2.009 Product engineering processes

people don’t know what they want

they want what they know
what the customer really needed

how the customer explained it
A product opportunity

idea + user + market + doable

3-ideas presentation
Identifying opportunities

idea + user + market + doable

Processes:

individual creativity strategies
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

idea + user + 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

idea + user + market + doable

Processes:

individual creativity strategies

brainstorming

one-on-one/few discussions
Identifying opportunities
idea + user + market + doable

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

all on time!
first in: Purple B at 3:38pm Wednesday
last in: Yellow B at 11:52am Thursday

2.009 Treasure Hunt
Team Silver A

Team Members
Alex Breton
Anna Leonard
Christina Sung
Ian Tolan
Louis Segall
Luther Banner III
Matthew Tancik
Natasha Gunther
Noam Buckman
Pedro Brito
Tamanna Urmia
Treasure hunt

feedback

all on time!

Question 1 - Solar Absorption for Different Materials

You are investigating a portable solar powered insulin monitor. You will want to investigate different materials for solar absorption and know a handbook is a good place to start. (Hint: standards and handbooks are great for finding this kind of information)

a. What is the solar absorption (shortwave) for red brick?
   The solar absorption (shortwave) for red brick is 0.55
b. What is the radiation ratio for polished Aluminum?
   The radiation ratio for polished aluminum is 6.00.

Source:

Question 2 - Craft Beer Production

You are trying to estimate the size of the market for your revolutionary new product, which is a new energy-efficient chiller for use in craft beer production. An advisor has suggested you find out what the outlook is for the craft beer production industry in the U.S. An industry report should be able to give you some idea about prospects for growth. Note: to cite this answer, provide the name and URL of the resource you used.

a. Currently, what prospects for industrial analysts projecting for craft beer production?

   "Although the Craft Beer Production industry’s recent success represents uncharted waters for rapidly expanding craft brewers, IBISWorld anticipates the industry to experience further growth over the five-year period to 2020. During the five years to 2020, IBISWorld projects the industry to experience 5.5% annualized revenue growth, reaching $6.5 billion by the end of the period."

Source:
Treasure hunt feedback

top sections:
incorporated the question into their response
provided all of the requested information
provided correct, consistent citations
provided a nicely formatted, easy to read document
used library resources and asked for help!

lower scoring sections:
provided incorrect information
did not provide complete/consistent citations, or were missing citations
typos that made answers incorrect (e.g, 16 1/8 is not 16.08)
did not use easiest source, even when there were hints
Treasure hunt results

top scavengers: green b
Identifying opportunities
idea + user + market + doable

Processes:
individual creativity strategies
brainstorming
ask, one-on-one/few discussions (idea fair)
secondary research (treasure hunt)
in-context observation of users
Why observe users?

you will learn something!
increase your odds for a successful product

help you to…
   identify leads for ideas
   clearly define product goals
   refine/test ideas
Identifying opportunities

in-context observation

learning to observe
key to being a designer/innovator

every user
compensation or adaptation is a potential
product opportunity
Observation exercise

the opportunity-finding process has just begun!

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

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

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

will post who is going where on Saturday in case you want to team up
Special tutorial
observing users

today, 5 PM in 3-333, ~45 minutes long

Meena Kothandaraman
Bentley University, human factors and design

information on course website
Identifying opportunities
idea + user + 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
Identifying opportunities
idea + user + market + feasibility

Engineering estimation
Order of magnitude calculations, back of the envelope

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
Estimation exercise

some practice

Estimate the usable energy in a D size battery

3 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 D 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
\( \text{(10800 s)} \)
D cells: 2

\[ 2E = 5 \text{ J/s} \times 10800 \text{ s} \]
E = \( \sim 3 \times 10^4 \) J
Feasibility estimation

general approach

1) what is the idea?

2) what are the critical questions?

3) develop/ideate models

4) apply quantities, checking units

5) decide if answer seems believable
Estimation

typical critical feasibility questions

is it possible?

is it difficult?

how efficient?

how much?

how big?

how expensive?
An idea!
battery powered, hand-held foam cutter

is it feasible?

key questions
develop a model
some numbers

name on paper
3 minutes
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 dia. 0.1 cm
- wire length 15 cm
- wire area ~5 cm$^2$
- power: 2 W/cm$^2$ x 5 cm$^2$
- ~10 W

key question?
power?
An idea!
Battery powered, hand-held foam cutter

what next?
feasibility test
(sketch model)

power ~10 W
reasonable: yes
A sketch model!

battery powered, hand-held foam cutter

what next?
sketch model
and last...

some logistics

observing users: 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
and last…

some logistics

now:

organize for observation exercise

one section member completes web signup form now

who-is-going-where online Saturday

scored treasure hunt submissions will be emailed