



6.910A/2.723A/16.662A /6.9101/2.7231/16.6621

Welcome to D-TILE
Design-Thinking, Innovation and Leadership for Engineers

We make things because...

People want to accomplish goals

People need things to help them accomplish goals

People want those things to be intellectually satisfying

People want those things to be emotionally satisfying

People need those things to be safe





Human-Factors, 1940s-1950s (formal, 1957)

Wicked Problems, 1973 Horst Rittel and Melvin Webber
(design theorists) Dilemmas in a General Theory of Planning
“problems that are complex, open-ended, and ambiguous”

User-Centered Design, Rob Kling (Comp Sci Professor) 1977

Design-Thinking, IDEO 1978

Human Factors is concerned with the application of what we know about people, their abilities, characteristics, and limitations to the design of equipment they use, environments in which they function, and jobs they perform.

Human Factors And Ergonomics Society



Top Speed: 246.9 mph

Acceleration:

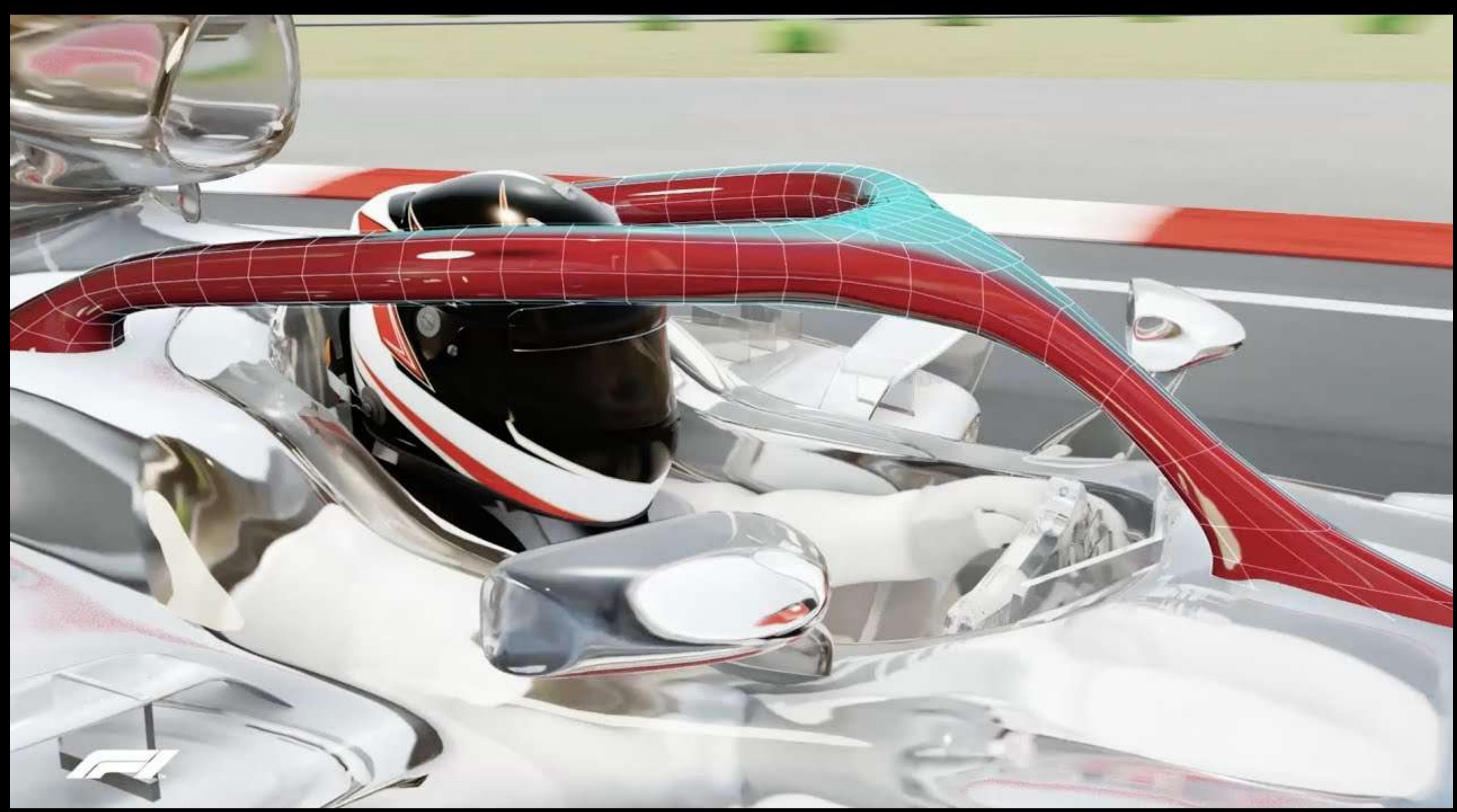
0-60 1.7 seconds

0-100 3.1 seconds

0-190 9.9 seconds



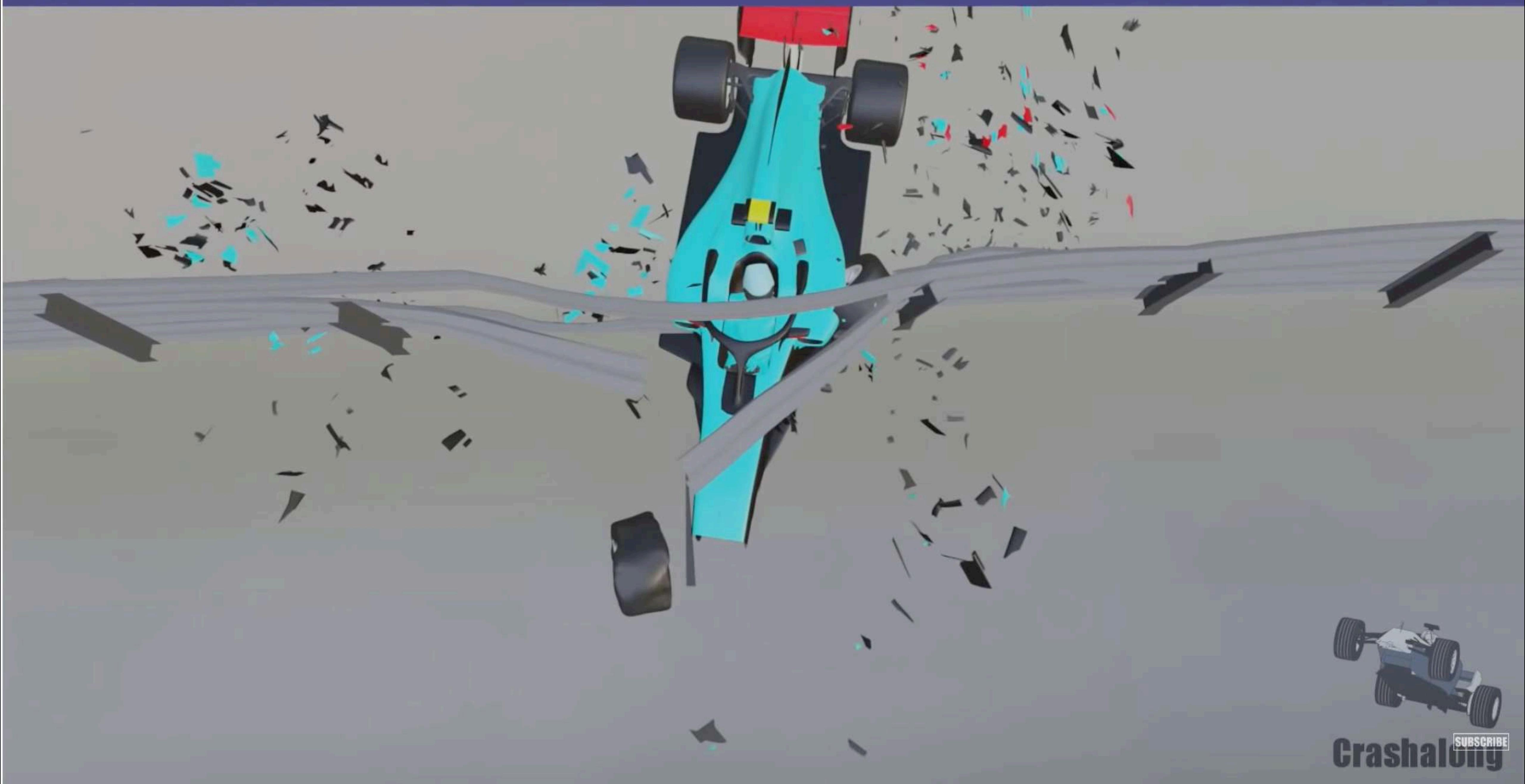
About The Class





straight away

The guardrail snaps and swings out away from the car



Force on a body, measured in Gs

Walking

1 g

Average sneeze

2.9 g

Space Shuttle, maximum during launch and reentry

3 g

Roller coasters up to

6.3 g

Apollo 16 on reentry

7.19 g

Plopping into a chair

10.1 g

Death or serious injury likely 50 g

Romain Grosjean Crash = 53 Gs



Q: Which systems (things)
involved in this crash
were designed?

Is this MIT course-of-study needed to keep an F1 Driver safe?

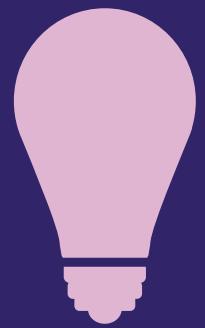
Aerospace (16)
Material Science and Engineering (3)
Art, Culture and Technology (4)
Chemistry (5)
Biology (7)
Business Analytics / Management (15)
Brain and Cognitive Science (9)
Civil/Environmental Engineering (1)
Mechanical Engineering (2)
Computer Science & Electrical
Engineering (6)
Mathematics (18)
Physics (8)
More...

**This class is all about
giving you tools you can
use right away to solve
complex problems, to
create big impact**

What Is Innovation?

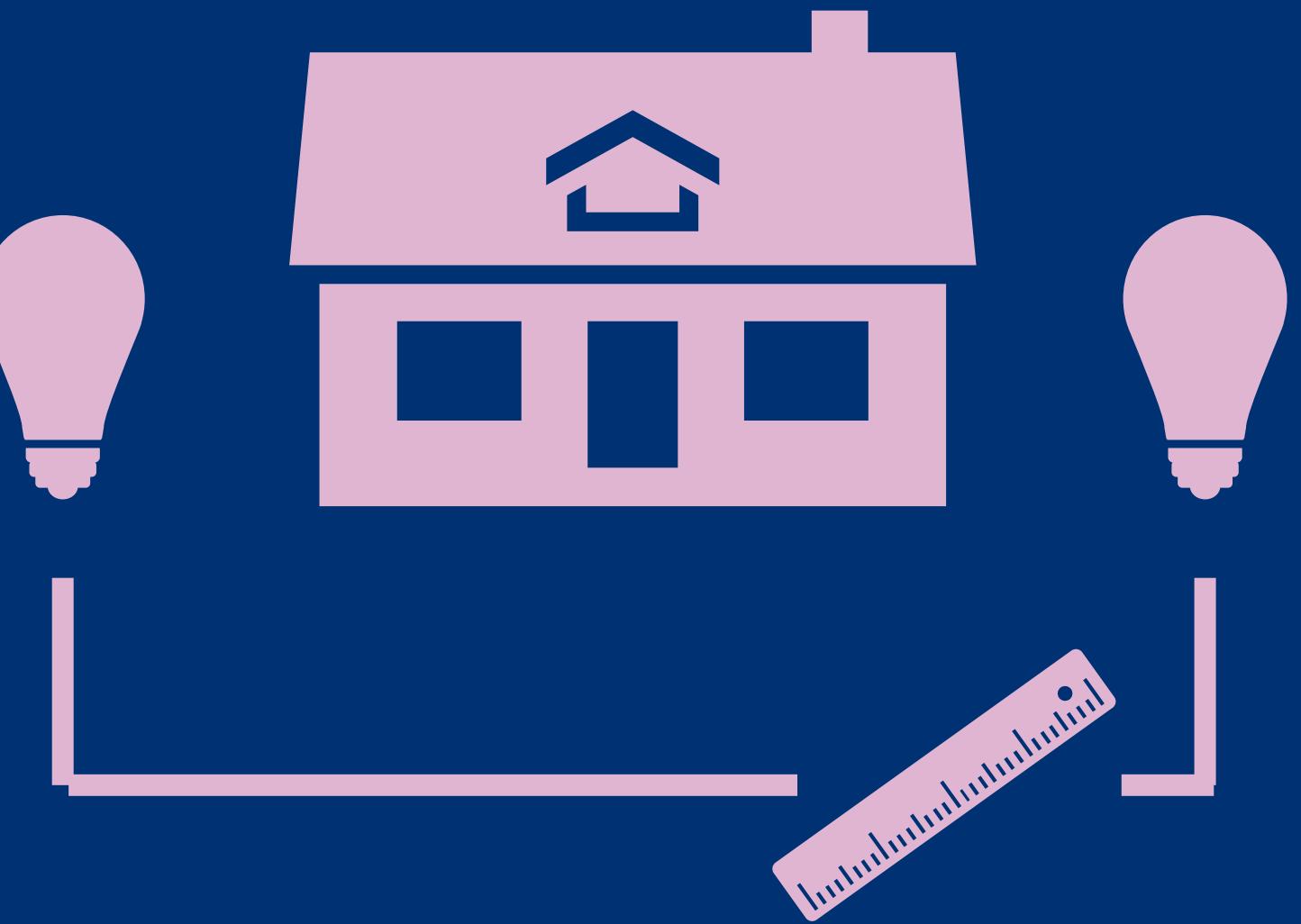
Invention

Creating Something New



Innovation

Value Capture



Uber

How did Uber innovate?

Some Uber Innovations

1. Mobile App-Based Booking
2. Real-Time Tracking
3. Cashless Payments
4. Rating System
5. Dynamic Pricing
6. Driver and Vehicle Information
7. Ride Options
8. Easy Expense Tracking
9. Promotions and Discounts
10. Accessibility
11. Pre-Trip Fare Estimates
12. Safety Features
13. Driver Flexibility
14. Integration with Other Services
15. Global Reach
16. Scheduled Rides
17. Shared Rides
18. Subscription Plans
19. In-App Messaging
20. Ride Verification PIN
21. Ride History
22. Family Profiles
23. Eco-Friendly Options
24. Business Profiles
25. Multi-Stop Rides
26. Event Partnerships
27. Enhanced Navigation
28. In-App Tips
29. Driver Support Programs
30. Local Language Support

**How to produce
great designs**

**Learn and apply
design-thinking to
any problem**

**Conceive, lead,
implement, and
evaluate successful
projects**

**Communicate with
high emotional and
intellectual impact**

What will you learn?

**Give compelling
presentations**

**Understand,
contextualize, and
analyze designs**

**Practice an
iterative design
process**

**Think Freshly,
Think Fearlessly**



About You!
Which Courses?



About You!
Class Year

How the Class Works

Design Thinking Innovation & Leadership for Engineers

(6 units)

Design Thinking Innovation & Leadership for Engineers

(6 units)

D - T I L E

Design Thinking
Innovation & Leadership for Engineers

(6 units)

D - T I L E

6.910A/2.723A/16.662A

Introduction to Design Thinking
and Innovation in Engineering

3 units, H1

6.910B/2.723B/16.662B

Design Thinking and Innovation
Project

3 units, H2

6.9101/2.7231/16.6621

Introduction to Design Thinking
and Innovation in Engineering

3 units, H1, all 1st year students

D - T I L E

6.910A/2.723A/16.662A

Introduction to Design Thinking
and Innovation in Engineering

H1

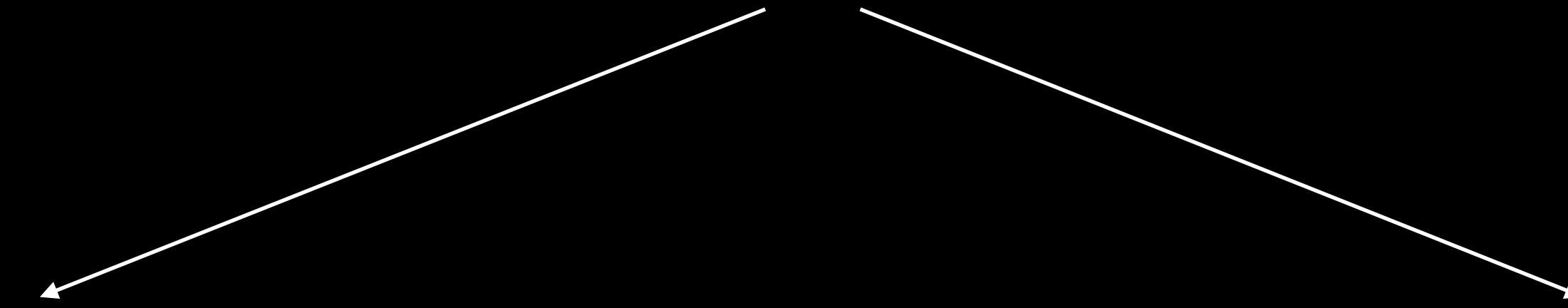
6.9101/2.7231/16.6621

Introduction to Design Thinking
and Innovation in Engineering

6.910B/2.723B/16.662B

Design Thinking and Innovation
Project

H2



D - T I L E

**3 Unit
H1 Course** =

**6 Units of
Work
Per Week**

Class Conduct

- Be present ready to interact
- Ask questions; clarify & over communicate
 - Running late? Need to miss class? Email dtile@mit.edu
 - Need an extension? Email dtile@mit.edu
- 1 unexcused absence allowed
- No unexcused late assignments
- Laptops for note taking allowed in the back row, tablet note taking allowed anywhere if tablet is a focused mode

Syllabus

Getting in touch

Blade Kotelly - Getting in touch 24/7

Cell: (857) 257-9595

Email: blade@mit.edu

Ready?

Design Challenge

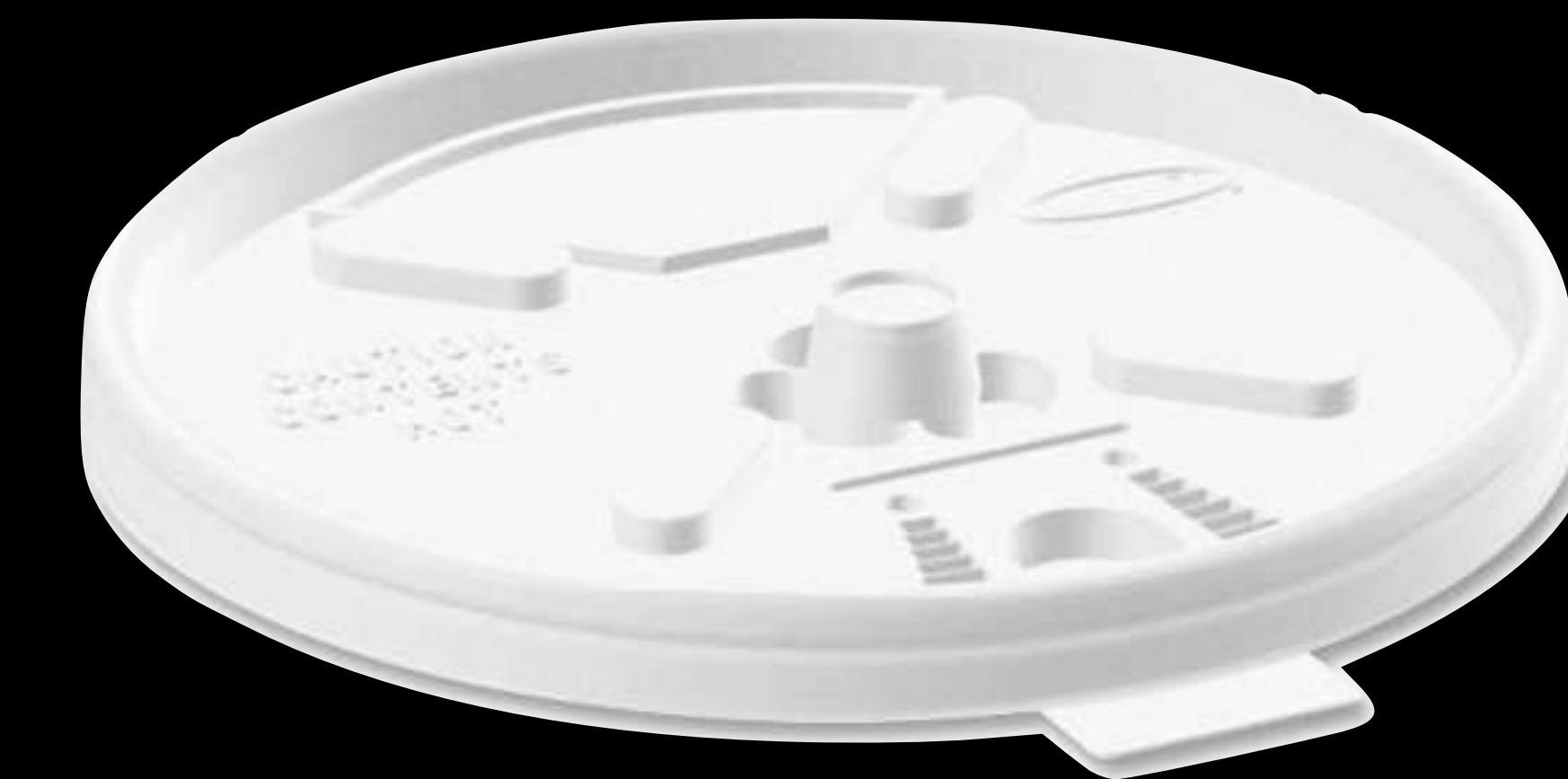
Make an iPhone Killer

What are the **first 3 steps** you would take?



**Ask “why?” and
challenge assumptions**

Good and Bad Design





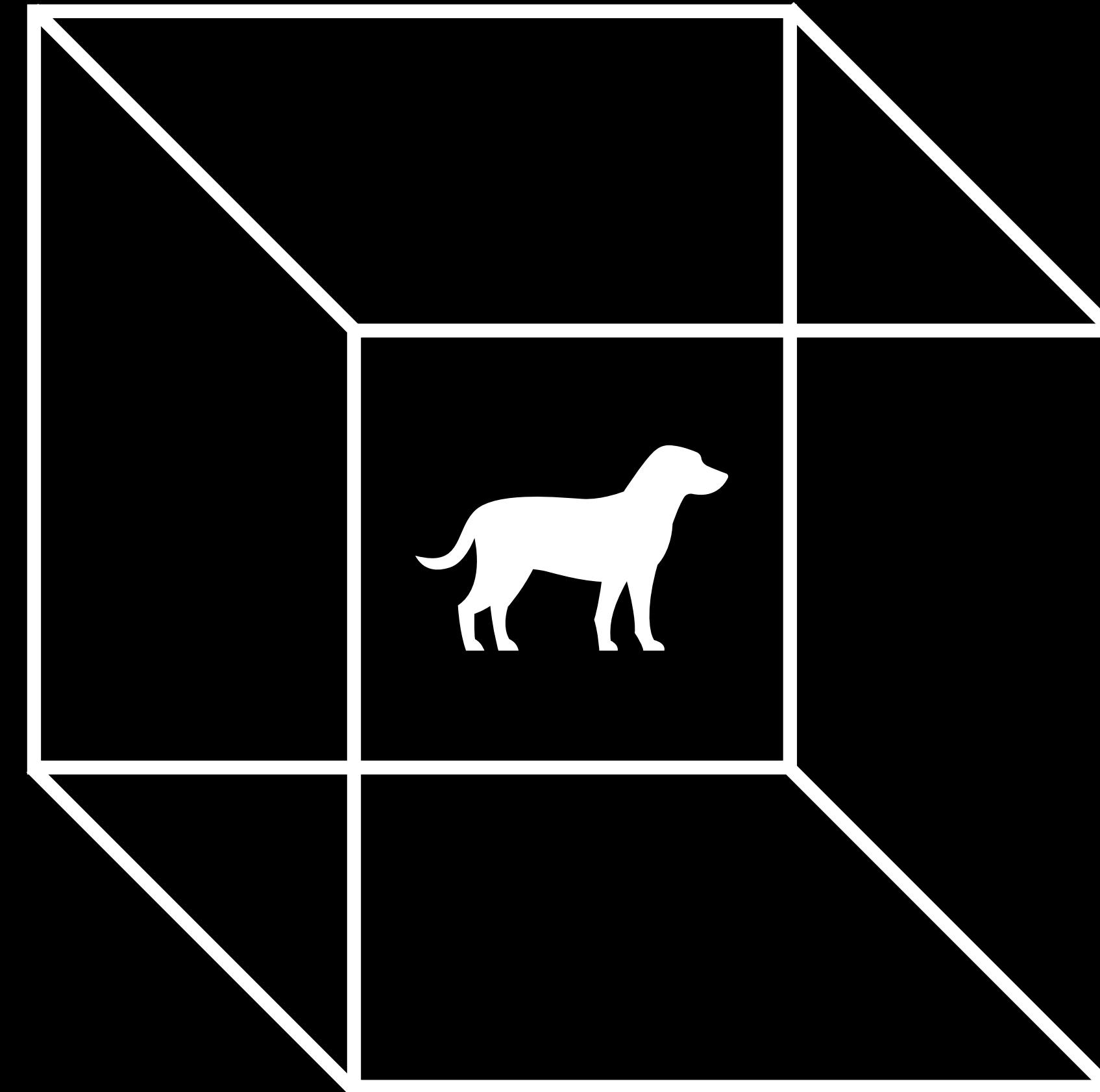




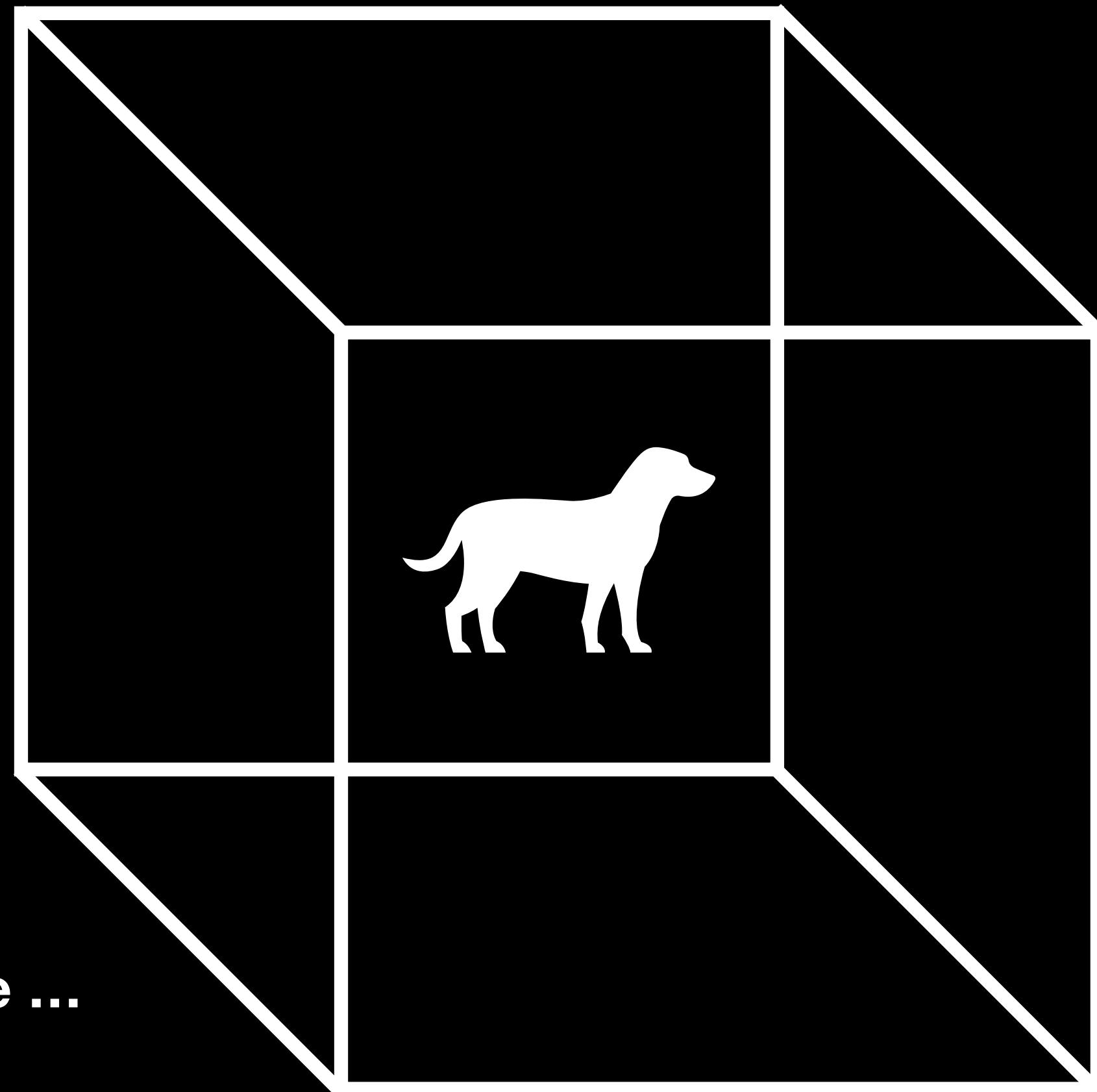


“Good” and “bad” are only
meaningful in a **context**

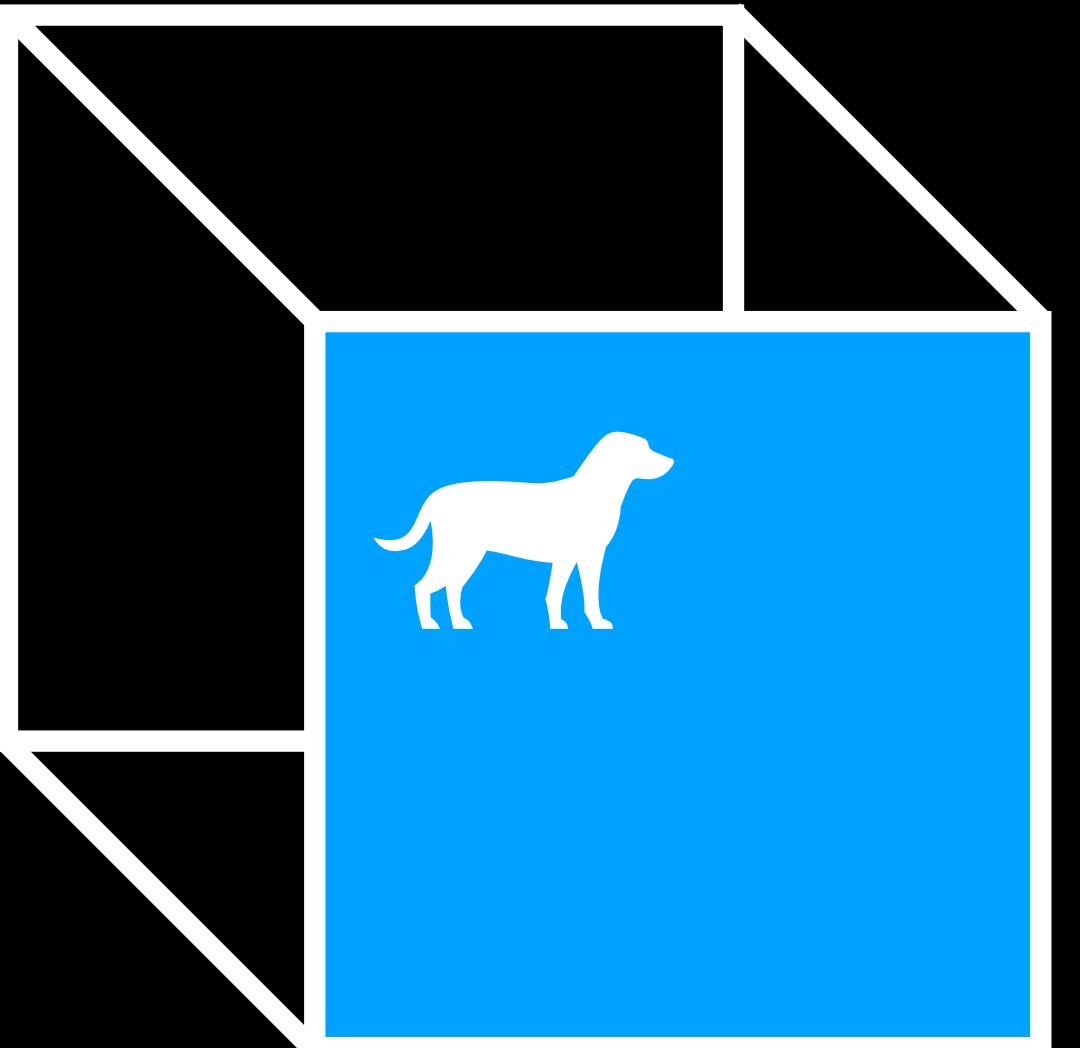
It can be hard to shift your context



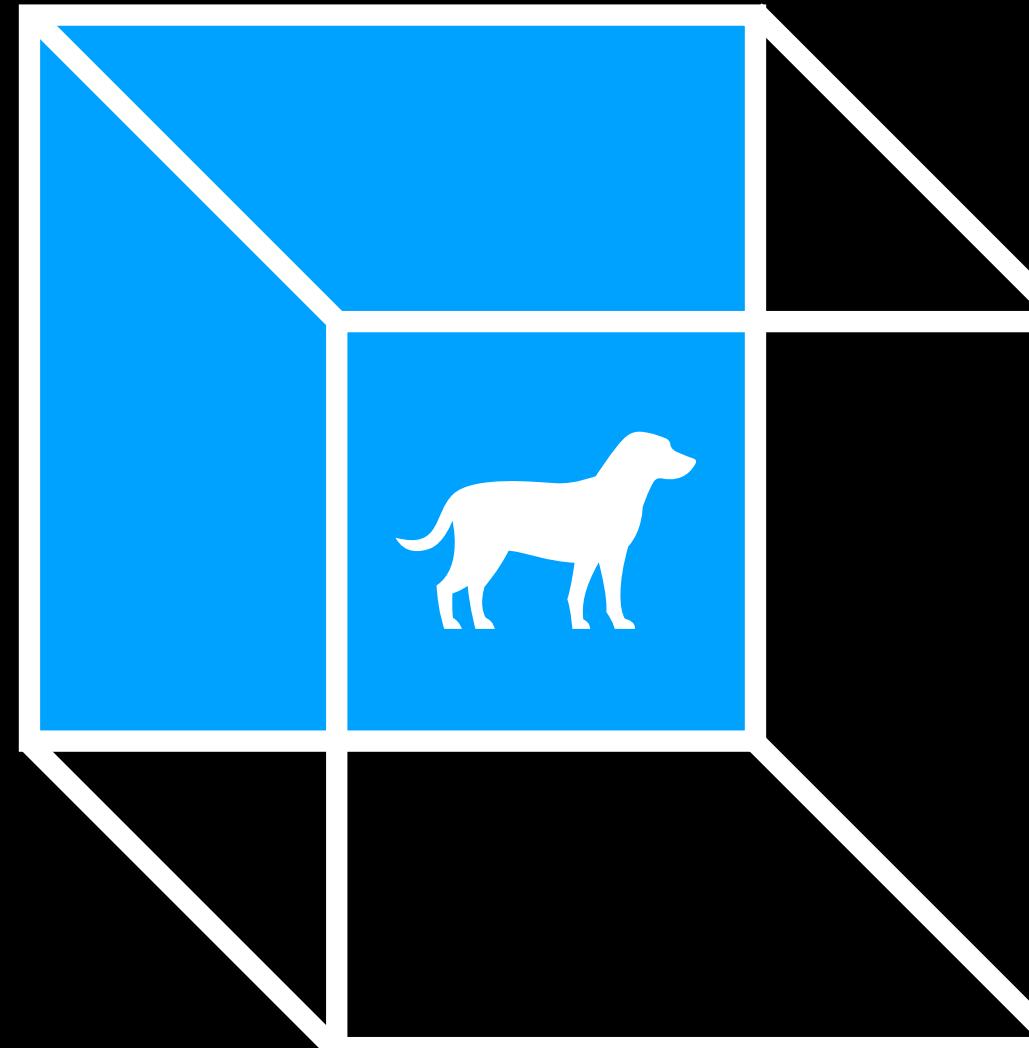
Can you see the dog in the ...



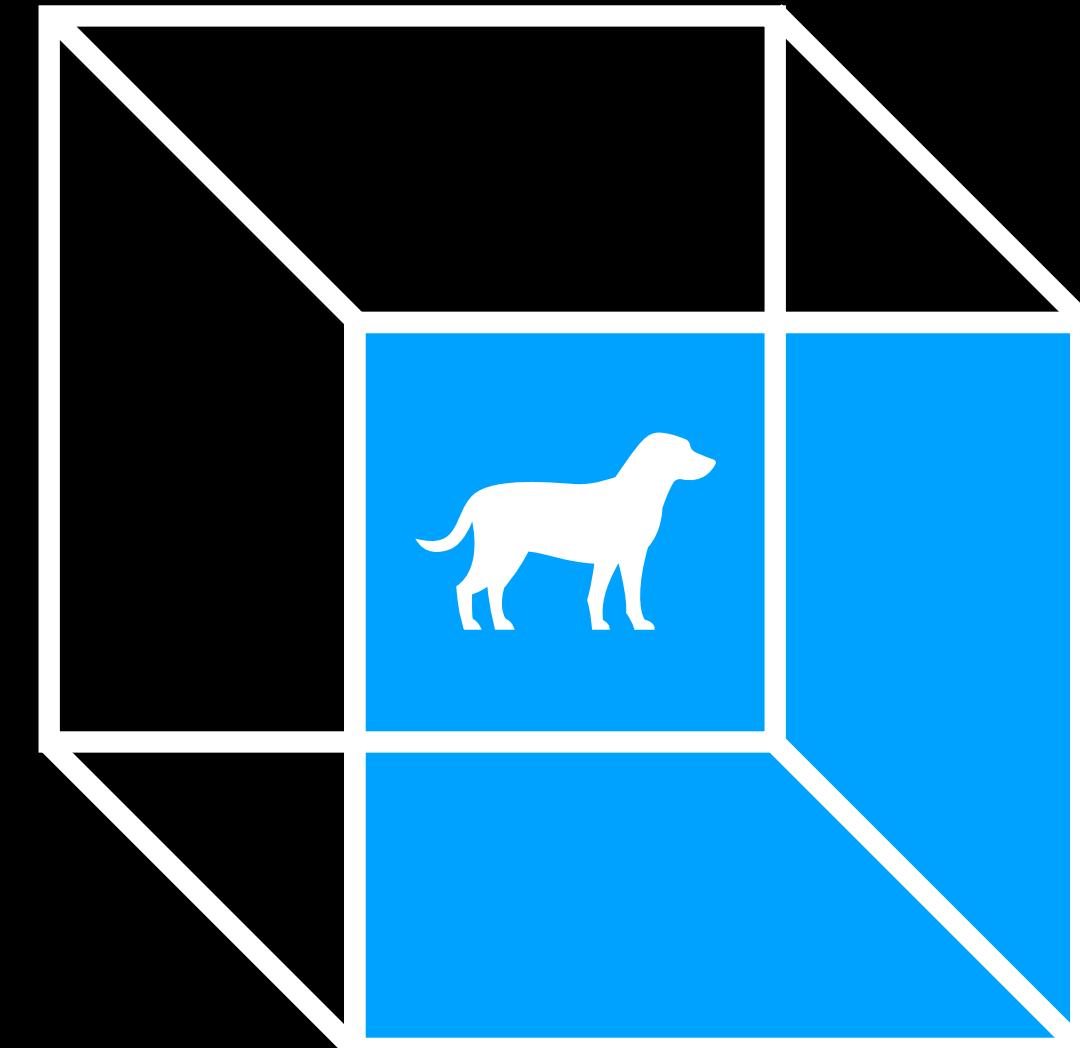
**Back bottom right?
Front top left?
Front bottom right?
Back top left?**



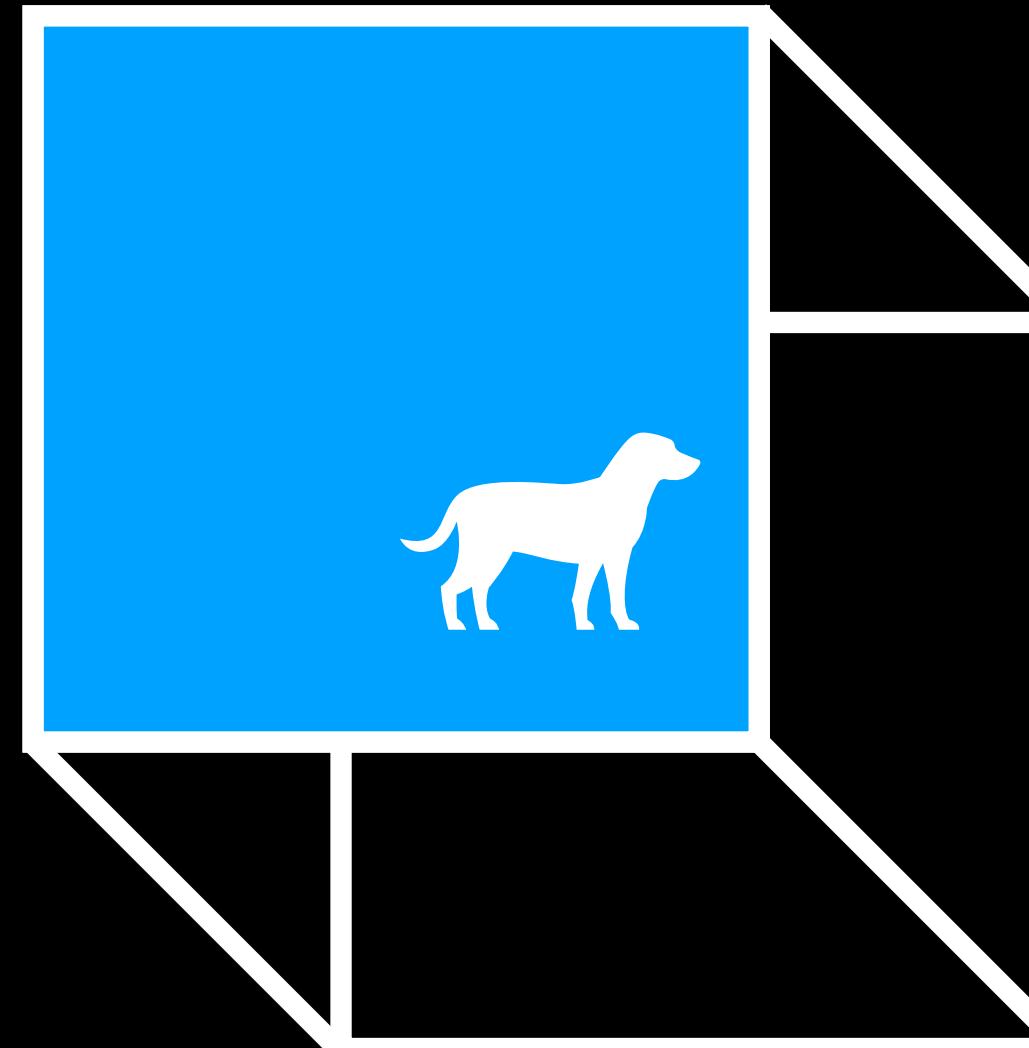
Front top left



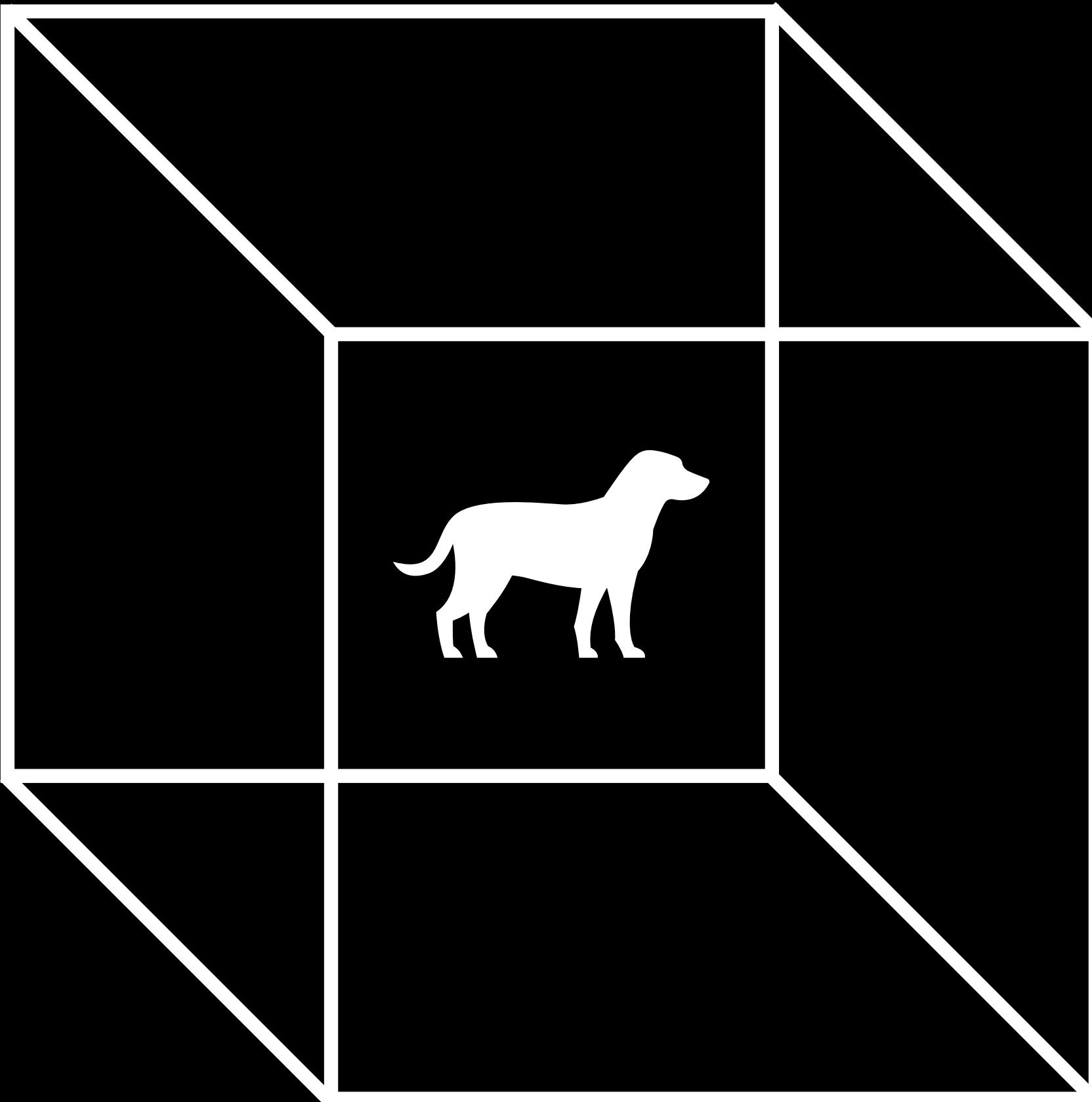
Back bottom right



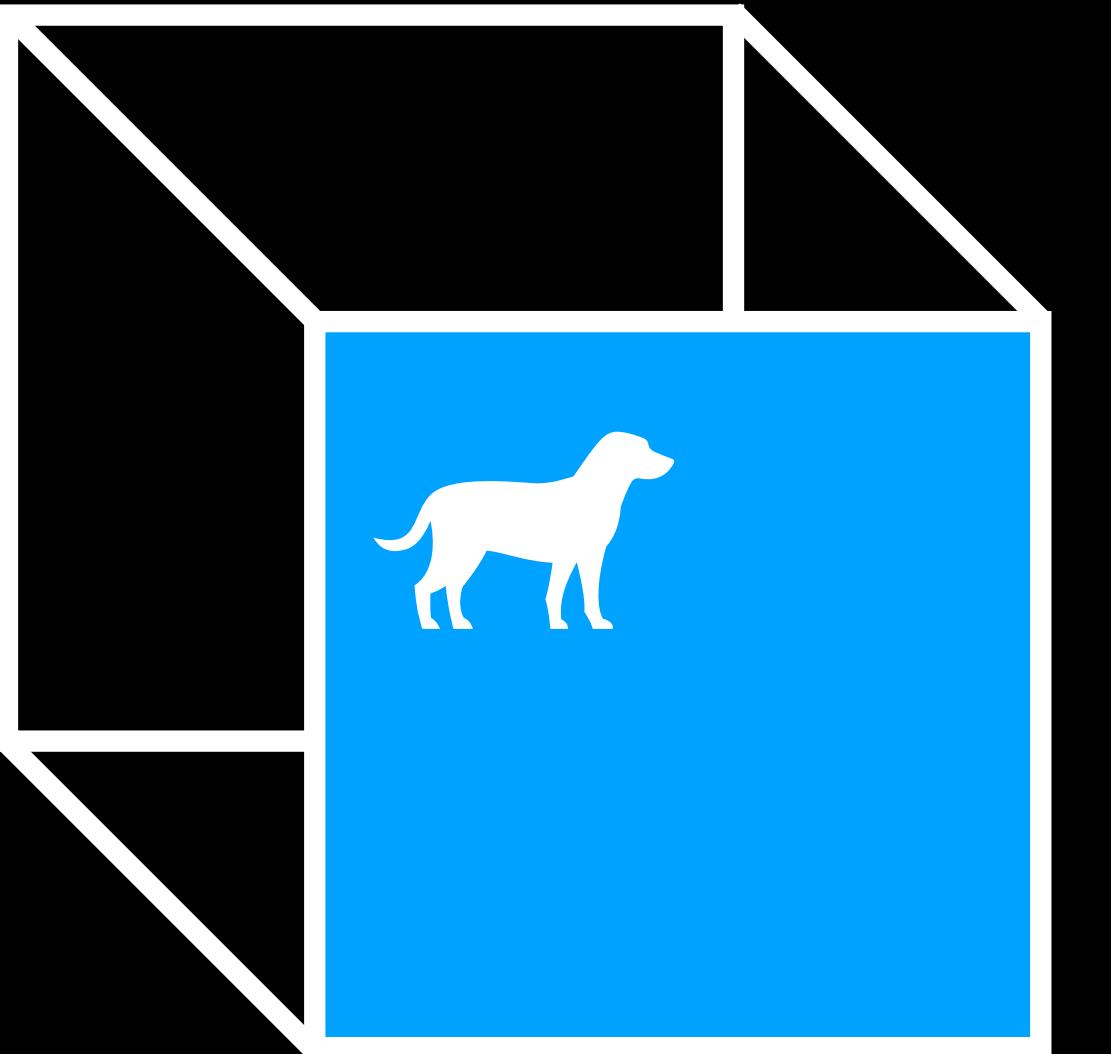
Back top left



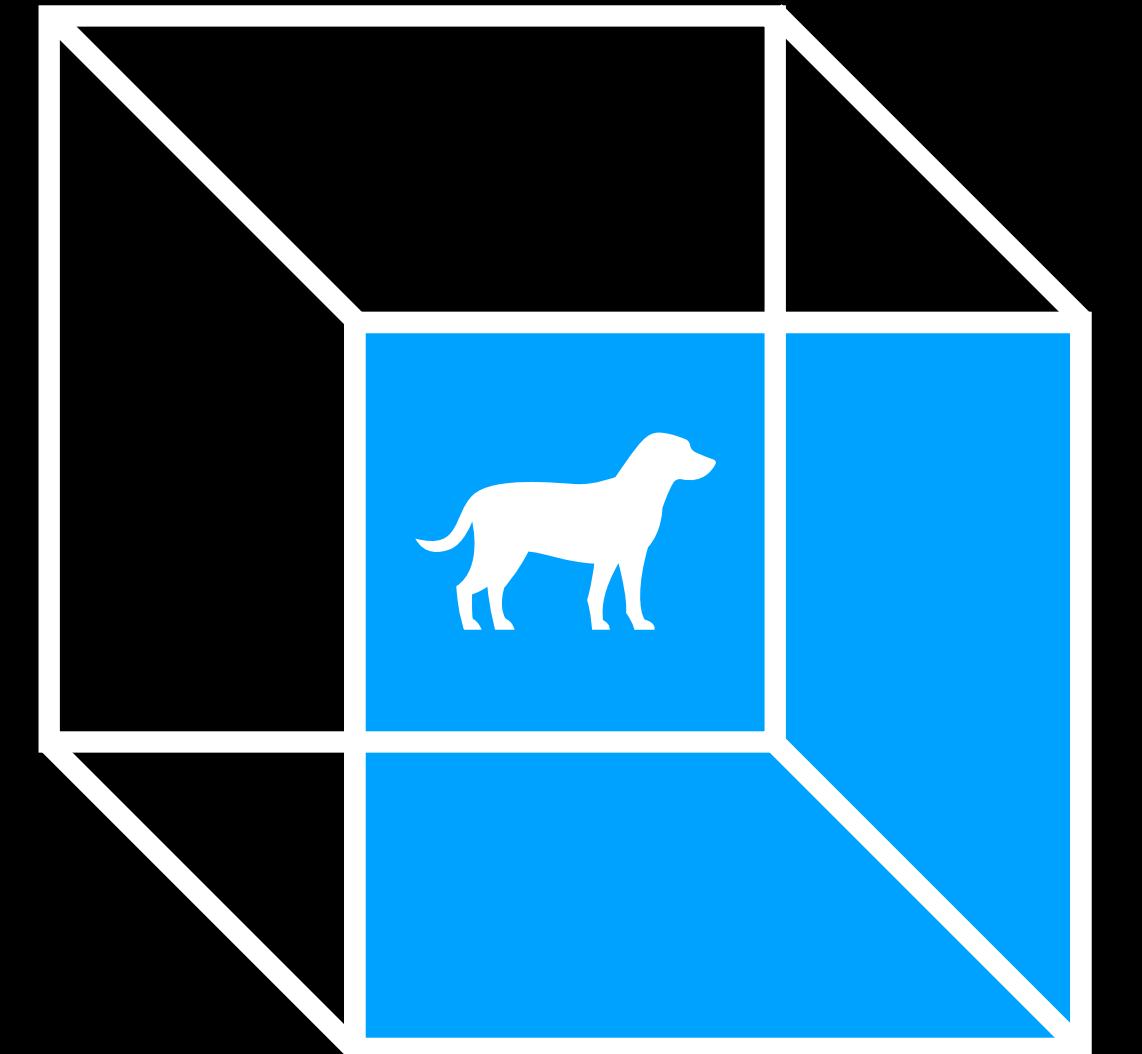
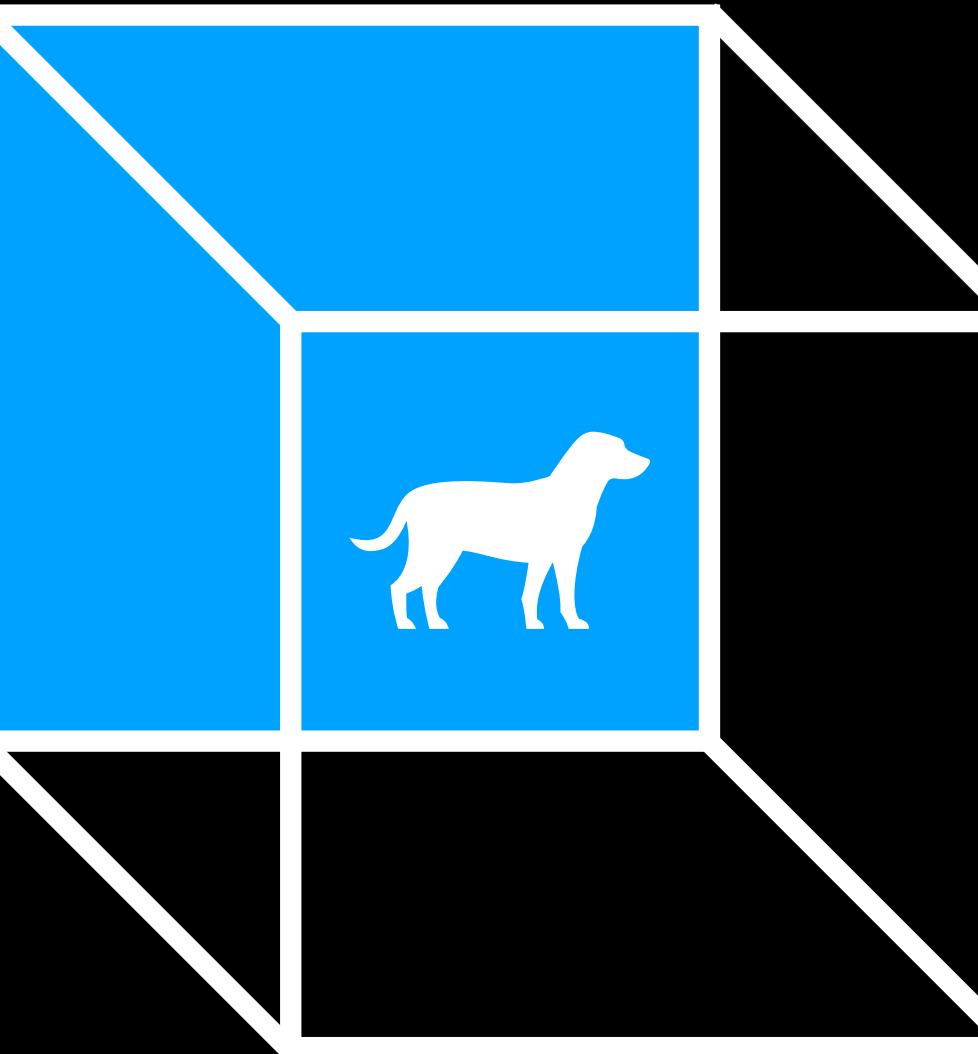
Front bottom right



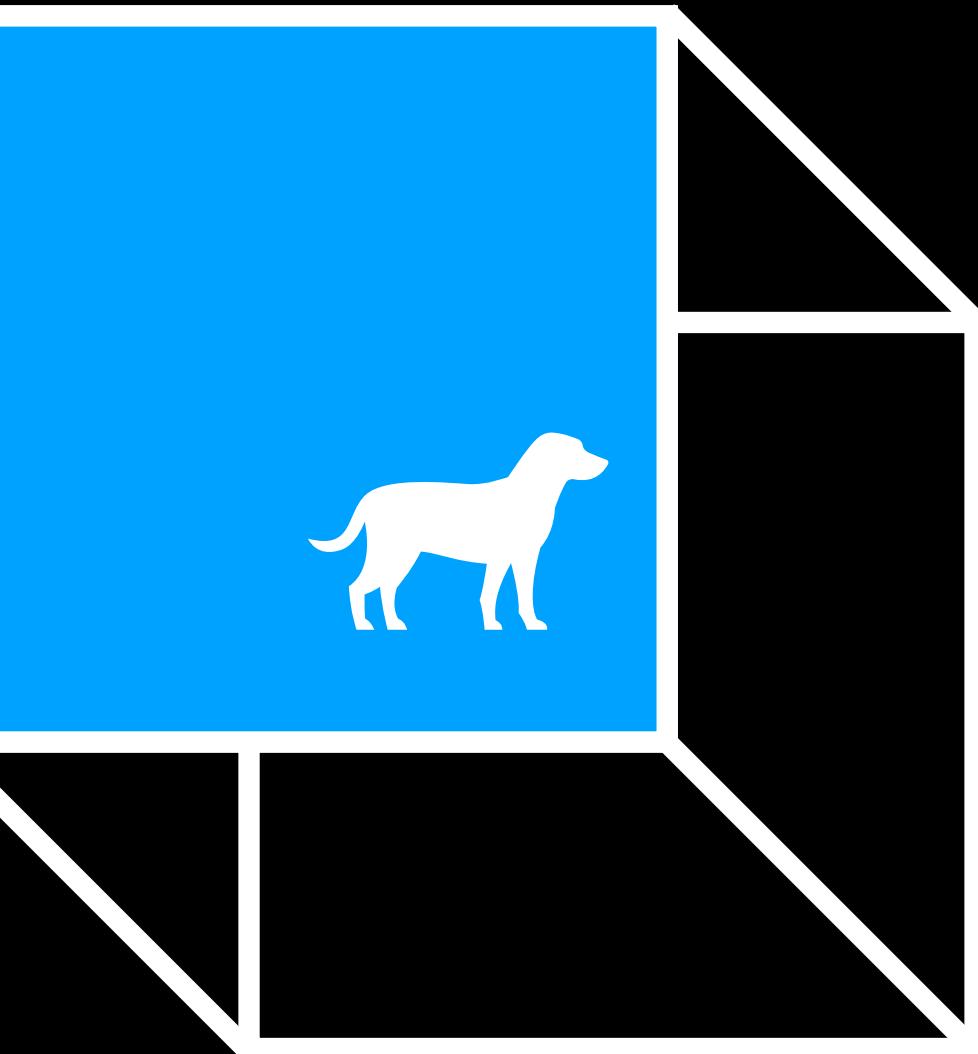
Your idea!



