2.009 Product Engineering Processes

you have to work hard to get your thinking clean to make it simple.
Steve Jobs, 1955-2011

thinking is the hardest work there is, which is probably the reason why so few engage in it.
Henry Ford, 1863-1947
What now

workflow

Three ideas presentation
September 23, during class
3 ideas per section

Mockup review
October 17
2 mockups per section

Assembly review
Oct. 30 & Nov. 1
1 assembly

Sketch model review
October 3
3 models per section

Final selection
October 22-24
1 concept per team

Technical review
November 14
1 (almost) prototype

Final presentation
December 9
1 alpha prototype
Assembly review

overview

digital submission 11 PM, Tuesday October 29 (red, green, blue, yellow)
digital submission 11 PM, Thursday October 31 (pink, orange, purple, silver)
images (up to 10), CAD files, list of who-did-what, product contract

product variations

storyboards, circuit designs, etc.
Assembly review

Overview

10 minute presentations/discussion
Wednesday October 30 (red, green, blue, yellow)
Friday November 1 (pink, orange, purple, silver)

project your contract (or large mounted poster)
contract! ...

list the 4 components of a specification

specification

love

I always forget the fourth one :(
Assembly review

Overview

10 minute presentations/discussion
Wednesday October 30 (red, green, blue, yellow)
Friday November 1 (pink, orange, purple, silver)

project your contract (or large mounted poster)
show your most current work

can work in pairs, everyone must contribute
no make work!
avoid meaningless detail
keep working to understand user needs
keep doing tests
Professional Ethics

wait wait, don’t tell me: bluff the listener

![Bar chart showing the number of students in VisualLab, Software, and Eng. students less honest.](chart.png)
Yep, one more…
mini quiz

put your name on the index card

list two words you should avoid when referring a design during a critique

what does G’DAY stand for?
2.009 Product engineering processes today

Product architecture structure the problem
Product architecture

definition

the organization or chunking of a product’s functional elements, and the definition of the interfaces between these elements

functional and physical decomposition
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
Product architectures

two fundamental types

Modular

Integral
Product architecture 1
hand power tools

Several different tools for same customer segment

Reverse engineering exercise
Blank index card, name on top of page
Draw the circuit for the drill
Collect cards 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**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Integral Modular</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight</td>
<td>1.2</td>
</tr>
<tr>
<td>charge time</td>
<td>0.2</td>
</tr>
<tr>
<td>power/weight</td>
<td>2.5</td>
</tr>
<tr>
<td>purchase price</td>
<td>~8-10</td>
</tr>
</tbody>
</table>
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 $f(\text{size}, \text{shape}, \text{mass})$

It is easier to optimize overall system with an integrated architecture
Product architecture decision
key role in defining what the product can be

integral

modular
Product architecture decision
key role in defining what the product can be

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
Finally

reminders

codes of value (final version today at 5 PM)
peer review 2 (5 PM today)

assembly 11 PM Oct. 29, (red, green, blue, yellow)
assembly 11 PM Oct. 31, (pink, orange, purple, silver)

in-class presentations Oct. 30, Nov. 1
(having design variations is a good thing)

technical review with alpha prototypes, Nov. 14
Finally

**reminders**

tonight, 7 PM in Pappalardo!

- mediating design decisions. SIs, Yodas, and all

**Yoda + SI workshop** (8 PM also in Pappalardo)

think about what you need work on/prepare so team can make a good, informed decision

please let me know your choice!

codes of values, 5 PM
peer review 2, 5 PM