



# illuminate



CREATIVE  
OWNERSHIP

*"Some see things as they are and ask why. Others dream things that never were and ask why not."*  
- George Bernard Shaw



# Course Pathway

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## Course Key



Time



Exercise



Video



Concept



Lecture



Notes



Dive Deeper

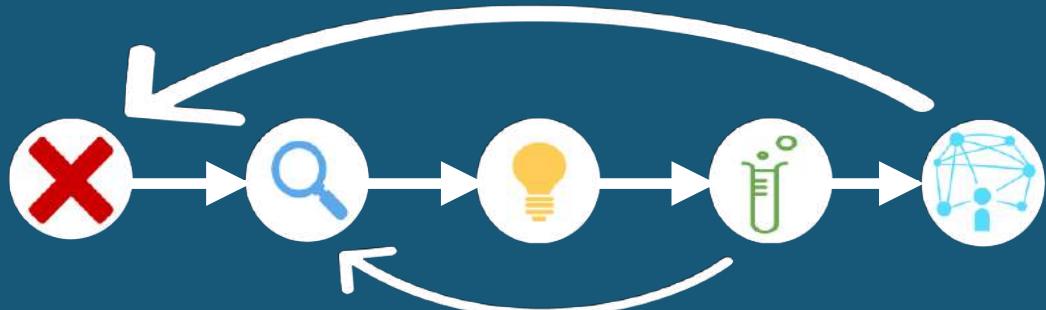
# Our Vision

*To help leaders and teams learn  
and adapt to pursue maximum  
possible performance*

## Objectives

- Depart from the status quo
- Clearly understand the problem to be solved
- Foster a questioning attitude and look at new ideas with an open mind
- Trust and empower individuals to take ownership and make a meaningful contribution
- Accept risk in order to learn and grow
- Embrace shortfalls as opportunities and overcome barriers and obstacles
- Promote ideation and creativity

# AIM - Applied Innovation Model



## Identify Improvement Opportunity

Be open and honest with weaknesses and shortcomings: actively seek out weak points in all things. Continuously strive to improve. If everything seems perfect, the standard needs to be re-evaluated.



## Define Issue

Peel the onion, be curious, and learn from history. Has someone else seen/solved this issue? Ask the 5 whys.



## Ideate

Swarm the issue, bringing together a diverse team. Encourage wild and radical ideas. Challenge all mental models and paradigms.



## Explore and Learn

Learning through iterative development is critical. Embrace risk by managing it. Design experiments and pilots.



## Share Knowledge

Share all lessons learned openly, and embrace collaboration.



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*"Management is doing things right; leadership is doing the right things." - Peter F. Drucker*





Learning and adapting is an inherent trait of our Navy. At our core, every Sailor and Marine is a problem solver. Regardless of rank or community, all of us are entrusted to shape and strengthen our Navy. Over its more than 241-year history, the United States Navy has grown into the world's most formidable expeditionary fighting force. We are uniquely positioned to provide a continuous sustainable presence around the globe - ensuring stability, deterring disruptions to commerce, and providing our nation's leaders the ability to respond in times of crisis. Critical to the continued success of our mission is instilling a sense of ownership and empowerment to capitalize on the creative intellect of our Sailors and Marines.

Our maritime superiority did not occur spontaneously. It was built from the keel up by generations of Sailors, Marines and citizens, like you, who recognized a strong navy was essential to maintaining a free and secure America. From the first six frigates to today's Carrier Strike Group, we have challenged expectations, experimented, and collaborated to make our Navy better. Throughout our history, we have confronted challenges head on, turning seemingly impossible ideas into reality. Our heritage is rich with examples of innovators; LT William Sims revolutionized naval gunnery tactics, Capt Victor Krulak helped transform amphibious operations, and Admiral Grace Hopper was a transformational leader widely considered the mother of modern computer programming. Transformational Navy capabilities all evolved from someone's idea.

The maritime domain and the threats we face continue to evolve and we must adapt. We must resist the complacency that can accompany being unchallenged for years. This dominance has been attributed by some to our technological edge, but I believe the real power of our Navy lies in the minds of our young Sailors and Marines – our center of gravity. We all must challenge our assumptions and embrace intelligent risk. Paramount to our success, leadership at every level must empower our innovators by providing them *time, trust, and top cover*.

More than a hundred years ago Abraham Lincoln said, "As our case is new, so we must think anew and act anew." The *Thinkshop* creates an environment for you to break from the mold, question deeply held (and often taken for granted) assumptions, think, and act anew. As you return to your different organizations, leverage this experience in order to approach every task and operation with ownership, creativity and an open mind. The future Navy is yours to shape – think about it!

*Challenge norms – learn faster – improve daily!*  
*R. P. Breckenridge*

R. P. BRECKENRIDGE  
VADM USN



15 min

# Icebreaker for *Individuals*



## Option 1: Superpowers

- Share your name
- Share a skill you are proud of
- Share a superpower you wish you had and why
- **Pass out name tags: label with superpowers**



## Option 2: Deserted Island

- The situation is dire - following a shipwreck, the entire class has been stranded on a deserted island.  
Everyone gets to choose one item to keep with them as the ship sinks. Items do not need to be realistic
- What would you choose to keep?
- **Pass out name tags: label with item**



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*"Many of life's failures are people who did not realize how close they were to success when they gave up." - Thomas Edison*



15 min

# Icebreaker for **Teams**



## Option 1: Similarities

- Break into 4 groups
- Talk amongst yourselves
- The first team to find 6 shared similarities wins
- Limitations: Teams are not allowed to use physical similarities like height, hair color, items worn, etc.
- **Have each team decide on a single similarity to use as a team name**



## Option 2: Heroes or Villains?

- Break into 4 groups
- Talk amongst yourselves
- Decide if you want to be good or evil
- **Have each team decide on an individual Super-hero or Super-Villain name, and a name for their Super-Team**



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*"When everything seems to be going against you, remember that the airplane takes off against the wind, not with it." - Henry Ford*



35 min

# Unleash Creativity



## Sir Ken Robinson - Schools Kill Creativity

Why don't we get the best out of people? Sir Ken Robinson argues it's because we've been educated to become good workers, rather than creative thinkers. Students with restless minds and bodies (far from being cultivated for their energy and curiosity) are ignored or even stigmatized, often with terrible consequences.



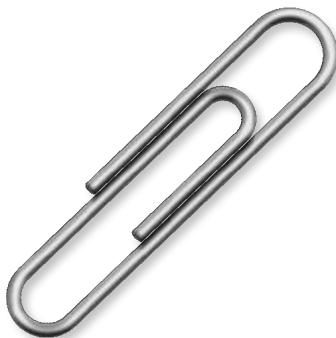
### Key Thoughts

- We don't grow into creativity, we grow out of it
- We are educating people out of their creative capacities
- If you are not prepared to be wrong, you'll never come up with anything original



### Exercise

Give yourself 2 minutes and see how many uses you can find for a paperclip. Now let the most junior person you know give it a try.



10



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*"To be yourself in a world that is constantly trying to make you something else is the greatest accomplishment." - Ralph Waldo Emerson*

Cue  
Column

Note Taking  
Column



Summary



35 min



# Marshmallow Challenge

## Rules:

- **Build the Tallest Freestanding Structure:** The winning team is the one that has the tallest structure measured from the table-top surface to the top of the marshmallow. The structure cannot be suspended from a higher structure, like a chair, ceiling or chandelier
- **The Entire Marshmallow Must be on Top:** Cutting or eating part of the marshmallow disqualifies the team
- **Use as Much or as Little of the Kit:** The team can use as much or as little of the items provided: spaghetti sticks, string, tape. The team cannot use the paper bag as part of their structure.
- **The Challenge Lasts 18 minutes:** Teams cannot hold on to the structure when the time runs out. Those touching or supporting the structure at the end of the exercise will be disqualified

## Marshmallow Challenge

Build the Tallest Freestanding Structure



- Teams of Four People
- Eighteen Minutes
- Using the Following Ingredients



20 sticks of spaghetti + one yard tape + one yard string + one marshmallow

\* recommend scotch tape

Watch After  [Tom Wujec - Build A tower, build a team](#)

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*"Leadership and learning are indispensable to each other." - John F. Kennedy Jr*

Cue  
Column

Note Taking  
Column



Summary



10 min



# Six Words (Bonus Exercise)



For sale.  
Baby shoes.  
Never worn.

Ernest Hemmingway

There is an urban legend that one of the greatest short stories of all time is written by Ernest Hemingway. When he was challenged to write a story in only six words, he wrote, “For sale. Baby shoes. Never worn.”

## HOW TO PLAY?

- This activity can be done solo or in a group
- Think about a story idea and how you can shorten it down to just six words
- Don’t worry about writing a masterpiece. Just have fun and share your stories with the group when you’re done

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*“Great spirits have always encountered violent opposition from mediocre minds.”*  
- Albert Einstein

Cue  
Column

Note Taking  
Column



Summary



10 min

# Risk Aversion



## Discussion

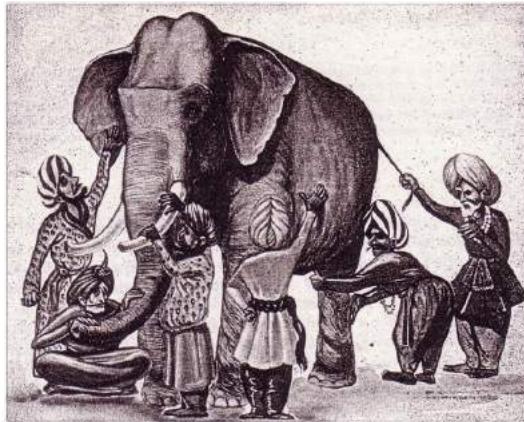
- What does it feel like to be wrong?
- Why are the new people in an organization so valuable when it comes to seeing problems or new solutions?
- What is the purpose behind experiments and pilots?
- What is the critical role of middle managers in the organization?



## Parable of the Blind Men and the Elephant

When the blind men had all felt a part of the elephant, the king said to each of them: 'Well, blind man, have you seen the elephant? Tell me, what sort of thing is an elephant?' Each in his own opinion concludes that the elephant is like a wall, snake, spear, tree, fan or rope, depending upon where they had touched. Their heated debate comes short of physical violence, but the conflict is never resolved.

"O how they *cling* and wrangle, some who *claim*. For preacher and monk the honored name! For, quarreling, each to his view they *cling*. Such folk see only one side of a *thing*." - Buddha



## A series of unfortunate assumptions

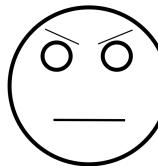
1. Ignorance



2. Idiocy



3. Evil



Watch Later



[Tim Harford - Trial, Error and the God Complex](#)

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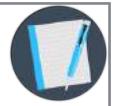


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*"Those who cannot change their minds cannot change anything." - George Bernard Shaw*

Cue  
Column

Note Taking  
Column



Summary



30 min

# Leadership



## Simon Sinek - Why Good Leaders Make You Feel Safe

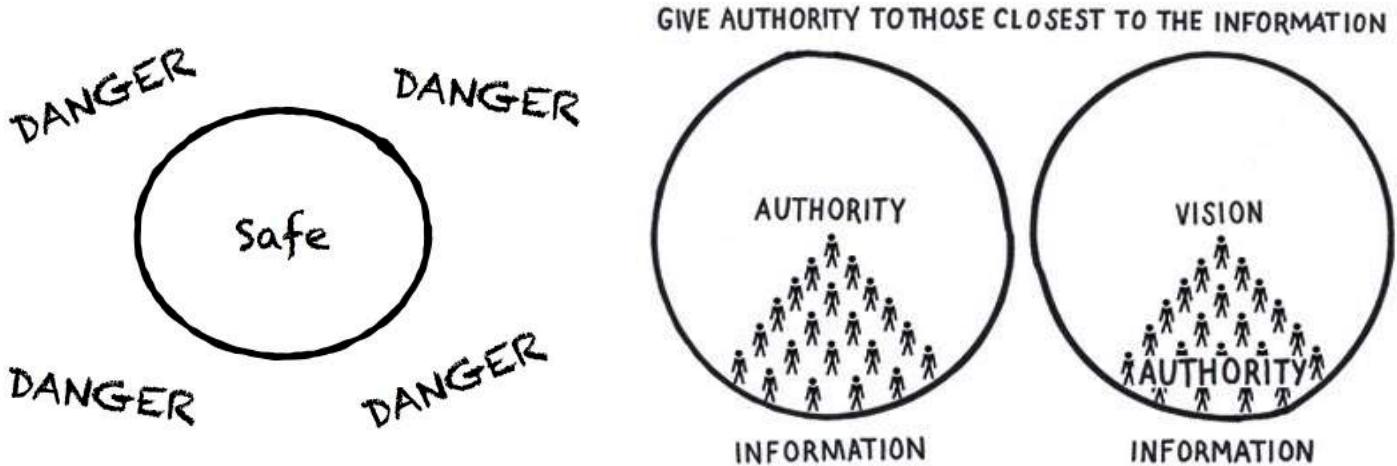
What makes a great leader? Management theorist Simon Sinek suggests, it's someone who makes their subordinates and peers feel secure, and draws others into a circle of trust. However, creating trust and safety, especially in an uncertain world, means taking on big responsibility.



### Key Thoughts

- When there is no circle of safety, we force our employees to expend their energy to protect themselves from each other, and as such they're less productive
- The quality of a leader cannot be judged by the answers they give but by the questions they ask
- Leadership sets the tone and the conditions. If you get the conditions right, the organization thrives

### Top 3 Concepts: **Time, Trust & Top-Cover**



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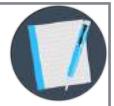


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*"There are no bad soldiers, only bad leaders."*  
- Napoleon Bonaparte

Cue  
Column

Note Taking  
Column



Summary



35 min

# Understanding Motivation



## Dan Pink - The Puzzle of Motivation

Career analyst Dan Pink examines the puzzle of motivation, starting with something social scientists know but most managers don't: Traditional rewards aren't always as effective as we think. Listen for illuminating stories, and maybe — a way forward.