**Ambiguity is
valuable early in the
design process**



**Ambiguity is
anxiety-producing
later in the design
process**



8:49



6.13.0 *Procurement Integrated
Enterprise Environment*



Success Message

Welcome to the Procurement Integrated
Enterprise Environment

Award



Solicitation

Post Award Admin

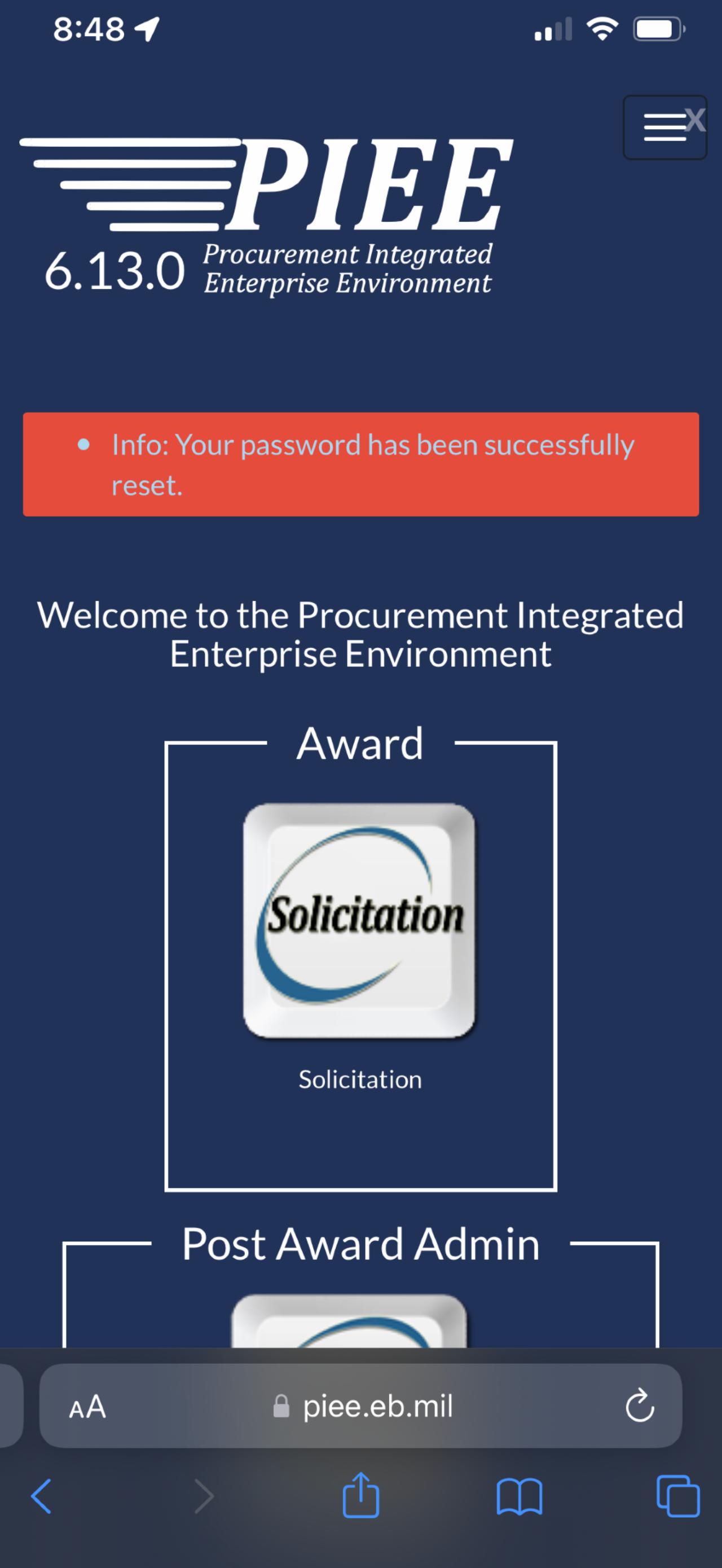


AA

piee.eb.mil



Success Message



Error Message



Quality Assurance Issue

1:52 1

The Battery Wharf Hotel - Great Rates
Online Book Now

Battery Wharf Hotel Boston Waterfront MA Book Online
for Best Rates.

Ad · <https://batterywharfboston.guestreservations.com/> :

Battery Wharf Hotel Boston - Boston,
MA Hotel Rooms

Battery Wharf Hotel Boston in Boston, Massachusetts. 3
Battery Wharf. Book Now.

Ad · <https://www.batterywharfhotelboston.com/> :

Boston Waterfront Hotel - Battery
Wharf Hotel Boston

Avoid this hotel. ↗

People also search for

- battery wharf
- restaurants near battery wharf hotel
- battery wharf hotel spa
- things to do near battery wharf hotel, boston
- battery wharf hotel reviews

Battery Wharf Hotel
Boston Waterfront

4.2 ★★★★☆ (959)
4-star hotel

1,749+

Q batter wharf hotel

Ad · <https://www.batterywharfhotelboston.com/>

Boston Waterfront Hotel - Battery Wharf Hotel Boston

Avoid this hotel.



People also search for



Quick Review

Step 1: Speaker Information > Step 2: Expenses Information > **Step 3: Submit Request**

Please confirm all the information below. Click "Previous" to modify your request, or click "Submit" to submit your request.

Speaker's Name: Blade Kotelly(Z) (1972)
Email: bladekotelly@me.com
Public Seminar #: 02034 - 00062 Innovation and Design Thinking Certificate Program
From 09/07/2023 to 09/08/2023
Saranac Lake, NY
Payee's Name: BLADE KOTELLY INC
Mailing Address: 25 CHANNEL CENTER ST #604
BOSTON MA 02210
UNITED STATES
Fees & Expenses Summary:

REQUEST FOR PAYMENT		
Speaker Fee		
Flat Rate/Finders Fee(s)		\$0.00
Per-Diem		\$0.00
Alternate Per-Diem		\$0.00
Other Expenses		\$0.00
TOTAL		

NOTE: Be advised that Request for Payment Forms claiming **Other Expenses** may take 1-2 weeks longer than usual for validation.

<< Previous **SubmitButton** Save as Draft Cancel Request

< Account

Done



Slack

Business Communication

OPEN



48 RATINGS

4.4



AGE

4+

Years Old

CHART

No 22

Business

DEVELOPER



Slack Technologies

Exploiting An Opportunity

What's New

Version History

Version 21.07.20

1w ago

What's new

- How's everybody doing out there? Are you getting enough sleep? Drinking enough water? Eating some vegetables here and there? We don't have any big updates this time around, so we wanted to use this space to remind you to be kind to yourself and those around you. That's all. Love ya.

Design Challenge

If you could do anything legal to **break existing records** in a current summer olympic sport (e.g. swimming, cycling, running), **what might you do?**

**Must be legal & ethical



Class #2



6.910A/2.723A/16.662A /6.9101/2.7231/16.6621

Welcome to D-TILE
Design-Thinking, Innovation and Leadership for Engineers

Design Challenge

Make an iPhone Killer

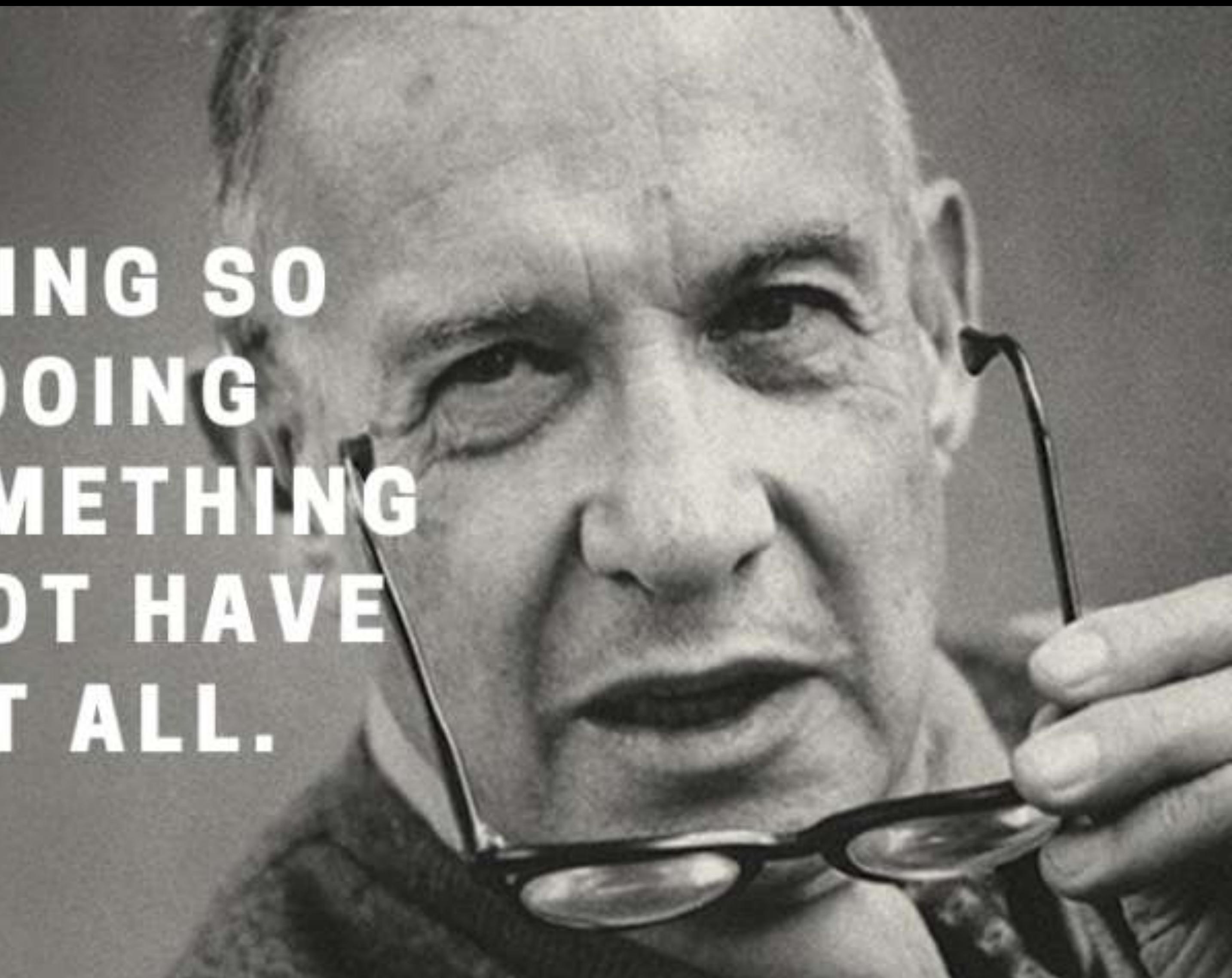
What are the **first 3 steps** you would take?



**Ask “why?” and
challenge assumptions**

**THERE IS NOTHING SO
USELESS AS DOING
EFFICIENTLY SOMETHING
THAT SHOULD NOT HAVE
BEEN DONE AT ALL.**

Peter Drucker



Good and Bad Design





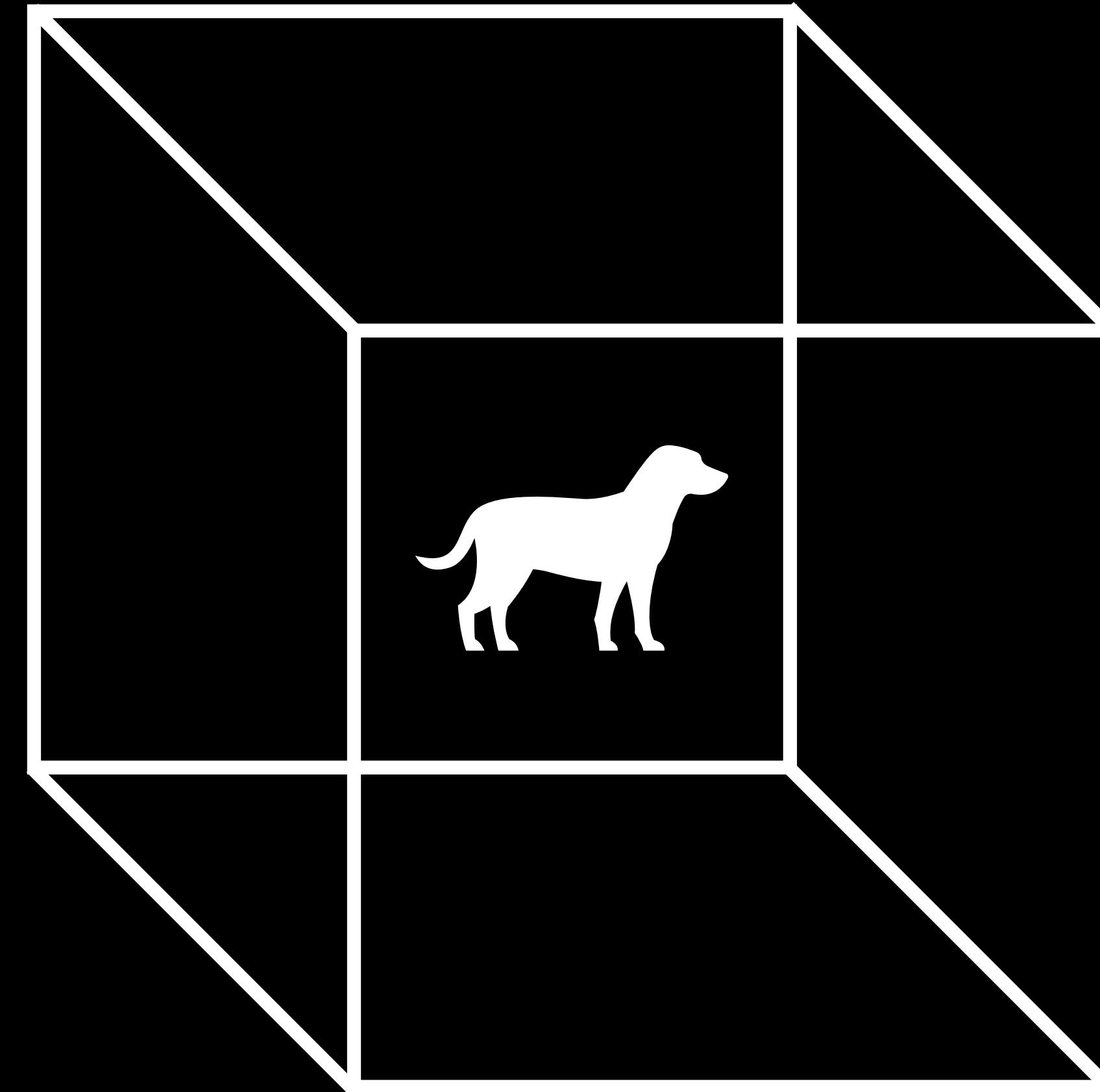




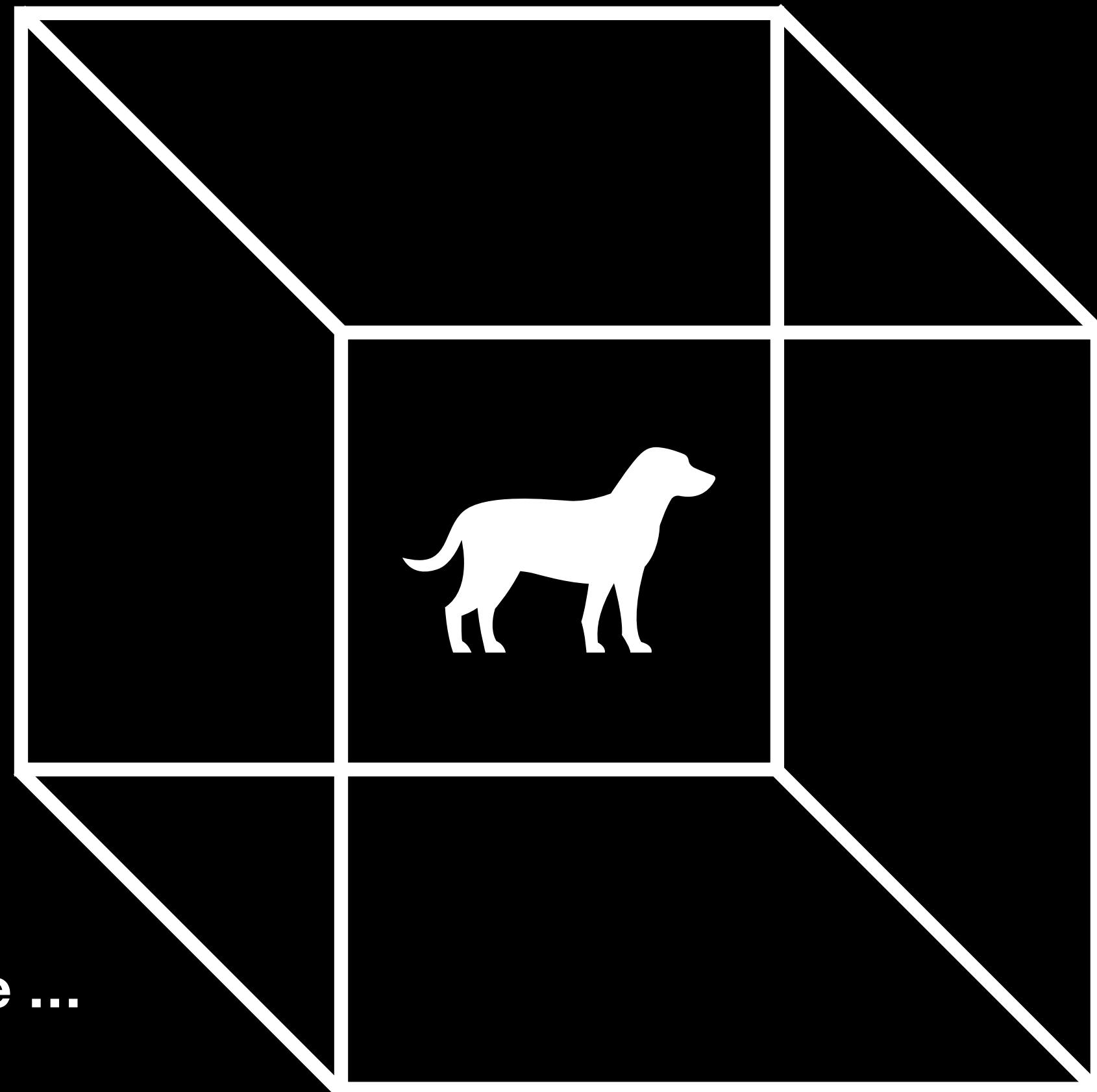


“Good” and “bad” are only
meaningful in a **context**

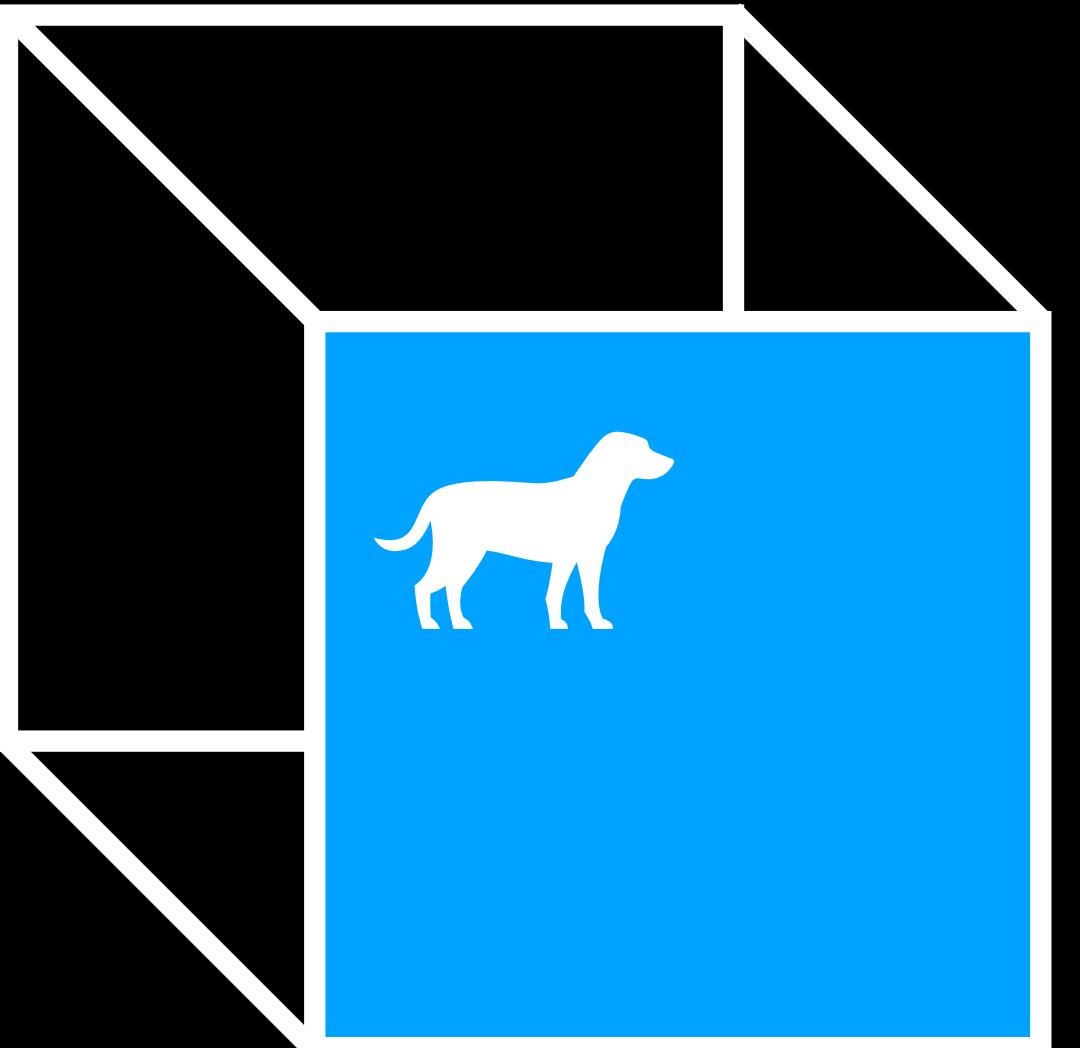
It can be hard to shift your context



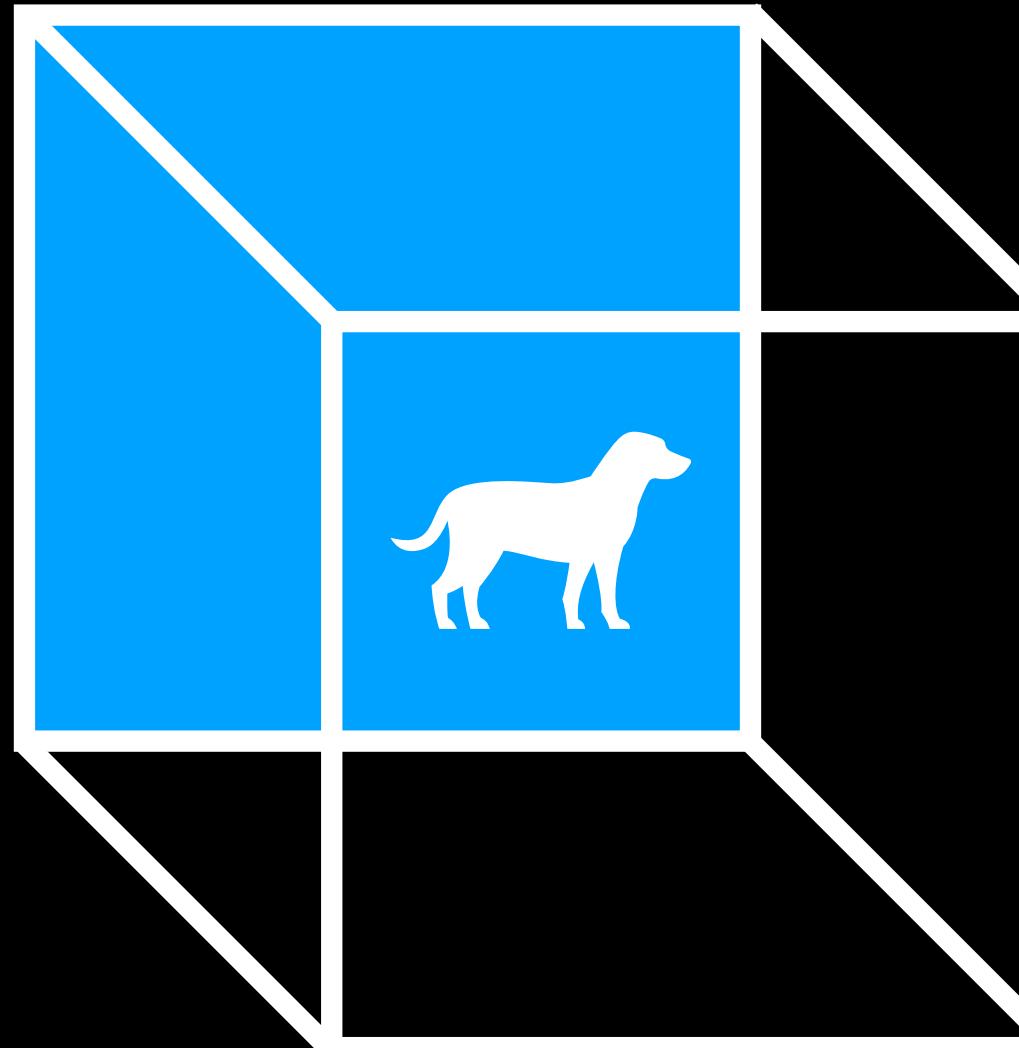
Can you see the dog in the ...



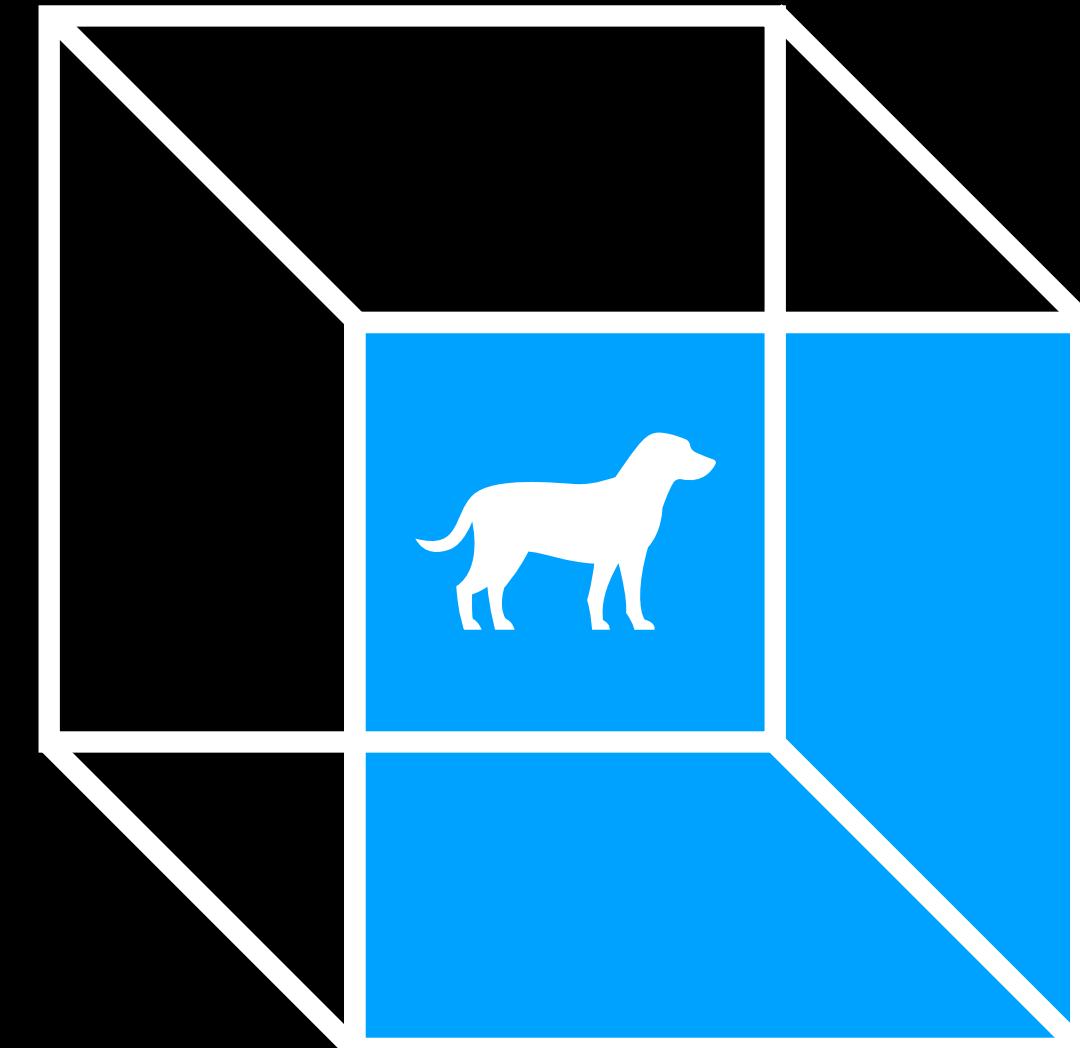
**Back bottom right?
Front top left?
Front bottom right?
Back top left?**



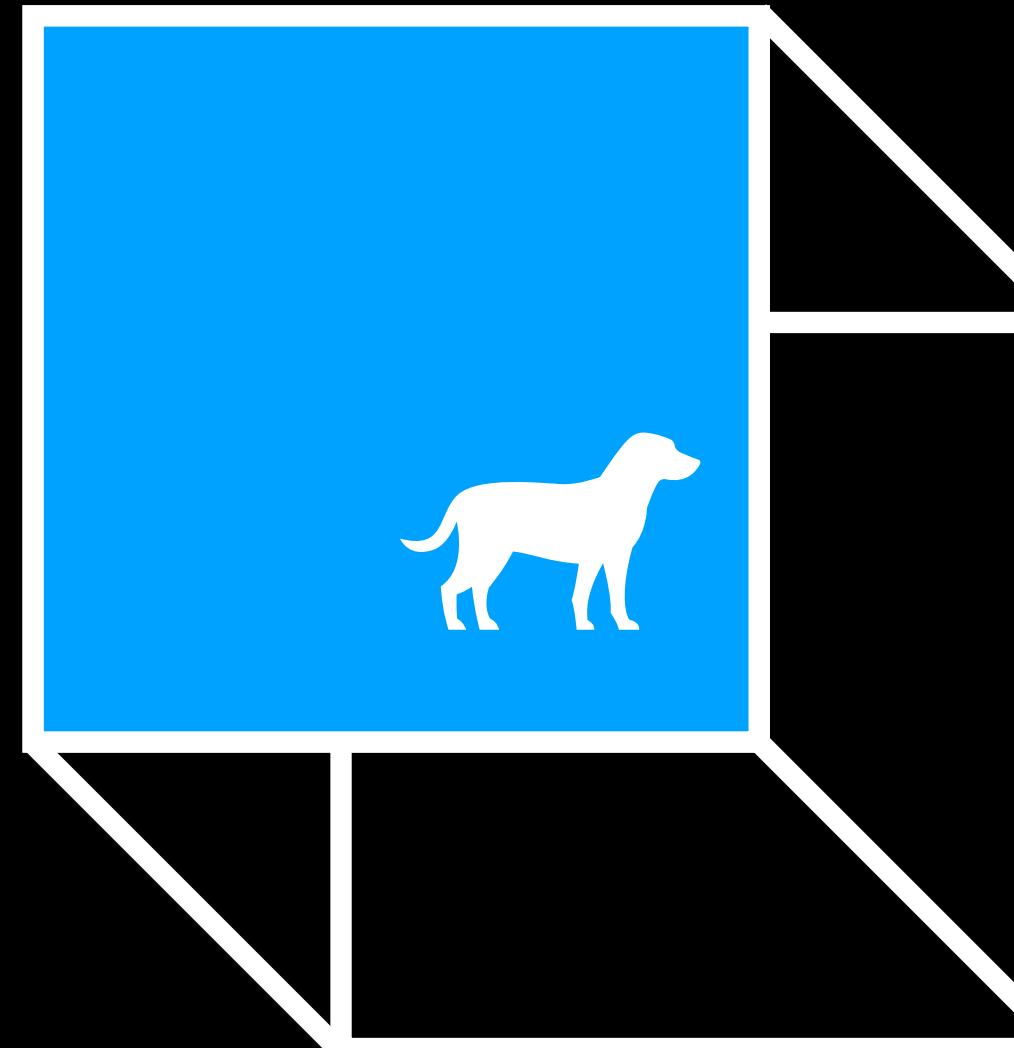
Front top left



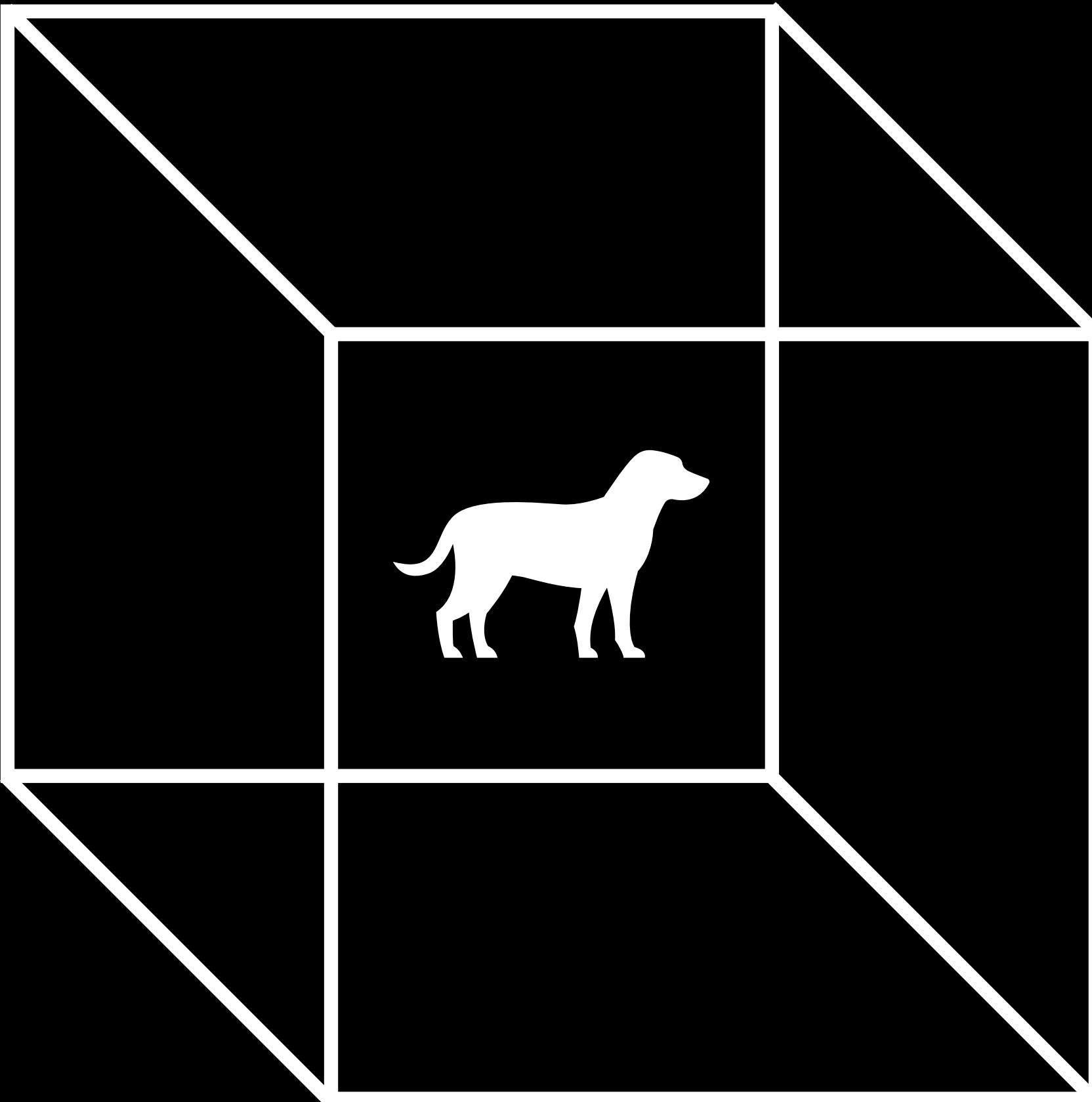
Back bottom right



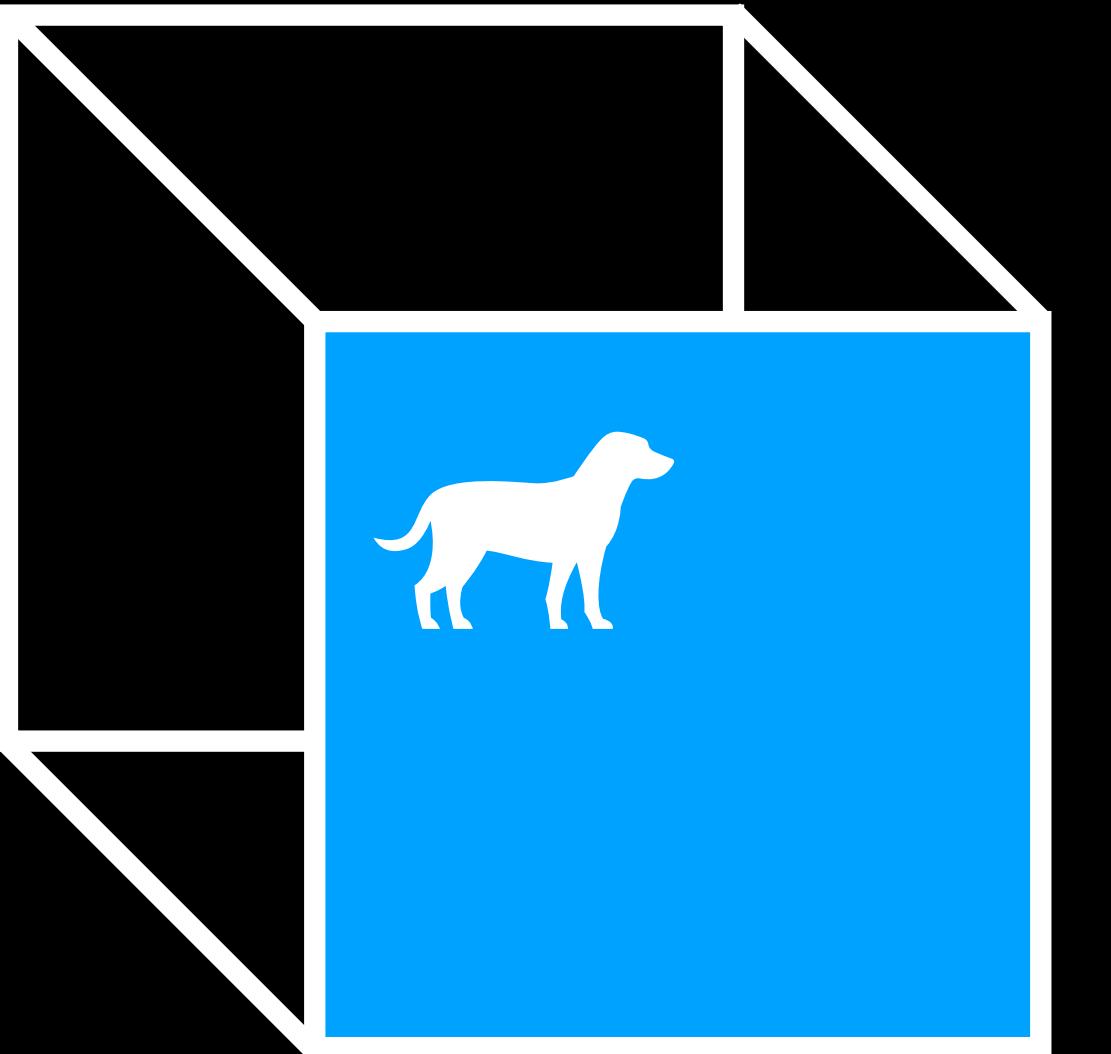
Back top left



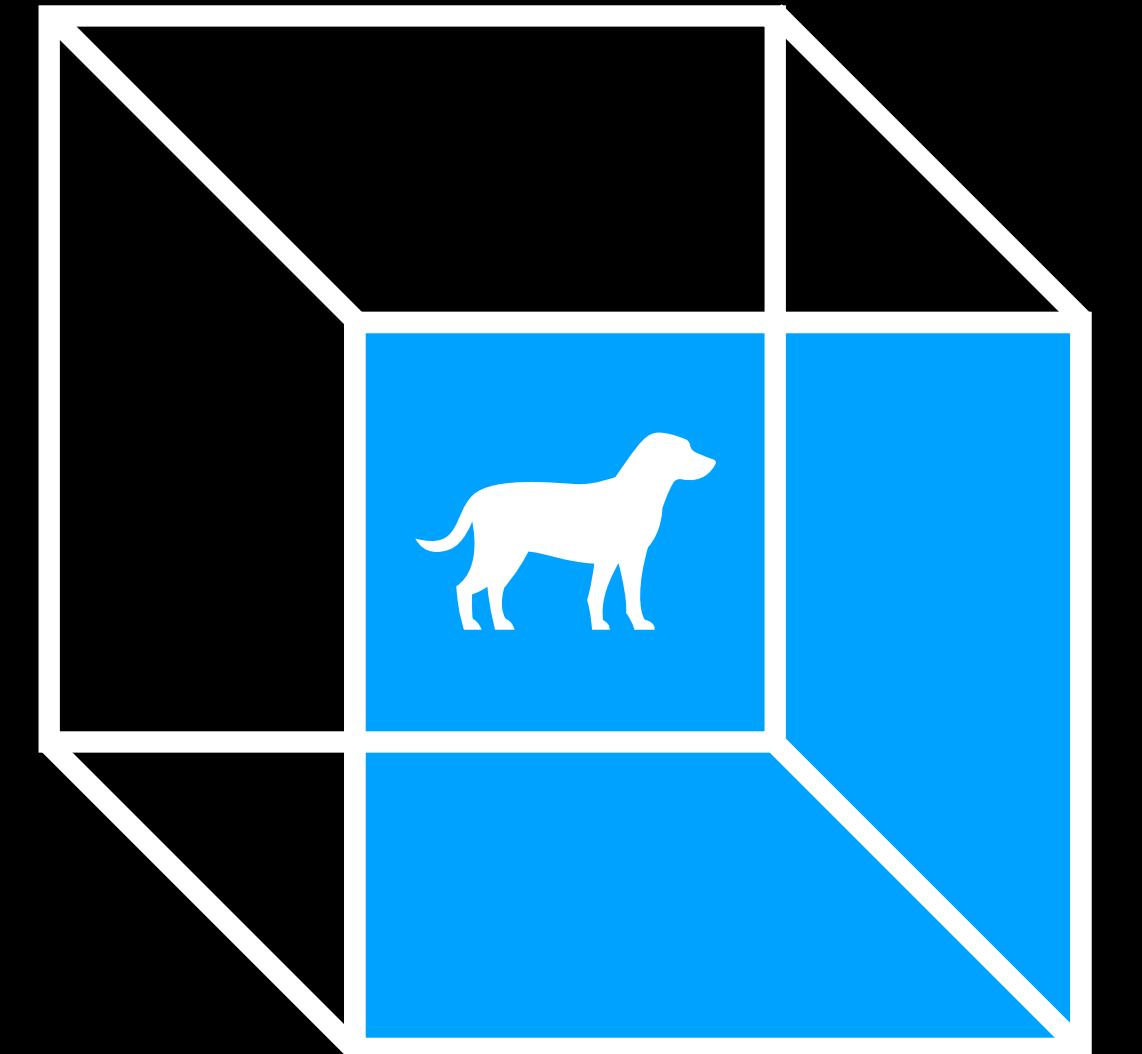
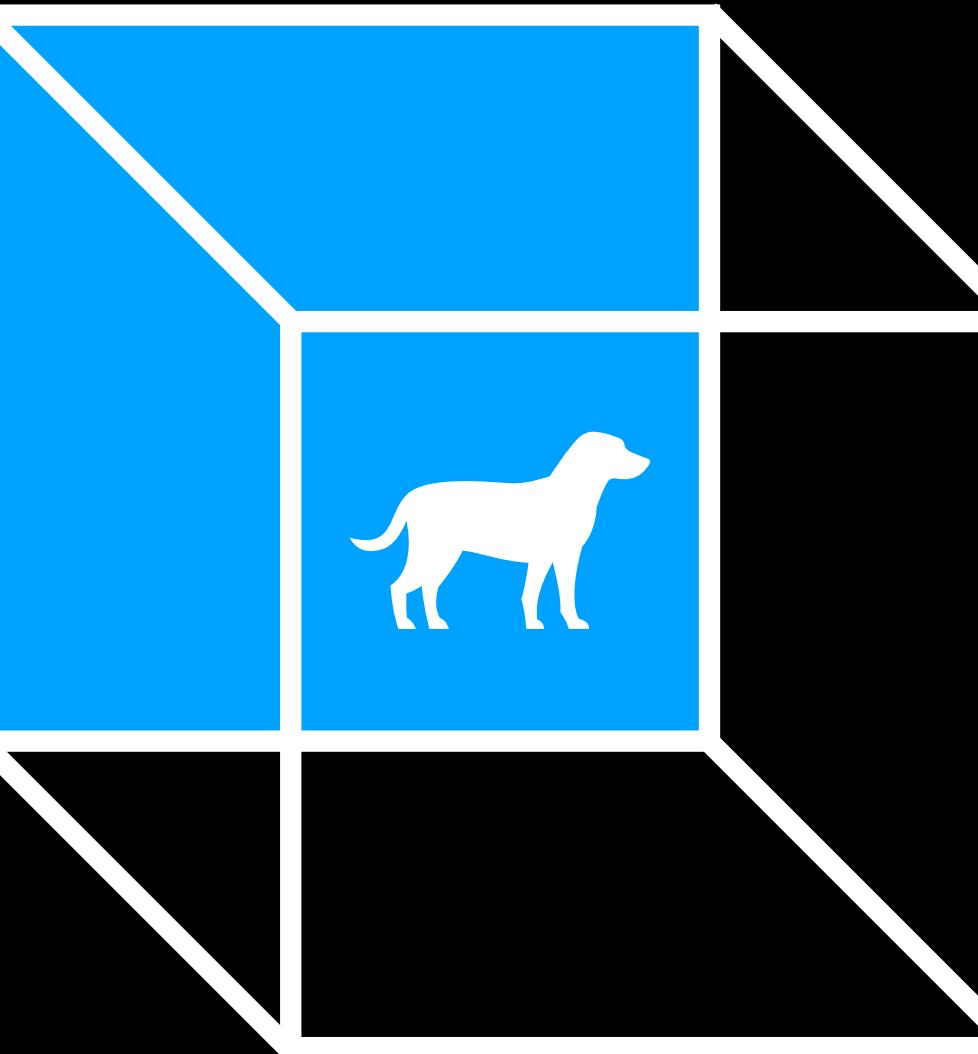
Front bottom right



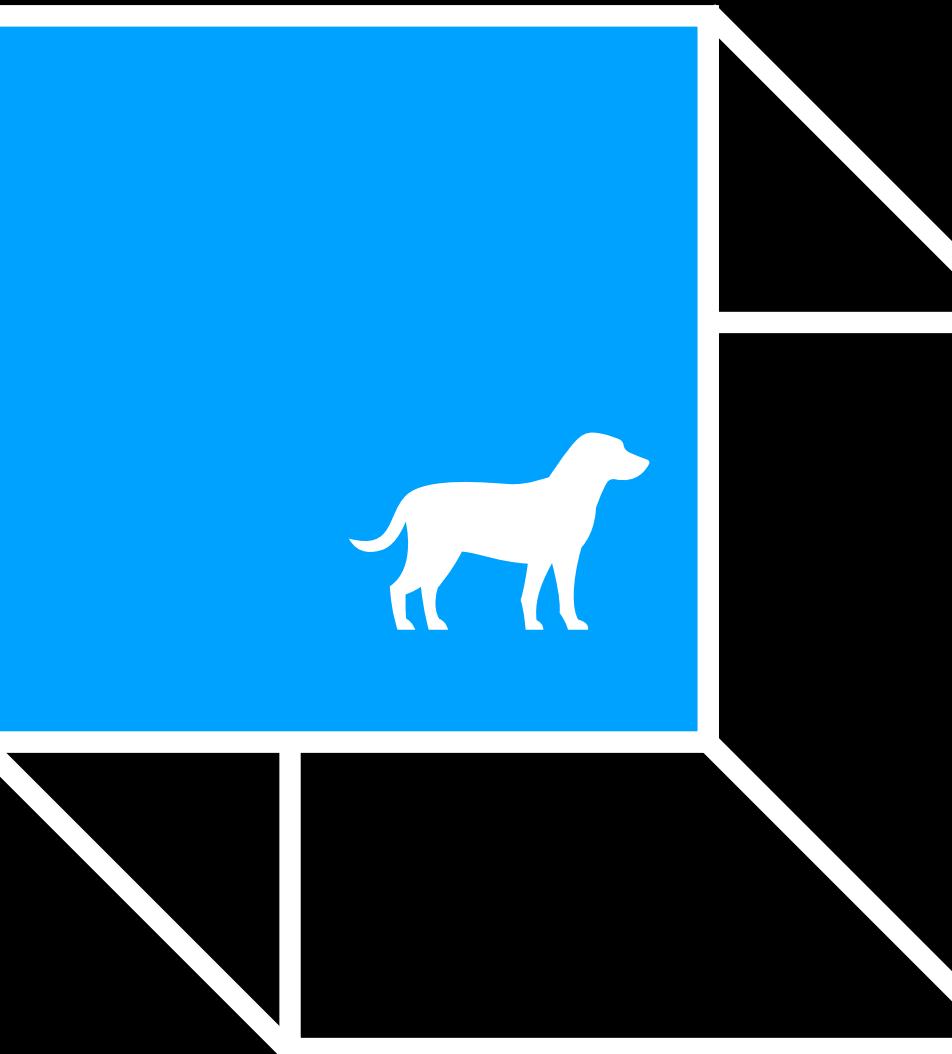
Your idea!



**Ambiguity is
valuable early in the
design process**



**Ambiguity is
anxiety-producing
later in the design
process**





Innovation Process: Overview

Why An Innovation Process?

- To easily remember important steps
- To have a shared language with your team
- Process produces consistently good outcomes
- Prevents “Inventor’s Block”

This process works for:

Products

Services

Processes

Policy

Everything!

Problem Space Definition

Define the Problem Space
Articulate a Problem Statement
Articulate With A Vision That Motivates

Discover and Define

Delve into the problem space
Make research conclusions
Determine emotional and intellectual outcomes

Explore and Explain

Brainstorm wildly
Down select and develop direction
Quickly render artifact to share concept

Make and Measure

Identify areas of uncertainty, develop inexpensive ways to reduce uncertainty
Present, observe and probe
Draw conclusions and insights

Launch, Iterate, or Stop

Determine if the solution is ready to be launched (implemented or placed on a product roadmap), if you should refine the problem space or iterate again

Problem Space Definition

Define the Problem Space
Articulate a Problem Statement
Articulate With A Vision That Motivates

Discover and Define

Decide what you need to solve

Research and learn

Understand who you will impact

Identify challenges

Define what success looks like

Generate lots of ideas

Select the best ideas

Find a way to share the ideas

Reduce uncertainty with mini-experiments

See if it works and if others like it

Explore and Explain

Determine if the solution is ready to be launched
(implemented or placed on a product roadmap),
if you should refine the problem space or iterate
again

Launch, Iterate, or Stop

Discover and Define

1. Problem Space Definition

Select Area For AI Solution
Define the Problem Space
Articulate a Problem Statement
Articulate With A Vision That Motivates

Explore and Explain

2. Needs & Assumptions Analysis

Decide what you need to solve

3. Research & Discovery

Research and learn

4. Stakeholder Analysis

Understand who you will impact

5. Boundary & Hazard Mitigation

Identify challenges

6. Specify Desired Outcomes

Define what success looks like

7. Concept Generation

Generate lots of ideas

8. Concept Downselection

Select the best ideas

9. Concept Articulation

Find a way to share the ideas

Make and Measure

10. Uncertainty Identification

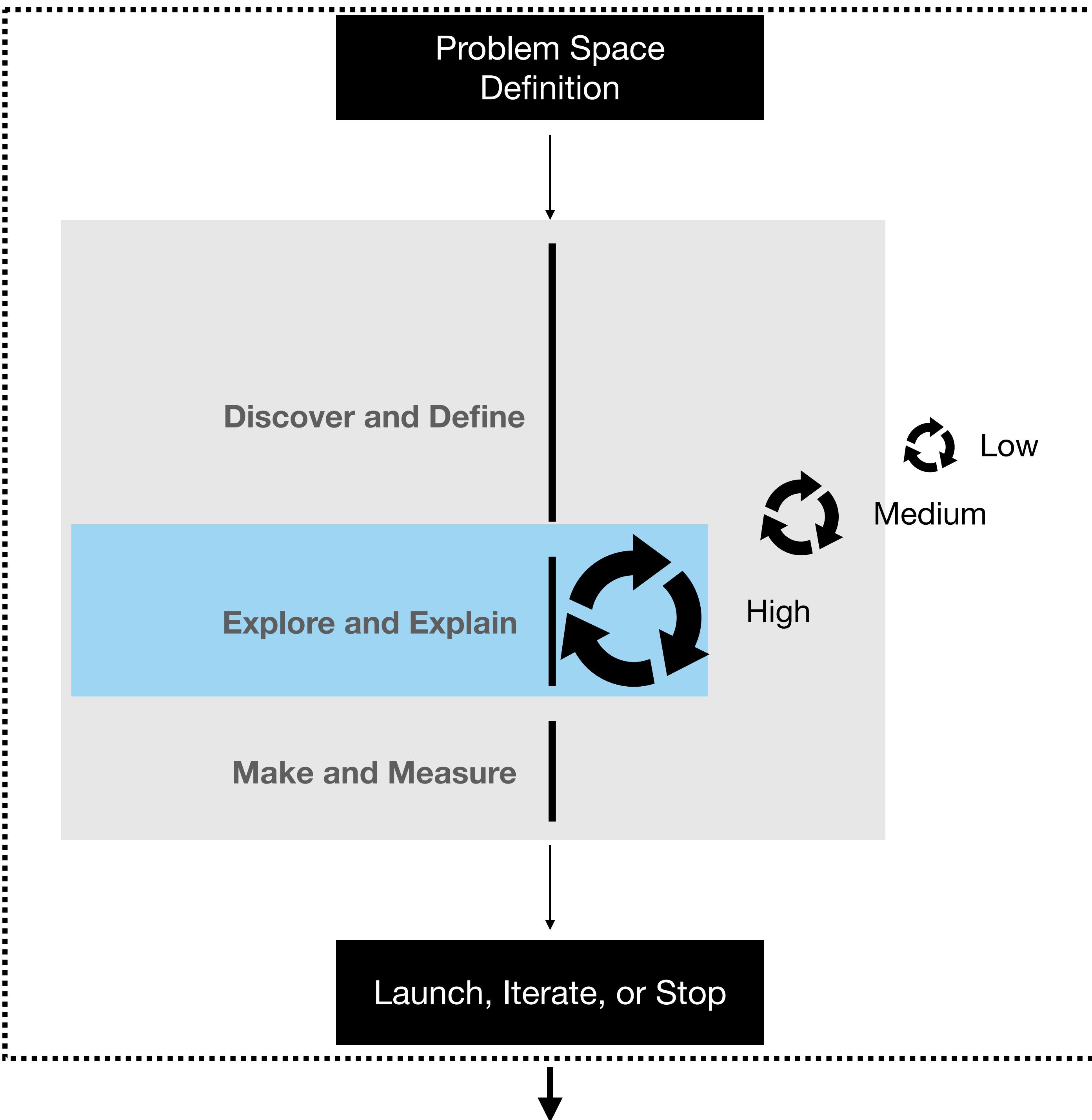
Reduce uncertainty with mini-experiments

11. Uncertainty Reduction

See if it works and if others like it

12. Launch, Iterate, or Stop

Determine if the solution is ready to be launched (implemented or placed on a product roadmap), if you should refine the problem space or iterate again



12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes

Explore and Explain

7. Concept Generation
8. Concept Downselection
9. Concept Articulation

Make and Measure

10. Uncertainty Identification
11. Uncertainty Reduction

12. Launch, Iterate, or Stop

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

Define the problem, why it's a problem, and our objective

Don't define a solution, here

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
- 2. Needs & Assumptions Analysis**
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

What's the underlying problem?

12-Step Innovation Process

Discover and Define

Explore and Explain

Make and Measure

1. Problem Space Definition
2. Needs & Assumptions Analysis
- 3. Research & Discovery**
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

What can inform us about this problem?

How do we learn from other related solutions?

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
- 4. Stakeholder Analysis**
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

Who benefits?

What do they all care about?

What do users really want?

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
- 5. Boundary & Hazard Mitigation**
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

What are we limited by?

How can we overcome boundaries and limitations?

What can go wrong?

How can we prevent errors and hazards?

