2.009 Product engineering processes

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

Thomas Jefferson
2.009 Product engineering processes

“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
2.009 Product engineering processes today

**logistics** hours leading to final presentation

**goals** what where we trying to accomplish?

**presenting data** avoid misleading messages
Final presentation
suggested time allocation (not order)

- the product, where and how it is used, use experience
- who it is for and why should we care (value proposition)
- how it works, principle of operation
- market and preliminary business model
2.009 Product engineering processes

but first

~1500 people current in pool, first lottery was Friday (advertisements out today)

Name cards give access prior to 7:15 and guaranteed seat
We have an overflow venue (Little Theatre)
We will have standby ticket system, and displays in lobby
We will webcast from the course website

Business model consultation, Monday (tonight) in Pappalardo
Presentation drop in, Wednesday

When things go wrong tutorial, Wednesday in Pappalardo
Logistics

important web pages

Details are linked from 2.009 home page
final presentation logistics & detailed timeline
final presentation practice session logistics
course wrap up timeline

Read the details carefully. Ask questions if something is not clear
Please watch for emails this week
Logistics

**critical timeline to presentation**

**Friday, 4:30-10 PM:** presentation practice sessions 3-370
schedule will be linked from the home page
no surrogate presenters
dress rehearsal, less the dress

**Sunday 5 PM:** digital brochure due

**Sunday 2-6:** communication staff presentation practice sessions scheduler will be posted

**Sunday 6:45:** class video in front of Kresge banners
Logistics

critical timeline to presentation

Monday: countdown to presentation
sets will be in basement, backstage

11:00-1:00 PM: presentation upload with TA, Pappalardo lab
2:00-4:35 PM**: final AV run-through, no changes
  presenters and projectionist’s assistants, Kresge
  15 min/team; come at scheduled time

5-6:00 PM: final foyer cleanup
(all coats, bags, supplies go in practice room, name cards will be in room)

6:00 PM: Pappalardo lab closes

7:00 PM: Discussion with silver presenters, backstage

7:15 PM: You MUST all be seated in your team’s area
Logistics

critical timeline to presentation

Monday: Final, 15 min AV run-through (do not be late!)
Team presenter’s & projectionist’s assistants, Kresge onstage
2:00 - 2:15 silver team
2:20 - 2:35 red team
2:40 - 2:55 green team
3:00 - 3:15 pink team
3:20 - 3:35 blue team
3:40 - 3:55 yellow team
4:00 - 4:15 purple team
4:15 - 4:35 orange team

We never go to the stage from the auditorium. Always enter backstage
Logistics
sets/booth setup

Sunday, 5:00 PM
course staff moves sets to Kresge foyer

Monday
9 AM: sets available for practice in Kresge basement
mid-day: silver set moved onstage, red set moved backstage, all other sets in basement by elevator (piano backstage)
5:00-6:00 PM: final set organization
  complete setting up prototype and set materials
  pick up name tag in your team’s area (practice room)
  all coats and bags in practice room
6:00 PM: be ready to talk with guests (with your name tag)
6:15 PM: standby tickets
Logistics

presentation logistics

only presenters onstage during presentation
don’t introduce your presentation by team color
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 lead 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 to backstage
• **red**: route for moving set from backstage to foyer
• course staff will assist teams in moving the sets
Logistics
Stage setup

- Slides
- Live video

Backdrop curtain

Front stage entry

Front stage exit

Lighting effect

Team set

Confidence monitor
At front edge of stage
## Logistics

**live presentation logistics (team viewpoint)**

<table>
<thead>
<tr>
<th>When Q&amp;A starts for</th>
<th>Team presenters, set setup crew leave for move backstage*</th>
<th>Team Q&amp;A participants leave for backstage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>Red</td>
<td>Pink</td>
<td>Green</td>
</tr>
<tr>
<td>Green</td>
<td>Blue</td>
<td>Pink</td>
</tr>
<tr>
<td>Pink</td>
<td>Yellow</td>
<td>Blue</td>
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<tr>
<td>Blue</td>
<td>Purple</td>
<td>Yellow</td>
</tr>
<tr>
<td>Yellow</td>
<td>Orange</td>
<td>Purple</td>
</tr>
<tr>
<td>Purple</td>
<td></td>
<td>Orange</td>
</tr>
</tbody>
</table>

* at this time, the team projectionist’s assistant moves to sit near projectionist
Logistics
Silver and red-specific startup

7:00 PM: Silver presenters meet me backstage to coordinate start
7:15 PM: Silver presenters and Q&A participants backstage
7:15 PM: Silver projectionist assistant sit with projectionist

7:15 PM: Red presenters report backstage
7:20 PM: Red 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
Your team name will be announced
Stage lights come on
Your slides come on
The curtain opens
You run on

You’re on! (but stop at your mark before starting)
Logistics

Seating

**7:15 PM:** all students seated in team area
only teams 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! Communicate with staff member (Billy)
  no elevator use or moving onto backstage during presentations
Logistics
after presentation timeline

Monday: after presentation

10:00 - 10:45 PM: 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 and brochures)

Wednesday
noon: final peer review, on-line class evaluation, due Saturday at noon
1-5 PM: feedback from guests available in lab
1 PM: submit physical design notebook in lab
1:00-3:30 PM: lab cleanup, tool checkout
3:00 PM: 2.009 lunch/dinner
midnight: final timesheets, online notebook submission
Last class…

how does the cost of building your alpha prototype relate to the product’s manufacturing cost?
And now…
a final mini quiz!