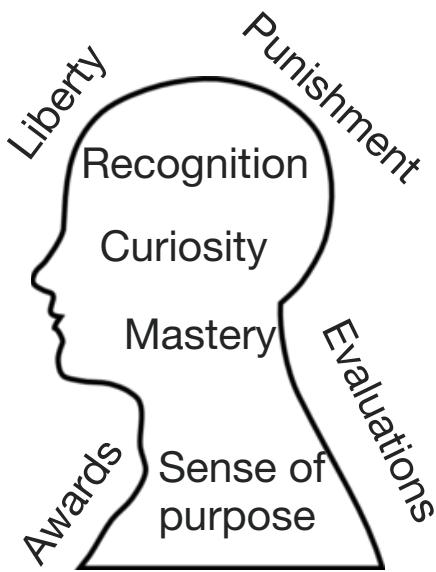


### Key Thoughts

- Control ⇒ Compliance; Autonomy ⇒ Engagement
- Asking **why** can lead to understanding. Asking **why not** can lead to breakthroughs
- Organizations need talented people more than talented people need organizations

### Top 3 Concepts: **Autonomy, Mastery & Purpose**

### Intrinsic vs Extrinsic Motivators



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*"If your actions inspire others to dream more, learn more, do more and become more, you are a leader."*  
- John Quincy Adams

Cue  
Column

Note Taking  
Column



Summary



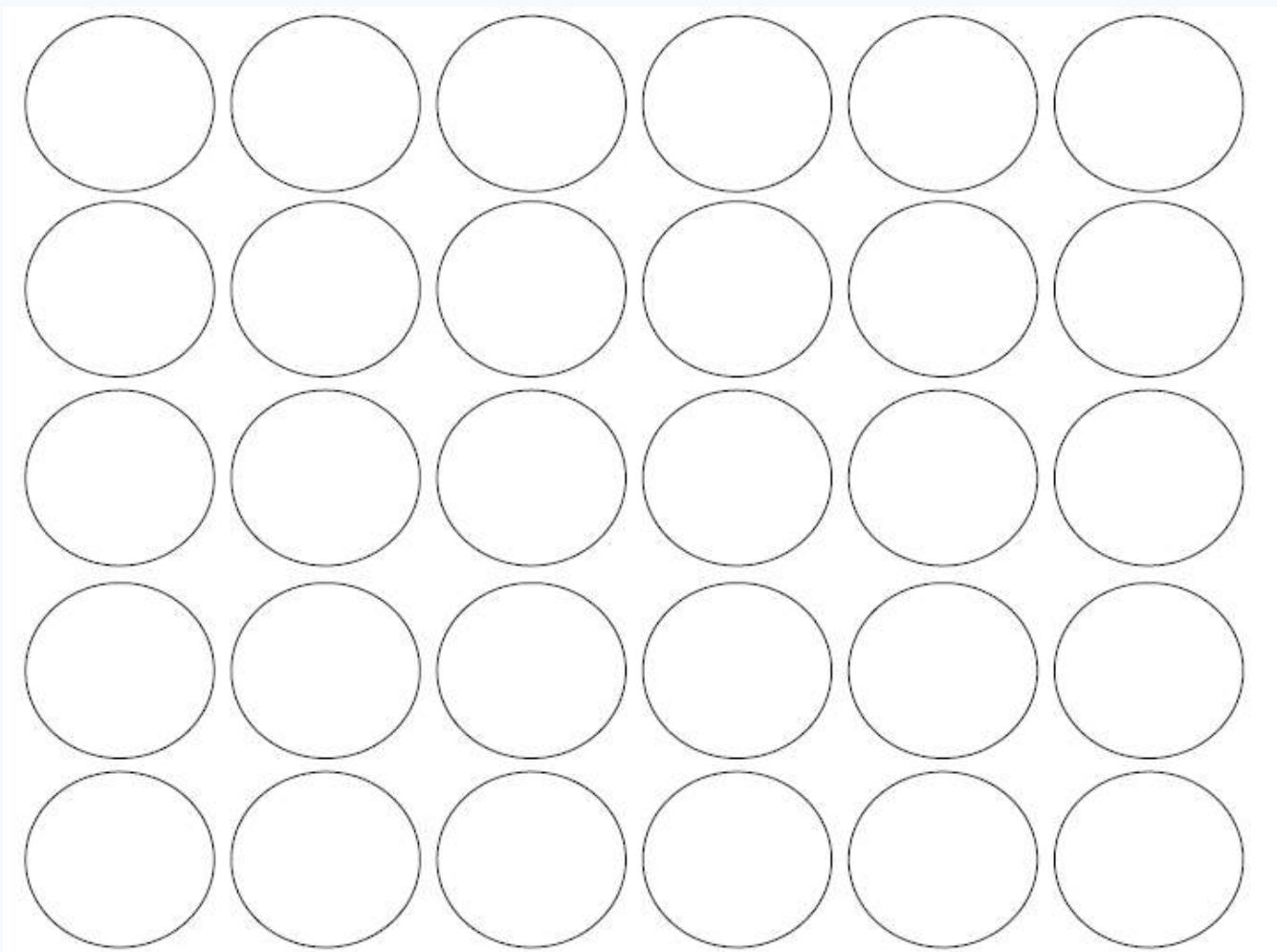
15 min



# 30 Circles Challenge

## Rules:

- Turn as many of the blank circles as possible into recognizable objects in two minutes
- Compare results. Focus on quantity not quality
- Discuss interesting findings as a group



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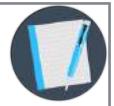


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*"Creativity is just connecting things."  
- Steve Jobs*

Cue  
Column

Note Taking  
Column



Summary



10 min



# Useless Objects Exercise (Bonus)



The popular improv television show, 'Whose Line is it Anyway' had a segment where host Drew Carey would take out seemingly useless props and have the team come up with imaginative ways to use them.

## How to play?

### **Individuals:**

- Think of ten objects around your office or house. Write them down on a piece of paper
- For each object, think of as many different uses as you can. Don't be afraid to put down uses that seem too big or silly
- Soon, you'll gather enough uses and see these objects in a whole new light!

### **Team:**

- Think of five to ten objects. You can use household items or stuff you find around the office
- Display each object and ask the group to come up with new uses for them
- Have a blast listening to ideas – some will be outstandingly brilliant, some just downright absurd

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*"Managers help people see themselves as they are; leaders help people to see themselves better than they are." - Jim Rohn*

Cue  
Column

Note Taking  
Column



Summary



35 min

# Collaborative Environments



## Steven Johnson - Where Good Ideas Come From

People often credit their ideas to individual "Eureka!" moments. Steven Johnson shows how history tells a different story. His fascinating tour takes us from the "liquid networks" of London's coffee houses through Darwin's slow hunch and up to today's high velocity web.



### Key Thoughts

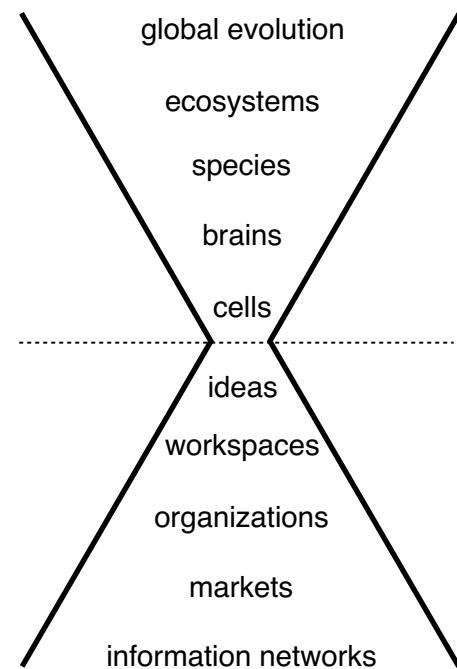
- Chance favors the connected mind
- If you look at history, innovation doesn't come from giving people incentives; it comes from creating environments where ideas can connect
- When you don't have to ask for permission, innovation thrives

#### The Hallway at Bell Labs

The building was designed to force everyone to interact with one another. Some of the hallways in the building were designed to be so long, to look down their length was to see the end disappear at a vanishing point. Traveling the hall's length without encountering a number of acquaintances, problems, diversions and ideas was almost impossible.



#### Nature Mirrors Our Culture



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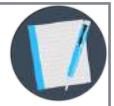


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*"We cannot solve our problems with the same thinking we used when we created them."*  
- Albert Einstein

Cue  
Column

Note Taking  
Column



Summary



30 min

# Biomimicry



## Michael Pawlyn - Using Nature's Genius in Architecture

How can architects build a new world of sustainable beauty? Potentially, by learning from nature. Michael Pawlyn describes three habits of nature that could transform architecture and society: radical resource efficiency, closed loops, and drawing energy from the sun.

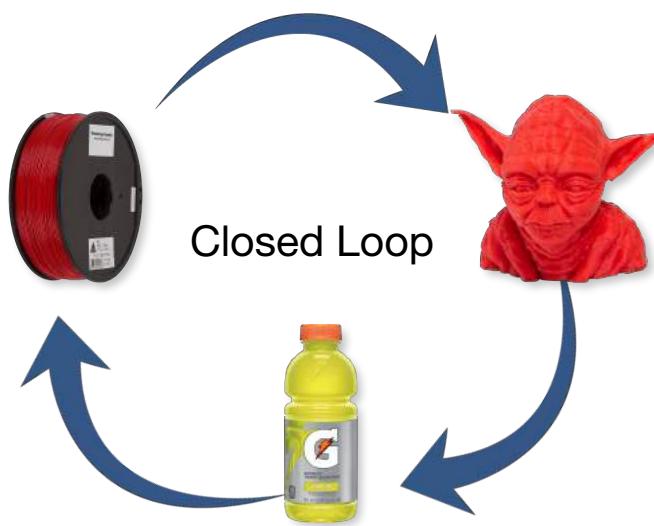


### Key Thoughts

- Nature is a catalog of products that have benefited from a 3.8-billion-year research and development period
- We tend to use resources by extracting them, turning them into short-life products and then disposing of them. Nature works very differently. In ecosystems, the waste from one organism becomes the nutrient for something else in that system
- In nature, we often expect to find competition and survival of the fittest. Upon a closer look however, you discover incredible examples of symbiosis in mature ecosystems

### 3D Printing from Trash

A group of high school students in Sicily invented a vending machine that turns trash into phone cases. The machine grinds plastic bottles into pellets which are then melted down into filament for 3D printers. As the Navy adopts 3D printing, imagine how we could turn our shipboard waste into a closed loop system.



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*"The ultimate measure of a man is not where he stands in moments of comfort, but where he stands at times of challenge and controversy." - Martin Luther King, Jr.*

Cue  
Column

Note Taking  
Column



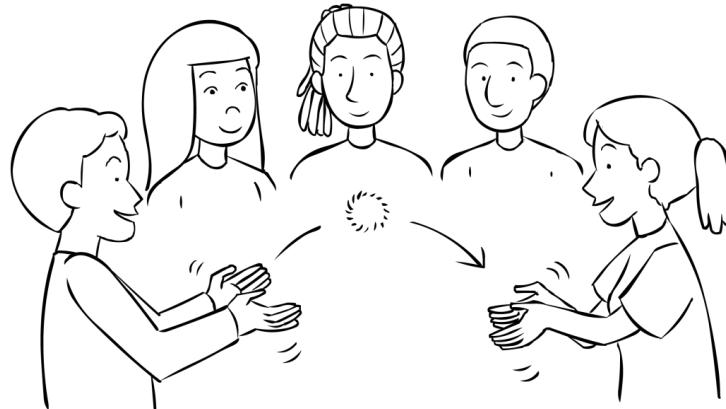
Summary



25 min



# Ball Exercise



A creative exercise that reinforces and emphasizes iteration and barrier removal

## How to play?

### Entire Class:

- Gather in a circle and have everyone **raise their hand** to indicate they have yet to catch the ball.
- **Pass the ball around the group** so that everyone has **touched it only once**.
- Put your **hand down** when you have caught the ball. Then pass to another person with their hand up so that the last person with their hand up can throw the ball back to the facilitator.
- Time this evolution and ensure everyone **remembers** who they got the ball from and who they gave it to.

## How can we make this faster?



**What mental models are limiting us?**

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*"Adversity causes some men to break; others to break records." - William A. Ward*

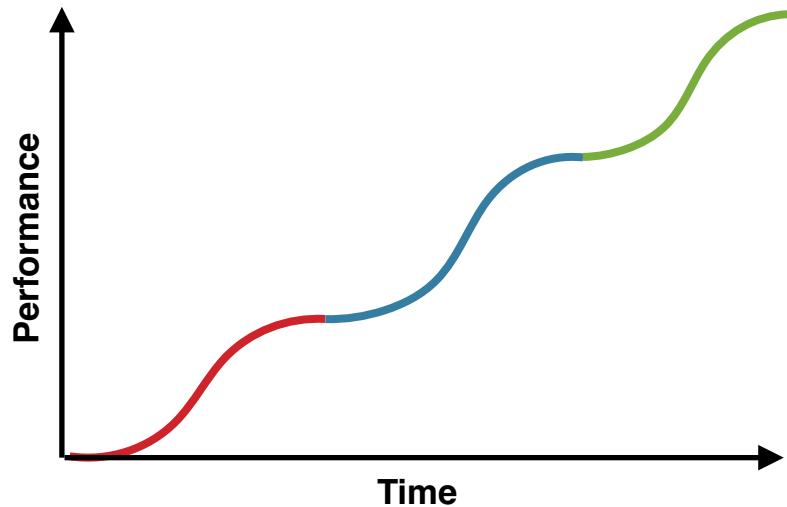


# Ball Exercise

## Iterative Development and Questioning Mental Models

### Rules

- Rapidly iterate
- Encourage group to go faster each time
- Accept only one suggestion at a time to improve



### Round 1: (35-20 seconds)\*

- Once they've learned the order they are passing the ball around in, have them stop raising their hands.
- Repeat current process several times, encouraging them to get faster each time until you hit a point where the increase in performance stagnates.

### Round 2: (8-4 seconds)\*

- Re-organize the location of each person based upon the order in which they receive the ball to produce a linear flow.
- Reduce excess operations through suggestions, rapidly iterating and increasing speed each time.

### Round 3: (3 seconds and less)\*

- Do things the “**other way round**”, have the facilitator move to the middle of the group and swing the ball around, touching everyone's hand.

\*Time estimates are based upon a class of 16-20

**Explain difference between a workaround and a paradigm shift**



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*“We spend a lot of time designing the bridge, but not enough time thinking about the people who are crossing it.”*  
- Prabhjot Singh

# Divergent Thinking



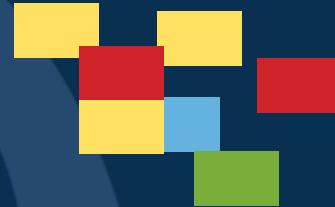
Opportunity



Peel The Onion



Brainstorming



**Define the issue, expand your mind, expand the possibilities**

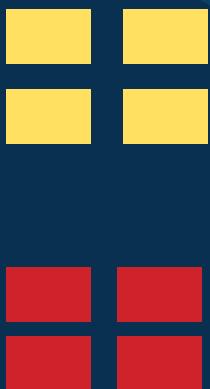
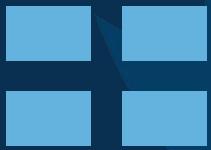
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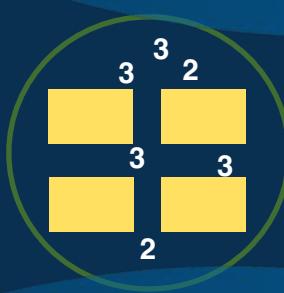
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*"The main tenet of design thinking is empathy for the people you're trying to design for. Leadership is exactly the same thing – building empathy for the people that you're entrusted to help." - David Kelley*

# Convergent Thinking



Affinity Diagram



Dotmocracy



PICK Chart



Narrow your focus, prioritize, and pitch your idea!



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*"User-centered design means understanding what your users need, how they think, and how they behave – and incorporating that understanding into every aspect of your process."*  
- Jesse James Garrett



20 min



# Yes, And

An exercise that breaks down barriers, enforces participants to defer judgement of others, and creates an open-mind for the remainder of the course.