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
- 6. Specify Desired Outcomes**
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

Develop research conclusions

Develop specifications that align different stakeholders

Determine desired outcomes from this process

Define project success criteria

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
- 7. Concept Generation**
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Structured and semi-structured concept generation

Explore and Explain

Address specific challenges or problems by exploring different angles, perspectives, and concepts

Make and Measure

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
- 8. Concept Downselection**
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Define evaluation criteria

Make and Measure

Chose the best concepts based on criteria

Use to prioritize or sequence subsequent work

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
- 9. Concept Articulation**
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

Create artifact to externalize idea, create vision

Enables sharing with team members

Enables tracking and cataloging

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes

Explore and Explain

7. Concept Generation
8. Concept Downselection
9. Concept Articulation

Make and Measure

- 10. Uncertainty Identification**
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Identify areas of uncertainty

Identify importance/value of key elements of the solution

Determine methods to reduce uncertainty

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
- 11. Uncertainty Reduction**
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

Reduce uncertainty with mini experiments

Consult with relevant stakeholders/experts

Test for usability with users

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop

Explore and Explain

Make and Measure

**Do the hard work here
(architecting, coding,
designing, modeling, etc.)**

12-Step Innovation Process

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes

Explore and Explain

7. Concept Generation
8. Concept Downselection
9. Concept Articulation

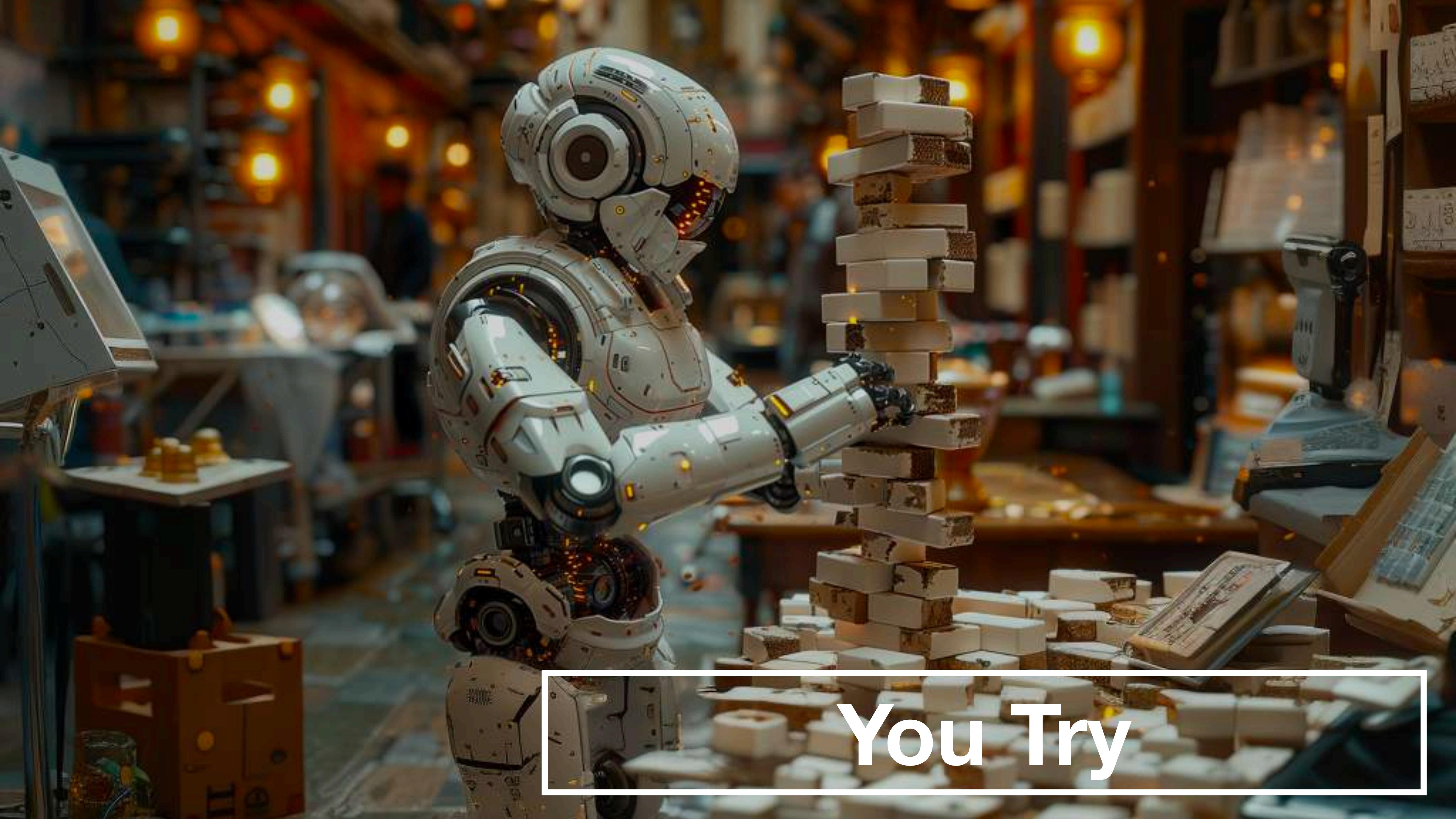
Make and Measure

10. Uncertainty Identification
11. Uncertainty Reduction

12. Launch, Iterate, or Stop

Reflect and determine next step

99% of time, iterate



You Try

Map the process to cooking dinner

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop



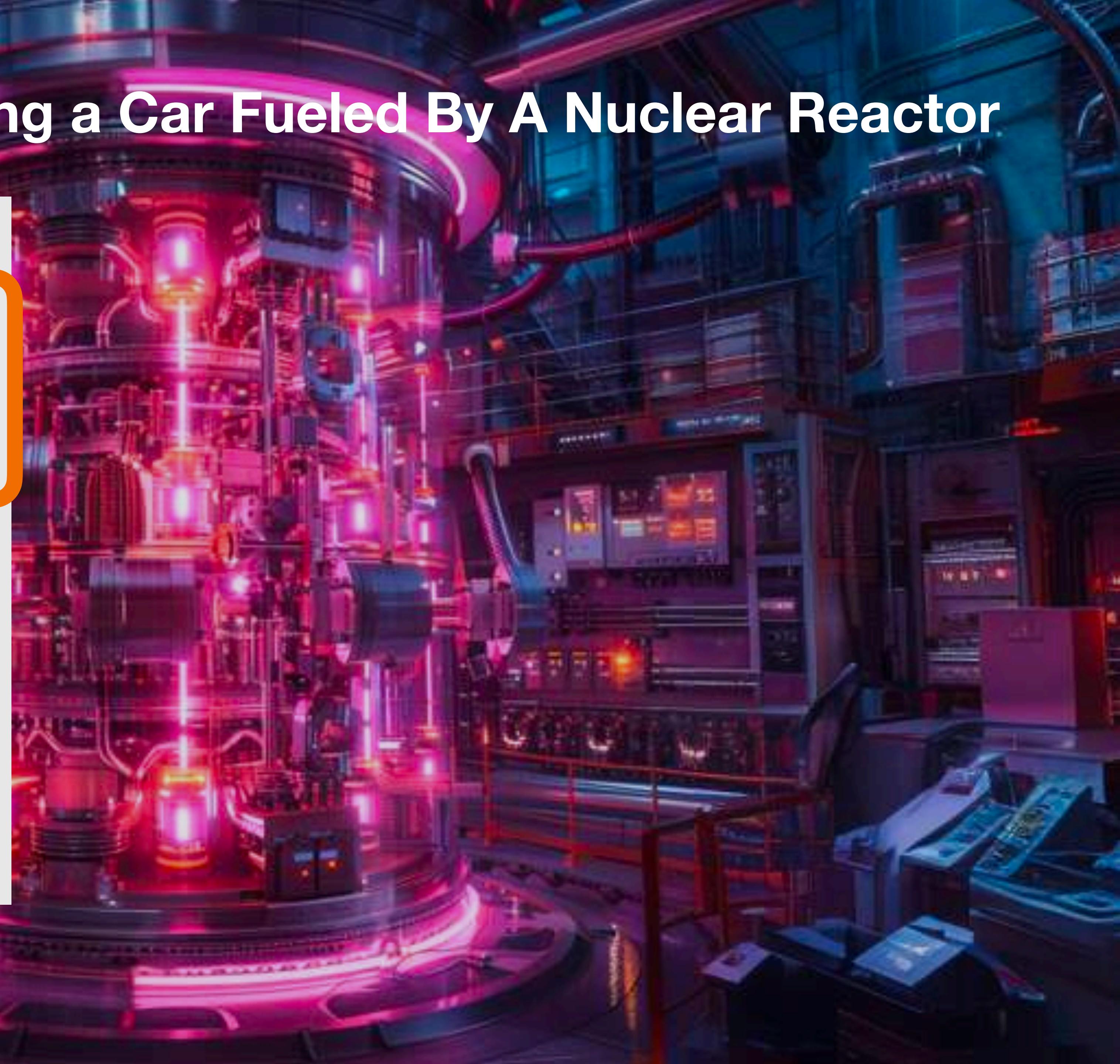
Throwing a surprise birthday for your best friend

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop



Map the process to making a Car Fueled By A Nuclear Reactor

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction
12. Launch, Iterate, or Stop



A close-up photograph of a person's hands playing the wooden block game Jenga. The person is wearing a red t-shirt and blue jeans. The background is dark, making the light-colored wood stand out. The word "Jenga" is printed on each block.

You Try

What's the correct order of the steps?

Homework

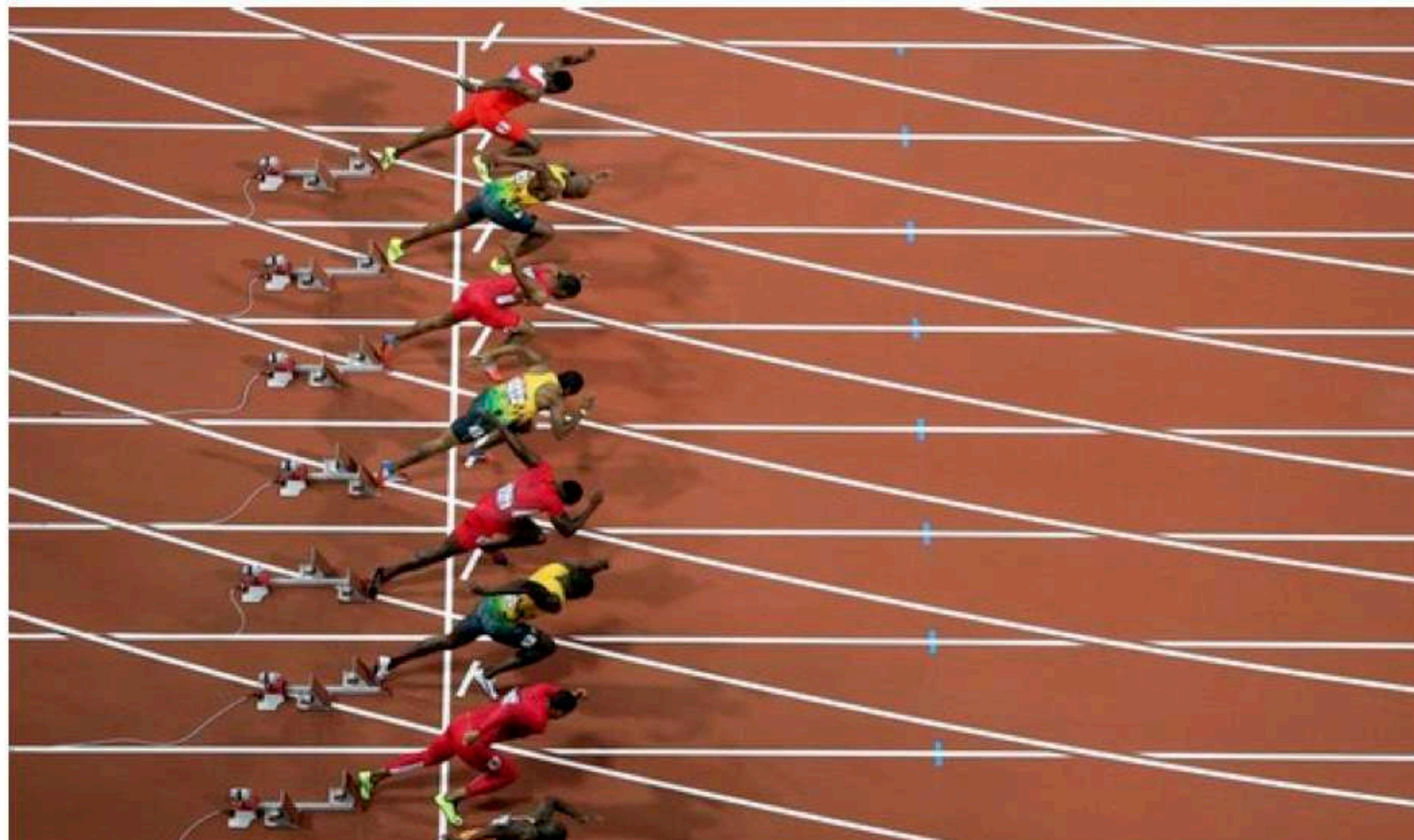
If you could do anything legal to **break existing records** in a current summer olympic sport (e.g. swimming, cycling, running), **what might you do?**

**Must be legal & ethical



An Olympics Built for Records

By MATTHEW FUTTERMAN, JONATHAN CLEGG and GEOFFREY A. FOWLER



Ian Crockford, project manager for the Olympic Delivery Authority, the public body responsible for developing and building the new venues, said creating the fastest pool possible was his aim from the beginning. The key, he said, was a depth of three meters, an overlapping duct system at the pool's edges that all but eliminates waves, and two circulation systems, one at the bottom of the pool and one near the surface.

Streaming Coverage

London Olympics



The London Olympics stream provides all coverage — every story, video, photo or tweet — in one easy scan. Also, check out the redesigned news page.

Schedule | Photos | 360s

Medal Count			
	Gold	Silver	Total
People's Republic of China	31	19	54
United States of America	28	14	61
Great Britain	17	11	38
Updated 22 minutes ago			
			Full Medals Table

Get the latest Journal coverage of the 2012 Games right here—every story, video, photo or tweet related to the competition and all news off the field.

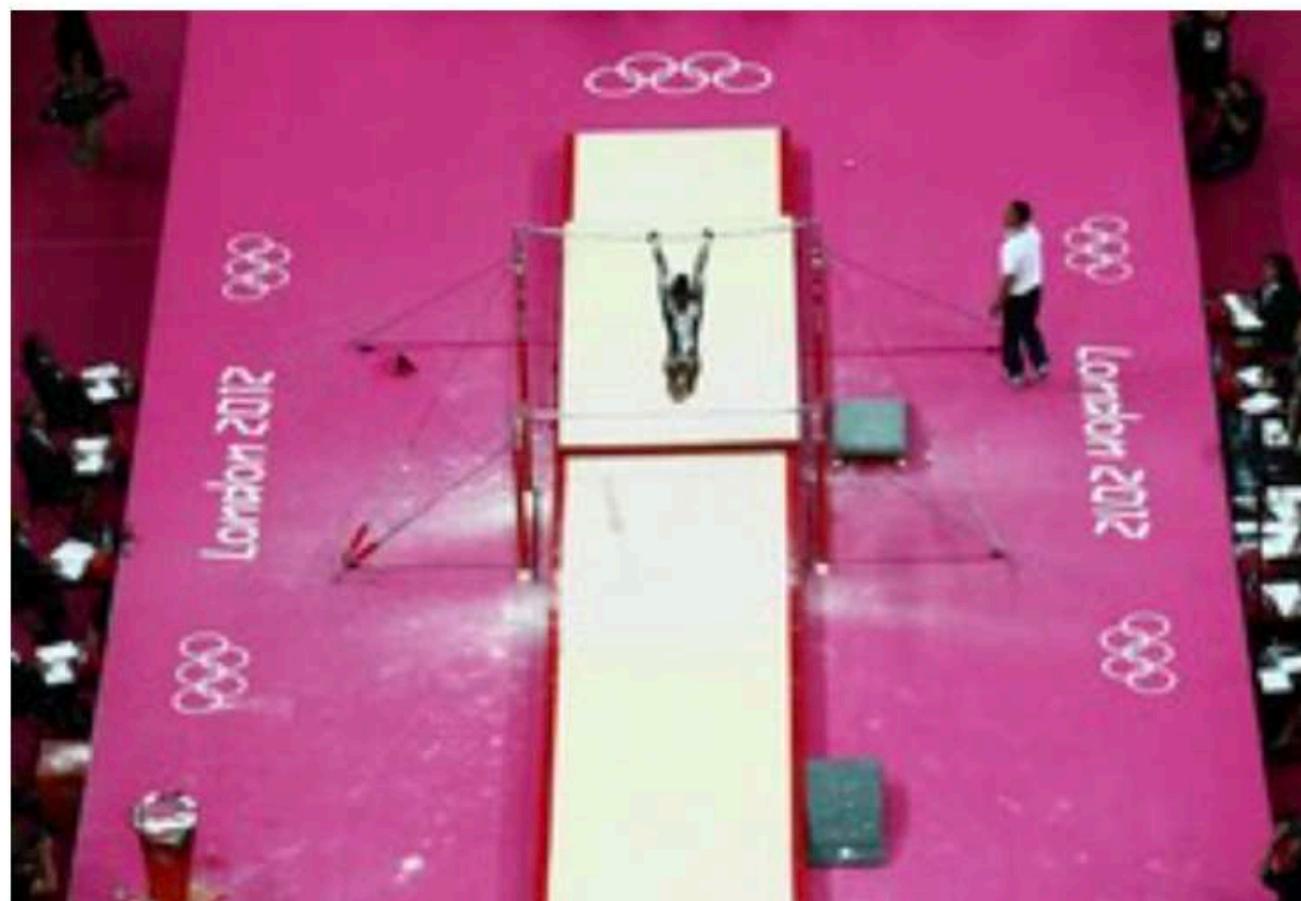
pool, allowing swimmers – at least the ones in front – to swim an entire race through practically flat water.

"We're obviously very happy that we're getting world records," Crockford said. "The sport is progressive, the sport science behind it is progressive. You want to give the ath-

At race time, operators turned off the upper circulation system to still the water. Even though only eight swimmers raced at one time, there were 10 lanes, meaning no swimmer was too close to the wall. And the walls aren't actually walls in the sense that most people who swim laps in ordinary pools are used to. The visible side of the Olympic pool is really just a barrier, and its top edge is 2 inches below the surface of the water. The water then falls into a trough and a recycle duct that recirculates it. The design prevents the wall from sending any ripples back into the center of the

It may have exceeded expectations. The velodrome delivered 10 world records during

the games. The British team has found the venue particularly to its liking: British riders broke world or Olympic records in all six timed events at the games.



Getty Images

Springier equipment helped gymnasts fly like never before.

The 250-meter track has a superfast surface made from 56 kilometers of Siberian pine wood. While the track itself is the same length as past Olympic tracks, the finish line has been moved roughly five meters from its usual location to provide a longer home straight for sprinters. That gives riders more time to accelerate off the banked turns, where speed decreases.

The steepest parts of the circuit, where the angle reaches 42 degrees, is similar to past tracks, but designers say the transitions from the banked turns into the straightaways are smoother to give team pursuit riders an easier and faster transition from straight sections to the banked areas of the track. Each international track varies slightly in terms of the balance between the length of the straights and radius of the bankings.

The steepest parts of the circuit, where the angle reaches 42 degrees, is similar to past tracks, but

Springier equipment helped gymnasts fly like never before.

The steepest parts of the circuit, where the angle reaches 42 degrees, is similar to past tracks, but

designers say the transitions from the banked turns into the straightaways are smoother to give team pursuit riders an easier and faster transition from straight sections to the banked areas of the track. Each international track varies slightly in terms of the balance between the length of the straights and radius of the bankings.

In addition, climate control experts were consulted to create optimal conditions for track cycling. They settled on 82 degrees Fahrenheit. The challenge was figuring out how to maintain that temperature with fans streaming in and out of the facility.

Heating under the floor was the first step, though it didn't end up being necessary. But there also is no air conditioning at the velodrome and fans entering the arena from outside are held in a glass corridor until the doors are closed, at which point they are ushered through an inner door leading into the velodrome. The elaborate entry system prevents the cool air from outside from seeping in. The heat keeps the air thin and more aerodynamic for cyclists, producing faster lap times.

Even the drizzly British weather has contributed to the blistering times. Air pressure has a major impact on speed in track cycling and low pressure allows riders to punch through the air more easily, meaning rain outside is actually conducive to faster times. Think of the weatherman who talks about a "low-pressure system moving in" when rain and dampness are on the way. London has gotten lucky with the weather during the past two weeks, but in British terms that means clouds and brief periods of showers on most days.

The running track at the Olympic Stadium created its first record Thursday with Kenya's David Rudisha in the 800-meter. Rudisha took the gold and clocked in at 1:40.91, slicing a fraction from his previous world record of 1:41.01, set in 2010. Other runners have set personal bests. Seven of the eight men's 100-meter sprinters finished in under 10 seconds, led by Usain Bolt's 9.62. Jamaican champion Veronica Campbell-Brown ran a season-best in the 200 Tuesday night. In a semifinal heat of the women's 100-meter hurdles, five of the eight competitors ran a season-best, or set a personal or national record.

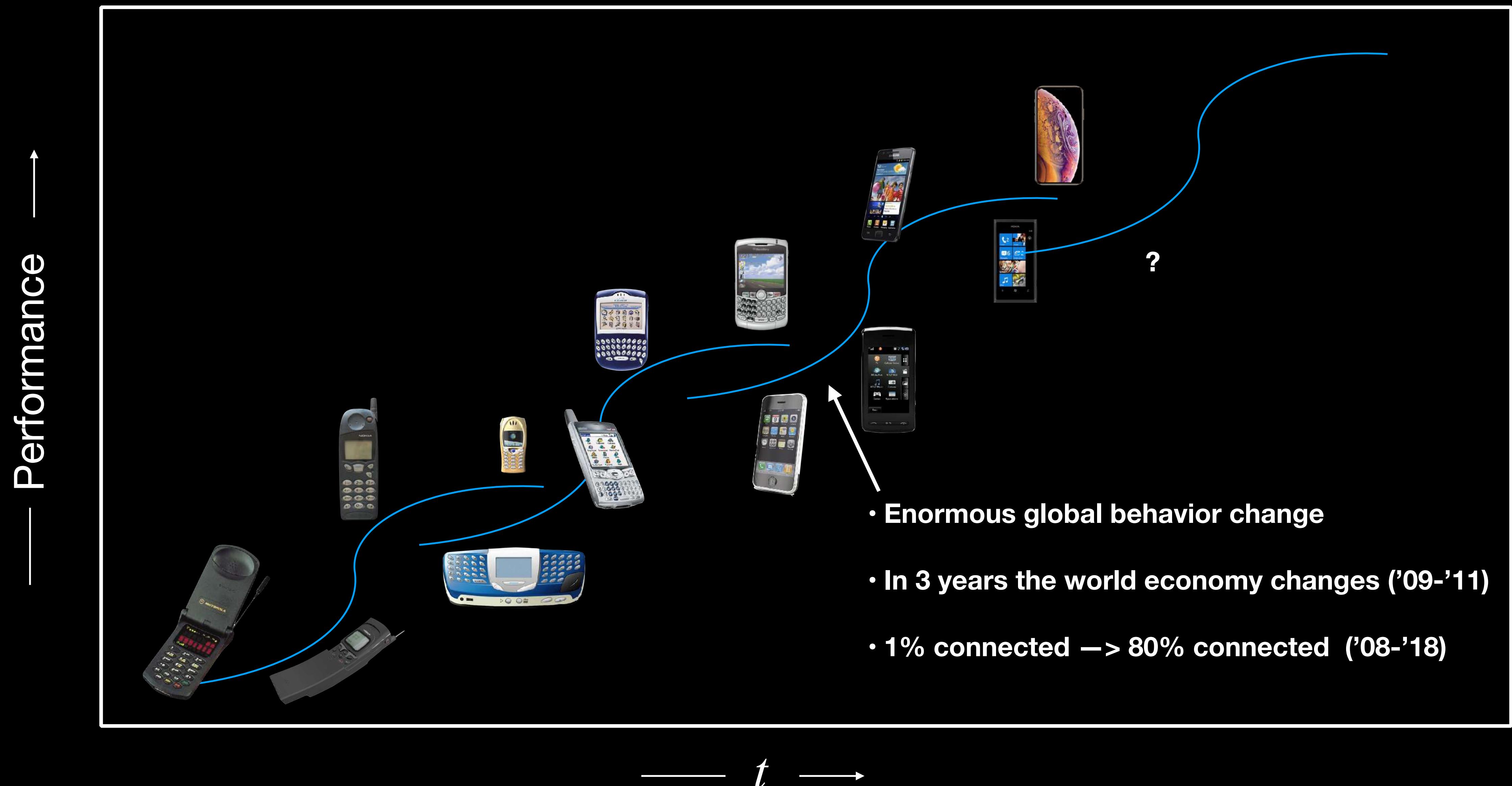
Mondo, the Italian company that designed the track, produced a softer, bouncier surface and installed an eight millimeter layer of diamond-shaped ridges below the top layer, which is five millimeters thick. Previously, the lower layer was made up of square pieces, but those pieces only absorbed shock of the foot forwards and backwards, not laterally. "This was quite a stupid thing because most running steps are as much as 45 degrees sideways," said Joe Hoekstra, project manager for London 2012. By angling pieces of the subsurface, the track provided shock deflection both laterally and backward and forwards, propelling and stabilizing runners all at once. Even the roof of the stadium is designed to reduce wind on the track.

"It's as fast a track as we've been on," said Stephen Francis, the Jamaican coach.

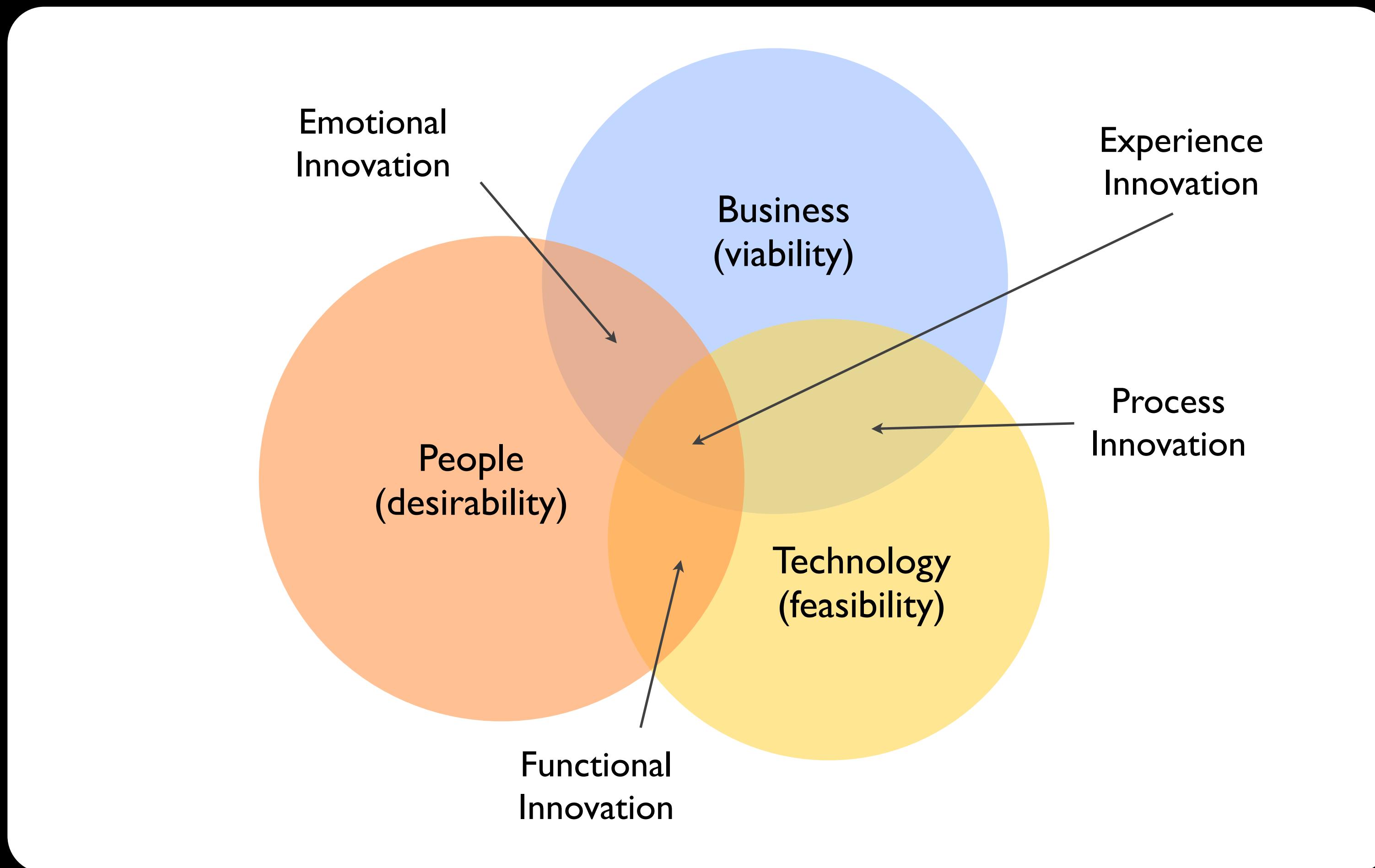
Write to Matthew Futterman at matthew.futterman@wsj.com, Jonathan Clegg at jonathan.clegg@wsj.com and Geoffrey A. Fowler at geoffrey.fowler@wsj.com

A version of this article appeared August 10, 2012, on page D1 in the U.S. edition of The Wall Street Journal, with the headline: When a Pool Is Not a Pool.

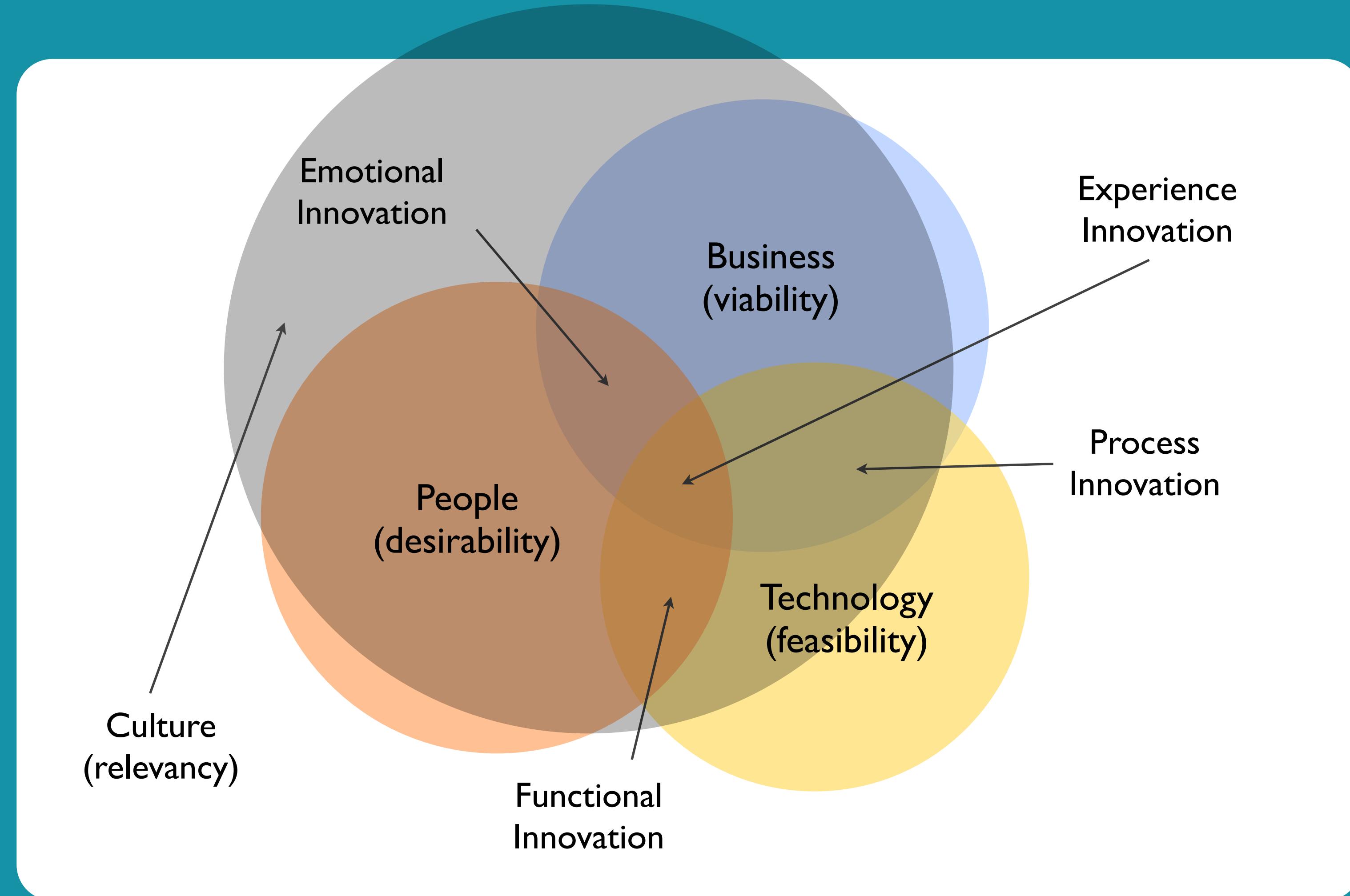
Dominant Design Theory



Innovation: a design-consultant's view



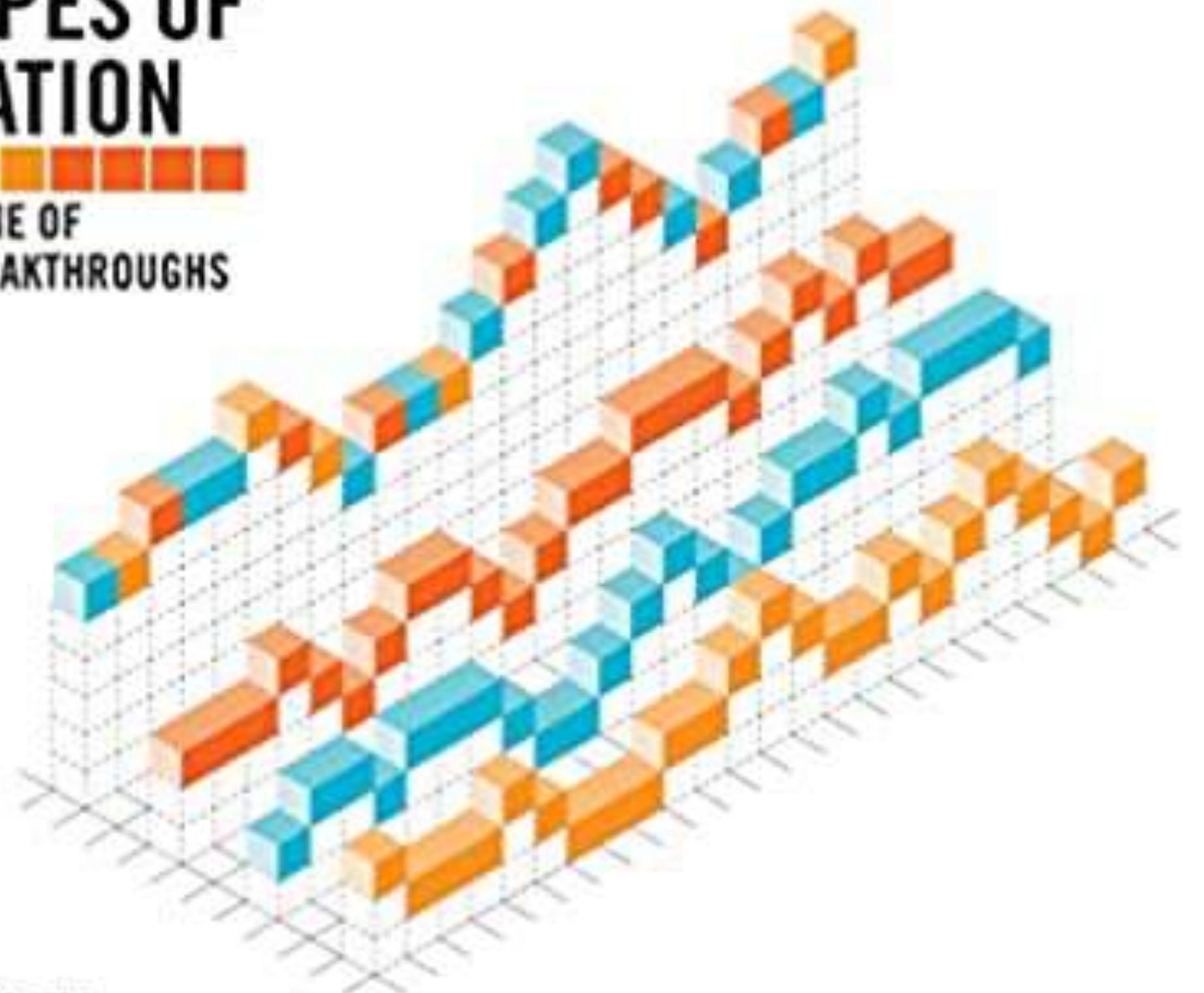
Innovation: Blade Kotelly Inc.





TEN TYPES OF INNOVATION

THE DISCIPLINE OF
BUILDING BREAKTHROUGHS



LARRY KEELEY

RYAN PIKKEL, BRIAN QUINN, HELEN WALTERS

TEN TYPES OF INNOVATION



TACTICS OVERVIEW

Profit Model

Premium
Price at a higher margin than competitors, usually for a superior product, offering, experience, service or brand.

Cost Leadership
Keep variable costs low and sell high volumes at low prices.

Scaled Transactions
Maximize margins by pursuing high volume, large scale transactions when unit costs are relatively fixed.

Microtransactions
Sell many items for as little as a dollar—or even only one cent—to drive impulse purchases at volume.

Forced Scarcity
Limit the supply of offerings available, by quantity, time frame or access, to drive up demand and/or prices.

Subscription
Create predictable cash flows by charging customers up front (a one-time or recurring fee) to have access to the product/service over time.

Membership
Charge a time-based payment to permit access to locations, offerings, or services that non-members don't have.

Installed Base
Offer a "core" product for slim margins (or even a loss) to drive demand and loyalty; then realize profit on additional products and services.

Switchboard
Connect multiple sellers with multiple buyers; the more buyers and sellers who join, the more valuable the switchboard.

Auction
Allow a market—and its users—to set the price for goods and services.

Network

User-Defined
Invite customers to set a price they wish to pay.

Freemium
Offer basic services for free, while charging a premium for advanced or special features.

Flexible Pricing
Vary prices for an offering based on demand.

Float
Receive payment prior to building the offering—and use the cash to earn interest prior to making margins.

Secondary Markets
Connect waste streams, by-products, or other alternative offerings to those who want them.

Financing
Capture revenue not directly from the sale of a product, but from structured payment plans and after-sale interest.

Ad-Supported
Provide content/services for free to one party while selling listeners, viewers or "eyeballs" to another party.

Licensing
Grant permission to some other group or individual to use your offering in a defined way for a specified payment.

Metered Use
Allow customers to pay for only what they use.

Bundled Pricing
Sell in a single transaction two or more items that could be sold as standalone offerings.

Disaggregate Pricing
Allow customers to buy exactly—and only—what they want.

Risk Sharing
Waive standard fees/costs if certain metrics aren't achieved, but receive outsize gains when they are.

Structure

Merger/Acquisition
Combine two or more entities to gain access to capabilities and assets.

Consolidation
Acquire multiple companies in the same market or complementary markets.

Open Innovation
Obtain access to processes or patents from other companies to leverage, extend, and build on expertise and/or do the same with internal IP and processes.

IT Integration
Integrate technology resources and applications.

Competency Center
Cluster resources, practices and expertise into support centers that increase efficiency and effectiveness across the broader organization.

Outsourcing
Assign responsibility for developing or maintaining a system to a vendor.

Corporate University
Provide job-specific or company-specific training for managers.

Decentralized Management
Distribute decision-making governance closer to the customer or other key business interfaces.

Alliances
Share risks and revenues to jointly improve individual competitive advantage.

Franchising
License business principles, processes, and brand to paying partners.

Cooperation
Join forces with someone who would normally be your competitor to achieve a common goal.

Asset Standardization
Reduce operating costs and increase connectivity and modularity by standardizing your assets.

Collaboration
Partner with others for mutual benefit.

Process

Process Standardization
Make form follow function and align infrastructure with core qualities and business processes.

Incentive Systems
Offer rewards (financial or non-financial) to provide motivation for a particular course of action.

IT Integration
Integrate technology resources and applications.

Competency Center
Cluster resources, practices and expertise into support centers that increase efficiency and effectiveness across the broader organization.

Outsourcing
Assign responsibility for developing or maintaining a system to a vendor.

Corporate University
Provide job-specific or company-specific training for managers.

Decentralized Management
Distribute decision-making governance closer to the customer or other key business interfaces.

Alliances
Share risks and revenues to jointly improve individual competitive advantage.

Franchising
License business principles, processes, and brand to paying partners.

Cooperation
Join forces with someone who would normally be your competitor to achieve a common goal.

Asset Standardization
Reduce operating costs and increase connectivity and modularity by standardizing your assets.

Collaboration
Partner with others for mutual benefit.

Product Performance

Superior Product
Develop an offering of exceptional design, quality, and/or experience.

Ease of Use
Make your product simple, intuitive and comfortable to use.

Process Efficiency
Create or produce more while using fewer resources—measured in materials, energy consumption or time.

Flexible Manufacturing
Use a production system that can rapidly react to changes and still operate efficiently.

Process Automation
Apply tools and infrastructure to manage routine activities in order to free up employees.

Crowdsourcing
Outsource repetitive or challenging work to a large group of semi-organized individuals.

On-Demand Production
Produce items after an order has been received to avoid carrying costs of inventory.

Lean Production
Reduce waste and cost in your manufacturing process and other operations.

Knowledge Management
Share relevant information internally to reduce redundancy and improve job performance.

Logistics Systems
Manage the flow of goods, information and other resources between the point of origin and the point of use.

Strategic Design
Employ a purposeful approach that manifests itself consistently across offerings, brands, and experiences.

Customization
Enable altering of the product or service to suit individual requirements or specifications.

Focus
Design an offering specifically for a particular audience at the expense of others.

Intellectual Property
Protect an idea that has commercial value—such as a recipe or industrial process—with legal tools like patents.

User Generated
Put your users to work in creating and curating content that powers your offerings.

Predictive Analytics
Model past performance data and predict future outcomes to design and price offerings accordingly.

Product System

Complements
Sell additional related or ancillary products or services to a customer.

Extensions/Plug-ins
Allow first- or third-party additions that add functionality.

Product Bundling
Offer several products for sale as one combined product.

Modular Systems
Provide a set of individual components that can be used independently, but gain utility when combined.

Safety
Increase the customer's level of confidence and security.

Feature Aggregation
Combine existing features found across offerings into a single offering.

Added Functionality
Add new functionality to an existing offering.

Performance Simplification
Omit superfluous details, features, and interactions to reduce complexity.

Environmental Sensitivity
Provide offerings that do no harm—or relatively less harm—to the environment.

Lean Production
Reduce waste and cost in your manufacturing process and other operations.

Conservation
Design your product so that customers can reduce their use of energy or materials.

Logistics Systems
Manage the flow of goods, information and other resources between the point of origin and the point of use.

Customization
Enable altering of the product or service to suit individual requirements or specifications.

Strategic Design
Employ a purposeful approach that manifests itself consistently across offerings, brands, and experiences.

Focus
Design an offering specifically for a particular audience at the expense of others.

Intellectual Property
Protect an idea that has commercial value—such as a recipe or industrial process—with legal tools like patents.

User Generated
Put your users to work in creating and curating content that powers your offerings.

Predictive Analytics
Model past performance data and predict future outcomes to design and price offerings accordingly.

Service

Try Before You Buy
Let customers test and experience an offering before investing in it.

Guarantee
Remove customer risk of lost money or time stemming from product failure or purchase error.

Loyalty Programs
Provide benefits and/or discounts to frequent and high-value customers.

Modular Systems
Provide a set of individual components that can be used independently, but gain utility when combined.

Added Value
Include an additional service/function as part of the base price.

Concierge
Provide premium service by taking on tasks for which customers don't have time.

Total Experience Management
Provide thoughtful, holistic management of the consumer experience across an offering's lifecycle.

Integrated Offering
Combine otherwise discrete components into a complete experience.

Supplementary Service
Offer ancillary services that fit with your offering.

Superior Service
Provide service(s) of higher quality, efficacy, or with a better experience than any competitor.

Personalized Service
Use the customer's own information to provide perfectly calibrated service.

User Communities/Support Systems
Provide a communal resource for product/service support, use and extension.

On-Demand
Deliver goods in real-time whenever or wherever they are desired.

Lease or Loan
Let customers pay over time to lower upfront costs.

Self-Service
Provide users with control over activities that would otherwise require an intermediary to complete.

Experience Center
Create a space that encourages your customers to interact with your offerings—but purchase them through a different (and often lower-cost) channel.

Channel

Diversification
Add and expand into new or different channels.

Flagship Store
Create a store to showcase quintessential brand and product attributes.

Go Direct
Skip traditional retail channels and connect directly with customers.

Non-Traditional Channels
Employ novel and relevant avenues to reach customers.

Pop-up Presence
Create a noteworthy but temporary environment to showcase and/or sell offerings.

Indirect Distribution
Use others as resellers who take ownership over delivering the offering to the final user.

Brand Extension
Offer a new product or service under the umbrella of an existing brand.

Component Branding
Brand an integral component to make a final offering appear more valuable.

Transparency
Let customers see into your operations and participate with your brand and offerings.

Multi-Level Marketing
Sell bulk or packaged goods to an affiliated but independent sales force that turns around and sells it for you.

Values Alignment
Make your brand stand for a big idea or a set of values and express them consistently in all aspects of your company.

Community and Belonging
Facilitate visceral connections to make people feel they are part of a group or movement.

Personalization
Alter a standard offering to allow the projection of the customer's identity.

Whimsy and Personality
Humanize your offering with small flourishes of on-brand, on-message ways of seeming alive.

Status and Recognition
Offer cues that infer meaning, allowing users—and those who interact with them—to develop and nurture aspects of their identity.

Brand

Co-Branding
Combine brands to mutually reinforce key attributes or enhance the credibility of an offering.

Brand Leverage
"Lend" your credibility and allow others to use your name—thus extending your brand's reach.

Private Label
Provide goods made by others under your company's brand.

Brand Extension
Offer a new product or service under the umbrella of an existing brand.

Component Branding
Brand an integral component to make a final offering appear more valuable.

Transparency
Let customers see into your operations and participate with your brand and offerings.

Mastery
Help customers to obtain great skill or deep knowledge of some activity or subject.

Autonomy and Authority
Grant users the power to use your offerings to shape their own experience.

Community and Belonging
Facilitate visceral connections to make people feel they are part of a group or movement.

Personalization
Alter a standard offering to allow the projection of the customer's identity.

Whimsy and Personality
Humanize your offering with small flourishes of on-brand, on-message ways of seeming alive.

Status and Recognition
Offer cues that infer meaning, allowing users—and those who interact with them—to develop and nurture aspects of their identity.

Customer Engagement

Process Automation
Remove the burden of repetitive tasks from the user to simplify life and make new experiences seem magical.

Experience Simpl

TEN TYPES OF INNOVATION



TACTICS OVERVIEW

Profit Model

Premium

Price at a higher margin than competitors, usually for a superior product, offering, experience, service or brand.

Cost Leadership

Keep variable costs low and sell high volumes at low prices.

Scaled Transactions

Maximize margins by pursuing high volume, large scale transactions when unit costs are relatively fixed.

Microtransactions

Sell many items for as little as a dollar—or even only

User-Defined

Invite customers to set a price they wish to pay.

Freemium

Offer basic services for free, while charging a premium for advanced or special features.

Flexible Pricing

Vary prices for an offering based on demand.

Float

Receive payment prior to building the offering—and use the cash to earn interest prior to making margins.

Financing

Network

Merger/Acquisition

Combine two or more entities to gain access to capabilities and assets.

Consolidation

Acquire multiple companies in the same market or complementary markets.

Open Innovation

Obtain access to processes or patents from other companies to leverage, extend, and build on expertise and/or do the same with internal IP and processes.

Secondary Markets

Connect waste streams, by-products, or other

Structure

Organizational Design

Make form follow function and align infrastructure with core qualities and business processes.

Incentive Systems

Offer rewards (financial or non-financial) to provide motivation for a particular course of action.

IT Integration

Integrate technology resources and applications.

Competency Center

Cluster resources, practices and expertise into support centers that increase efficiency and

Process

Process Standard

Use common production processes, procedures and policies to reduce complexity, costs, and

Localization

Adapt an offering, product or experience to target culture or region.

Process Efficiency

Create or produce more using fewer resources measured in materials, energy consumption,

Flexible Manufacture

Use a production system that can rapidly react to market changes and still operate efficiently.

Process

Process Standardization

Use common products, processes, procedures, and policies to reduce complexity, costs, and errors.

Localization

Adapt an offering, process, or experience to target a culture or region.

Process Efficiency

Create or produce more while using fewer resources—measured in materials, energy consumption or time.

Flexible Manufacturing

Use a production system that can rapidly react to changes and still operate efficiently.

Process Automation

Apply tools and infrastructure to manage routine activities in

Product Performance

Superior Product

Develop an offering of exceptional design, quality, and/or experience.

Ease of Use

Make your product simple, intuitive and comfortable to use.

Engaging Functionality

Provide an unexpected or newsworthy experiential component that elevates the customer interaction.

Safety

Increase the customer's level of confidence and security.

Feature Aggregation

Combine existing features found across offerings into a single offering.

Product System

Complements

Sell additional related or ancillary products or services to a customer.

Extensions/Plug-ins

Allow first- or third-party additions that add functionality.

Product Bundling

Offer several products for sale as one combined product.

Modular Systems

Provide a set of individual components that can be used independently, but gain utility when combined.

Product/Service Platforms

Develop systems that connect with other partner

Service

Try Before You Buy

Let customers test and experience an offering before investing in it.

Guarantee

Remove customer risk of lost money or time stemming from product failure or purchase error.

Loyalty Programs

Provide benefits and/or discounts to frequent and high-value customers.

Added Value

Include an additional service/function as part of the base price.

Concierge

Provide premium service by taking on tasks for which customers don't have time

Customer Engagement

Process Automation

Remove the burden of repetitive tasks from the user to simplify life and make new experiences seem magical.

Experience Simplification

Reduce complexity and focus on delivering specific experiences exceptionally well.

Curation

Use a distinct point of view to separate the proverbial wheat from the chaff—and in the process create a strong identity for yourself and your followers.

Experience Enabling

Extend the realm of what's

Service

Try Before You Buy

Let customers test and experience an offering before investing in it.

Guarantee

Remove customer risk of lost money or time stemming from product failure or purchase error.

Loyalty Programs

Provide benefits and/or discounts to frequent and high-value customers.

Added Value

Include an additional service/function as part of the base price.

Concierge

Provide premium service by taking on tasks for which customers don't have time.

Channel

Diversification

Add and expand into new or different channels.

Flagship Store

Create a store to showcase quintessential brand and product attributes.

Go Direct

Skip traditional retail channels and connect directly with customers.

Non-Traditional Channels

Employ novel and relevant avenues to reach customers.

Pop-up Presence

Create a noteworthy but temporary environment to showcase and/or sell offerings.

Brand

Co-Branding

Combine brands to mutually reinforce key attributes or enhance the credibility of an offering.

Brand Leverage

“Lend” your credibility and allow others to use your name—thus extending your brand’s reach.

Private Label

Provide goods made by others under your company’s brand.

Brand Extension

Offer a new product or service under the umbrella of an existing brand.

Component Branding

Brand an integral component to make

TEN TYPES OF INNOVATION



TACTICS OVERVIEW

Profit Model

Premium
Price at a higher margin than competitors, usually for a superior product, offering, experience, service or brand.

Cost Leadership
Keep variable costs low and sell high volumes at low prices.

Scaled Transactions
Maximize margins by pursuing high volume, large scale transactions when unit costs are relatively fixed.

Microtransactions
Sell many items for as little as a dollar—or even only one cent—to drive impulse purchases at volume.

Forced Scarcity
Limit the supply of offerings available, by quantity, time frame or access, to drive up demand and/or prices.

Subscription
Create predictable cash flows by charging customers up front (a one time or recurring fee) to have access to the product/service over time.

Membership
Charge a time-based payment to permit access to locations, offerings, or services that non-members don't have.

Installed Base
Offer a “core” product for slim margins (or even a loss) to drive demand and loyalty; then realize profit on additional products and services.

Switchboard
Connect multiple sellers with multiple buyers; the more buyers and sellers who join, the more valuable the switchboard.

Auction
Allow a market—and its users—to set the price for goods and services.

Network

User-Defined
Invite customers to set a price they wish to pay.

Freemium
Offer basic services for free, while charging a premium for advanced or special features.

Flexible Pricing
Vary prices for an offering based on demand.

Float
Receive payment prior to building the offering—and use the cash to earn interest prior to making margins.

Secondary Markets
Connect waste streams, by-products, or other alternative offerings to those who want them.

Financing
Capture revenue not directly from the sale of a product, but from structured payment plans and after-sale interest.

Ad-Supported
Provide content/services for free to one party while selling listeners, viewers or “eyeballs” to another party.

Licensing
Grant permission to some other group or individual to use your offering in a defined way for a specified payment.

Metered Use
Allow customers to pay for only what they use.

Bundled Pricing
Sell in a single transaction two or more items that could be sold as standalone offerings.

Disaggregate Pricing
Allow customers to buy exactly—and only—what they want.

Risk Sharing
Waive standard fees/costs if certain metrics aren't achieved, but receive outsize gains when they are.

Collaboration
Partner with others for mutual benefit.

Structure

Merger/Acquisition
Combine two or more entities to gain access to capabilities and assets.

Consolidation
Acquire multiple companies in the same market or complementary markets.

Open Innovation
Obtain access to processes or patents from other companies to leverage, extend, and build on expertise and/or do the same with internal IP and processes.

IT Integration
Integrate technology resources and applications.

Competency Center
Cluster resources, practices and expertise into support centers that increase efficiency and effectiveness across the broader organization.

Supply Chain Integration
Coordinate and integrate information and/or processes across a company or functions of the supply chain.

Outsourcing
Assign responsibility for developing or maintaining a system to a vendor.

Corporate University
Provide job-specific or company-specific training for managers.

Decentralized Management
Distribute decision-making governance closer to the customer or other key business interfaces.

Alliances
Share risks and revenues to jointly improve individual competitive advantage.

Franchising
License business principles, processes, and brand to paying partners.

Cooperation
Join forces with someone who would normally be your competitor to achieve a common goal.

Asset Standardization
Reduce operating costs and increase connectivity and modularity by standardizing your assets.

Intellectual Property
Protect an idea that has commercial value—such as a recipe or industrial process—with legal tools like patents.

User Generated
Put your users to work in creating and curating content that powers your offerings.

Predictive Analytics
Model past performance data and predict future outcomes to design and price offerings accordingly.

Process

Process Standardization
Make form follow function and align infrastructure with core qualities and business processes.

Incentive Systems
Offer rewards (financial or non-financial) to provide motivation for a particular course of action.

IT Integration
Integrate technology resources and applications.

Competency Center
Cluster resources, practices and expertise into support centers that increase efficiency and effectiveness across the broader organization.

Outsourcing
Assign responsibility for developing or maintaining a system to a vendor.

Corporate University
Provide job-specific or company-specific training for managers.

Decentralized Management
Distribute decision-making governance closer to the customer or other key business interfaces.

Alliances
Share risks and revenues to jointly improve individual competitive advantage.

Franchising
License business principles, processes, and brand to paying partners.

Cooperation
Join forces with someone who would normally be your competitor to achieve a common goal.

Asset Standardization
Reduce operating costs and increase connectivity and modularity by standardizing your assets.

Intellectual Property
Protect an idea that has commercial value—such as a recipe or industrial process—with legal tools like patents.

User Generated
Put your users to work in creating and curating content that powers your offerings.

Predictive Analytics
Model past performance data and predict future outcomes to design and price offerings accordingly.

Product Performance

Superior Product
Develop an offering of exceptional design, quality, and/or experience.

Ease of Use
Make your product simple, intuitive and comfortable to use.

Process Efficiency
Create or produce more while using fewer resources—measured in materials, energy consumption or time.

Flexible Manufacturing
Use a production system that can rapidly react to changes and still operate efficiently.

Process Automation
Apply tools and infrastructure to manage routine activities in a single offering.

Crowdsourcing
Outsource repetitive or challenging work to a large group of semi-organized individuals.

On-Demand Production
Produce items after an order has been received to avoid carrying costs of inventory.

Lean Production
Reduce waste and cost in your manufacturing process and other operations.

Knowledge Management
Share relevant information internally to reduce redundancy and improve job performance.

Logistics Systems
Manage the flow of goods, information and other resources between the point of origin and the point of use.

Customization
Enable altering of the product or service to suit individual requirements or specifications.

Strategic Design
Employ a purposeful approach that manifests itself consistently across offerings, brands, and experiences.

Focus
Design an offering specifically for a particular audience at the expense of others.

Styling
Impart a style, fashion or image.

User Generated
Put your users to work in creating and curating content that powers your offerings.

Predictive Analytics
Model past performance data and predict future outcomes to design and price offerings accordingly.

Product System

Complements
Sell additional related or ancillary products or services to a customer.

Extensions/Plug-ins
Allow first- or third-party additions that add functionality.

Product Bundling
Offer several products for sale as one combined product.

Modular Systems
Provide a set of individual components that can be used independently, but gain utility when combined.

Safety
Increase the customer's level of confidence and security.

Feature Aggregation
Combine existing features found across offerings into a single offering.

Added Functionality
Add new functionality to an existing offering.

Performance Simplification
Omit superfluous details, features, and interactions to reduce complexity.

Environmental Sensitivity
Provide offerings that do no harm—or relatively less harm—to the environment.

Lean Production
Provide offerings that do no harm—or relatively less harm—to the environment.

Conservation
Design your product so that customers can reduce their use of energy or materials.

Logistics Systems
Manage the flow of goods, information and other resources between the point of origin and the point of use.

Customization
Enable altering of the product or service to suit individual requirements or specifications.

Strategic Design
Employ a purposeful approach that manifests itself consistently across offerings, brands, and experiences.

Focus
Design an offering specifically for a particular audience at the expense of others.

User Generated
Put your users to work in creating and curating content that powers your offerings.

Service

Try Before You Buy
Let customers test and experience an offering before investing in it.

Guarantee
Remove customer risk of lost money or time stemming from product failure or purchase error.

Product Bundling
Offer benefits and/or discounts to frequent and high-value customers.

Modular Systems
Provide a set of individual components that can be used independently, but gain utility when combined.

Added Value
Include an additional service/function as part of the base price.

Concierge
Provide premium service by taking on tasks for which customers don't have time.

Total Experience Management
Provide thoughtful, holistic management of the consumer experience across an offering's lifecycle.

Integrated Offering
Combine otherwise discrete components into a complete experience.

Supplementary Service
Offer ancillary services that fit with your offering.

Superior Service
Provide service(s) of higher quality, efficacy, or with a better experience than any competitor.

Personalized Service
Use the customer's own information to provide perfectly calibrated service.

User Communities/Support Systems
Provide a communal resource for product/service support, use and extension.

