2.009 Product engineering processes

people don’t know what they want
they want what they know
how the customer explained it

what the customer really needed
A product opportunity

user need + idea + market + doable

3-ideas presentation
Identifying opportunities
user need + idea + market + doable

Processes:
individual creativity strategies

DANCING WHEELCHAIR
for wheelchair users who want freedom of movement

- eliminating material from the back and side gives freedom of movement and room to dance with a partner
- sensors in side ribs and seat allow user to move wheelchair by changing body angle
- seatbelt keeps user secure
- no need to manually rotate wheels, freeing up arms

Vianna Quenon
Identifying opportunities

User need + Idea + Market + Doable

Processes:
- Individual creativity strategies

IGNITE

Brainstorming:
- Self cooking pots that rotate and shake food
- Smart air filter that shows daily pollen levels
- Smart planter that regulates pH

Home Appliances:
- Smart storage containers
- Medical devices

Leads into medical assistant that reads medical pill label and stores pills in suitcase environment

Light:
- LED lights

Medical Device:
- Medical sensors

Cooking:
- Electric stove

Ignite Ideation:
- Brainstorming sessions
why raise the bar?
“the best way to get a good idea is to get a lot of ideas”

Linus Pauling, 1901-1994
Chemist, Nobel prize winner
Nobel peace prize

Nature of chemical bonds
Identifying opportunities
user need + idea + market + doable

Processes:
individual creativity strategies
brainstorming

1. DEFER JUDGMENT
2. ENCOURAGE WILD IDEAS
3. GO FOR QUANTITY
4. BUILD ON THE IDEAS OF OTHERS
Identifying opportunities

**user need** + idea + market + doable

Processes:

*individual creativity strategies*

brainstorming

*one-on-one/few discussions*
Identifying opportunities

user need + idea + market + doable

Processes:

individual creativity strategies
brainstorming
one-on-one/few discussions (idea fair)
secondary research (treasure hunt)
Treasure hunt feedback

overall, well done!

first in: Pink B at 5:54 pm Wednesday
last in: Red A at 11:54 am Thursday
Treasure hunt
feedback

overall, well done!

first in: Pink B at 5:54 pm Wednesday
last in: Red A at 11:54 am Thursday
Treasure hunt

feedback

top sections:
incorporated the question into their response
provided all of the requested information, plus additional context
provided correct, consistent citations
provided a nicely formatted, easy to read document
used resources efficiently (and asked for help!)
Treasure hunt results

top scavengers: blue b

orange b
Treasure hunt
some team lessons

how did your section manage delegation?
Identifying opportunities
user need + idea + market + doable

Processes:
individual creativity strategies
brainstorming
ask, one-on-one/few discussions (idea fair)
secondary research (treasure hunt)
in-context observation of users
Identifying opportunities
observing people, observing things
Identifying opportunities
observing people, observing things

you are a detective looking for clues
why observe users?
you will learn something!
increase your odds for a successful product
right now…
  identify leads for opportunities
  define product goals

observing people:
5 PM today in 3-333
Observation exercise
the opportunity-finding process has just begun!

each person in your section will sign up to observe at one of several place options

based on your observations, report at least one new, product opportunity to the team in lab next week

at the end of class, organize as section and complete ‘observation places’ signup form

who is going where page in case you want to work in across-team groups of up to 3 (recommended)
Identifying opportunities
user need + idea + market + doable

Processes:
individual creativity strategies
brainstorming
ask, one-on-one/few discussions (project fair)
secondary research (treasure hunt)
in-context observation (observation exercise)
engineering (feasibility) estimation
Estimation exercise

some practice

estimate the usable energy in a C size battery

2 minutes
blank index card
name and section on top of page
no computers or mobile devices
hand in to center isle
Usable energy in a C cell solution example

Develop a model

simple, familiar, analogous

\[ E = P \times t \]
Usable energy in a D cell solution example

Apply some numbers, check units

\[ E = P \times t \]

Flashlight bulb: 5W
Battery life: 3 hr
(10800 s)
C cells: 2

\[ 2E = 5 \text{ J/s} \times 10800 \text{ s} \]
\[ E = \sim 3 \times 10^4 \text{ J} \]
Identifying opportunities
user need + idea + market + doable

engineering estimation
order of magnitude calculations, *back of the envelope*

why?
explore the feasibility ideas and potential degree of difficulty quickly, even though many details are unresolved

analysis analog of an idea sketch

*Something that requires practice (and creativity)*
Feasibility estimation

general approach

1) you have an idea!

2) what worries you? (critical feasibility questions)

3) develop/ideate analogous models

4) apply quantities, checking units

5) decide if answer seems believable
Good news everybody!
I have an idea
An idea!

battery powered, hand-held foam cutter

is it feasible?

Step 2
key “is it possible” question

name on index card
1 minute
no computers or mobile
An idea!
battery powered, hand-held foam cutter

is it feasible?

key question?
how big for reasonable use time?
how much battery?
power?

Steps 3 + 4
develop an analogous model
some numbers
decide if it is feasible
1 minute
no computers or mobile
An idea!
Battery powered, hand-held foam cutter

- Light bulb: 100 W
  - Sphere dia. ~4 cm
  - Area ~50 cm$^2$
  - Need ~2 W/cm$^2$

- Wire: 0.1 cm dia.
  - Length 15 cm
  - Area ~5 cm$^2$

- Power: 2 W/cm$^2$ \times 5 cm$^2$ 
  \approx 10 W

Key question?
How big?
Power?
An idea!

Battery powered, hand-held foam cutter

power ~10 W

reasonable: yes

what next?

feasibility test
(sketch model)
A sketch model!
battery powered, hand-held foam cutter

what next?
sketch model
and last…

some logistics

observing people: 5 PM today in 3-333

over the weekend:
  read chapters 3 and 4 in text
  read details for the 3-ideas presentation

if you have not received email from me yet…
  add drwallac, drwallace as safe sender
scored treasure hunt submissions will be emailed to your section

now!

organize for observation exercise

one section member completes web signup form

who-is-going-where summary online