nickel $/lb _____
- Tin $/lb _____
- Zinc $/lb _____
- Steel hot dipped galvanized $/ton _____
- Oil $/barrel _____
- Natural Gas $/MMbtu _____
- Kraft $/ton _____
- ABS plastics $/lb _____
- Nylon 66 plastic $/lb _____
- Polystrene plastic $/lb _____
- LCP plastic $/lb _____

Product Cost

www.bls.gov/

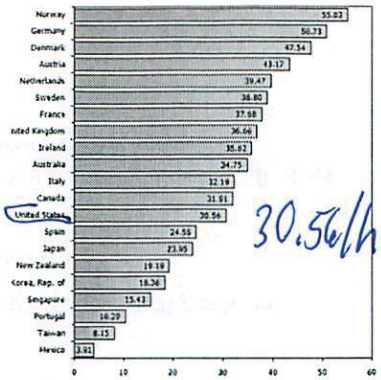
Bureau of Labor Statistics



[1] Trade-weighted average
[2] The Asian NIEs are Hong Kong SAR, Republic of Korea, Singapore, and Taiwan.

Hourly compensation costs measure the cost to employers to hire one hour of labor in manufacturing. They include payments made directly to workers, as well as employer expenditures on social insurance. In some countries, taxes and subsidies related to employment also are included. For this measure, hourly compensation costs in national currencies have been converted to U.S. dollars using market exchange rates.

Manufacturing hourly compensation costs were highest in Norway, at 1.8 times the U.S. level. Australia, Canada, and 10 of the 12 European countries had higher hourly compensation costs than the United States; Spain and Portugal were the only two European countries that had lower hourly compensation costs than the United States. Hourly compensation costs were under $11 in Mexico, Taiwan, and Portugal.



30.56/hr

http://www.bls.gov/fls/chartbook/section3.htm#chart3.1

"including overhead – I don't think so

Product Cost

What do Materials Cost ?

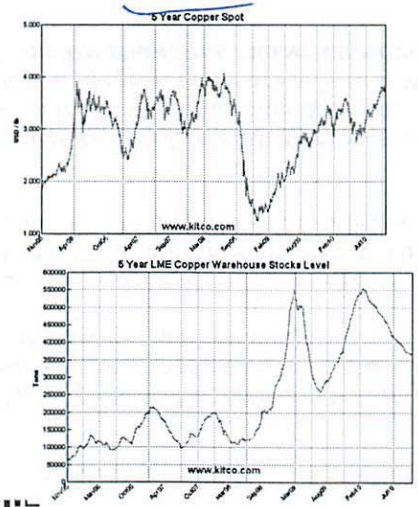
• Copper $/lb	3.94
• Aluminum $/lb.	1.11
• Magnesium $/lb	2.35
• Nickel $/lb	11.09
• Tin $/lb	11.97
• Zinc $/lb	1.14
• Steel hot dipped galvanized $/ton	780
• Oil $/barrel	86.60
• Natural Gas $/MMbtu	4.05
• Kraft #42 $/ton	690
• ABS plastics $/lb	1.17 – 1.18
• Nylon 66 plastic $/lb	1.83 – 1.94
•Polystrene plastic $/lb	1.02 – 1.04
•LCP plastic $/lb	6.10 – 9.80

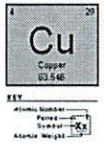
•www.lme.co.uk--

•http://www.plasticsnews.com/resin-pricing/all-resins.html

Product Cost

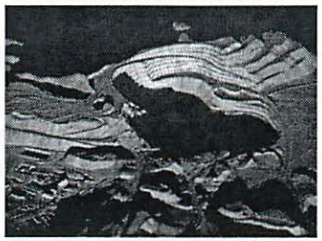
All materials are Commodities





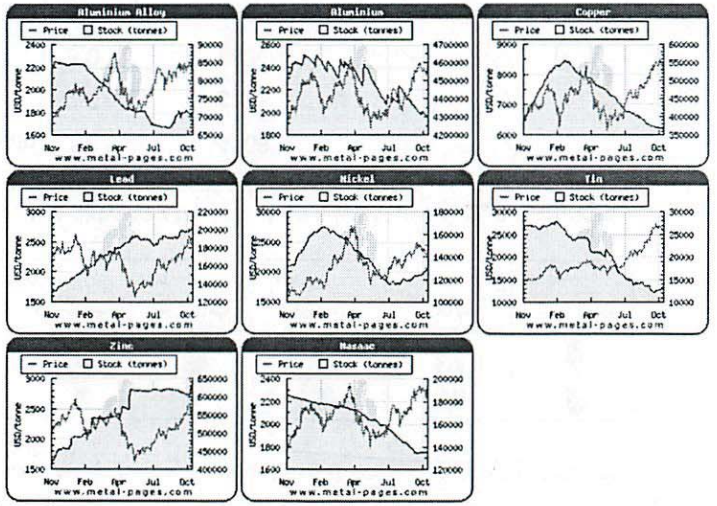
Price of raw material is effected by:

- **Supply and Demand**
- **Global Distrubution**
- **Institutional Investors**



Chuquicanita open pit mine in Chile

London Metals Exchange(LME) 1 year supply / cost curves



Define Levels of Cost Analysis

Level 1 **- A first impression by knowledgeable engineers of what a part , assembly or system would cost based on prior experience. (parametric)**

Level 2 **- An estimation based on prior experience with similar products, budgetary estimates, vendor quotes and expert opinion and experience. (analogy)**

Level 3 **- Detailed costing of every part accomplished by using material cost estimation data bases, and time/motion studies. A high degree of accuracy is achieved by comparisons to industry standards and vendor quotes. (analytical)**

Product Cost

Level 1 **- A first impression by knowledgeable engineers of what a part , assembly or system would cost based on prior experience. (parametric)**

	Pro-Lite Spine Board	Aquaboard	SKED Rapid Deployment	Flotation Assist Device	Our Product
Cost	$250	$600	$1,164	$300 (add-on)	Goal: $600

Quick and dirty way to look at cost is try to figure out markup for the industry or the company.

Markup	1.2	$208.
	2.0	$125.
	3.0	$83.
	4.0	$62.5
	5.0	$ 50.

Product Cost

Level 2 **- An estimation based on prior experience with similar products, budgetary estimates, vendor quotes and expert opinion and experience. (analogy)**

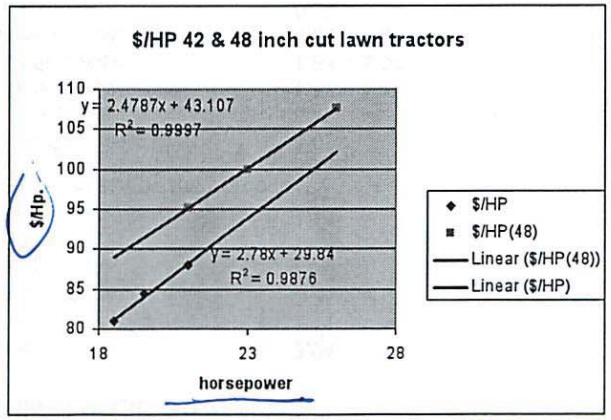
Might look at the major subassemblies, what they are made of, look at a trend line or a benchmark rule of thumb.

General rules of thumb:

- Printed circuit Boards 4 cents per square inch per layer
- Power supplies PC 10 cents per watt
- Large enclosures (servers) 1 cent per cubic inch
- Heatsinks Alum. Extrusions 50 -100 K volume no finish 3.0 times cost per pound **(LME London Metals Exchange *www.lme.co.uk/*)**

Trend Line Analysis

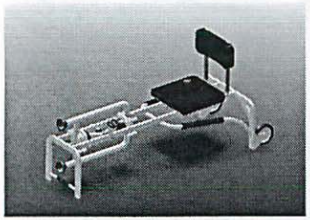
Tractor example

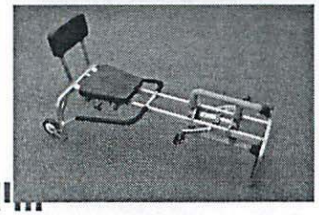


Still making decisions

Product Cost

Level 3 **- Detailed costing of every part accomplished by using material cost estimation data bases, and time/motion studies. A high degree of accuracy is achieved by comparisons to industry standards and vendor quotes. (analytical)**





Bill of Materials	
Custom Components	**Qty.**
Structure	1
Pump housing	2
Pump crank	2
Pump linkages	2
Pump membrane	2
Seat	1
Seat attachments	2
Manifolds	2
Wheel brackets	2
Standard Components	
Pedals	1
Tubing	20
Pump valves	4
Wheels	2
Tube plugs	4
Sleeve bearings	4
Assembly (qty = hrs, unit cost	
Pumps to structure	0.25
Shaft insert & align	0.5
Pump assembly	0.25
Seat installation	0.25

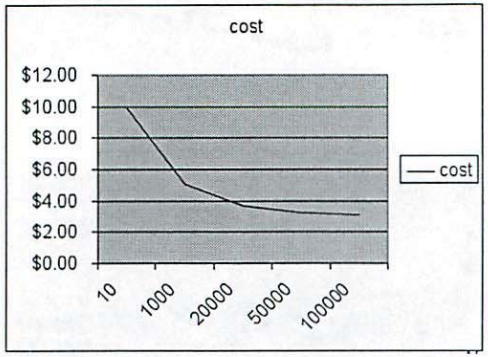
Creating A Product Cost

When you are off buying material for you product. Remember to get quotes for larger quantities than you are buying.

Ideally several quantities which include you highest volume.

40mm x 20mm 12 volt 10.8 cfm fan

Quanity	Price $
10	$9.98
1K	$5.08
20K	$3.66
50K	$3.25
100K	$3.09



Creating A Product Cost

First

You need a bill of material BOM
This is a listing of all the materials, and parts it takes to making your product. The BOM should have a part name, description, quantity used in the product, dimensions and weights, and the material it is made of.

Ideally the BOM should be indented starting with the finished product. Next all the subassemblies should be under it, and the parts and subassemblies that go into those listed under them respectively.

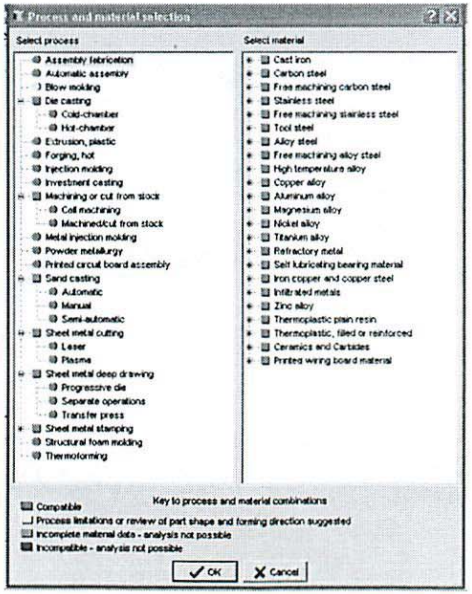
Second

You need to know the Volume of units you plan to produce. You want to cost your product at the max volume you plan to make for the year. Volumes can increase over time if you believe your sales of units will increase.

Creating A Product Cost

Software That Helps You Estimate part cost

Boothroyd and Dewhurst DFM Concurrent Costing Version 2.3 Can estimate cost on the following processes and materials.

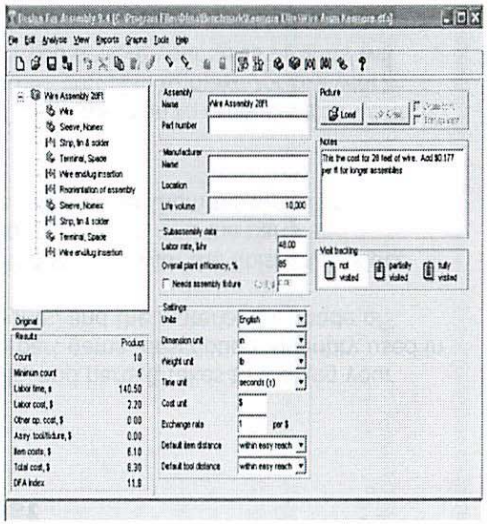


Creating A Product Cost

Labor Cost:

Can be calculated by using Boothroyd and Dewhurst Design for Manufacturing and Assembly.

The Software estimates time to assemble various parts and subassemblies into a product.



Costing Case Study

Aluminum Tubing

There are several ways to make Aluminum tubing. The most common way is by extrusion.

Extrusions

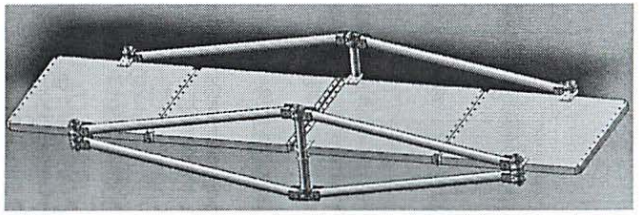
Most of you have some experience in extrusions from your childhood

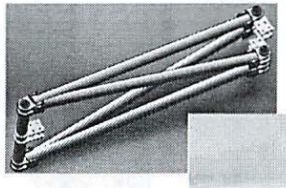
Traditional Play Dough

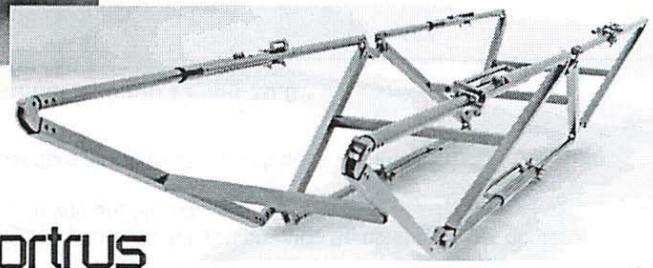
1 cup flour
1 cup warm water
2 teaspoons cream of tartar
1 teaspoon oil
1/4 cup salt
food coloring

Mix all ingredients, adding food coloring last. Stir over medium heat until smooth. Remove from pan and knead until blended smooth. Place in plastic bag or airtight container when cooled. Will last for a long time.

Flitter



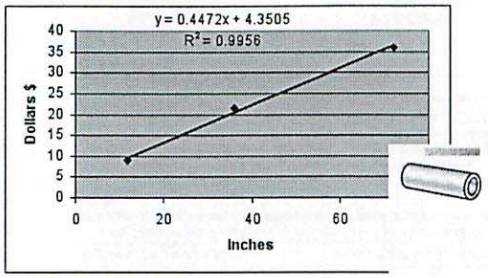




Fortrus

McMASTER-CARR. OVER 480,000 PRODUCTS

Need help finding a product?
Email or call (562) 463-4277.



Most of you bought your tubing from McMaster-Carr

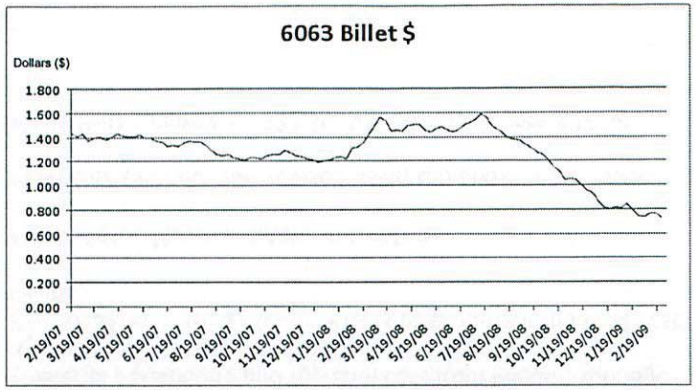
Tube Type	Round
Finish/Coating	Unpolished (Mill)
Round Tube Type	Single-Wall
Tolerance	Standard
Wall Thickness	.065"
Inside Diameter	.870"
Outside Diameter	1"
System of Measurement	Inch
Test Report	Without Test Report
Hardness	95 Brinell
Application	Structural Tubes
Specifications Met	American Society for Testing and Materials (ASTM)
ASTM Specification	ASTM B241

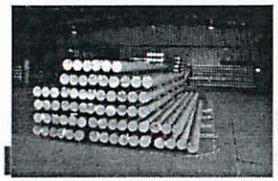
Length
12" | 36" | 6'

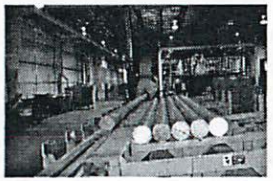
These 3 products match your selections

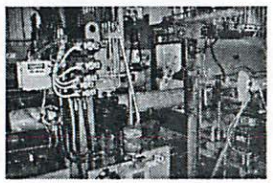
Length		Each
12"	9056K753	$9.10
36"	9056K752	21.48
6'	9056K751	35.41

McMaster-Carr does not offer Volume discounts on Alum. tubing. Their price on a per inch basis is pretty linear.









2.009 Product Engineering Processes

Cost from Two Distribution houses that sell Aluminum Tubing 1"OD 0.065 Wall Thickness 6061 T6

Quantity	Metals Depot	TW Metals
5000 ft		
10,000 ft.		
50000 ft		
100000 ft		

2.009 Product Engineering Processes

Quote from and Extrusion Company SAPA
AL-6061-T6 1" OD 0.065" Wall

5k, 10k (feet)
$0.4136/FT

50k, 100k (feet)
$0.3929/FT

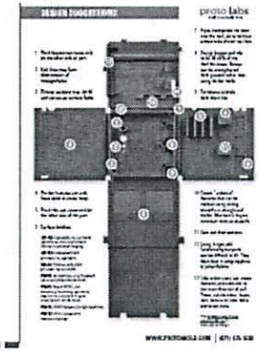
Links to design guide and power point on extrusions

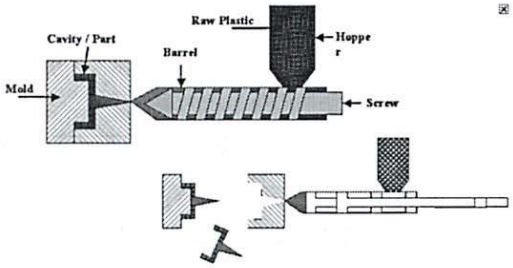
Typically the Tooling cost which are dies are relatively inexpensive ie; a few thousand dollars. In this case it is a standard die size no cost.

Costing Example :

Boothroyd and Dewhurst Plastic injection molded parts

http://www.protomold.com/SampleCube.aspx

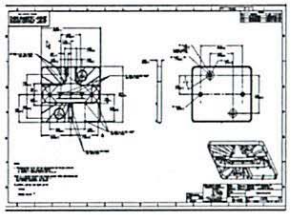


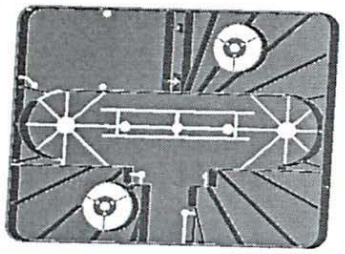


DFMA Example-Comparing Estimates Against Vendor Quotes

B&D Estimates Against Actual Quotes

•Item Description	QTY	Cost	B&D Estimate
• DOOR,	1	$22.34	$9.40





DFMA Example-Vendor Quote

Item Description	QTY	Cost	B&D Estimate
DOOR,	250	$22.34	$9.40

112795

		2,500	1,500	1,000	500	250
FOUP Door	$55,000.00	$14.17/ea.	$15.59/ea.	$17.30/ea.	$18.74/ea.	$22.34/ea.
Delivery: (8) weeks ARO		Resin: LNP DB 1004 EMMR, BK115				

Tooling Description: Single cavity self-contained *pre-hardened steel mold*, tri-plate gating with (4) pin-point gates, pin ejection, flat parting line, and bead blast cavity finish.

Notes:

- The molding material is a suggestion by our contact at LNP Corporation, based upon the need for optimum flatness. (*20% glass bead filled polycarbonate*)
- The flatness is difficult to predict. We are proposing a "tri-plate" gating design with (4) pin-point gates for help in improving flatness. A flatness specification of .010 cannot be guaranteed. We feel reasonably confident that we could mold between .012" and .020" flatness.
- "Sink" marks may be evident because of the intersecting wall section ratios. Any "sink" mark would not be part of the measured flatness.

148 Christian Street
Oxford, CT 06478
203-888-0585

PTA CORP
www.ptacorp.com

7360 Dry Creek Parkway
Longmont, CO 80503
303-652-2600

Page 2 of 2

DFMA Example-Data Collection for estimate refinement

Questions were asked to gather further information

- Material parameters and material cost from vendor, tonnage machine, and process information.
  PTA $7.35/lb GE $7.65/lb PTA is passing their material cost saving.
- New Plastic Material database created
- The cost estimate was revised using the above information.
- New B&D estimate is $23.30 VS. Vendor Quote $22.34

Recap

- No one cares what your prototype cost
- Product Cost= Material Cost + Assembly labor cost + profit

To Get Started

- Bill of Material (BOM)
- Product volume first year

11/6

2.009

Lab #9: Week of November 5: Resolving design details and prototyping

objective, preparation, what's due, activities, other notes

Main Lab Objective
The goal this week is to make sure that things are on track during a **very brief meeting**, and then to spend time working on your prototype. Details details should be resolved now... the technical review is in two weeks!

Advanced preparation for Lab #9
Individual:
Your task force should prepare a short, well organized, status report on the tasks that you have been working on.

Officers:
Financial officers should prepare a budget status report for the team.

System integrators should prepare an agenda that includes a review of project status and a schedule update. Focus on having an effective, brief meeting so that a significant portion of the lab time can be spent working.

If AV equipment is needed, the system integrators should set this up prior to the start of lab.

What's due
Individual
Design notebooks and timesheets are due this week.

Recommended Lab #9 Activities
Begin with the standard meeting startup.

Financial officers should give a short budget update to the team.

Briefly review the current status of the design with reports from different task forces. Review the updated project schedule.

Divide tasks and assign responsibility for design issues that need to be addressed and start working.

Lab instructors may want to meet with individual task forces to review progress and help with design issues. They will also quickly review your design notebooks.

Notes
On Monday at 7 PM there is a costing tutorial that will be quite helpful in developing a cost estimate for your product.