On-Demand
Deliver goods in real-time whenever or wherever they are desired.

Lease or Loan
Let customers pay over time to lower upfront costs.

Self-Service
Provide users with control over activities that would otherwise require an intermediary to complete.

Experience Center
Create a space that encourages your customers to interact with your offerings—but purchase them through a different (and often lower-cost) channel.

Channel

Diversification
Add and expand into new or different channels.

Flagship Store
Create a store to showcase quintessential brand and product attributes.

Go Direct
Skip traditional retail channels and connect directly with customers.

Loyalty Programs
Provide benefits and/or discounts to frequent and high-value customers.

Non-Traditional Channels
Employ novel and relevant avenues to reach customers.

Pop-up Presence
Create a noteworthy but temporary environment to showcase and/or sell offerings.

Indirect Distribution
Use others as resellers who take ownership over delivering the offering to the final user.

Component Branding
Brand an integral component to make a final offering appear more valuable.

Transparency
Let customers see into your operations and participate with your brand and offerings.

Multi-Level Marketing
Sell bulk or packaged goods to an affiliated but independent sales force that turns around and sells it for you.

Values Alignment
Make your brand stand for a big idea or a set of values and express them consistently in all aspects of your company.

Community and Belonging
Develop a brand or mark that signifies and ensures certain characteristics in third-party offerings.

Personalization
Alter a standard offering to allow the projection of the customer's identity.

Whimsy and Personality
Humanize your offering with small flourishes of on-brand, on-message ways of seeming alive.

Status and Recognition
Offer cues that infer meaning, allowing users—and those who interact with them—to develop and nurture aspects of their identity.

Brand

Co-Branding
Combine brands to mutually reinforce key attributes or enhance the credibility of an offering.

Brand Leverage
“Lend” your credibility and allow others to use your name—thus extending your brand's reach.

Private Label
Provide goods made by others under your company's brand.

Brand Extension
Offer a new product or service under the umbrella of an existing brand.

Component Branding
Brand an integral component to make a final offering appear more valuable.

Experience Enabling
Extend the realm of what's possible to offer a previously improbable experience.

Mastery
Help customers to obtain great skill or deep knowledge of some activity or subject.

Autonomy and Authority
Grant users the power to use your offerings to shape their own experience.

Community and Belonging
Facilitate visceral connections to make people feel they are part of a group or movement.

Personalization
Alter a standard offering to allow the projection of the customer's identity.

Wh

TOP INNOVATOR PERFORMANCE BY THE NUMBERS



This chart takes a more detailed look at the top innovators, public companies using one or two, three or four, and five or more types. We charted their performance over five years, benchmarked against the S&P 500.

Obviously, it is impossible to credit innovation alone for the performance premium of these firms. Still, it is reasonable to argue that innovation does contribute to the value of a firm, including the future expectations that investors value.

6.902/2.723/16.662

Design Research

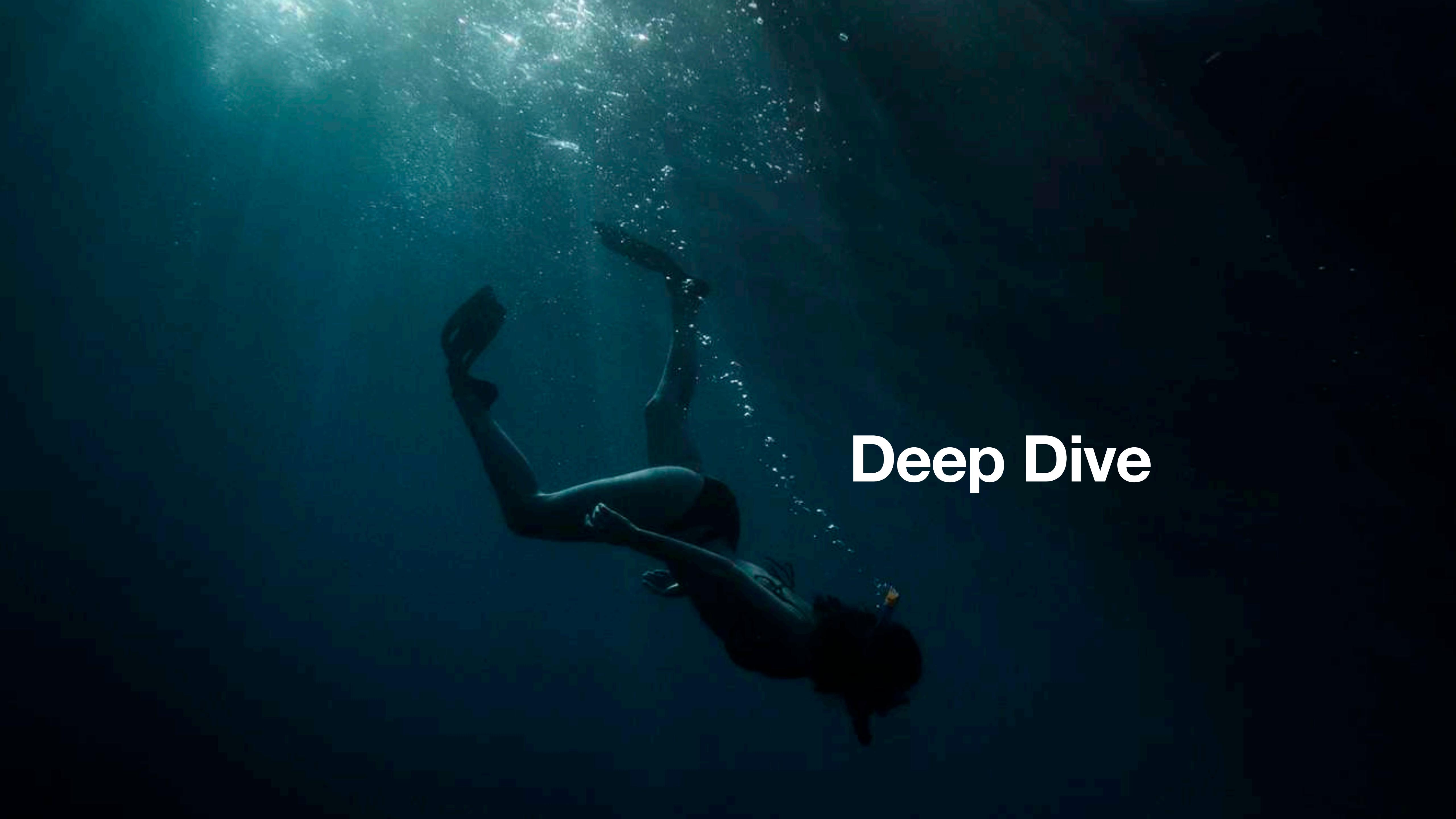


*"You can use an eraser
on the drafting table
or a sledge hammer
on the construction site"*

Frank Lloyd Wright

Architect



A scuba diver is shown from behind, swimming in a dark, teal-colored underwater environment. The diver is wearing a wetsuit and fins, and is carrying a scuba tank on their back. Sunlight filters down from the surface in bright rays, creating a dramatic play of light and shadow. The overall atmosphere is mysterious and deep.

Deep Dive

A close-up photograph of a person's hand holding a small, round compass. The compass has a white face with black markings for cardinal directions (N, S, E, W) and smaller increments. The needle is pointing towards the North. The hand is positioned in the lower-left foreground, with a blurred background of a dense forest and rocky mountains under a clear sky.

Discover & Define

Discover and Define

1. Needs & Assumptions Analysis
2. Research & Discovery
3. Stakeholder Analysis
4. Boundary & Hazard Mitigation
5. Specify Desired Outcomes

Explore and Explain

6. Concept Generation
7. Concept Downselection
8. Concept Articulation
9. Uncertainty Reduction
10. Stakeholder Testing

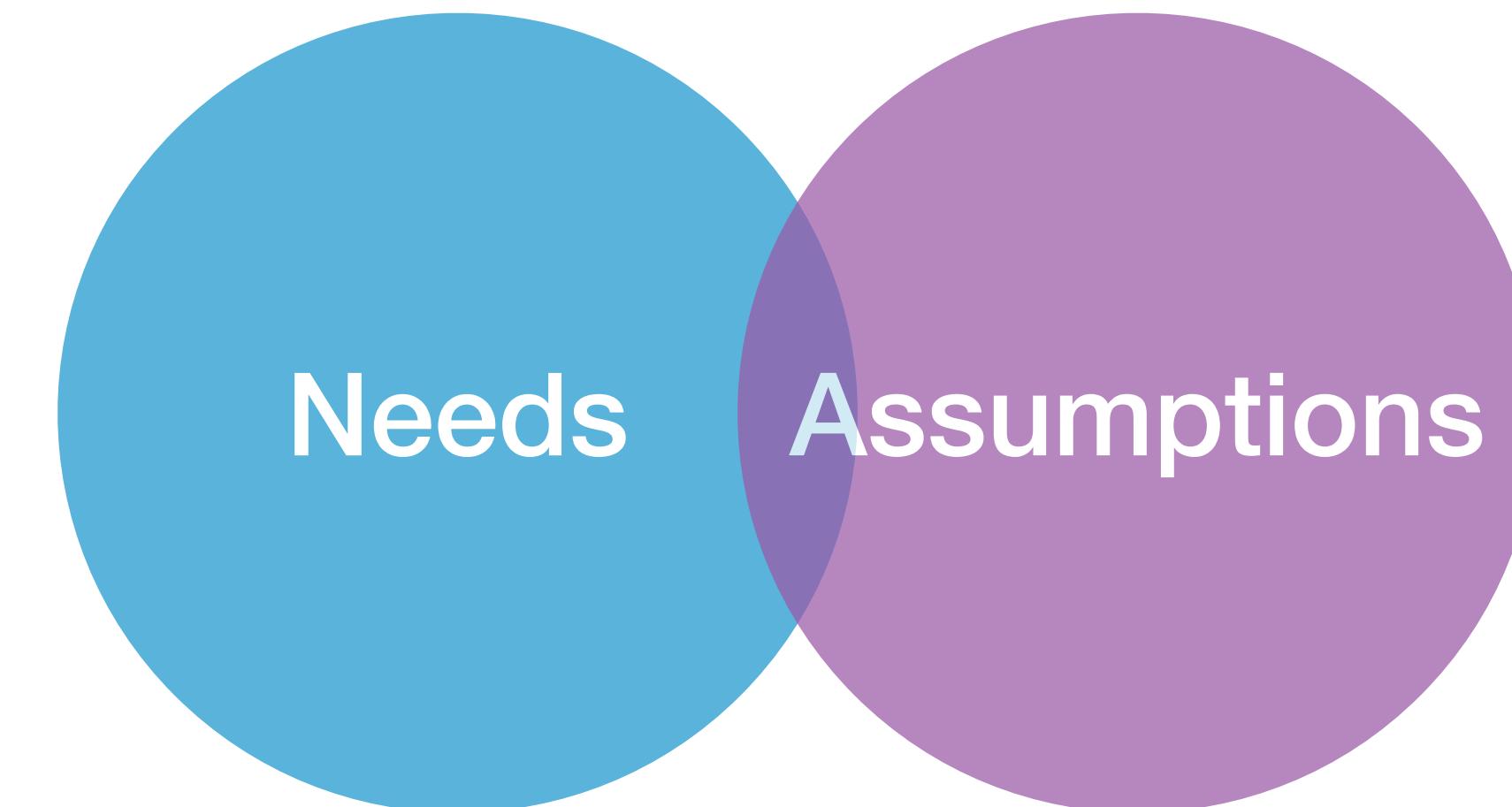
Make and Measure



1. Needs & Assumptions Analysis

Needs & Assumptions Analysis

- Understand the **needs** that we want to satisfy
- Identify areas that we **assume** can't be challenged or have't been challenged
- Use this information to **explore opportunities for innovation**



Needs Analysis



- What are the needs of the customer/user?
- What are the needs of our company/team?

Needs Analysis



- What are the needs of the customer/user?

Banking: get a loan at a good rate, access their money easily, prepare for the future...

- What are the needs of our company/team?

Banking: develop the best customer experience, robust security, invest customer money with low risk...

Needs Analysis: Headphones for Cell Phone

What are the
obvious / clear
needs?

What are the less
obvious / hidden
needs?

- Play music / control music
- Without wires that tangle
- Fits into a pocket easily
- Stay in my ears while I work out
- Charge quickly
- Know when the user takes out the headphone (to pause the music)
- Easily change between hearing the outside world and blocking it off
- Connects quickly to different devices
- Share audio with someone else



Innovation Assumptions



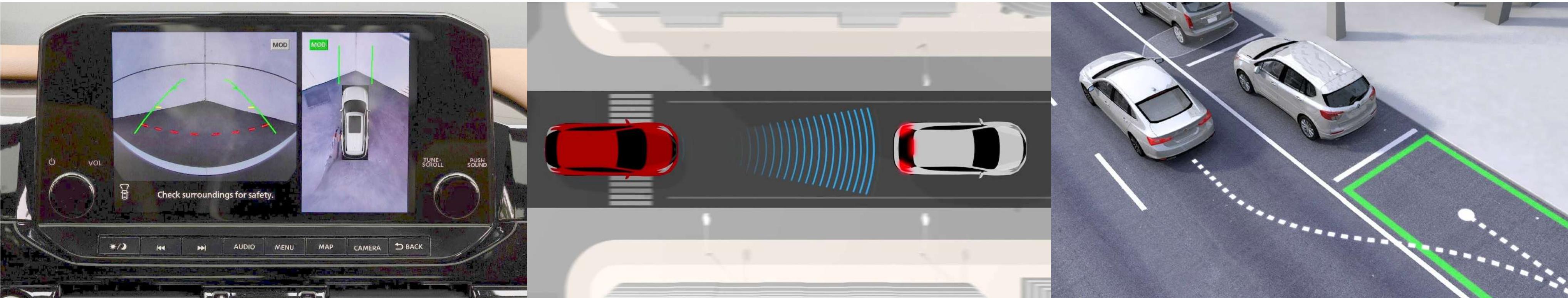
Assumptions

- An **Innovation Assumption** is something we may have not considered improving or changing, or which hasn't changed in a long time
- Innovation Assumptions provide opportunities for exploration

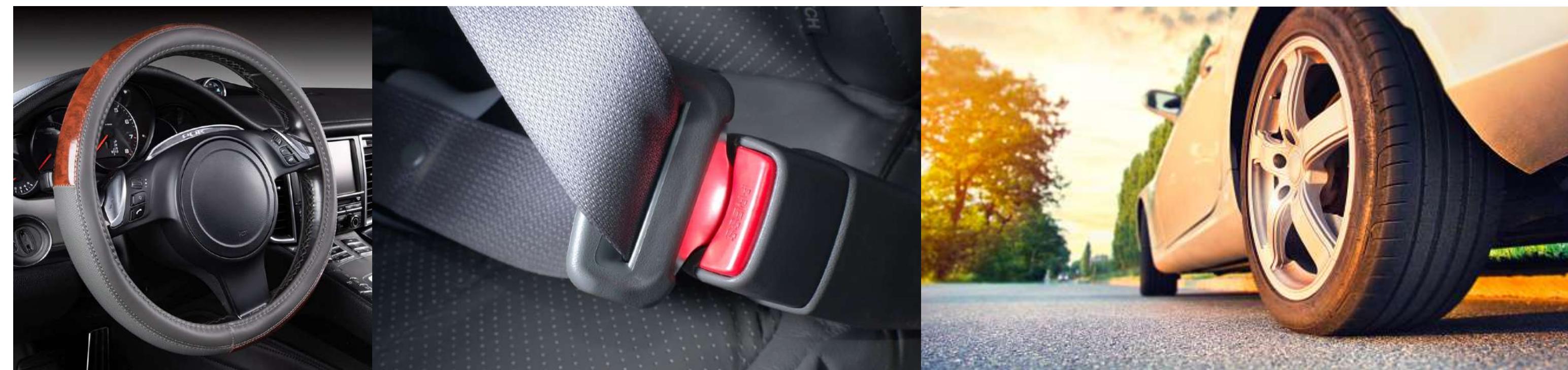
Innovation Assumptions

Assumptions

- What parts of a car, that a driver uses, **have changed** in the past 10 years?



- What parts of a car, that a driver uses, **have NOT changed** in the past 10 years?

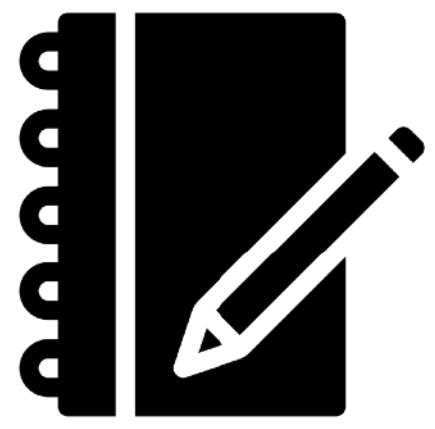


A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try

Needs And Assumption Analysis

Example: Inventing a new camera





Needs And Assumption Analysis

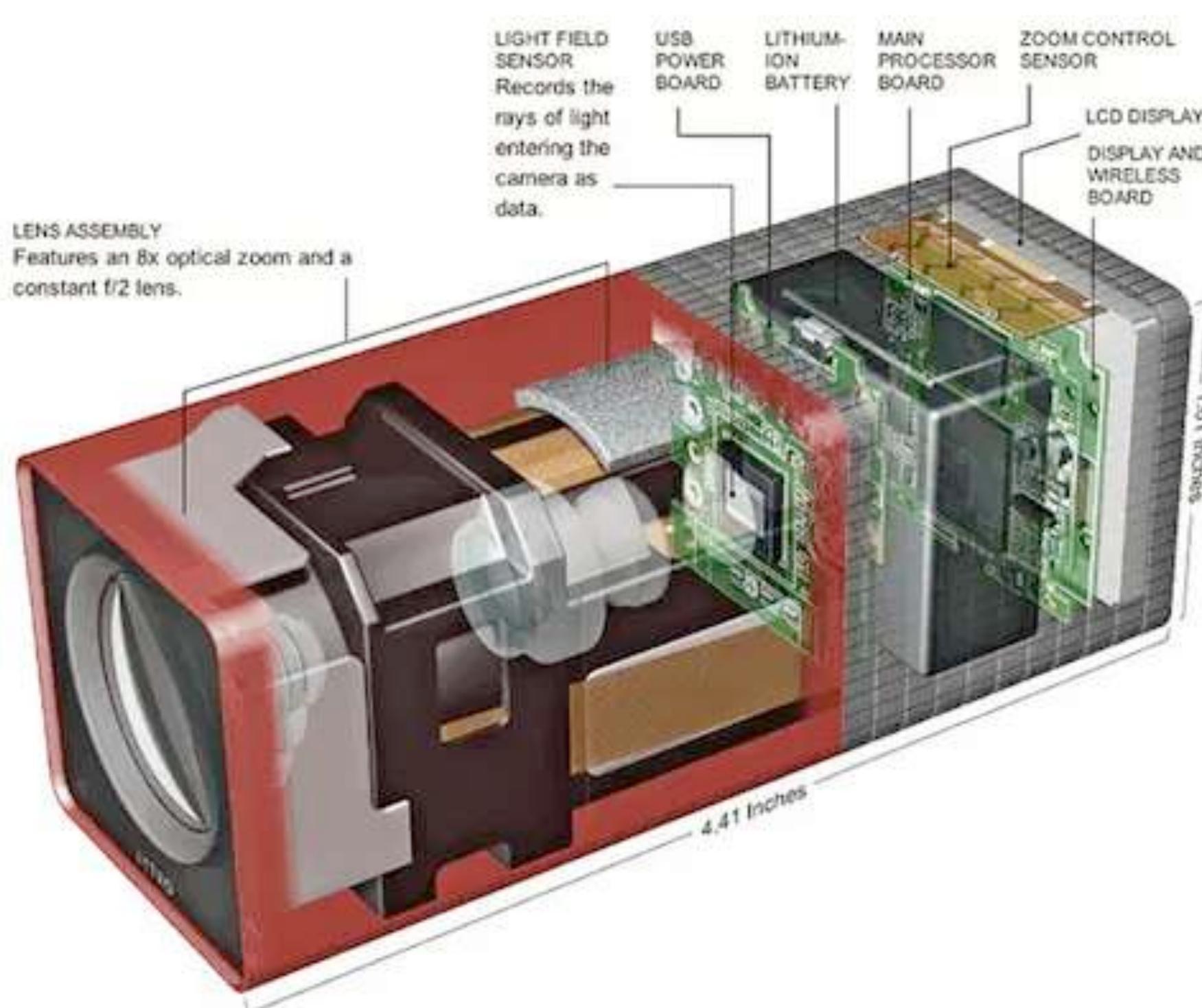
Example: Inventing a new camera

- What needs must this solution satisfy?
(Consider user needs, and needs from other perspectives)
- What can we assume about this design has been historically consistent, that others have not challenged?



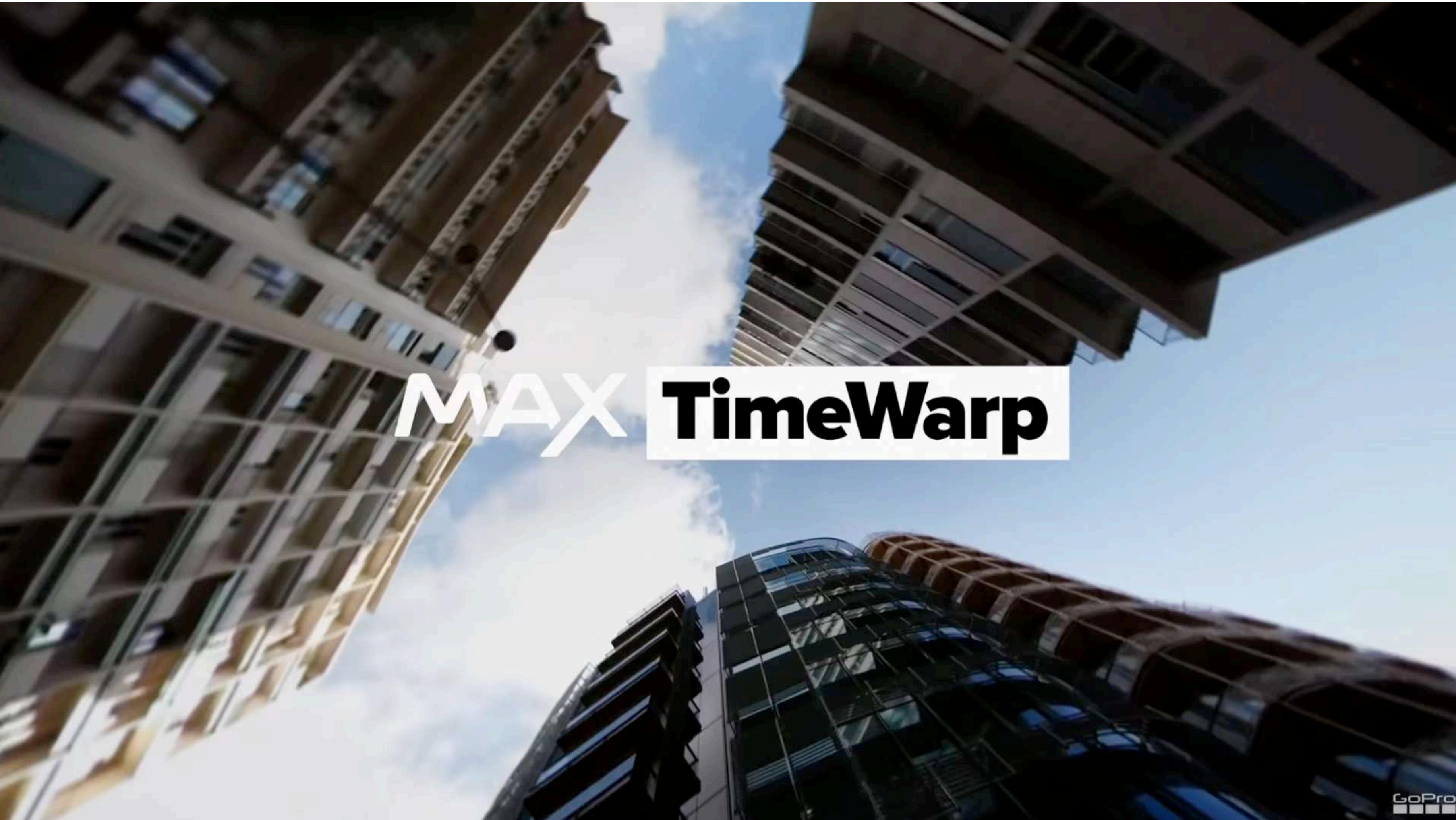
Needs And Assumption Analysis

Example: Inventing a new camera



Needs And Assumption Analysis

Example: Inventing a new camera





2. Research And Discovery

Common Research Methods

- Ethnographic (participant observation)
- Surveys/interviews/feedback analysis
- Expert analysis
- Architecture analysis
- Patent/literature review
- Meta analysis
- Eye tracking/electroencephalography (EEG)

Common Research Methods

- **Ethnographic (participant observation)**
- Surveys/interviews/feedback analysis
- Expert analysis
- Architecture analysis
- Patent/literature review
- Meta analysis
- Eye tracking/electroencephalography (EEG)



Common Research Methods

- **Ethnographic (participant observation)**
- Surveys/interviews/feedback analysis
- Expert analysis
- Architecture analysis
- Patent/literature review
- Meta analysis
- Eye tracking/electroencephalography (EEG)



Common Research Methods

- Ethnographic (participant observation)
- **Surveys/interviews/feedback analysis**
- Expert analysis
- Architecture analysis
- Patent/literature review
- Meta analysis
- Eye tracking/electroencephalography (EEG)

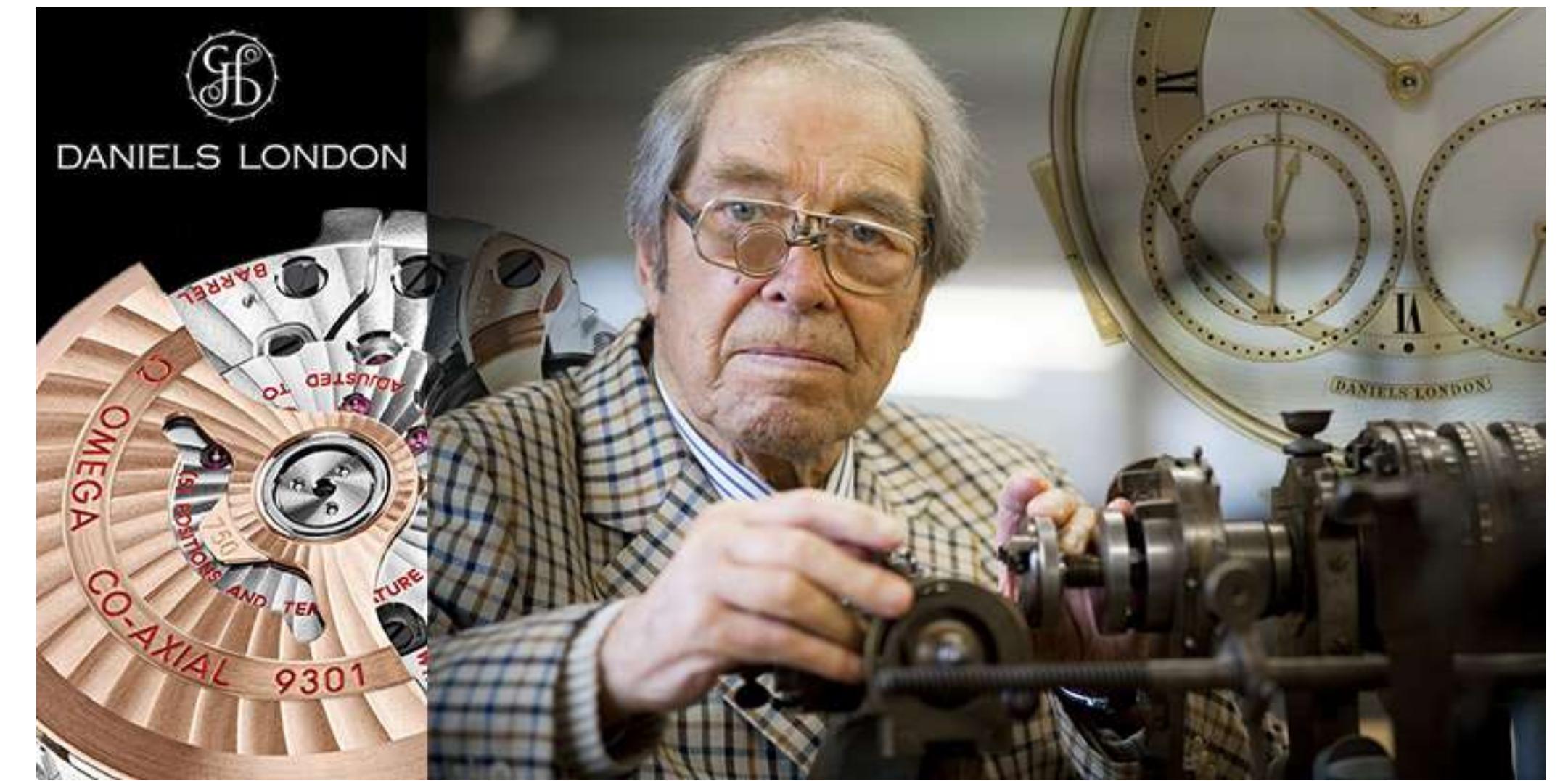
1 Access

How do you personally evaluate the importance of the following aspects of coordinated care?

How important is.....?	very important	important	so-so	less important	not important
The surgery hours of the doctor/service provider are flexible.	<input type="radio"/>				
The doctor/service provider takes a proactive approach with me (far-sighted, preventative) and agrees check-up appointments or reminds me that an appointment is due.	<input type="radio"/>				
My doctor/service provider is available around the clock in case of emergencies.	<input type="radio"/>				
The health insurer actively supports me.	<input type="radio"/>				
The interfaces between GP, specialist and hospital are not perceptible to me. There are no problems at these interfaces in the case of referral from GP to specialist or admission to hospital (loss of information)	<input type="radio"/>				

Common Research Methods

- Ethnographic (participant observation)
- Surveys/interviews/feedback analysis
- **Expert analysis**
- Architecture analysis
- Patent/literature review
- Meta analysis
- Eye tracking/electroencephalography (EEG)

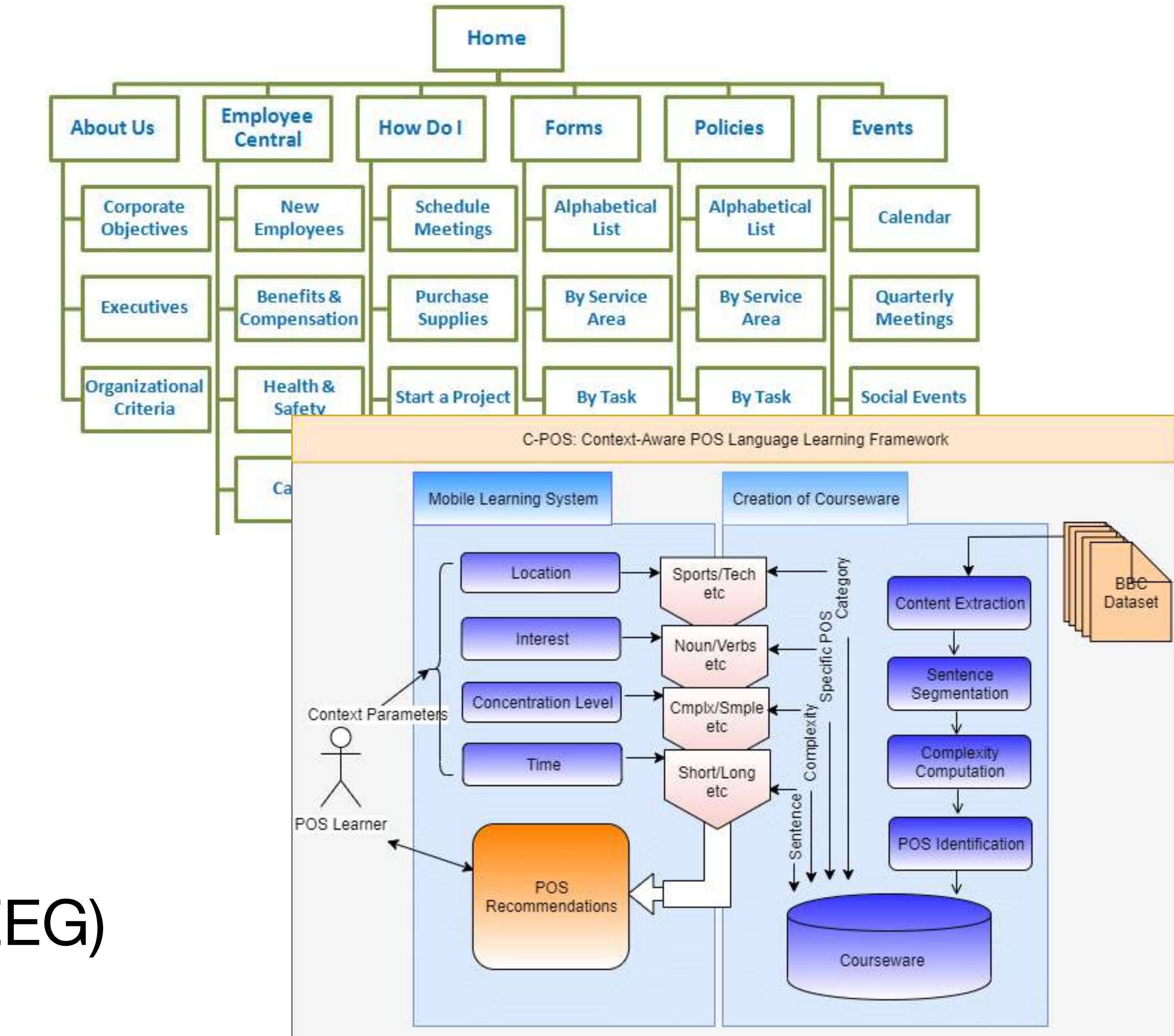


Dr. George Daniels (19 August 1926 to 21 October 2011), was generally considered to be the world's greatest horologist during his lifetime. He was the only watchmaker ever to have received a CBE and an MBE for his services to horology.

[\(https://www.dreamchrono.com/2013/12/george-daniels-watchmaker/\)](https://www.dreamchrono.com/2013/12/george-daniels-watchmaker/)

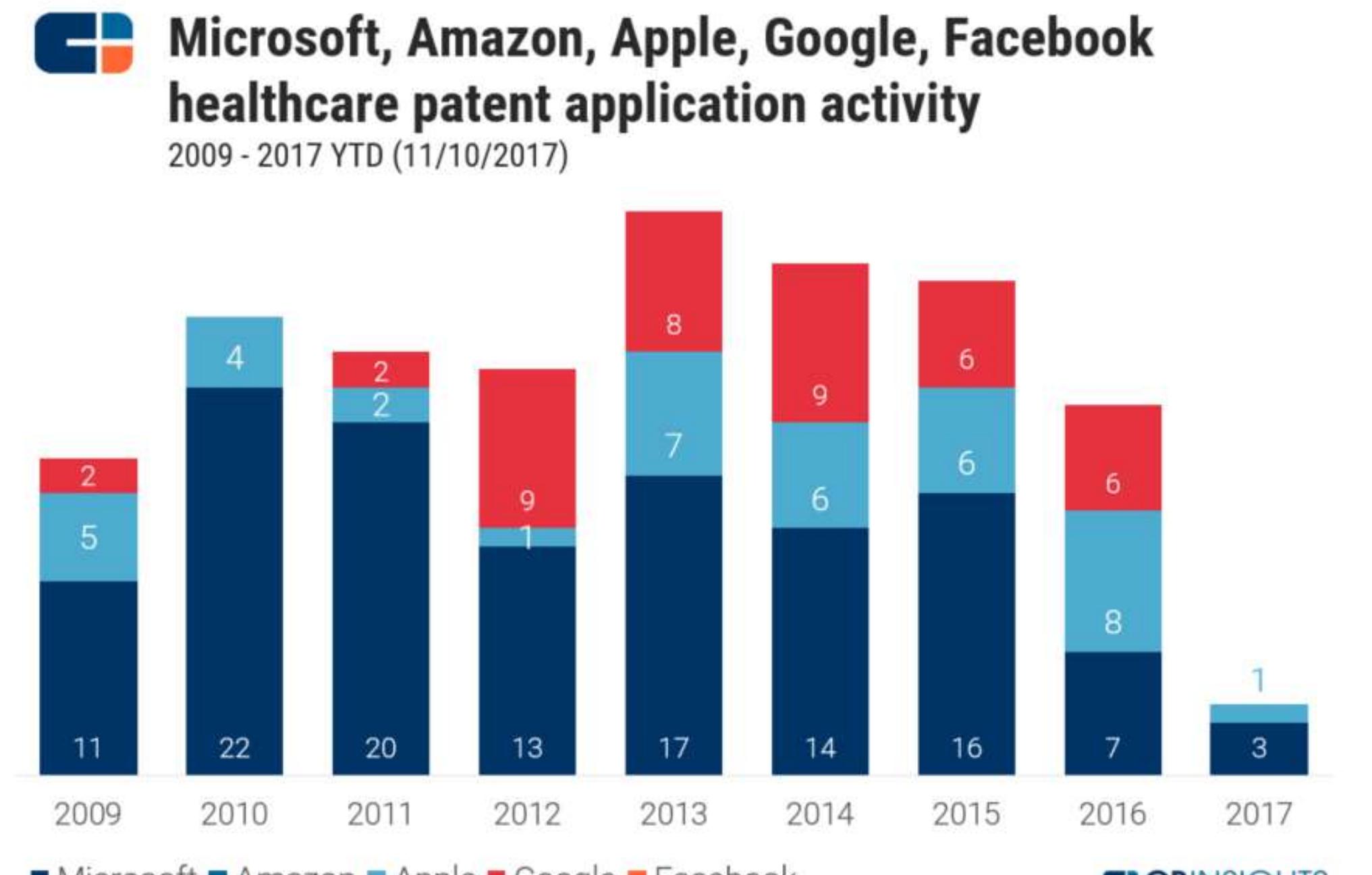
Common Research Methods

- Ethnographic (participant observation)
- Surveys/interviews/feedback analysis
- Expert analysis
- **Architecture analysis**
- Patent/literature review
- Meta analysis
- Eye tracking/electroencephalography (EEG)



Common Research Methods

- Ethnographic (participant observation)
- Surveys/interviews/feedback analysis
- Expert analysis
- Architecture analysis
- **Patent/literature review**
- Meta analysis
- Eye tracking/electroencephalography (EEG)

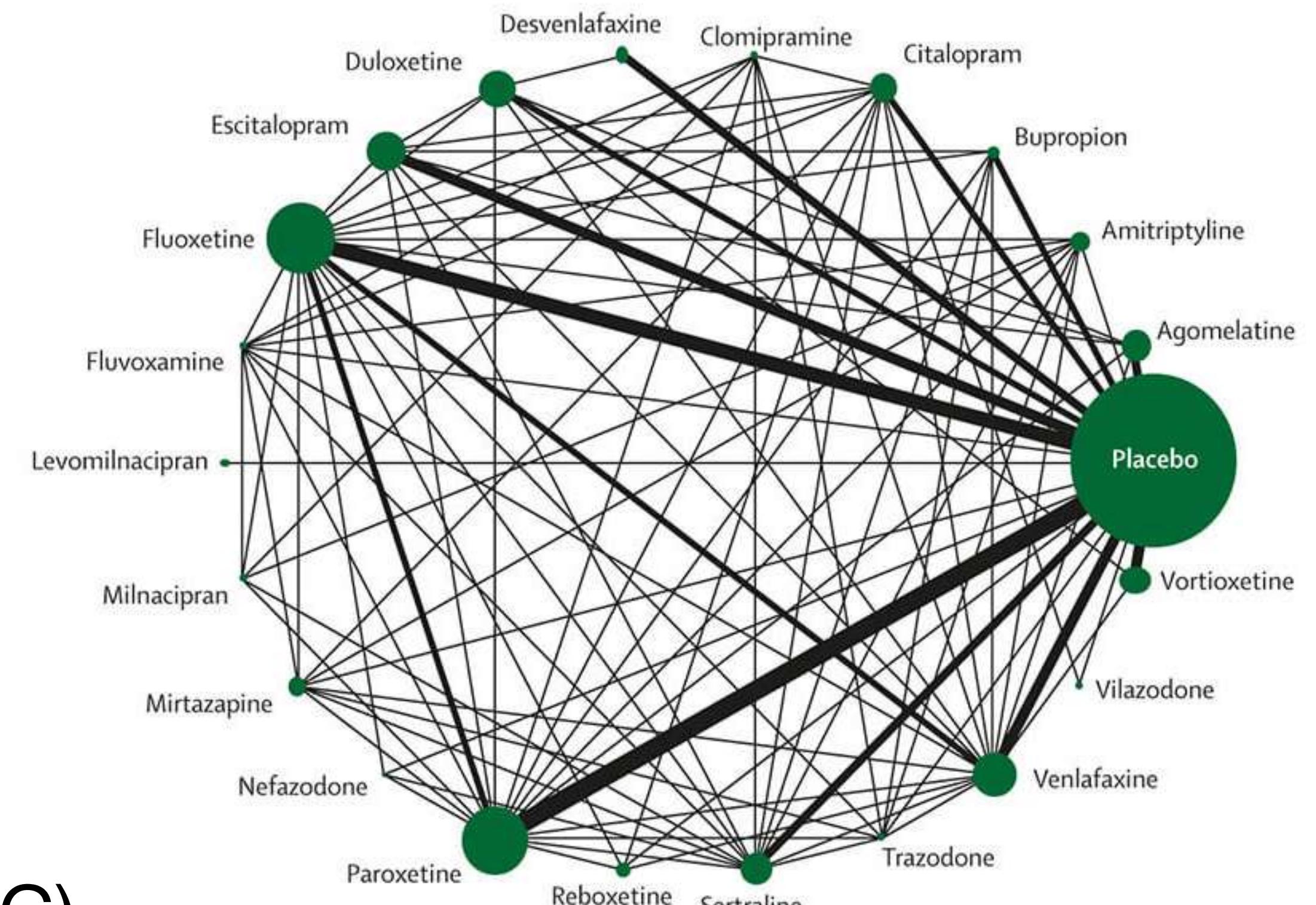


Analysis filters patent titles and abstracts for select relevant keywords, e.g. "health". Does not include pre-acquisition patent activity of purchased companies.

Note: The patent filing process involves a significant time-lag before the publishing of patent applications. This delay can range from several months to over two years, meaning that records prior to 2013 are likely complete at the time of analysis, but there may be applications from 2014 on that have yet to be published.

Common Research Methods

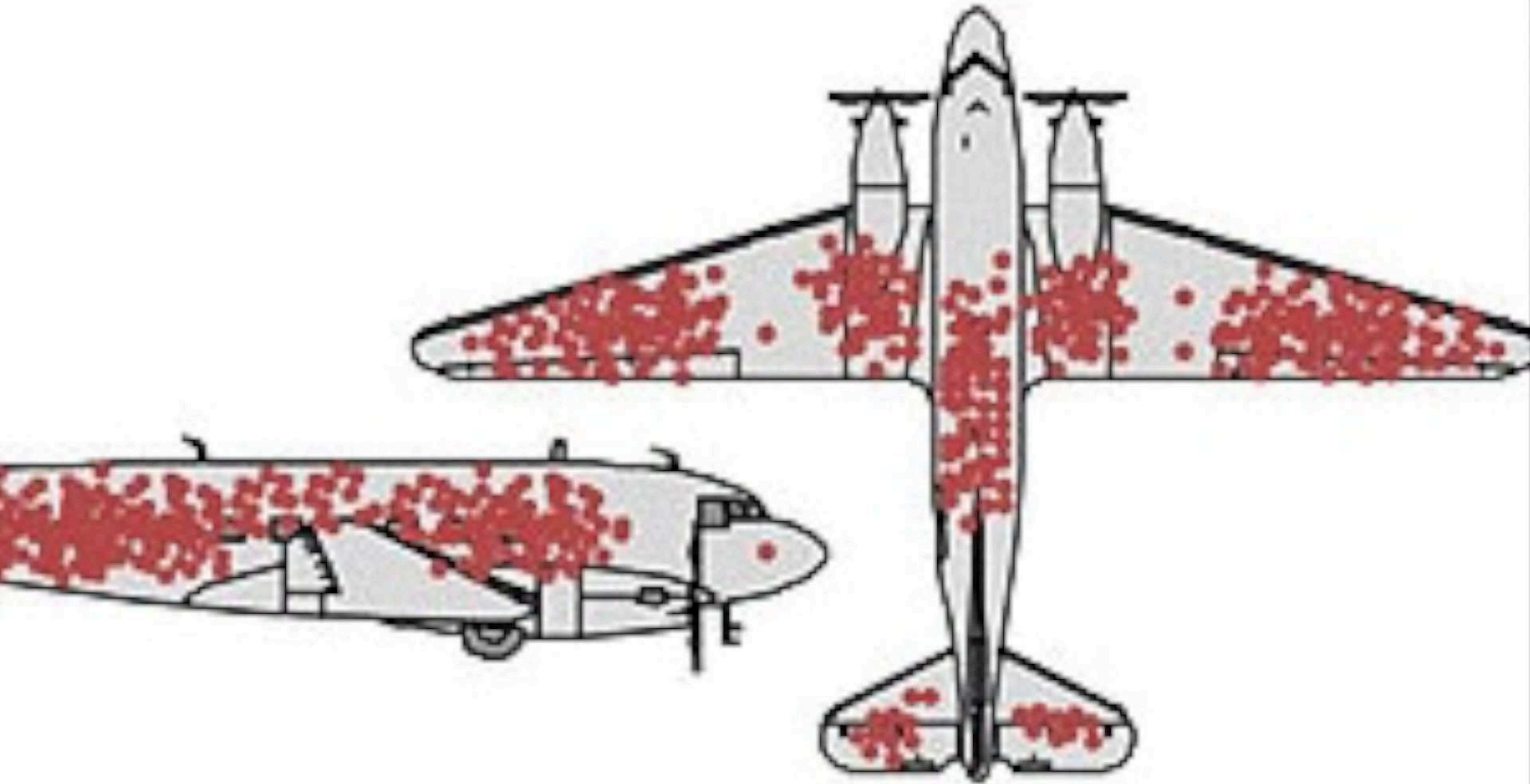
- Ethnographic (participant observation)
- Surveys/interviews/feedback analysis
- Expert analysis
- Architecture analysis
- Patent/literature review
- **Meta analysis**
- Eye tracking/electroencephalography (EEG)



Common Research Methods

- Ethnographic (participant observation)
- Surveys/interviews/feedback analysis
- Expert analysis
- Architecture analysis
- Patent/literature review
- Meta analysis
- **Eye tracking/electroencephalography (EEG)**





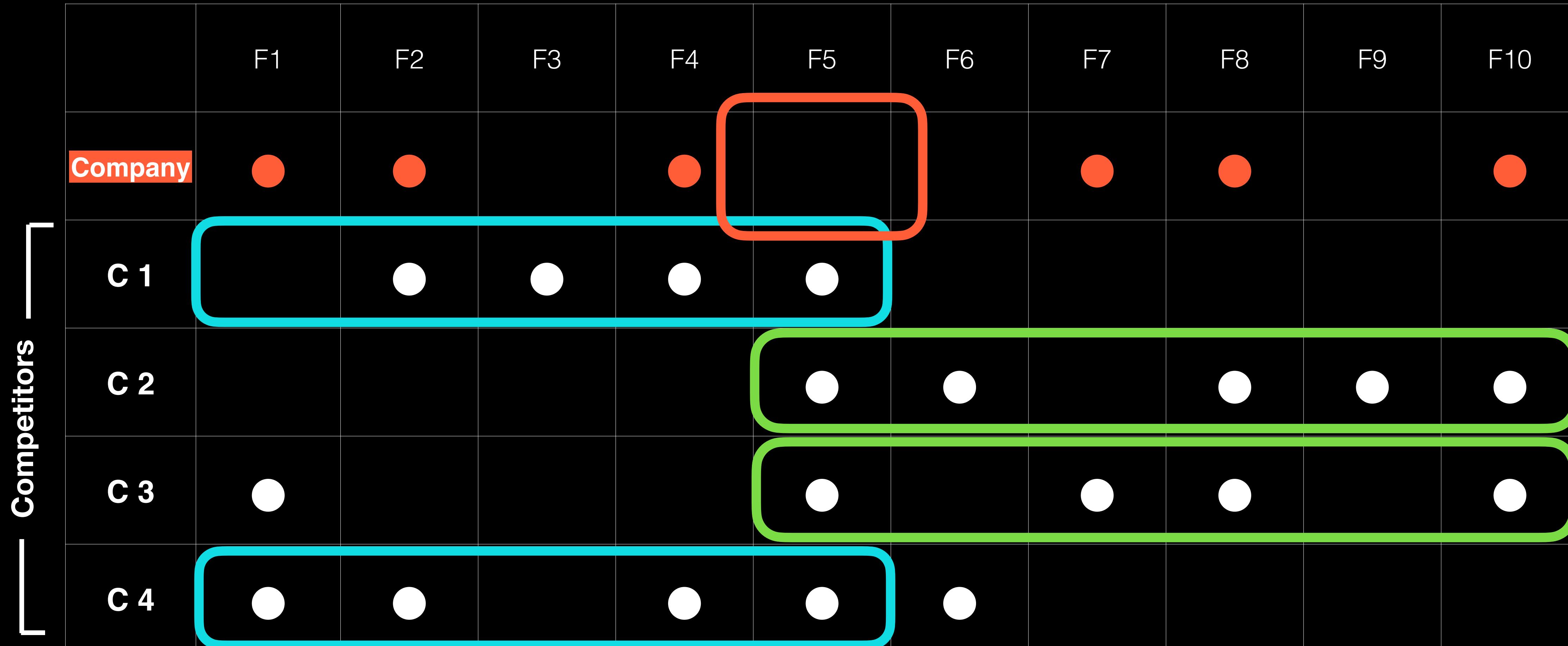
How would you conduct research...

- If you wanted to make a phone app that tracks fitness & diet & sleep?
- If you wanted to make a tool for the kitchen that made it easy for older people to open jars?

Morphological Analysis

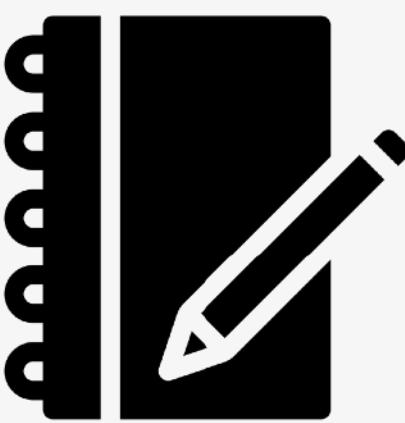
- Learn about your problem space by **comparing similar solutions**, and dissimilar solutions (**analog**s)
 - E.g., Designing a better toothbrush? Examine currently sold toothbrushes, old toothbrushes, other ways of cleaning teeth (dentist tools, floss, water picks) and other ways to clean mechanically (mops) or chemically (acid)
- Choose relevant criteria: **subjective and objective**
- Look for patterns, **draw interesting conclusions from the analysis**

Morphological Analysis For Features, Redacted



A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try



Make a **morphological analysis**
comparing **3 wearables**

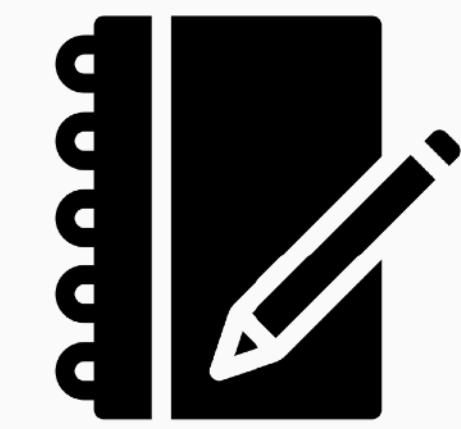
Pick Objective & Subjective Facets To Compare

Apple Watch
Whoop
FitBit

What **trends** do you see?
What **interesting conclusions**
can you draw?



Example: Morphological Analysis For Designing a Better Toothbrush



	Price	Look	Colors/Style	Target Buyer / Buyer feelings
Reach Essentials	\$3.69 for 6		Silver handle with green/blue/purple/silver/rose head	35-55 years old. “Comfortable” “Good price”
Quip Electric Toothbrush 2022	\$29.99		5 options (gold, copper, dark aqua, silver, slate)	25-32 years old. “Cool” “Modern” “My friends have them also”

Pick Objective & Subjective Facets To Compare



3. Stakeholder Analysis

What Is A Stakeholder?

- A person or group that benefits: has an investment, share, or interest in something
- Who are the stakeholders in this class?

Why Analyze Stakeholders?

- Systems Thinking - Establishing a global perspective
- Understand how to make good decisions & tradeoffs, establish priorities and communicate effectively
- Not all stakeholder hold the same value
 - Some stakeholders benefit us more
 - Some stakeholders we benefit more

Not All Stakeholders Benefit Positively

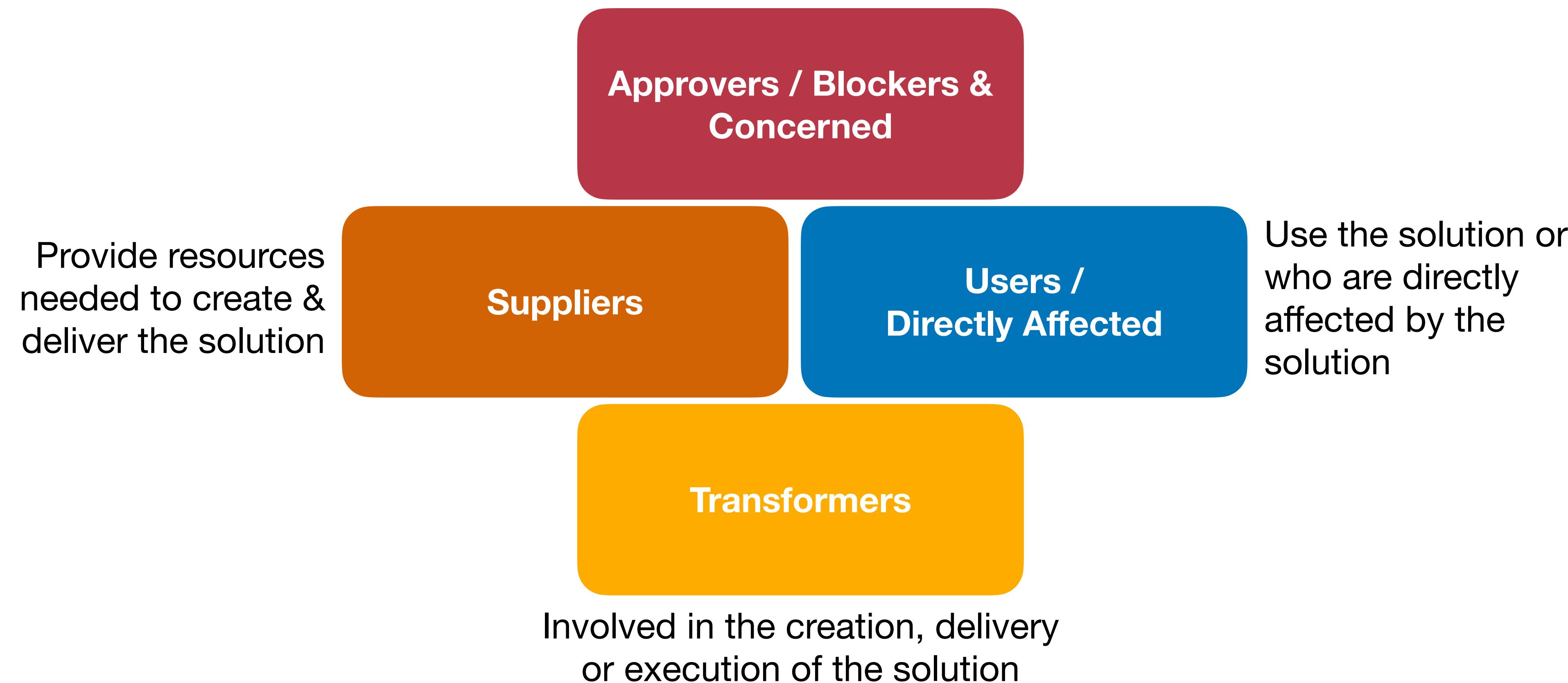


The stakeholders of the Nerf Blaster are the person shooting it **and** the person being shot

Analyzing Stakeholders

4 Groups

Can prevent creation, delivery or execution, or may be concerned about how the solution may effect them indirectly



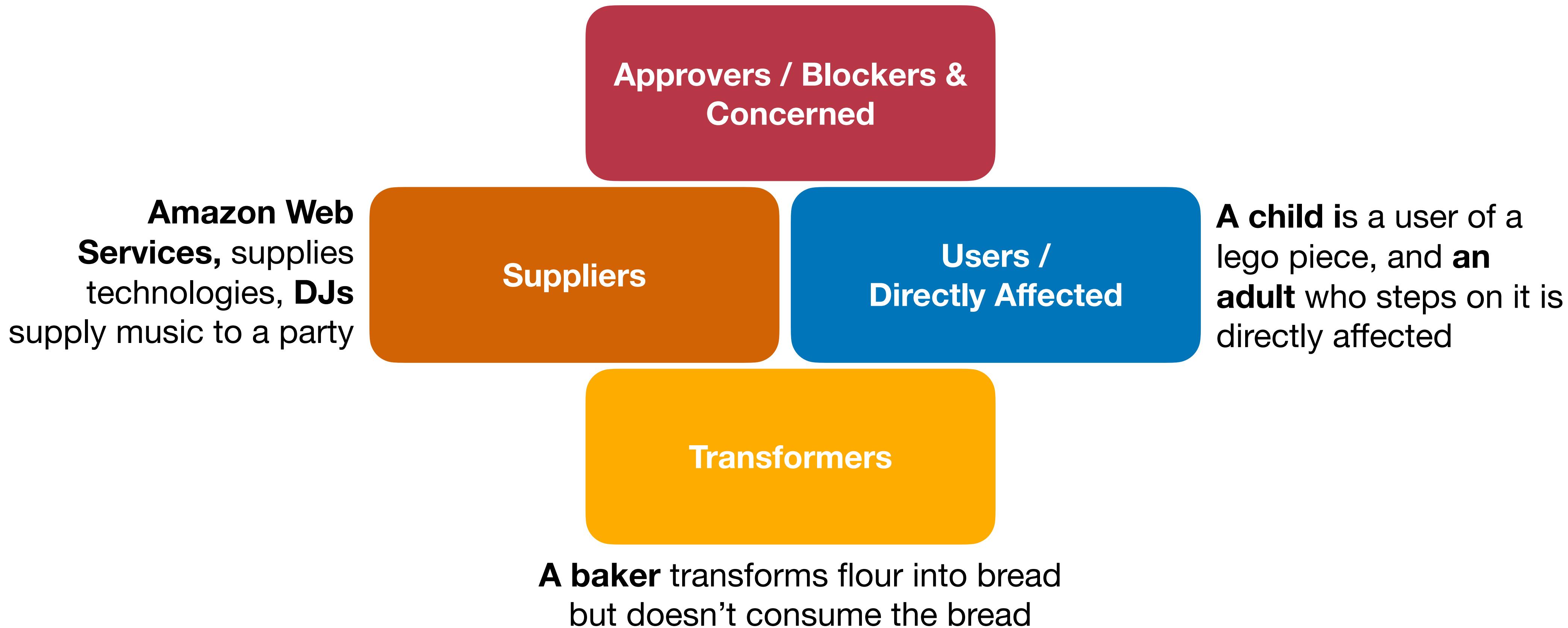
Analyzing Stakeholders

Examples

The **legal team** could block the deployment of a new product.