1. Recommend two facilitators come to the center of the room
2. **Facilitator-A** will be asking **Facilitator-B** a question, to which **B** can only respond “no” to. **A** will try as hard as they can to persuade **B** into saying yes - they will fail in doing so
3. **A** asks **B** a question. Example - “Do you want to go to lunch” and **B** responds “no”
4. Class breaks into groups of two and take turns doing the same thing. Recommend 1 minute each



5. **Facilitator-A** will be asking **Facilitator-B** a question, to which **B** can only respond “no, but” to
6. **A** asks **B** a question. Example - “Do you want to go to lunch” and **B** responds “no, but I would like to go to dinner”
7. Class breaks into groups of two and take turns doing the same thing. Recommend 1 minute each
8. Ask the group what the main differences were between ‘no’ and ‘no, but’



9. **Facilitator-A** will be asking **Facilitator-B** a question, to which **B** can only respond “yes, and” to
10. **A** asks **B** a question. Example - “Do you want to go to lunch” and **B** responds “yes, and I would like to go to dinner as well”
11. Class breaks into groups of two and take turns doing the same thing. Recommend 1 minute each
12. Discuss the main differences between each approach: “no”, “no, but” and finally “yes, and”
13. Now showcase this new method for divergent thinking by having the facilitators “yes, and” each other until it becomes ridiculous

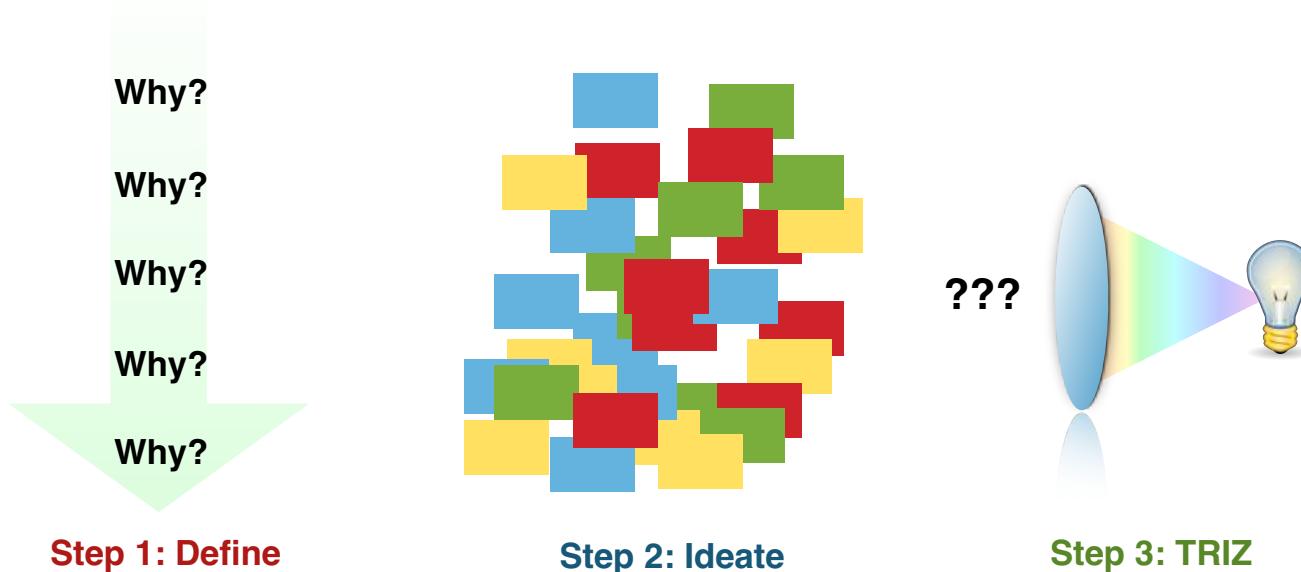




60 min

# Brainstorming

## An Exercise in Divergent Thinking



### Step 1: Define the challenge

- Ask the 5 “whys” and dig deeper, try to get the root cause

### Step 2: Ideate

- Go for **volume** here, the larger the pool of potential solutions the better. Shoot to fill an entire wall with stickies
- Build upon the ideas of others. Use “**Yes, And**”

### Step 3: TRIZ (Theory of Inventive Problem Solving)

- Use Lenses - Ask yourself the following questions:
  - ✓ How can I do this the other way around?
  - ✓ What can I take out to make it better?
  - ✓ What can I add or merge with it to make it better?
- TRIZ** is a more advanced brainstorming concept. To learn more go to the Dig Deeper reference on this page



page 59



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*"We are what we repeatedly do.  
Excellence, then, is not an act, but a  
habit." - Aristotle*

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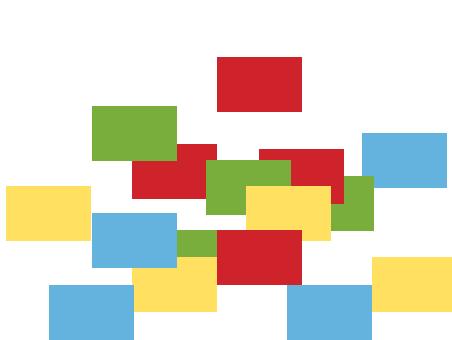


30 min

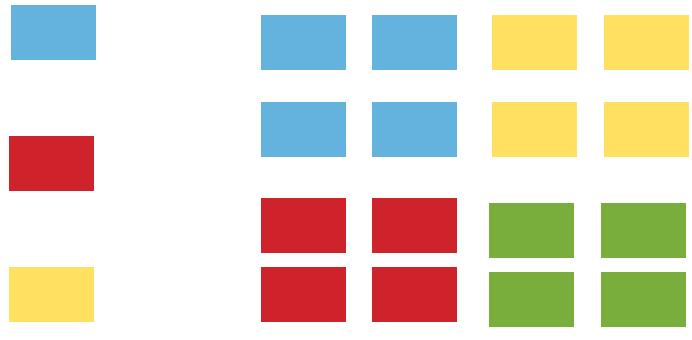


# Affinity Diagram

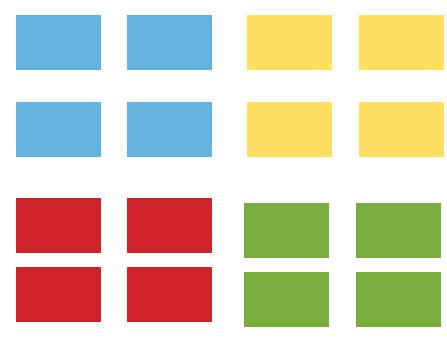
## Finding the Clusters of Concepts in Seemingly Random Noise



Step 1: Massive Group



Step 2: Separate Out



Step 3: Clusters

### Step 1: Massive Group

- Start with as **many ideas as possible** after brainstorming (divergent thinking) exercise. These stickies should be placed off to the far left or right of the wall this exercise is to take place

### Step 2: Separate Out

- Have the group form into a **single file line** and **silently** select **one** sticky at a time and place it into either its own cluster or an existing cluster, each time rotating to the back of the line after moving their one sticky.

### Step 3: Clusters

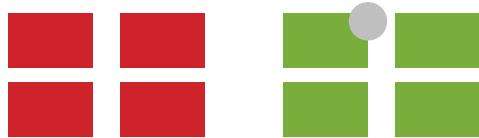
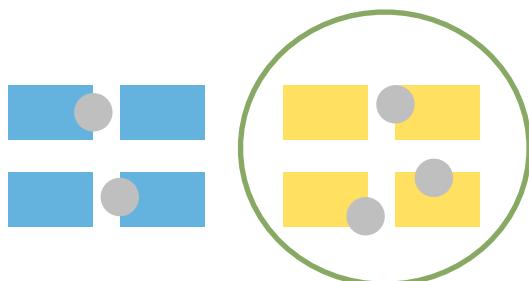
- Once rough clusters have formed, there should be some discussion to resolve conflicts and to explain logic.





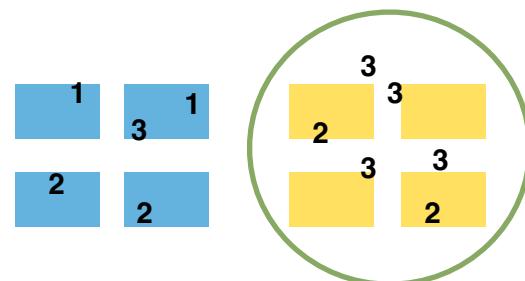
# Dotmocracy

## Selecting the Cluster to Work On



**Pick One**

**or**



**Three for Three**

### How to do it:

- Each person picks a single cluster they want to work on
- They put a sticky dot on that cluster to vote
- The cluster with the highest concentration of votes wins
- Recommend everyone vote at the exact same time to prevent bias

### How to do it:

- Each person gets three votes with weighted point values: 3pts, 2pts, and 1pt
- Each cluster can only have a single vote by an individual
- Whichever cluster has the highest subtotal wins

### Bonus Compromise:

If anyone puts a value of 3 in a separate cluster from the winning cluster, they get to pick **one** sticky from that cluster and move it to the winning cluster



**CREATIVE  
OWNERSHIP**

*“Never delegate understanding.”*  
- Charles Eames



15 min



# Grandma's House

Doorbell doesn't work



Faucet is dripping

An exercise which helps to understand and develop a PICK chart. Participants should be able to easily prioritize solution-sets once they have gone through this

## Where do we start?

Front door lock isn't aligned

- Grandma has some issues around the house that need to be fixed and she needs your help figuring out the best “**bang for the buck**”
- Note the recommended issues on this page; they need to be prioritized
- **(Tip)** Get the class to physically move their hand one way or the other to describe/vote on impact/feasibility; this will make it easier to understand direction without prolonged discussion

House phone batteries are dead

Freezer needs to be defrosted (2 inches)

Broken handrail going into house

Most of bulbs in bedroom are burned out

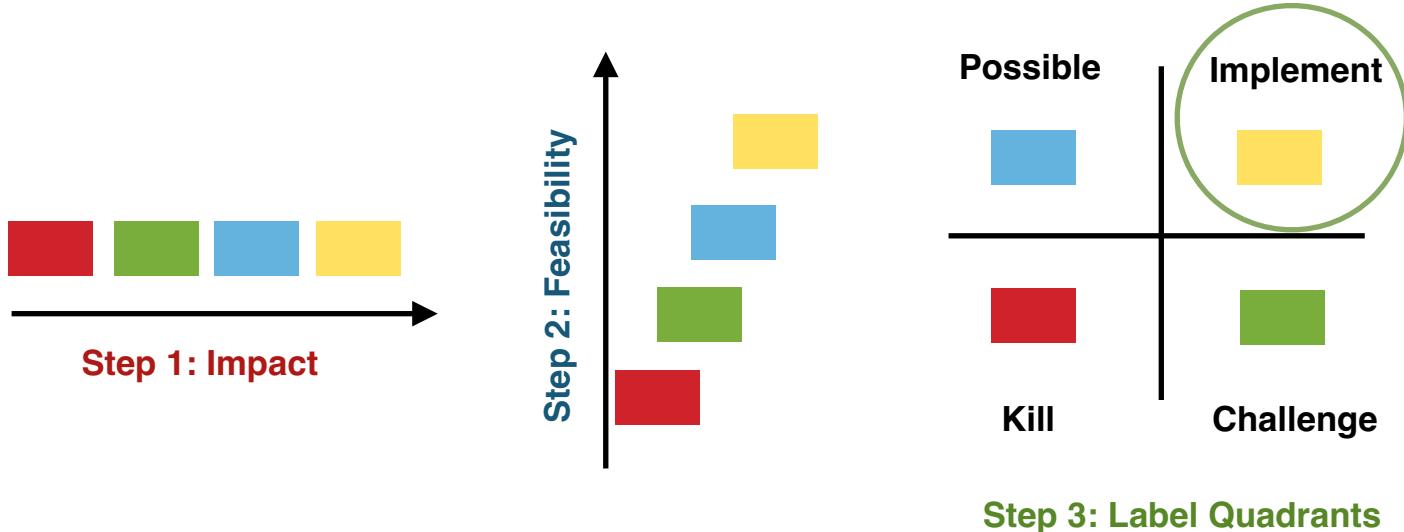
2 strips of siding are missing (no damage possible)





# Grandma's House

## The PICK Chart (Possible - Implement - Challenge - Kill)



### Step 1: (X-Axis) Impact Low to High

- Walk through impact only on X-axis from Low to High. Mention one stickie at a time and crowd-source where it belongs on the axis. Compare stickies so there are no tied stickies and they are side-to-side in a line

### Step 2: (Y-Axis) Feasibility Low to High

- Walk through feasibility for each stickie on Y-axis. Stay with one stickie at a time - no tied topics/issues

### Step 3: Label Quadrants and Identify Best Bang for the Buck

- Once complete, talk through the items at the top-right and explain how these are the things you should help Grandma with first



CREATIVE  
OWNERSHIP

*"Repetition is the death of magic."*  
- Bill Watterson

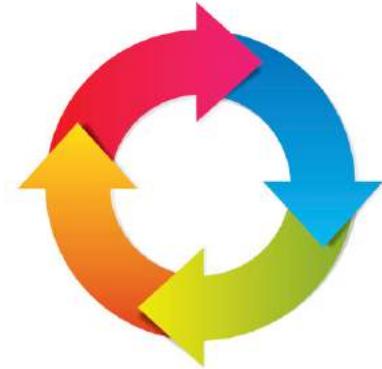
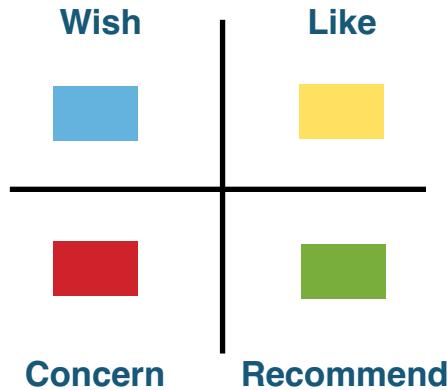


45 min



# Pitch Trade-offs

## Minimum Viable Products and Iterative Development



### Step 1: Soft Pitch

### Step 2: Group Feedback

### Step 3: Learn and Iterate

An exercise that refines presentations and teaches several methods for getting one's point across to potential gatekeepers

#### Step 1: Soft Pitches

- Once teams are at about a 50-60% solution with their presentation, have each of them present to the entire class

#### Step 2: Group Feedback

- Have each member in the class write down their thoughts on stickies and place on the wall as they relate to these 4 categories:
  - I wish...
  - I like...
  - I recommend...
  - My concern is...

#### Step 3: Learn and Iterate

- Allow the team to collect these stickies so they can use this feedback to improve

40



CREATIVE  
OWNERSHIP

*"Motivation is everything. You can do the work of two people, but you can't be two people. Instead, you have to inspire the next guy down the line and get him to inspire his people." - Lee Iacocca*

# Stress Communication



## Mental Noise

Hearing and listening are two very different acts. Before you can even begin to make your point, you first have to prepare others to listen

## Approaches

- Be brief and to the point
- Be clear and convey three key points
- Use good visuals

## Factors

- Emotional arousal (stress, anxiety, anger)
- Mental agitation (perceived significant threat)
- Exposure to risks associated with negative psychological attributes



### Effects of stress on communication

#### Low stress

- People can process an average of 7 messages.
- They recall information in linear order (1,2,3 ...)
- They process messages at an eighth-grade level
- Trust is built on competence and experience.