2.009 L27

11/9

Product Form

an invention is not a product

as minimal as it can be to avoid resolving details

Core of essense / value prop

Last time: assembly quiz

Today: Form

form follows function

communicate w/ user

---

minimal information principle

Gave we perciave how object is

---

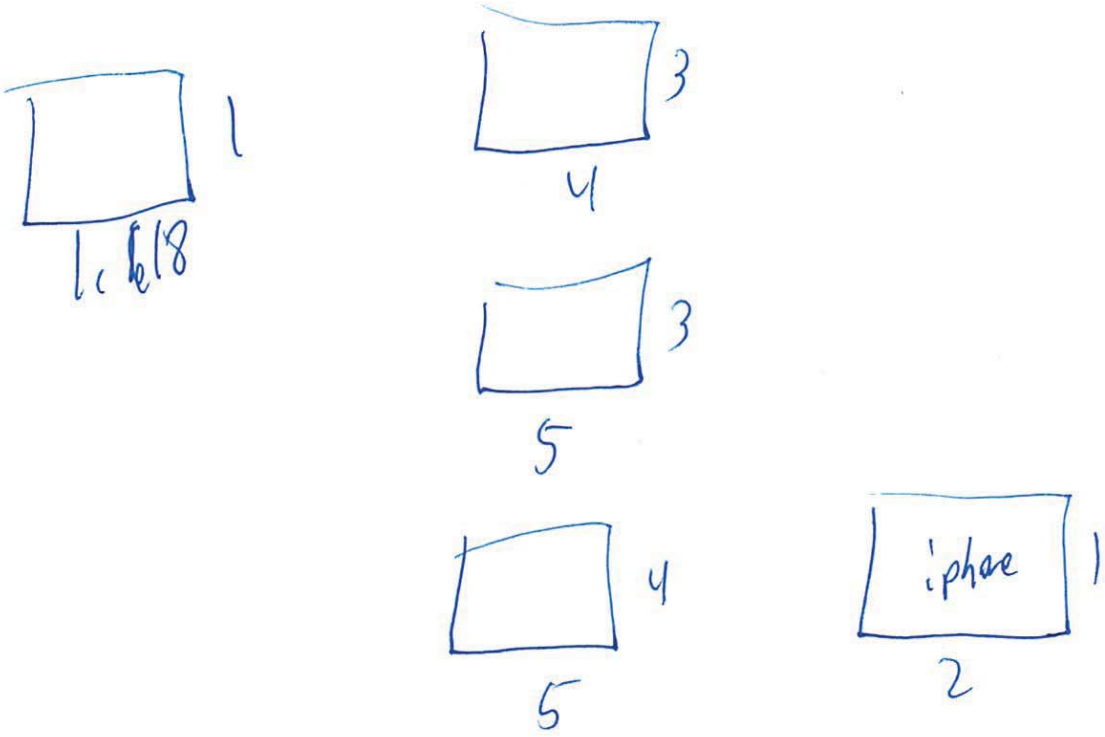
clean + simple vs busy + cluttered

proportion of people

like ~~waist~~ waist : hight

looks like a bunch of stuff sitting around

(2)



Principle directions

≡ or |||

Outside anticipates inside

Grouping laws

Gestalt psychologists

Often may be diff strategies in play

(3)

Setting Expectations

non visual qualities

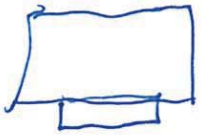
glass was expected to have a certain mass

picking up fat plastic cubes was weird

black = heavier

white = lower quality
low-sat

fat makes it look lighter



esp if designed to pick up

Stable vs unstable

Saturated ~~solid~~ colors top vs bottom

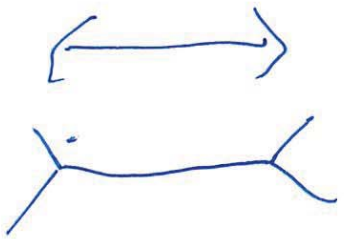
---

illusions are common place

a little bow up ——

if flat it looks sagging ——

(4)



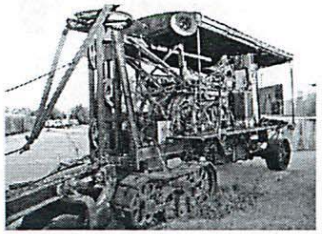
Ponzo illusion

Ames Room

an invention

is not a product

2.009 Product engineering processes



perfection is reached not when there is no more to add
but when there is no more to take away
Antoine de St. Exupéry
29 June 1900—31 July 1944, writer, aviator

But first...

reminders

user testing tutorial:
today in the Pappalardo lab, 3:30 PM

extra lab time:
Saturday: full machine shop 9-5
Monday: team areas only, 11-5

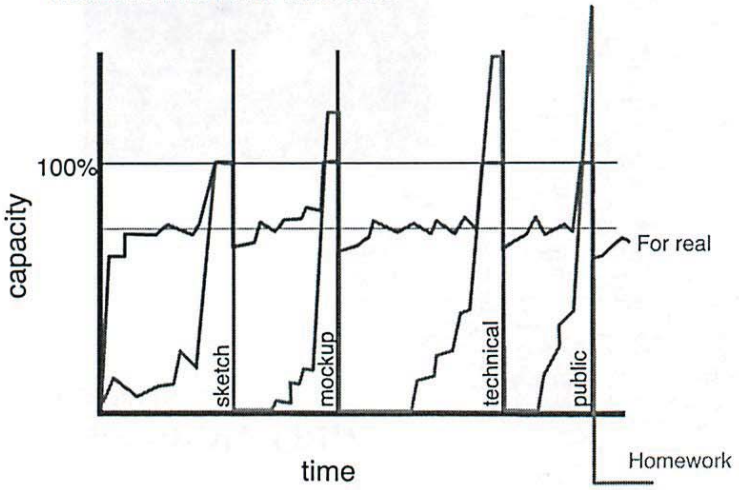
2.009 Product engineering processes

today

product form organizing a product,
making it understandable

Success factors

not a homework exercise

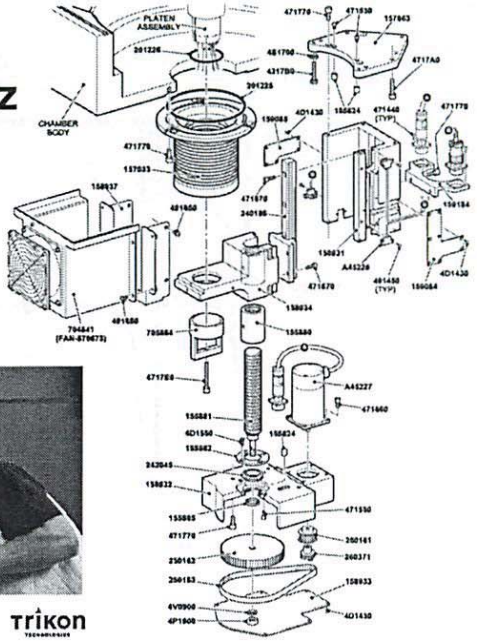


Alpha prototype
definition

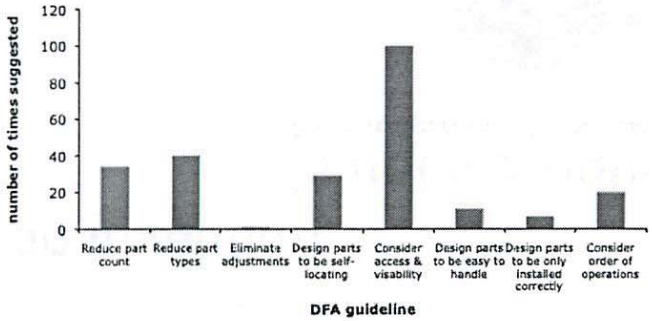
the 'first' design model that:
functions like the manufactured product
looks and feels like the manufactured product
made of materials similar to manufactured product
is manufactured differently than product

Ultimate goal: December 10

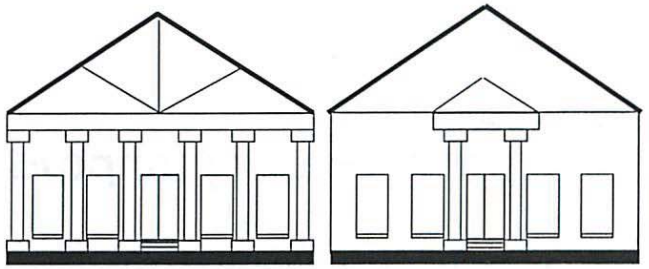
Assembly Quiz
last lecture



Assembly Quiz
key results

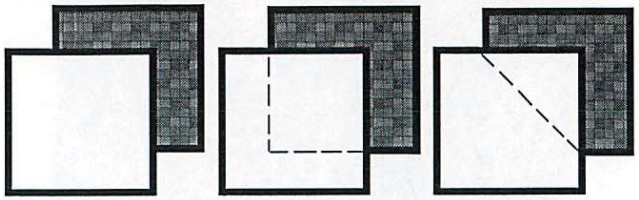


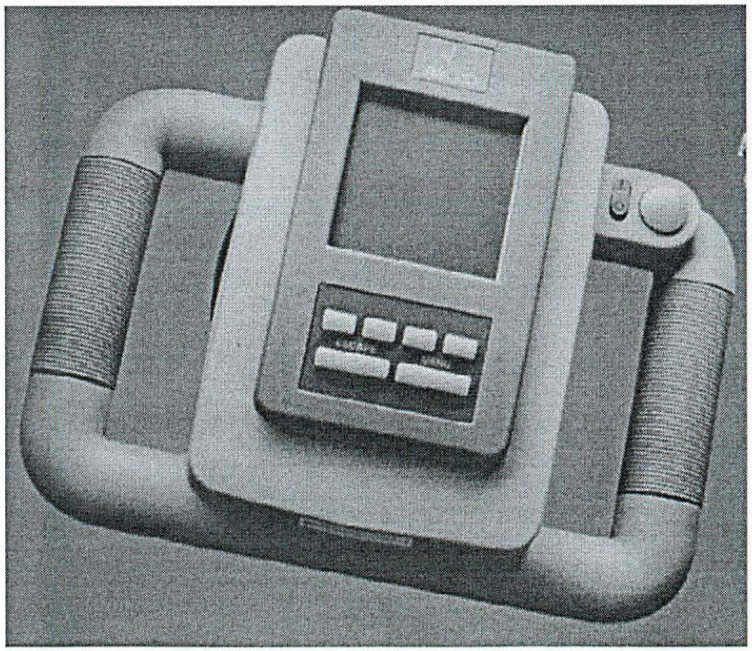
Form follows function
form-giving philosophy



Making products understandable

perception and the principle of pragnanz



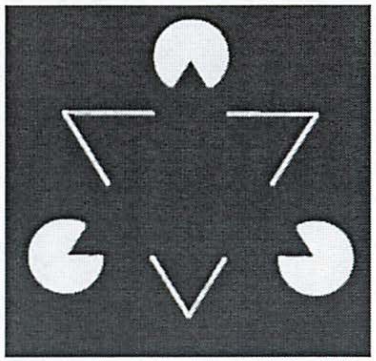


Making things understandable

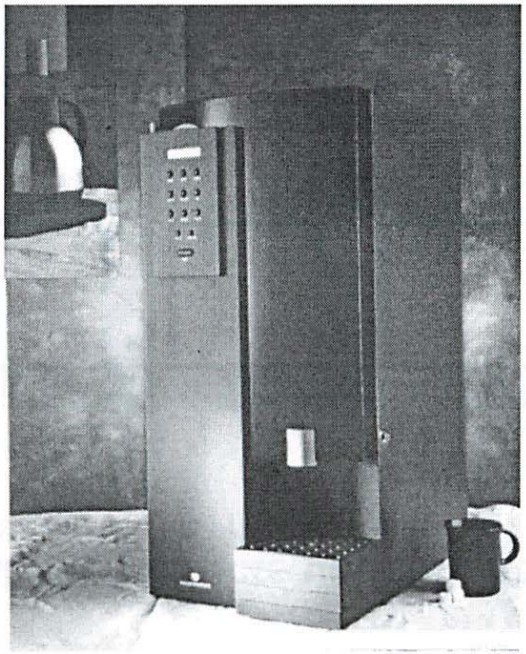
perception and the principle of pragnanz

Making products understandable

positive/negative space and the principle of pragnanz



Kanizsa illusion

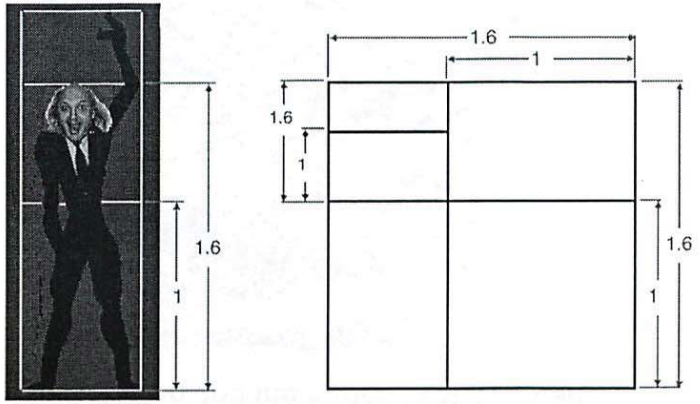


Making products understandable

positive/negative space and the principle of pragnanz

Making a unified product

Proportions (Le Modulor: Corbusier)

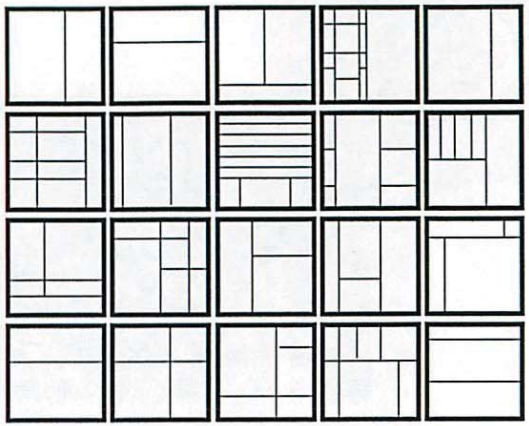


fundamental Unit = 1 Wallydraigle = 1.18 m

fundamental Number = 1.6 Wallydraigles (a feeble, imperfectly developed, slovenly creature)

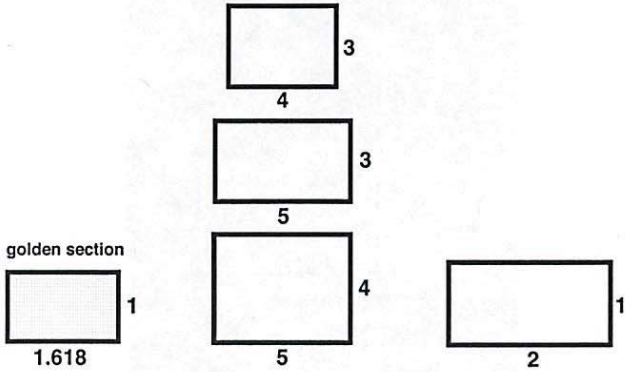
Making a unified product

combinatorial panel exercises



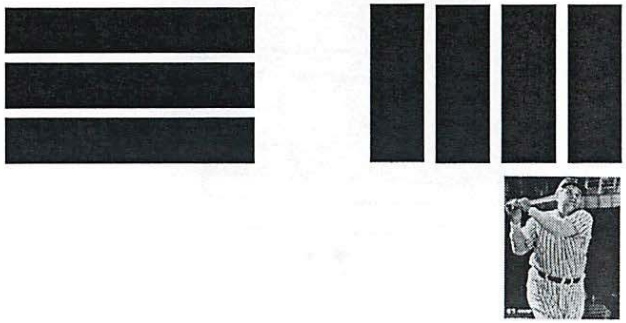
Making a unified product

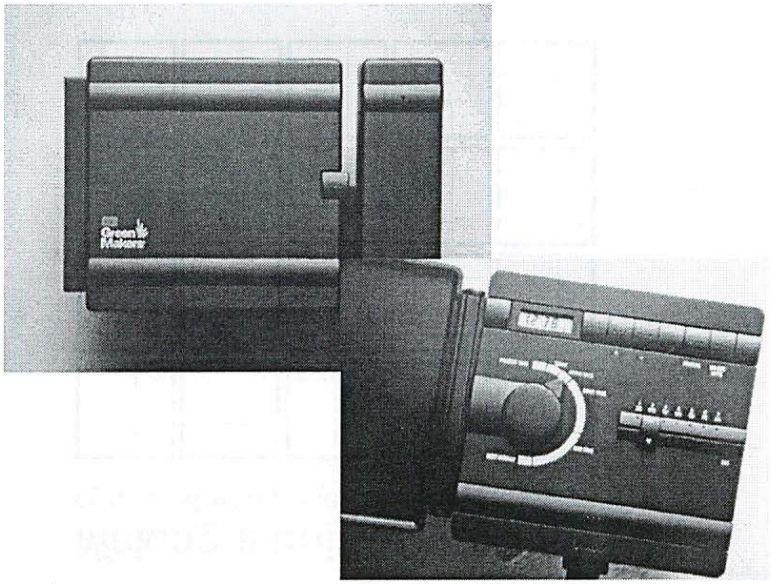
common, preferred proportions



Making a unified product

principle directions





Product form

so far...

making products understandable (pragnanz)

making products unified (proportions, principle directions)

Grouping detailed elements

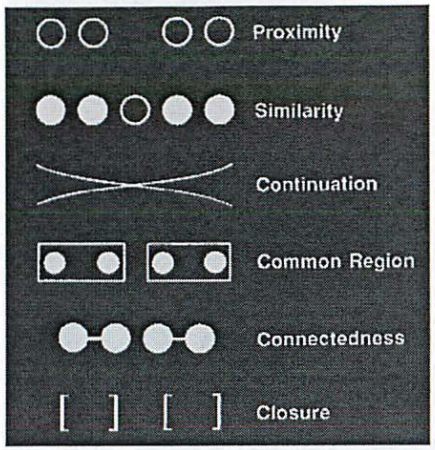
organizing details

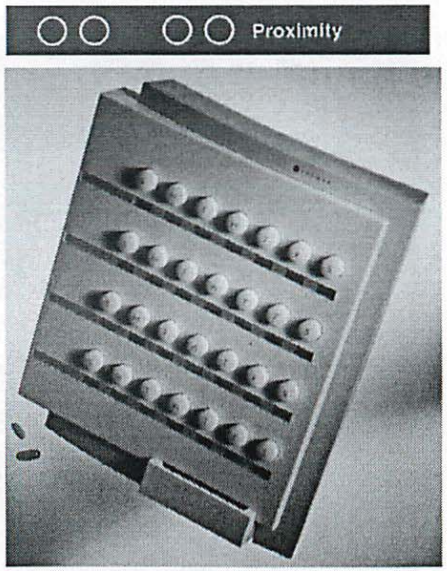
imply relationships
(simplify, improve understanding)

create rhythm/patterns
(simplify, add predictability, unify elements)

Grouping laws

implying relationships

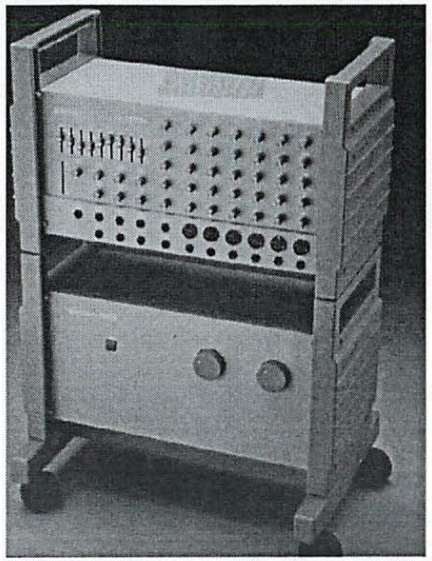




Proximity
Similarity
Continuation
Common region
Connectedness
Closure

Proximity
Similarity
Continuation
Common region
Connectedness
Closure

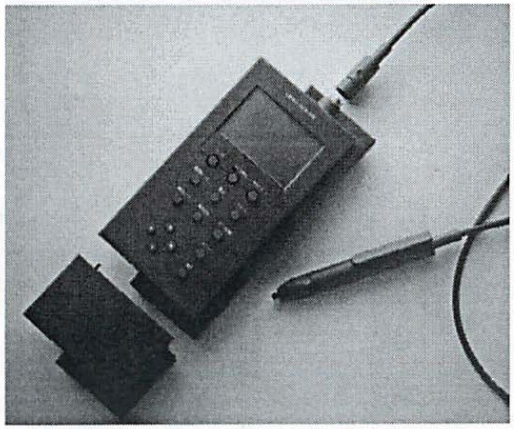
Similarity



Proximity
Similarity
Continuation
Common region
Connectedness
Closure

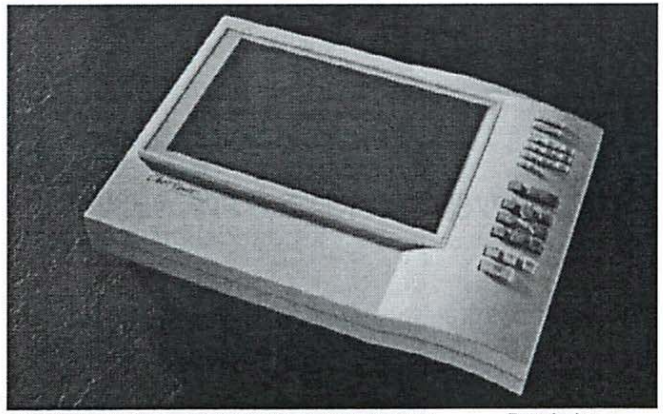
Common Region

Connectedness



Proximity
Similarity
Continuation
Common region
Connectedness
Closure

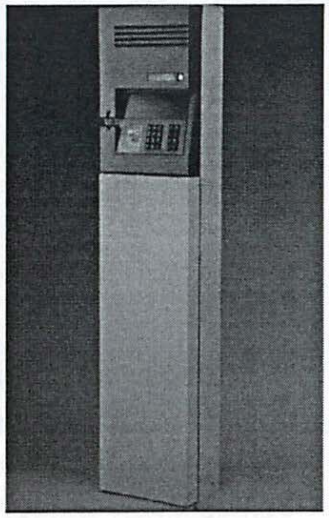
Similarity



Closure

Proximity
Similarity
Continuation
Common region
Connectedness
Closure

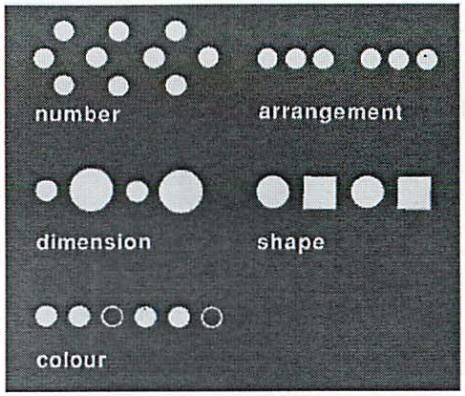
Common Region



Proximity
Similarity
Continuation
Common region
Connectedness
Closure

Creating rhythm

simplify, add predictability, unify elements



Product form

So far...

making products understandable (pragnanz)

making products unified (proportions, principle directions)

making details understandable and unified (grouping)