A **boss** might increase or limit funding.

The user of an airplane cargo loading machine isn't a pilot, but **the pilot** may be concerned if the cargo is loaded correctly for a safe flight



Analyzing Stakeholders

Ranking Stakeholders

List of stakeholders

The value they provide to us

Prioritize based on influence, impact or need to address

Stakeholder	Why We Care About Them

Not Prioritized	Low	Med	High

What They Care About/ How To Satisfy

Approvers / Blockers & Concerned

Suppliers

Transformers

Users / Directly Affected

Analyzing Stakeholders

Ranking Stakeholders

List of stakeholders

The value they provide to us

Users /
Directly Affected

Prioritize based on influence,
impact or need to address

Stakeholder	Why We Care About Them

Not Prioritized	Low	Med	High

What They Care About/ How To Satisfy

Approvers / Blockers &
Concerned

Suppliers

Transformers

For Users

Ensure solution is emotionally
and intellectually satisfying

Analyzing Stakeholders

EXAMPLE: New Minivan

Users /
Directly Affected

List of
stakeholders

The value they provide to us

Prioritize based on influence,
impact or need to address

Approvers / Blockers &
Concerned

Suppliers

Transformers

Stakeholder	Why We Care About Them
New Parent	Biggest segment
Occasional Users	Need to standardize for use in rental cars and reduce accidents
Younger children (4-8)	Children drive parents buying decisions
Gas station attendant	Needs easy way to fill tank without scratching car

Not Prioritized	Low	Med	High
			✓
	✓		
		✓	
✓			

What They Care About/ How To Satisfy
Diaper bag storage, automatic doors, space organizers, cellphone holder...
Knowing how to open the door and trunk, accessing light switch, parking assistance...
Entertainment system, ability to look out, ability to access storage...
—

For Users

Ensure solution is emotionally and intellectually satisfying

Analyzing Stakeholders

EXAMPLE: New Minivan

Approvers / Blockers &
Concerned

List of
stakeholders

The value they provide to us

Prioritize based on influence,
impact or need to address

Stakeholder	Why We Care About Them

Not Prioritized	Low	Med	High

What They Care About/ How To Satisfy

Users /
Directly Affected

Suppliers

Transformers

For Approvers, Blockers + Concerned
Reduce uncertainties, engage &
motivate, keep informed

Users /
Directly Affected

Suppliers

Transformers

Analyzing Stakeholders

EXAMPLE: New Minivan

Approvers / Blockers &
Concerned

List of
stakeholders

The value they provide to us

Prioritize based on influence,
impact or need to address

For Approvers, Blockers + Concerned
Reduce uncertainties, engage &
motivate, keep informed

Stakeholder	Why We Care About Them
NHTSA	Publications use this data for reviews
J.D. Power	Customers use them to determine trust
EPA	Can't launch if we don't adhere to requirements
Competitors	They might try to respond quickly to our new concepts

Not Prioritized	Low	Med	High
			✓
		✓	
			✓
	✓		

What They Care About/ How To Satisfy
Safety
Customer satisfaction, value retention over time...
Fuel economy, emissions
How it effects their bottom line / competitive pressures

Analyzing Stakeholders

EXAMPLE: New Minivan

List of stakeholders

The value they provide to us

Suppliers

Prioritize based on influence, impact or need to address

Stakeholder	Why We Care About Them

Not Prioritized	Low	Med	High

What They Care About/ How To Satisfy

Users / Directly Affected

Approvers / Blockers & Concerned

Transformers

For Suppliers

Prevent disruption, ensure preference, understand trends

Analyzing Stakeholders

EXAMPLE: New Minivan

Users /
Directly Affected

Approvers / Blockers &
Concerned

Transformers

Suppliers

List of
stakeholders

The value they provide to us

Prioritize based on influence,
impact or need to address

For Suppliers

Prevent disruption, ensure
preference, understand trends

Stakeholder	Why We Care About Them
Chip manufacturers	Single point of failure
Steel/Metal	Necessary to maintain volume to ensure margin
Apple for Car Play	Reduces our need to develop parity solution
Tire Manufacturers	Necessary part we can't manufacture

Not Prioritized	Low	Med	High
			✓
			✓
	✓		
✓			

What They Care About/ How To Satisfy
Ability to provide latest tech, all mfg in one location
Consistent volume of sales, long term contracts, plenty of alternatives exist
Extending their network, consistent user experience
Tire mfg all over the world, easy substitution

Analyzing Stakeholders

EXAMPLE: New Minivan

List of stakeholders

The value they provide to us

Transformers

Prioritize based on influence, impact or need to address

Stakeholder	Why We Care About Them

Not Prioritized	Low	Med	High

What They Care About/ How To Satisfy

Users / Directly Affected

Approvers / Blockers & Concerned

Suppliers

For Transformers

Ensure they can be successful, keep happy, and use to gain upstream and downstream insights

Analyzing Stakeholders

EXAMPLE: New Minivan

Transformers

Users /
Directly Affected

Approvers / Blockers &
Concerned

Suppliers

List of
stakeholders

The value they provide to us

Prioritize based on influence,
impact or need to address

For Transformers

Ensure they can be successful, keep
happy, and use to gain upstream and
downstream insights

Stakeholder	Why We Care About Them
Factory worker	Single point of failure
Dealerships	Necessary to maintain volume to ensure margin
Mechanic	Reduces our need to develop parity solution

Not Prioritized	Low	Med	High
	✓		
		✓	
			✓

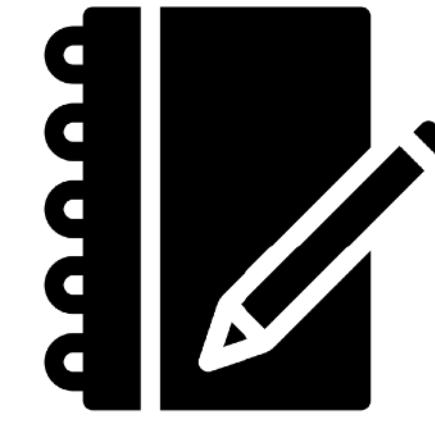
What They Care About/ How To Satisfy
Easy to assemble, safe environment, pride of production
Need to understand keep differentiators, use to gain insight into customer needs
Mechanics should want to work on the car, speed contributes to their cash flow

A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try



<https://flourbakery.com>



Analyze stakeholders for Flour Bakery



Analyze 8 Stakeholders for flourbakery.com (2 for each category)

Prevent disruption,
ensure preference,
understand trends

Suppliers

Reduce uncertainties, engage &
motivate, keep informed

**Approvers / Blockers &
Concerned**

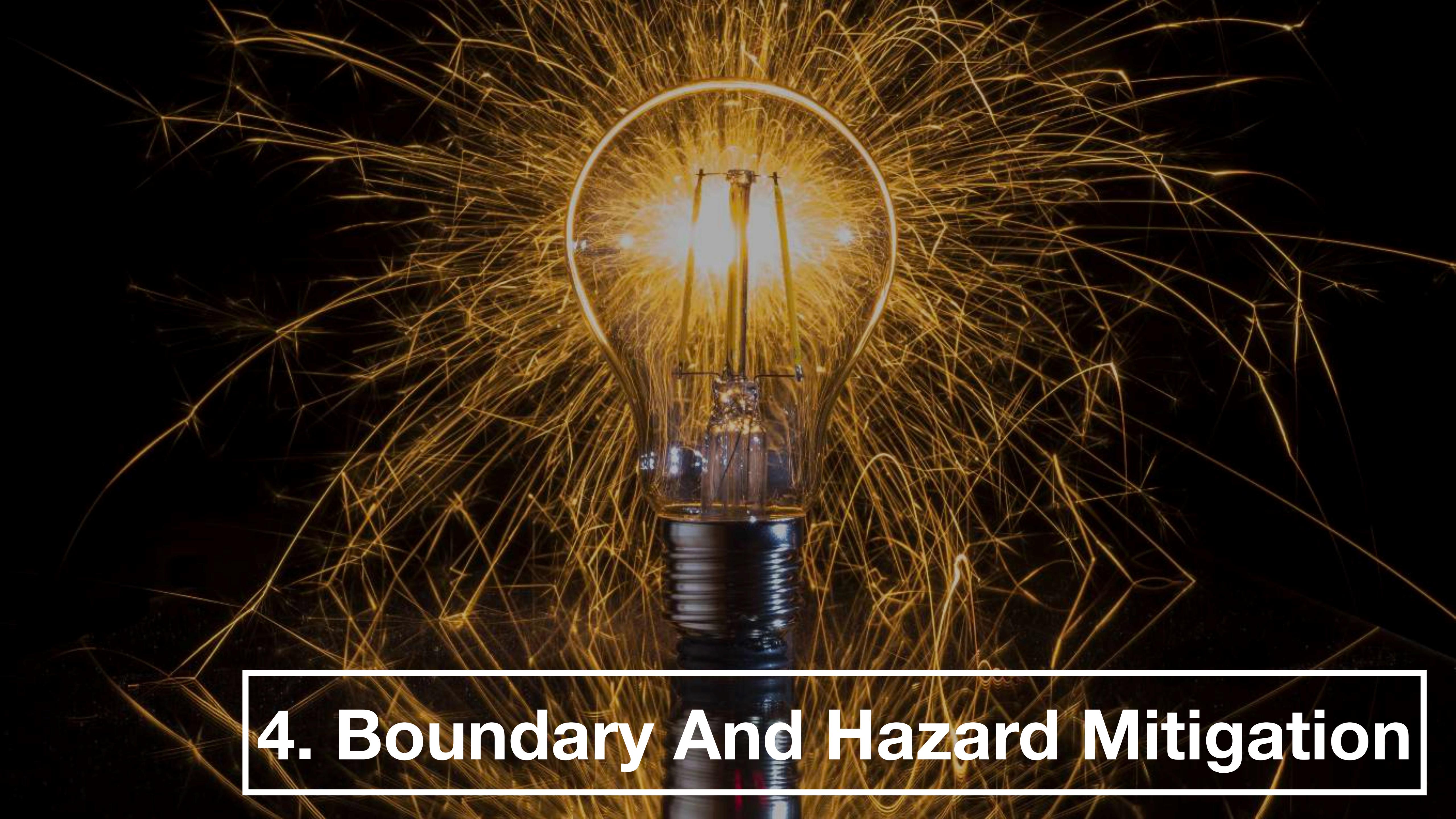
Transformers

**Users /
Directly Affected**

Ensure solution
is emotionally
and intellectually
satisfying

Ensure they can be successful, keep
happy, and use to gain upstream and
downstream insights

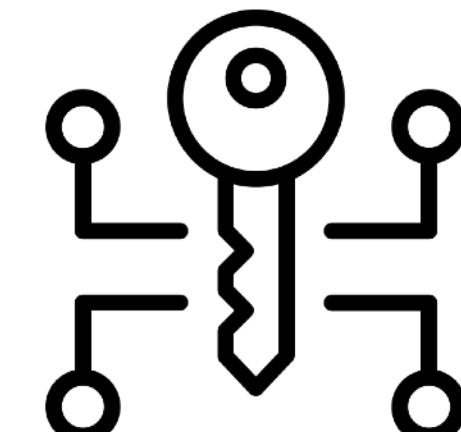
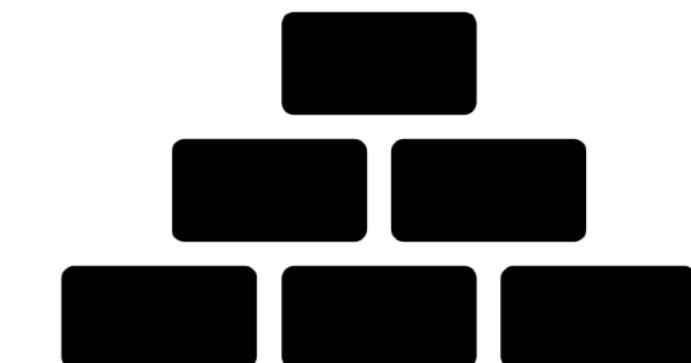
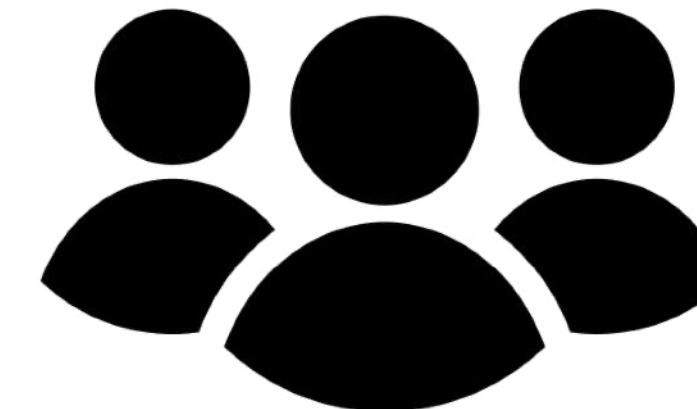
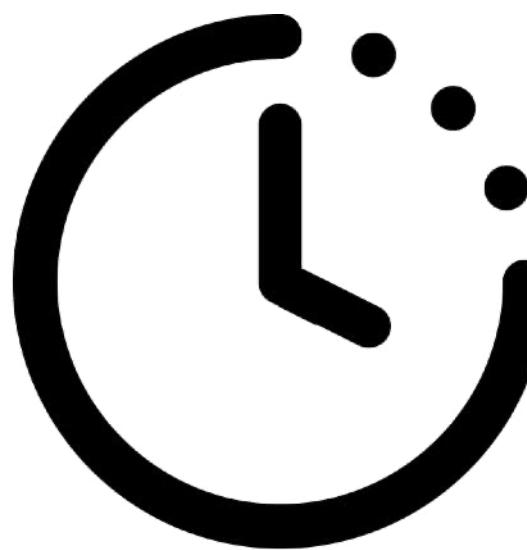
Stakeholder	Type	Why We Care About Them	Not Prioritized	Low	Med	High	What They Care About/ How To Satisfy
	Orange						



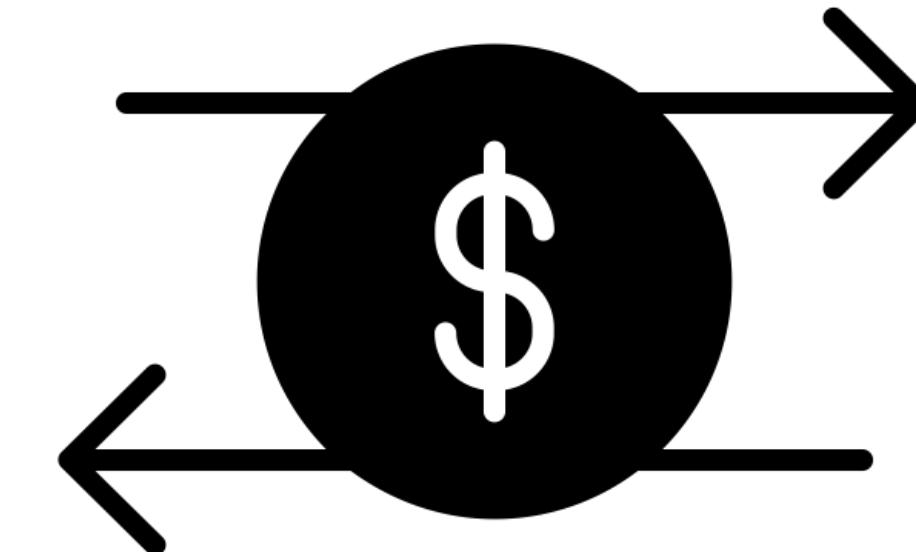
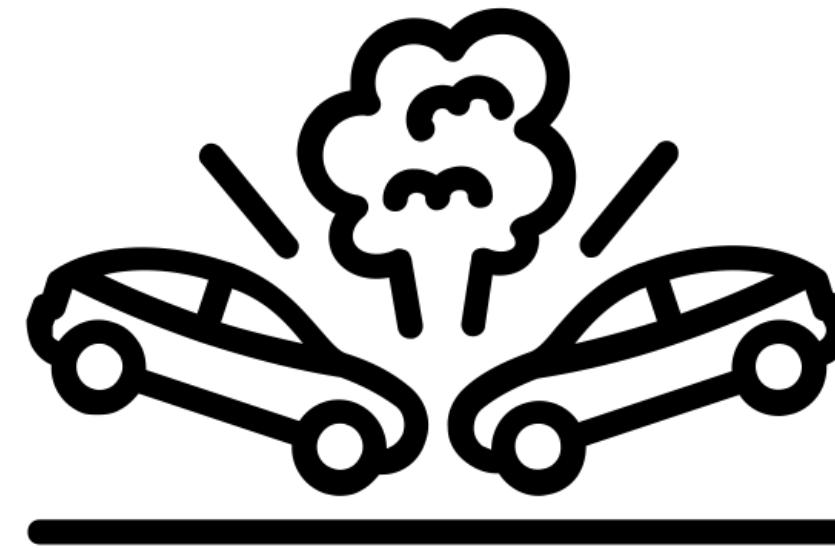
4. Boundary And Hazard Mitigation

Boundaries & Hazard *Identification*

- Identify what you are (or might be) limited by (boundaries)

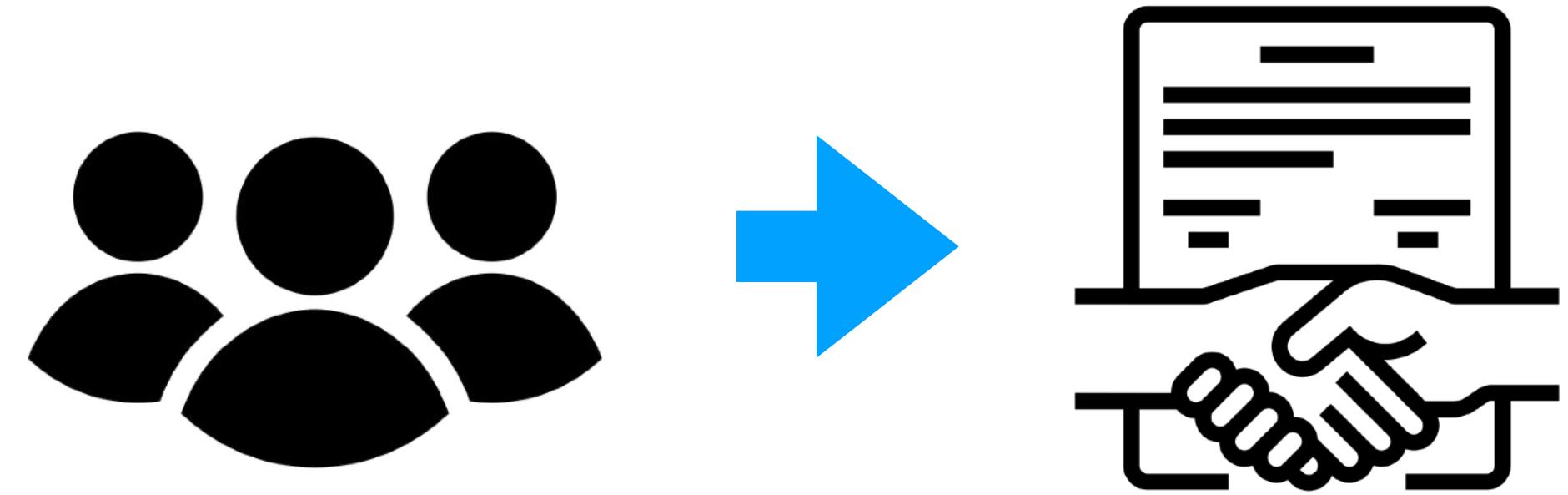
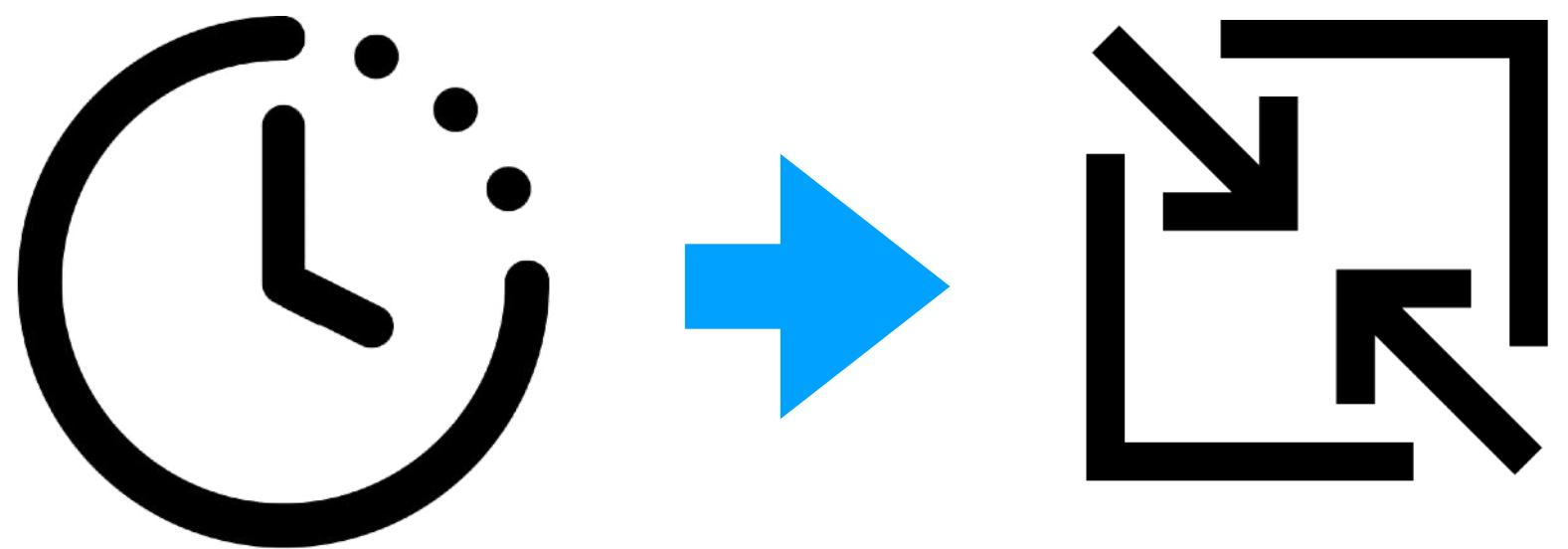


- Identify what could go wrong (hazards)

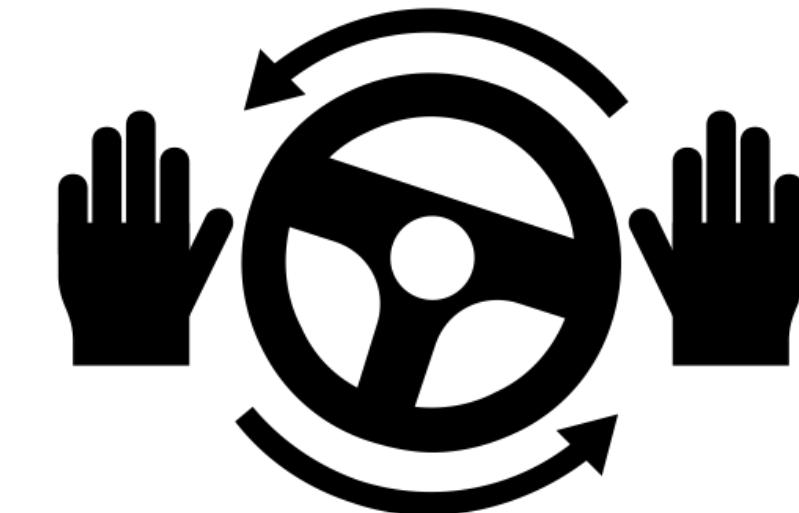
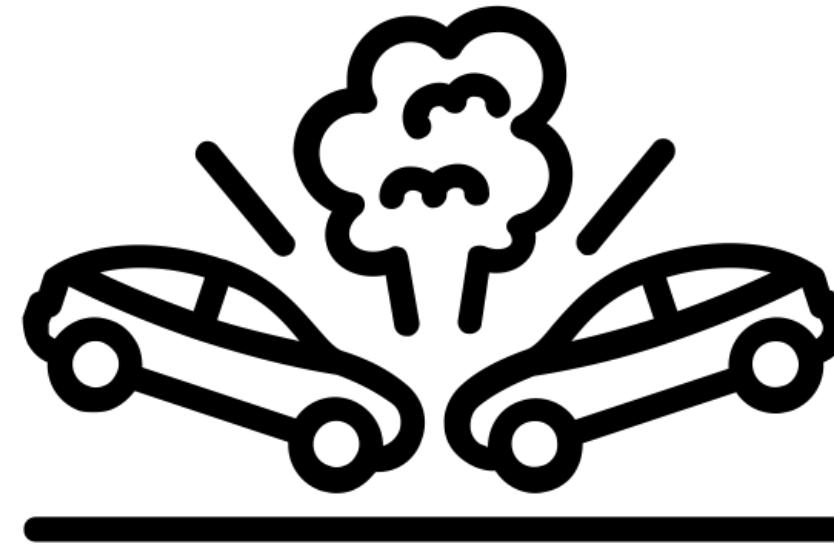


Boundaries & Hazard *Mitigation*

- Identify boundary mitigation strategies



- Identify hazard mitigation strategies



Rank Boundaries & Hazard

- Assign all the boundaries and hazards **likelihood** and **severity** ratings (what's the chance the issue happens, and if it happens how bad is it?)
- Calculate the expected impact by multiplying the likelihood by the severity.

Boundary/Hazard

(Feel free to use percentages or a 0-10 scale)

Rank Boundaries & Hazard

- Assign all the boundaries and hazards **likelihood** and **severity** ratings (what's the chance the issue happens, and if it happens how bad is it?)
- Calculate the expected impact by multiplying the likelihood by the severity.

Boundary/Hazard	Likelihood (0-10)	Severity (0-10)	Expected Impact
			(= Likelihood x Severity)

(Feel free to use percentages or a 0-10 scale)

Rank Boundaries & Hazard

- Assign all the boundaries and hazards **likelihood** and **severity** ratings (what's the chance the issue happens, and if it happens how bad is it?)
- Calculate the expected impact by multiplying the likelihood by the severity.

Example: Planning a wedding in LA	
Boundary/Hazard	Likelihood (0-10)
Weather cancels event	3
People get lost on the way	6
Band doesn't show up	1

(Feel free to use percentages or a 0-10 scale)

Rank Boundaries & Hazard

- Next determine **Mitigation Strategies** (each boundary/hazard may have multiple strategies)
- For each strategy determine **the effectiveness of the strategy** (based on your ability to successfully implement the strategy **and** how good it is at addressing the issue)

Example: Planning a wedding in LA			
Boundary/Hazard	Expected Impact	Mitigation Strategy	Cost-Effectiveness
Weather cancels event	24		
People get lost on the way	42		
Band doesn't show up	3		

Rank Boundaries & Hazard

- Next determine **Mitigation Strategies** (each boundary/hazard may have multiple strategies)
- For each strategy determine **the effectiveness of the strategy** (based on your ability to successfully implement the strategy **and** how good it is at addressing the issue)

Example: Planning a wedding in LA			
Boundary/Hazard	Expected Impact	Mitigation Strategy	Cost-Effectiveness
Weather cancels event	24	Find indoor venue	High
People get lost on the way	42	People stay at location	Low
Band doesn't show up	3	Use Spotify playlist	High

Rank Boundaries & Hazard

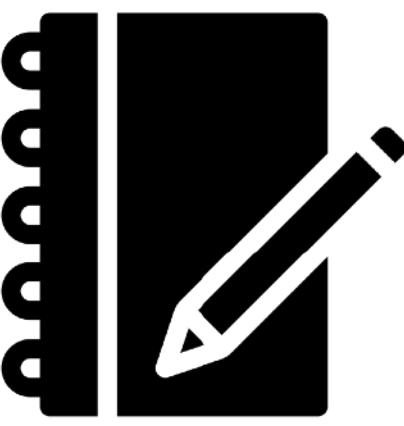
Example: Planning a wedding in LA			
Boundary/Hazard	Expected Impact	Mitigation Strategy	Cost-Effectiveness
Weather cancels event	24	Find indoor venue	High
People get lost on the way	42	People stay at location	Low
Band doesn't show up	3	Use Spotify playlist	High

- Which boundaries/hazards are most concerning?
- Are the mitigation strategies good enough for the concerning boundary or hazard?

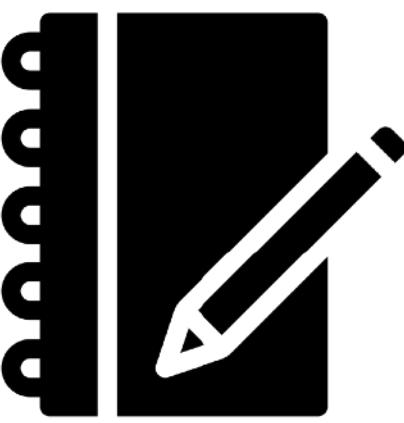
A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try

A Police Robot For The City Of Cambridge



A Police Robot For The City Of Cambridge



Boundary/Hazard	Likelihood (0-10)	Severity (0-10)	Expected Impact (=likelihood x severity)	Mitigation Strategy	Cost-Effectiveness

Consider

Resources

Creation, Delivery,
Execution

Operation/Use

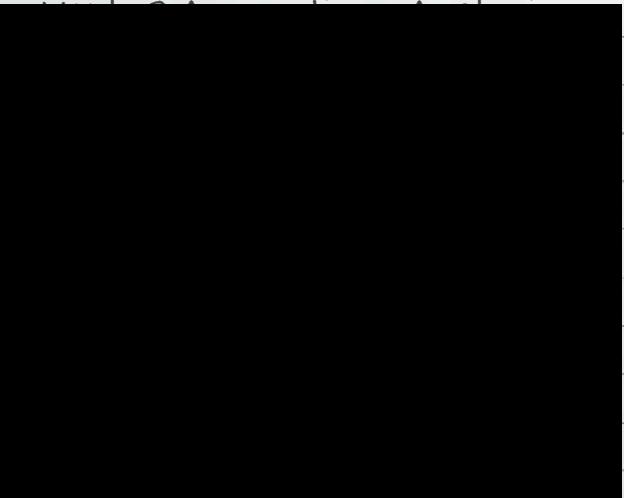
Externalities



MUSIC



The 10 Step
Design Process



6.910A/2.723A/16.662A /6.9101/2.7231/16.6621

D-TILE Articulating Design

A photograph of a person's hand holding a small, round compass in front of a blurred background of a forested mountain range. The compass has a white face with black markings for cardinal directions (N, S, E, W) and smaller increments. The hand is positioned palm-up, with the compass centered in the frame.

Discover & Define

Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes

Explore and Explain

7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction

Make and Measure

12. Launch, Iterate, or Stop



6. Specify Desired Outcomes

Desired Outcomes

- Desired outcomes define parameters for what must happen
- Desired outcomes should not define parameters for how the outcome is reached
- There are many different methods in corporations to specifying desired outcomes, including:
 - MRD (Market Requirements Document)
 - PRD (Product Requirements Document)
 - Manufacturing specification

Desired Outcomes For Innovations

- Intellectual objectives (i.e., appeals to the rational mind)
- Emotional objectives (i.e., appeals to feelings)
- Success criteria & goals (objective and subjective)

Desired Outcomes For Innovations

Example: a faster MRI machine

- Intellectual objectives (i.e., appeals to the rational mind)

An MRI machine that's 3x as fast, will make the hospital more money per hour

- Emotional objectives (i.e., appeals to feelings)

An MRI machine that's 3x as fast, will make patients happier because it will be faster to finish a procedure

- Success criteria & goals (objective and subjective)

80% of patients will rate this solution a 4 out of 5 for comfort

90% of MRI operators can complete the set-up task in under 3 minutes

Desired Outcomes For Innovations

Example: a faster MRI machine, grid

Objective	Objective Type	How Will You Measure Success?
Develop an MRI machine that's fast enough to significantly make the hospital more money	Intellectual	Reduce total time for most common MRIs by 30% 90% of MRI operators can complete the set-up task in under 3 minutes
Develop an MRI machine that's patients feel is comfortable and feels quick	Emotional	80% of patients will rate this solution a 4 out of 5 for comfort

Creating Desired Outcomes

- Develop a set of outcomes
- Break those down into smaller outcomes as necessary
- Outcomes should be **aggressive and attainable, clear and inspiring.**
- Too specific is just as bad as too vague
- Construct objective and subjective measurements of success that the solution will satisfy
- Articulate desired outcomes by creating vision

A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize the tower. The blocks are stacked in a traditional staggered pattern, with the word "Jenga" printed in red on each block. The background is dark, making the light wood stand out.

You Try

Creating Desired Outcomes

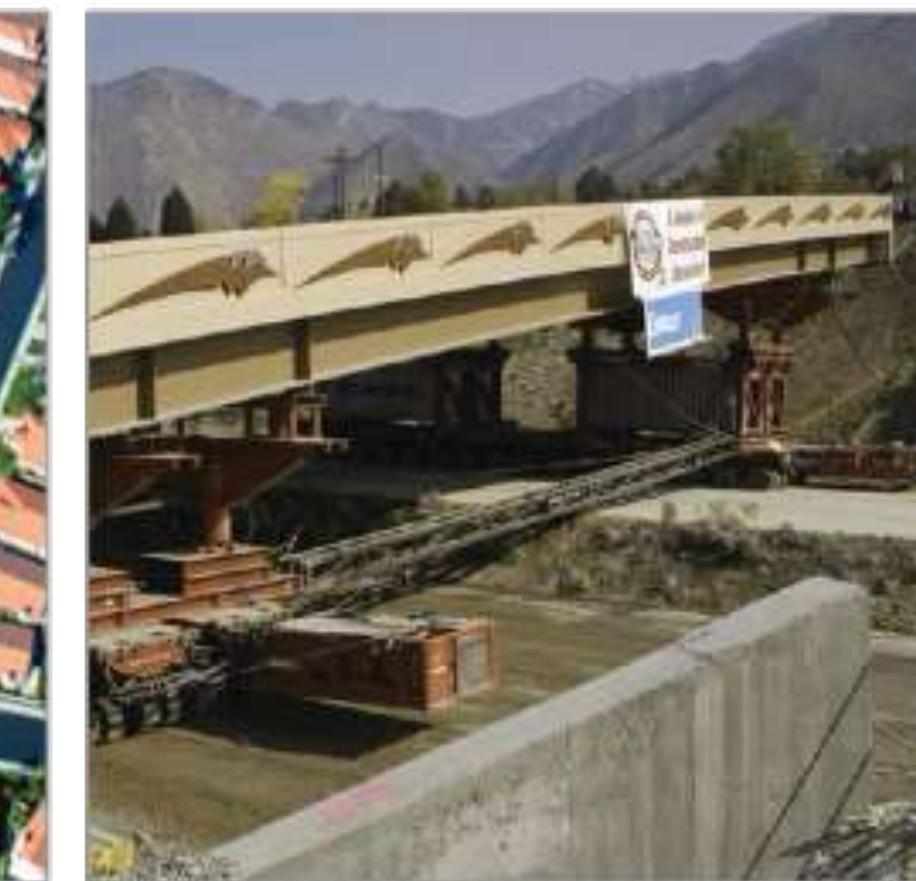
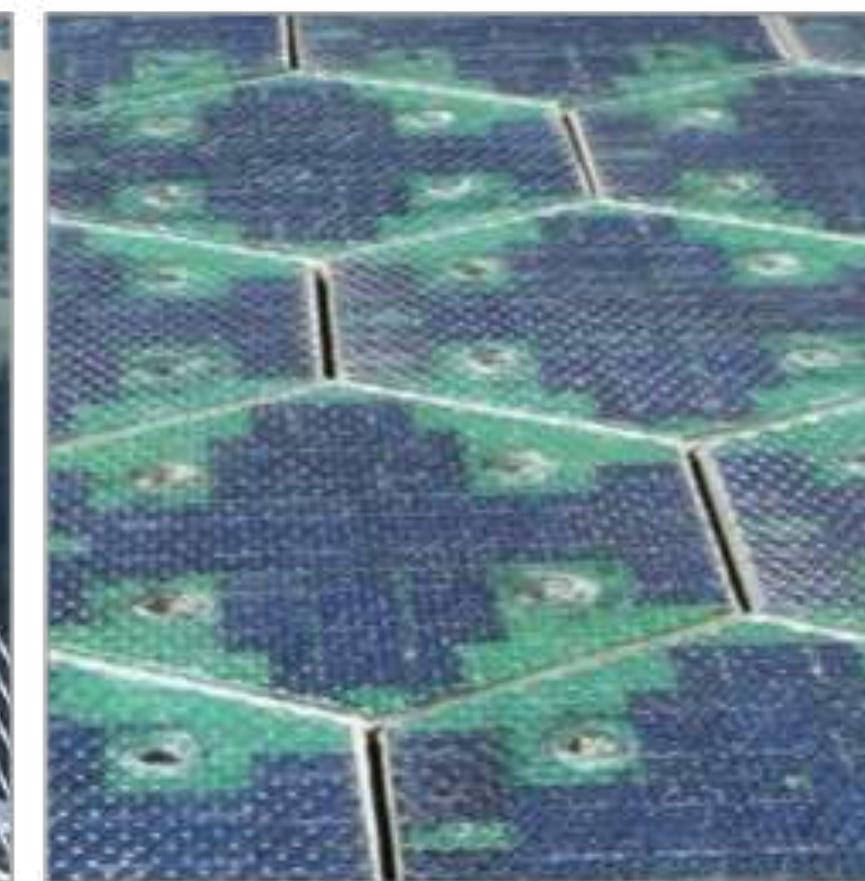
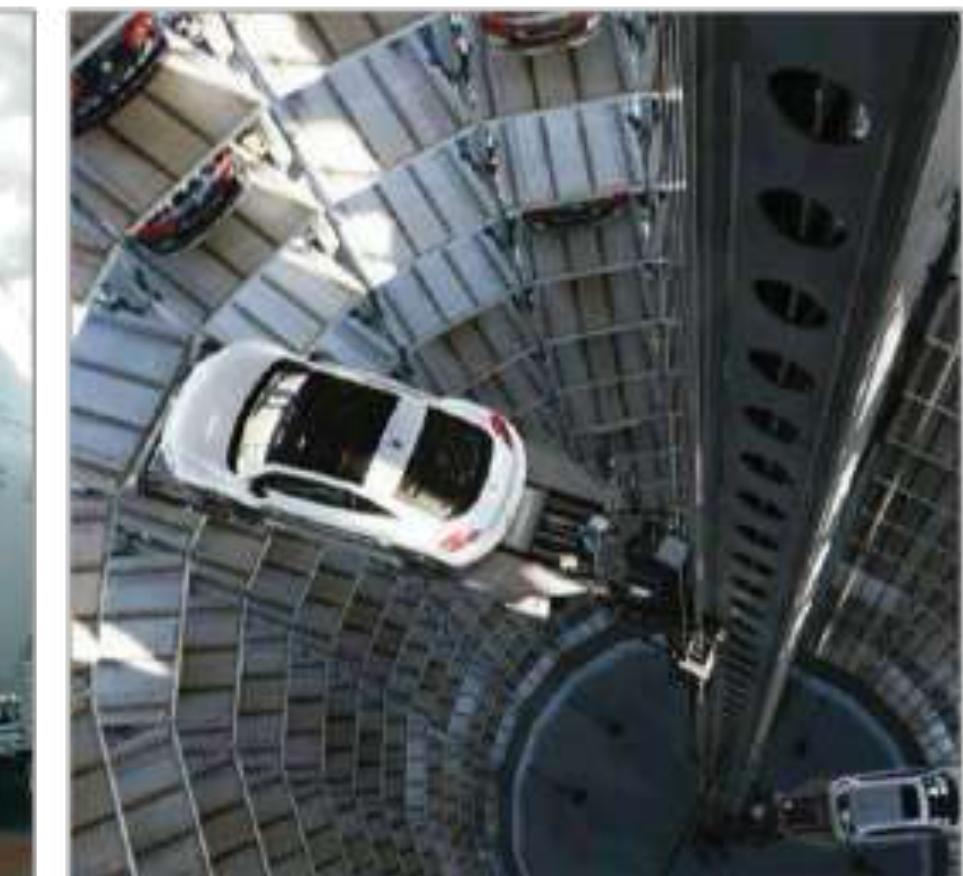
A New Use For An Old Town Hall

- Intellectual objectives (i.e., appeals to the rational mind)
- Emotional objectives (i.e., appeals to feelings)
- Success criteria (objective and subjective, qualitative and quantitative)

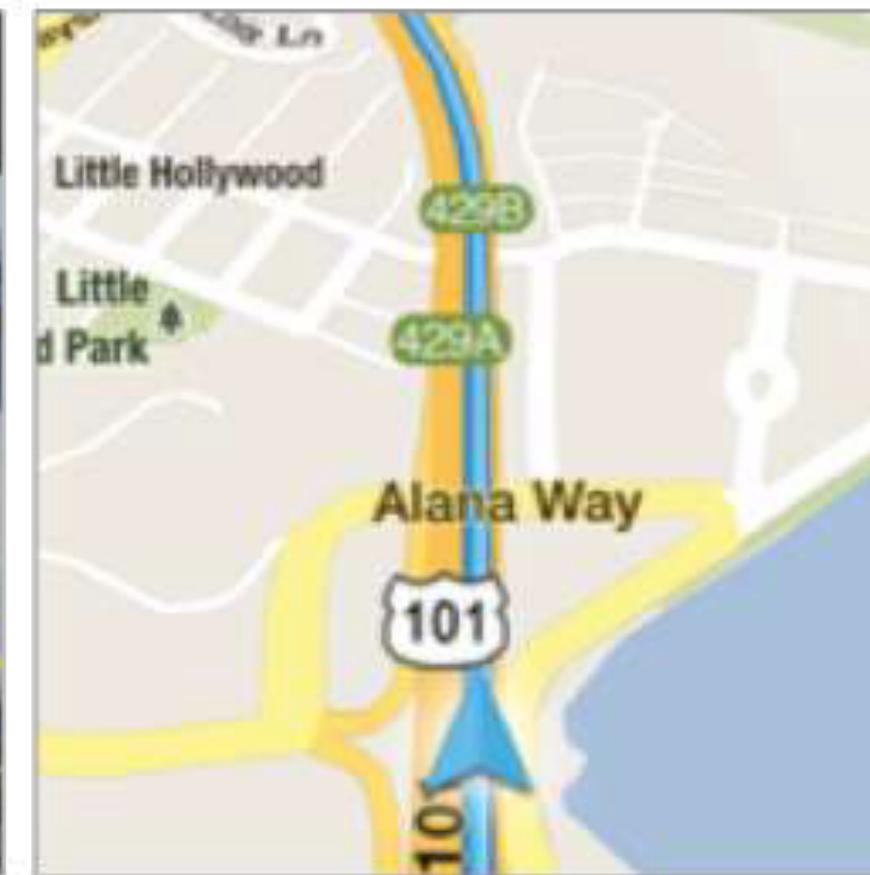
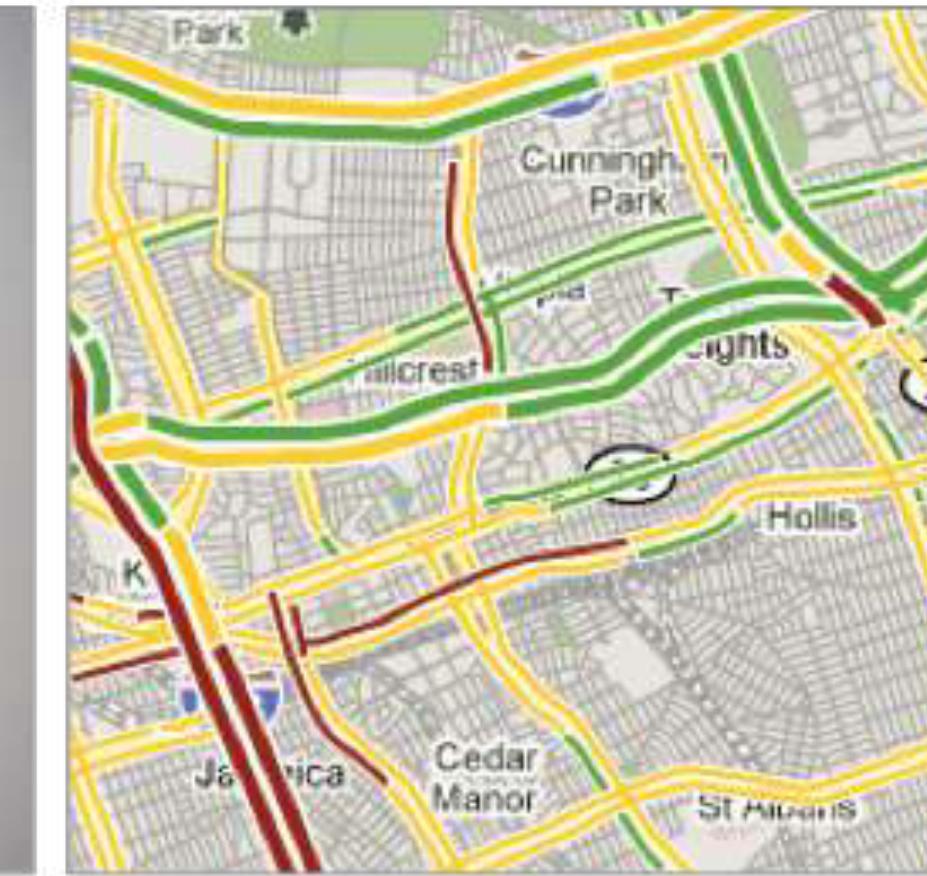


Vision Articulation: Magic Highway USA, 1958

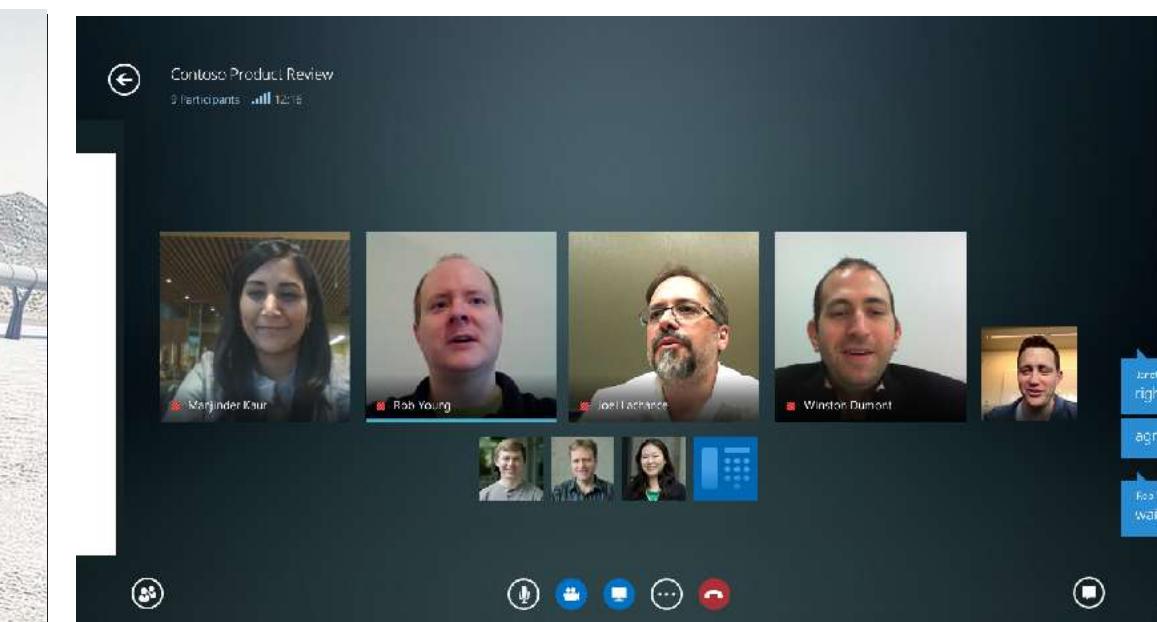
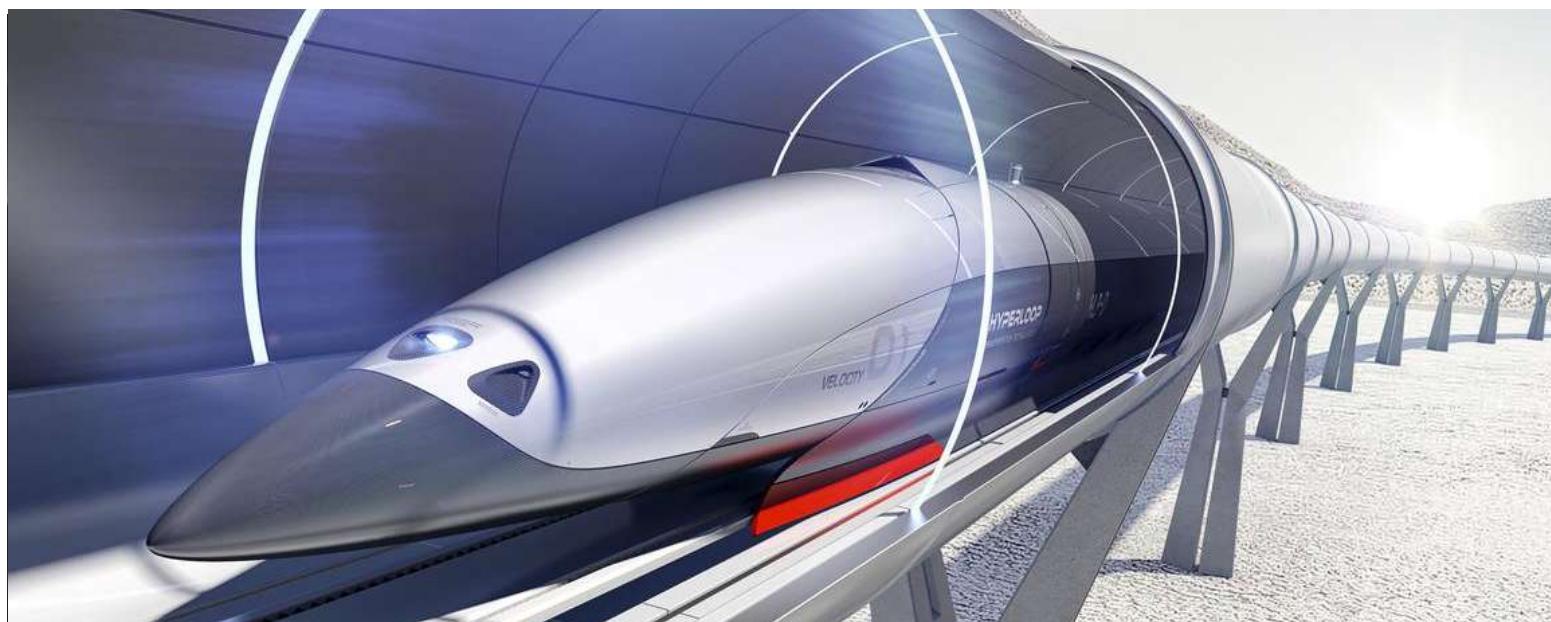
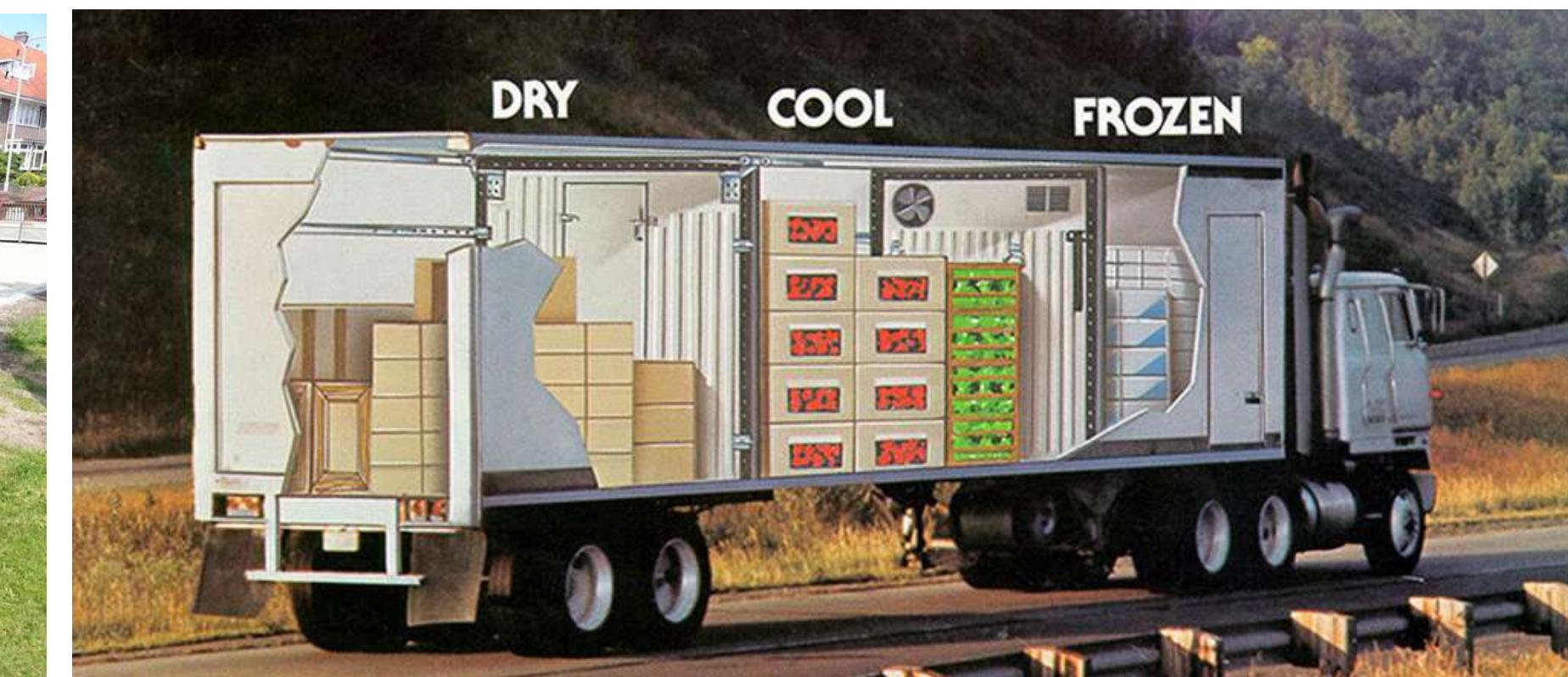
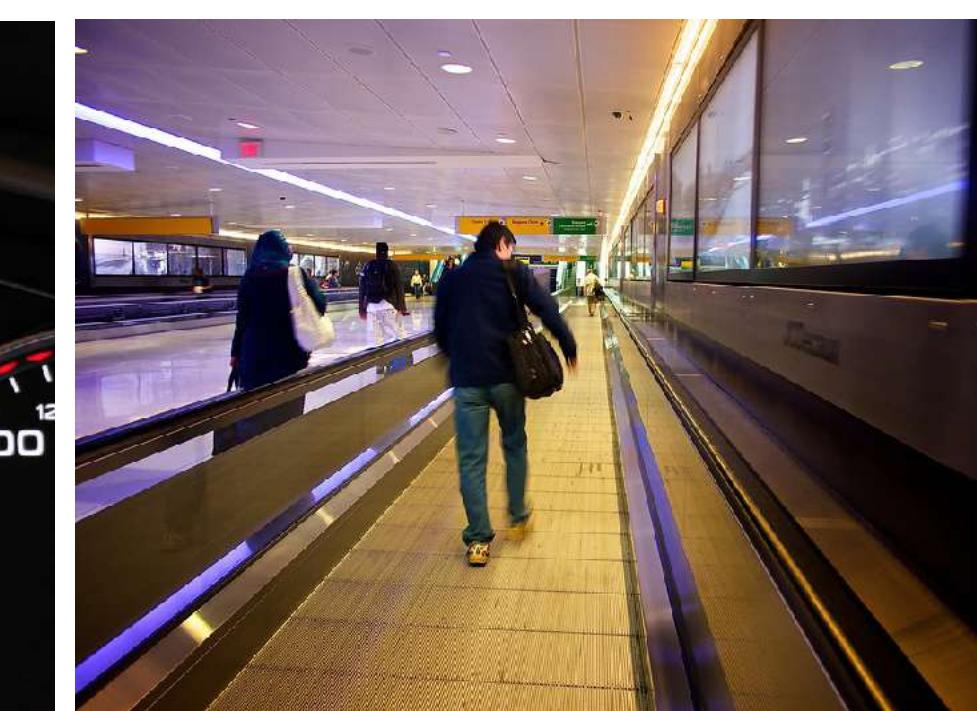
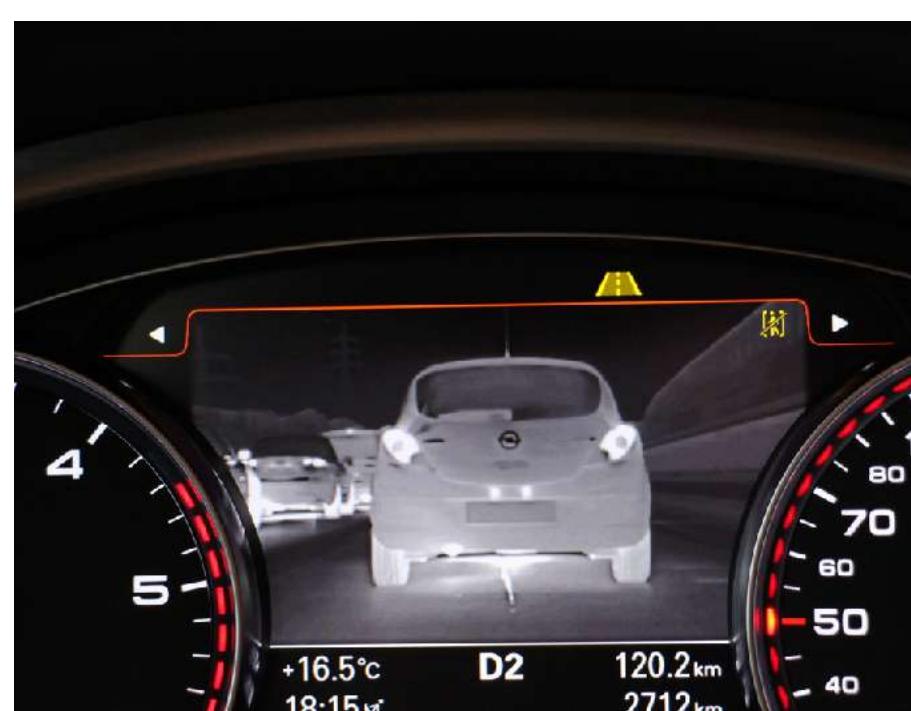