#### High stress

- People can process an average of 3 messages.
- They recall what they perceive as most important or what is said last.
- They process messages at a fourth-grade level.
- Trust is built on listening, empathy, caring and compassion

Dr. Vincent Covello



CREATIVE  
OWNERSHIP

*"The single biggest problem in communication  
is the illusion that it has taken place."  
- George Bernard Shaw*

41

# Pilot to Reduce Risk

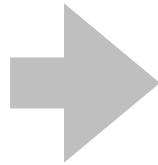


Creativity + Iterative Development = Innovation

When should you use iterative development? You should only use it on the projects you want to succeed. Without the constant feedback provided, you run a very real risk of failure

## The 3 Excuses

- “I need more time”
- “I need more money”
- “I need more people”

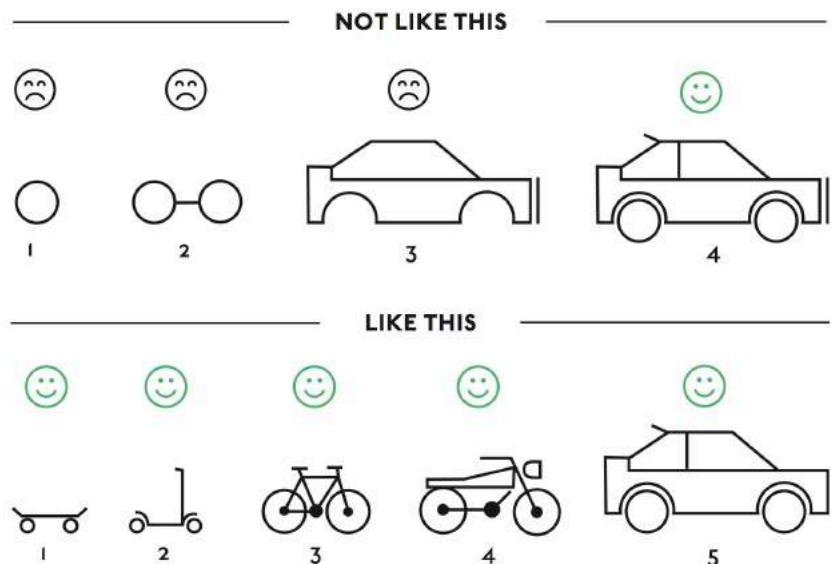


## The 3 Rules

- You aren't getting 2 years
- You aren't getting a million dollars
- You aren't getting more people

Now go prove your idea works

## HOW TO BUILD A MINIMUM VIABLE PRODUCT (MVP)



# The Extended Collection

The material beyond this point is a collection of readings and resources, which helps shape the mental model of an effective innovator



Keep  
Calm  
and  
Dive  
On



**CREATIVE**  
OWNERSHIP

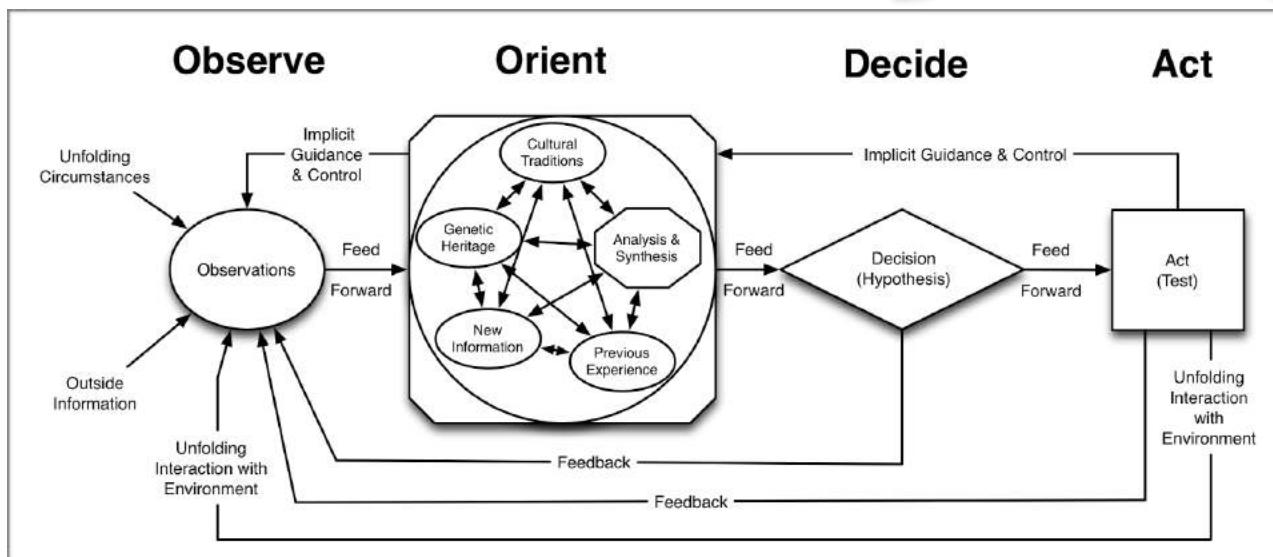
*"The most important six inches on the battlefield is between your ears."*  
- James Mattis

# OODA Loop



Think like a fighter pilot

John Boyd, widely regarded as one of the most influential of modern military thinkers, developed a theory of effective action in dynamic situations. Boyd called it the "OODA Loop."



From Marine Corps Doctrinal Publication 1 - Warfighting

Tempo is often associated with a mental process known variously as the **decision cycle**, **OODA loop**, or **Boyd cycle** after John Boyd who pioneered the concept in his lecture, "The Patterns of Conflict." He identified a four-step mental process: observation, orientation, decision, and action. He theorized that each party to a conflict first **observes** the situation. On the basis of the observation, they **orient**; that is, they make an estimate of the situation. On the basis of the orientation, they make a **decision**. Finally, implementing the decision—they **act**. Because this action has created a new situation, the process begins anew. He argued that the party who consistently completes the cycle faster gains an advantage which increases with each cycle. Your enemy's reactions become increasingly slower by comparison and therefore less effective until, ultimately, they are overcome by events. "A Discourse on Winning and Losing: The Patterns of Conflict," unpublished lecture notes and diagrams, August 1987.



# OODA Loop



## Destruction and Creation

"Ambiguity is central to Boyd's vision... not something to be feared, but something that is a given...We never have complete and perfect information. The best way to succeed is to revel in ambiguity." –Grant Hammond, The Mind of War: John Boyd and American Security



## Key Thoughts

- When our circumstances change, we often fail to shift our perspective and instead continue to try and see the world as it should be
- The more we rely on outdated mental models, even while the world around us is changing, the more our mental "entropy" goes up



## Exercise

"Imagine that you are on a ski slope with other skiers...that you are in Florida riding in an outboard motorboat, maybe even towing water-skiers. Imagine that you are riding a bicycle on a nice spring day. Imagine that you are a parent taking your son to a department store and that you notice he is fascinated by the toy tractors or tanks with rubber caterpillar treads.

Now imagine that you pull the skis off but you are still on the ski slope. Imagine also that you remove the outboard motor from the motorboat, and you are no longer in Florida. And from the bicycle you remove the handle-bar and discard the rest of the bike. Finally, you take off the rubber treads from the toy tractor or tanks. This leaves only the following separate pieces: skis, outboard motor, handlebars and rubber treads..."

**Did you figure it out?**



**CREATIVE  
OWNERSHIP**

*"To be somebody or to do something.  
In life, there is often a roll call. That's  
when you will have to make a decision.  
To be or to do? Which way will you go?"*  
- John Boyd

**45**

# OODA Loop

## It is a Snowmobile



"A loser is someone (individual or group) who cannot build snowmobiles when facing uncertainty and unpredictable change; whereas a winner is someone (individual or group) who can build snowmobiles, and employ them in an appropriate fashion, when facing uncertainty and unpredictable change." - John Boyd

## On Doctrine

"The Air Force has got a doctrine, the Army's got a doctrine, Navy's got a doctrine, everybody's got a doctrine. [But if you] read my work, 'doctrine' doesn't appear in there even once. You can't find it. You know why I don't have it in there? Because it's doctrine on day one, and every day after it becomes dogma. That's why...." - John Boyd

## On Mental Models

You've got to have models in your head. You also need to array your experience — both vicarious and direct — on this lattice work of mental models. You may have noticed your peers, whom just rely upon what they have been taught. Well, they are limited in school and in life. You need to overlay experience on a lattice work of mental models in your head. What are the structures in our minds? Well, the first rule is that you've got to have multiple — because if you just have one or two that you're using, the nature of human psychology is such that you'll torture reality so that it fits your experience, or at least you'll think it does...So you must have multiple orientations. These frameworks must come from multiple disciplines — because all the wisdom of the world is not to be found in one little area or a single approach to problem solving. - Adapted from the words of John Boyd

# Revolutionary vice Evolutionary



“Would You Rather be Revolutionary or Evolutionary?”

by Jeff Stibel

Suppose you were alive in 1884 and were approached by an aspiring entrepreneur who had developed the most efficient and durable horse carriage ever created. Would you invest in this company?

It might not have worked out well for you since, one year later, another inventor by the name of Karl Benz would patent what is now considered the first automobile. Within 20 years, the horse and carriage industry would be under assault from the automobile. And within another 15, the nascent automobile industry found itself rocked by yet another innovation: Henry Ford's system of mass production, which obliterated hundreds of competitors who could not produce cars as quickly or cheaply.

Inventors... innovators... entrepreneurs... these terms are often used interchangeably. Yet I would argue that they each refer to different links in the total value-chain of progress.

While inventors are more idea-oriented and entrepreneurs are more action-oriented, they both share an approach to problem solving that is non-linear. Innovators, however, can either be linear or non-linear. The linear innovators tend to be evolutionary, making incremental improvements, while the non-linear innovators tend to be revolutionary.

We can all think of innovations that were revolutionary in nature: the automobile, the phonograph, the Internet. Likewise, we can also think of more linear innovations that were evolutionary: better engines for cars; better sound systems for the phonograph; the World Wide Web (enabled by another incremental invention, html code) for the Internet.

Evolutionary innovators ask questions based on the limitations of existing solutions; revolutionary innovators ask questions no one else has thought of. This sentiment was eloquently captured by Robert Kennedy when he paraphrased a quote by George Bernard Shaw: “Some people see things as they are and say why? I dream things that never were and say why not.”



**CREATIVE  
OWNERSHIP**

*“Creativity is thinking up new things.  
Innovation is doing new things.”  
- Theodore Levitt*

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# Revolutionary vice Evolutionary

While both types of innovation play a vital role in the developmental ecosystem of technology, industry and business, it is the non-linear or revolutionary innovations that make the most significant advances. These are the ones that make the real difference. The really huge achievements in technology, and the world at large, are the result of visionary activists who imagine and then build something none of us had previously thought possible.

In the era of Karl Benz, the light bulb, the phonograph, the telephone, and the automobile embodied this vision for possibilities that did not yet exist. But while quantum leaps like this tend to get more attention than incremental improvements, we should not minimize the importance of evolutionary innovations, the accumulation of which make the world a better place through millions of small, gradual steps. Many incremental improvements become far better products and businesses.

To use a nature analogy, revolutionary innovation is like the Cambrian explosion or the extinction of the dinosaurs (by an asteroid that hit northern Mexico). Evolutionary innovation is more like, well, evolution. And just as nature derives most of its change from evolution, most entrepreneurs focus on incremental gains.

For the most part, revolutionary ideas are implemented and commercialized by entrepreneurs who make evolutionary advances: the Wright brothers may have invented the airplane, but it was innovations such as airmail, military air forces, and commercial airlines that evolved the invention into a commercial enterprise. The precursor to today's steam engine — the Greek aeolipile invented in the 1st century by Heron of Alexandria — went nowhere because no evolutionary innovator picked up on it to take it to the next level. Even after the first automobile was developed by Benz, mass adoption took decades. The car would not have revolutionized so many lives if someone hadn't figured out how to mass-produce cars at an affordable price.



# Revolutionary vice Evolutionary

What is truly innovative today versus merely incremental?

Revolutionary Innovations	Evolutionary Innovations
Internal Combustion Engine, Hybrid Cars	Electric cars, Biofuels
Telephone, Mobile Phone	iPhone
Photography	Digital Photography, Flickr, PhotoBucket
Computers	Laptops
Internet	World Wide Web
Napster	iTunes

Reasonable people can debate whether a particular innovation belongs in the first category or the second. What is not debatable is that while both play a role in the ecology of innovation, it is the truly revolutionary innovations that make all subsequent incremental improvements possible.



# Paradigm Shifts



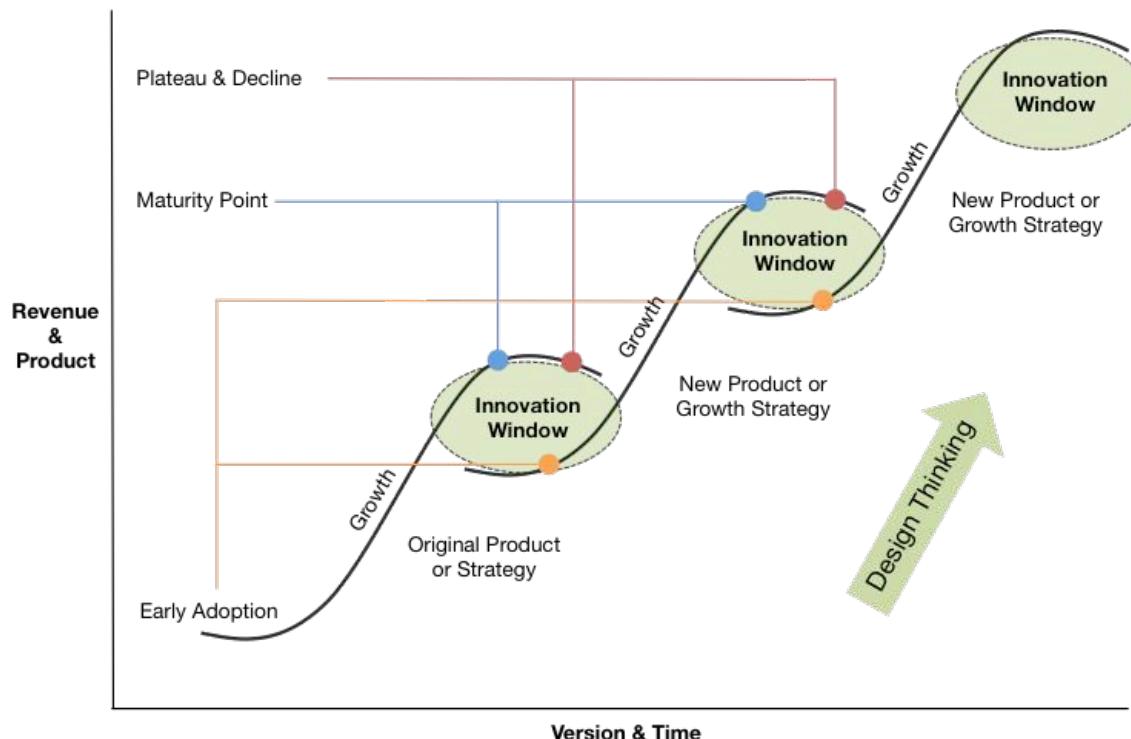
## Understanding Horizons of Innovation and Paradigm Shifts

In 1962, Thomas Kuhn wrote *The Structure of Scientific Revolution*, and fathered, defined and popularized the concept of the "paradigm shift". Kuhn argues that scientific advancement is not evolutionary, but rather is a "series of peaceful interludes punctuated by intellectually violent revolutions", and in those revolutions "one conceptual world view is replaced by another".

Think of a Paradigm Shift as a change from one way of thinking to another. It's a revolution, a transformation, a sort of metamorphosis. It does not just happen, but rather it is driven by agents of change.

For example, agriculture changed early primitive society. The Native Americans existed for centuries, roaming the earth constantly hunting and gathering for seasonal foods and water. However, by 2000 B.C., Middle America was a landscape of very small villages, each surrounded by patchy fields of corn and other vegetables.

### Paradigm Shifts and Innovation



# Paradigm Shifts

Agents of change helped create a paradigm-shift, moving scientific theory from the Ptolemaic system (the earth at the center of the universe) to the Copernican system (the sun at the center of the universe), and moving from Newtonian physics to Relativity and Quantum Physics. Both movements eventually changed the world view. These transformations were gradual as old beliefs were replaced by the new paradigms, creating "a new gestalt."

Likewise, the printing press, the making of books and the use of vernacular language inevitably changed the culture of a people and had a direct affect on the scientific revolution. Johann Gutenberg's invention in the 1440's of moveable type for printing was an agent of change. With the invention of the printing press, books became readily available, smaller and easier to handle and cheap to purchase. Masses of people acquired direct access to the scriptures. Attitudes began to change as people were relieved from church domination.

Similarly, agents of change are driving a new paradigm shift today. The signs are all around us. For example, the introduction of the personal computer and the internet have impacted both personal and business environments, and is a catalyst for a Paradigm Shift. We are shifting from a mechanistic, manufacturing, industrial society to an organic, service based, information centered society, and increases in technology will continue to impact globally. Change is inevitable. It's the only true constant.

