“discovery consists of looking at the same thing as everyone else and thinking something different”

Albert Szent-Gyorgyi 1893-1996
Nobel prize winner
Physician

Director of Muscle Research, Woods Hole
Cell respiration, biological combustion,
muscle contraction

helmet vending machine
2.009 Product Engineering Processes

today

Wednesday’s class exercises
strategies to enhance creativity
project theme for 2015
preparation for next week
lab signup

5 PM Saturday!
http://web.mit.edu/2.009
2.009 Product Engineering Processes

but first…

put your name on the top of a blank index card

2.009 Product Engineering Processes

but first…

put your name on the top of a blank index card

motivation

+ creativity

+ informed craft

+ process

= innovation
Which object is different?

frequency of answers

creative:
seeing things differently
Which object is different?
the least creative solution

why?
believe there is
only one right answer
“nothing is more dangerous than an idea when it is the only one we have”

Emile Chartier
French Philosopher, metaphysics
1868-1951

Metaphysics?
Writings of Aristotle on physics, as arranged by Andronicus of Rhodes three centuries after Aristotle's death.
Branch of philosophy that attempts to understand the fundamental nature of reality.
Which object is different?

seeing things differently

Christina Sung
Zach Mikaya
Nathan Varady
Tobi Rudoltz
Krithika S.
Michelle Navarro
Emmanuel Simpni
Jack Greenfield

believe in more than one right answer
creativity strategy #1

look for the next right answer!
Creativity exercise

Using only one stroke, turn the Roman numeral seven, shown below, into an eight.

VIII
Creativity exercise

Using only one stroke, turn the Roman numeral 9, shown below, into a 6.

SIX

Context (viewpoint) shift from Roman numerals to Latin characters and English
Creativity exercise

Using only one stroke, turn the Roman numeral nine, shown below, into a six.

IX6

Context (viewpoint) shift from Roman numerals to Arabic numerals and mathematics
creativity strategy #2

look from multiple viewpoints
Ways to mitigate droughts

number of ideas per student

average ~ 1.76 ideas/minute/person

target ~ 4 ideas/minute

entire class: 279 ideas/minute

sell California to Japan

Mario Prado, Katie Ward,
Natasha Gunther, Adrian Samsel,
Skyler Adams, Melody Liu,
Jonah Hessels, Braden Knight
McCall Huston

number of ideas

number of students
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
Ways to improve MIT experience

2007

The graph shows the number of ideas vs. the number of students. The x-axis represents the number of ideas, while the y-axis represents the number of students. The graph indicates a distribution where a larger number of students have fewer ideas, and a smaller number of students have a higher number of ideas.
How?

Creativity to see many unique viewpoints

strategy 2: look from multiple viewpoints
- classes, labs, dorms, food, student life, campus, people…

Capability to understand/analyze viewpoints

select promising viewpoints
- labs, dorms, food

Creativity to address viewpoints uniquely

solutions for each viewpoint
- food: snacks in classes, free meal plan, stocked kitchens, …
Ways to mitigate droughts
what made it hard to think of ideas?

average ~ 1.6 ideas/minute/person
Mental locks
thoughts that prevent ideas from flowing

There is only one good answer
That’s not logical
Follow the rules
Be practical
Play is frivolous
That’s not my area
Don’t be foolish
Avoid ambiguity
To err is wrong
Why do mental-locks lock?

a typical professor’s brain
(but not mine)
Why do mental-locks lock?

left:
primarily systematic, analytical

right:
primarily intuitive, associative
Mental locks
all left brain (analytical) thinking

There is one good answer
That’s not logical
Follow the rules
Be practical
Play is frivolous
That’s not my area
Don’t be foolish
Avoid ambiguity
To err is wrong
Why do mental-locks lock??

our formal education trains the left hemisphere

we learn to suppress the right hemisphere
creativity strategy #3

defer all judgments
tell the left side of your brain to be quiet
Creativity practice

arrange 4 blocks
so that each block touches only one other block
Creativity
practice

arrange 4 blocks
so that each block touches only one other
creativity strategy #4

challenge assumptions

question assumed boundaries or norms

Clouseau: Does your dog bite?
Hotel Clerk: No.
Clouseau: [bowing down to pet the dog] Nice doggie.
[dog bites Clouseau’s hand]
Clouseau: I thought you said your dog did not bite!
Hotel Clerk: That is not my dog.

The Pink Panther Strikes Again (1976)
a quick question

I have been asked to plant 4 trees equidistant from each other

what about a hill?
We are part of a successful product development firm that prides itself on being at the cutting edge.
Project

Innovation strategy

Each year our company challenges a select group of teams to propose and develop new products, all positioned within a broad theme.
magic
magic ?
magic is overwhelming
magic?

feelings evoked by the product
memorable experiences afforded by products
magic?
magic is satisfying
magic ?
magic is terrifying
magic?
magic is fun
magic?
magic is thrilling
magic?
magic is special
magic!
Project
your charge

Explore opportunities, develop ideas, build an alpha prototype

Under-served client, products distributed on a non-profit basis, highly profitable mass-produced goods

A realistic plan for how the product can be produced and sustained
Project
the budget

your team has a budget of $6500
Project
the timeline

we start now!

we finish with a prototype launch on December 7
Project

**team workflow: cooperative competition**

- **Section A**
  - 1 lab instructor
  - 12 students
  - 3 ideas
  - 1 idea
  - 3 sketch models
  - 2 concept mockups
  - Team
  - 1 team concept
  - 1 alpha prototype

- **Section B**
  - 4-6 mentors
  - 3 ideas
  - 1 lab instructor
  - 12 students
  - 3 sketch models
  - 2 concept mockups

- **Final Selection**
  - sketch model review
  - mockup review
  - assembly drawing

- **Technical Review**

- **Three Ideas Presentation**

- **One Team**
Workflow

each stage builds on prior effort

Homework

For real
Effort and results

2008: total hours spent by team vs. final outcome
Effort and results

2008: hours spent on ideation vs. final outcome

importance of rigor in breadth
and finally...

preparation for next week... see homepage

brainstorming deliverable: a significant task
idea sketching tutorial at 5 PM in 3-333

lab signup by 5 PM Saturday
lookup your lab assignment Sunday night
read about the Monday evening project idea fair
read about notebook and submission process

http://web.mit.edu/2.009
not on stellar
strategy #1
look for the next right answer

strategy #2
look from multiple viewpoints

strategy #3
defer all judgments
tell the left side of your brain to be quiet

strategy #4
challenge assumptions
question assumed boundaries or norms