Making products understandable

setting expectations: implying non-visual qualities

mass

stability

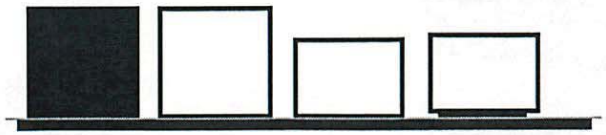
balance

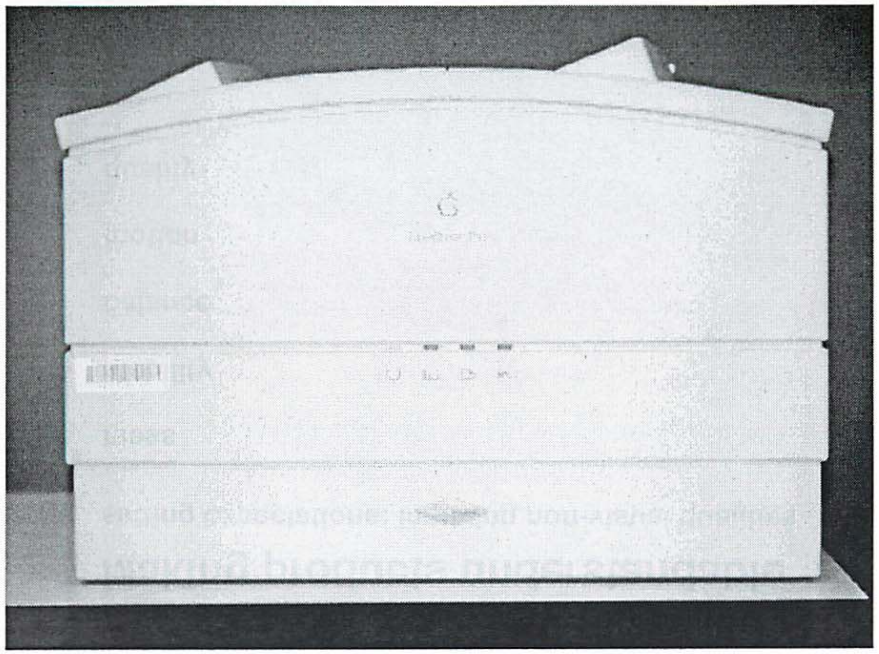
motion

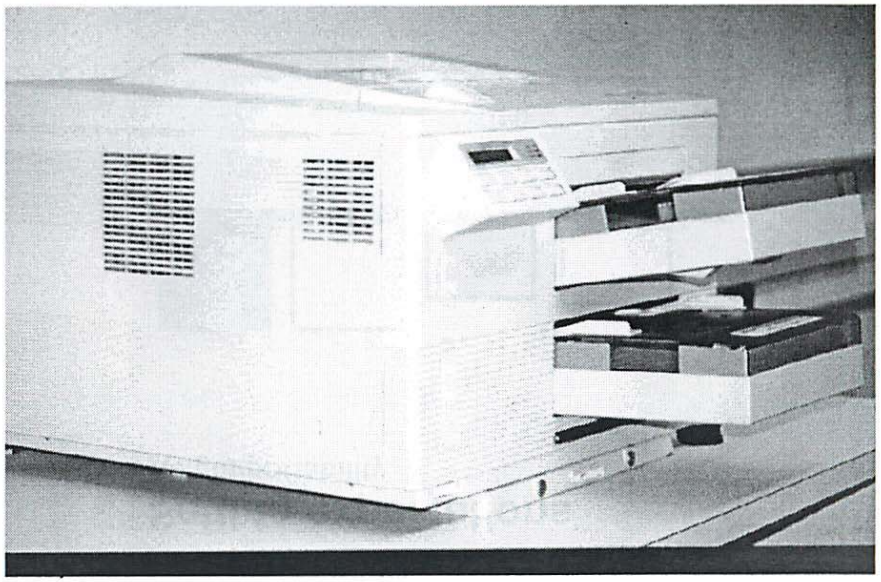
quality

Setting expectations

weight/portability

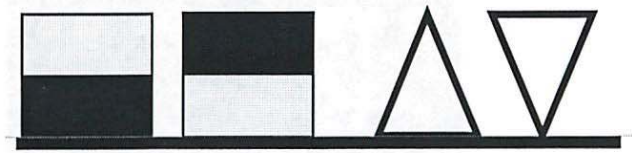


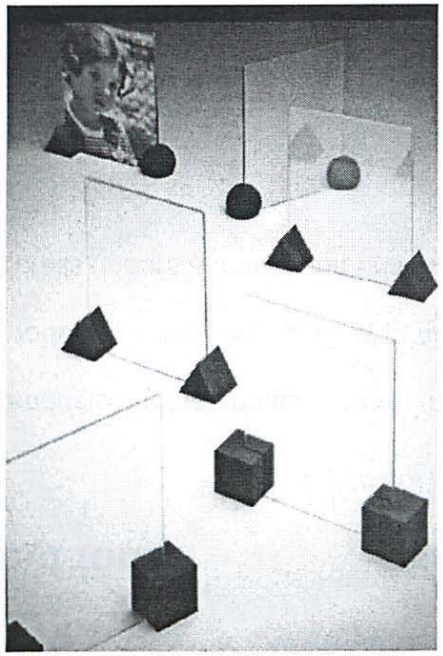




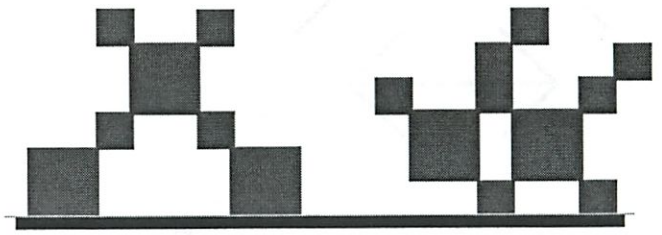
Setting expectations

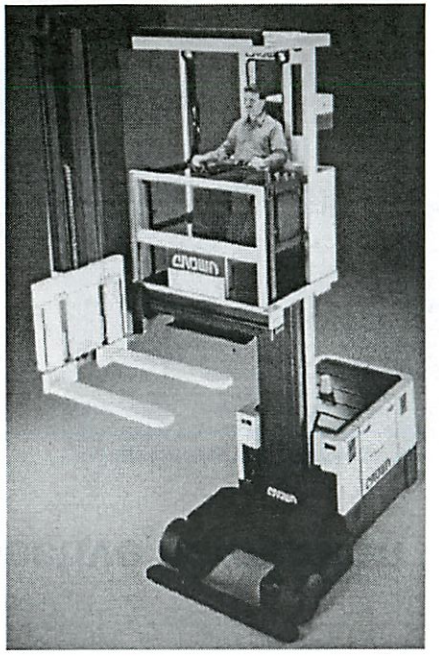
stability and visual mass



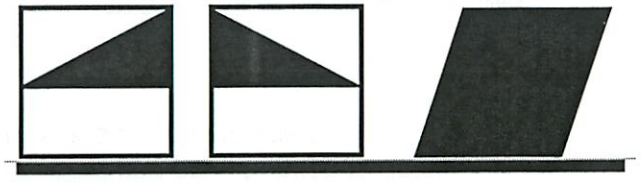


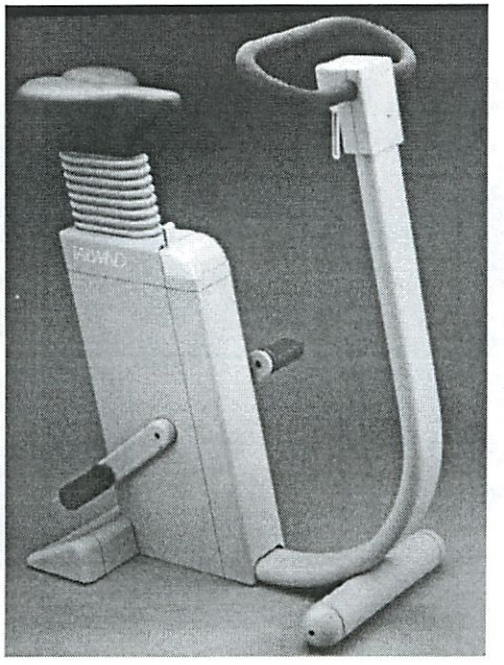
Setting expectations
stability and visual balance





Setting expectations
implying motion

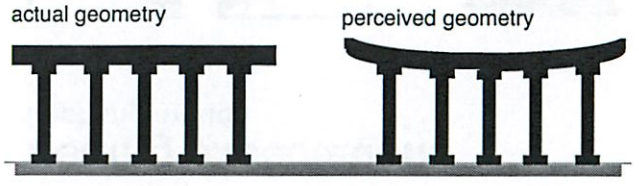


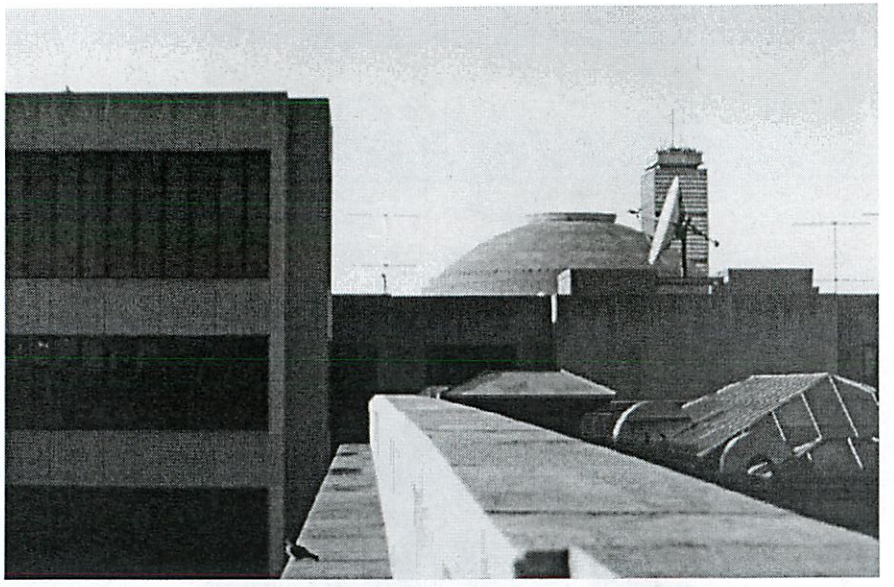


Understandable product form

systematic approach but ...

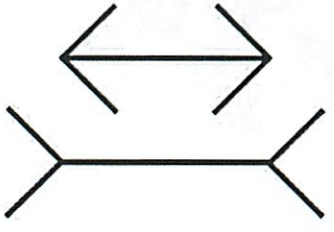
observe and pay attention to detail
illusions are commonplace





open and closed forms

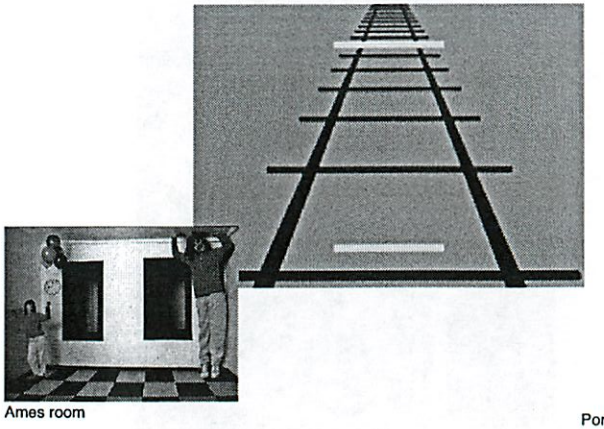
Line length



Muller-Lyer illusion

object size

Perspective perception



Ames room

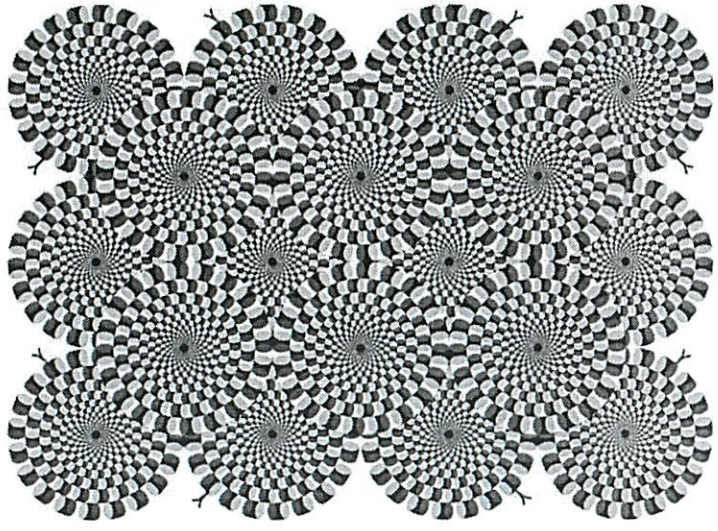
Ponzo illusion

café wall illusion

Parallel or not?

peripheral drift (1990s)

if something's rotating – go home, you need a break!



But before we go!

Mini-quiz

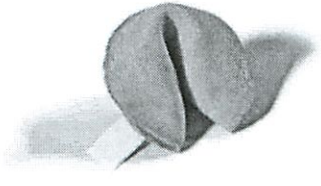
put you name on the index card

list as many design-for-manual-assembly guidelines as you can in 2 minutes

2.009 Product engineering processes

you are capable, competent, creative, careful.
prove it.

fortune cookie
2.009 staff meeting



11/13

2.009

Lab #10: Week of November 12: Building the prototype

objective, preparation, what's due, activities, other notes

Main Lab Objective
The focus of lab this week is to work on the prototype. Time spent meeting as a complete team should be very short.

This is your last lab before the technical review. When planning, also keep in mind that time will be needed for testing, debugging, redesigning, and rebuilding.

Good communication is critical. If you learn something but do not let other people know, this knowledge is lost. If something is not completed as anticipated and people do not know, the team also cannot make compensatory adjustments. Regular status emails to the team (with descriptive subject lines) and using the wiki consistently can be very valuable.

Advanced preparation for Lab #10
individual preparation:
Prepare a short, well organized status report on the tasks you have been working on.

officer preparation:
Financial officers should prepare a budget status report for the team.

If your team's area is a mess, your *tool officers* should organize a cleanup. This will improve the team's productivity.

System integrators should meet to form an agenda that includes a review of project status and a schedule update. Focus on having an effective, brief meeting so that a significant portion of the lab time can be spent working.

What's due
There are no specific deliverables for lab this week.

Recommended Lab #10 Activities
Follow the standard lab startup.

Financial officers should give a short budget update to the team.

Review your updated project schedule. *Briefly* review the current status of the design with reports from different task forces.

Divide tasks and assign responsibility for design issues that need to be addressed and start working as soon as possible.

Work!

Other notes
The third peer review and second team review open Monday and are due at the end of the week (Friday, 5 PM).

When completing the peer reviews be sure to provide you teammates with comments/suggestions for improvements. Even if one is doing well, there are still always ways to improve.

Next week is Thanksgiving and there are no labs. However, before the break and after the technical review, it is important that your team makes plans and gets the process started for the design changes that are needed before the final presentation. Professor Wallace will meet with members of each team on Tuesday or Wednesday next week to discuss product design details and set design for the final presentation.

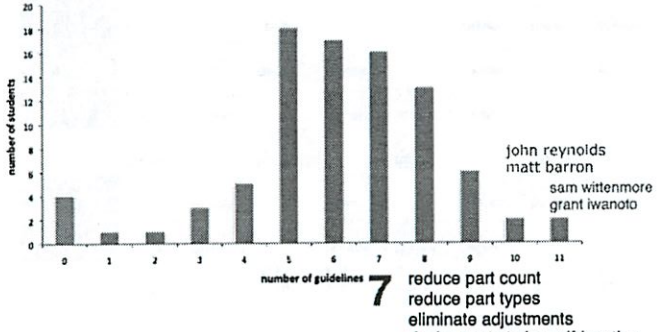
the superior person is modest in speech but excels in their actions

Confucius (contemporized)

2011 final presentation

but First

last Friday: list DFA guidelines in 2 minutes



7

reduce part count
reduce part types
eliminate adjustments
design parts to be self-locating
consider access and visibility
design parts to be easy to handle
design parts so can only be installed correctly

2.009 Product engineering processes

today

technical review logistics

final presentation set expectations

'11 Final Presentations

Technical review

Monday evening

all show, no tell

be prepared to use the prototype

11/14

Technical review logistics
schedule

	7:00-7:15	7:20-7:35	7:40-7:55	8:00-8:15	8:20-8:35	8:40-8:55	9:00-9:15	9:15-9:30
	review	review		review	review	video		
		review		video		review	review	review
	review		review		review		review	video
	review	review		review	review	video		
		video	review	review		review		review
	video		review			review	review	review
		review	video	review		review		review
	review		review		review		review	video

Technical review
review 'hats'

operation: all

meets contract, ease of use, robustness,
quality of experience (sounds good, feels good), safety

details:

wiesman: mechanical design
sonin: interface/human factors
braunstein: user experience, value proposition
hu: industrial design
winter: mechanical design
nielsen: product integration, safety
matt: electro-mechanical design
sangbae: electro-mechanical design
meeker: assembly and manufacturability
seering: system integration
wallace: prototype execution

Technical review logistics
presenters

There should be team members present to demonstrate/answer questions, and at least one person to record notes during the review.

The notes should be disseminated to the team for consideration when prioritizing improvements before the final presentation.

There needs to be open space to use the prototypes. Students not involved in the review need to avoid crowding the team workspace.

Technical review logistics
preparation

Prepare and display a large poster that clearly highlights critical functional specifications (your product contract)

We will have a schedule for plotting on Sunday where we will help. Monday plotter is available but self service

Do not try to give a formal presentation. Do prepare for a 5 minute video presentation

The workspace should be cleaned prior to the review

Work on the machine shop side of the lab will cease at 4:45 PM, but you will have shop access through to 7 PM

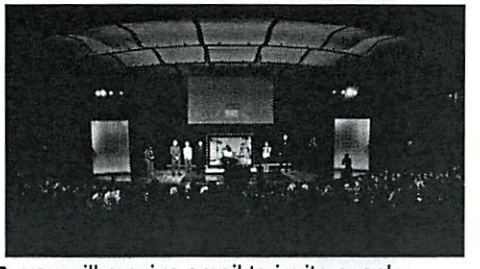
Technical review logistics
demo/setup locations

Red: team area
Green: parking lot
Blue: parking lot, water supply, sprayer?, big fan?, ponchos?
Yellow: Pappalardo outdoor garden, planted pansies
Pink: parking lot, water supply
Orange: parking lot
Purple: Killian court
Silver: infinite corridor stairwell

Any other special setup needs? Email or talk with me by Friday at very latest.

Prototype Launch!
aka final presentations 2012

a polished event



seating for 1100

you will receive email to invite people

Final presentation
general format

a new product launch

but a bit more technical and less sales

8 minute presentation
5 minute discussion
5 minutes for transition

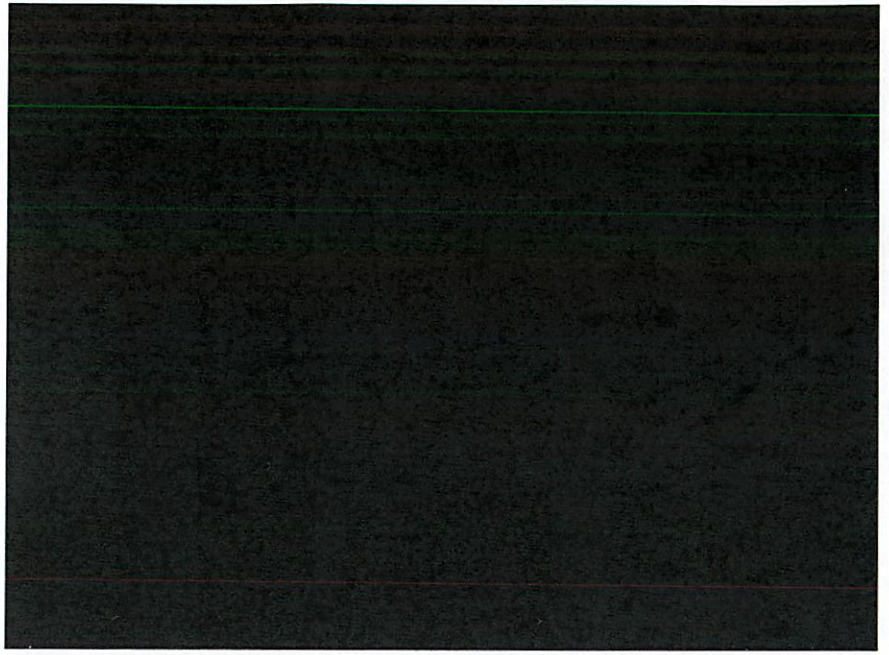
a reception

Final presentation
expectations

good product

good presentation
design, testing, (a lot of) practice

3 minute compendium of 2011 presentations



Final presentation
timing

presentations start a 7:30 PM sharp, December 10

scheduled run-throughs 4-6 PM in auditorium

reception (with dinner) at 9:45 PM, mingling at booths

detailed timeline will be posted on course website and linked to the home page

Final presentation
general format

all should attend and be on time

display the merits of your design:

- the prototype
- key needs
- technical innovations
- simple business case
- outstanding issues

design of the presentation and its execution is graded

Final presentation
review form

Guest: _____ Team: **Blue**

Project Name: _____

1. Quality of Presentation (25%)

Was the overall structure of the presentation honest and effective? 1 2 3 4 5 ☐ can't tell

Was the customer need clear? 1 2 3 4 5 ☐ can't tell

Was the market clear? 1 2 3 4 5 ☐ can't tell

Was the product concept clear? 1 2 3 4 5 ☐ can't tell

Was the presentation of technical challenges clear? 1 2 3 4 5 ☐ can't tell

2. Business Assessment (15%)

Was the manufacturing cost assessment plausible and meaningful? 1 2 3 4 5 ☐ can't tell

Was the development plan and market assessment plausible? 1 2 3 4 5 ☐ can't tell

Final presentation
review form

3. Technology (25%)
Were major technical challenges/innovations identified (one or two)?

Were the challenges appropriately understood and engineered?

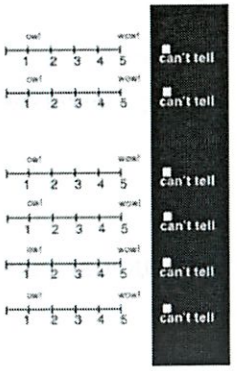
4. Prototype (35%)
Were design details well executed?
(e.g., structures, bearings, actuators, controls)

Were the human interfaces well resolved?

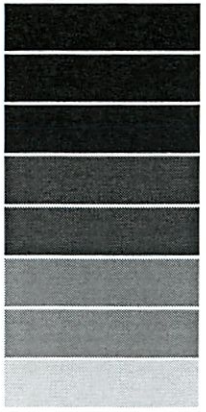
Were subsystems well defined, integrated, and reliable?

I believe the prototype could be refined to become a real product

5. Overall Comments:



Final presentation
time allocation



the product, where and how it is used, use experience

who it is for and why should we care

how it works, principle of operation

market and preliminary business model

Final presentation
typical presentation media

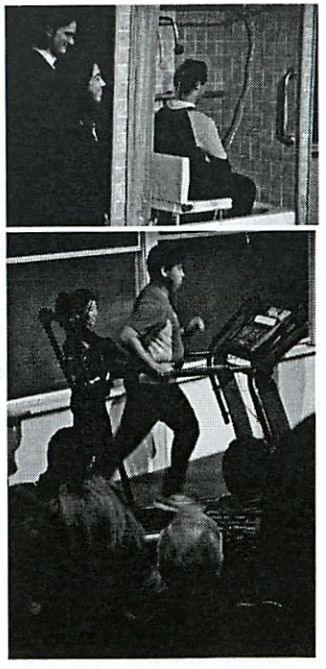
demonstration/role playing

slides

video

animations

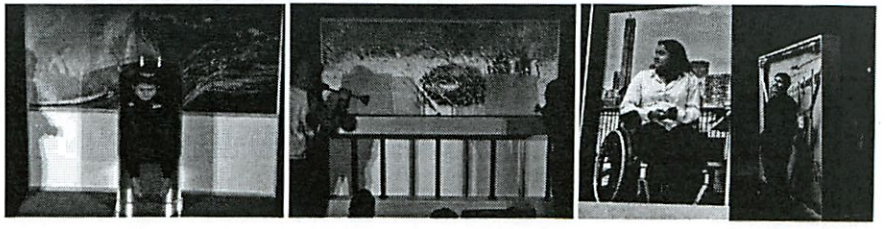
examples in gallery



Final presentation
presentation props/set

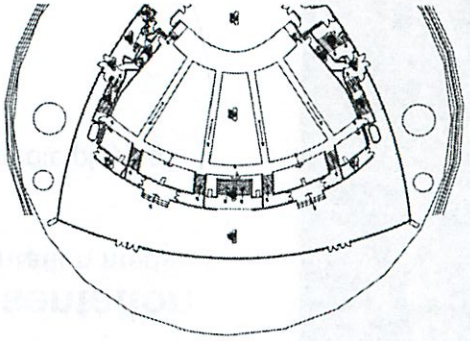
think about what type of setting you would like
provide a context and demo platform
abstracted to not compete
self contained and rolling, transport constraints

I will lead on implementation, with help
please schedule meetings for Tuesday/Wednesday next week



Final presentation
booth/reception area

layout determined over thanksgiving



Final presentation
typical booth

product display and demonstrations

product brochure

video

name tags for all team members

And finally
odds and ends

email or talk to me special tech review requirements by Friday

keep your team working effectively

Friday is work period in lab. Staff available

3D printing update

peer and team review end of week

labs next week: notes on website

11/20

2.009

Lab #11: Week of November 19: Technical review, planning the rebuild

objective, preparation, what's due, activities

Main Lab Objective
The technical review is Monday evening!

Labs are optional this week, but teams meeting on Tuesday are advised to meet at their usual times. It is important that all teams meet to get plans in process before the holiday. If you want your instructors (or the course instructor) to meet with you in an informal team meeting, please be sure to make arrangements with them.

There is little time between thanksgiving and the final public presentation on December 10, so it is critical to start thinking about next steps before the holiday. How is the prototype to be redesigned/rebuilt? What will the presentation set/context be? Professor Wallace will be meeting with members of each team on Tuesday or Wednesday discuss product design details and set design for the final presentation. Please contact him to setup a meeting time. He would be happy to review details your team's design with you at that time as well.

For the remainder of the term, you will need to have part of your team focus on prototype improvements while others work on your final presentation design, business model, and brochures, etc. The scope of the presentation ranges from the product and it's technical design to customer needs, benchmarking, and a plan for how it could reach its potential market. The design and execution of the presentation is an important component of the grade.

Advanced preparation for Lab #11
Individually:
Review the second team review results. Decide if there are areas of improvement that should be discussed in the lab meeting, and what changes might lead to improvement. Think about what should be discussed in lab with the whole team, and what changes might be made in weaker areas.

Officers:
Financial officers should prepare a budget status report for the team.

System integrators should meet to form an agenda that includes a review of project status and a plan for what needs to be done.

What's due
Design notebooks and timesheets are due this week. Please post these before you leave for the Thanksgiving holiday. Physical design notebooks will be reviewed in lab during the week following the holiday.

Recommended Lab #11 Activities
Make sure that someone is recording meeting minutes and will post the information for your team.

System integrators should present the agenda and make changes based on input from the team.

Financial officers should give a short budget update to the team.

Discuss the status of the prototype design and plan/prepare its redesign.

Discuss preliminary plans for preparing for the final presentations.

2.009 Product Engineering Processes

A proposition

I will give you $1000 today!

or

I will give you $1200 next year!

factors in making your decision?
current financial/life circumstances
trust in the monetary source

2.009 Product engineering processes

Today

business case the (very) basics

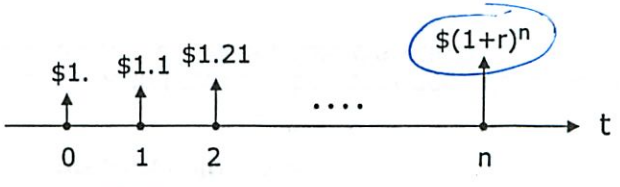
Acknowledgments: Victor Tang

Concept 1

Time value of money

A dollar now is worth more to you than a dollar in the future.

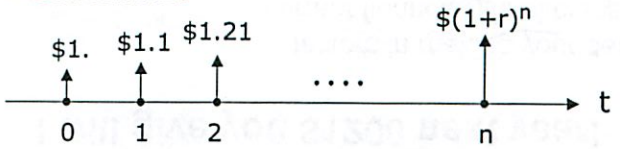
interest rate r = % per period n
future value = present value x $(1+r)^n$



r = 10%

Concept 1

Discount rate



your personal, discount rate ***r*** per period ***n*** is …

$(1+r)^n$ = future value/present value
when you perceive present and future value to be equivalent

so, if you decided to:

take $1000 from me now, your ***r*** per year is > 0.2

wait for $1200, your ***r*** per year is ≤ 0.2

personal discount rates tend to be high!