Rocket car
Medical helicopter
Tunneling machine
Car elevator
Suspension bridge
Solar road
Video chat
Autonomous car
Underwater bridge
Suburbia
Prefabricated bridge



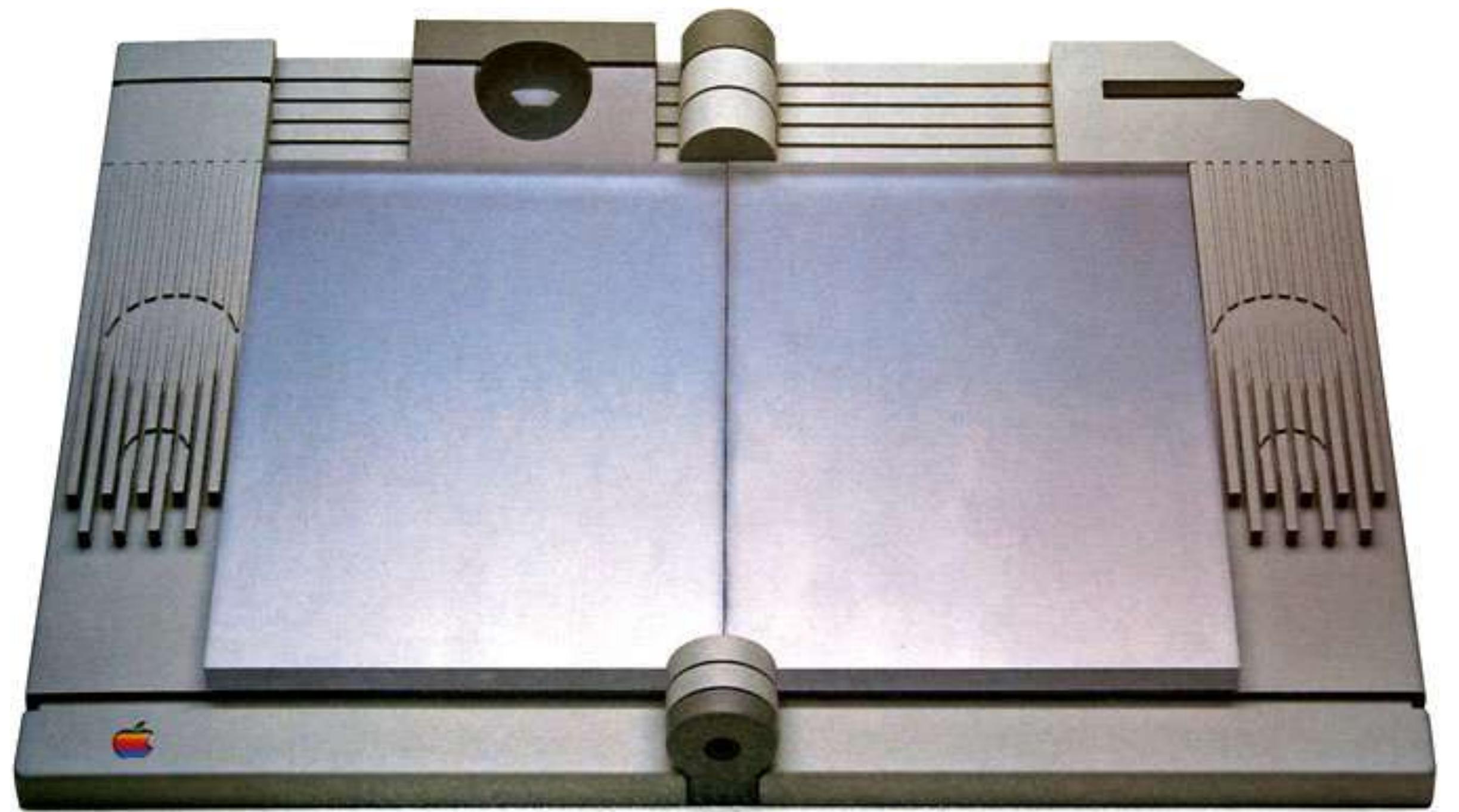
Interstate highway
Maglev train
Commercial space cargo
Solar car
Mobile store
Aquatic car
Automatic car wash
Traffic report
Rear-view camera
Map & vehicle tracking
Urban sprawl



Big highway signs
Audi night vision camera
Moving walkways
Bridge building machine
Waze speed limit alert
Brick road laying machine

Refrigerated transportation
Electric car charging at home
Mercedes Night view assist
Mobile video conferencing
FedEx overnight air delivery
Supply chain management
Hyperloop

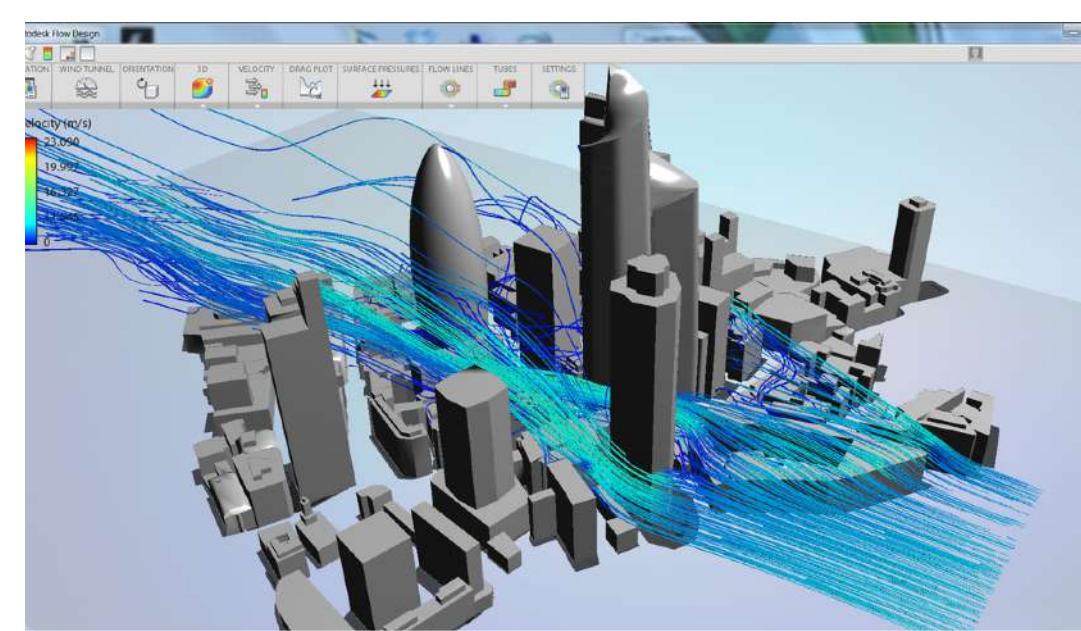
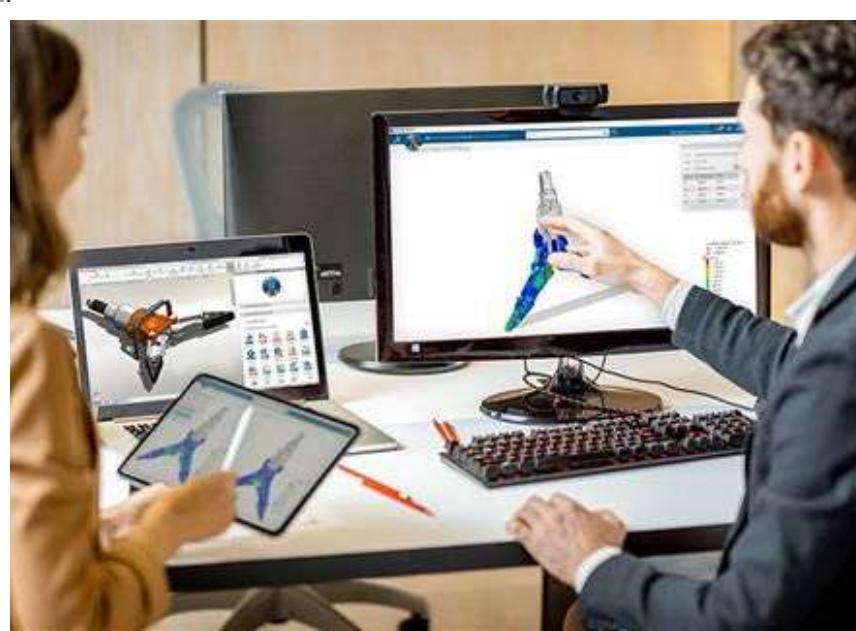
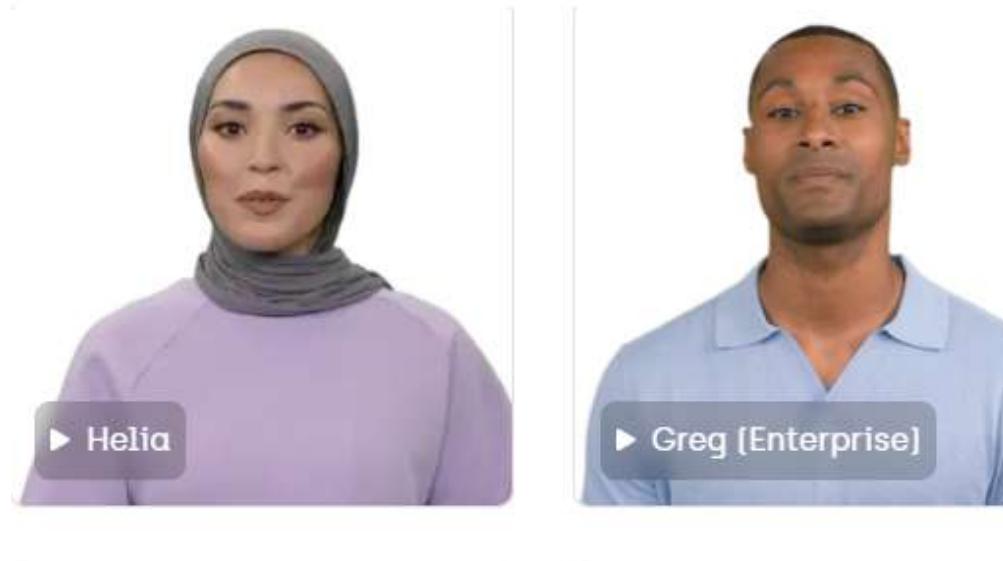
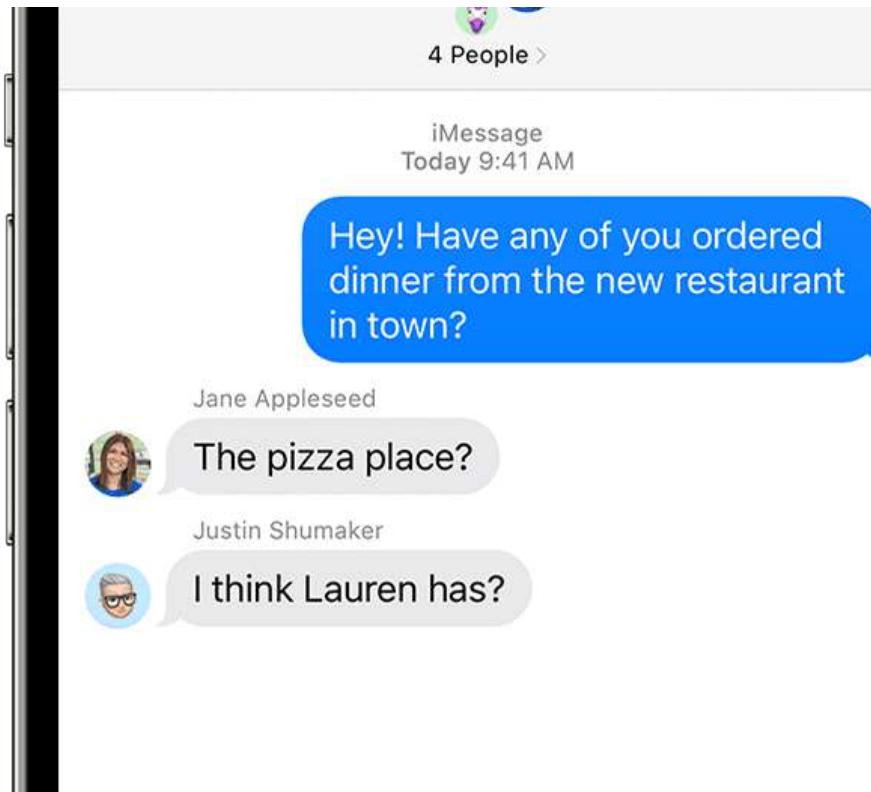
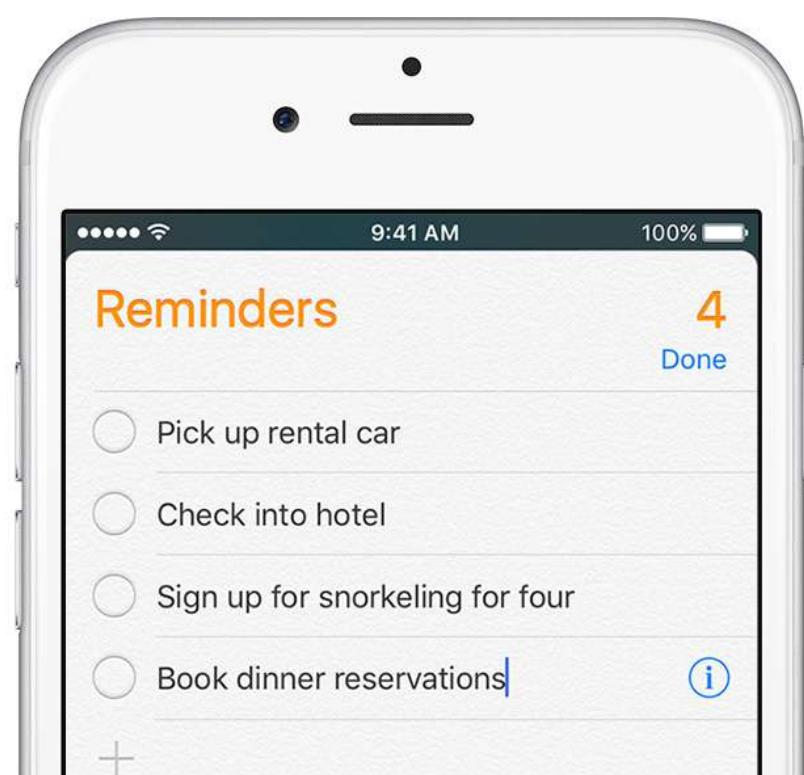






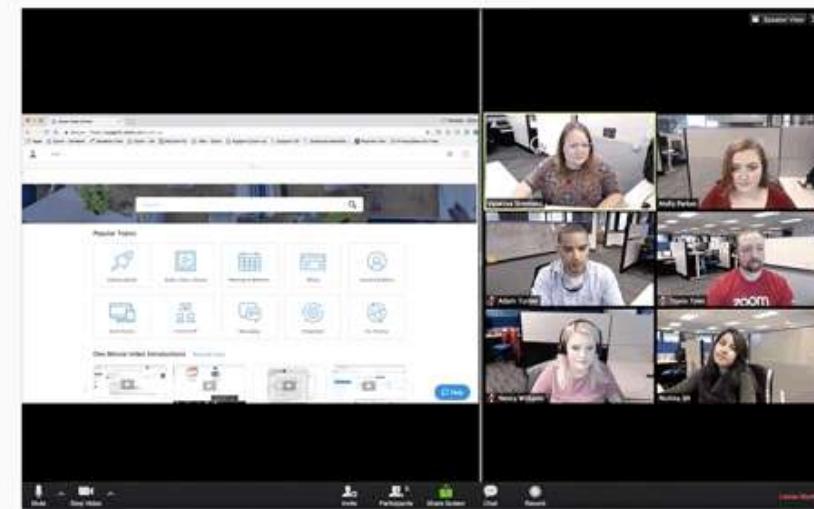
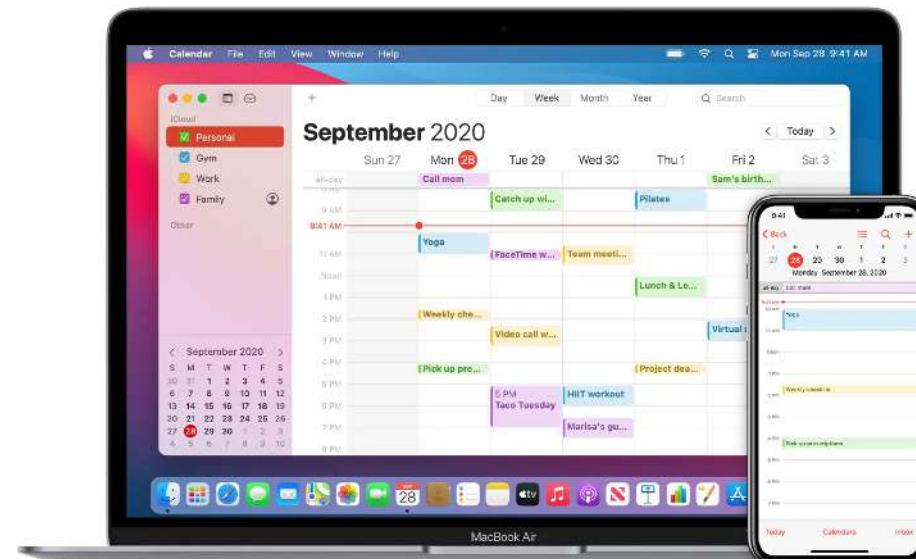
WIKIPEDIA

The Free Encyclopedia



Small Camera
Online Research Databases
Touchscreen
Digital Maps
Digital Reminders
Text Messaging
Internet
Video Conferencing

Realistic AI Avatars
Portable Thin Computers
Micro Storage Cards
Collaborative Simulations
AI Modelling and Simulation Software
Voice Assistant



Show results for **FACETED SEARCH** allows shoppers to narrow search results using attribute filters

- Any Category
- Home & Kitchen
- Furniture
- Living Room Furniture
- Chairs

Refine by

- Amazon Prime
- Chair Type
 - Reclining
 - Upholstered
 - Contemporary
 - Accent
 - Over Sized
 - Extra Wide
 - Reception
 - See more
- Set Depth
 - Clear
 - 20 Inches & Under
 - 21 to 25 Inches
 - 26 to 50 Inches
 - 31 Inches & Above

Faceted Material

See Color & Style Options

See Color Options

See Style & Color Options

Ashley Furniture Signature Design - Laredo Rocker Recliner - Manual Reclining Chair - Traditional Style - Earth

by Signature Design by Ashley

\$489⁹⁰

More Buying Choices
\$397.99 (14 new offers)

FREE Shipping on eligible orders
★ ★ ★ ★ ★ • 281

Best Selling Leather Recliner Club Chair - Signature Design by Ashley

by Best-selling

\$163⁵⁹ with coupon

Save \$94.40 with coupon

FREE Delivery by Wed, Oct 10

More Buying Choices
\$142.86 (11 used & new offers)

★ ★ ★ ★ ★ • 170

Best Selling Davis Leather Club Chair, Black

by Best-selling

\$125⁹⁹ with coupon

Save \$18.00 with coupon

FREE Delivery Fri, Nov 2 – Tue, D

★ ★ ★ ★ ★ • 315

NHI Express James Recliner (1)



AI Web Search
Digital Calendar
Foldable Screens
Screen Sharing
Faceted-Navigation
Voice over IP (VoIP)



Explore & Explain

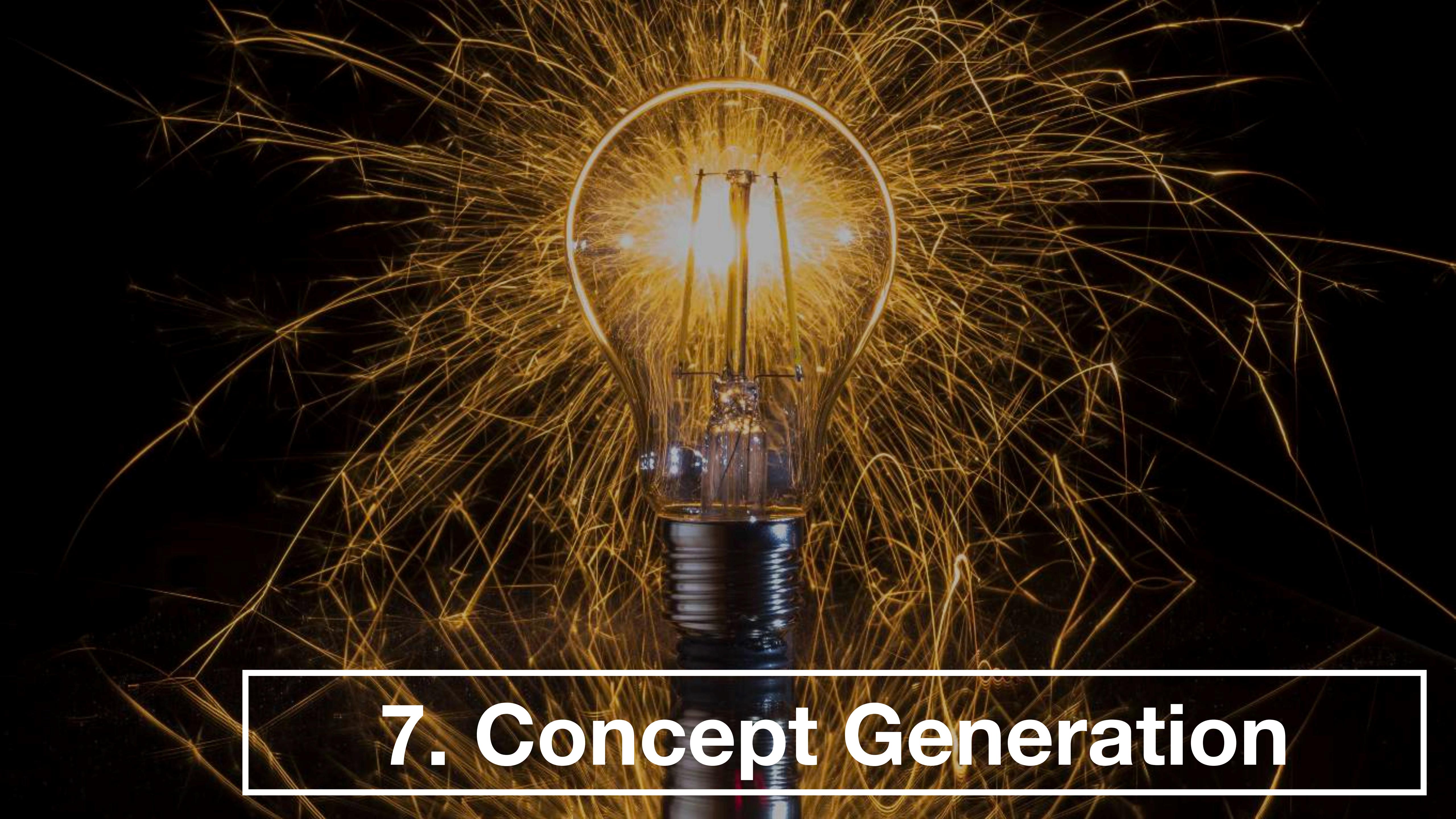
Discover and Define

1. Problem Space Definition
2. Needs & Assumptions Analysis
3. Research & Discovery
4. Stakeholder Analysis
5. Boundary & Hazard Mitigation
6. Specify Desired Outcomes
7. Concept Generation
8. Concept Downselection
9. Concept Articulation
10. Uncertainty Identification
11. Uncertainty Reduction

Explore and Explain

Make and Measure

12. Launch, Iterate, or Stop



7. Concept Generation

Concept Generation Techniques

- Open Brainstorming
- Mind Mapping
- Forced Relationships
- “To”-“By”-“Using”

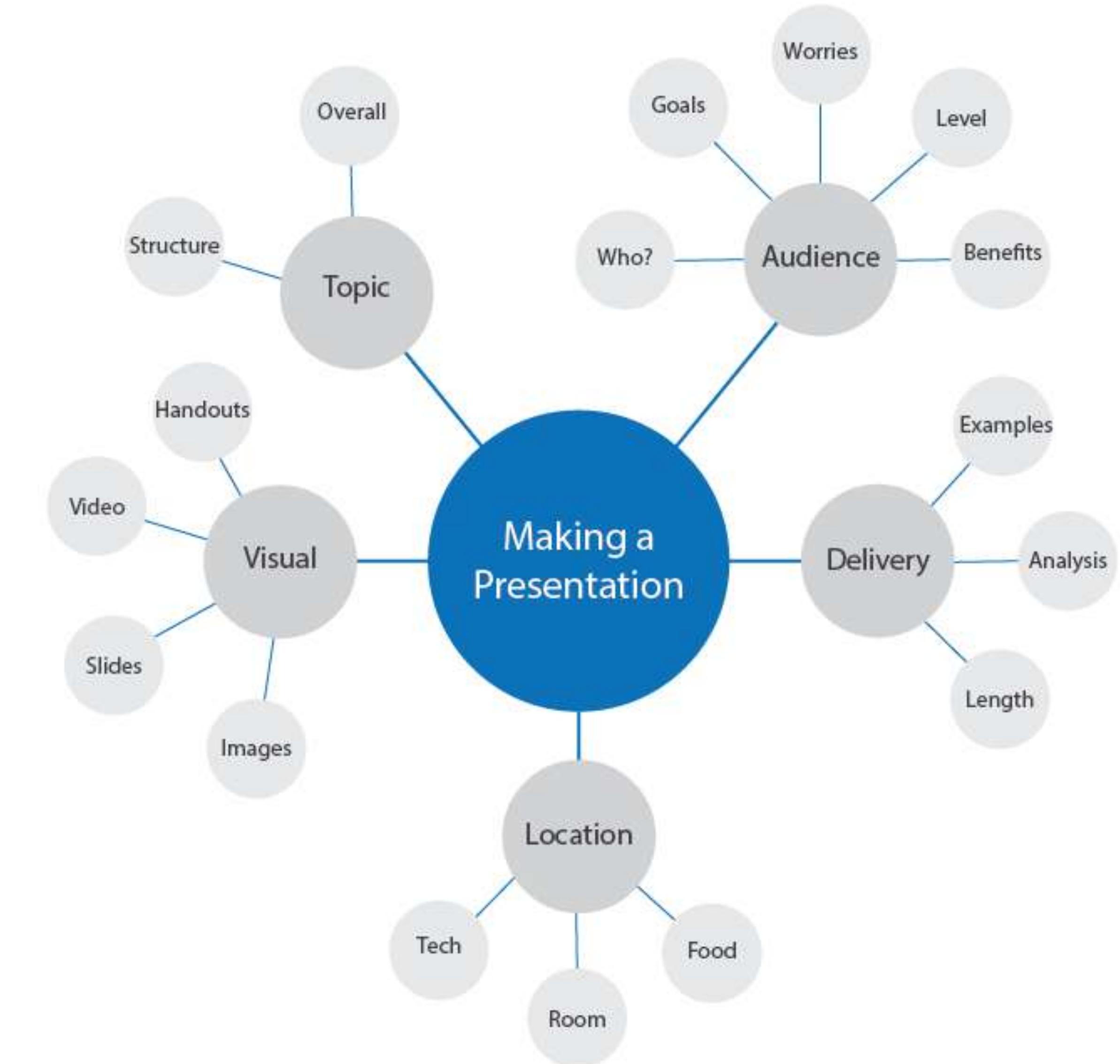
Concept Generation Techniques

- Open Brainstorming
- Mind Mapping
- Forced Relationships
- “To”-“By”-“Using”

1. In a group: generate concepts silently (1 per card)
2. Explain ideas out loud
3. Generate more ideas silently
4. Group cards into concepts
5. Generate new ideas out loud

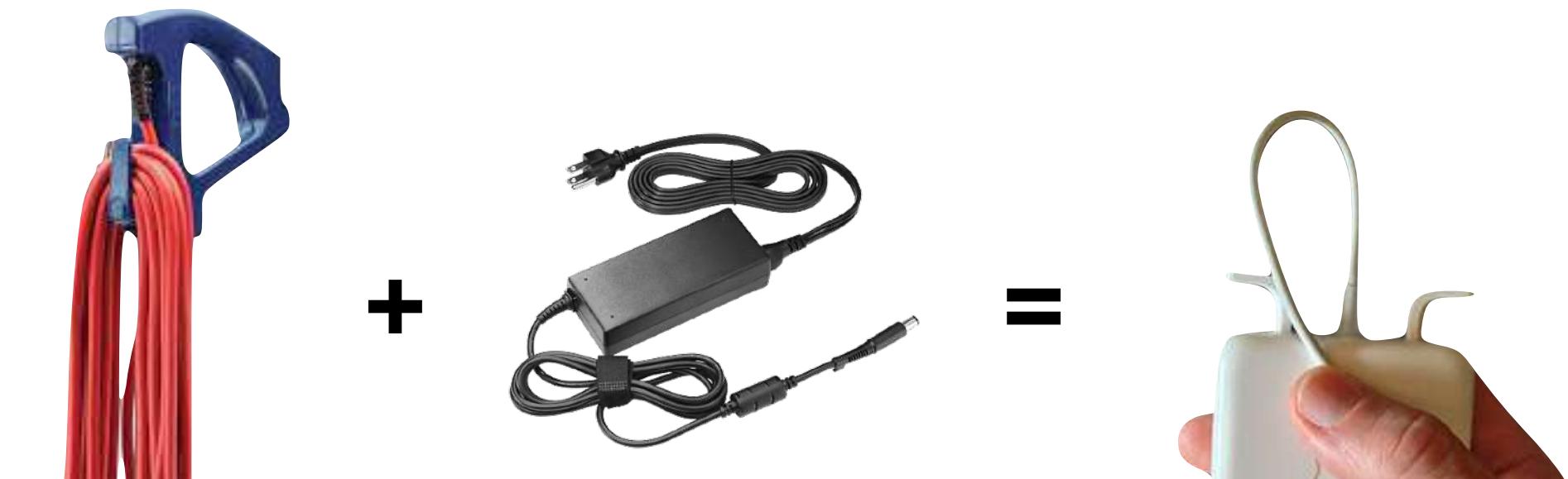
Concept Generation Techniques

- Open Brainstorming
- **Mind Mapping**
- Forced Relationships
- “To”-“By”-“Using”



Concept Generation Techniques

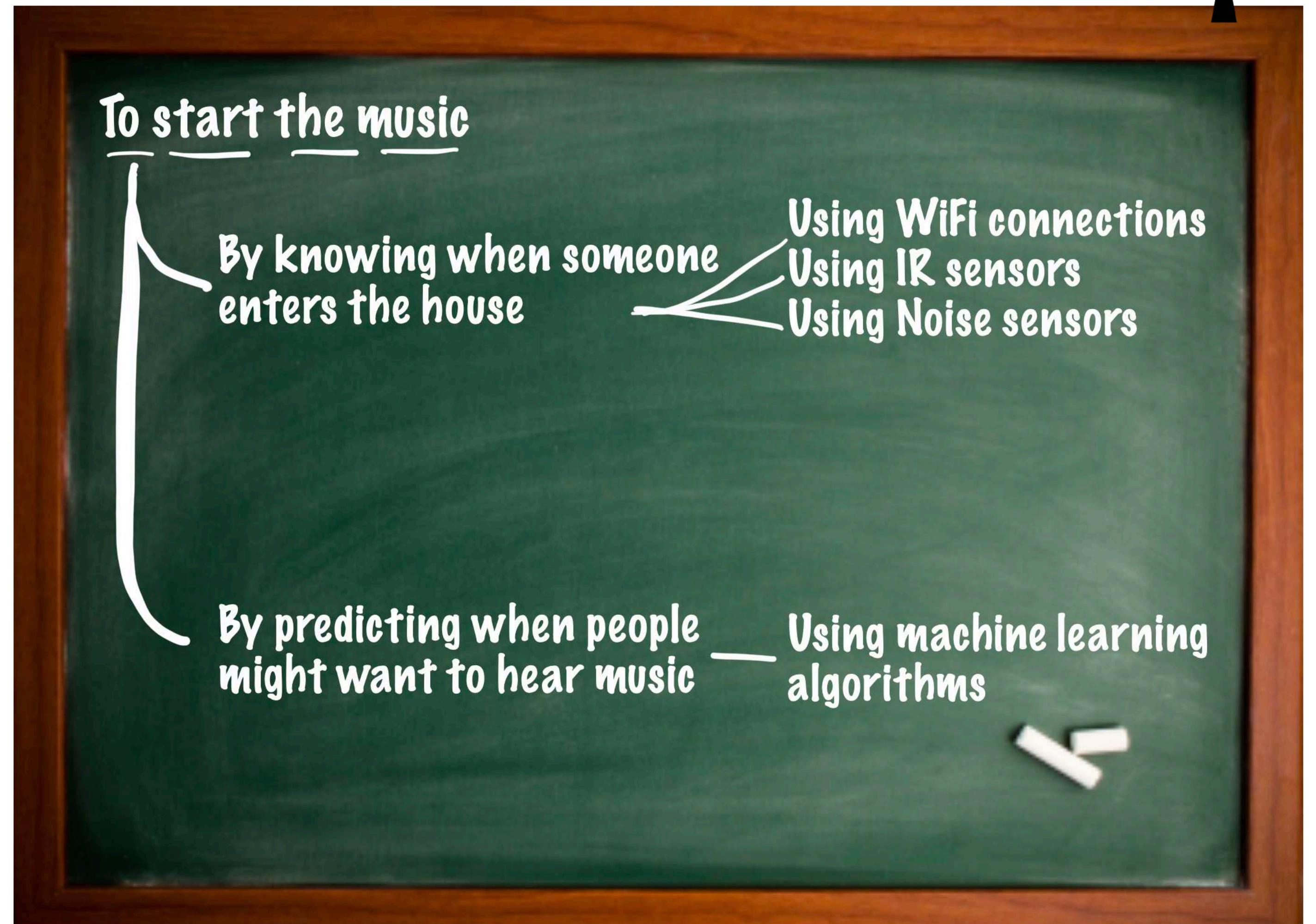
- Open Brainstorming
- Mind Mapping
- **Forced Relationships**
- “To”-“By”-“Using”



Concept Generation Techniques



- Open Brainstorming
- Mind Mapping
- Forced Relationships
- “To”-“By”-“Using”





8. Concept Downselection

Concept Downselection

- Examine all your ideas from a single session, or a group of sessions
- Eliminate as many as possible (for now). You might consider:

Does the concept...

Satisfy core user needs

Provide competitive advantage

Technical Fea

Produce strong ROI

Ensures low risk to brand

Low Resource Re

Concept Downselection Scoring

- Score concepts on a numeric scale (e.g., 1-5)
- Multiply score against weighted criteria

Criteria
Totals

Concept Downselection Scoring

- Score concepts on a numeric scale (e.g., 1-5)
- Multiply score against weighted criteria

Criteria	Weight	Concept 1 (1-5)		Concept 2 (1-5)	
		Score	Weighted	Score	Weighted
Meets user needs	5	3	15	3	15
Aligns to brand	2	4	8	2	4
Easy to prototype	2	3	6	3	6
Totals			29		25

Concept Downselection Scoring

- Score concepts on a numeric scale (e.g., 1-5)
- Multiply score against weighted criteria

Criteria	Weight	Concept 1 (1-5)		Concept 2 (1-5)	
		Score	Weighted	Score	Weighted
Meets user needs	5	3	15	3	15
Aligns to brand	2	4	8	2	4
Easy to prototype	2	3	6	3	6
Deployable in 18 months	5	3	15	5	25
Totals			44		50

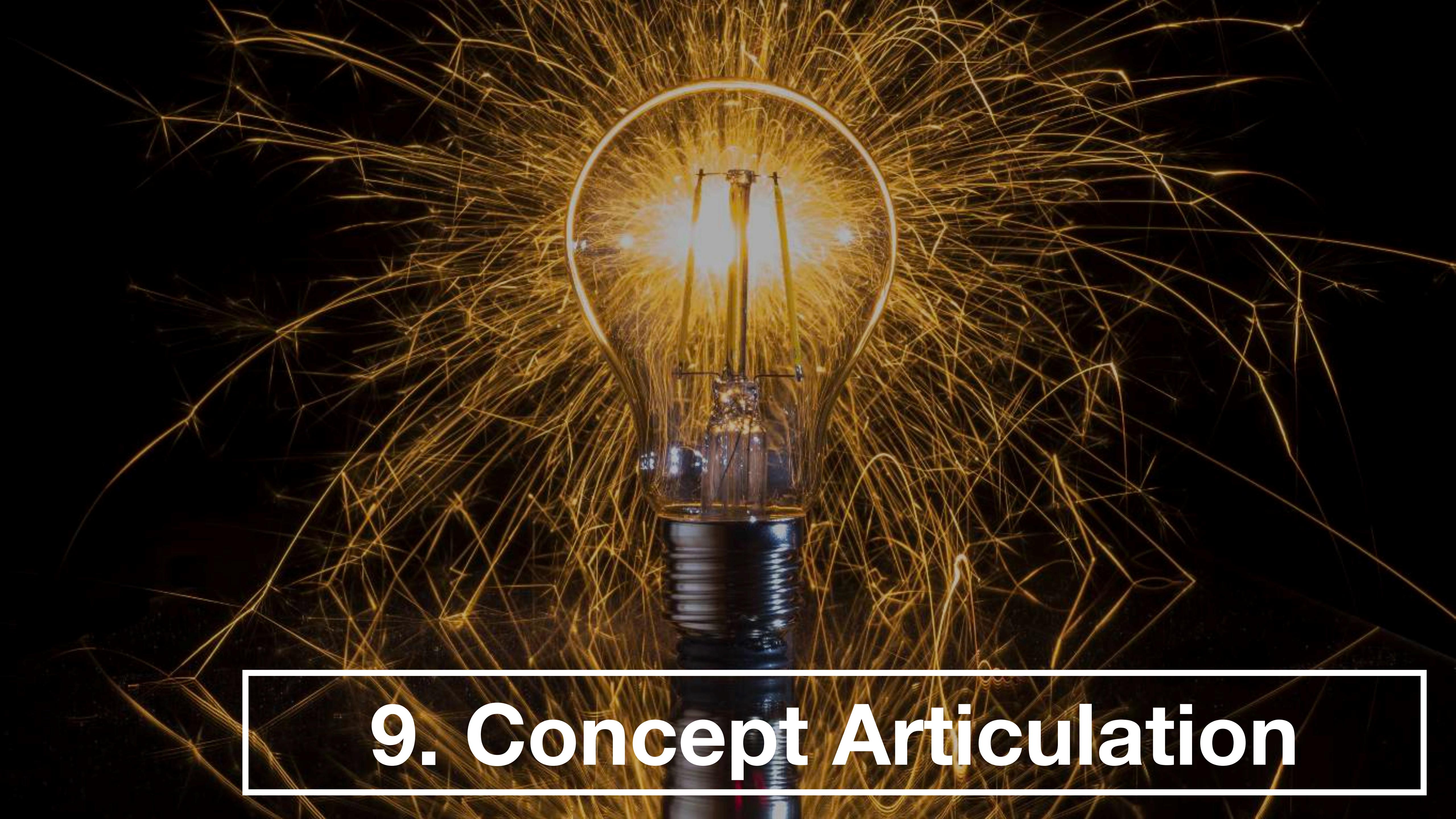
A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try

Concept Downselection Practice

- Concept 1: Transportation to the office (5km away) **by bike** for a couple
- Concept 2: Transportation to the office (5km away) **by car** for a couple

Criteria	Weight	Concept 1 (1-5)		Concept 2 (1-5)	
		Score	Weighted	Score	Weighted
Comfort			0		0
Ease of transporting items			0		0
Getting though traffic			0		0
<i><add your own></i>			0		0
Totals			0		0



9. Concept Articulation

Concept Articulation

- Quickly capture the essence of the concept
- Articulate the concept in *any* medium that explains the important aspects of the concept
- Use this articulation to show a vision of a better future for your stakeholders

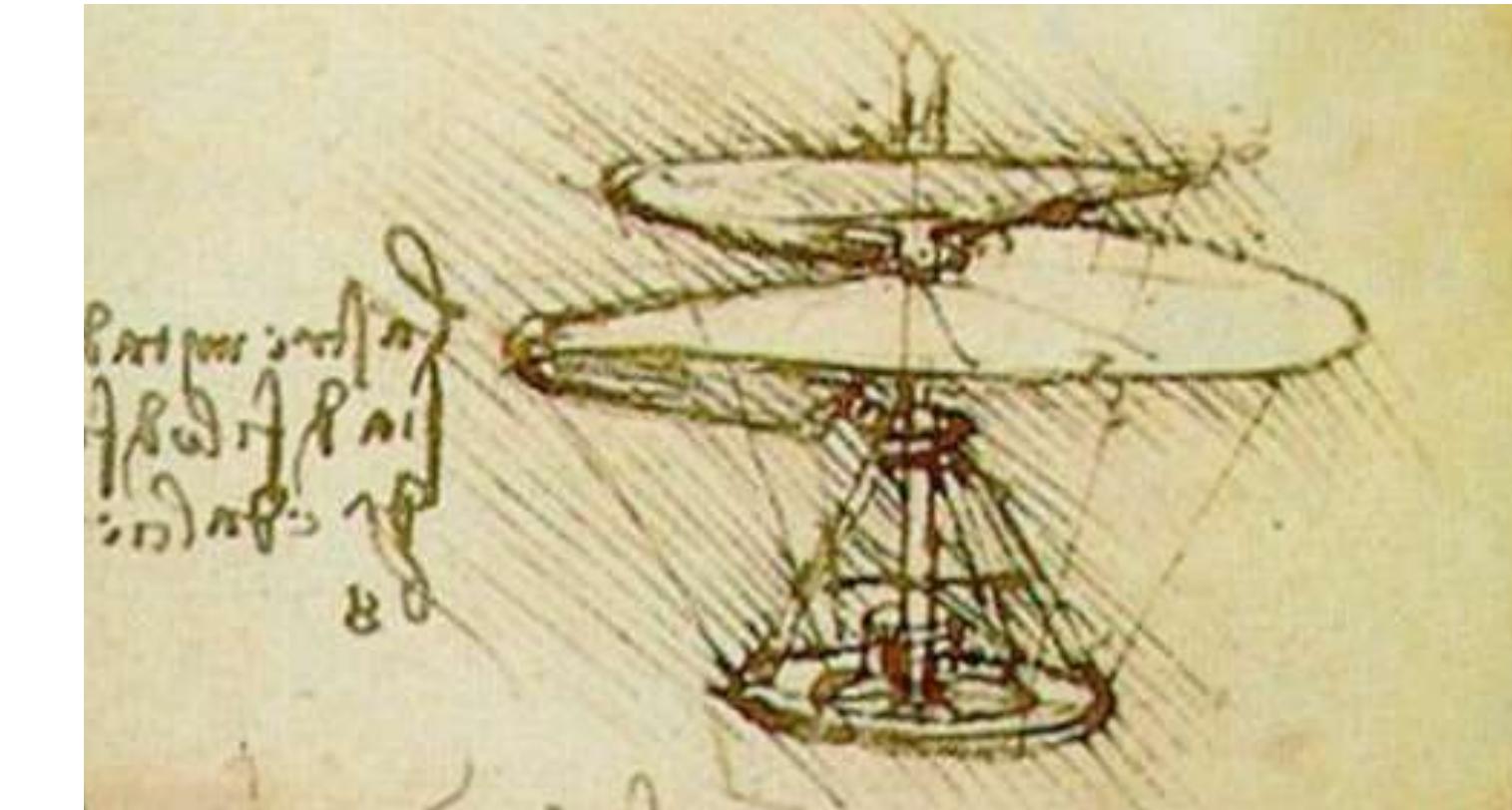
Concept Articulation Methods

- Visual
 - Sketching (paper or digital tools)
 - 3D modeling (CAD or cardboard)
- Textual
 - K-Scripts
 - Audio recordings

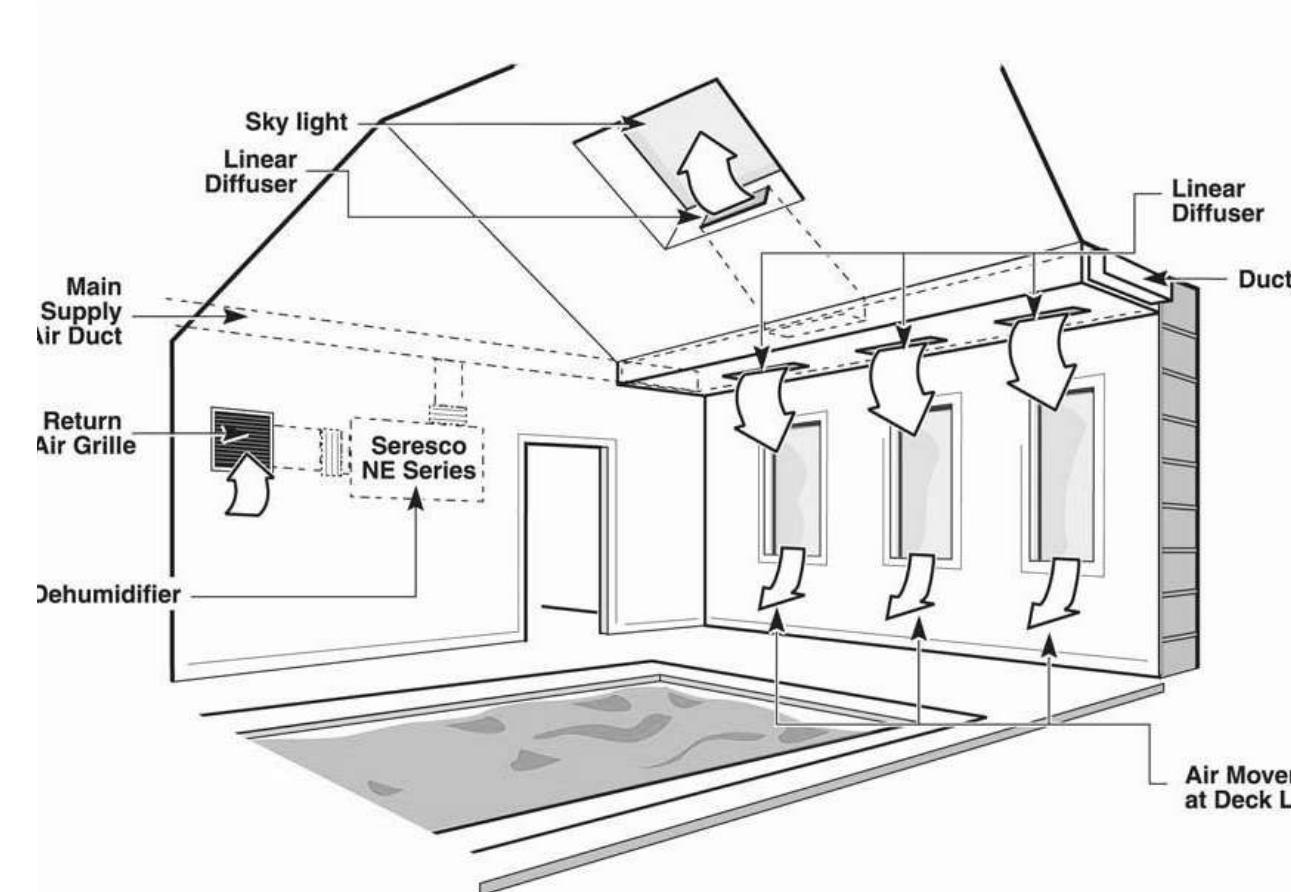
2-D Visual Sketching



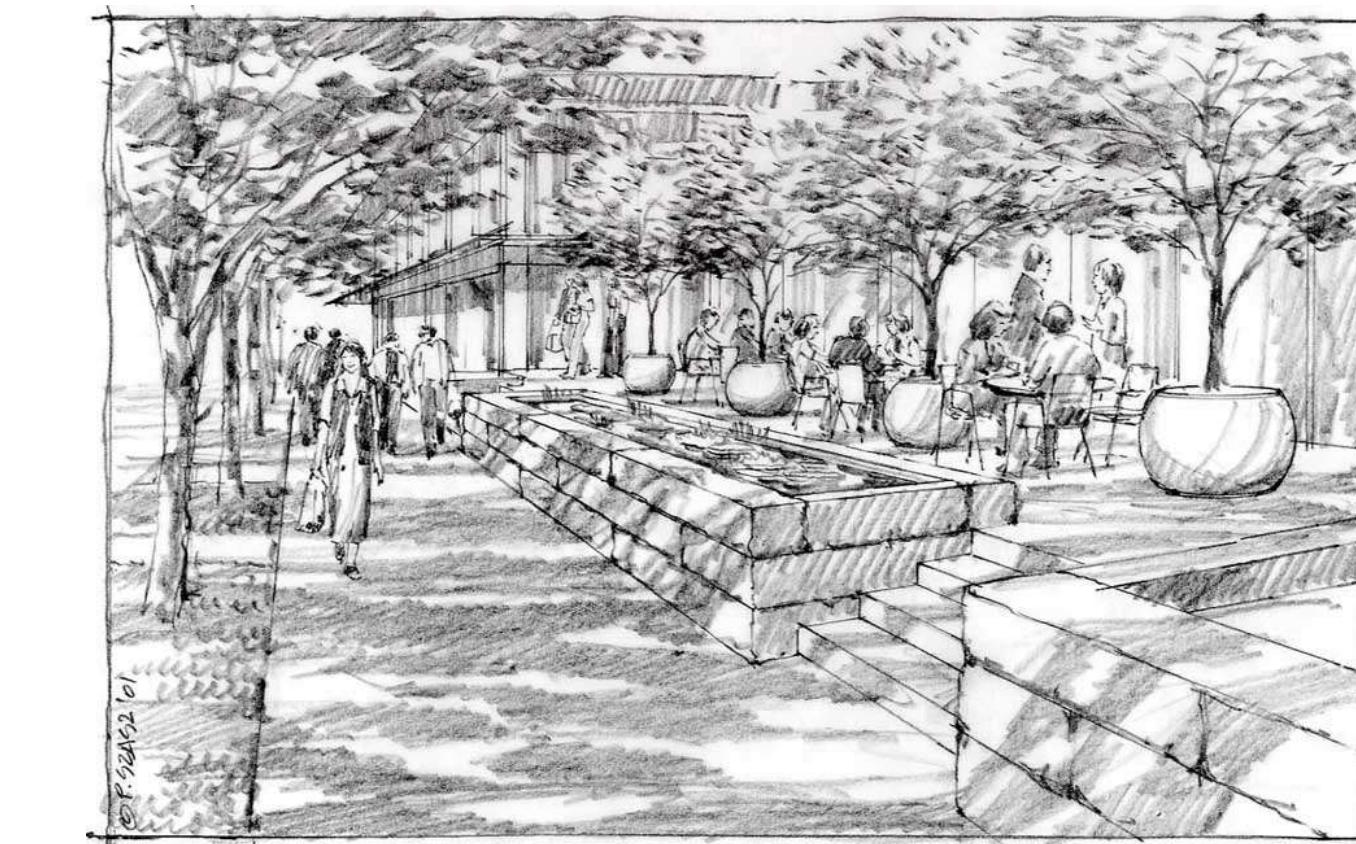
Share Analysis



Share Early Concepts



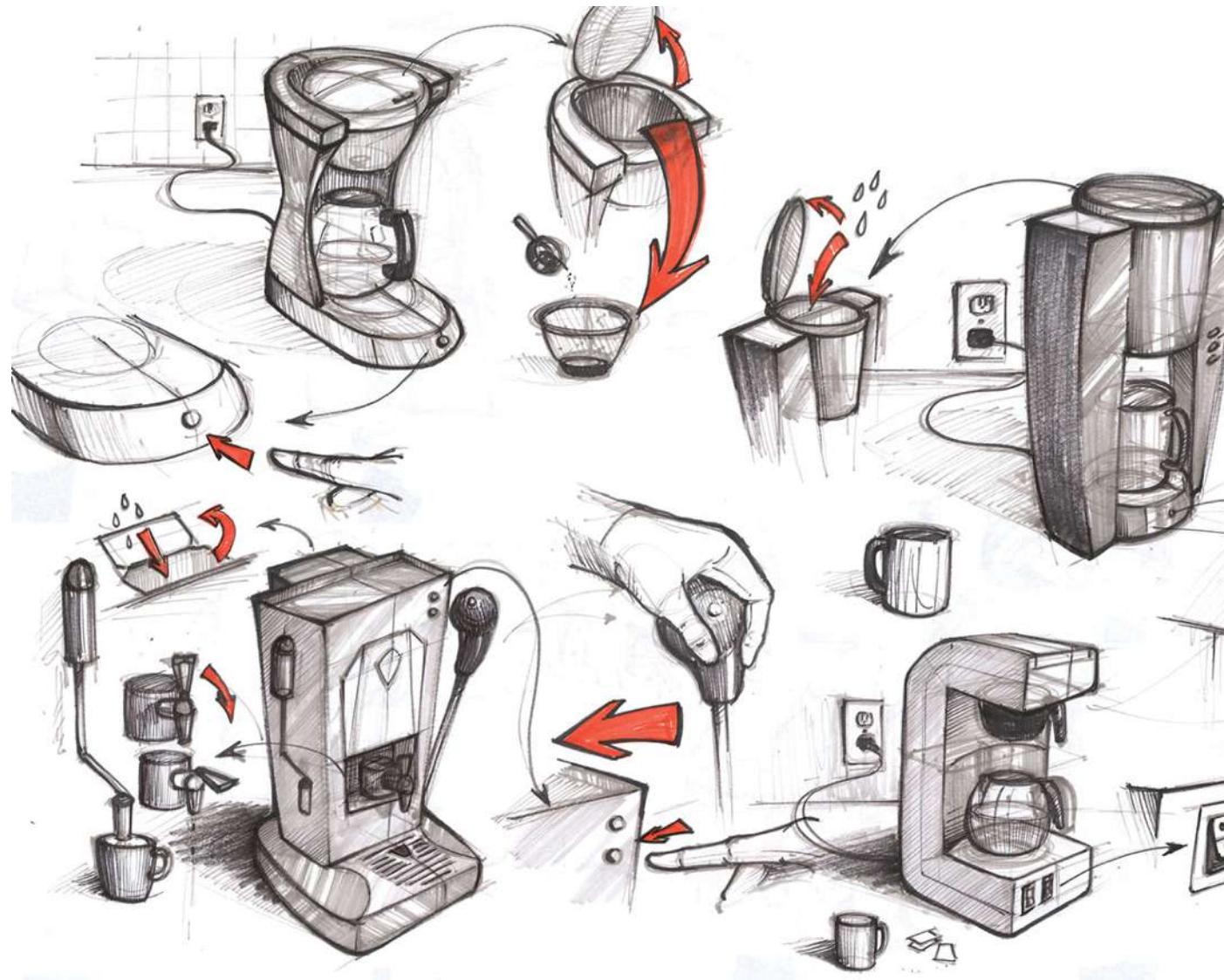
Share Structures



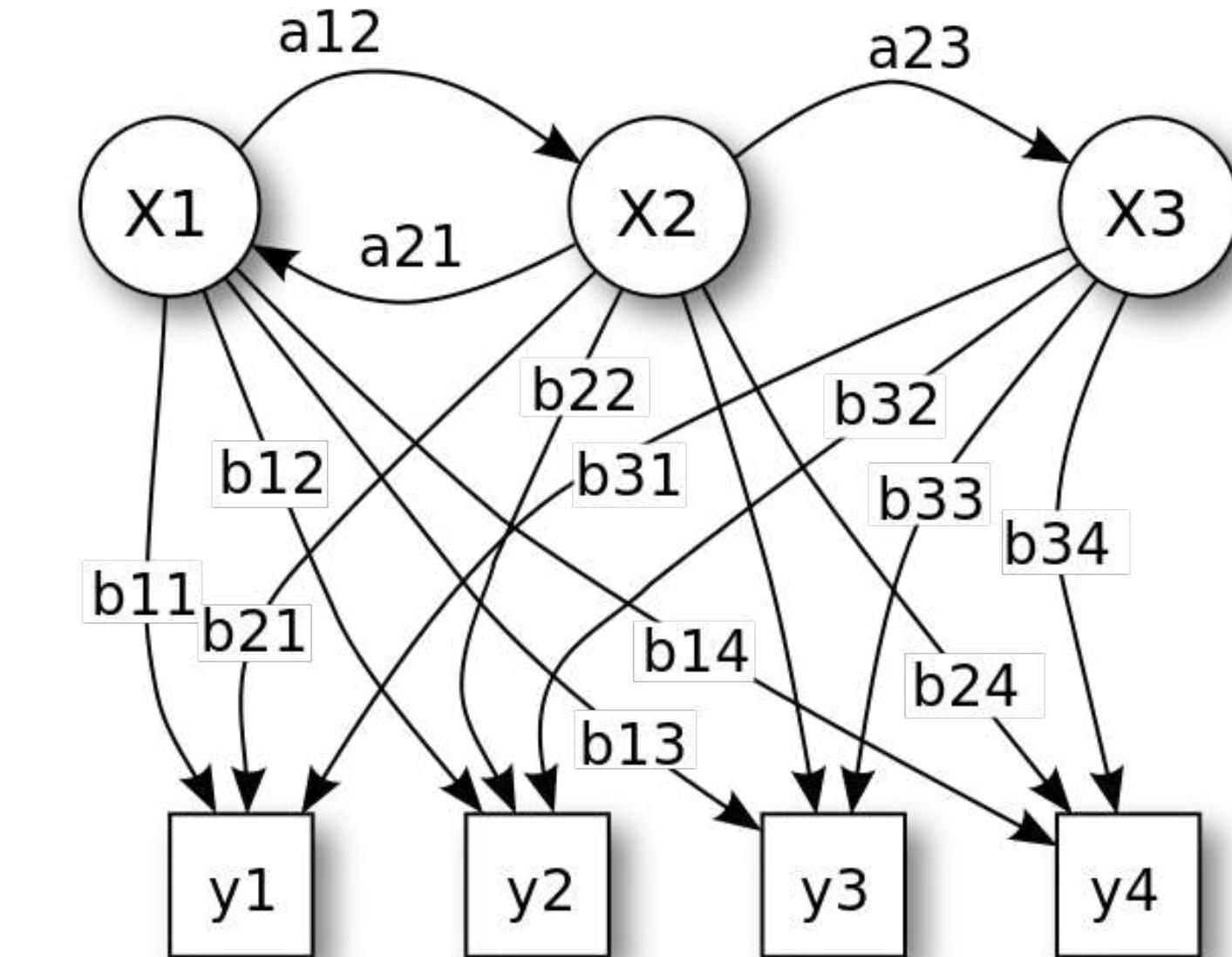
Share Experience Concepts

How Do We Sketch Concepts For...