In conclusion, for millions of years we have been evolving and will continue to do so. Change is difficult. Human beings resist change; however, the process has been set in motion long ago and we will continue to co-create our own experience. Kuhn states that "awareness is prerequisite to all acceptable changes of theory". It all begins in the mind of the person. What we perceive, whether normal or metanormal, conscious or unconscious, are subject to the limitations and distortions produced by our inherited and socially conditional nature. However, we are not restricted by this for we can change. We are moving at an accelerated rate of speed and our state of consciousness is transforming and transcending. Many are awakening as our conscious awareness expands.



# Diffusion of Innovations



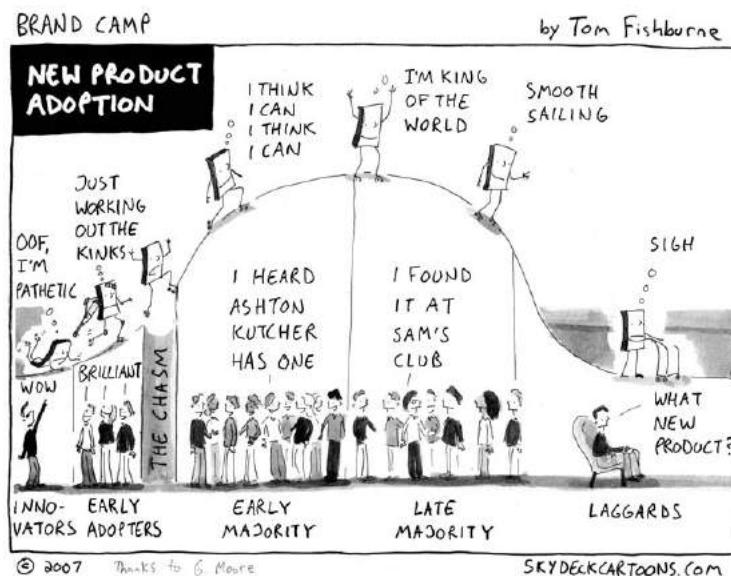
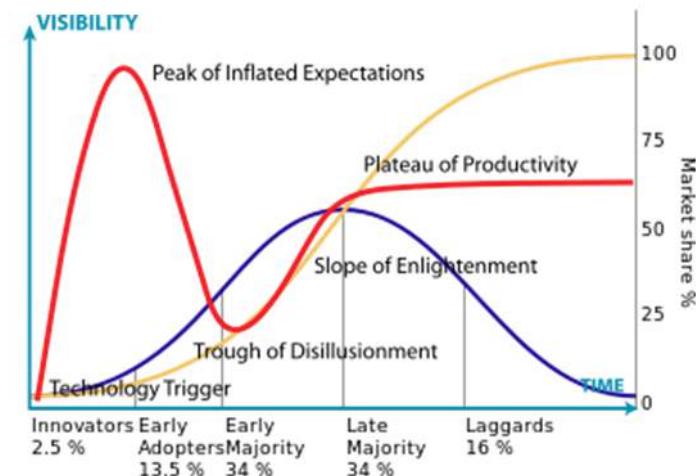
## Everett Rogers - Diffusion of Innovations

Rogers argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. The origins of the diffusion of innovations theory are varied and span multiple disciplines.



## Key Thoughts

There are three concepts interlaced which need to be understood. The first is the **diffusion of innovation**, which shows the distribution between different adoption behaviors in any group of people. The second is the **hype curve**, which shows how expectations rise rapidly due to the vocal adoption of new concepts and technologies by the innovators and early adopters. Eventually collapsing and then settling on a “happy medium”. The final concept is **market adoption**, which shows what percentage of a group has adopted a new concept or technology over time.



# Diffusion of Innovations



“When You Change the World and No One Notices”  
by Morgan Housel



Do you know what's happening in this picture? Literally one of the most important events in human history.

But here's the most amazing part of the story: hardly anyone paid attention at the time.

Wilbur and Orville Wright conquered flight on December 17th, 1903. Few inventions were as transformational over the next century. It took four days to travel from New York to Los Angeles in 1900, by train. By the 1930s it could be done in 17 hours, by air. By 1950, six hours.

Unlike, say, mapping the genome, a lay person could instantly grasp the marvel of human flight. A guy sat in a box and turned into a bird.



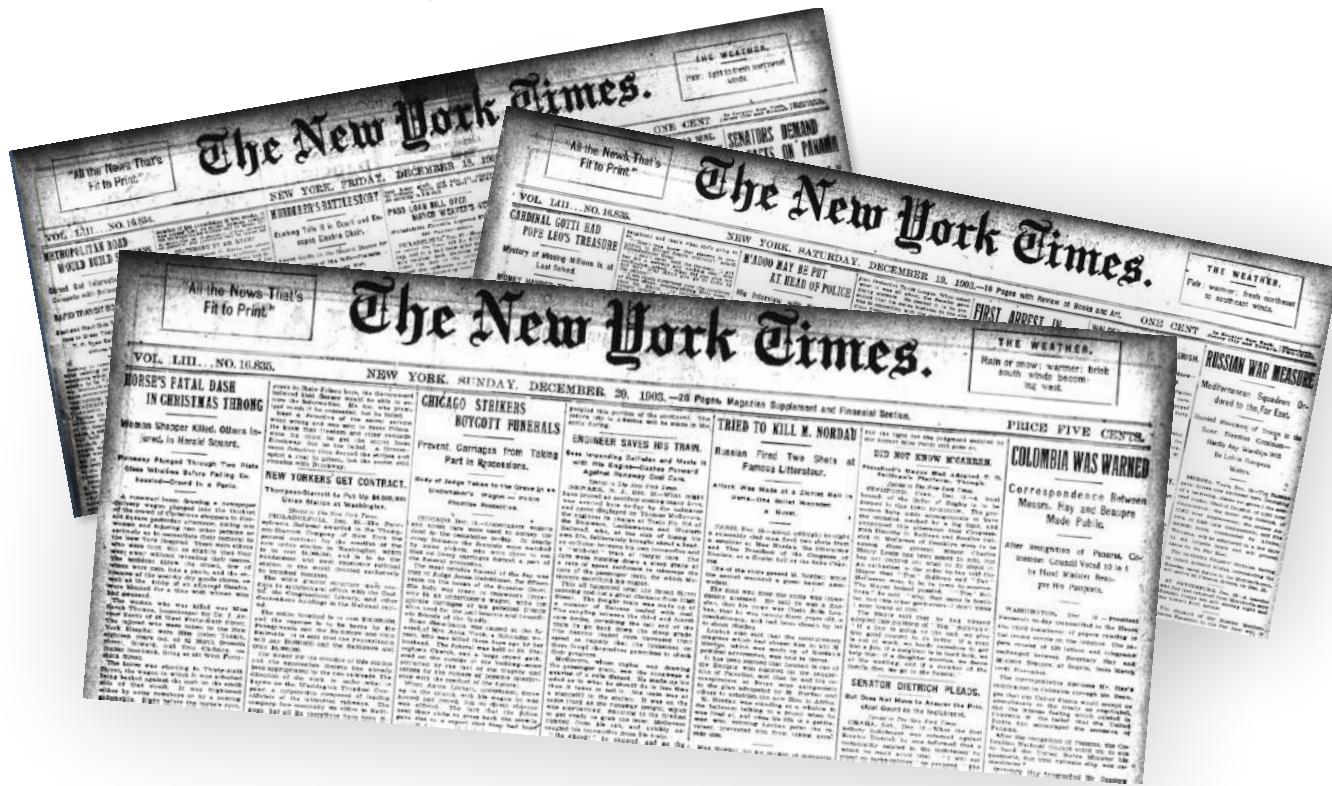
CREATIVE  
OWNERSHIP

*“The Wright brothers flew right through  
the smoke screen of impossibility.”*  
- Charles Kettering

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# Diffusion of Innovations

Here's the front page of The New York Times for the next few days after the first flight. Not a word about the Wrights:



This goes on. Four days. Five days, six days, six weeks, six months ... no mention of the men who conquered the sky for the first time in human history.

The Library of Congress, where I found these papers, reveals two amazing details. One, the first passing mention of the Wrights in The New York Times came in 1906, three years after their first flight. Two, in 1904, the Times asked a hot-air-balloon tycoon whether humans may fly someday. He answered:

-----  
“In the very, very, very far future,” said the Count, with a crescendo accent on the “very,” and a shoulder shrug that suggested an eternity, “there may be flying machines, but not now, not now.”

That was a year after the Wright's first flight.



# Diffusion of Innovations

In his 1952 book on American history, Frederick Lewis Allen wrote:

*“Several years went by before the public grasped what the Wrights were doing; people were so convinced that flying was impossible that most of those who saw them flying about Dayton [Ohio] in 1905 decided that what they had seen must be some trick without significance – somewhat as most people today would regard a demonstration of, say, telepathy. It was not until May, 1908 – nearly four and a half years after the Wright’s first flight – that experienced reporters were sent to observe what they were doing, experienced editors gave full credence to these reporters’ excited dispatches, and the world at last woke up to the fact that human flight had been successfully accomplished.”*

The Wrights' story shows something more common than we realize: There's often a big gap between changing the world and convincing people that you changed the world.

Jeff Bezos once said:

*“Invention requires a long-term willingness to be misunderstood. You do something that you genuinely believe in, that you have conviction about, but for a long period of time, well-meaning people may criticize that effort ... if you really have conviction that they’re not right, you need to have that long-term willingness to be misunderstood. It’s a key part of invention.”*



# Diffusion of Innovations

It's such an important message. Things that are instantly adored are usually just slight variations over existing products. We love them because they're familiar. The most innovative products – the ones that truly change the world – are almost never understood at first, even by really smart people.

It happened with the telephone. Alexander Graham Bell tried to sell his invention to Western Union, which quickly replied:

*"This 'telephone' has too many shortcomings to be seriously considered as a practical form of communication. The device is inherently of no value to us. What use could this company make of an electrical toy?"*

It happened with the car. Twenty years before Henry Ford convinced the world he was onto something, Congress published a memo, warning:

*"Horseless carriages propelled by gasoline might attain speeds of 14 or even 20 miles per hour. The menace to our people of vehicles of this type hurtling through our streets and along our roads and poisoning the atmosphere would call for prompt legislative action. The cost of producing gasoline is far beyond the financial capacity of private industry... In addition the development of this new power may displace the use of horses, which would wreck our agriculture."*



# Diffusion of Innovations

It began with the index fund and became the most important financial innovation of the last half-century. John Bogle launched the first index fund in 1975, and no one paid much attention for the next two decades. In the 1990s, it started to gain popularity, an inch at a time. Then, three decades after inception, the idea spread like wildfire.



It's happening now, too. For instance, 3D printing has taken off over the last five years, but it's hardly a new invention. 3D printing, like so many innovations, had a multi-decade lag between invention and adoption. Solar Power is similar. Photovoltaics were discovered in 1876. They were commercially available by the 1950s, and Jimmy Carter put solar panels on the White House in the 1970s. But they didn't take off – really take off – until the late 2000s.



# Diffusion of Innovations

Big breakthroughs typically follow a seven-step path:

1. First, no one has heard of you.
2. Then they've heard of you but think you're nuts.
3. Then they understand your product, but think it has no opportunity.
4. Then they view your product as a toy.
5. Then they see it as an amazing toy.
6. Then they start using it.
7. Then they couldn't imagine life without it.

This process can take decades. It rarely takes less than several years.

Three points arise from this.

1. It takes brilliance to change the world. It takes something else entirely to wait patiently for people to notice. "Zen-like patience" isn't a typical trait associated with entrepreneurs. But it's often required, especially for the most transformative products.
2. When innovation is measured generationally, results shouldn't be measured quarterly. History is the true story of how long, messy, and chaotic change can be. The stock market is the hilarious story of millions of people expecting current companies to perform quickly, orderly, and cleanly. The gap between reality and expectations explains untold frustration.
3. **Invention is only the first step of innovation.**

Stanford professor Paul Saffo put it this way:

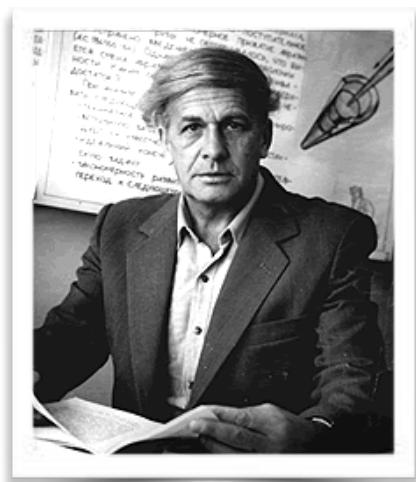
*It takes 30 years for a new idea to seep into the culture. Technology does not drive change. It is our collective response to the options and opportunities presented by technology that drives change.*

# TRIZ



## The Theory of Inventive Problem Solving

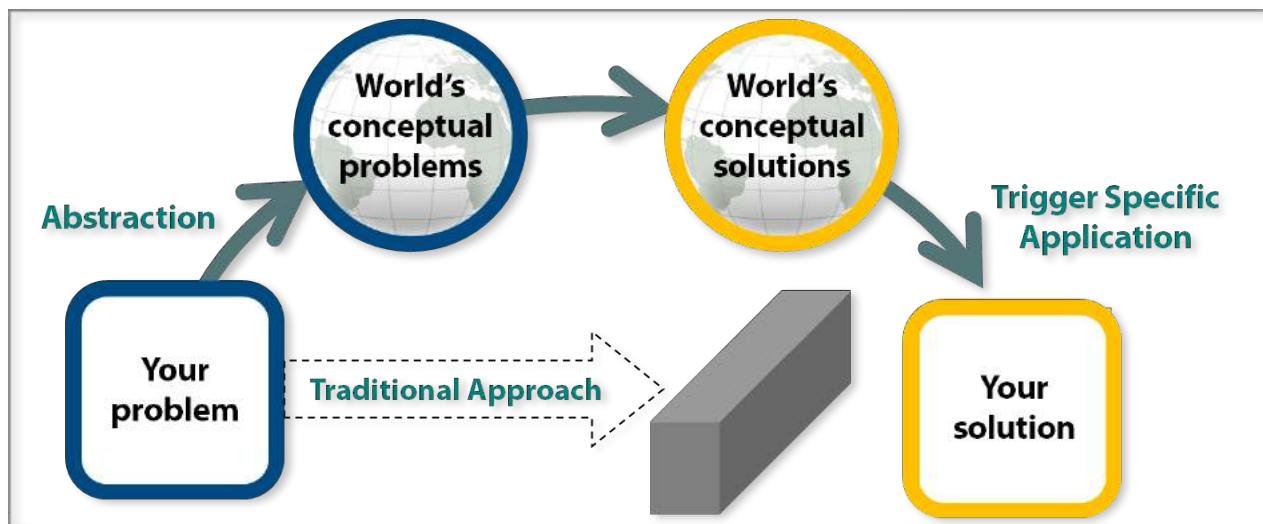
TRIZ is a problem solving methodology based on logic, data and research... not intuition. It draws on past knowledge and ingenuity of thousands of historical patents to accelerate a team's ability to solve problems creatively.



## Key Thoughts

Someone, somewhere, has already solved your problem (or one very similar to it). Today, creativity involves finding *that* solution and adapting it to *your* particular problem.

