2.009 Product engineering processes

a chair is to sit on
What’s now?

workflow
2.009 Product engineering processes

a chair is to sit on
Team down-select: 6 to 4
review ranking data

all teams have ideas ranked in the top third!
(but what does that mean?)
Team down-select: 6 to 4
review ranking data

what does top third actually mean?
Team down-select: 6 to 4
what does it mean?

top tier
perhaps has good potential as understood, unless many of us are missing something or misunderstood

middle tier
may or may not have good potential, may or may not have been well understood

lower tier
probably has less potential as understood, unless many of us are missing something or misunderstood
Team down-select: 6 to 4
review ranking data

all teams have ideas ranked in the top third! but…

a good sketch model phase can tell you and opportunity should not be highly ranked!

think carefully about your written feedback

it only takes one, we just can’t tell what it is right now!

don’t keep working on something that you are confident does not have potential
why raise the bar?

Anders Haggman, Doctoral Candidate
Professor Maria Yang
Team down-select: 6 to 4
think strategically

scenario 1:
2 top tier, 2 middle or lower tier
top + top + middle + middle
top + top + middle + lower (misunderstood)
top + top + middle/lower + new
top + middle + middle/lower + new

scenario 2:
1 top tier, 3 middle or lower tier
top + middle + middle + new
top + middle + lower (misunderstood) + new
top + middle/lower + new + new

the only scenario I don’t recommend:
new + new + new + new + new
Down-select: 6 to 4

project success factors

- strong connection to user need (how real is it?)
- 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 or small)
- understanding of technology, context
- innovative, not inventive
- understand market and competition
- ability to test
- demonstrable
- working in Pappalardo lab, where you can get help
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

need + product vision
product cost: how much can it be?
is it doable?
Mockup phase
Petra, 2.009 2015
Mockup phase

Rhino, 2.009 2017
Mockup phase
Otto, 2.009 2014
Mockup phase

decompose the problem

- idea sketch
- form sketch model
- functional sketch model
- feasibility estimate
- embodiment
- user interviews
- UI model
- user (vision, need, usability)
- operational principles (technical and business)
- engineering BLP
- alpha prototype
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

you need to have this!
Ergonomic mockups
test and validate human factors decisions
Analytical mockups
predict how the product will behave

engineering analysis, CAD, CAE

economic analysis
Engineering BLPs
key operational principle

resolve key technical issues and functionality

test components

verify analytical models
2.009 Product engineering processes today

mockups resolve key risks

customer needs know your core proposition
Process
textbook viewpoint

- Define scope
  - Identify needs
  - Target needs
  - Preliminary concepts (sketch models)
  - Select concepts
  - Solve key risks
  - Resolve concepts (mockup)
  - Refine needs
  - Preliminary contract
  - (3-ideas)
Needs and contract

mockup review

- define scope
- identify needs
- target needs
- preliminary concepts
- solve risks
- resolve concepts

(3-ideas)

analyze competition

(sketch models)

(select concepts)

refine needs

preliminary contract

(mockup)
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

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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

*inappropriate:* written surveys—too little context, poor for hidden needs
Exploratory interviews
interacting with potential users

with a problem in mind …

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 potential users

go with the flow

use props (competitive products, sketch models)

discourage technology speculation or detailed design

have the user demonstrate use whenever possible

watch carefully for unexpressed or non-verbal needs
Eliciting key needs
interacting with potential users
don’t lead users to the answer that you want!

how do you like MY idea?
empathizing with users and user centric design
Eliciting key needs
OK, so I’ve talked to potential users

Now what?

you have a long list of comments, some important, some not, that need to be translated into customer needs
Eliciting key needs
translating raw data into needs

cluster customer statements into themes
Eliciting key needs
translating raw data into needs

express needs in terms of what product has to do

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# Eliciting key needs

translating raw data into needs

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Eliciting key needs

translating raw data into needs

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

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translating raw data into needs

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

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Eliciting key needs
translating raw data into needs

avoid must and should, as these imply priority

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Mockup review
Core 3-6 needs on product contract

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Mockup review
design attributes and specifications

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Friday
it could get a bit messy!
But first …

odds and ends

staff feedback for sketch models is compiled online

peer review 1, team review A due 9 PM tonight!

notebooks this week in lab, digital Thursday PM

if you realign your sections, please let me know!

user-centric, empathetic design: Friday at 5 PM