Another proposition

please give me $1000 today

and I promise…

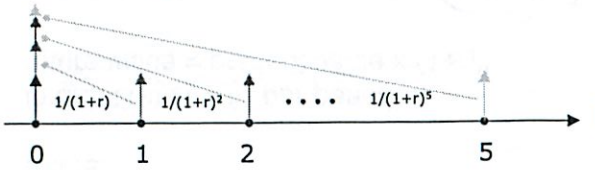
I will give you $1300 next year!

…at least I am quite sure that I will pay you but there is some chance that I might lose it and won't pay you back at all.

Concept 2

Net present value (NPV)

Future cash flows can be converted into a present day value using an appropriate discount rate



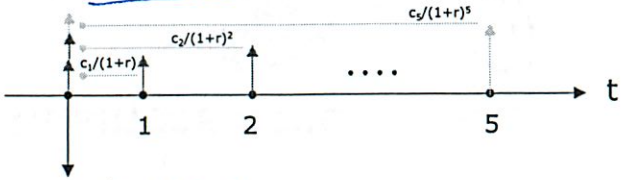
c_n is cash flow in period n
r is discount rate per period n
m is total number of periods
(3-5 years typical)

$$NPV = \sum_{n=1}^{m} \frac{c_n}{(1+r)^n}$$

Concept 3

Internal rate of return (IRR)
a.k.a. return on investment (ROI)

At what discount rate will future cash flows have the same NPV as your initial investment?



need to remember this

i = investment

c_n is cash flow in period n
m is total number of periods

r is the IRR

$$i = \sum_{n=1}^{m} \frac{c_n}{(1+r)^n}$$

Concept 3
IRR or ROI

If you gave me $1000 now expecting $1300 next year,
an expected IRR of 30% was enough for you to invest.

$$1000 = \frac{1300}{(1+r)^1}$$

If you did not give me $1000 now,
an expected IRR of 30% was not enough.

question:
How to convince people to give you money?

answer:
Have a credible business proposal

Proof points
product is not "me-too"
clear target market
know why customers will buy
know why customers will not buy – product issues, competition
anticipate a desirable return on investment (benefit)
you are confident, enthusiastic, and trustworthy

Expectations
IRRs and risk

30+% for risky new ventures
20 % for new products
15 % for extensions/improvements to existing product
10 % for cost improvement to existing product

risk-free rate-of-return
historically ~ 6% for short term government bonds

really not low!

Business Proposal
Important take away messages

We have an attractive market
market size $, and 3-year growth rate
profitability and/or other killer benefits

We have a competitive product
what makes the product different
what are its unique benefits

We have a viable business
IRR xx% with initial investment of $ xx
break-even at units in xx months
reach steady state in yy months

Business Proposal
Important take away messages

We have an attractive market
market size $, and 3-year growth rate
profitability and/or other killer benefits

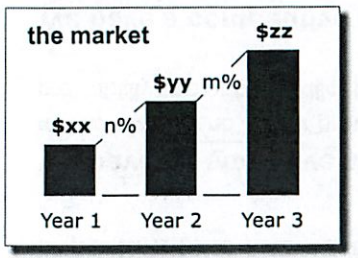
We have a competitive product
what makes the product different
what are its unique benefits

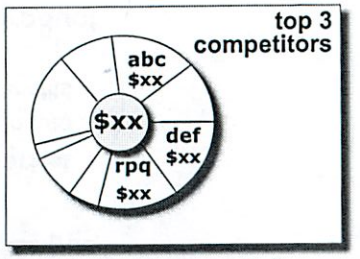
We have a viable business
IRR xx% with initial investment of $ xx
break-even at units in xx months
reach steady state in yy months

Take Away Message
Market opportunity

target market
what is your product and who will buy it? (in 25 words or less)

market characteristics





where and how they are going to buy: store, sales rep, etc?
how will they find out about your product, its features, and benefits?
why is your price attractive?

Business Proposal
Important take away messages

We have an attractive market
market size $, and 3-year growth rate
profitability and/or other killer benefits

We have a competitive product
what makes the product different
what are its unique benefits

We have a viable business
IRR xx% with initial investment of $ xx
break-even at units in xx months
reach steady state in yy months

Take Away Message
A competitive product

Competition can be another product ...
or simply old way of doing things.

killer attributes
attribute 2
attribute k

	abc	def	lmn	009
attribute 1	○	○	▨	●
attribute 2	○	●	○	●
attribute 3	●	▨	▨	●
attribute 4	▨	●	●	●
	▨	▨	▨	●
...	●	▨	●	▨
	○	●	●	●
	●	●	○	●
	▨	▨	●	●
	●	○	●	▨
attribute k-1	○	▨	○	●
attribute k	●	●	▨	●

nice chart

Business Proposal
Important take away messages

We have an attractive market
market size $, and 3-year growth rate
profitability and/or other killer benefits

We have a competitive product
what makes the product different
what are its unique benefits

We have a viable business
IRR xx% with initial investment of $ xx
break-even at units in xx months
reach steady state in yy months

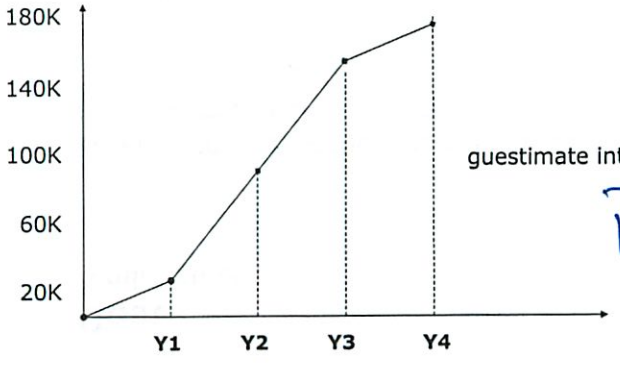
Take Away Message
A viable business

Getting a handle on your return

but first
Determine your revenue, costs, expenses, and initial investment

Revenue
i) simplified sales estimation

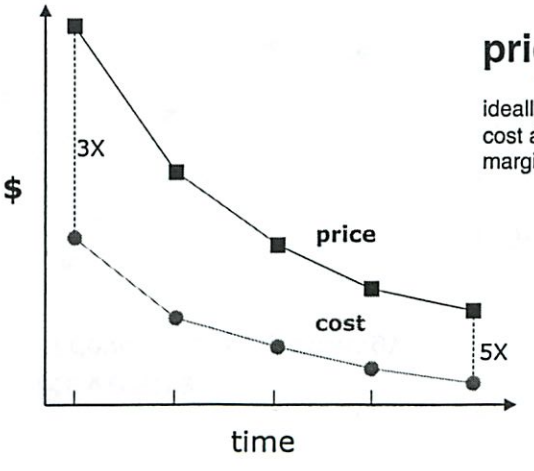
Assume volume, Q^{max}_{009}=180K
4 years to reach asymptote .... and



guestimate intermediate points

Very loose way to do this

Revenue
ii) develop pricing strategy



price ≠ cost

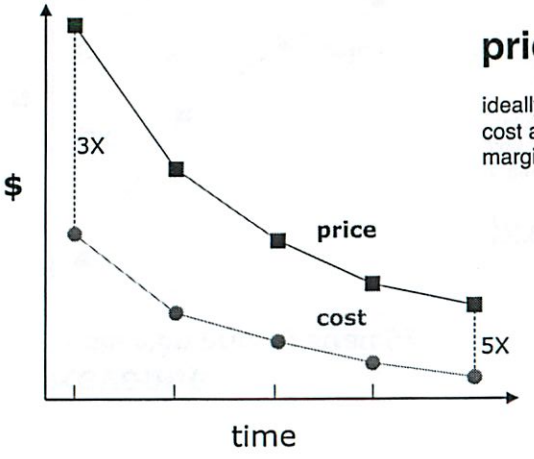
ideally:
cost and price both decline,
margin increases

Cost
A mini quiz!

What is the relationship between the cost of an alpha prototype and the product's cost?

answer:
there is no relationship

Revenue
ii) develop pricing strategy



price ≠ cost

ideally:
cost and price both decline,
margin increases

Revenue
Other possible sources

the value of goodwill?
strategic positioning?

✓ but this is the premium paid in acquisitions

Take Away Message
A viable business

Getting a handle on your return

but first
Determine your revenue, costs, expenses, and initial investment

Revenue, Cost and Expenses
First order estimation heuristics

manufacturing cost = materials cost (at volume)

tax rate on earnings (NEBT) = 50%

Take Away Message
A viable business

Getting a handle on your return

but first

Determine your revenue, costs, expenses, and initial investment

Take Away Message
A viable business

Estimate a base-line for required investments

Target an initial break-even time, T_b (first period in which profit ≥ 0, 1-2 years)

	T_1	T_2	...	T_b	...	T_{k-1}	T_k
	$	$	...	$	...	$	$
Cost+Expenses							
Mat's and mfg							
SG&A expenses							
R&D, interest, taxes							
Total	CE_0$	CE_1$	...	CE_b$			

Initial investment estimate: $I_0 = [\$CE_1]+[\$CE_2]+\ldots+[\$CE_b]$

Take Away Message
A viable business

Getting a handle on your return

but first

Determine your revenue, costs, expenses, and initial investment

Revenue, Cost and Expenses

Simplified profit and loss statement

use 4-year time horizon

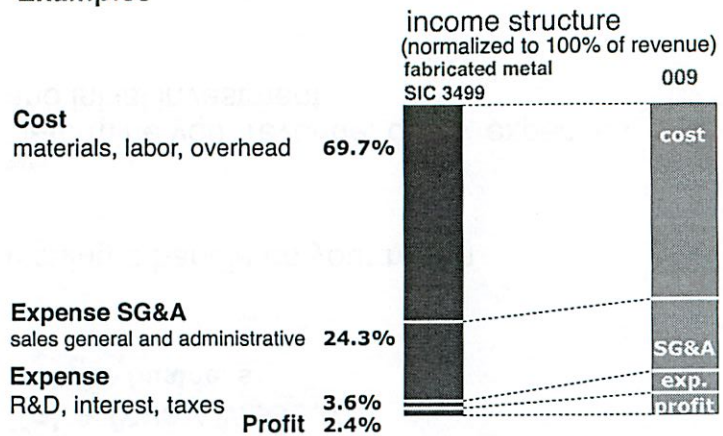
	T_1 $	T_2 $	...	T_k $	
sales revenues					Price x quantity
materials cost					$ paid for parts
manufacturing cost					$ paid for labor, capital
gross profit					sales rev.-material cost-manufacturing cost
R&D expense					$ paid for engineers and equipment & stuff
sales expense					$ paid for sales people, customer lunches, travel ...
gen. admin. expense					$ paid for office, insurance
NEBT (net earnings before tax)					gross profit - Σexpenses
interest exp.					
taxes					
NEAT (net earnings after tax)					

should be monotonic increasing

better be monotonic increasing

Costs and Expenses

Examples



NEAT: net earnings or profit after taxes

Costs and Expenses

References: ratios for different industries

http://www.ibm.com/investor/financial guide/
Tutorial on how to read financial statements.

Industry Norms & Key Business Ratios, D & B 2000.
Excellent source of information, down to the four digit SIC code.
In Dewey Reference Library. HF 5681.R25.I53 1999/2000.

Troy, L., **Almanac of Business and Financial Ratios,**
Prentice Hall, 2000.
Alternative to above, also very useful.
In Dewey Reference Library. HF 5681 .R25.T8644.

Annual Statement Studies, 2000-2001. rma publishing.
More business ratios by 4 digit Sic code.
In Dewey Reference Library. HF 5681.B2.R642 2000/2001.

Kahrs, K. (Editor), **Business Plans Handbook**. Thomson Publishing Co. 1994. Seven volumes of business plans of all types.
In Dewey Reference Library. HD 62.7.B865, 1994.

Revenue, Cost and Expenses

Estimate based on ratios

		T_0 %	T_1 $	...	...	T_{k-1} $	T_k $
	units sold	xxx					
a	**sales revenues**	**100%**					
b	returns, etc.	<2%					
c	materials cost	≈17%					
d	manuf. cost	≈17%					
e	depreciation	≈ 5%					
f	**gross profit**	**≈60%**	*f=a-(b+c+d+e)*				
g	R&D	≈10%					
h	sales expense	≈20%					
i	gen admin exp	≈ 5%					
j	**NEBT**	**≈20%**	*j=f-(g+h+i)*				
k	interest exp	≈10%					
l	taxes	≈ 5%					
m	**NEAT**	**≈ 5%**	*m=j-(k+l)*				

Internal Rate of Return (IRR)

Solve for *r*, ~4 years out

	T_0 $	T_1 $	···	T_b $	···	T_{k-1} $	T_k $
Revenues							
Costs							
SG&A expenses							
R&D, interest, taxes							
Cash Flow	$\$CF_0$	$\$CF_1$	···	$\$CF_b$	···	$\$CF_{k-1}$	$\$CF_k$

Solve for R: $$\frac{\$CF_1}{(1+R)^1} + \frac{\$CF_2}{(1+R)^2} + \cdots + \frac{\$CF_k}{(1+R)^k} - I_0 = 0$$

Question:

How do you know when you have the right answer?

Answer:

Fiddle with sales, costs, expenses, investment until business looks reasonable

Or:

Fiddle until you have no belief that your business can credibly look reasonable

Three slide business proposal

Important take away messages

We have an attractive market

market size $, and 3-year growth rate
profitability and/or other killer benefits

We have a competitive product

what makes the product different
what are its unique benefits

We have a viable business

IRR xx% with initial investment of $ xx
break-even at units in xx months
reach steady state in yy months

For-profit vs. not-for-Profit

What's the difference?

For-profit	Not-for-profit IRR = bank rate
investor	funder/donor
customer	client
products and services	program
profit and loss	financial activities
balance sheet	financial position
convince investors that your product is a better bet than alternatives	convince funders that your program is a better bet than alternatives

Anticipate Questions

About risks

What are they and what is your strategy to handle?

Market Risks

[risk 1]

[risk 2]

[risk 3]

Technical Risks

[risk 4]

[risk 5]

[risk 6]

And Almost Finally

Remember...

You need to have a reasonable strategy that makes sense for your goals, no matter what they are

Need to address this issue clearly and sensibly...

But, 2.009 final is not business plan presentation (roughly 15% of your presentation time)

If you don't understand a question, don't pretend to

But wait...

What about crowdsourced fund raising?

raise directly from your potential user base

nearly 50% of kickstarter projects get funded

pros: *just do it*
don't need to fit the pattern of typical venture funding

cons:
don't need to fit the pattern of typical venture funding

75% of hardware/design projects don't complete on time

And Finally

coming up...

Thursday 7 PM: product naming

Friday
30 minute design review with each team
not make-work

Monday, December 3 at 7 PM: product costing

11/27

2.009

Lab #12: Week of November 26

objective, preparation, what's due, activities, other notes

Main Lab Objective
The focus of the lab this week is to organize and prepare for the final public presentation, which is on December 12. An overview of the final presentation was provided in class before Thanksgiving, along with a 3 minute compendium from 2011 (mov).

Key areas to focus on are both the prototype and final presentation design. Please do not underestimate the importance of preparing and practicing for the final presentation.

Advanced preparation for Lab #12
individual preparation:
Prepare a short, well organized status report on the tasks you have been working on.

officer preparation:
Financial officers should prepare a budget status report for the team.

System integrators should form an agenda, including a review of project status and a plan for what needs to be done. Plan to spend a good portion of the lab working.

The final presentation includes both a team booth for the reception and a formal presentation. The scope of the presentation ranges from the product and it's technical design to customer needs, benchmarking, and a plan for how it could reach its potential market. The design and execution of the presentation is an important component of the grade.

What's due
Your instructors will check your physical design notebook during lab. There are no digital submissions this week.

Recommended Lab #12 Activities
Follow the standard lab startup.

System integrators should present the agenda and make changes based on input from the team.

Financial officers should give a short budget update to the team.

If all of the team did not have a chance to discuss feedback from the technical review before the holiday, take a few minutes to bring everybody up to speed.

Review your team's work plan proposed by the system integrators.

Review the current status of the design with reports from different task forces.

Divide tasks and assign responsibility for prototype and presentation issues that need to be addressed and start working as soon as possible.

Work!

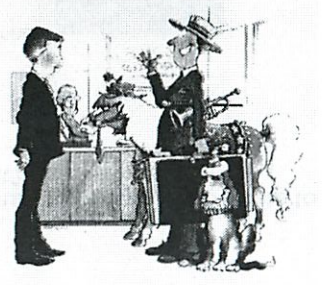
Other notes
The course instructor will be scheduling 30 minute meeting for this Friday with each team. The goal will be to discuss/review your prototype design and also briefly review your presentation plans. You do not need to explicitly prepare materials for this review, but you will need to be able to show your final design.

Remember that there is a presentation practice session the Friday before the final presentation.

2.009 product engineering processes

one hour of preparation for each minute of presentation

Wayne Burgraff, 18th century American philosopher



do ever refer to specific slides
on the website?

TAP DECK

do you download notes
from the website after lectures?

TAP DECK

L28 Presentation Design

A new tool

Vahe Taamazyan, SkolTech/MIT student, Energy Science
Petya Kaplunovich, MIT student, Mechanical Engineering
Nikita Rodichenko, SkolTech/MIT student, Computer Science

TAP DECK

11/28

How to use it

1. Go to tapdeck.co/qwe
2. Enter your e-mail
3. Tap "Add slide" to save current slide for later
4. Get the slides in your inbox after the lecture

TAP DECK

2.009 Product engineering processes

today

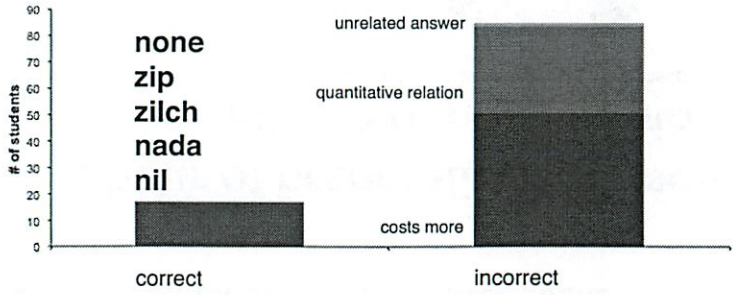
presentation structure the story

graphic layout design make it clear

reference: "The Presentation Design Book", Ventana Press

But first...

how does the cost of building your alpha prototype relate to the product's manufacturing cost?



But first...

updates

presentation invitations go out this afternoon, feel free to invite

extra shop hours on website

product naming tutorial: Thursday 7 PM, details on website

finding presentation images: Friday 4 PM, details on website

design review/updates: this Friday 1-5 PM, 30 minutes per team. I'll email you when scheduling tool is posted.

final presentation practice sessions: Friday (Dec 7) 5-9 PM. 30 minutes per team. I will be posting a scheduling tool.

And now...

a mini quiz!

how does the cost of building your alpha prototype relate to the product's manufacturing cost?

what does net present value mean?

what does return on investment mean?

estimate your personal, real, financial discount rate for one year. (include your rationale for the estimate)

list three key take-away points for a business case

Business Proposal

Important take away messages

We have an attractive market

market size $, and 3-year growth rate
profitability and/or other killer benefits

We have a competitive product

what makes the product different
what are its unique benefits

We have a viable business

IRR xx% with initial investment of $ xx
break-even at units in xx months
reach steady state in yy months

Presentation design

another product design problem

determine needs and set key specifications

generate presentation concepts (story)

detailed layout design (graphic design)

Presentation structure

telling a story using visual aids

overview

introduction

body (in chapters!)

conclusion

no one can remember more than three points

Philip Crosby, Pioneer of quality management

early on ...what is your product and its core benefit?

what is your presentation's take home message?

Presentation structure

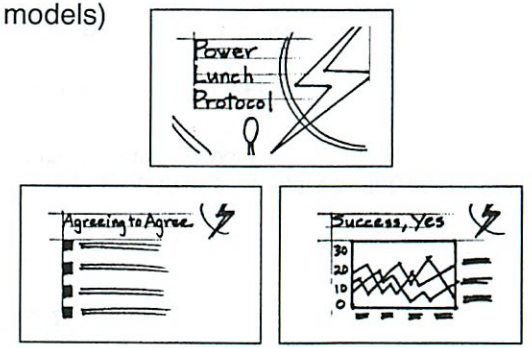
typical story telling tools...

prototype
physical props
music/sounds
computer animations
video (recorded or live)
role playing
team members and audience

Presentation structure

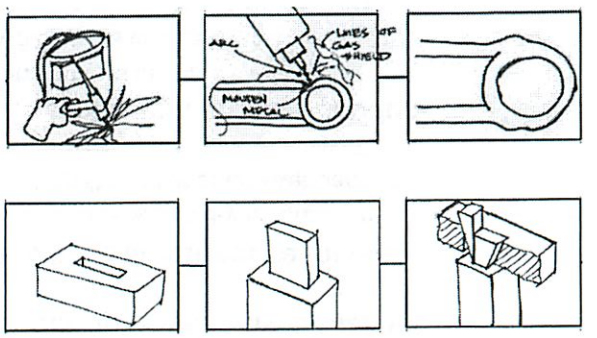
develop the story: idea phase

thumbnail sketches of key presentation 'highlight frames'
(sketch models)



Presentation structure

thumbnails: movies, animation, user experience

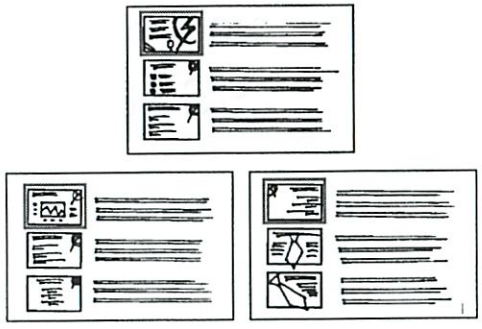


Presentation structure

concept development phase

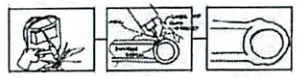
after establishing 'key frames'...