- Physical objects
 - Calculator, Coffee Machine
 - Shopping mall, Phone



- Process
 - Line at Disney World
 - Manufacturing, Chemical up-scaling



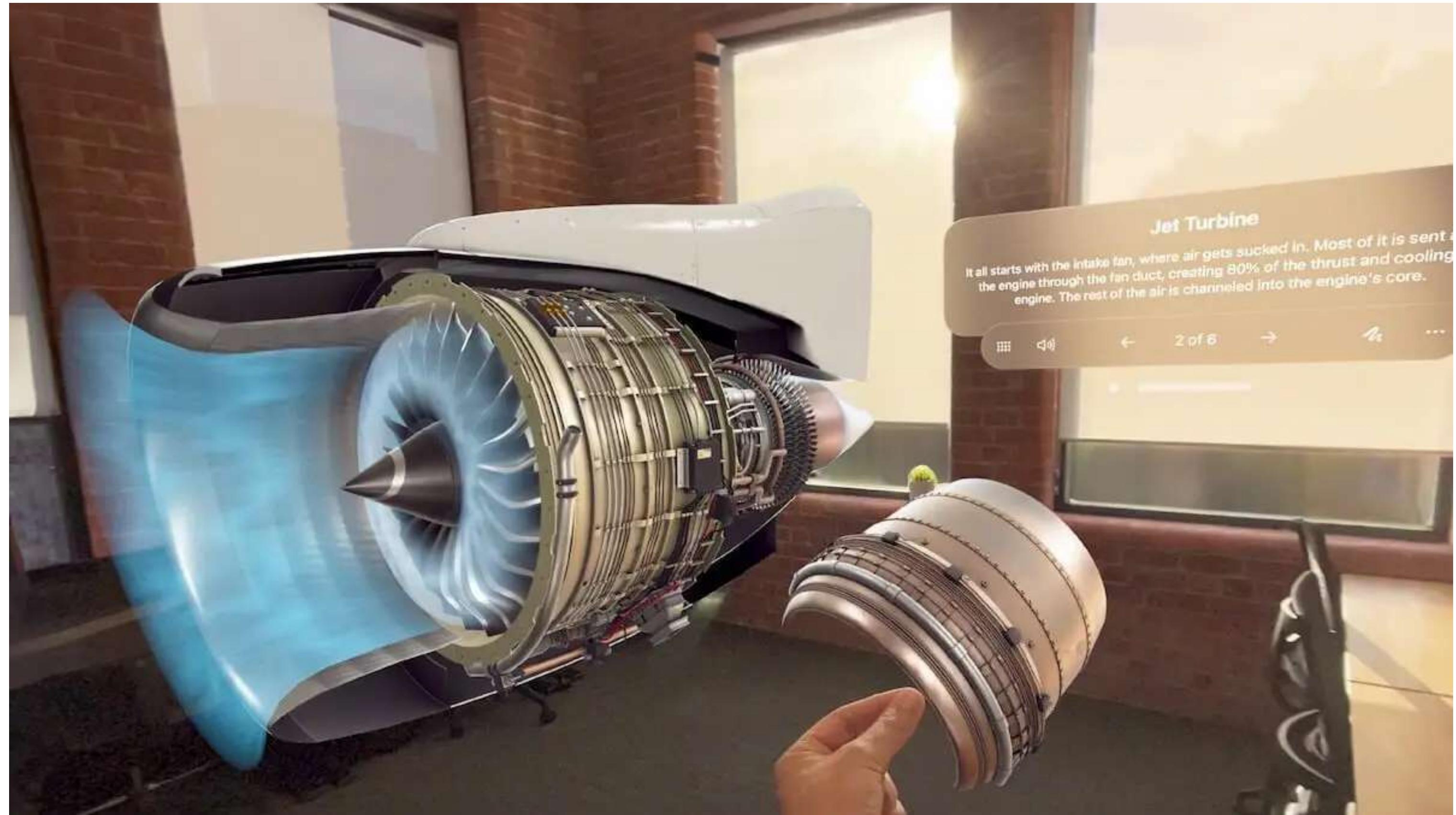
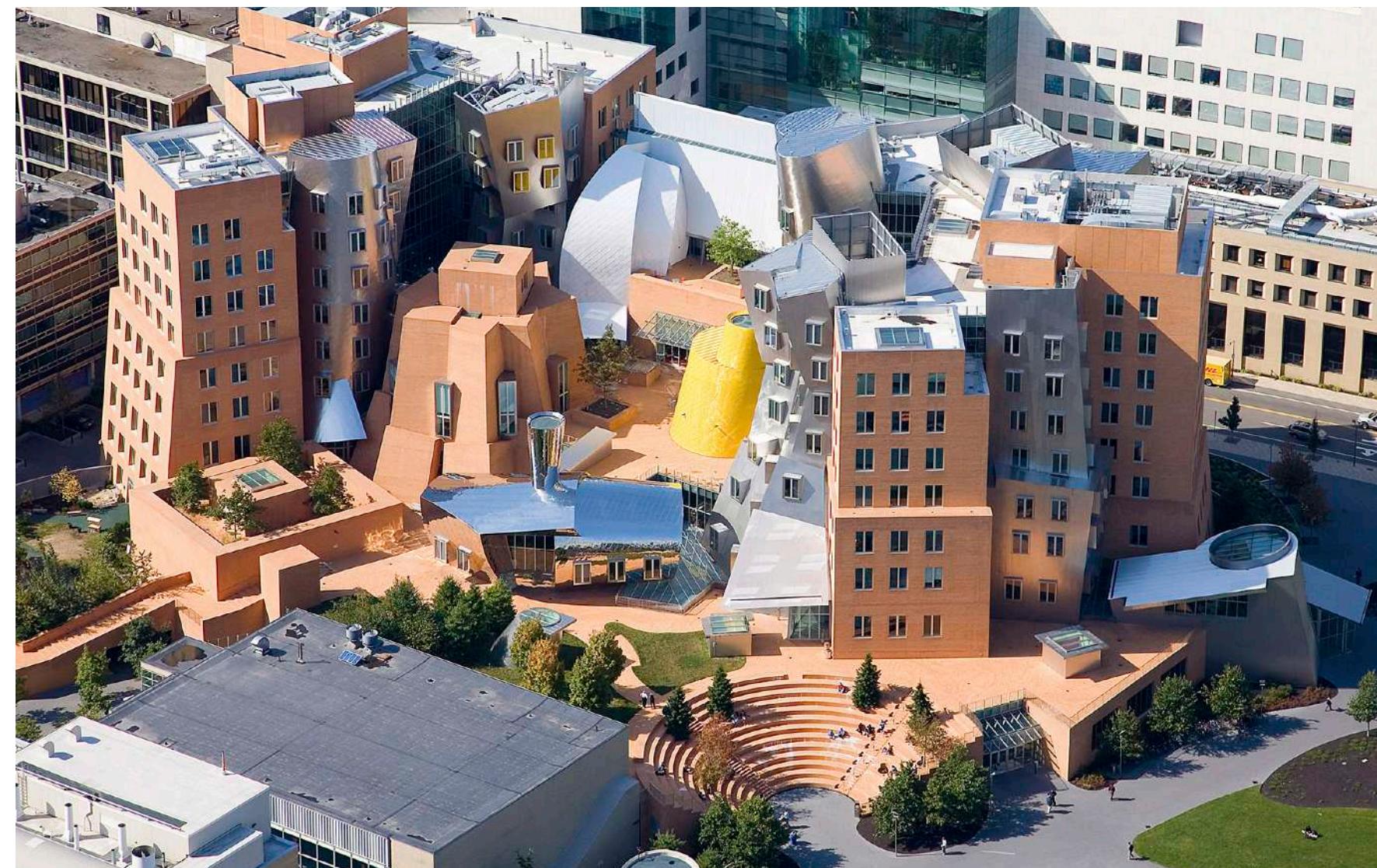
Textual Sketching

K-Script

- Easier to collaborate than 2-D visual sketching
- Creates compelling vision

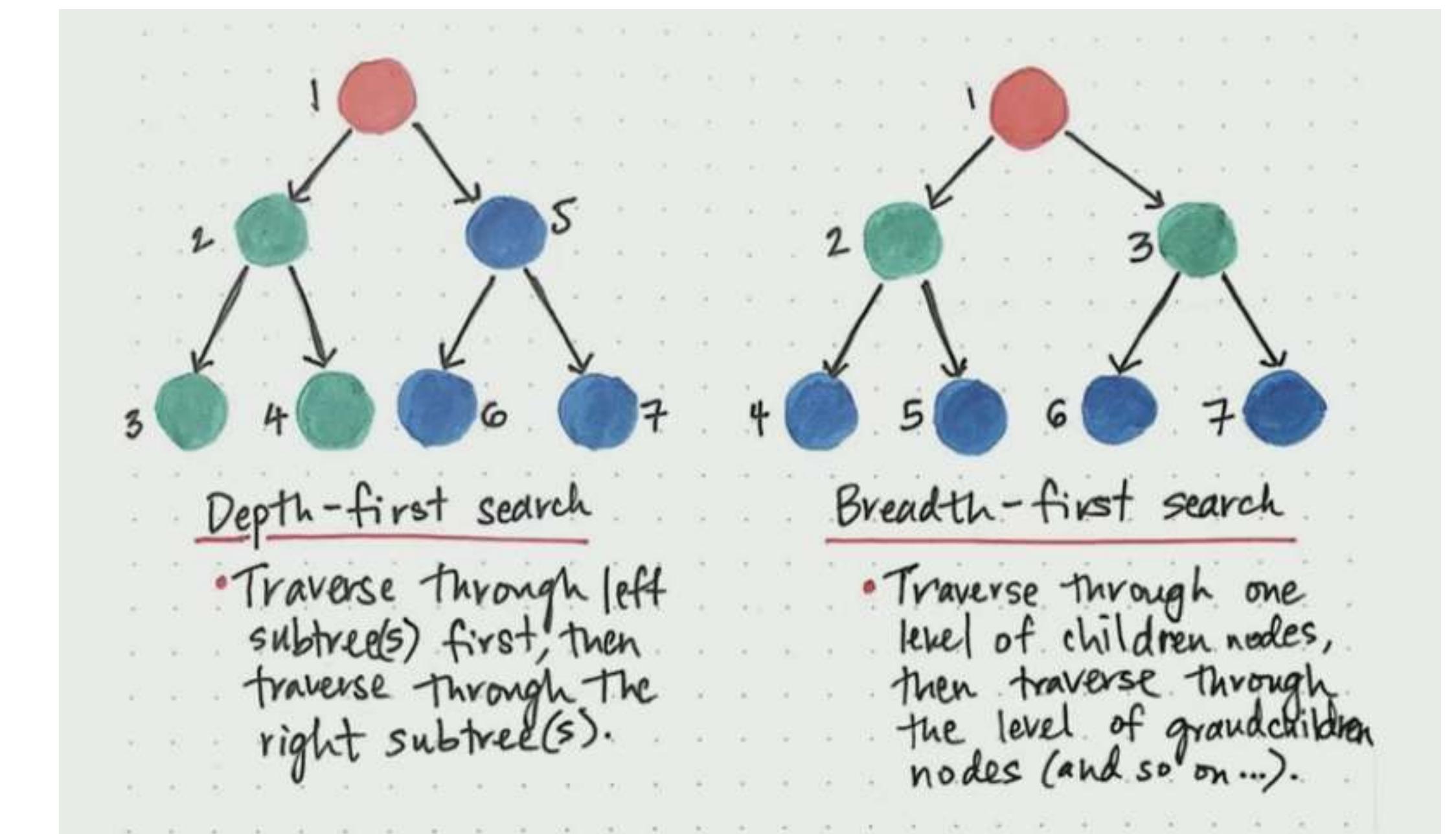
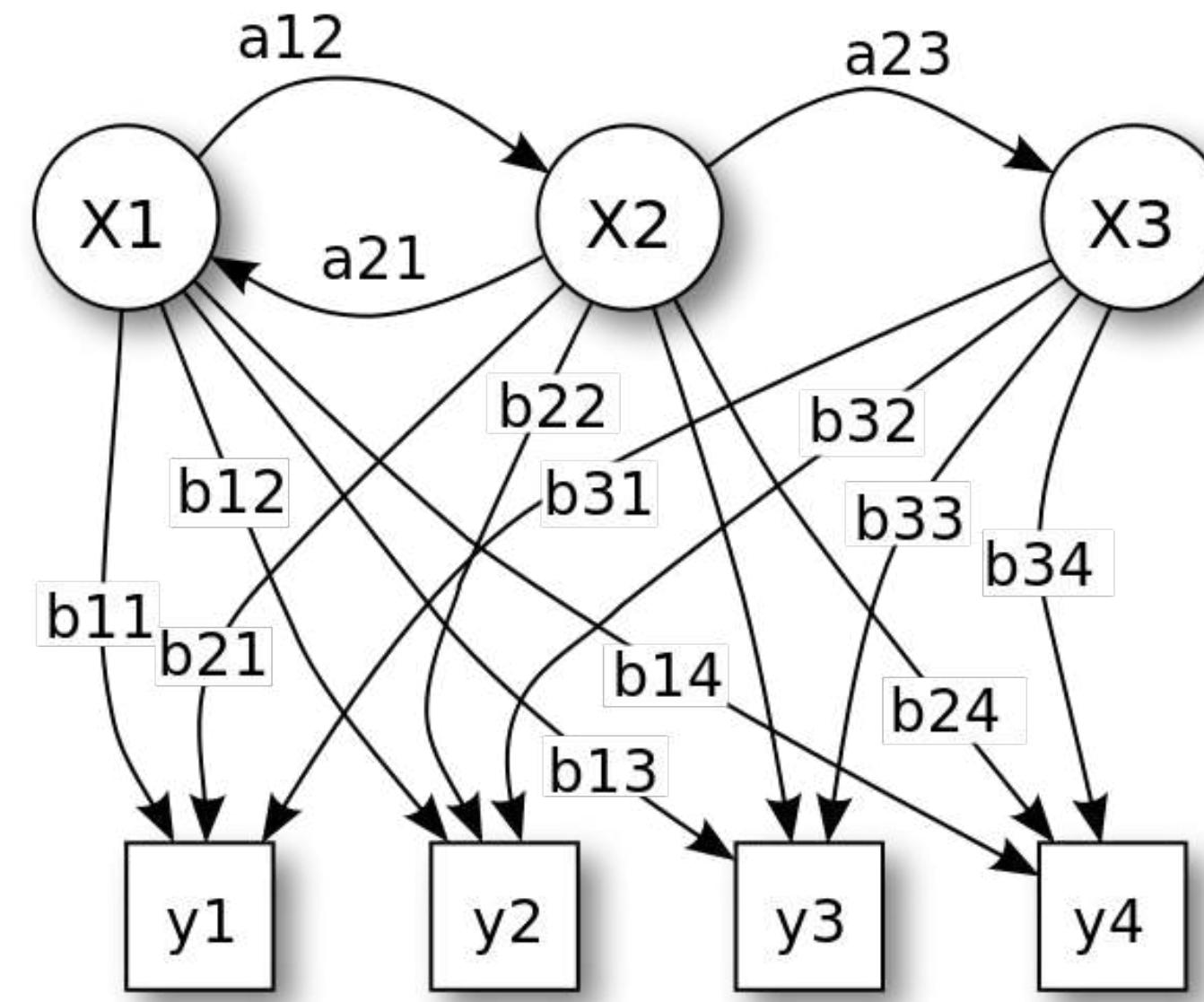
Who	Observable Action	Unobservable Action / Notes
Customer	Walks into the fair ground and sees a bunch of very modern touch-screen kiosks in a row, like at an airport. She sees the screen which has 2 buttons, "Buy Tickets", "Make dinner reservations"	In research, we found that people generally want these 2 options, and we expect to have a limited number of staff there to handle other kinds of requests
Customer	Clicks on "Buy tickets"	Is this odd if they have a coupon for free tickets? How about just "Tickets" ?
Kiosk	The screen shows "Number of Adults?" with a "+" and "-" button and it's default is set to "1", and "Number of Children?" with a "+" and "-" button and it's default is set to "0" and a "Next" button	What if the user made a mistake? Can they start over? Why not show prices here too? Prices aren't displayed now, because there's another screen which allows people to enter or scan discount codes/coupons Smart idea to have "1" as the default number of adults!
Customer	Hits the "Next" button	
Kiosk	Screen shows the price "\$24.00 Enter discount code, or scan a coupon" and a "Next" button	Will people know how to scan a coupon? where's the scanner?
Customer	Taps "Next"	
Kiosk	With the price still on the screen, directs the customer to swipe their credit card.	Are we going to be able to use ApplePay here?
Customer	Swipes the card	
Kiosk	Plays a success sound, shows a success message and a ticket is printed out	I love the idea of the sound – can we have more sounds in this interaction?
Customer	There's a "Done" button that takes them back to the home screen. A confirmation number is shown so that if tickets don't print out they can talk to someone about their transaction.	How about this? I just want to make sure we don't have issues if the printers don't work

3-D Visual Sketching



Algorithm Sketching

- Process
 - Line optimization at Disney World
 - Manufacturing, chemical up-scaling
- Software
 - AI models
 - Database connection relationships



A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try

The K-Script Vision Creation Method

Who	Observable Action	Unobservable Action / Notes
------------	--------------------------	------------------------------------

Who	Observable Action	Unobservable Action / Notes
Customer	Walks into the fair ground and sees a bunch of very modern touch-screen kiosks in a row, like at an airport. She sees the screen which has 2 buttons, “Buy Tickets”, “Make dinner reservations”	In research, we found that people generally want these 2 options, and we expect to have a limited number of staff there to handle other kinds of requests
Customer	Clicks on “Buy tickets”	
Kiosk	The screen shows “Number of Adults?” with a “+” and “-“ button and it’s default is set to “1”, and “Number of Children?” with a “+” and “-“ button and it’s default is set to “0” and a “Next” button	Prices aren’t displayed now, because there’s another screen which allows people to enter or scan discount codes/coupons
Customer	Hits the “Next” button	
	Screen shows the price “\$24.00. Enter	

New design of a new ticketing kiosk at a large fair

Who	Observable Action	Unobservable Action / Notes
Customer	Walks into the fair ground and sees a bunch of very modern touch-screen kiosks in a row, like at an airport. She sees the screen which has 2 buttons, “Buy Tickets”, “Make dinner reservations”	In research, we found that people generally want these 2 options, and we expect to have a limited number of staff there to handle other kinds of requests
Customer	Clicks on “Buy tickets”	
Kiosk	The screen shows “Number of Adults?” with a “+” and “-“ button and it’s default is set to “1”, and “Number of Children?” with a “+” and “-“ button and it’s default is set to “0” and a “Next” button	Prices aren’t displayed now, because there’s another screen which allows people to enter or scan discount codes/coupons
Customer	Hits the “Next” button	
Kiosk	Screen shows the price “\$24.00 Enter discount code, or scan a coupon” and a “Next” button	
Customer	Taps “Next”	
Kiosk	With the price still on the screen, directs the customer to swipe their credit card.	
Customer	Swipes the card	
Kiosk	Plays a success sound, shows a success message and a ticket is printed out	

The Revised K-Script With edits by 2 readers using collaboration tools

Who	Observable Action	Unobservable Action / Notes
Customer	Walks into the fair ground and sees a bunch of very modern touch-screen kiosks in a row, like at an airport. She sees the screen which has 2 buttons, "Buy Tickets", "Make dinner reservations"	In research, we found that people generally want these 2 options, and we expect to have a limited number of staff there to handle other kinds of requests
Customer	Clicks on "Buy tickets"	Is this odd if they have a coupon for free tickets? How about just "Tickets" ?
Kiosk	The screen shows "Number of Adults?" with a "+" and "-" button and it's default is set to "1", and "Number of Children?" with a "+" and "-" button and it's default is set to "0" and a "Next" button	What if the user made a mistake? Can they start over? Why not show prices here too? Prices aren't displayed now, because there's another screen which allows people to enter or scan discount codes/coupons Smart idea to have "1" as the default number of adults!
Customer	Hits the "Next" button	
Kiosk	Screen shows the price "\$24.00 Enter discount code, or scan a coupon" and a "Next" button	Will people know how to scan a coupon? where's the scanner?
Customer	Taps "Next"	
Kiosk	With the price still on the screen, directs the customer to swipe their credit card.	Are we going to be able to use ApplePay here?
Customer	Swipes the card	
Kiosk	Plays a success sound, shows a success message and a ticket is printed out	I love the idea of the sound – can we have more sounds in this interaction?
Customer	There's a "Done" button that takes them back to the home screen. A confirmation number is shown so that if tickets don't print out they can talk to someone about their transaction.	How about this? I just want to make sure we don't have issues if the printers don't work

K-Script for Ethnographic Research: Ordering a Meatball Sub

Who	Observable Action	Unobservable Action / Notes
Customer	Walks up to the counter and sees a menu listing sandwiches. Looks at the deli guy and says "I'll take a large meatball sub."	If the deli guy is busy, the customer would generally have to wait. Perhaps we should add a bell?
Deli guy	"Ok, do you want cheese?"	
Customer	"...uh..."	The cheeses are not listed on the menu, most people know what they want. If there were a long enough pause, the deli guy would tell them their options.
Customer	"Yeah do you have provolone?"	
Deli guy	"Yeah. Sauce?"	
Customer	"Yeah."	Customers generally know that meatball subs have tomato sauce, and not some other kind. And the deli guy will make it in view of the customer.

Who	Observable Action	Unobservable Action / Notes
System	<Audio Icon> Are you calling for technical support of an Apple product?	
Caller	Yes	
System	Just say the name of the product for which you want technical support. For example, you could say: "PowerMac G4" or "iPod." Go ahead:	
Caller	It's an iPod.	
System	An iPod. Okay, what type of computer are you using it with, primarily? Say the name of the Macintosh computer or say "a Windows machine." Go ahead:	
Caller	Uh... A graphite iMac.	
System	Alright. Was the <i>computer</i> bought by a school or using an educational discount?	Language emphasis here to indicate that the question is regarding the "computer" not the "iPod."
Caller	No.	
System	Great. I'll transfer you to an iPod specialist. Hold on. <Exit Audio Icon>	

K-Script for Apple Speech System

Medium Article

<https://medium.com/@bladekotelly/k-scripts-the-fastest-and-most-flexible-way-to-articulate-a-user-experience-97264d9c4786>

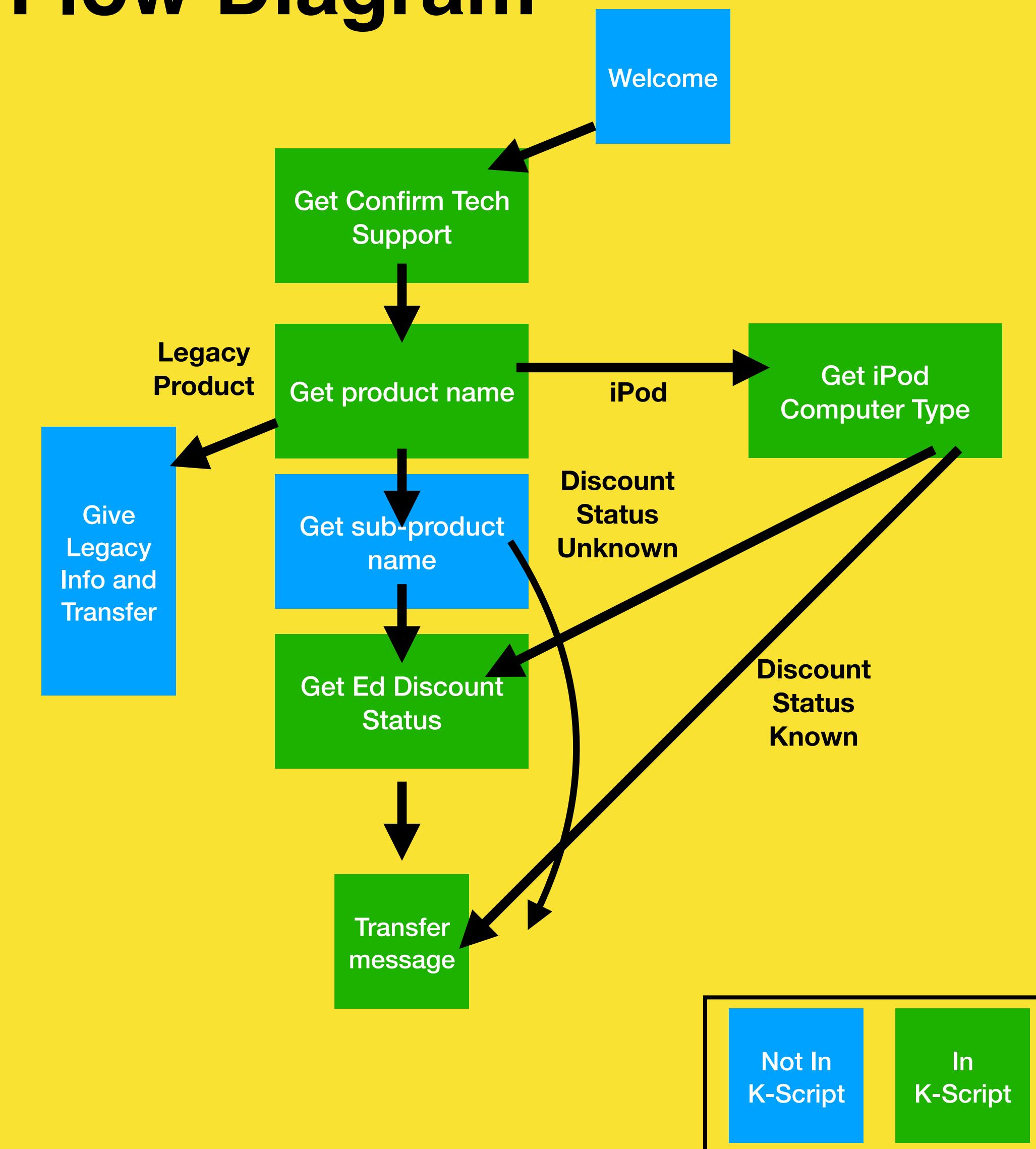
K-Script

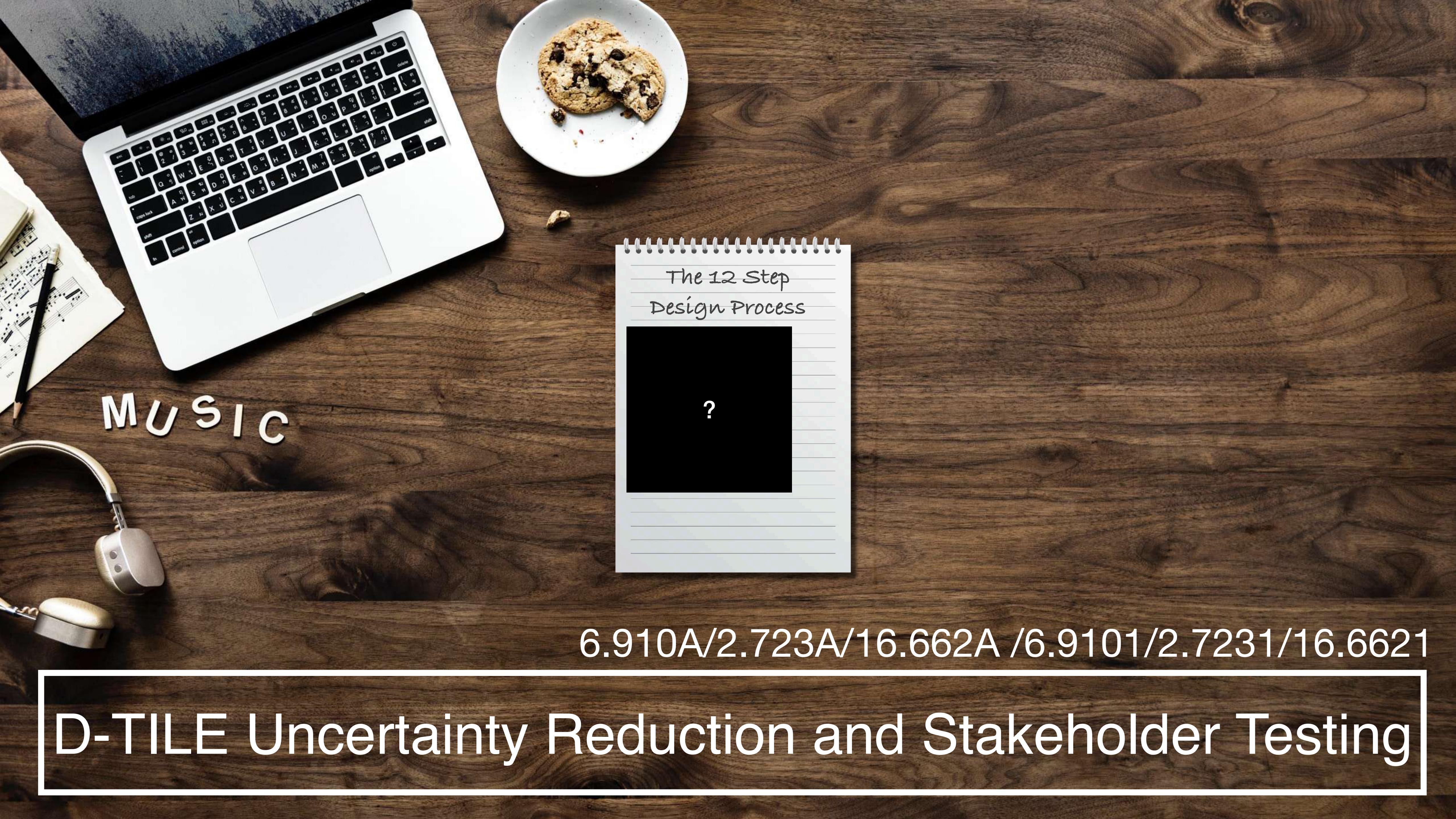
Who's Speaking	What they're saying
System	<Audio Icon> Are you calling for technical support of an Apple product?
Caller	Yes
System	Just say the name of the product for which you want technical support. For example you could say: "PowerMac G4" or "iPod". Go ahead:
Caller	It's an iPod
System	An iPod. Okay, what type of computer are you using it with, primarily? Say the name of the Macintosh computer or say "a Windows machine". Go ahead:
Caller	Uh...a graphite iMac
System	Alright, was the <i>computer</i> bought by a school or using an educational discount?
Caller	No.
System	Great. I'll transfer you to an iPod specialist. Hold on. <exit audio icon>

K-Script

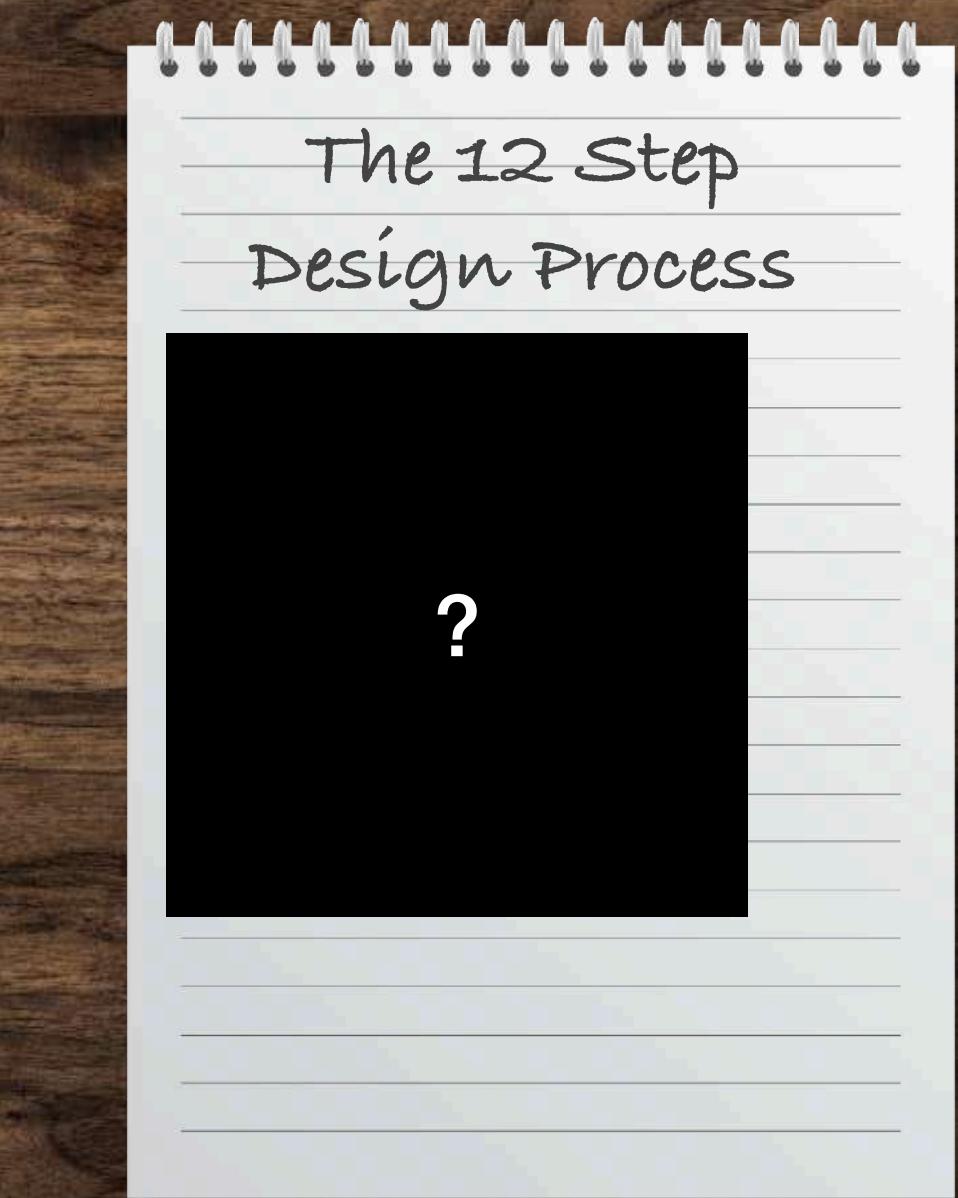
Who's Speaking	What they're saying
System	<Audio Icon> Are you calling for technical support of an Apple product?
Caller	Yes
System	Just say the name of the product for which you want technical support. For example you could say: "PowerMac G4" or "iPod". Go ahead:
Caller	It's an iPod
System	An iPod. Okay, what type of computer are you using it with, primarily? Say the name of the Macintosh computer or say "a Windows machine". Go ahead:
Caller	Uh...a graphite iMac
System	Alright, was the <i>computer</i> bought by a school or using an educational discount?
Caller	No.
System	Great. I'll transfer you to an iPod specialist. Hold on. <exit audio icon>

Flow Diagram





MUSIC

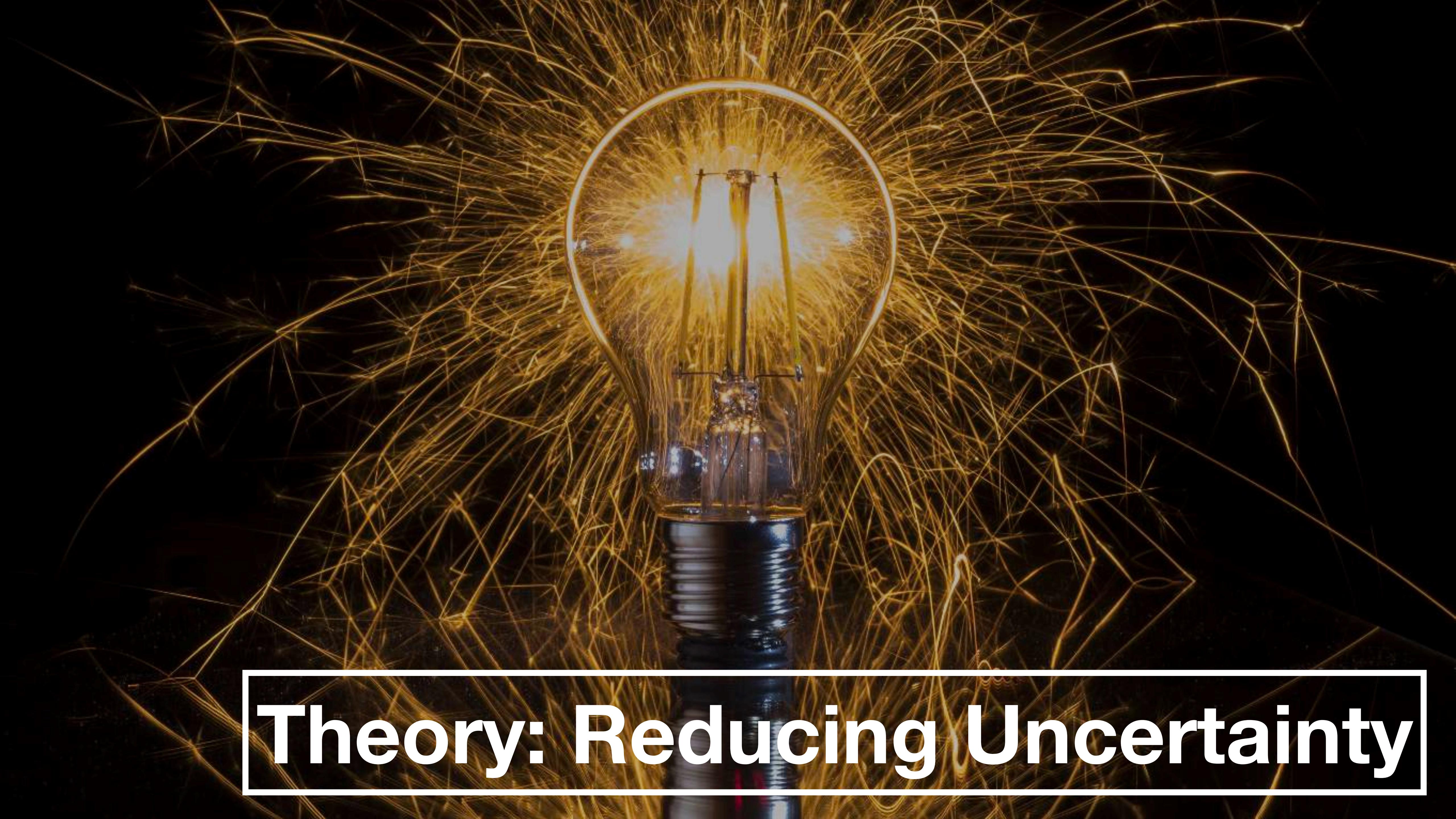


6.910A/2.723A/16.662A /6.9101/2.7231/16.6621

D-TILE Uncertainty Reduction and Stakeholder Testing



Make & Measure



Theory: Reducing Uncertainty

Accelerate Learning

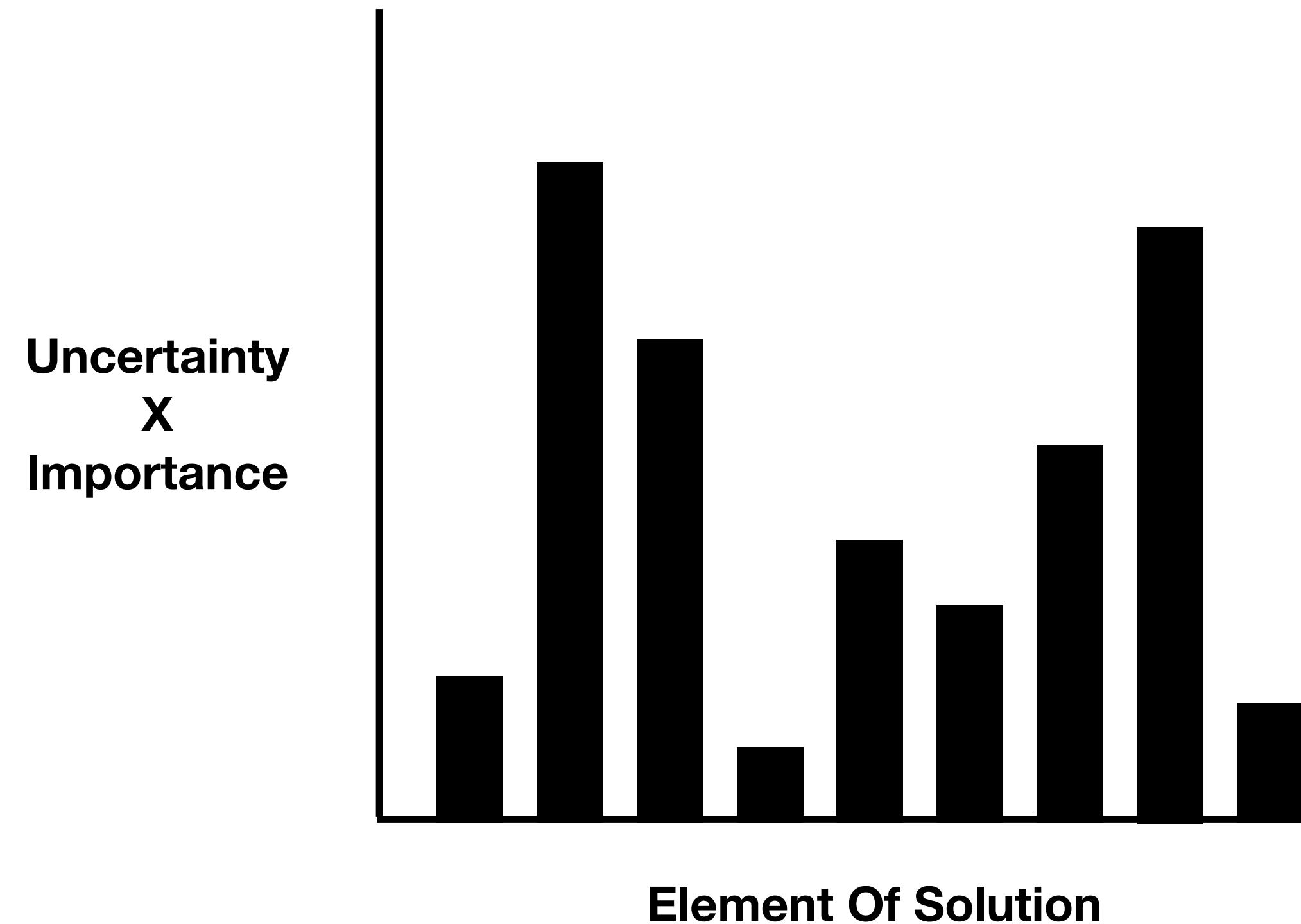
1. Identify areas of uncertainty
2. Develop methods to accelerate learning in order to reduce uncertainty
3. Reassess risk-tolerance based on new information

Thought experiment:

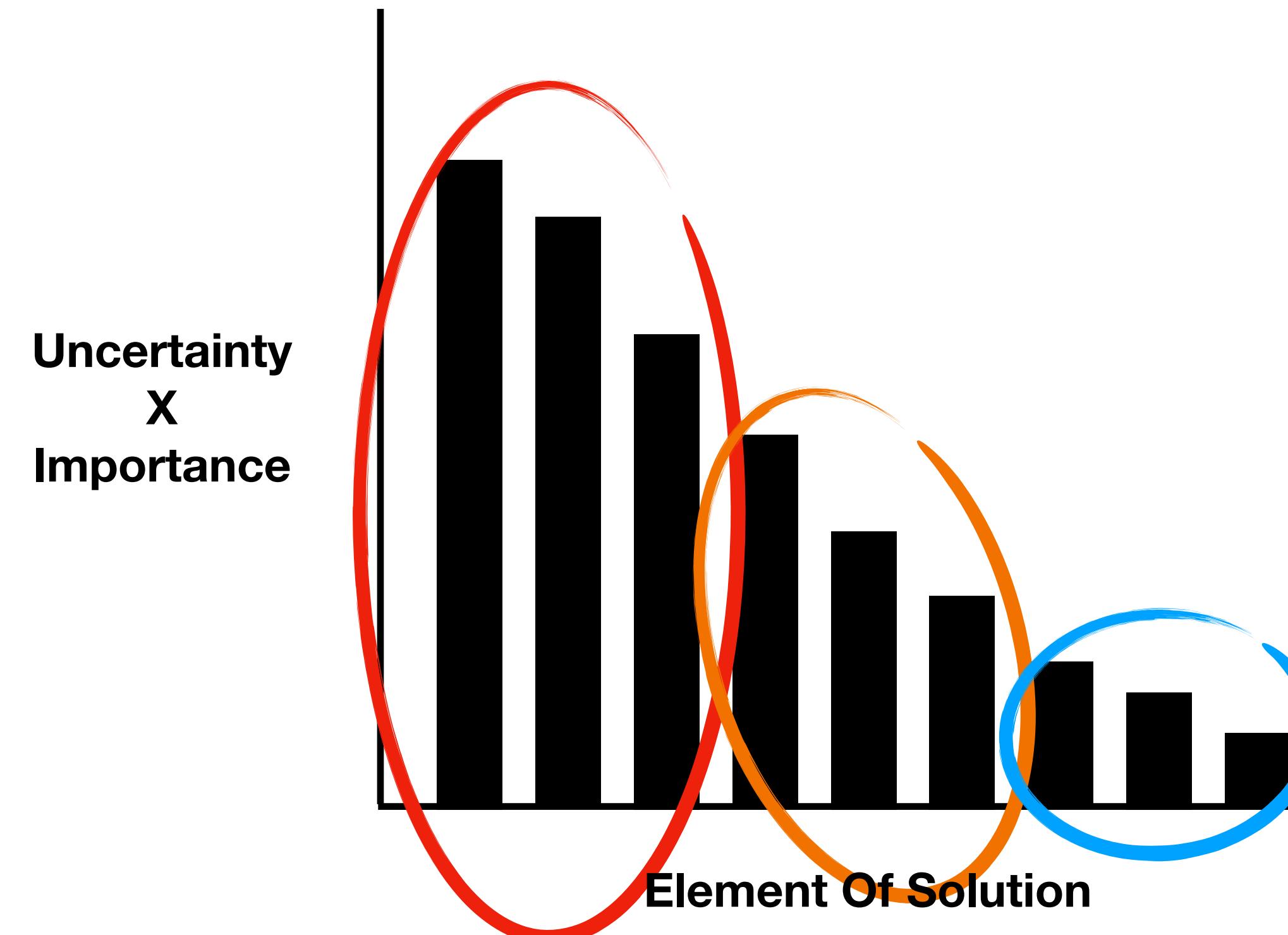
You've just been hired to run the math & science department of a high-school and you'll teach a subject of your choice.

1. *What aspects of this situation would you be **most confident** about?*
2. *What would you be **most uncertain** about?*
3. *How could you **reduce** your **uncertainty**?*