- Problems and solutions are repeated across industries and sciences. By classifying the "contradictions" in each problem, you can predict good creative solutions to *your* problem
- Patterns of technical evolution tend to be repeated across industries and sciences
- Creative innovations often use scientific effects outside the field where they were developed



CREATIVE  
OWNERSHIP

*"In real life, unlike in Shakespeare, the sweetness of the rose depends upon the name it bears. Things are not only what they are. They are, in very important respects, what they seem to be."*  
- Hubert Humphrey



# Genrich Altshuller: Father of TRIZ

by Leonid Lerner

*The person we are going to discuss is unique.  
He is unique not just because he developed an amazing science.  
He is unique because he never asked for anything in return.  
He never said, "Give me."  
He always said, "Take this."  
His name is Genrich Altshuller.*

## LETTER TO STALIN

In December of 1948, while a Lieutenant of the Caspian Sea Military Navy, Genrich Altshuller wrote a dangerous letter addressed: "Personally to Comrade Stalin." The author pointed out to his country's leader that there was chaos and ignorance in the USSR's approach to innovation and inventing. At the end of the letter he expressed an even more "outrageous" thought: There exists a theory that can help any engineer invent. This theory could produce invaluable results and revolutionize the technical world. The harsh answer to this letter did not arrive until two years later. Meanwhile, let's introduce this brash young Lieutenant.

Genrich Altshuller was born on October 15, 1926 in Tashkent in the former USSR. He spent many years in Baku, the Capital of Azerbaijan. Since 1990 he has resided in Petrozavodsk, Karelia.

Altshuller received his first Author's Certificate [internal Russian patent] for an underwater diving apparatus while a student in the ninth grade. In the tenth grade he built a boat having a rocket engine that used carbide for fuel. In 1946 he developed his first mature invention, a method for escaping from an immobilized submarine without diving gear. This invention was immediately classified as a military secret — and Altshuller was offered employment in the patent department of the Caspian Sea Military Navy.

The head of that patent department was a man who indulged in fantasies. He asked Altshuller to find a solution to one fantasy: find a military diversion to help a soldier trapped behind enemy lines with no resources. In response, Altshuller invented a new



kind of weapon — an extremely noxious chemical substance made from common medical drugs. This invention was a success, and the inventor was brought to meet Mr. Beria, the head of the KGB in Moscow. Four years later, while in one of Beria's prisons, Altshuller would be charged with disrupting a parade in Red Square with this same invention.

Altshuller was a successful young inventor. What triggered his desire to write a letter to Stalin that would destroy his career and change his life forever?

"The point is," Altshuller says, "not only did I have to invent, I had to help those who wanted to invent as well."

Dozens of people came to his office. "Here is a problem," they said. "I cannot solve it. What can I do?" In response, Altshuller searched all the scientific libraries but did not find even the most elementary text book on the subject of inventing. Scientists claimed that inventions were the result of accidents, mood, or "blood type." Altshuller could not accept



this — if a methodology for inventing did not exist, one should be developed.

Altshuller shared his ideas with his former schoolmate Rafael Shapiro, an inventor driven to achieve maximum success. By this time, Altshuller had already learned that invention is nothing more than the removal of a technical contradiction with the help of certain principles. Invention is certain if an inventor possesses knowledge of these principles. Shapiro was excited about this discovery and suggested that they should immediately write a letter to Stalin to get his support.

Altshuller and Shapiro prepared themselves. They searched for new methods, studied all the existing patents and took part in inventing competitions. They even received a National Competition Award for inventing a flame and heat resistant suit. Suddenly, they were asked to come to Tbilisi, a town in Georgia. They were arrested as they arrived and, two days later, their interrogation began. They were charged with “inventor’s” sabotage and, as was usual in those days, sentenced to 25 years imprisonment.

This happened in 1950. The reader may think this is the beginning of a story about “a martyr for his ideas.” However, Altshuller views his arrest differently.

“Before prison, I struggled with simple human doubts. If my ideas were so important, why weren’t they recognized? All my doubts were resolved by the MGB [Moscow Committee of State Security].” After his arrest a series of situations occurred where, in order to stay alive, Altshuller utilized TRIZ (The Theory of Solving Inventive Problems) concepts as his only means of defense.

In a Moscow prison, Altshuller refused to sign a confession and was placed on an “interrogation conveyor.” All night he was questioned. During the day, he was not allowed to sleep. Altshuller understood that he could not survive under these conditions. He stated the problem: How can I sleep and not sleep at the same time? The task seemed unsolvable. The most rest he was permitted was to sit with his eyes open. This meant that, in order to sleep, his eyes must be open and closed at the same time. This was easy. Two pieces of paper were torn from a cigarette package. With a charred match, he drew a pupil on each piece of paper. Altshuller’s roommate spit on the papers

and stuck them to Altshuller’s closed eyes. After that he sat across from the door’s peek hole and calmly fell asleep. He was thus able to sleep for several days in a row. His interrogator wondered why Altshuller seemed fresh every night.

Finally, Altshuller was sentenced to Siberia’s Gulag where he worked 12 hours every day logging. Knowing that he could not survive working so hard, he asked himself the question: “Which is better — continue to work, or refuse and be put into solitary confinement?” He chose confinement and was transferred to a section with criminals. Here survival was much simpler. He befriended the prisoners by telling them many fictional stories he knew by heart.

Later, Altshuller was transferred to a camp where the older intelligentsia — scientists, lawyers, architects — were slowly dying. To cheer up these desperate people, Altshuller opened his “One Student University.” Each day, for 12 to 14 hours, he attended classes and seminars that the revived professors gave him. This is how Altshuller received his “college education.”

In the Vorkuta coal mines — another gulag camp — he spent 8 to 10 hours a day developing his TRIZ theory while constantly resolving emergency technical situations in the mines. Nobody believed that this young inventor was working in the mines for the first time. Everybody thought he was tricking them. The chief engineer did not want to hear that TRIZ methods were helping.

One night, Altshuller heard that Stalin had died. A year and a half later, Altshuller was released. Upon his return to Baku he learned that his mother, having lost all hope of ever seeing her son, committed suicide.

In 1956, the first paper written by Altshuller and Shapiro, “Psychology of Inventive Creativity,” was published in the journal *Voprosy of Psichologii* [Problems of Psychology]. For scientists who study the creative process it was as if a bomb had exploded. Until that time, Soviet and foreign psychologists believed it a fact that inventions were born through accidental enlightenment — the sudden spark of an idea.

After analyzing a fund of worldwide patents, Altshuller offered a different method based on the results of human inventive activity. Invention de-



rives from a problem analysis revealing a contradiction.

After studying 200,000 patents, Altshuller concluded that there are about 1,500 technical contradictions that can be resolved relatively easily by applying fundamental principles.

"You can wait a hundred years for enlightenment, or you can solve the problem in 15 minutes with these principles," he said.

What would Altshuller's opponents say if they knew that the obscure "H. Altov" [Altshuller's pen name] was making a living writing science fiction stories utilizing TRIZ concepts? Altov wrote his fictions utilizing his inventive ideas. In 1961 Altshuller wrote his first book *How to Learn to Invent*. In this small book he laughs at the popular opinion that one must be born an inventor. He criticizes the trial and error method used to make discoveries. Fifty thousand readers, each paying only 25 kopecks [25 cents], learned the first 20 inventive methods of TRIZ.

In 1959, trying to get acceptance of his theory, Altshuller wrote a letter to the highest patent organization in the former Soviet Union — VOIR [All Union Society of Inventors and Innovators]. He asked for a chance to prove his theory. Nine years later, after writing hundreds of letters, he finally got his answer. His requested seminar on inventive methodology would be held in Dsintary, Georgia, not later than December of 1968.

It was the first ever seminar on TRIZ. There for

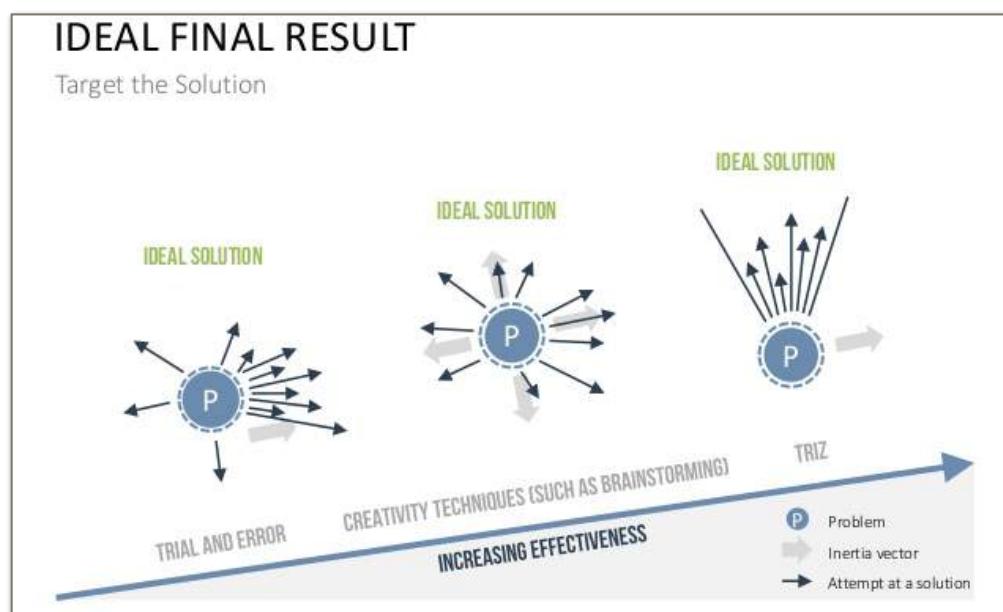
the first time he met people who had considered themselves his students. Alexander Seloutschi from Petrosavodsk, Voluslav Mitrofanov from Leningrad, Isaak Buchman from Riga, and others. These young engineers — and later many others — would open TRIZ schools in their cities. Hundreds of people that went through Altshuller's schools asked him to come and conduct seminars in different towns of the Soviet Union.

In 1969 Altshuller published a new book: *Algorithm of Inventing*. In this book he gave his readers and students 40 Principles, and the first algorithm to solve complex inventive problems.

Voluslav Mitrofanov, the founder of Leningrad University of Technical Creativity, told a story about Robert Anglin, a prominent inventor from Leningrad. Once, Anglin — who has over 40 inventions developed through the agony of trial and error creativity — came to a TRIZ seminar. He was very quiet during the TRIZ training session. After everyone had left, he was still sitting at the table, covering his head with his hands. "How much time was wasted!" he was saying. "How much time ... If I only knew TRIZ earlier!"

The Russian TRIZ Association was established in 1989 with Altshuller as President.

*This is an excerpt from an article written by Leonid Lerner and published in the Russian Magazine Ogonek in 1991.*



## How to use TRIZ

1. **Identify Contradiction:** The TRIZ method believes that for an organization to gain, it has to sacrifice something. This is what is called a contradiction in TRIZ jargon. For instance, if you want to build a faster engine, you lose fuel efficiency. This contradiction is the general problem that an organization faces and must be used as an input to the TRIZ matrix.
2. **Determine Improvement and Degradation:** The next step would be to explicitly state the trade-off. In the above case, one can look at speed as the improvement parameter while fuel efficiency is the parameter which must not be degraded.
3. **Design Parameters:** The TRIZ matrix uses the above information as input. It will then cross-verify similar problems that have been faced in the past, then give a specific solution. This solution could be something like using a lighter metal to build the vehicle, so the weight of the vehicle is reduced and speed is increased without losing fuel efficiency.
4. **Examine Proposed Principle:** The TRIZ method is like an advisor; it proposes solutions. However the final decision lies in the hands of the managers. For instance, in the above example, using a lighter metal could compromise the safety of the vehicle. The management must then make a call whether this is the correct solution.
5. **Select Best Principle:** TRIZ usually gives more than one inventive solution to the problem. This solution is usually in the form of a *general solution*. The TRIZ matrix allows organizations to create alternative solutions before they actually decide to implement the best one.
6. **Apply Inventive Principle:**  
Each proposed *general solution* must then be converted into a *specific solution* for the problem at hand. Thus, at the end of a TRIZ exercise, you have multiple solutions with which you can then provide as an input to your decision making process.

Link to an Online  
Contradiction  
Matrix at  
[TRIZ40.com](http://TRIZ40.com)



### Technical Contradiction Matrix

This information was organized in a matrix.

	Worsening Feature →	Weight of moving object	Weight of stationary object
	↓ Improving Feature ↓	1	2
1	Weight of moving object		
2	Weight of stationary object		
3	Length of moving object		↓
4	Length of stationary object →	35, 28, 40, 29	

Consider Using Inventive Principles:  
28 - Mechanics Substitution  
29 - Pneumatics and Hydraulics  
35 - Parameter Changes  
40 - Composite Materials



CREATIVE  
OWNERSHIP

*"There is no such thing as a new idea. It is impossible. We simply take a lot of old ideas and put them into a sort of mental kaleidoscope. We give them a turn and they make new and curious combinations. We keep on turning and making new combinations indefinitely; but they are the same old pieces of colored glass that have been in use through all the ages."*  
- Mark Twain

# Leader Profiles - John Boyd



## The Fighter Pilot Who Changed the Art of Air Warfare

by Robert Coram



During the 1950s, John Boyd dominated fighter aviation in the U.S. Air Force. His fame came on the wings of the quirky and treacherous F-100; the infamous "Hun." Boyd was known throughout the Air Force as "Forty-Second Boyd," because he had a standing offer to all pilots that if they could defeat him in simulated air-to-air combat in under 40 seconds, he would pay them \$40. Like any gunslinger with a name and a reputation, he was called out many times. As an instructor at the Fighter Weapons School (FWS) at Nellis AFB, he fought students, cadre pilots, Marine and Navy pilots, and pilots from a dozen countries, who were attending the FWS as part of the Mutual Defense Assistance Pact.

He never lost.

Boyd was famous for a maneuver he called "flat-plating the bird." He would be in the defensive position with a challenger tight on his tail, both pulling heavy G-forces, when he would suddenly pull the stick full aft, brace his elbows on either side of the cockpit, so the stick would not move laterally, and stomp the rudder. It was as if a manhole cover were sailing through the air and then suddenly flipped 90 degrees. The underside of the fuselage, wings, and horizontal stabilizer became a speed brake that slowed the Hun from 400 knots to 150 knots in seconds. The pursuing pilot was thrown forward and now Boyd was on his tail radioing "Guns. Guns. Guns."

The legend of "Forty-Second Boyd" continues to resonate with AF fighter pilots. They say there is no "best" pilot; that everyone has a bad day. But if they went through Nellis in the late 1950s, they know Boyd had no bad days. And they cannot come up with the name of anyone who ever defeated him.



# Leader Profiles - John Boyd

Boyd was equally famous in the classroom where he developed the "Aerial Attack Study." Until Boyd came along, fighter pilots thought that air combat was an art rather than a science; that it could never be codified. Boyd proved them wrong when he demonstrated that for every maneuver there is a series of counter maneuvers. And there is a counter to every counter. Afterwards, when fighter pilots attacked (or were attacked), they knew every option open to their adversary and how to respond.

After the study was declassified, foreign pilots passing through Nellis started taking it home. This changed the way every air force in the world flies and fights. Even today, more than 40 years later, nothing substantial has been added to the Aerial Attack Study.

After a six-year assignment at Nellis, Boyd returned to college for another undergraduate degree. He went to the Georgia Institute of Technology where, one night while studying for an exam in thermodynamics, he had the epiphany that became his famous Energy-Maneuverability Theory, or E-M Theory, as it came to be known.

The E-M Theory changed everything that everyone thought they knew about fighter combat. It enabled fighter pilots to evaluate their energy potential at any altitude and at any maneuver. And, perhaps more importantly, the energy potential of their adversary. It changed forever the way aircraft are fought in combat.