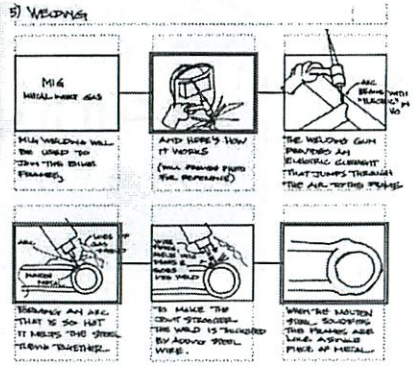
develop storyboards (mockup phase)



Presentation structure

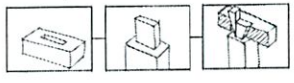
storyboards: movies, animation, user experience

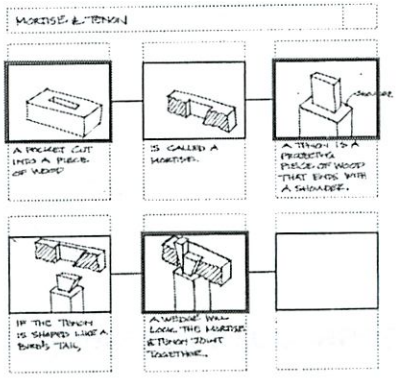




Presentation structure

storyboards: movies, animation, user experience





Presentation structure

Use storyboards to...

get feedback from your team
craft your story (not a mystery)
make sure the 'key frames' will work as a whole
make sure that main points dominate (product)
balance between importance, complexity, understandability
resolve presentation pace, flow and shifts
keep audience focused
test presentation design (out loud and with others)
allocate tasks (clearly identifiable parts)

better results, less time

2.009 Product engineering processes

presentation design

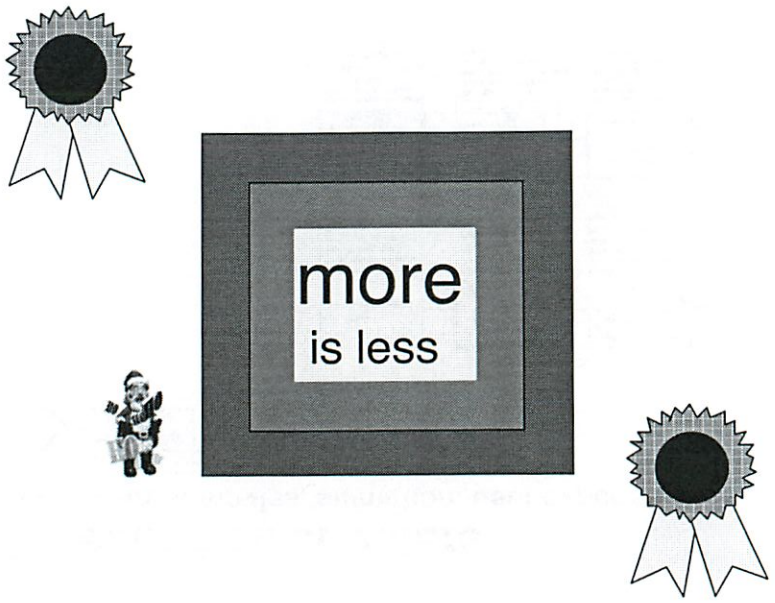
developing a presentation structure

graphic layout design

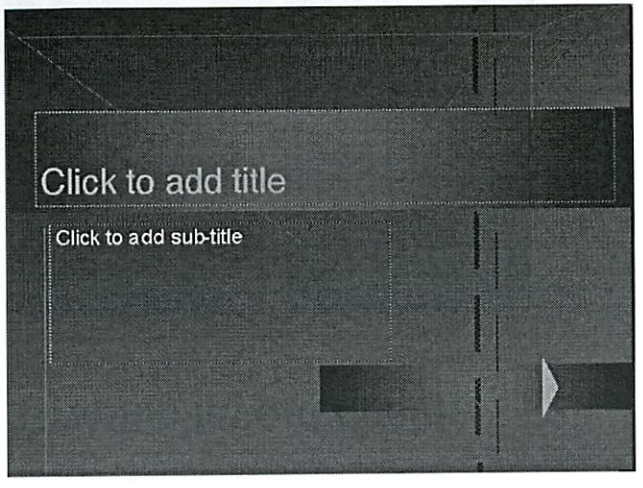
use of color

common mistakes

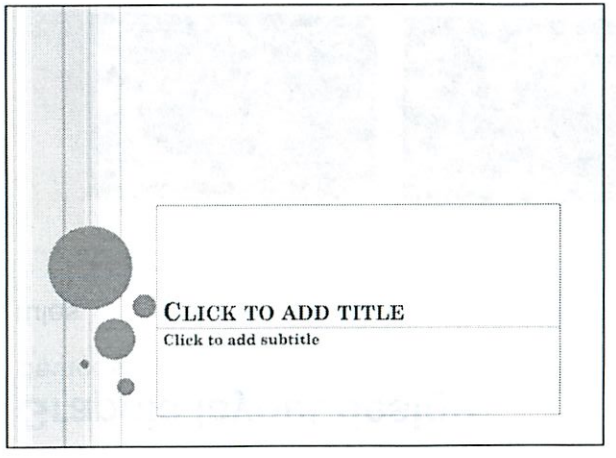
less
is more



Graphical noise
example



Graphical noise
example



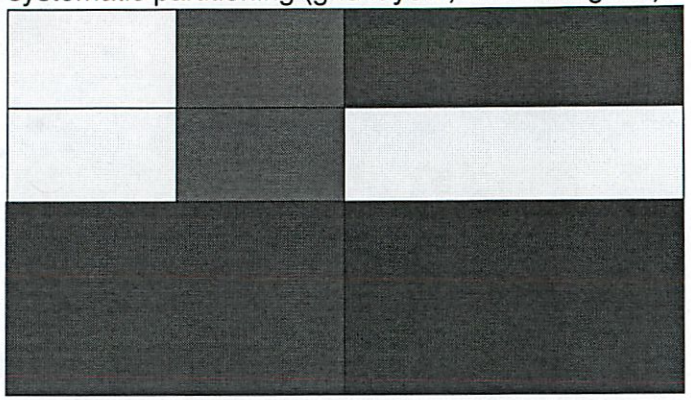
Graphical noise
example

Graphical noise
example

Graphical noise
example

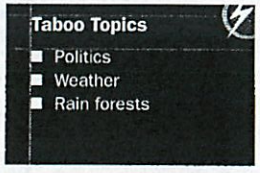
Graphic layout design
detail design phase

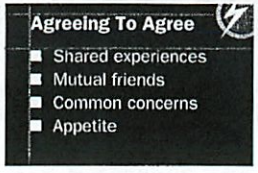
systematic partitioning (grid layout, or blocking out)

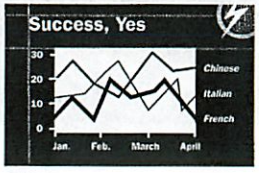


Not just for your slides! … your entire presentation presence

Graphic layout design
use grid structure consistently

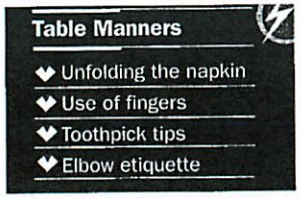


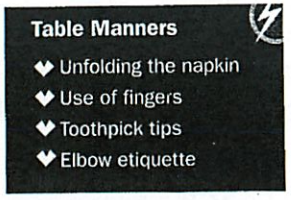




Graphic layout design
devices

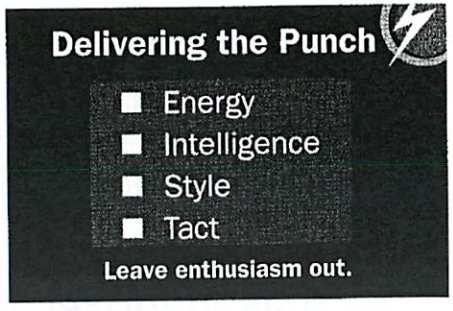
rules





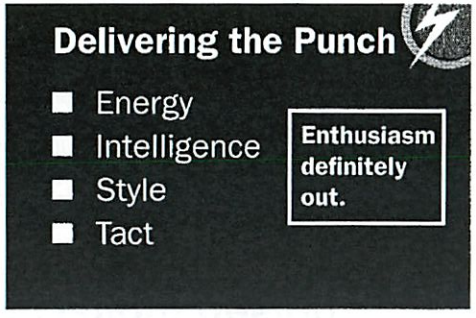
Graphic layout design
devices

boxes



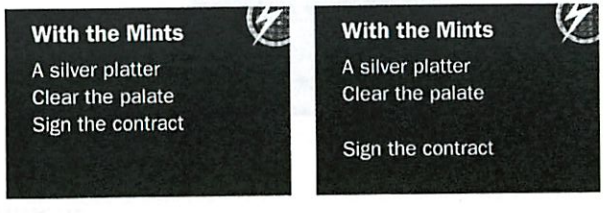
Graphic layout design
devices

borders



Graphic layout design
devices

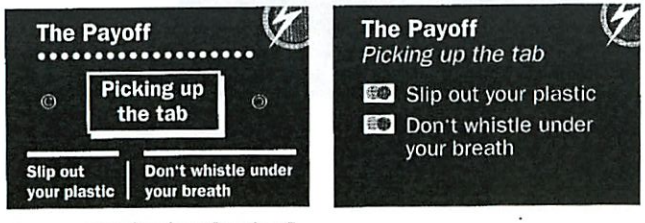
open spaces



gestalt grouping laws, product form lecture

Graphic layout design
devices

less is more!



confusing? why?

Graphic layout design
alignment

Graphic layout design
justification

Graphic layout design
type (word recognition)

I CDNUOLT BLVEIEE TAHT I CLUOD AULACLTY UESDNATNRD WAHT I WAS RDANIEG THE PHAONMNEAL PWEOR OF THE HMUAN MNID! AOCCDRNIG TO A RSCHEEARCH AT CMABRIGDE UINERVTISY, IT DEOSN'T MTTAER INWAHT OREDR THE LTTEERS IN A WROD ARE, THE OLNY IPRMOATNT TIHNG IS TAHT THE FRIST AND LSAT LTTEER BE IN THE RGHIT PCLAE. THE RSET CAN BE A TAOTL MSES AND YOU CAN SITLL RAED IT WOUTHIT A PORBELM. TIHS IS BCUSEAE THE HUAMN MNID DEOS NOT RAED ERVEY LTETER BY ISTLEF, BUT THE WROD AS A WLOHE.

I cdnuolt blveiee taht I cluod aulaclty uesdnatnrd waht I was rdanieg The phaonmneal pweor of the hmuan mnid! Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer inwaht oredr the ltteers in a wrod are, the olny iprmoatnt tihng is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

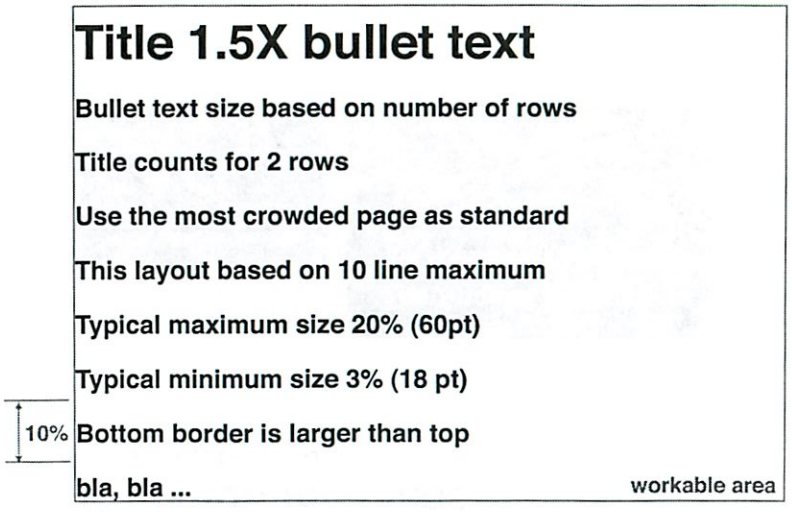
Graphic layout design
type (sans serif and serif)

Guidelines are very useful and convenient design aids. However, in the DFX paradigm interactions between different life-cycle objectives become critically important. Thus, in our opinion, selection of appropriate design guidelines can become extremely context sensitive and complex. Blindly following guidelines may lead to inferior designs because more appropriate general solutions are overlooked.

Guidelines are very useful and convenient design aids. However, in the DFX paradigm interactions between different life-cycle objectives become critically important. Thus, in our opinion, selection of appropriate design guidelines can become extremely context sensitive and complex. Blindly following guidelines may lead to inferior designs because more appropriate general solutions are overlooked.

Graphic layout design
text line length

a long line is difficult to read, so try to keep it short



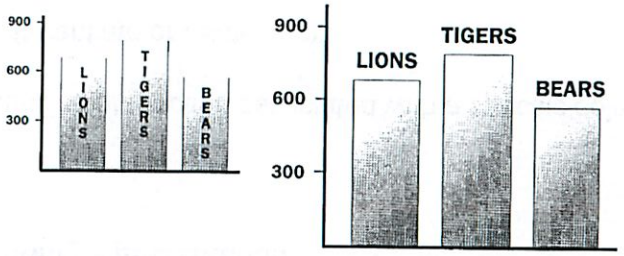
Use of color
coding a presentation

consistent function associated with a specific color

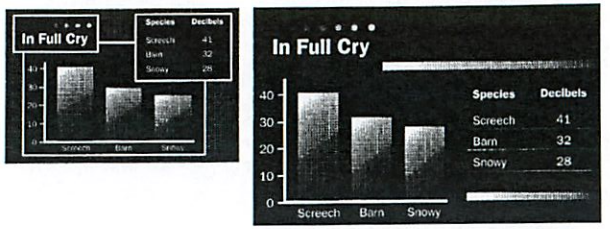
differentiate or relate items

Use of color
differentiate, prioritize

Common mistakes
type distortion

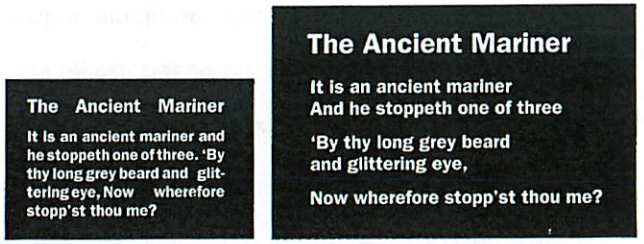


Common mistakes
too many elements



Common mistakes
competition with background

Common mistakes
unjust justification



Common mistakes
capital punishment

WISE FOWL
COPING WITH THE SUN

Wise Fowl
Coping with the Sun

Common mistakes
clip art cliche

12/4

2.009

Lab #13: Week of December 3: the final push

Main Lab Objective
This is your final lab meeting. The focus of the lab this week is to continue preparation for the final public presentation, which is on December 10.

Advanced preparation for Lab #13

Read about the practice sessions on Friday evening. While your presentation will not be in final form on Friday, your should have the full presentation structure and draft slides in place, including draft visuals. The actual presenters must be at the practice session. If your team is well prepared for the session, it will benefit from high-quality feedback. In the past, preparedness for the practice session has been a good indicator of how the team will do in the real thing.

Understand the general presentation requirements.

Understand the booth layout requirements.

Understand the detailed timeline for the day of the presentation.

Understand the timeline for course wrap up, starting with submiting presentation materials right after the presentations through the final week of class.

Recommended Lab #13 Activities
Make sure that someone is recording meeting minutes and will post the information for your team.

System integrators should present the agenda and make changes based on input from the team.

Financial officers should give a short budget update to the team.

Review the work plan proposed by the system integrators. Remember that there is a presentation practice session Friday.

Briefly review the current status of the prototypes and presentation design with reports from different task forces.

Work!

2009

12/5

L3| Presenting Data

The more you work the more luck you have

Far worse to use too many words

- Refine your message
  - to waffle

Final Presentation sold at

- I didn't get a ticket!

Presentation pratice

(skipping listening)

Reminds me of doing tech theatre

Clear focus for slides

- less is more

Class Goals

- process
- Significant social context
- Creative thinking
- Opportunity analysis

(7)

Very interesting chart on what people learned where!

How much do ya use each type of knowledge

(Interesting reversal of what I saw at MIT)

(Optimized on wrong thing?)

Vision test

Color wheel

Not as ~~cool~~ bright bg

Graphs

including context

try to tell the truth

log vs regular scale

Chart junk

adding natural death

(3)

Diff scales → tricky

What scale you pitch is tricky!!

esp when not same thing

Very decorative

Scimaphic graph

Stage Fright / Mics

lots of echo

120 ms

makes speech sound muddy (> 50ms)

drops off fast

inverse square

Unidirectional more complicated processes

12/5

Go w/ team to places ie conferences
Meet them there

I am a great believer in luck, and
I find the harder I work,
the more I have of it

Thomas Jefferson

"always remember that while it is wrong to use too few words, it is often far worse to use too many"

Milo: "I never knew words could be so confusing"

Tock: "only when you use a lot to say a little"

Norton Juster
the phantom toll booth

L31 Presenting Data

2.009 Product engineering processes
today

logistics hours leading to final presentation

goals what where we trying to accomplish?

presenting data avoid misleading messages?

2.009 Product engineering processes
but first

Final presentation is at capacity
Name cards give access prior to 7:15 and guaranteed seat
We will have standby ticket system, and displays in lobby
We will webcast on the course website

Final product name by tonight
(currently have red, yellow, orange)
Photoshop tutorial on Thursday, 7 PM in Pappalardo

12/5

Logistics
important web pages

Details are linked from 2.009 home page

- **final presentation practice session logistics**
  - http://web.mit.edu/2.009/www/assignments/FPSessionLogistics.html
- **final presentation logistics & detailed timeline**
  - http://web.mit.edu/2.009/www/assignments/FinalPresentationLogistics.html
- **course wrapup timeline**
  - http://web.mit.edu/2.009/www/schedule/WrapupSchedule.html

Read the details carefully. Ask questions if you don't understand anything.

Logistics
critical timeline to presentation

Friday, 4-9 PM: presentation practice sessions, 5-134

Schedule linked from the home page
No surrogate presenters

Sunday 2-6: communication staff are available to meet with you.
A scheduler will be posted on website.

Logistics
critical timeline to presentation

Monday: countdown to presentation

1:00-3:00 PM: presentation upload with TA, Pap. lab
4:00-6:00 PM: final AV run-through, no changes
presenters and projectionist's assistants, Kresge
15 min/team; come at scheduled time
5-6:00 PM: booth setup, Kresge foyer
(all coats, bags, supplies go in little theatre, name cards will be on your set)
6:00 PM: Pappalardo lab closes
7:00 PM: Discussion with orange presenters, backstage
7:15 PM: You MUST all be seated in your team area

Logistics
critical timeline to presentation

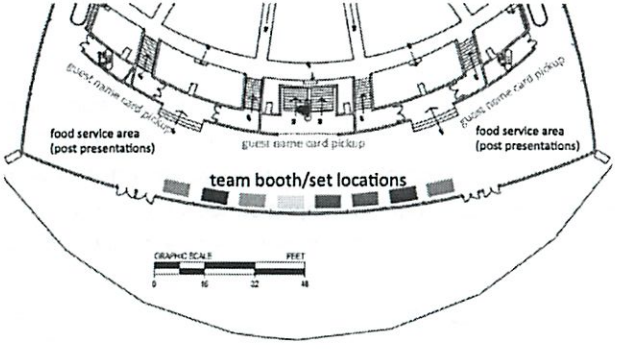
Monday: Final AV run-through (do not be late!)
Team presenter's & projectionist's assistants, Kresge onstage
4:00 orange team
4:15 blue team
4:30 red team
4:45 green team
5:00 yellow team
5:15 silver team
5:30 purple team
5:45 pink team
We never go to the stage from the auditorium. Always enter backstage.

Logistics
booth setup

Sunday, 7:00PM-midnight:
course staff moves sets to Kresge foyer

Monday, Dec 10
10AM-5PM: sets available for practice
mid-day: orange set moved onstage, blue set moved backstage
5:00-6:00 PM: final booth setup
complete setting up prototype and booth materials
pick up name tag in your booth area
coats and bags in Little Theater
6:00 PM: be ready to talk with guests
6:15 PM: standby tickets

Logistics
team booth/set locations



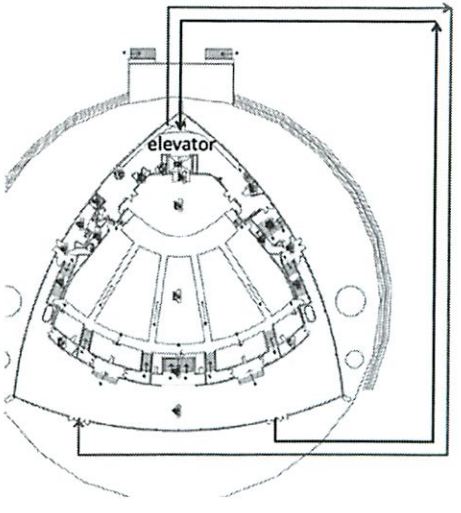
set descriptions

Logistics
presentation logistics

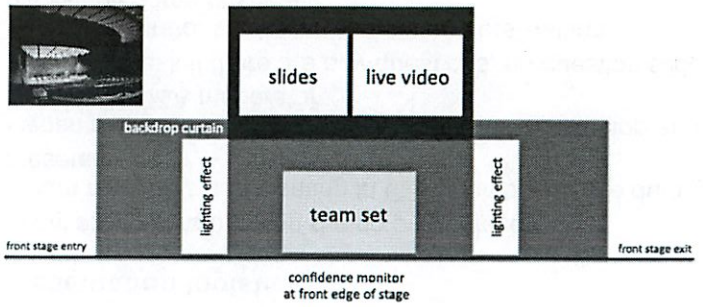
- only presenters onstage during presentation
- team members participating in Q&A wait backstage during presentation
- when presentation is finished, presenters should stop and look at the Q&A moderator
  - do not ask if there are any questions, no question slide
- Q&A moderator will let the team members waiting backstage come onstage
- Q&A moderator will moderate question session
- always enter stage from the backstage
  - go from seating area to backstage and back using prescribed route (same route as sets)
  - do not enter from the audience area

Logistics
Kresge foyer – backstage route

- **black**: route for moving set from foyer to backstage
- **red**: route for moving set from backstage to foyer
- course staff will assist teams in moving the sets
  - do not move your set without course staff assistance



Logistics
Stage setup



Logistics
live presentation logistics (by time viewpoint)

When Q&A starts for	Team presenters, set movers leave for foyer to move backstage*	Team Q&A participants leave for backstage
Orange	Red	Blue
Blue	Green	Red
Red	Yellow	Green
Green	Silver	Yellow
Yellow	Purple	Silver
Silver	Pink	Purple
Purple		Pink

* at this time, the team projectionist's assistant moves to sit near projectionist

Logistics
Orange and Blue-specific startup

7:00PM: Orange presenters meet me backstage to coordinate start
7:20PM: Orange presenters and Q&A participants backstage
7:20PM: Orange projectionist assistant sit with projectionist

7:20PM: Blue presenters report backstage
7:20PM: Blue projectionist assistants sit with projectionist

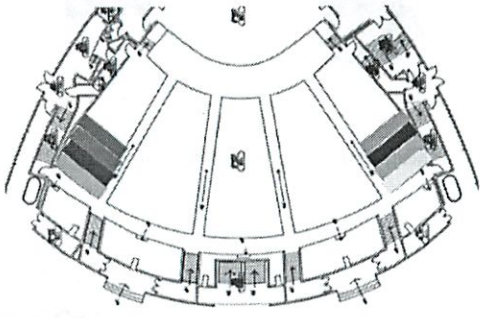
Hard to remember? Your team's logistics will be on the back of your name card

Logistics
When does your presentation start?

Your set will have been moved onstage in darkness
I will lead you out from backstage when music starts (in darkness)
When you are set I will leave front of stage
Stage lights come on
Your slides come on

Logistics
Seating

7:15 PM: all students seated in team area



Logistics
general considerations

Do not enter or leave Kresge seating area while another team is presenting

- watch on screen in lobby until team's presentation is over, then return to your seats

Be very quiet when backstage

- backstage is separated from onstage only by a curtain

Be very quiet in Kresge foyer during the presentations

- doors to auditorium will be open

Start moving backstage on-time! Wait for the moving team

- no elevator use or moving onto backstage during presentations

Logistics
after presentation timeline

Monday: after presentation

10:00 - 10:45PM: eat, talk to guests at booth

~10:45PM: Return materials to Pappalardo lab

Logistics
critical timeline for course wrap up

Tuesday 9 AM: submit final presentation materials (other than slides)

Wednesday

9:00 AM: final peer review, on-line class evaluation, due Saturday at noon

1-5 PM: feedback from guests available in lab

1 PM: submit design notebook in lab

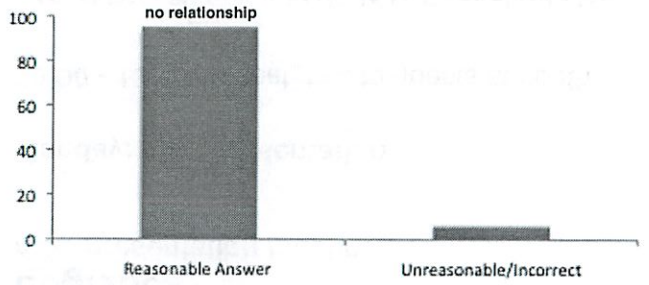
1:00-3:30 PM: lab cleanup, tool checkout

3:00 PM: 2.009 dinner

midnight: final timesheet, online notebook submission

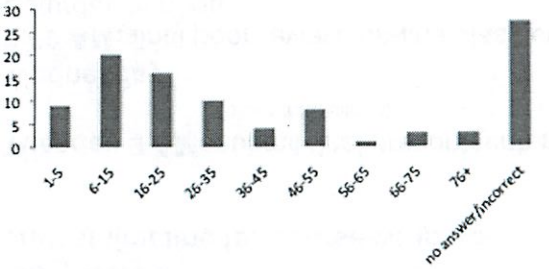
And now...

how does the cost of building your alpha prototype relate to the product's manufacturing cost?



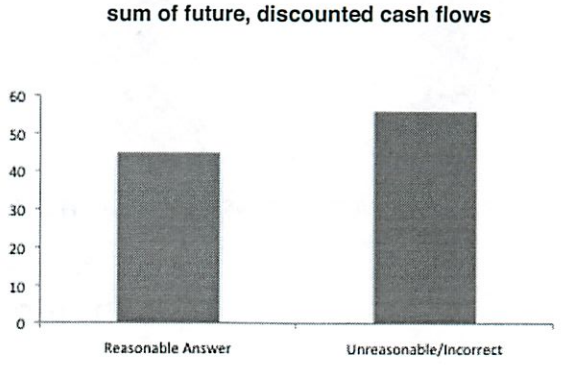
And now...

what is your personal discount rate for one year?



And now...