Name on index card

to make a graphic/slide understandable, you need to ________

and, keep in mind that

less is ____________________________________
And now...
the final mini quiz part II

Please take 4 minutes to complete the survey
(related to Josh Ramos’s research)
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 centric/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
2.009 Class goals
a bit different, but do they matter?

ME graduates, 1992-1996
Warren Seering
I learned it at...

did not
elsewhere
job
grad school
MIT ungd
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
engineering reasoning and problem solving
experimentation and knowledge discovery
system thinking
personal skills and attributes
professional skills and attitudes
independent thinking
teamwork
communications
testing

designing

developing an idea

market context

business context

societal context

how and why
I learned it at...

- **ME core**
- **professional skills**
- **how and why**

Categories:
- did not
- elsewhere
- job
- grad school
- MIT ungd
I use this knowledge…

proficiency that was expected of me…
learned at MIT

used pervasively

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
Which is clearer?
Which is clearer?

A

B
Which is clearer?

B

[Eye chart image]
Which is clearer?
Which is clearer?

A

B

E
F
P
T
O
Z

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

A

Hello
Which is clearer?

B

Hello
Which is clearer?

A

Hello

B

Hello
Color Wheel

Opposites sides are contrasting colors
Which is clearer?

A

Hello
Which is clearer?
Which is clearer?

A

Hello

B

Hello
Traffic Deaths and Speeding
Traffic Deaths and Speeding

[Graph showing a decrease in traffic deaths after stricter enforcement]
Traffic Deaths and Speeding
Traffic Deaths, Speeding and Trends

A

Before stricter enforcement

After stricter enforcement

1955 1956

B

1951 1953 1955 1957 1959
Variable relationships
Variable relationships

Death Rate Plotted against Age,
Prospective Study of Mortality in U.S. Veterans

Death Rate per 10,000 Man-Years

Age (in Years)

Smokers

Non-Smokers
Variable relationships

![Graph showing death rate (log scale) plotted against age for smokers and non-smokers. The graph shows two linear trends, with smokers having a higher death rate at each age compared to non-smokers.](image)
Variable relationships

**A**

Death Rate Plotted against Age,
Prospective Study of Mortality in U.S. Veterans

- **Smokers**
- **Non-Smokers**

**B**

Death Rate (Log Scale) Plotted Against Age

- **Smokers**
- **Non-Smokers**
Variable relationships

Death Rate Plotted against Age,
Prospective Study of Mortality in U.S. Veterans

Death Rate per 10,000 Man-Years

Smokers

Non-Smokers

Age (in Years)
Variable relationships

A

B

Smoking and Death Rates Shown By Age

Age (Years)

Death Rate (per 100,000 Man Years)

Non-Smokers
Smokers
Variable relationships

A

Death Rate Plotted against Age,
Prospective Study of Mortality in U.S. Veterans

B

Smoking and Death Rates Shown By Age

- Non-Smokers
- Smokers

Age (Years)
0 40 50 60 70 80

Death Rate (per 100,000 Man Years)

Variable relationships

Smoking and Death Rates Shown By Age

- Non-Smokers
- Smokers

Death Rate (per 100,000 Man Years)
Variable relationships

A

Surgeon General Reports
Aging is the Primary Cause of Death

B

Smoking and Death Rates Shown By Age

Non-Smokers
Smokers

Death Rate (per 100,000 Man Years)
Trends
Trends

SAT scores and funds for education rise together.
Trends

SAT scores soar despite sluggish funding of education
Trends

**A**

SAT scores and funds for education rise together

- **Per Pupil Expenditures**
- **SAT Score**

Year:

SAT Score:
- 3.4 3.6 3.8 4.0 4.2 4.4 4.6

Per Pupil Expenditures (thousands):
- 3.4 3.6 3.8 4.0 4.2 4.4 4.6

**B**

SAT scores soar despite sluggish funding of education

- **Per Pupil Expenditures**
- **SAT Score**

Year:

SAT Score:
- 0 2 4 6 8 10 12 14 16 18 20

Per Pupil Expenditures (thousands):
- 0 2 4 6 8 10 12 14 16 18 20
Scale of effect
The purchasing power of the dollar declined most sharply during the Nixon administration.
Scale of effect
The purchasing power of the dollar declined most sharply during the Nixon administration.
Readability
Readability

Fast Track Appetizers

- Escargot
  $7.50
- Shrimp Cocktail
  $8.00
- Tempura
  $6.00
Readability

Fast Track Entrees

- Salmon Steak $19.95
- Stuffed Trout $18.00
- Filet Mignon $21.95
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
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)

2.744, product design in spring