Boyd then used E-M as a design tool. Until E-M came along, fighter aircraft had been designed to fly fast in a straight line or fly high to reach enemy bombers. The F-X, which became the F-15, was the first Air Force fighter ever designed with maneuvering specifications. Boyd was the father of the F-15, the F-16, and the F-18.

America has dominated the skies for the past 30 years because of John Boyd.

After he retired, he developed a theory of combat that, according to Vice President Dick Cheney who was Secretary of Defense at the time, was responsible for America's swift and decisive victory in the Gulf war.

But it is as a fighter pilot that many retired Air Force officers today remember John Boyd.



# Leader Profiles - William Sims



Excerpts from The 21st Century  
Sims Edited with an introduction  
by Benjamin F Armstrong

## The Gun Doctor

In 1900 William Sowden Sims was a lieutenant in the US Navy, fresh off staff duty in Europe. He had orders to China Station to join the USS Kentucky, lauded in the press as the United States' newest and most powerful battleship. His duties at the U.S. Embassy in Paris had included traveling across Europe to study the battleships and gunnery practices of both potential adversaries and potential allies. In the pre-dreadnought era, he became a self-taught expert on battleship design and gunnery, and he had arrived on board his new ship with a perspective far different from that of your average officer. Sims checked on board and discovered that the "newest and most powerful" may have been new, but it certainly wasn't powerful. It didn't take long for him to determine that the ship had a number of serious design problems. Sims was incensed. He set about recording these deficiencies and others, and he put together a report to send back to the Navy Department.



## A Junior Officer and an Idea

Yet the lieutenant was part of Kentucky's crew, and he realized that he couldn't really change the design of the ship while they were on China Station. So as he began standing his bridge watches, he looked for a way to make the ship better through what today are called tactics, techniques, and procedures. While steaming through the South China Sea and visiting the coastal cities of China, he met a man from the Royal Navy who would serve as an inspiration.

Percy Scott was a Captain in the Royal Navy in 1901 and the Commanding Officer of the HMS Terrible. On board his previous ship, the HMS Scylla, Scott had developed something called "continuous-aim fire." Working with the concept, he concluded it was a gunnery technique that would revolutionize naval warfare. But he couldn't get anyone to listen to him or understand that the idea was important. As Sims watched Terrible conduct gunnery practice, he realized this new technique would change naval tactics forever. Sims immediately sat down and wrote a report on what he had seen and sent it to the Bureau of Ordnance in Washington, D.C.

Sims befriended Scott and observed how the British crew was accomplishing their dramatic results. Soon he had an American gun crew performing nearly as well as the Terrible's crew. Sims wrote another report to Washington detailing his crew's experience and waited for a response, but heard nothing.



# Leader Profiles - William Sims

## The Forces of the Status Quo

Sims' reports arrived at the Bureau of Naval Ordnance at the Washington Navy Yard. They were read, but to the experts on the staff the claims of the lieutenant on China Station appeared outlandish. Nobody could improve gunnery that dramatically and in such short a time. The reports were filed away in a basement cabinet and forgotten. Nobody even wondered if Sims' reports were true. They simply couldn't be. Sims knew what was happening. He knew that the bureau was ignoring him simply because he was a lieutenant, and one that was deployed on the other side of the world. He had never served on the bureau staff and wasn't a known expert whom they regularly consulted.

The language in the messages he sent back to Washington became more dramatic as he pointed out the risks involved in ignoring the techniques he was developing. Besides sending his reports to the bureau, on his own initiative he also began to send them directly to American battleship Captains and senior officers.

The word spread through the fleet, and the Bureau of Ordnance realized it needed to do something. Captains were writing messages back to headquarters and asking questions. In order to respond, the staff at the bureau developed a test to prove that continuous-aim fire wouldn't work. After the test, they wrote a report that declared Sims' claims a mathematical impossibility. However they had conducted the test without making the modifications to the guns that Sims required, and they had completed the test on shore-for a gunnery practice designed for a rolling ship at sea. Belief in Sims' claims evaporated overnight.

Sims submitted a total of thirteen reports on continuous-aim fire over the span of two years, each one continually improving the method and technique. When he heard that the Bureau of Ordnance had completed a test and claimed to prove that what he was doing was impossible, he finally had enough. He knew that if the United States Navy went up against a force that was using continuous-aim fire it would be decimated. LT William Sims did something that he later characterized as the "rankest kind of insubordination." He wrote a letter to the president.

## Fighting Back

William Sims returned to the United States from China Station and assumed the responsibilities of the U.S. Navy's inspector of target practice. Tasked with revolutionizing naval gunnery, he began by circulating his reports to the fleet and instituting mandatory practice for gunnery. He didn't make his method of continuous-aim fire mandatory, he simply sent out the reports for gunnery officers to read.

At the end of his time as inspector of target practice, one gunner on the winning ship made fifteen hits in one minute at a target seventy-five by twenty-five feet at the same range as the test ordered by President Roosevelt years before; half of the hits were in the bull's eye.



**CREATIVE  
OWNERSHIP**

*"I am perfectly willing that those honestly holding views differing from mine should continue to live; but with every fibre of my corpse I loathe indirection and shiftiness, and where it occurs in high places, and is used to save a face at the expense of the vital interests of our great service..., I want that man's blood and I will have it, no matter what it costs me personally." - William Sims*

# Leader Profiles - Grace Hopper



Grace Hopper  
by [biography.com](#)  
Authors



## Brief Overview:

Born Grace Brewster Murray on December 9, 1906 in New York City, she joined the U.S. Navy during World War II and was assigned to program the Mark-I computer.

## Further Bio:

Grace Brewster Murray was the daughter of two parents with a passion for mathematics. Following in her family's footsteps she went on to study math and physics at Vassar College at the age of 17. After graduating from Vassar in 1928 with a Bachelor of Arts degree in mathematics and physics, she proceeded to Yale University, where she received a Master's degree in mathematics in 1930. That same year, she married Vincent Foster Hopper and in 1931 began teaching at Vassar while continuing to study at Yale, where she earned her Ph.D. in mathematics in 1934 - a Ph.D. not earned by women of her time.

Hopper became an associate professor up until World War II when she felt compelled to join the Armed Forces. Her grandfather had served in the U.S. Navy and she felt compelled to follow in his footsteps. Hopper was too old to join the Active Duty Service of the Navy, however, her skills were critically needed and she was sworn into the U.S. Naval Reserve in 1943 and was commissioned as a Lieutenant in 1944. She was assigned to the Bureau of Ordnance Computation Project at Harvard university due to her extensive mathematical background; here she learned to program a Mark-I computer.

# Leader Profiles - Grace Hopper

Upon the conclusion of the War, Hopper remained in the Navy as a research fellow at Harvard. She worked with the Mark-II and Mark-III computers. While at the Bureau of Ordnance, trying to repair the Mark-I, she discovered a moth caught in a relay. She taped the moth into a log book and from that the phrase “a bug in the computer” was popularized.

Her devotion to computers led her to the private sector, joining the Eckert-Mauchly Computer Corp as a senior mathematician. She oversaw programming for the UNIVAC computer. Seeing programmers retying commands over and over, she oversaw the execution of programs that transformed commands into binary codes that were executable by the computer. These innovations led to programs such as FLOW-MATIC and helped the UNIVAC I and II understand twenty English statements. In 1966, she was called back to active duty as the director of Navy Programming Languages Group. Her team created the first compiler for computer languages; these are worded instructions placed into code that can be read by computers. This compiler was a precursor for the Common Business Oriented Language (COBOL), a widely adapted language that would be used around the world.

Hopper tried to retire from the Navy twice. Her first recall, she was promoted to Captain and at the age of 60 was recalled to tackle standardizing communication between different computer languages. She was promoted to Commodore in 1983 and Rear Admiral Lower Half in 1985 and remained with the navy for 19 years. She finally retired at the age of 79 in 1986 as a Rear Admiral Lower Half and was the oldest serving officer in service.

She was awarded the National Medal of Technology in 1991, becoming the first female recipient with that honor. She was also the first person from the United States and first women to be made Distinguished Fellow of British Computer Society. Additionally, she was awarded numerous awards and over 39 honorary degrees from Universities around the world. At the age of 85, she died in Arlington, Virginia, on January 1, 1992. In 1997, the U.S. Navy named the guided missile destroyer DDG-70 USS HOPPER in her honor. She was laid to rest in Arlington National Cemetery. She considered her greatest accomplishment to be training young people. They would come to her and ask if something could be done and her response would always be “try it.” She would back them up and help them along the way so they would not forget to take chances.

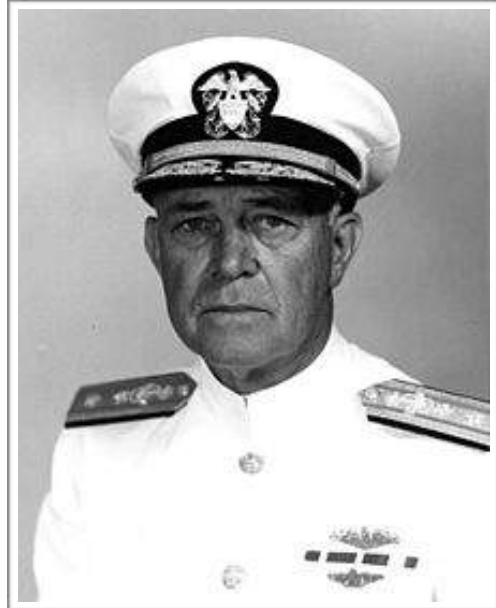


# Leader Profiles - Charles Momsen



by Squid Thoughts

On May 23, 1939 the newly commissioned USS Squalus (SS-192) was off the coast of Portsmouth, New Hampshire conducting her 19th test dive. After reaching a depth of about 60 feet, they experienced a critical failure of the 31" main induction valve, which fed air to the diesel engines, and had been closed at the start of the dive. Massive flooding ensued, and the Captain ordered the main and bow ballasts blown to try and surface. The Squalus gained an up angle, but the flooding was too severe and it sank by the stern, coming to rest at nearly 250 feet off the Isle of Shoals. All electric power and propulsion was lost; the aft battery/crew's quarters, the forward and aft engine rooms, and the aft torpedo rooms were completely flooded. Because of the skill of the highly trained crew who responded immediately to the flooding, the watertight doors were closed very quickly and 33 of the 59 crew aboard found safety in the forward torpedo room and control room.



A massive search effort was launched after the Squalus failed to report in as expected after the dive. Due to a mistranslation of the coordinates, the boat sent in Morse code indicating their dive location. The searching ships were nearly 5 miles from where the Squalus actually lay. The sub launched a marker buoy and multiple flares, one of which was seen and the ships were able to close on their position. This was before the days of sonar however, and their exact location could not be pinpointed with accuracy since the line connecting the marker buoy to the sub had parted when hauled aboard one of the ships. Efforts were made to communicate with the Squalus using submerged oscilloscopes, the sub's crew valiantly trying to respond by hammering on the hull in Morse code. After surviving dozens of hours in near-freezing temperatures and increasingly toxic atmospheric conditions, 33 men were rescued.

Beyond the skill and heroism of the Squalus' crew, what makes this story so remarkable was that they were actually able to be rescued. A few short years previously, a rescue at that depth would have been impossible. During those days, submarine duty was called the "Coffin Service"—if anything went wrong while submerged, unless the sub happened to be in warm and very shallow water, there was no hope of escape. The 33 men of the Squalus owe their successful escape to one man: Charles 'Swede' Momsen.

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CREATIVE  
OWNERSHIP

*"Forget about surface performance. Think only about submerged capability which will provide the utmost speed with minimum of power. When in doubt, think speed" - Charles Momsen*

# Leader Profiles - Charles Momsen

Momsen was a Naval Academy graduate, a line officer, and a technical and scientific whiz. In 1925, while commanding the S-1 (SS-105) submarine, his sister ship the S-51 collided with a cargo ship and went down. Momsen was involved in trying to locate the S-51, and eventually found its oil slick. The downed sub was at 130 feet and there was no way to rescue them. On board the S-51 was a good friend of Swede's, and he later discovered that most of the crew didn't die immediately as had been assumed. He was tortured with the knowledge that his friend had torn the skin away from his fingers trying to pry open a hatch, and that most of the dead had lived for hours before succumbing. 33 men aboard perished. Momsen dedicated himself to finding out methods to rescue trapped submariners. He designed a diving bell which could be lowered down to the submarine and thus the men could escape. He sent the plans up the chain of command, and they were ignored for more than a year before finally being rejected as impractical. By that time, Momsen was assigned to the Navy's Bureau of Construction and Repair, and decided to proceed with other rescue ideas on his own. Shortly after his diving bell plans were rejected, another sub, the S-4, went down off Cape Cod—another 40 souls lost, with 6 of the dead surviving for 3 days. Swede became a man possessed.

Simultaneously while developing a working prototype of his diving bell, Momsen invented what would later become the Momsen lung: a rubber bag that hung around the neck that could be filled with oxygen, containing soda lime to scrub CO<sub>2</sub> from exhaled air. It would allow the person to be able to breathe until he got to the surface, as well as providing a controlled amount of buoyancy to allow slow ascent thereby avoiding the bends. Swede personally tested all phases of the Momsen lung, eventually using it to ascend successfully from a depth of 200 feet. In addition to the diving bell and escape lung, He also developed the Heliox gas mixture—replacing nitrogen in compressed air with varying amounts of helium—thus making it possible for a diver to descend below 200 feet, the point at which nitrogen narcosis becomes a serious danger.

Swede Momsen was flown in to personally direct the rescue of the *Squalus*' crew. Because of his ingenuity, passion for his service, and dedication to ensuring that trapped submariners had a means of escape, 33 men were able to return home to their families. Because of his achievements, development of deep diving became possible, and naval services around the world have been able to build on his rescue and escape inventions. The Momsen lung led to the Steinke hood, Submarine Escape Immersion Equipment, and free-ascent techniques. His diving bell design led to others, and most likely to the ideas that became Deep Submergence Rescue Vehicles. Because of this one man, a man who wouldn't accept defeat, submariners who survive casualties at sea have hope of rescue, no longer members of the "Coffin Service".



**CREATIVE  
OWNERSHIP**

*"My officers and men acted instinctively and calmly. There were no expressions of fear and no complaints of the bitter cold. Never in my remaining life do I expect to witness so true an exemplification of comradeship and brotherly love. No fuller meaning could possibly be given the word 'shipmate' than was reflected by their acts." - Charles Momsen*

# Leader Profiles - Victor Krulak



## How a Little Man Became a Big, Big Marine in World War II and Beyond

by Dwight Garner

When the legendary Marine Corps Lieutenant General, Victor Krulak, was a boy, his father, a jeweler, gave him two pieces of advice. The first was: "Nobody ever learned a bad habit from a horse." The second: "You will be short, and you will be bald. But you don't have to be fat."

Lt Gen Krulak (1913-2008) took both lessons to heart. He became a skilled bareback rider, and though he was just a mere 5' 4" and 116 pounds during his final year at Annapolis, he was fanatical for the rest of his life about remaining fit. (He never quite went bald!)



Fighting is the operative word. General Krulak was equal parts Patton, Popeye, Rahm Emanuel and the Great Santini; he packed the snorting personality and irritable drive of 10 men into his tiny, squirming physique. The nickname "Brute," first applied ironically, came to fit him perfectly. As one awed soldier put it, "That is the biggest little man I have ever seen."

Krulak's story is not a simple one to tell. During his long career with the Marines, he didn't accomplish one great thing but played a single role in many, many great things. He was a man who made his superiors look good. He was the Corps' fox, not its hedgehog.

He was posted to Shanghai as an Intelligence Officer during the Japanese incursions of the 1930s, and during World War II he led a battalion on a daring raid in the Solomon Islands, though his soldiers were vastly outnumbered. He was a mastermind of the Okinawa invasion.