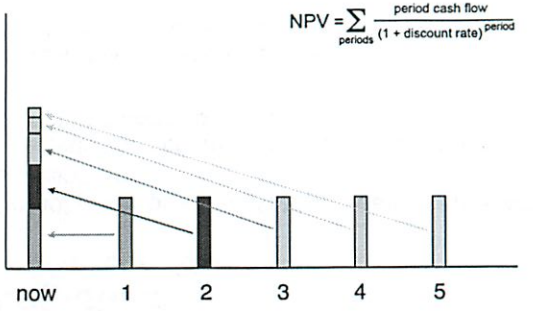
what does net present value mean?



And Now...

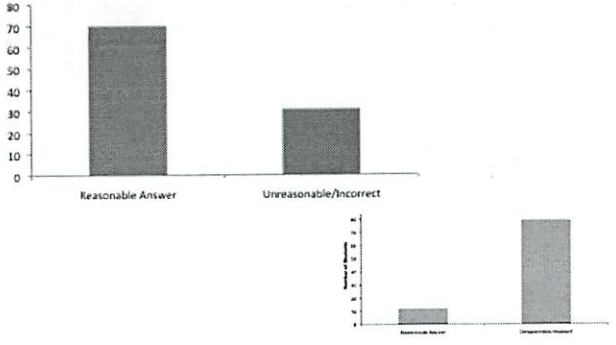
What does net present value mean?

sum of future, discounted cash flows



And now...
what does return on investment mean?

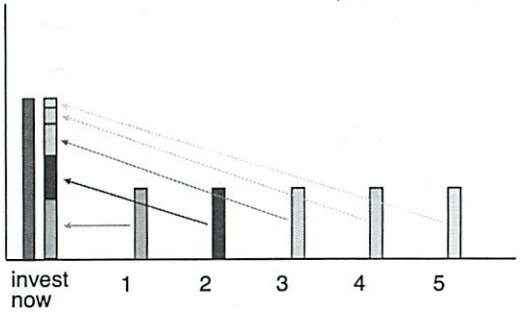
discount rate for
NPV to equal initial investment



And now...
what does return on investment mean?

what discount rate?

$$\text{up front investment} = \sum_{\text{periods}} \frac{\text{period cash flow}}{(1 + \text{discount rate})^{\text{period}}}$$



And now...
a final mini quiz!

Name on index card

to make a graphic/slide understandable you need to _____

and to keep in mind that

less is _____

2.009 Product engineering processes

class goals

develop an understanding of the engineering activities involved with designing a new product

develop an appreciation for the significance of societal contributions that can be made as a technological innovator. User driven design

your projects are real

2.009 Product engineering processes

class goals

improve creative-thinking capability and ability to identify the most significant opportunities

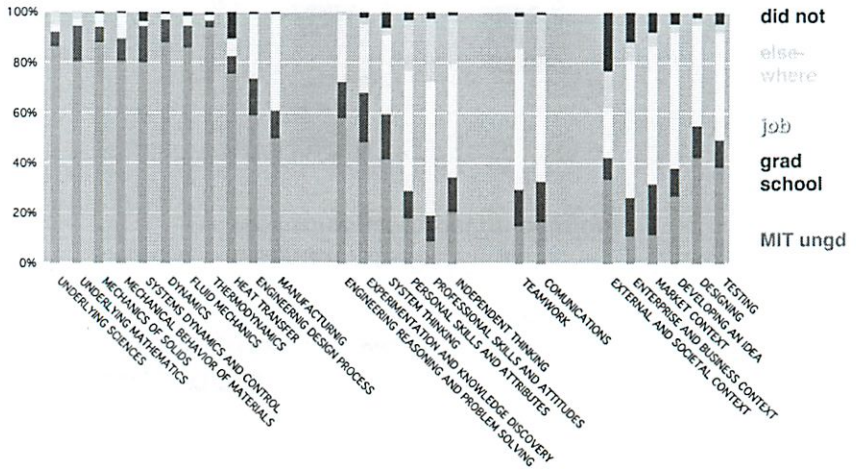
improve expertise in constructing models for reasoning about design alternatives. (estimation, sketch models, geometric models, mockups and prototypes)

improve engineering expertise and proficiency in building product models and prototypes

learn about and experience methods for working in large teams

improve presentation skills using a wide variety of media

I learned it at...



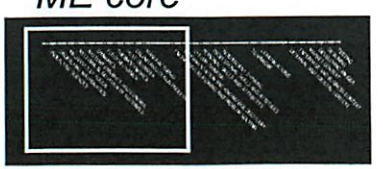
2.009 Class goals

different than typical class, but do they matter?

ME graduates, 1992-1996
Survey in 2004
Warren Seering

underlying sciences
underlying mathematics
mechanics of solids
mechanical behavior of materials
systems dynamics and control
dynamics
fluid mechanics
thermodynamics
heat transfer
engineering design process
manufacturing

ME core



engineering reasoning and problem solving

experimentation and knowledge discovery

system thinking

personal skills and attributes

professional skills and attitudes

independent thinking

teamwork

communications

professional skills

testing

designing

developing an idea

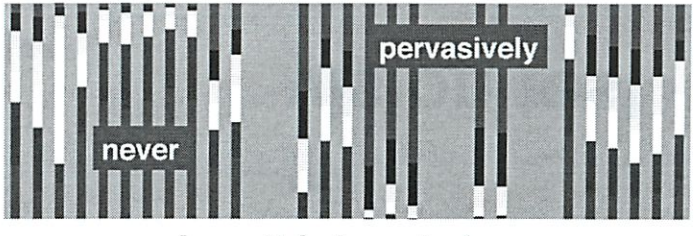
market context

business context

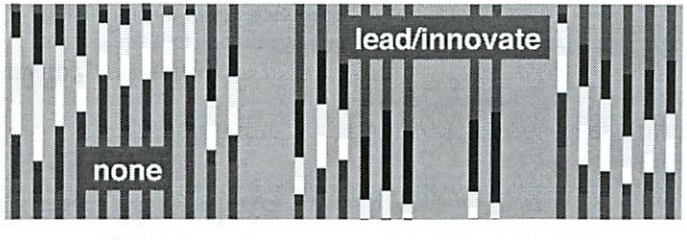
societal context

how and why

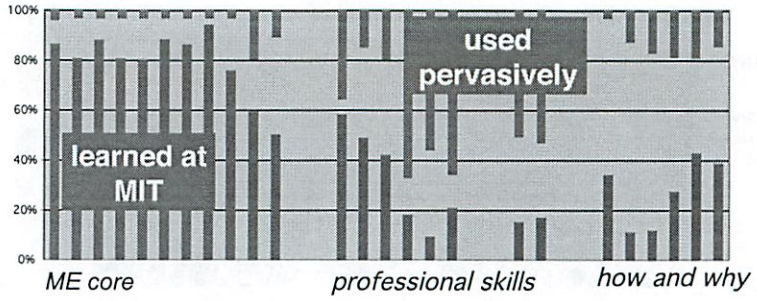
I learned it at...



I use this knowledge...



proficiency that was expected of me...



data consistent across gender and career paths
(engineering, management, consulting, other)

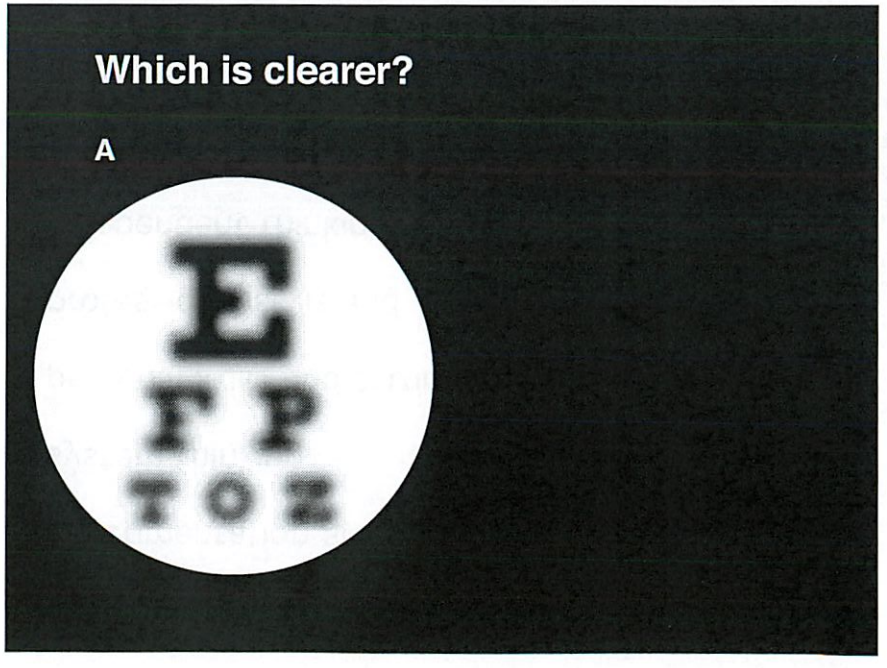
2.009 goals aim at several of the gaps

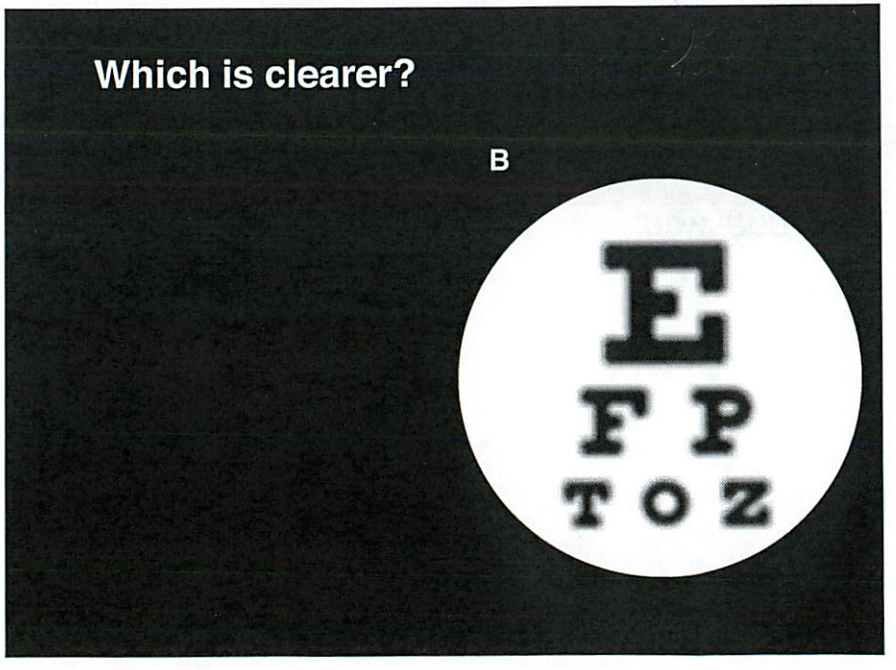
Presenting data
key questions

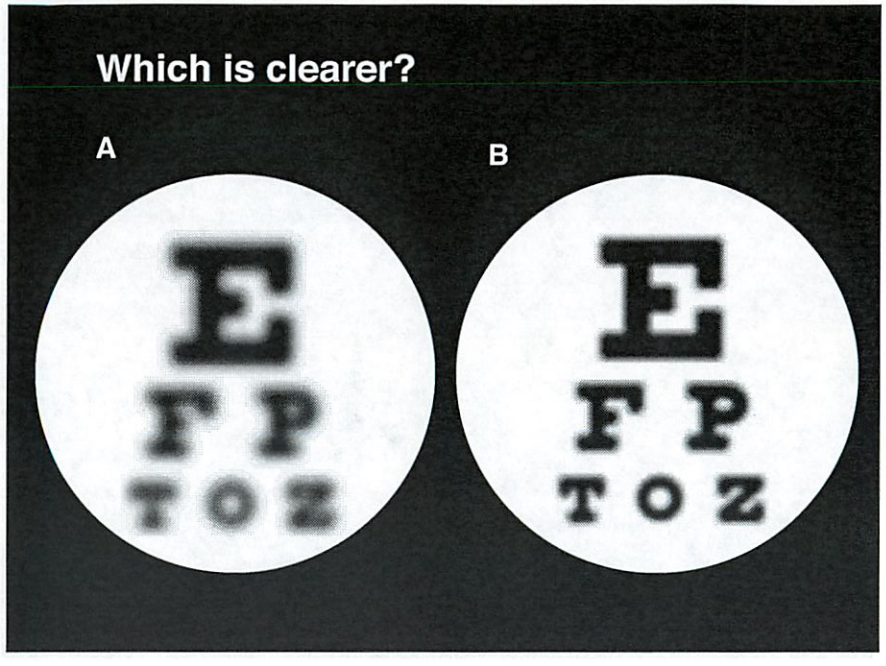
how to?

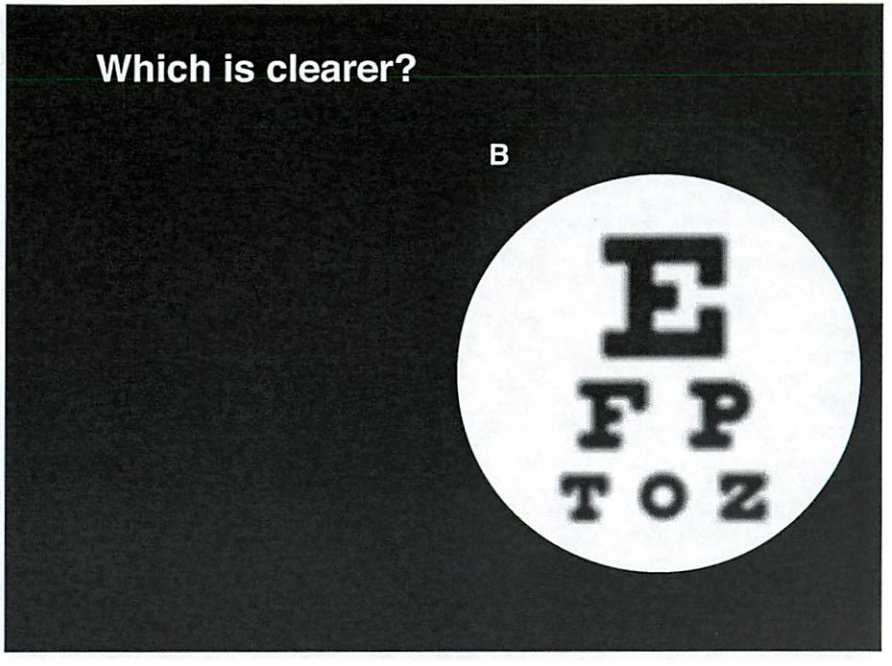
- convert abstract information into a visual representation
- make meaning easily accessible
- preserve the underlying meaning
- provide new/desired insight

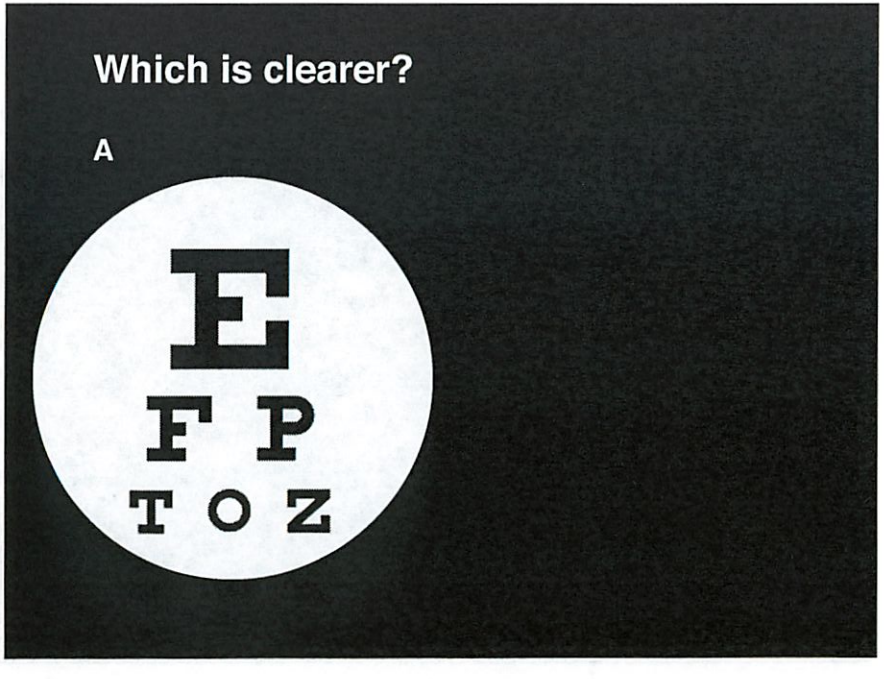
vision test

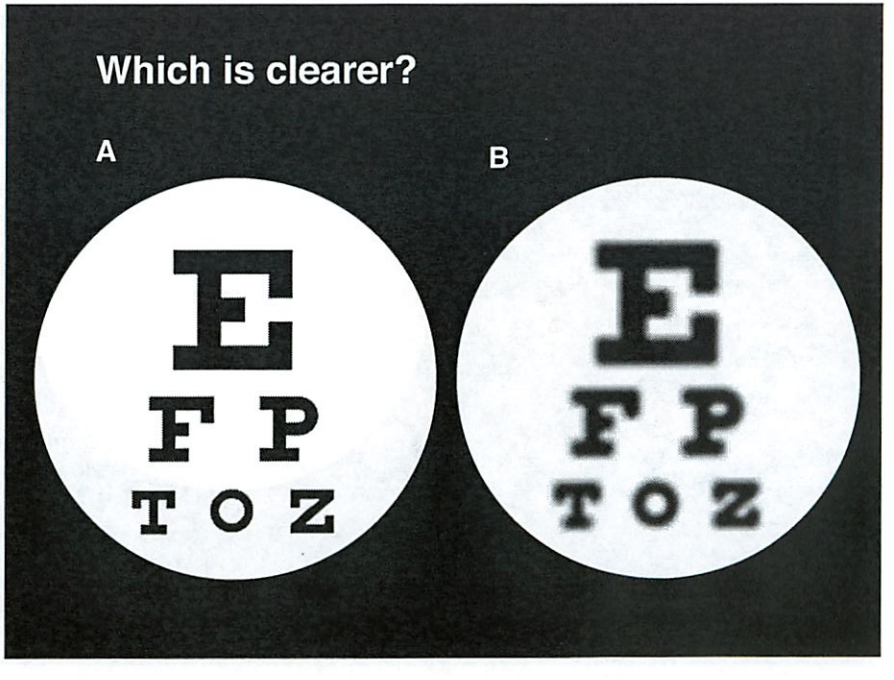





Which is clearer?
A
B
E
F P
T O Z
E
F P
T O Z


Which is clearer?
B
E
F P
T O Z


Which is clearer?
A
E
F P
T O Z


Which is clearer?
A
B
E
F P
T O Z
E
F P
T O Z

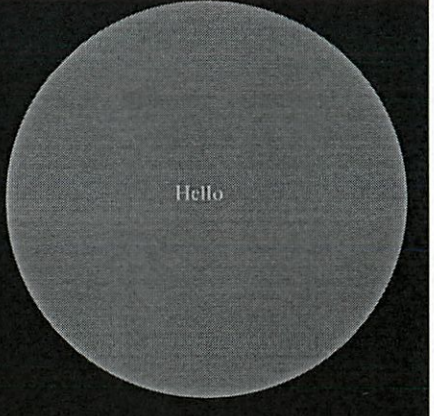
Which is clearer?

Which is clearer?

A

Which is clearer?

B



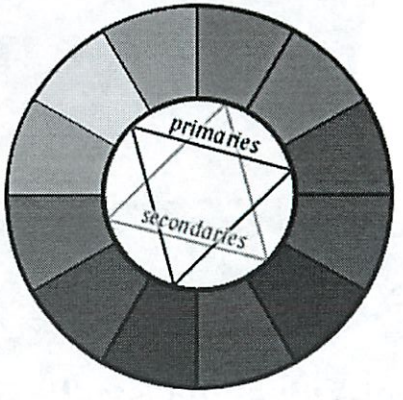
Which is clearer?

A

B

Color Wheel

Opposites sides are contrasting colors



Which is clearer?

A

Hello

Which is clearer?

B

Hello

Which is clearer?

