“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
product theme for 2017
preparation for next week
lab signup

not on stellar

5 PM Saturday!

http://web.mit.edu/2.009
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
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

number of students

michael larson
elizabeth bianchini
lucia liu
annie chen
zoe hilton

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.

\textbf{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.

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

look from multiple viewpoints
Ways to mitigate floods

number of ideas per student

average ~1.6 ideas/minute/person

target ~ 4 ideas/minute

entire class: 965 ideas
241 ideas/minute

William Ruschel
move to Mars

Hannah Rudoltz
Elliot Owen

James Roggeven
Aaron Lytle
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
why raise the bar?

number of ideas

Geoff Tsai, PhD
Professor Maria Yang
Creativity Rank

number of ideas

R² = 0.6896

\[ y = -26.46 \ln(x) + 60.51 \]
why raise the bar?

Anders Haggman, Doctoral Candidate
Professor Maria Yang
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

(number of students vs. 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 floods
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)
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.
super
extend our minds
super human
master challenges
metamorphosis
super!
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 business model for how the product can be produced and sustained
Project the budget

your team has a budget of $7000
Project
the timeline

we start now!

we finish with a prototype launch on December 11
Project

team workflow: cooperative competition

Three ideas presentation
September 25, during class
3 ideas per section

Mockup review
October 19
2 mockups per section

Sketch model review
October 5
3 models per section

Final selection
October 23-26
1 concept per team

Assembly review
November 1 & 3
1 assembly

Technical review
November 16
1 (almost) prototype

Final presentation
December 11
1 alpha prototype
and finally…
preparation for next week… see homepage

brainstorming deliverable: a significant task
optional idea sketching tutorial at 5 PM in 1-390

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