Krulak's mind was as fit and wiry as his body. He was a driving force behind the development and adoption of the drop-bow Higgins boat, used for amphibious landings, a boat that Gen. Dwight D. Eisenhower said "won the war for us." He was a pioneer in the use of helicopters, seizing on their potential as early as the 1940s and putting them to use in Korea. He advised Presidents Kennedy and Johnson on Vietnam. He was repeatedly involved in rescuing the Marine Corps from government plans to disband or weaken it.



# Leader Profiles - Victor Krulak

Krulak seemed to be everywhere. He was one of those men who simply slept less, and wanted more, than others did. He was so fearful of not being tall enough to join the Marines that — as one famous story about him goes — he had a friend whack him on the head with a piece of lumber so that the resulting lump would enable him to meet the height requirement.

His parents were Russian Jews. He lied about this heritage, claiming he was raised an Episcopalian. Perhaps he was only attending to reality. At the time, the author points out, the Marine Corps was “a veritable witches’ brew of racism and discrimination.” But Lt Gen Krulak went further than he had to, essentially disavowing his parents and family back home in Denver for the rest of his life.

He never spoke of an early marriage that ended in divorce. He was a remote and sometimes brutal father to his three sons. (One of them, Charles C. Krulak, would advance even further than his father, serving as 31st Commandant of the Marine Corps from 1995 to 1999.)

Krulak was also a fabulist, often exaggerating his exploits or making them up out of whole cloth, something that, given his proven record of bravery, was utterly unnecessary.

Napoleon Complex? Perhaps. Either way, “Brute” has a sense of humor about Lt Gen Krulak’s height that he himself did not. He once called a Marine photographer into his office, climbed on a chair and said, “This is how tall I am going to be in every picture you take of me.” Later, another Officer translated this order for the photographer: “It means you dig a hole and get in it before you take a picture of the General.”

Brute Krulak made his share of enemies. Some Officers resigned rather than serve under him. He adhered, Mr. Coram writes, to the French military expression “De l’audace, encore de l’audace, et toujours de l’audace” (“Audacity, more audacity, and audacity forever”). The sign on his office wall read: “The Harder I Work, the Luckier I Get.”

In the field, his men loved him. One Marine who fought under Lt Gen Krulak said, “We would have followed him to hell.”



# Videos Used During Course



[Sir Ken Robinson - Schools Kill Creativity](#)

[Dan Pink - The Puzzle of Motivation](#)



[Tim Harford - Trial, Error and the God Complex](#)

[Steven Johnson - Where Good Ideas Come From](#)



[Simon Sinek - Why Good Leaders Make You Feel Safe](#)

[Michael Pawlyn - Using Nature's Genius in Architecture](#)



[Tom Wujec - Build a Tower, Build a Team](#)

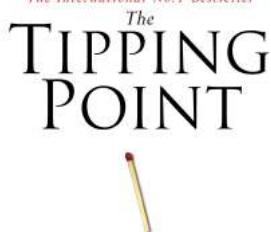


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# Reading List

The International No.1 Bestseller



HOW LITTLE THINGS CAN MAKE  
A BIG DIFFERENCE

MALCOLM  
GLADWELL

"Spear has dazzled readers with his insights."  
—Harvard Business Review

Awarded the  
AMERICAN SOCIETY OF BOOKS  
CRITICS AWARD

## THE HIGH-VELOCITY EDGE

HOW MARKET LEADERS LEVERAGE  
OPERATIONAL EXCELLENCE  
TO BEAT THE COMPETITION

STEVEN J. SPEAR  
FIVE-TIME SHINGO PRIZE AWARD WINNER

FOREWORD BY CLAYTON M. CHRISTENSEN  
BESTSELLING AUTHOR OF THE INNOVATOR'S DILEMMA

NEW YORK TIMES BESTSELLER

From One of the World's Leading Thinkers  
On Creativity and Innovation

KEN ROBINSON, Ph.D.

WITH LOU ABRONICA

## The Element



HOW FINDING YOUR PASSION  
CHANGES EVERYTHING



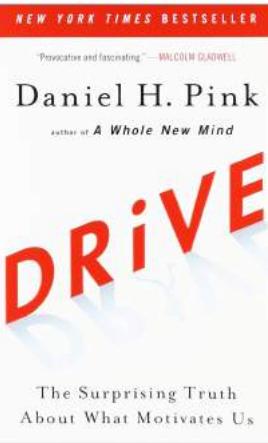
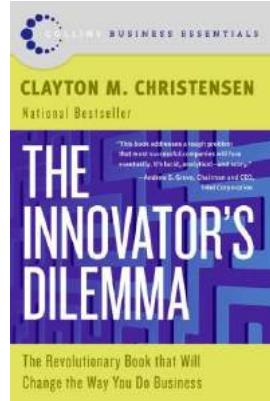
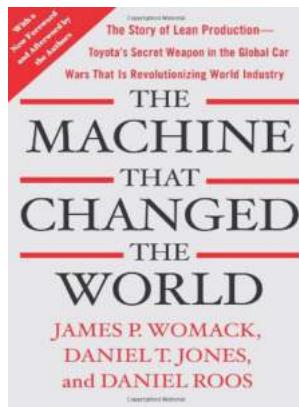
## blink

by the author of The Tipping Point

The Power of Thinking  
Without Thinking

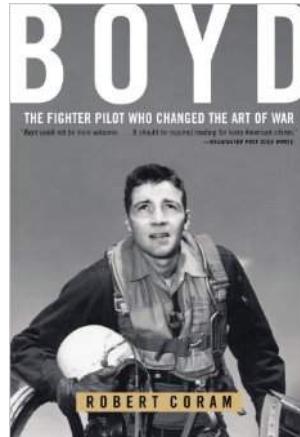
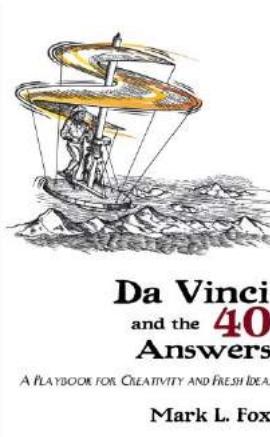
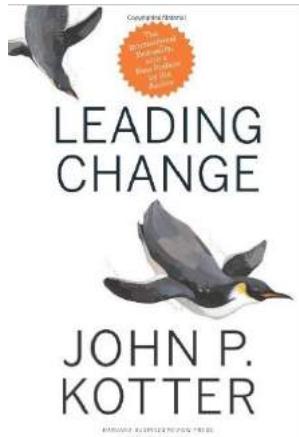
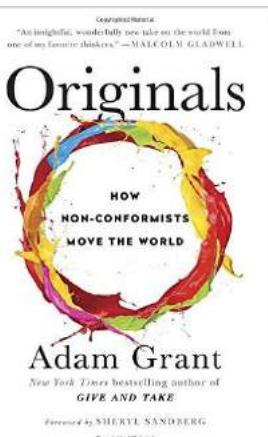
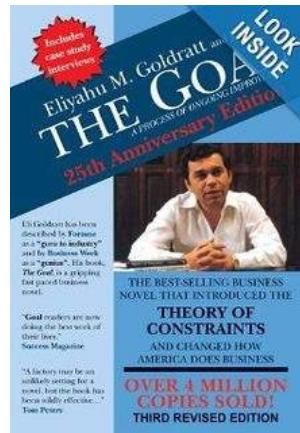
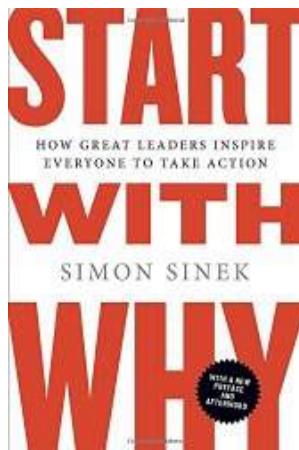
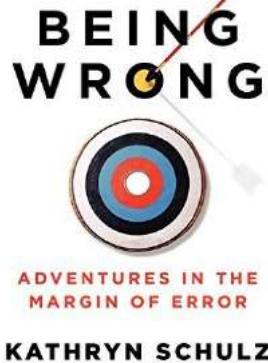
Malcolm Gladwell

Insanely  
Simple  
The  
Obsession  
That Drives  
Apple's  
Success  
Ken Segall

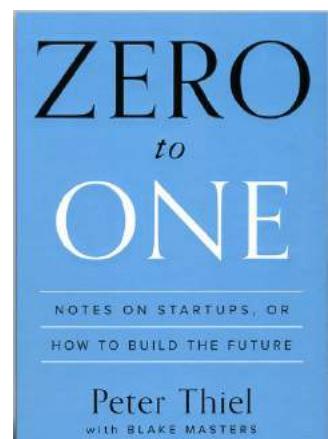
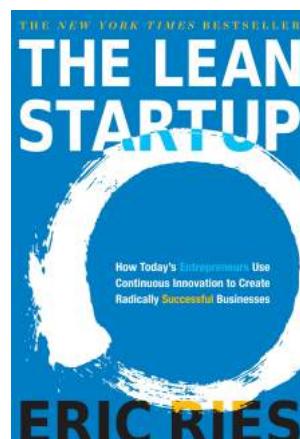
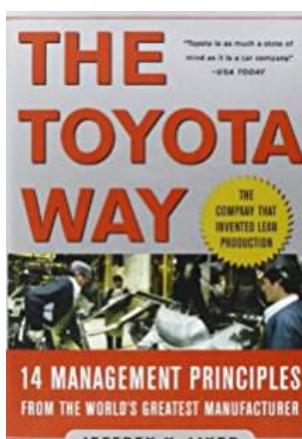
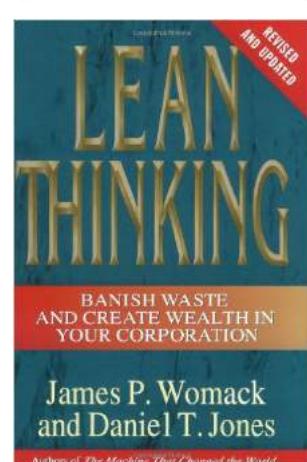
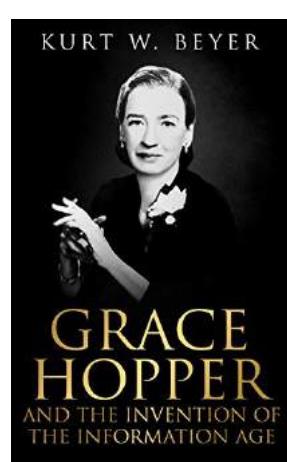
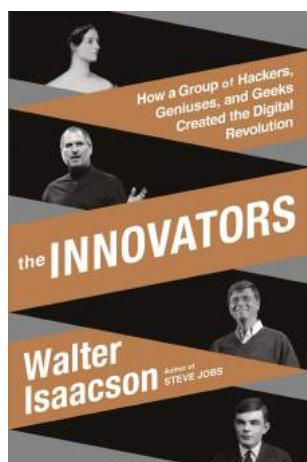
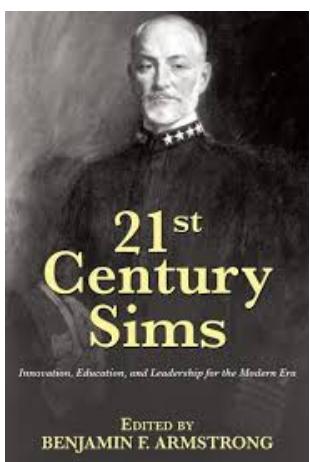
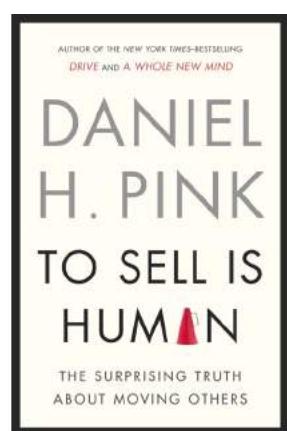
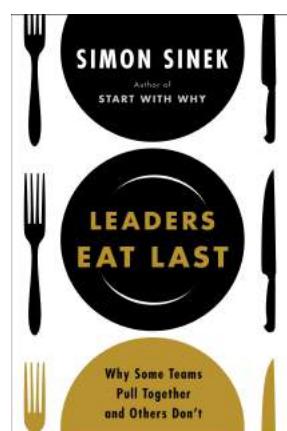
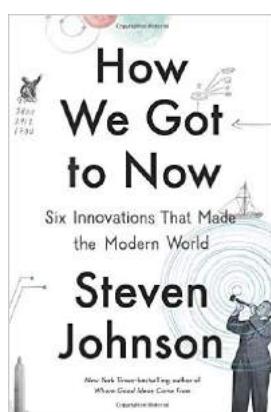
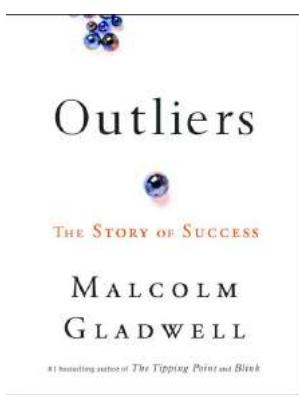
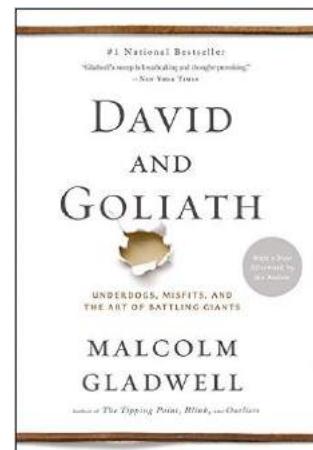
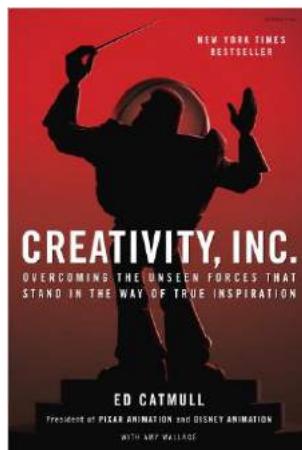
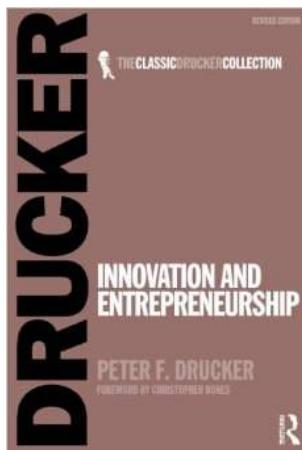
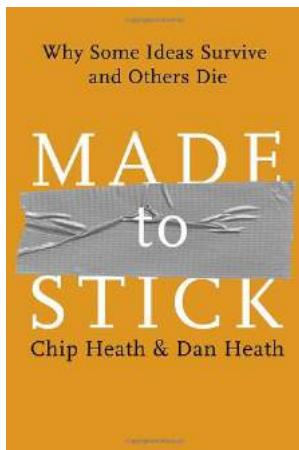


"If you want to feel better about not being perfect and see the potential  
inside in your errors, read *Being Wrong* by Kathryn Schulz."

—PRESIDENT BILL CLINTON



# Reading List



*Roll call time:  
To be or to do?  
Which way will you go?*

join the  
Naval Constellation

<https://navalconstellationinvite.herokuapp.com>

It is our mission to help leaders and teams learn and adapt to pursue maximum possible performance by challenging norms, learning faster, and improving daily.

A large, semi-transparent watermark of the U.S. Forces Command seal is centered on the page. The seal features a globe with a map of the world, an eagle with spread wings perched on top, and a banner at the bottom. The words "UNITED STATES FORCES COMMAND" are inscribed around the perimeter of the seal.

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