A

Hello

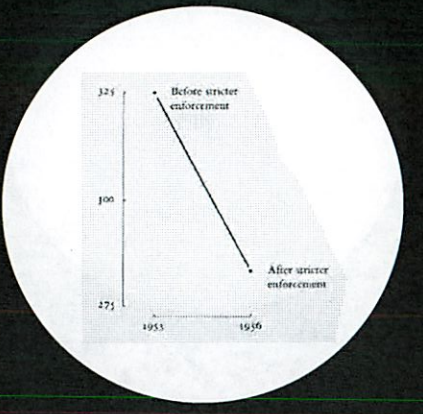
B

Hello

Traffic Deaths and Speeding

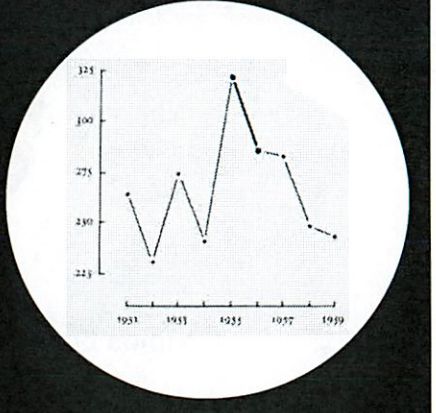
Traffic Deaths and Speeding

A



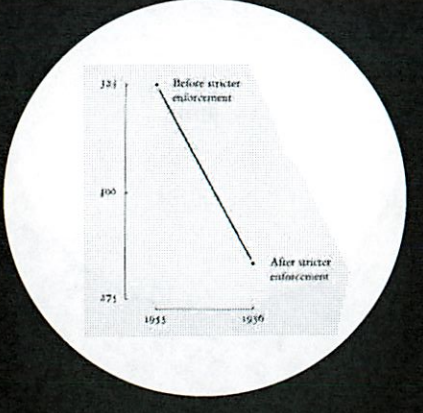
Traffic Deaths and Speeding

B

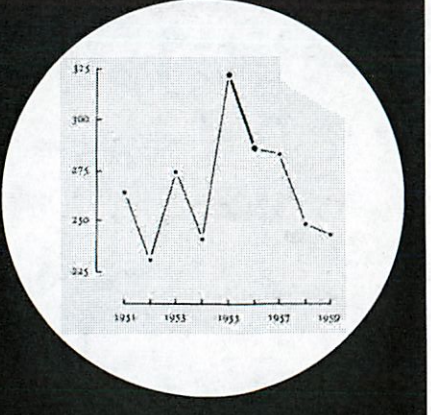


Traffic Deaths , Speeding and Trends

A



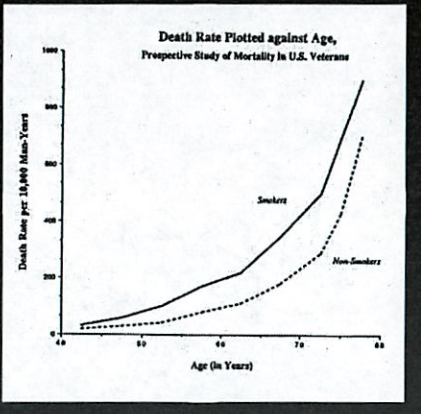
B



Variable relationships

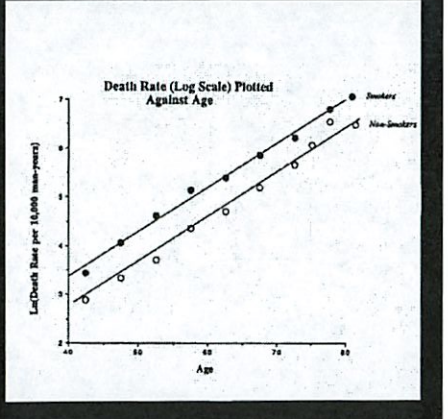
Variable relationships

A



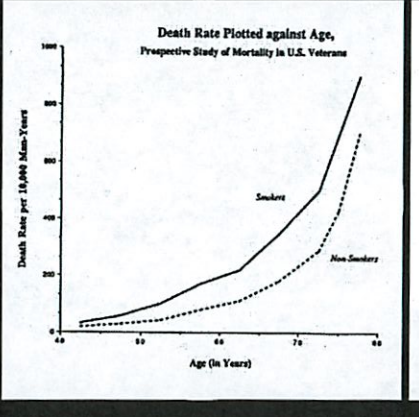
Variable relationships

B

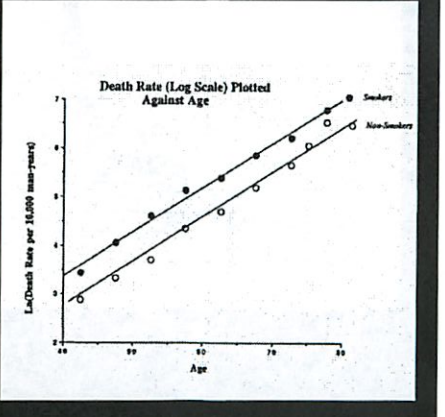


Variable relationships

A

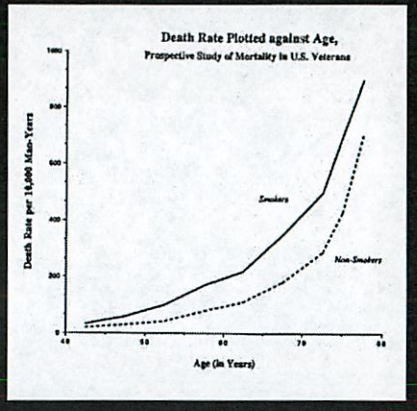


B



Variable relationships

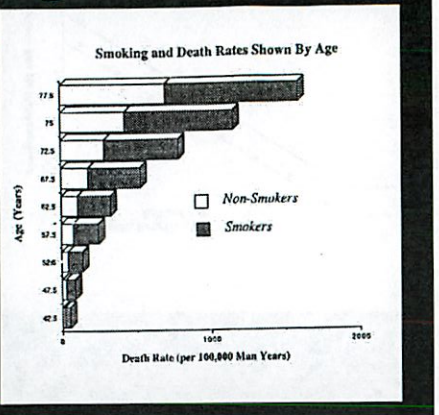
A



Variable relationships

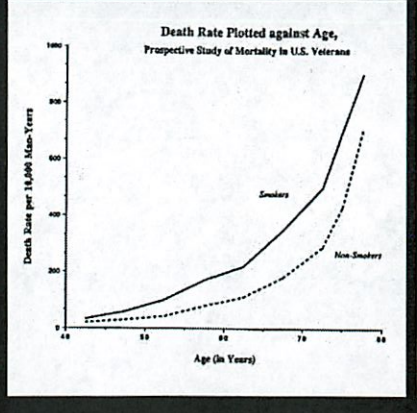
A

B

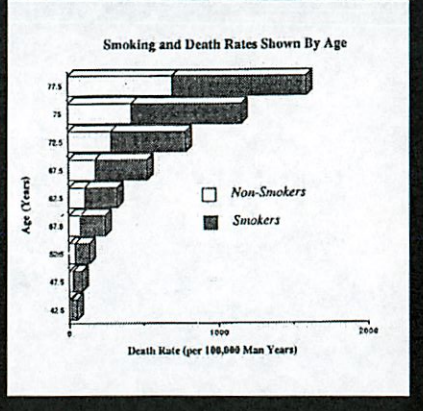


Variable relationships

A

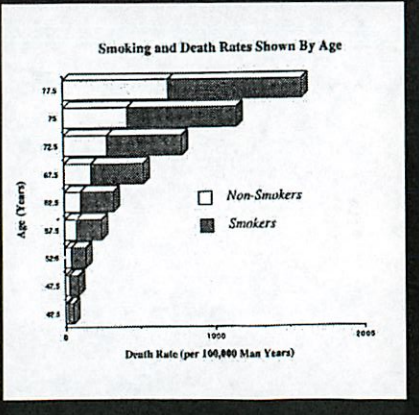


B



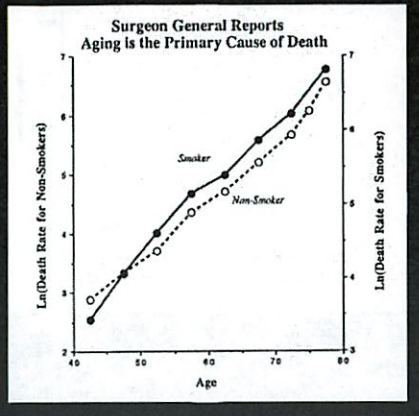
Variable relationships

B

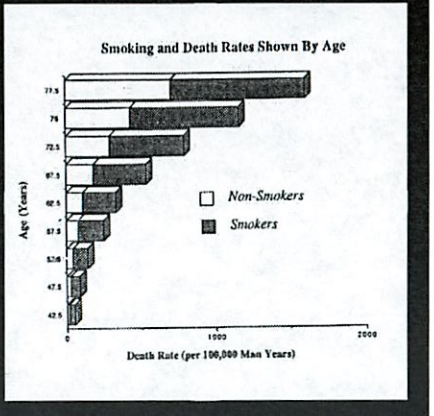


Variable relationships

A



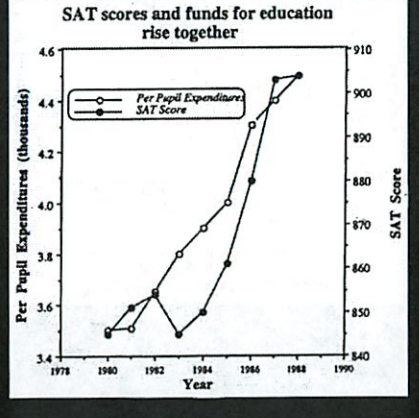
B



Trends

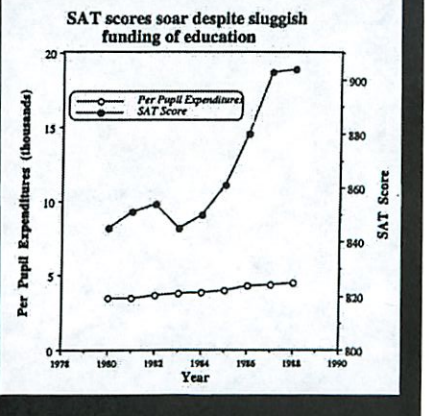
Trends

A



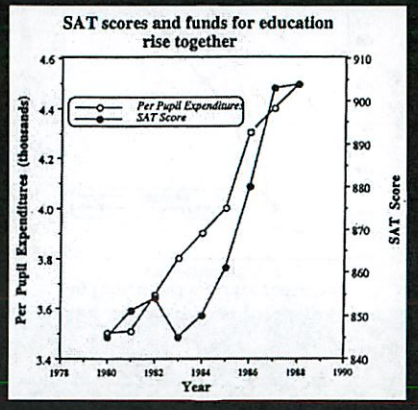
Trends

B

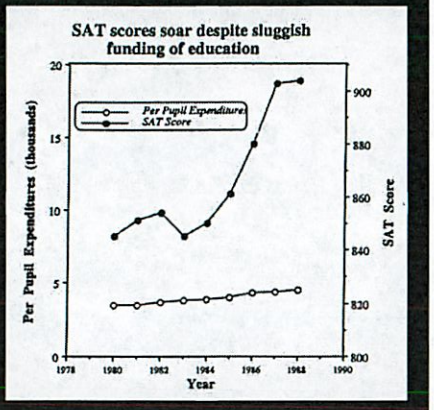


Trends

A



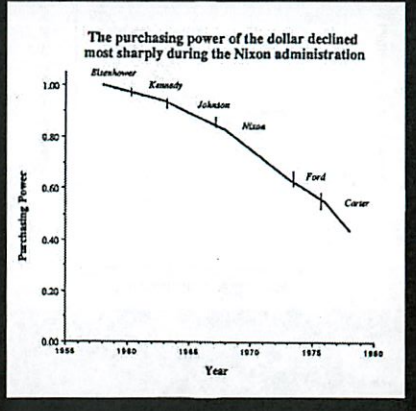
B



Scale of effect

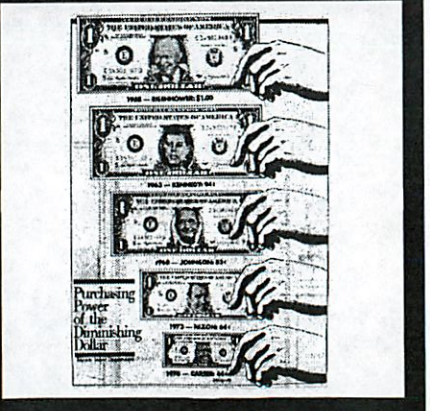
Scale of effect

A



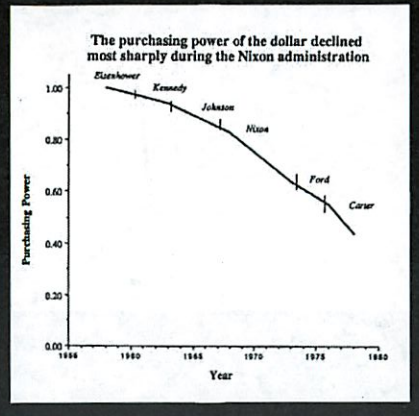
Scale of effect

B

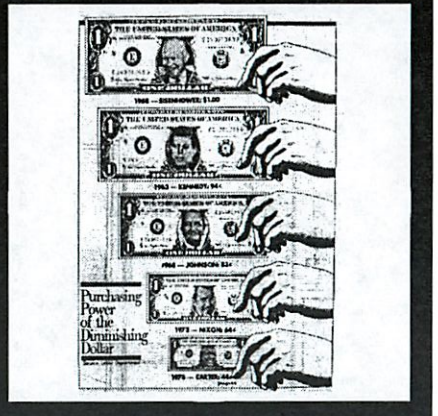


Scale of effect

A



B



Readability

Readability

A

Readability

B

Readability

A

Fast Track Appetizers

Escargot
$7.50

Shrimp Cocktail
$8.00

Tempura
$6.00

B

Fast Track Entrees

Salmon Steak
$19.95

Stuffed Trout
$18.00

Filet Mignon
$21.95

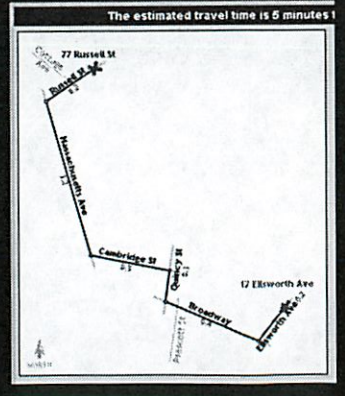
Multiple Viewpoints

Multiple Viewpoints

A

Multiple Viewpoints

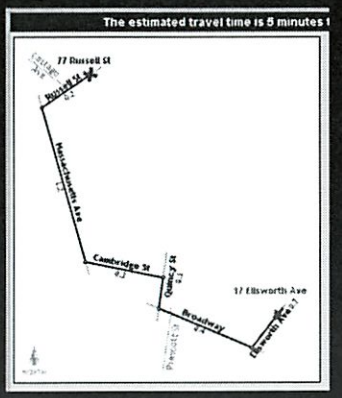
B



Multiple Viewpoints

A

B



Presenting data

Key questions

How to?

- Convert abstract information into a visual representation
- Preserve the underlying meaning
- Provide new/desired insight

Make meaning easily accessible: direct representations

Tufte, envisioning information
(details in of-interest section)

2.009

Home > Final presentation

Final Presentation

overview, detailed logistics and timeline, results

Overview

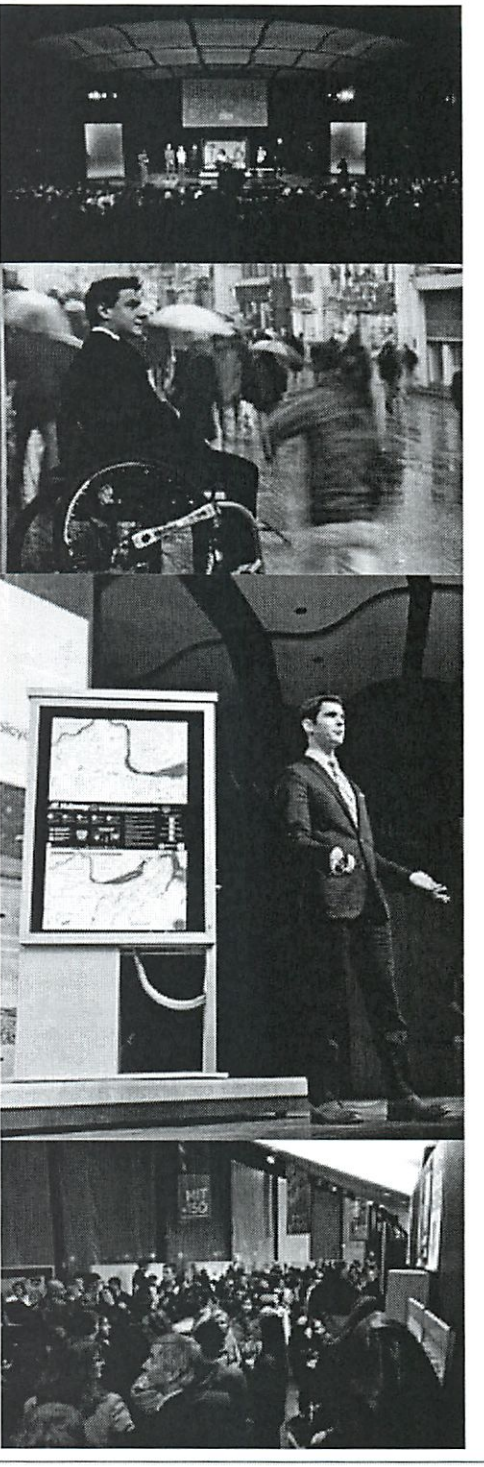
The final project milestone is a formal presentation that is attended by the entire class, all instructors, course sponsors, and guests from product development firms. There may be in excess of 1000 guests! It takes place during the evening on the date indicated in the class schedule and contributes to a portion of your shared team-wide grade.

The presentation provides each team with the opportunity to show their work to a wide audience that includes academics and industry representatives. It will help you learn how to prepare a polished technical presentation that is intended for a diverse, but educated, technical, non-technical, and business oriented audience. The presentation will also serve as a crowdsourced-funding launch event (such as kickstarter) for your product!

You will want to demonstrate your prototype and may present customer data, market information, specifications, or benchmarks for your product. The audience will evaluate your work. The evaluation form will ask them to rate the quality of your presentation, your product, and your customer data. This information will be provided to each team as feedback.

Examples from previous final presentations are on the right. You can also view final presentations from other years in the gallery (select a project and the final presentation will start playing automatically). The communication instructors have also prepared some final presentation pointers.

Please review the detailed presentation logistics carefully. See results of final presentation.



2.009

Home > Final presentation invitation

Final Presentation Invitation

The students and staff of MIT's 2.009 Product Engineering Processes class invite you to participate in the exciting launch of 8 new product prototypes, developed by student teams, all focused around the theme "outdoors".

Monday, December 10, 2012
MIT Kresge Auditorium
Presentations 7:30 PM sharp-10:00 PM
Reserved seating until 7:15PM

We already have enough RSVPs to fill Kresge Auditorium. Those who have RSVP'd already will have nametags and guaranteed seats until 7:15 pm. After 7:15, the auditorium will be made available for standby ticket holders.

If you have not yet RSVP'd and want to attend, we suggest that you arrive early to pick up a numbered standby ticket, which will be available at Kresge on a first-come, first-serve basis starting at 6:15 pm. As seats become available, we will use the standby tickets to determine admission order.

If your standby number has not been reached when the event begins, you may watch the event on video monitors in the Kresge lobby. In addition, the event will be webcast live. The link will be accessible from the course home page during the event.

You may still RSVP to be added to our invitation list for next year, but you will not be guaranteed a seat this year. Please RSVP, edit your name card information, and send a note to Professor Wallace (if you wish to) using the **RSVP link**. Also, you are enthusiastically encouraged to invite other colleagues, friends, and family by generating an invitation for them or adding them as your personal guests through the RSVP website.

During the presentations, guests are invited to review products and provide feedback to the student teams via forms provided at the event. This is a valued part of the educational experience. So, too, is the reception that follows in the Kresge lobby, where you can mingle with students and friends and try out the products at team booths.

We hope to see you there!

Sincerely,
The 2.009 lab instructors:
David Wallace, Danny Braunstein, Matt Duplessie, Tony Hu, Sangbae Kim, David Meeker, Peter Nielsen, Warren Seering, Juhan Sonin, Richard Wiesman, Amos Winter

Parking information:
The West Garage, at 125 Vassar Street, will be open for guest parking starting from 5 pm. The garage is close to Kresge Auditorium. The Kresge lot, adjoining the auditorium, is also available for people with special needs.

If you need further logistical assistance, please contact Chevalley Duhart.

2.009

Home > Final presentation > Logistics

Final Presentation Logistics

There are important changes to the booth setup and timeline. Please read carefully! Changes are in italics.

The final presentation will be from 7:30-10:00 PM in Kresge Auditorium on the date indicated in the course schedule.

There are a number of activities that need to be coordinated, so please review the **general information**, **booth setup** instructions, and the **detailed timeline** below carefully. In the timeline, note that there are run though times scheduled between 4-6 PM in the auditorium. Guests are arriving at 6 PM so the run thoughts cannot run late. Everything must be ready to go at 6 PM.

stage setup
seating plan
booth locations
path from foyer to backstage
presentation upload schedule
kresge run through schedule

General information

There are 8 minutes for each presentation, followed by a 5 minute discussion period and a maximum of 5 minutes for transition between teams.

The goal of the presentation is to display the merits of your design: the prototypes, key needs, technical innovation, how it could be realized as a product (simplified business case/development plan), and outstanding issues.

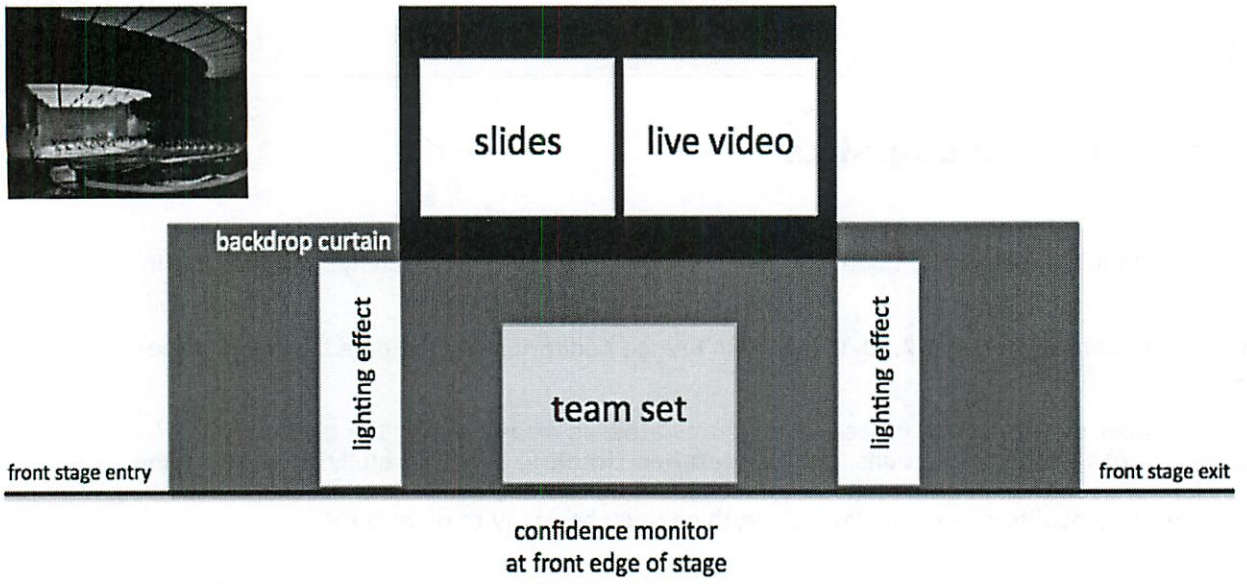
Guests will be provided with a **review form** to provide feedback. Your team's grade for the final presentation will be determined by your team instructors. Presentation design and execution is an important component of the review.

Video of prior presentations are in the course gallery. Presentations typically include elements such as product demonstrations, slides, video and animations. It is advisable to **show the product right at the start of the presentation**. A set of presentation tips has been prepared by the communications instructors. Some additional details about starting and ending your presentation are in the presentation portion of the setup timeline.

The presentation order is:

Orange	camp stove
Blue	bike rain protection
Red	camping pot
Green	bike navigation
Yellow	greens harvester
Silver	keg mover
Purple	rescue beacon
Pink	pail washer

Food will be provided during the reception after the presentations. Please see the timeline for details about what-needs-to-happen-when leading up to the presentation. A schematic of the stage setup is shown below.



Booth setup

Your team has a booth so that guests can see your products *after* the presentation and meet with you during the reception immediately following the presentations. The booths are located in the Kresge Auditorium foyer.

The team booth is centered around the stage set used for your presentation, and typically also includes a brochure. *When guests arrive before the program, your sets and prototypes will be backstage so that your presentation can have the element of surprise. This will also help us manage people arriving for standby tickets before the presentations. The lobby will be nicely decorated and spacious.*

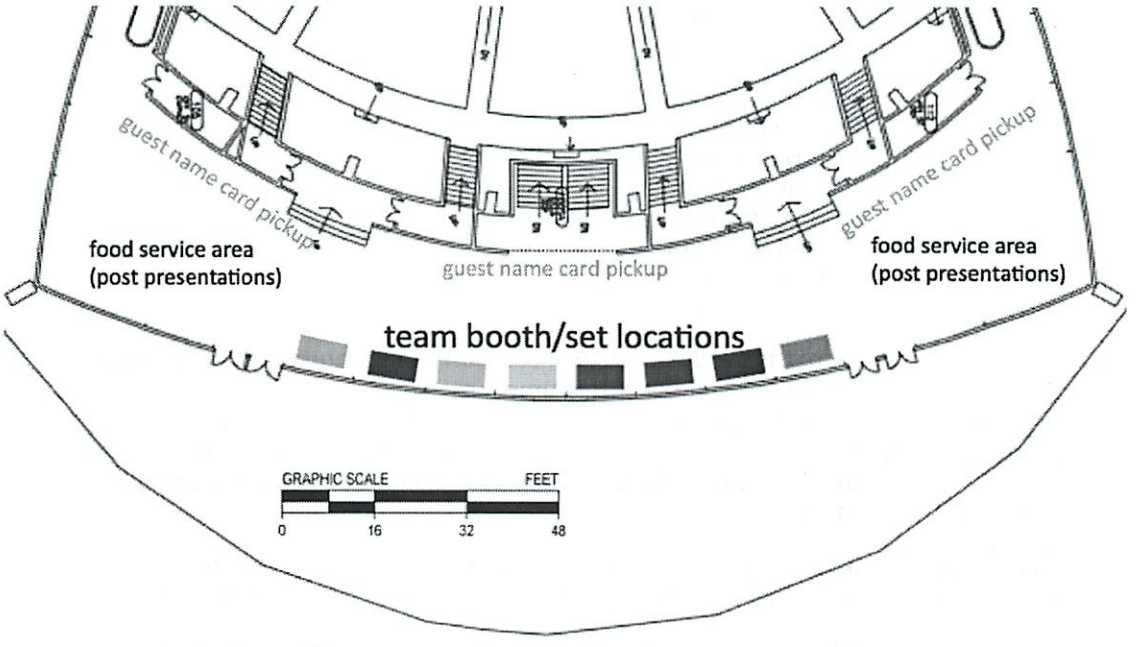
As soon as your presentation is over, your set and prototype will be transported to the foyer and set up in front of your team's banner. During the time that guests are arriving before the start of the program you should be wearing your name tag and mingling. You might want to hand out your brochures at this time as well. The communications staff have prepared guidelines for brochure design.

You will also pickup your nametags in your team area in Little Theater prior to 6 PM.

110 VAC outlets and spot lighting from above will be provided in the lobby for your booth. Please let the course instructor know if other special equipment will be needed. Water will not be available in the lobby. There is not room in the foyer for extra tables or posters or monitors.

Bags, coats, brochures before your set is in the foyer, and any other supplies or items must *not* be stored at the booth. Each team has a secure area in Little Theater for storage of such items.

The layout for the booths is shown below.



Timeline

Day and time	Activity	Notes
Friday, Dec. 7 **4:00-9:00 PM**	**Presentation practice sessions**	Please see the practice session logistics for details. We will be posting an online scheduling tool so that you can pick a 30 minute time slot that works for your team.
Sunday, Dec. 9 **7:30 PM**	**Set moving**	Course staff will move the team sets from Pappalardo lab to the Kresge Auditorium foyer. Prototypes should be tested in the set context prior to moving. Sets will be available in the Kresge foyer for practicing presentations *up until 3 PM. At 3 PM, all sets will be moved to the basement by the stage elevator.* Orange and blue team sets will move onstage mid-day Monday, as noted below.
Monday, Dec. 10 **1:00-3:00 PM**	**Presentation uploading**	The course TAs will be in the Pappalardo lab to upload the final version of your slides to the presentation computer. Please have a team member present that is familiar with the details of the presentation so that they can make sure everything is working correctly. Please arrive exactly on time because we must have all presentations loaded by 3:00 PM. You will be able to schedule your time slot for the upload period. The schedule is very tight so this cannot run late. *Presentations cannot be changed* after this time.
Monday, Dec. 10 **4:00-6:00 PM**	**Presentation run through**	Each team will run through their presentation on stage (less sets and prototypes). The actual presenters from each team must attend to make sure everything is working and become familiarized with the presentation setup. This is your chance to try out the microphones, slide remote, confidence monitor, and get used to being on the stage in Kresge. Additionally, each team must have a designated projectionist's

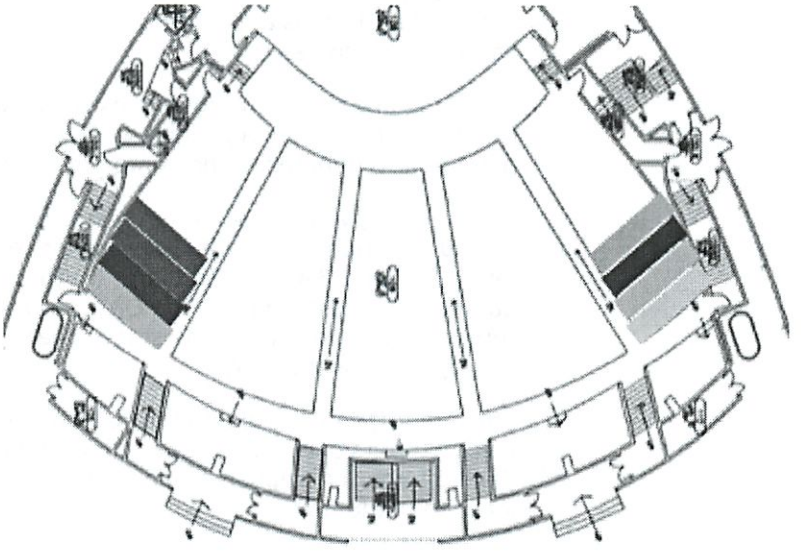
		assistant who will sit with the projectionist during the team's presentation to provide instructions about starting videos or other details. This person must also be at the practice session. *The run through schedule is:* 4:00 orange team 4:15 blue team 4:30 red team 4:45 green team 5:00 yellow team 5:15 silver team 5:30 purple team 5:45 pink team Do not be late! Guests will start arriving around 6:00 so practice cannot continue past this time.
Monday, Dec. 10 **5:00-6:00 PM**	***Moving prototypes to stage elevator, lobby preparation for guests***	*All prototypes and sets are staged in the basement by the elevator. Any other booth materials (such as brochures) and coats, bags are stored in Little Theater. You have picked up and are wearing your name tag.* If help is needed for planning how to move materials from Pappalardo please see Dick Fenner or the course instructor. ***The foyer must be cleared, with prorotypes and sets backstage by 6:00*** since guests will start showing up at this time. 6:15 PM is when standby tickets become available for this interested in attending but did not RSVP before the event was full. *Your name tag can be picked up at the at your team area in Little Theater. The timing for when presenters and Q&A participants report backstage will be on the back of your namecard.* *Please make sure that the lobby is clean and free of coats and other items. There will be an area for your team to store backpacks and coats, etc. in the Little Theater.* **Orange** team's set will be setup front stage since they will be presenting first. The orange team set must also be ready to go by 6:15 since the front stage should remain clear once guests begin arriving. **Blue** team, presenting second, will setup backstage, so that they are ready to roll out after red team's presentation. This also need to be ready by 6:00. Orange and blue, please do not bring your materials in through the auditorium to the front of stage. Staff will show you how to bring in your materials backstage.
Monday, Dec. 10 **6:00 PM**	**Pappalardo lab closes**	
Monday, Dec. 10 **7:00 PM**	**Orange team instructions**	Members of orange team that are presenting will meet the course instructor backstage to coordinate the beginning of the program.
Monday, Dec. 10 **7:20 PM**	**First two teams report backstage**	All presenters from orange and blue team must be backstage. Additionally, any team members from orange team that wish to participate in the Q&A should be backstage at this time (at no time during the presentations will people entering from the front of the stage). There will be a monitor backstage so you can watch the

presentations while you are waiting.

Monday, Dec. 10 **7:15 PM** **Students seated**

All students should be seated in their allocated area no later than 7:15 PM. After 7:15 standby admissions begin and you may have trouble keeping your seat if you are not in it.

Orange and blue team projectionist's assistants must report to the projectionist.



Monday, Dec. 10 **7:30-10:00 PM** **Presentations**

The presentations start at 7:30PM sharp. All students are expected attend the presentations. Please never enter or leave the room while another team is presenting.

When the Q&A period begins for the team *two presentations* prior to your presentation, *presenters and people needed to help load the set on the elevator must leave the auditorium for the foyer. Course staff will be in the foyer. You will meet with them and then leave for backstage either following the set moving path, or using the indoor route marked with signs.*

Your team's projectionist's assistant should also report to the projectionist at this time.

Times to leave the auditorium to move set backstage:
Red team: when Orange team's Q&A begins
Green team: when Blue team's Q&A begins
Yellow team: when Red team's Q&A begins
Silver team: when Green team's Q&A begins
Purple team: when Yellow team's Q&A begins
Pink team: when Silver team's Q&A begins

If a staff member comes at an earlier time saying it is time for you to head backstage, please go with them promptly.

The route for moving sets backstage is shown at the end of this section. Sets will only be moved in the elevator to and from backstage during the transition periods.

Once the set is backstage, only the people needed for the presentation may remain backstage. **It is really important to be quiet backstage since you are separated from the front stage only by a curtain.**

Students that will participate *only in the the Q&A* should leave the auditorium through the rear of the auditorium and proceed to the backstage, following the same route used to move the prototypes, when the Q&A prior to your team's presentation begins (*again remember that we will not have people entering stage from the front of the stage*).

When presenters arrive backstage they will be fitted with wireless microphones. When the 5 minute Q&A for the team ahead of you ends, course staff will help you roll your setup front stage through the entry side. There is a maximum of 5 minutes for setting up, and shorter is much better.

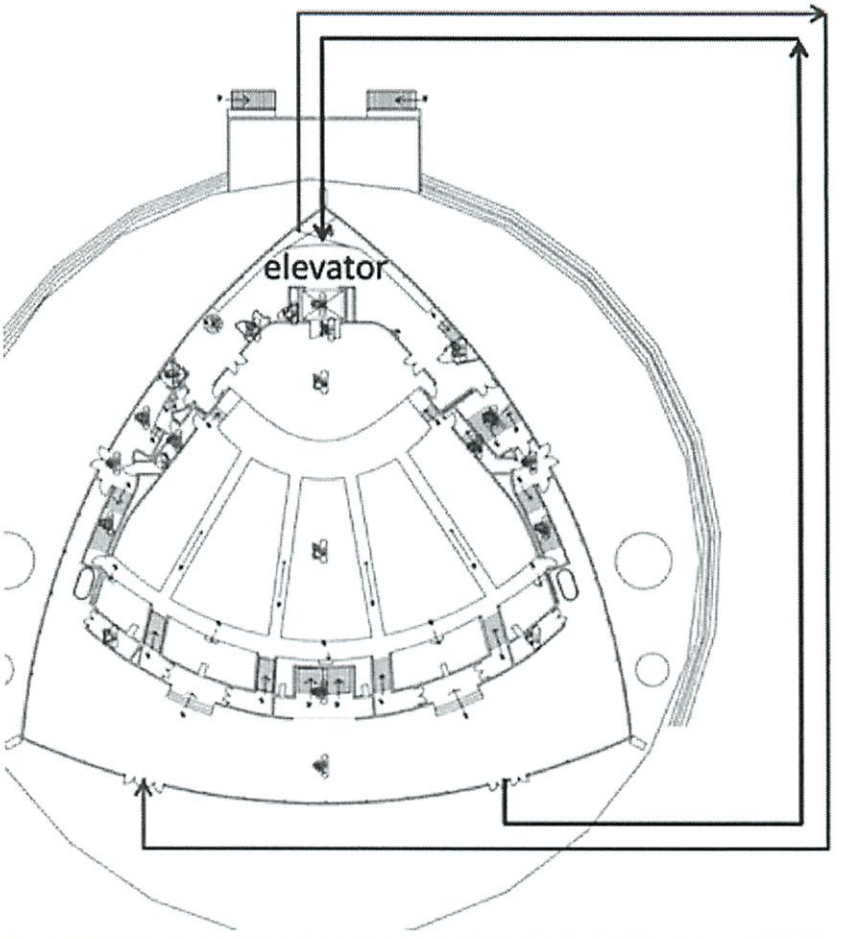
Once you are setup, the course instructor will check that everything is set, and then the stage lights and your slides will come on. At this point your 8 minutes for presentation begins.

When ending your presentation, please ***DO NOT*** **invite questions** or end on a questions slide. There is a question moderator that will introduce the Q&A for each team. If other team members are waiting backstage to participate in the Q&A, they should come onstage through the entry side of the stage. There will be an extra hand-held microphone for the Q&A.

After your Q&A ends and the transition period begins, course staff will help you roll your setup off stage through the exit side of the stage. Take off your microphones and return your materials to your booth location in the foyer.

Please setup your booth so that it is ready for the reception immediately after the presentations. Return back to the presentations as soon as possible, but please do not return to your seat when another team's presentation is in progress. Also, when in the foyer, you must be quiet so you do not disturb other presentations.

Pink presents last, and we will return your set to the foyer as quickly as possible so it is there for all but the first few minutes of the reception.



Monday, Dec. 10 **10:00 PM**	**Reception**	Be prepared to mingle with guests at your team booth area. Dinner will be available.
Monday, Dec. 10 **~10:45 PM**	**Return prototypes**	The Pappalardo lab will be opened so that prototypes can be returned. The exact return time will be based upon when most guests have left the reception. Team members need to help return their materials back to Pappalardo lab and help with cleanup. The final presentation video will be posted on the website Wednesday afternoon.

12/13

2.009

Course Wrap up Timeline and Course Dinner

The wrap up timeline covers activities on Tuesday and Wednesday (December 13 and 14) following the final presentation.

Day and time	Activity	Notes
Tues., 9 AM	**Deadline to submit final presentation materials**	Please upload all of your presentation materials (brochures, etc. We already have your slides) using the upload link we will provide on the home page. Please email the course instructor when the materials are uploaded. The final presentation materials will be posted on the website Wednesday afternoon, but the webcast is available immediately.
Wed., 9 AM - Sat., noon	**Peer review, staff evaluation, course survey**	Complete the final peer review and PTS evaluations. Instructions will be linked to the course home page. PTS evaluations close Friday
Wed., noon-5 PM	**Presentation feedback from guests**	Detailed presentation comments from guests will be available for review in the Pappalardo lab. Summaries will also be available on the final presentation results page.
Wed., 1-5 PM	**Design notebook submission and timesheet submission**	There will be a box for each section in the Pappalardo lab. Leave your design notebook in the appropriate box so that it can be graded. Also, please make you final digital notebook submission for your teammates to reference while completing the final peer review. Your final timesheet should be submitted electronically by midnight.
Wed., 1:00-3:30 PM	**Cleanup in Pappalardo lab**	Teams need to cleanup their work areas. Tool officers must have Steve sign off on their tool inventory. All materials abandoned in team areas will be discarded by shop staff. There will be tables setup for unused materials and tools purchased by the team during the term.
Wed., 3:00-5 PM	**Dinner!**	Dinner is available in the Pappalardo lab for all class members. The food will be good!

2.009

Home > Final presentation > Results

Results of Final Presentation

Congratulations to **all teams** on a job well done. Presentation night was wonderful with over 1200 guests in attendance and about 600 viewers for the webcast. Alll of your presentation materials (slides, brochures, etc.) and feedback forms will be available on Thursday.

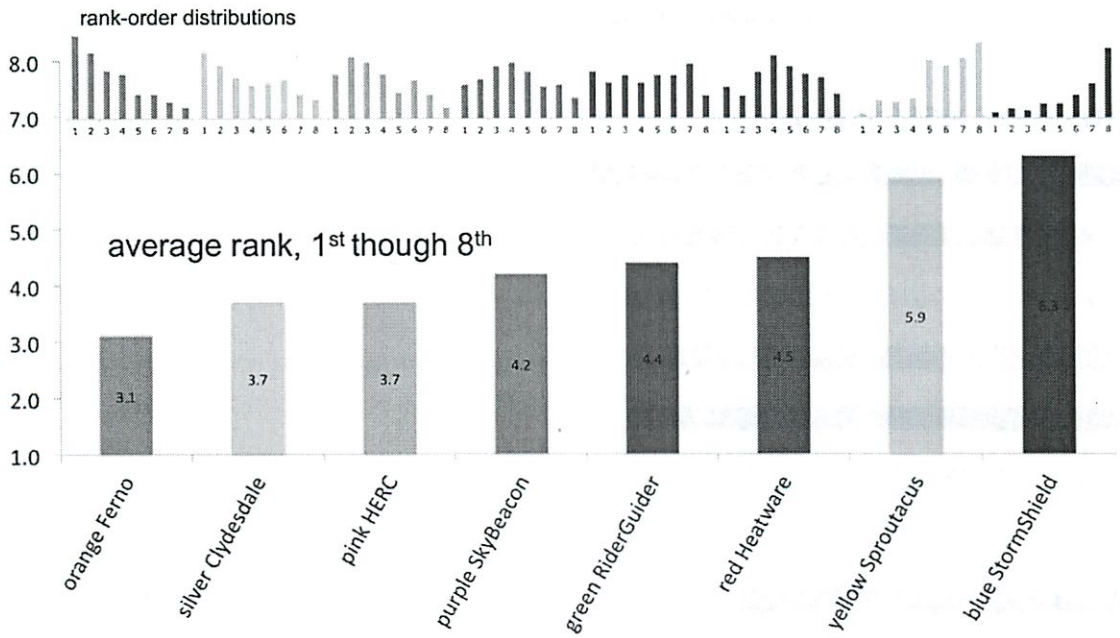
Up to 230 guests provided feedback on your presentations using the review form. **This is feedback only, not grades,** but it should be useful in helping to reflect upon aspects of the different presentations. The differences between the teams are very small.

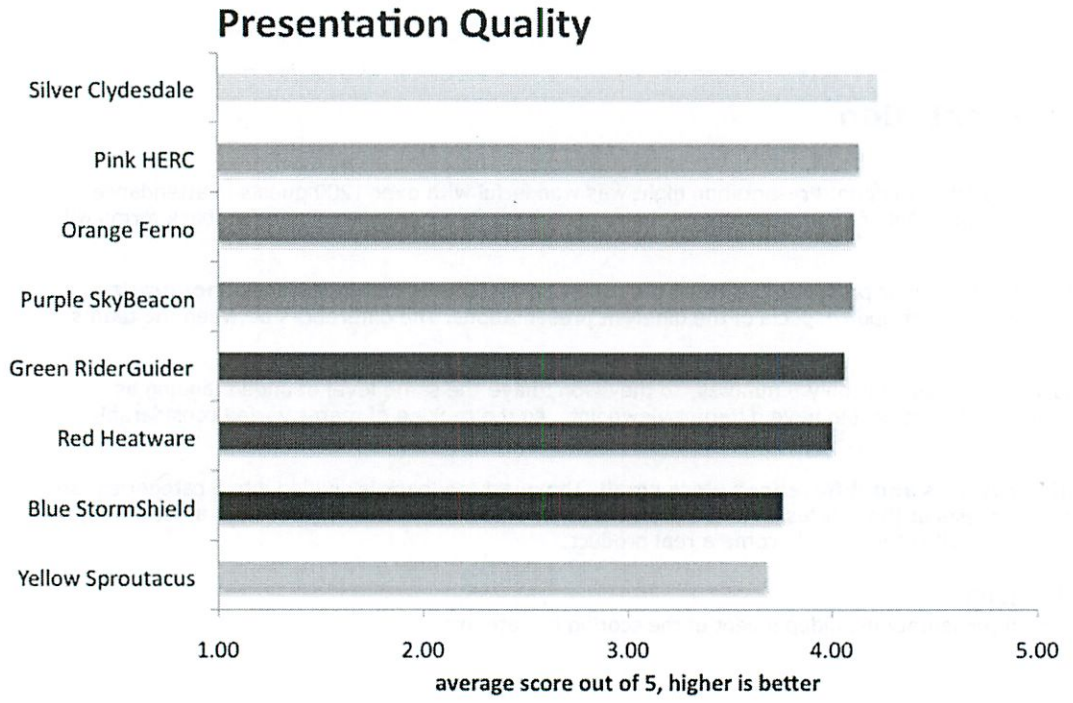
Remember the audience saw each product for only 8 minutes, so they won't have the same level of understanding as those involved in the class. Also, different people have different viewpoints, so the ranking of teams varied considerably from reviewer-to-reviewer.

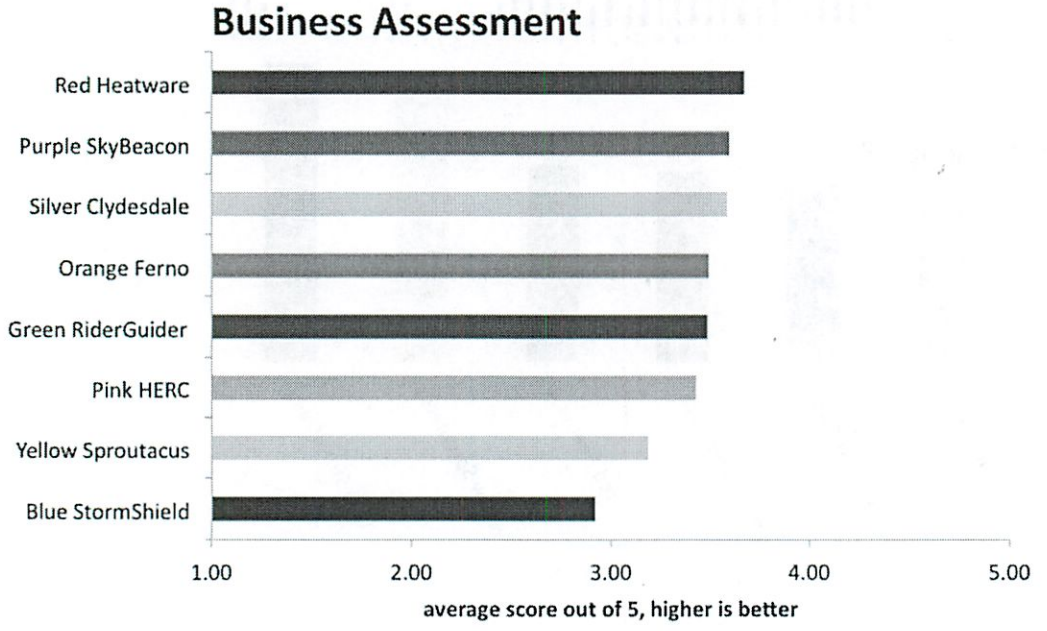
All teams received positive reviews and differences were small. The guest feedback is divided into 5 categories: an overall ranking assigned by the guests at the conclusion of the presentations; presentation quality; business assessment; technology, the prototype, and overall potential to become a real product.

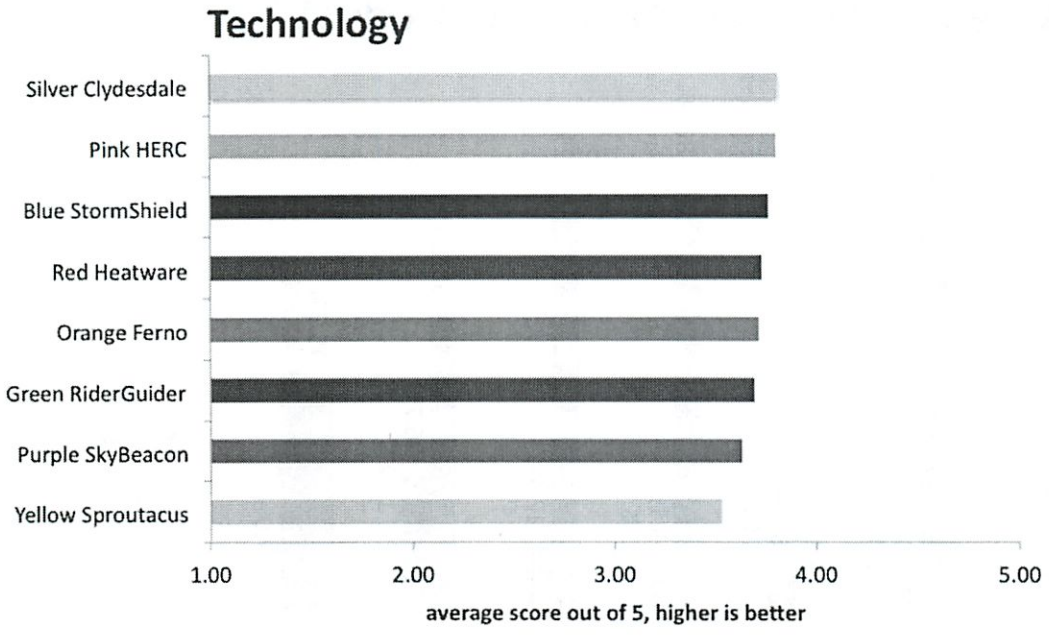
Overall rank ordering

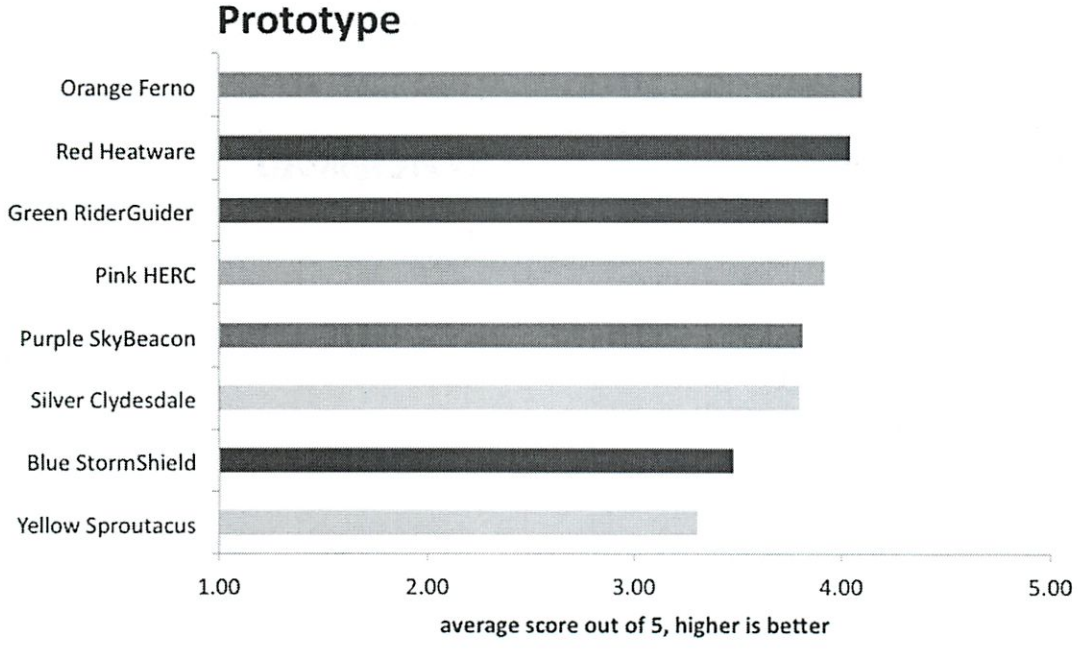
Assessed at the conclusion of all presentations, independent of the scoring by category.




Presentation Quality
Silver Clydesdale
Pink HERC
Orange Ferno
Purple SkyBeacon
Green RiderGuider
Red Heatware
Blue StormShield
Yellow Sproutacus
1.00
2.00
3.00
4.00
5.00
average score out of 5, higher is better


Business Assessment
Red Heatware
Purple SkyBeacon
Silver Clydesdale
Orange Ferno
Green RiderGuider
Pink HERC
Yellow Sproutacus
Blue StormShield
1.00
2.00
3.00
4.00
5.00
average score out of 5, higher is better


Technology
Silver Clydesdale
Pink HERC
Blue StormShield
Red Heatware
Orange Ferno
Green RiderGuider
Purple SkyBeacon
Yellow Sproutacus
1.00
2.00
3.00
4.00
5.00
average score out of 5, higher is better


Prototype
Orange Ferno
Red Heatware
Green RiderGuider
Pink HERC
Purple SkyBeacon
Silver Clydesdale
Blue StormShield
Yellow Sproutacus
1.00
2.00
3.00
4.00
5.00
average score out of 5, higher is better