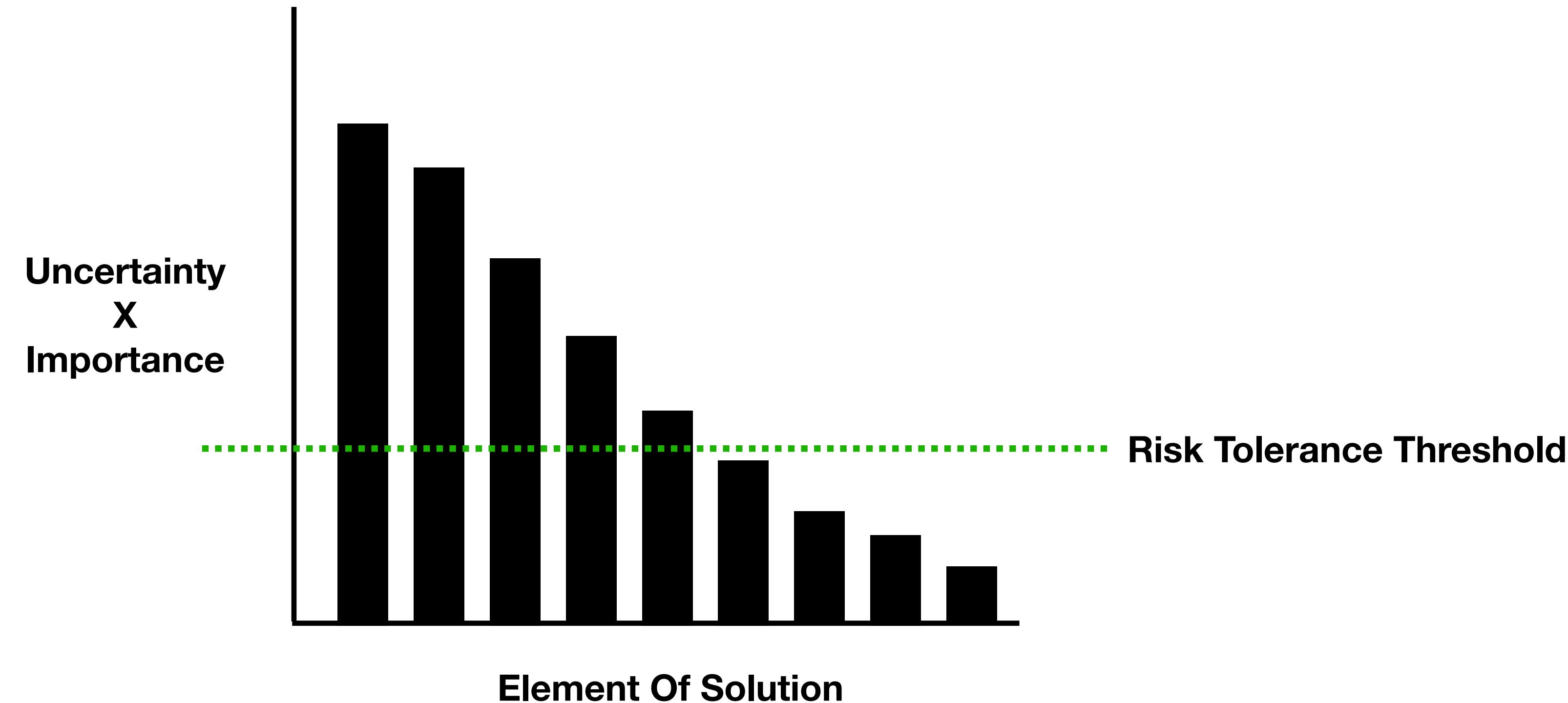
Uncertainty Identification + Reduction



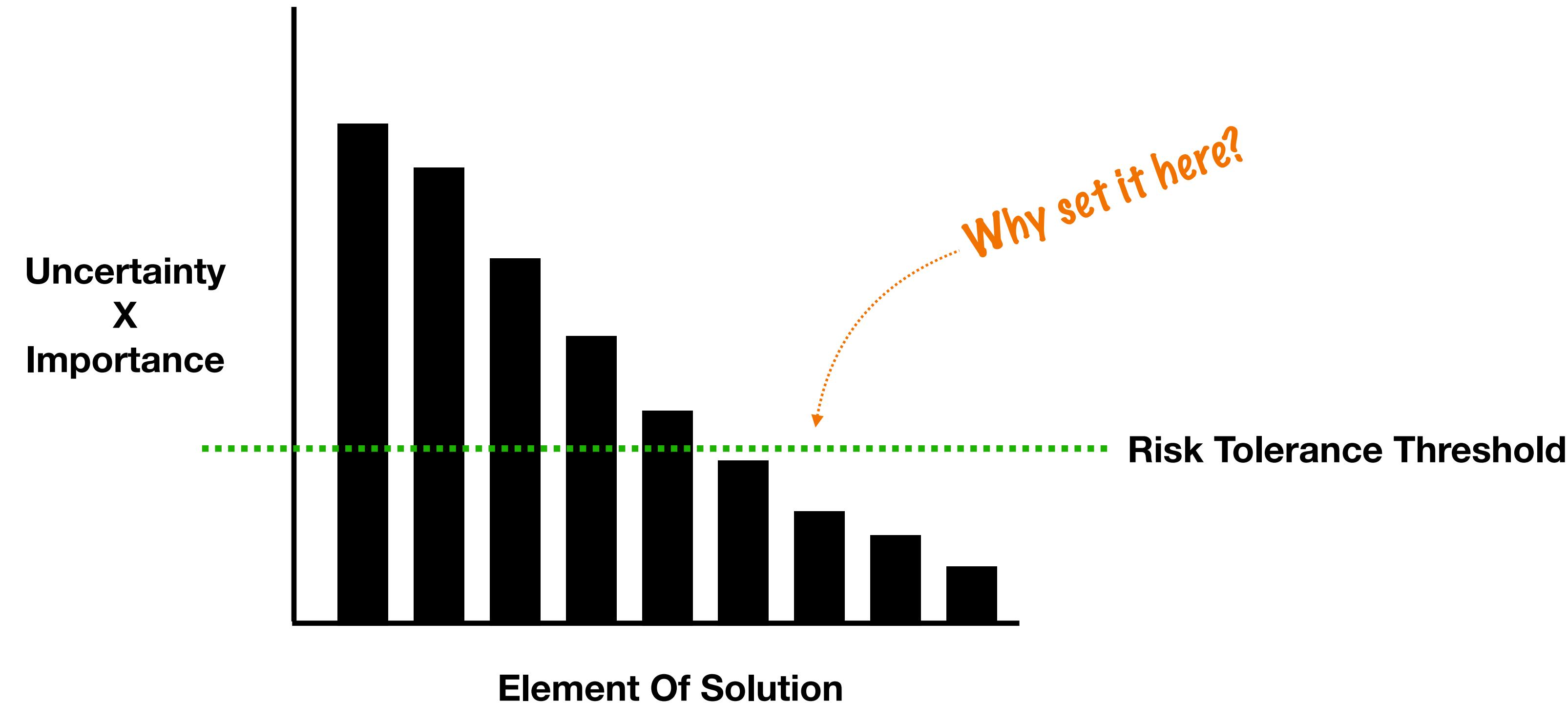
Uncertainty Identification + Reduction



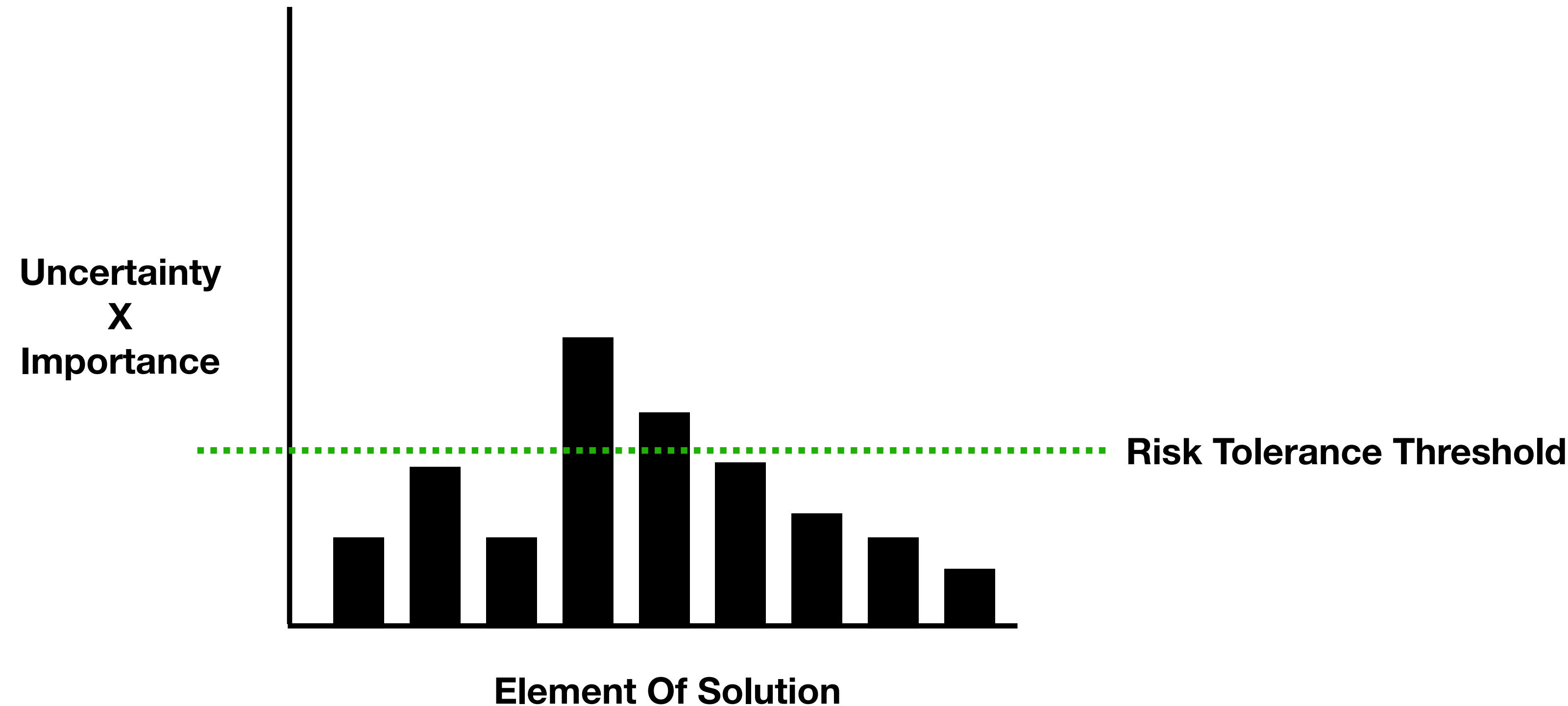
Uncertainty Identification + Reduction



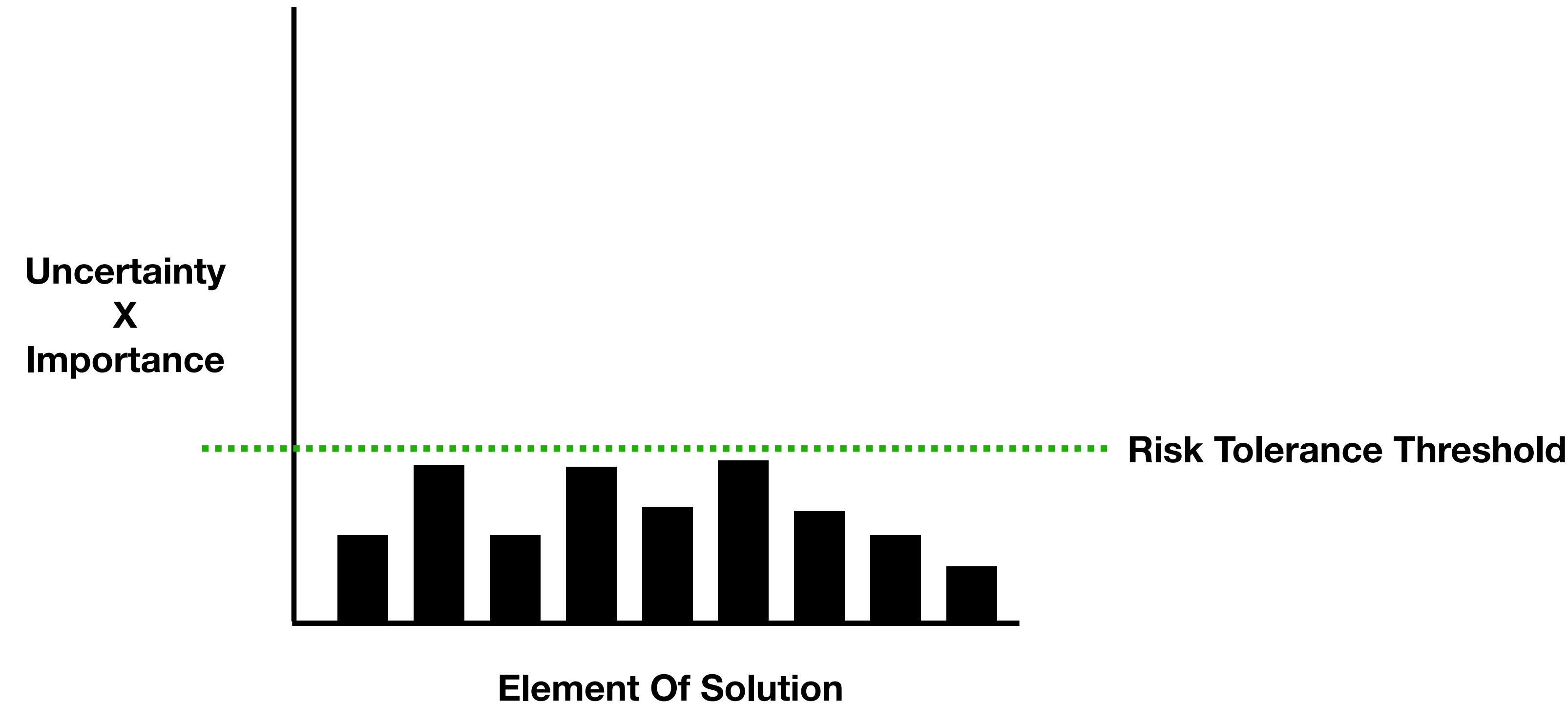
Uncertainty Identification + Reduction



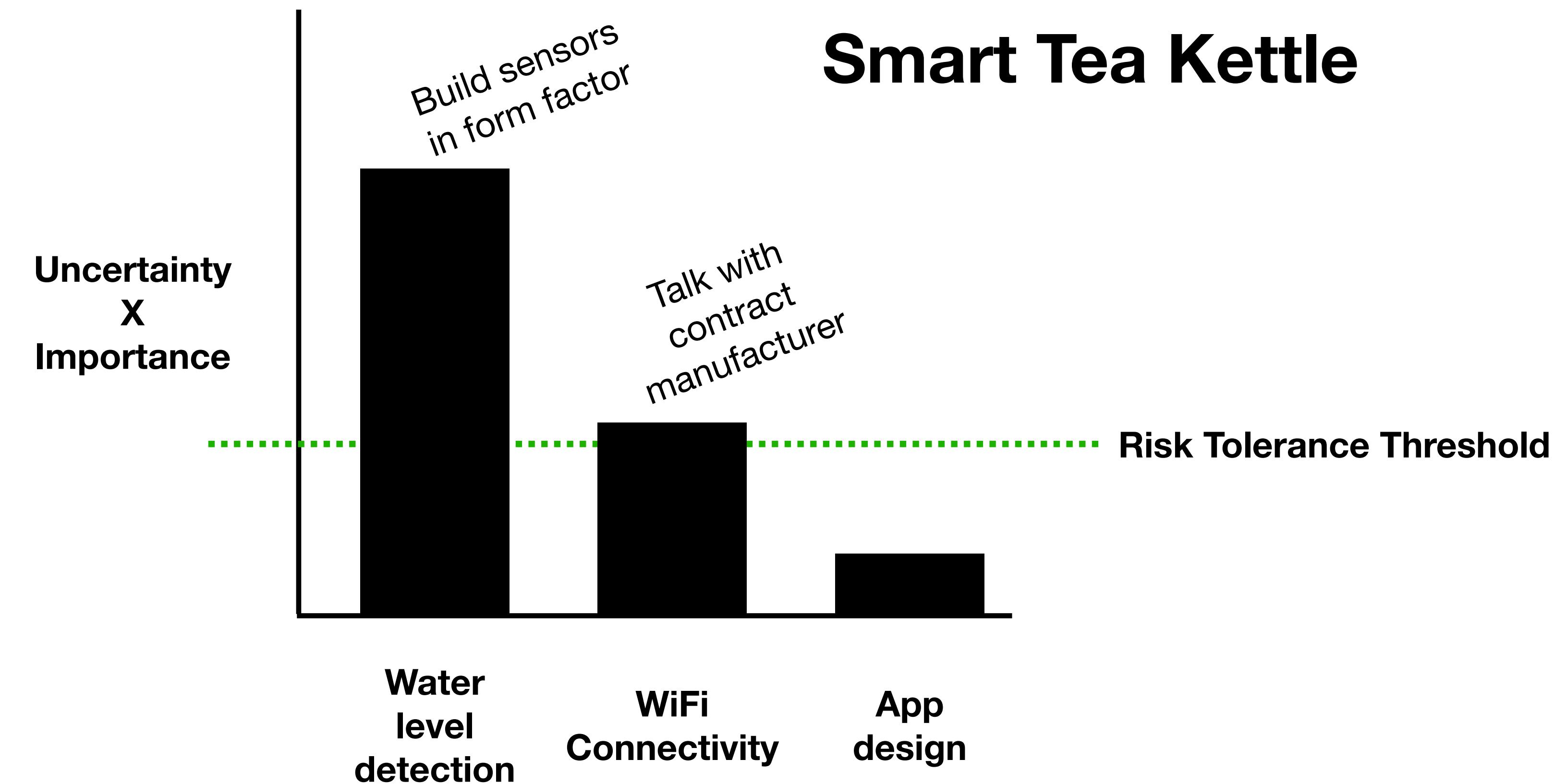
Uncertainty Identification + Reduction



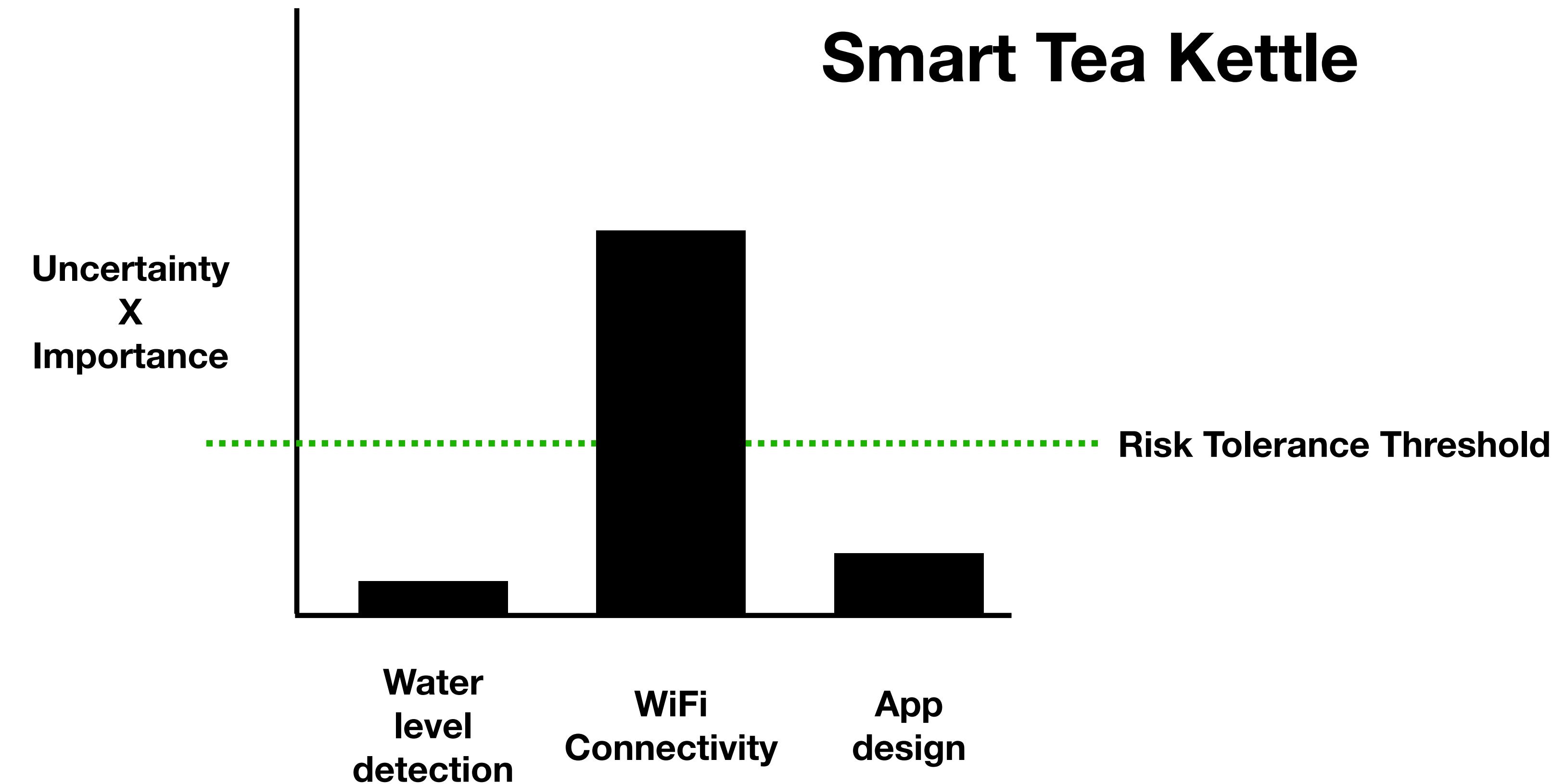
Uncertainty Identification + Reduction



Uncertainty Identification + Reduction Example



Uncertainty Identification + Reduction Example





9. Uncertainty Identification

3 Steps Of Uncertainty Identification

1. For **each** element of the **solution**, determine:

The **importance** of the element to the success of the solution
(e.g., *a critical feature vs. a nice-to-have feature*)

The **uncertainty** that you can successfully develop the element
(e.g., *we make software but not hardware, so successful hardware manufacturing is more uncertain than making an app*)

2. **Multiply** the **importance** by the **uncertainty** to determine the **risk**

3. Determine which elements are above the **risk tolerance threshold**

NOTE: Also, look back at your Boundaries & Hazards and Stakeholder analyses and be sure you've considered reducing uncertainties for those objectives

Identifying Uncertainty for a Health App

You've developing a new concept for a health app that uses the camera to automatically figure out the nutrition of what people eat

User Experience:

People hold up their phone and take a picture of their food

The app will figure out calories & fat, protein, carbohydrates



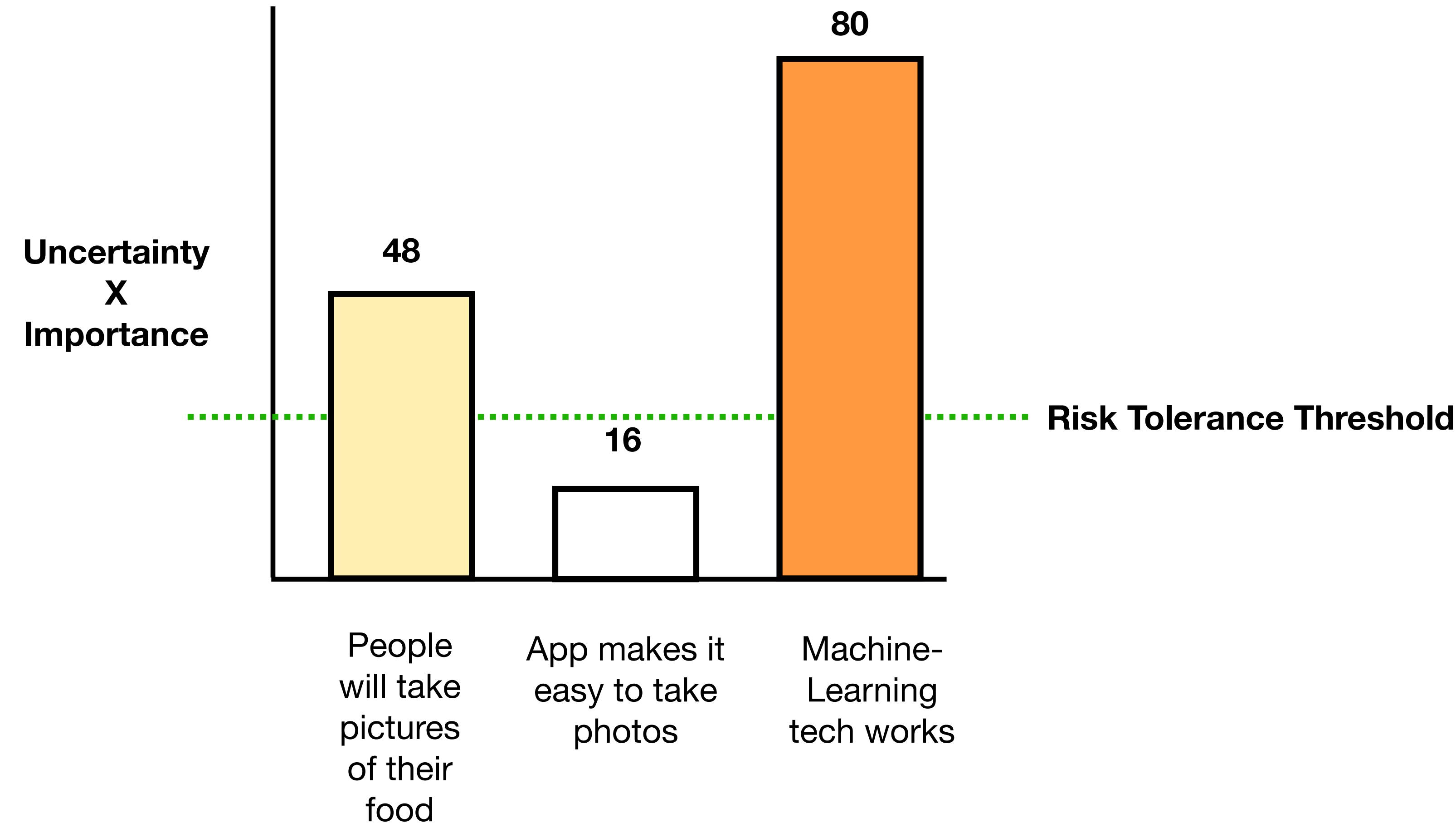
Identifying Uncertainty for a Smartphone Health App

Element Of Possible Uncertainty	Importance (1-10)	Uncertainty (1-10)	Uncertainty X Importance
People will take pictures of their food	8	6	48
We can make an app that makes it easy to take photos	8	2	16
Machine-learning technology can provide nutrition information from a picture of food	10	8	80

Identifying Uncertainty for a Smartphone Health App

Element Of Possible Uncertainty	Importance (1-10)	Uncertainty (1-10)	Uncertainty X Importance
People will take pictures of their food	8	6	48
We can make an app that makes it easy to take photos	8	2	16
Machine-learning technology can provide nutrition information from a picture of food	10	8	80

Identifying Uncertainty for a Smartphone Health app



A close-up photograph of a person's hands playing the wooden block game Jenga. The person is wearing a red short-sleeved shirt and blue long-sleeved sleeves underneath. The Jenga blocks are light-colored wood, and the word "Jenga" is printed on each one. The background is dark and out of focus.

You Try

Uncertainty Identification for a Cookie Manufacturing Service



Key Features Of Your Solution

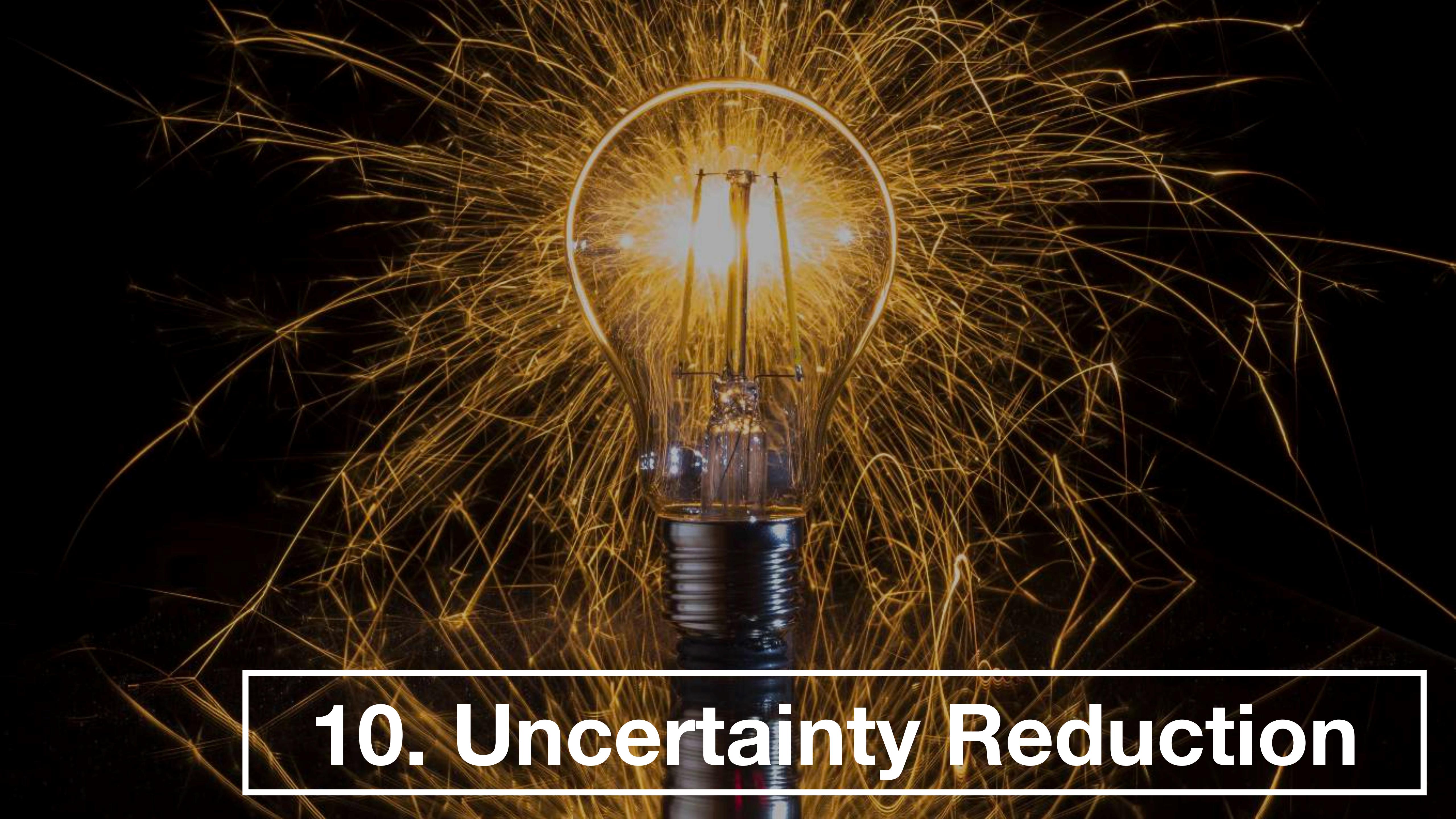
- 1) Cookies remind people of their childhood
- 2) Packaging is easy to see on a shelf of other popular cookies
- 3) Manufacture cookies in accordance with local food safety requirements



Reducing Uncertainty for a Cookie Manufacturing Service



Feature	Importance	Uncertainty	Uncertainty X Importance
Cookies remind people of their childhood			
Packaging is easy to see on a shelf of other popular cookies			
Manufacture cookies in accordance with local food safety requirements			



10. Uncertainty Reduction

Reducing Uncertainty *Inexpensively*

- For each uncertain element, determine the **least expensive** way to reduce uncertainty
 - Example:** Uncertain if people will want a garbage bag that has a fragrance? Spray some bags with perfume and give them to co-workers to bring home
 - Example:** Uncertain if people want a motorcycle with back-up sensors? Strap together an inexpensive LiDAR detector and speaker and give it to someone who rides a motorcycle
- Increase time, effort and cost to reduce uncertainty **only when necessary**

Uncertainty Reduction Through Prototyping

- Prototypes are versions of a **whole solution**, **or parts** of the solution
- Prototypes can be **physical** (looks-like), **operational** (works-like), **experiential** (feels-like)



Physical



Operational

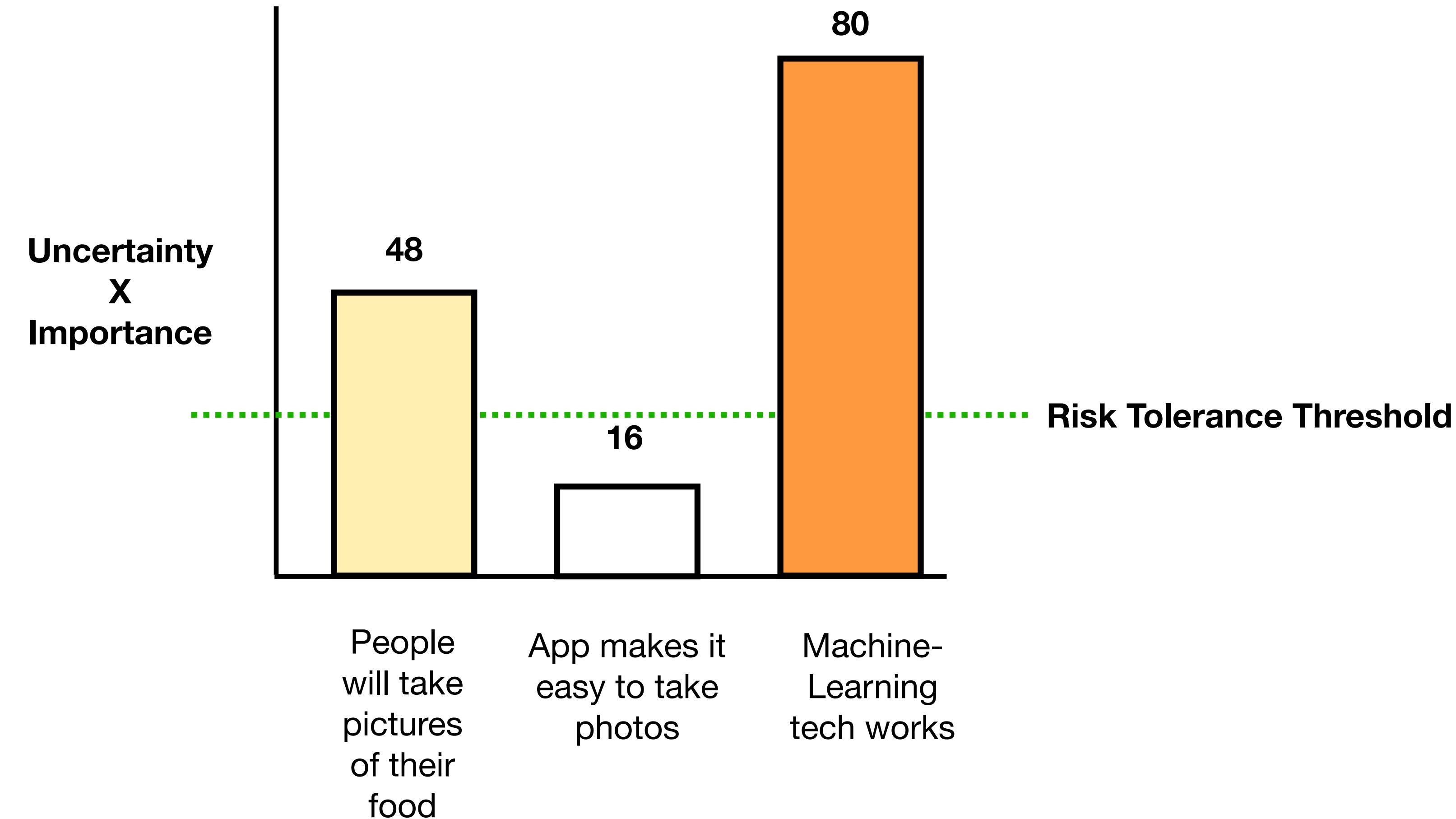


Experiential

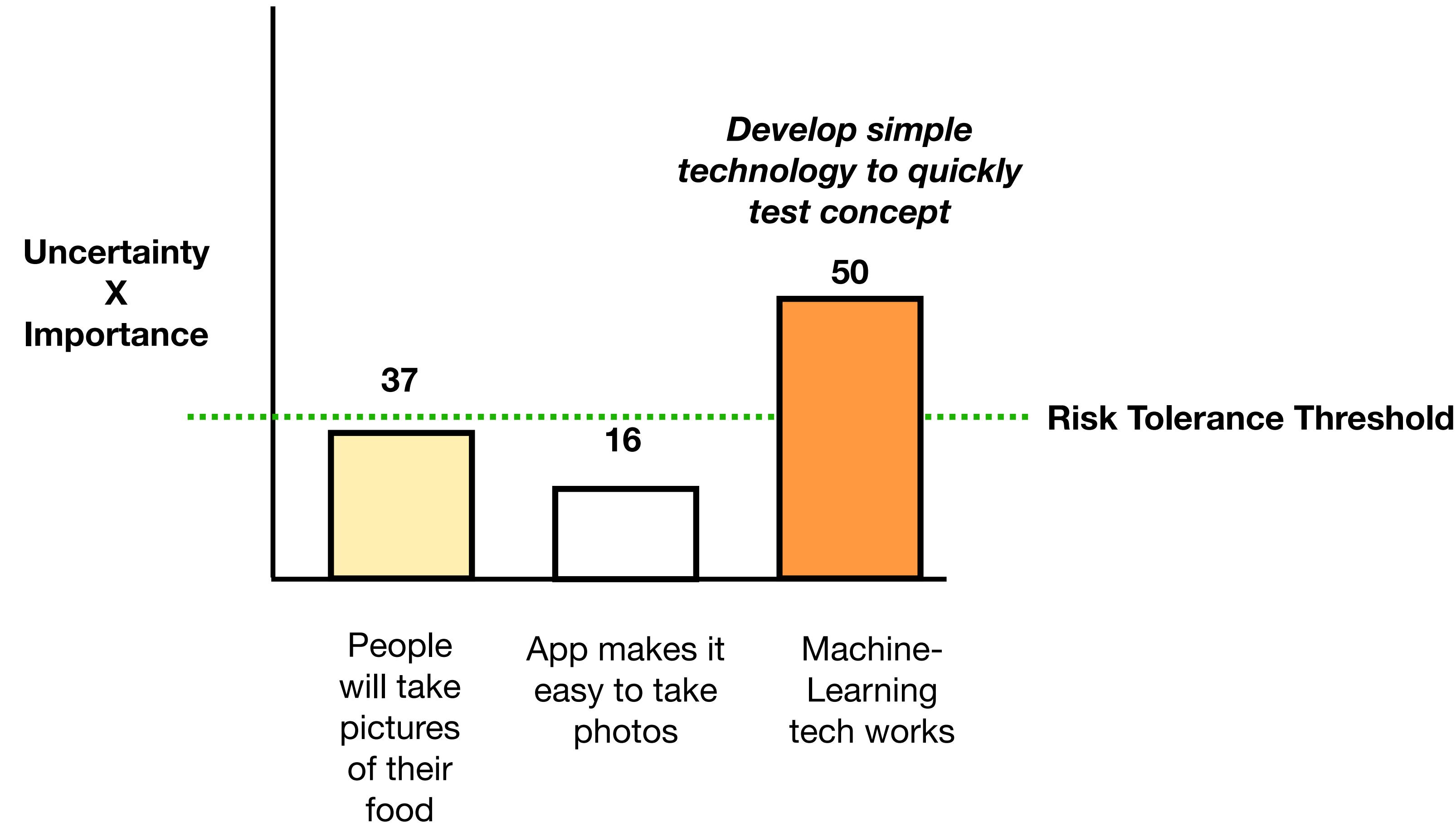
Uncertainty Reduction for a Smartphone App

Feature	Uncertainty X Importance	Inexpensive methods to reduce uncertainty
People will take pictures of their food	48	Ask people to take pictures of everything they eat for 3 days, then interview them
Machine-learning technology can provide nutrition information from a picture of food	80	Ask a machine learning expert

Uncertainty Reduction for a Smartphone Health app



Uncertainty Reduction for a Smartphone Health app



Reducing Uncertainty *Iteratively*



Reducing Uncertainty *Iteratively*



A close-up photograph of a person's hands playing the wooden block game Jenga. The person is wearing a red t-shirt and blue sleeves. The background is dark, making the light-colored wood stand out. The word "Jenga" is printed on each block.

You Try

Uncertainty Reduction for a Cookie Manufacturing Service



Key Features

- 1) Cookies remind people of their childhood
- 2) Packaging is easy to see on a shelf of other popular cookies
- 3) Manufacture cookies in accordance with local food safety requirements



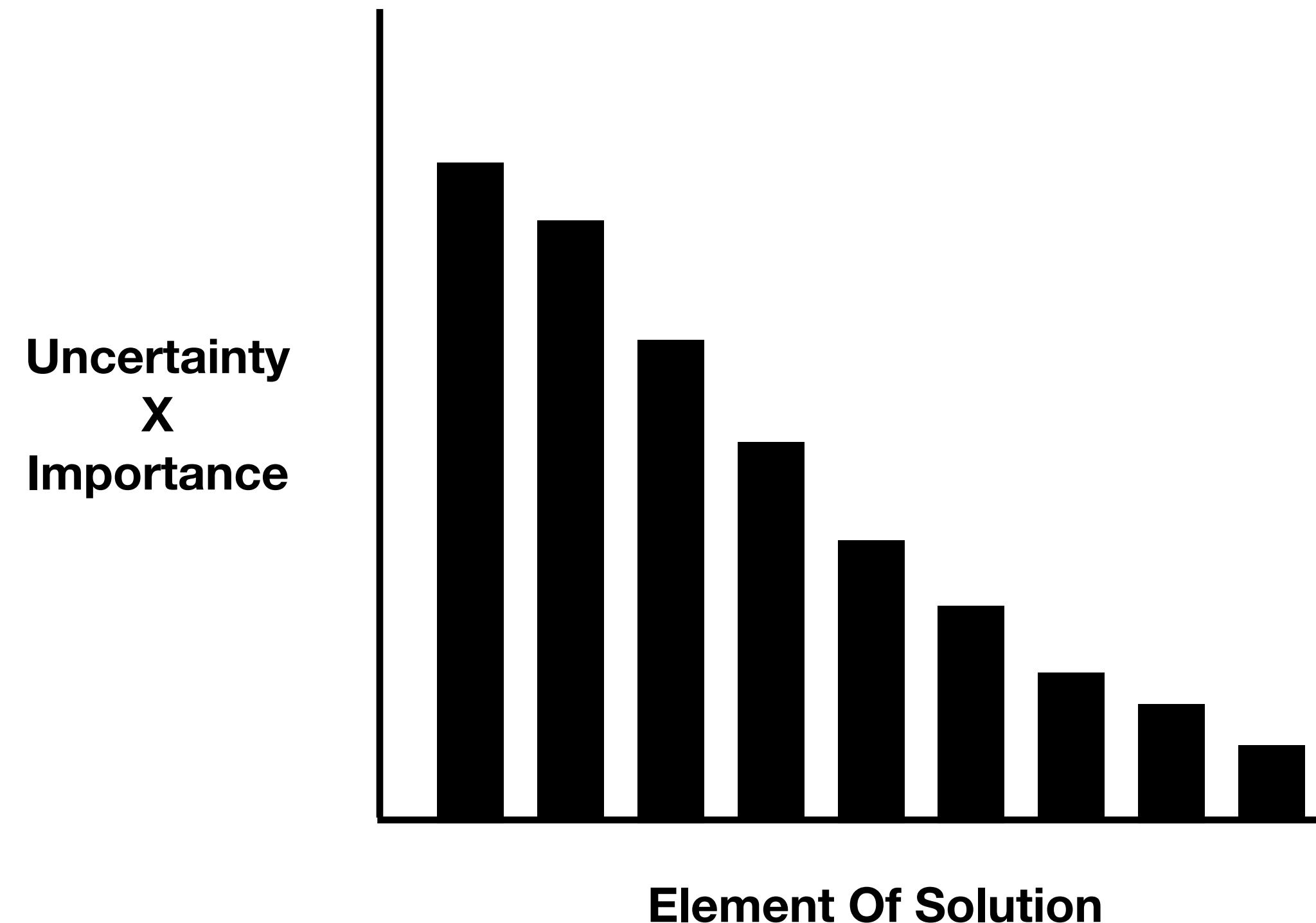
Reducing Uncertainty for a Cookie Manufacturing Service



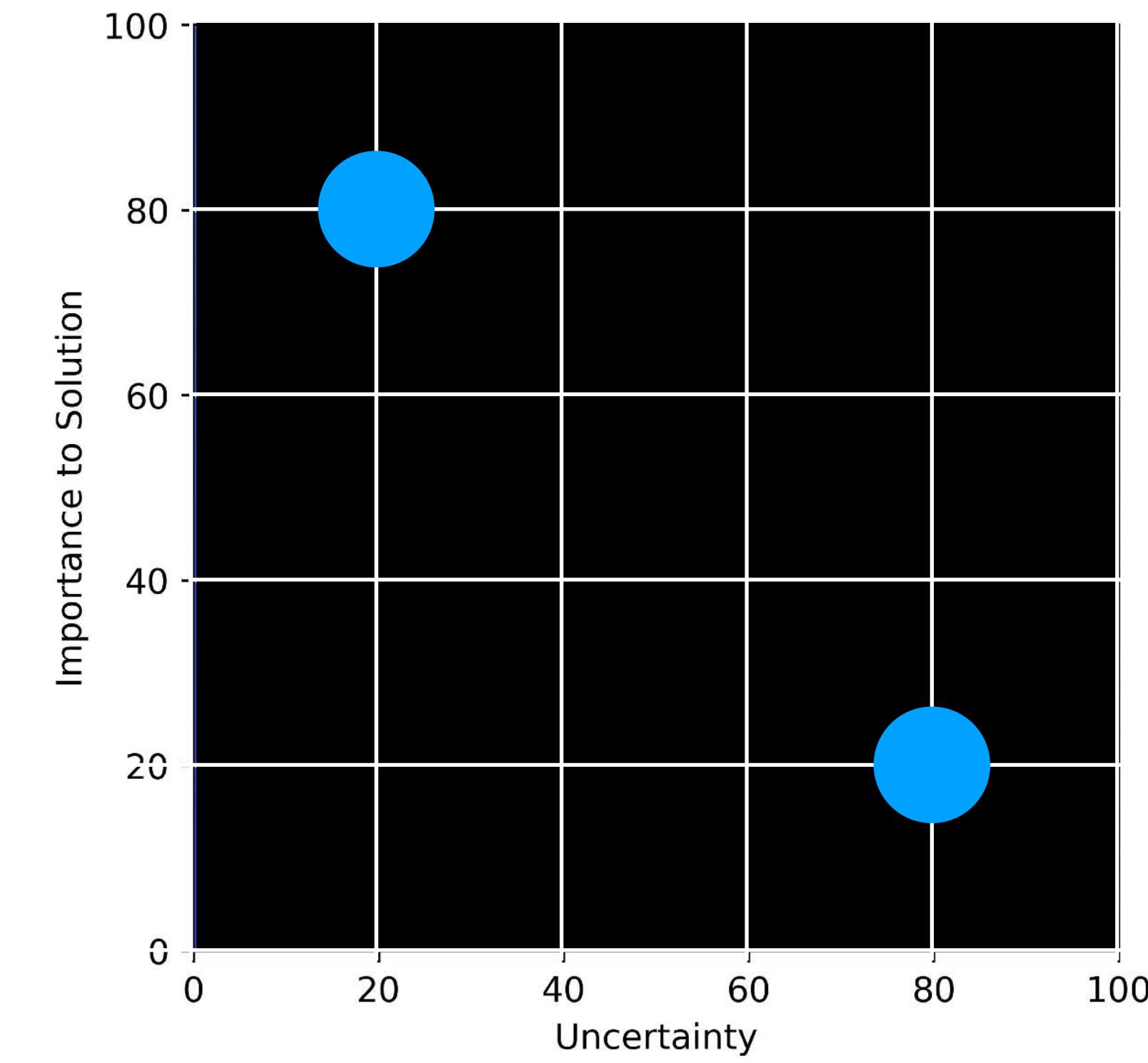
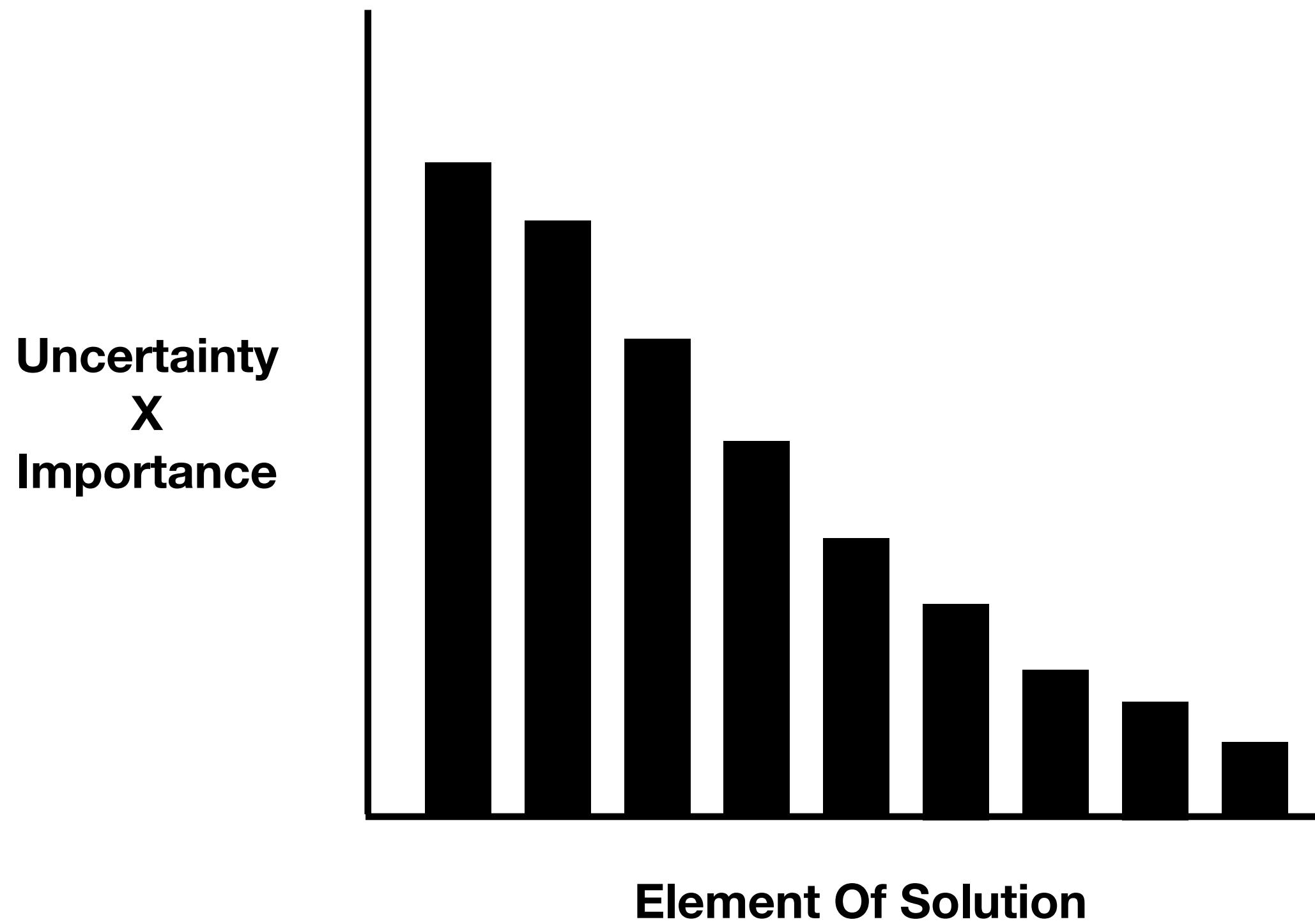
Feature	Importance	Uncertainty	Uncertainty X Importance	Inexpensive ways to reduce uncertainty
Cookies remind people of their childhood				
Packaging is easy to see on a shelf of other popular cookies		(Refer To Your Previous Step)		
Manufacture cookies in accordance with local food safety requirements				

Uncertainty Identification + Reduction

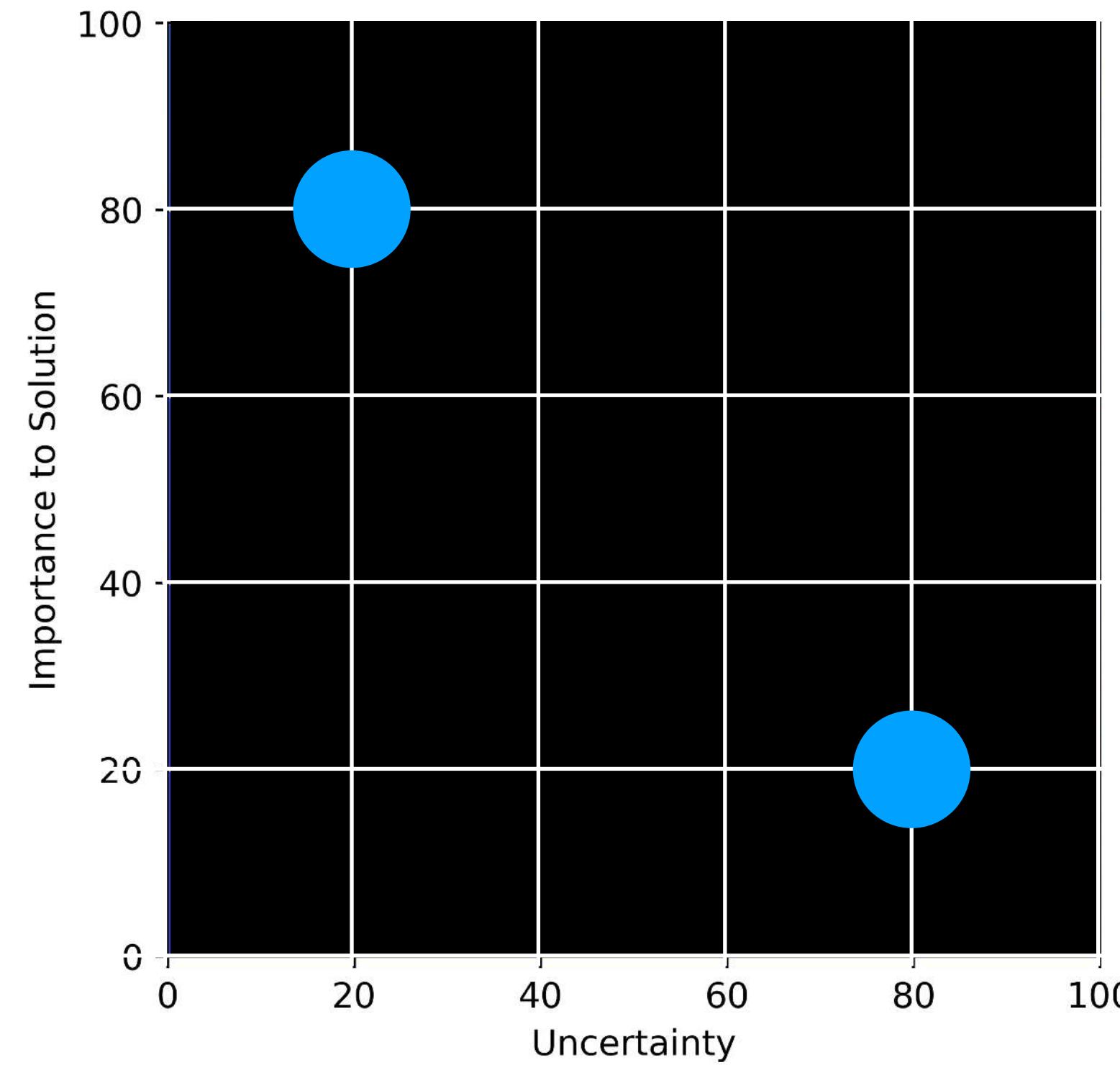
(Side note)



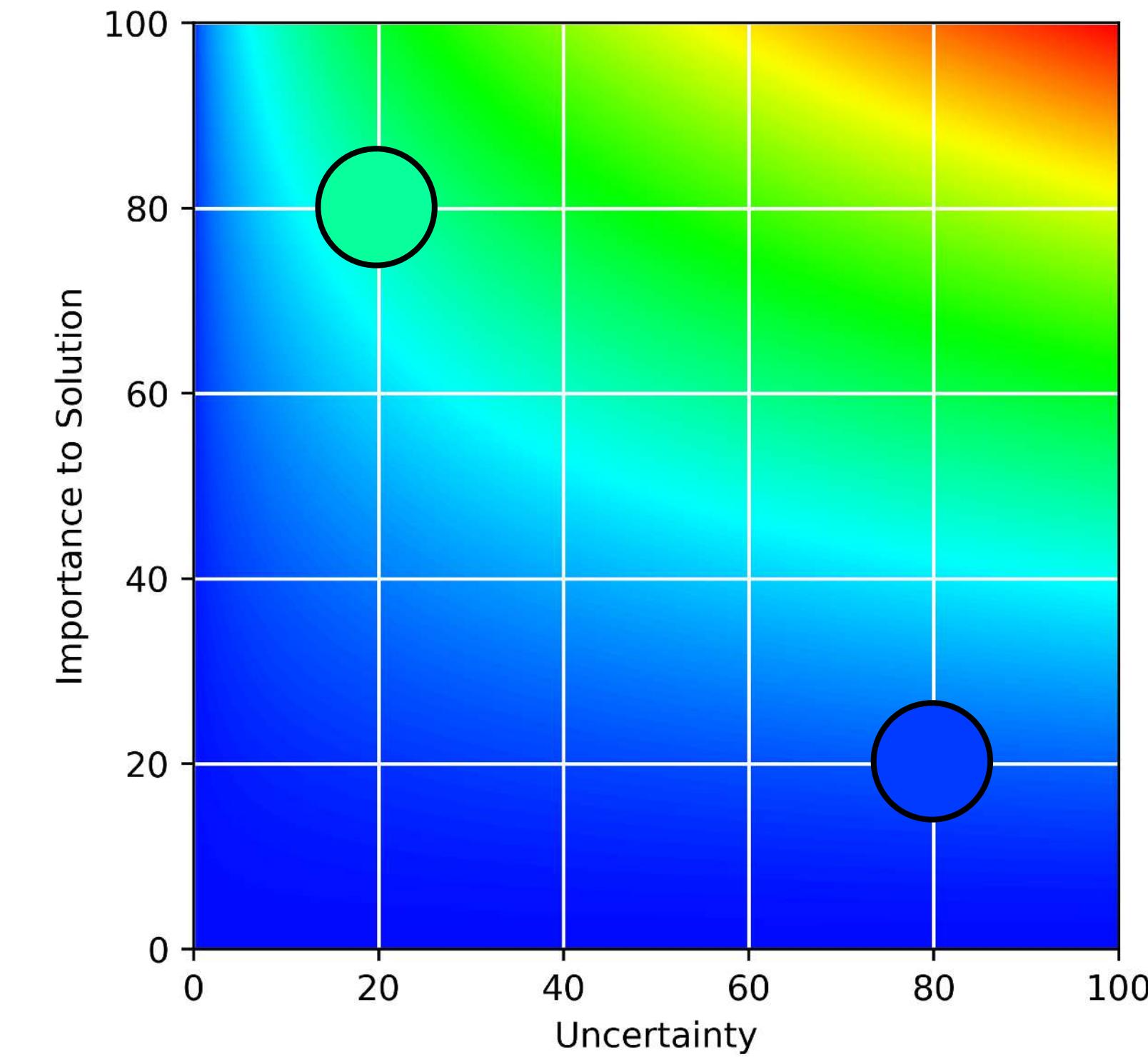
Uncertainty Identification + Reduction



Uncertainty Identification + Reduction

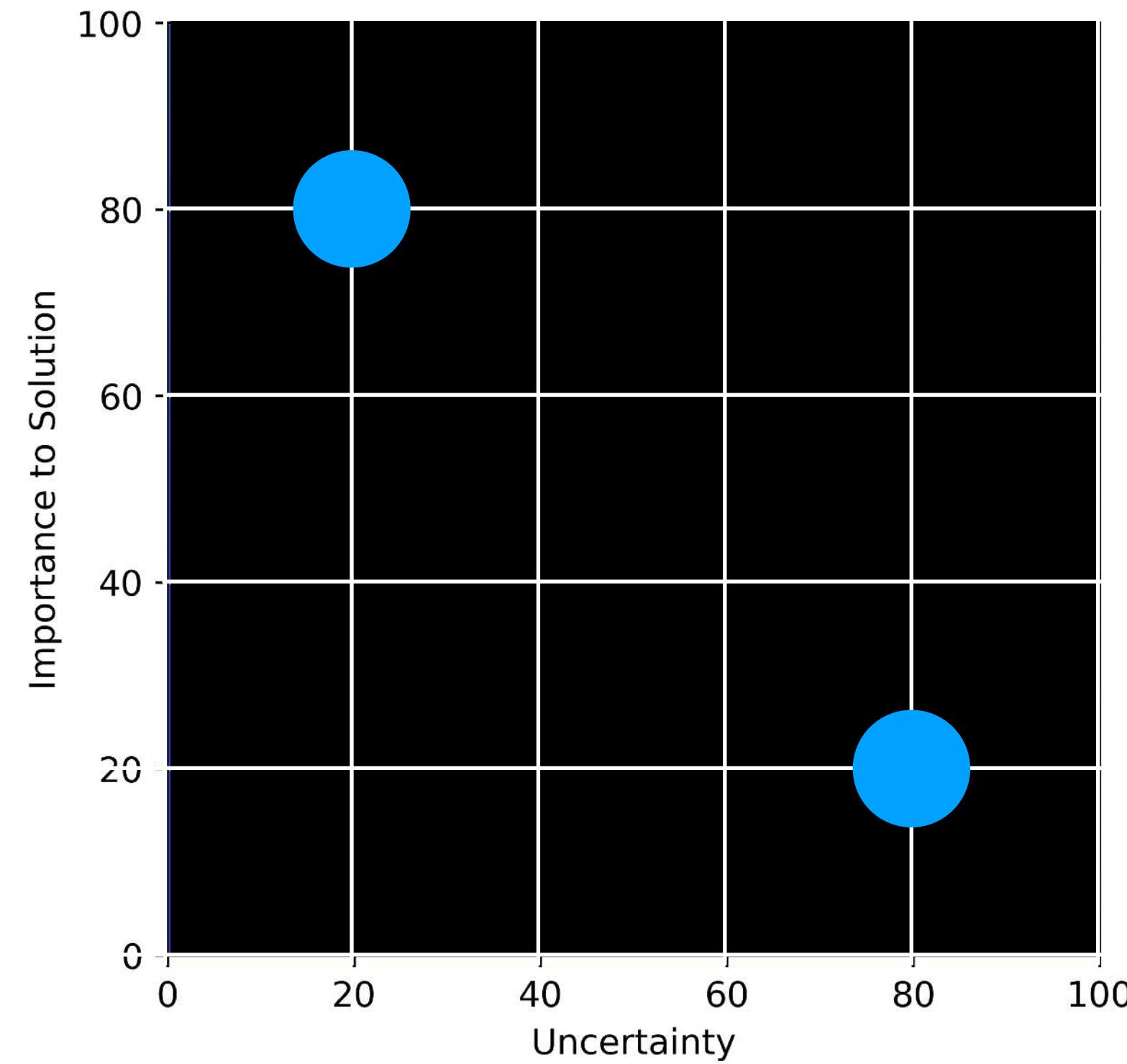


Risk = Importance \times Uncertainty

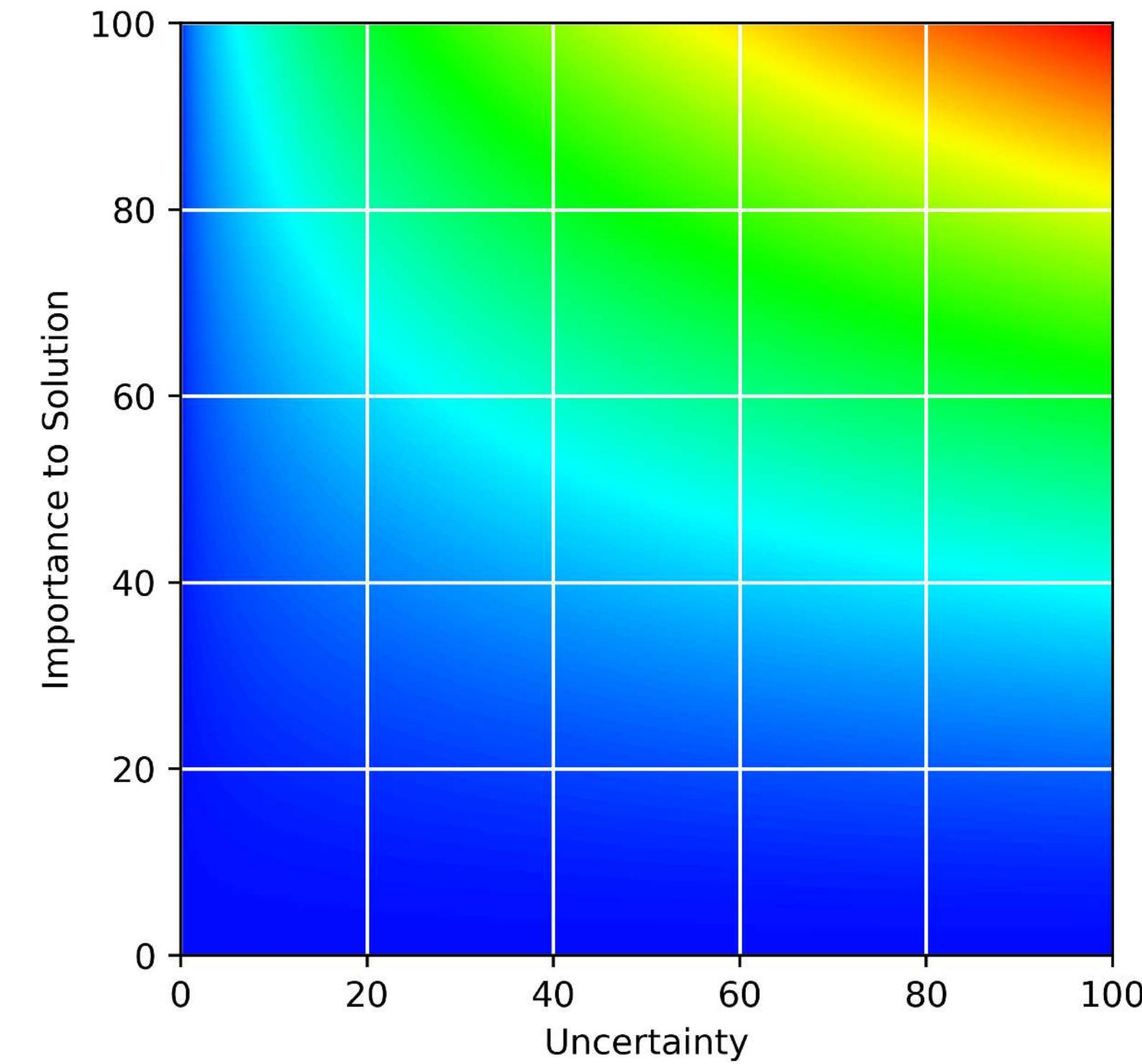


Risk = Importance³ \times Uncertainty

Uncertainty Identification + Reduction



Risk = Importance \times Uncertainty



Risk = Importance³ \times Uncertainty



Uncertainty Reduction Via Concept Articulation + Vision Creation

- Use prototypes to share concepts with stakeholders and get feedback
- Determine which stakeholders you need feedback and insights from
- Non-user stakeholders can provide tremendous value

Usability Testing (to reduce uncertainty)

Definition: A usability test is an **uncertainty reduction method** used to evaluate a product by having real users interact with it, and identify issues as well as areas for improvement

The primary goal of a the test is to identify problems, collect qualitative and quantitative data, in order to improve the product, and determine the participant's satisfaction with the product

Process:

A participant attempts to complete tasks

Observers note challenges and user reactions

When: Can be performed at various stages of the product development cycle

Objective: Enhance product design based on direct feedback from target users

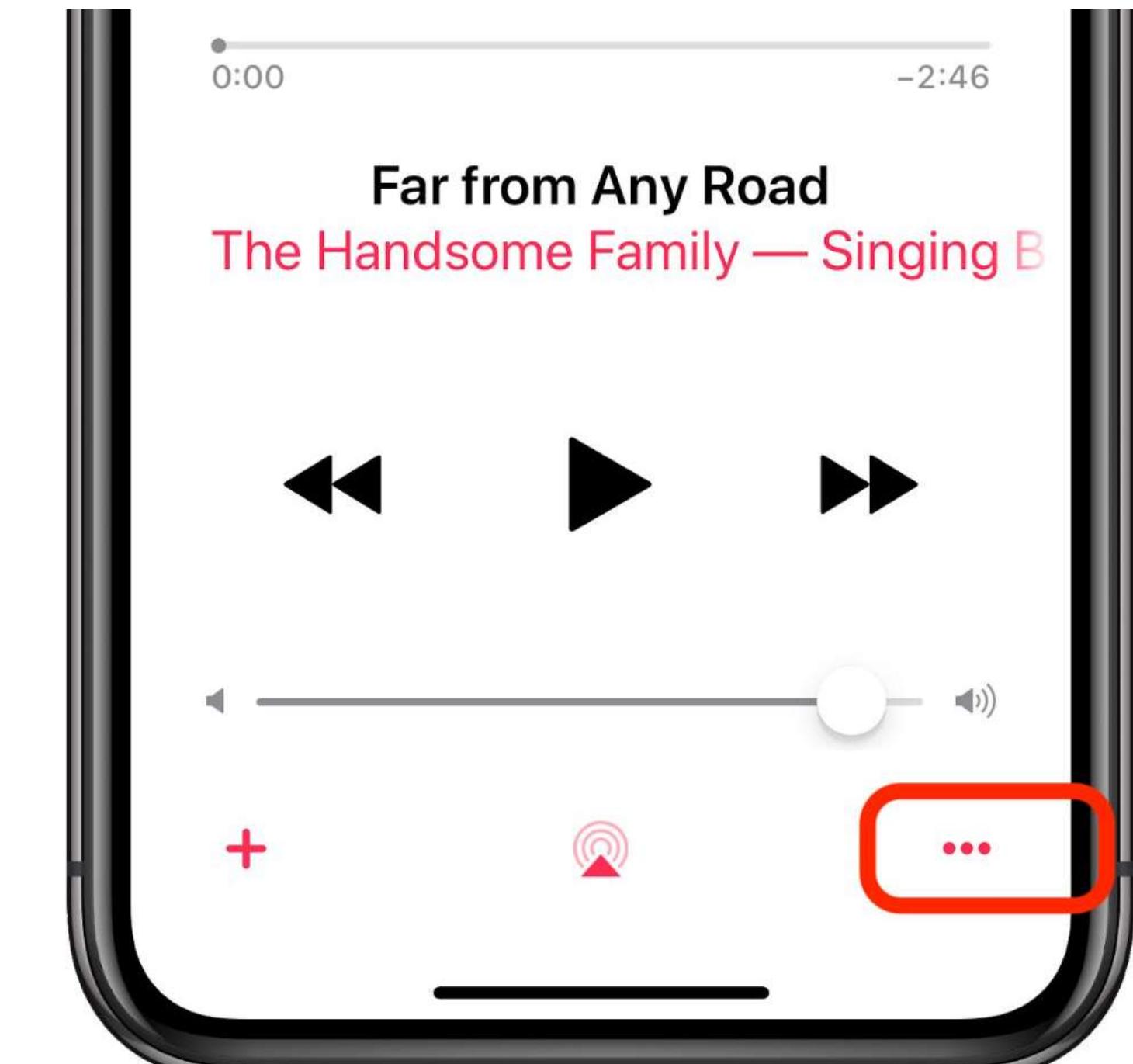
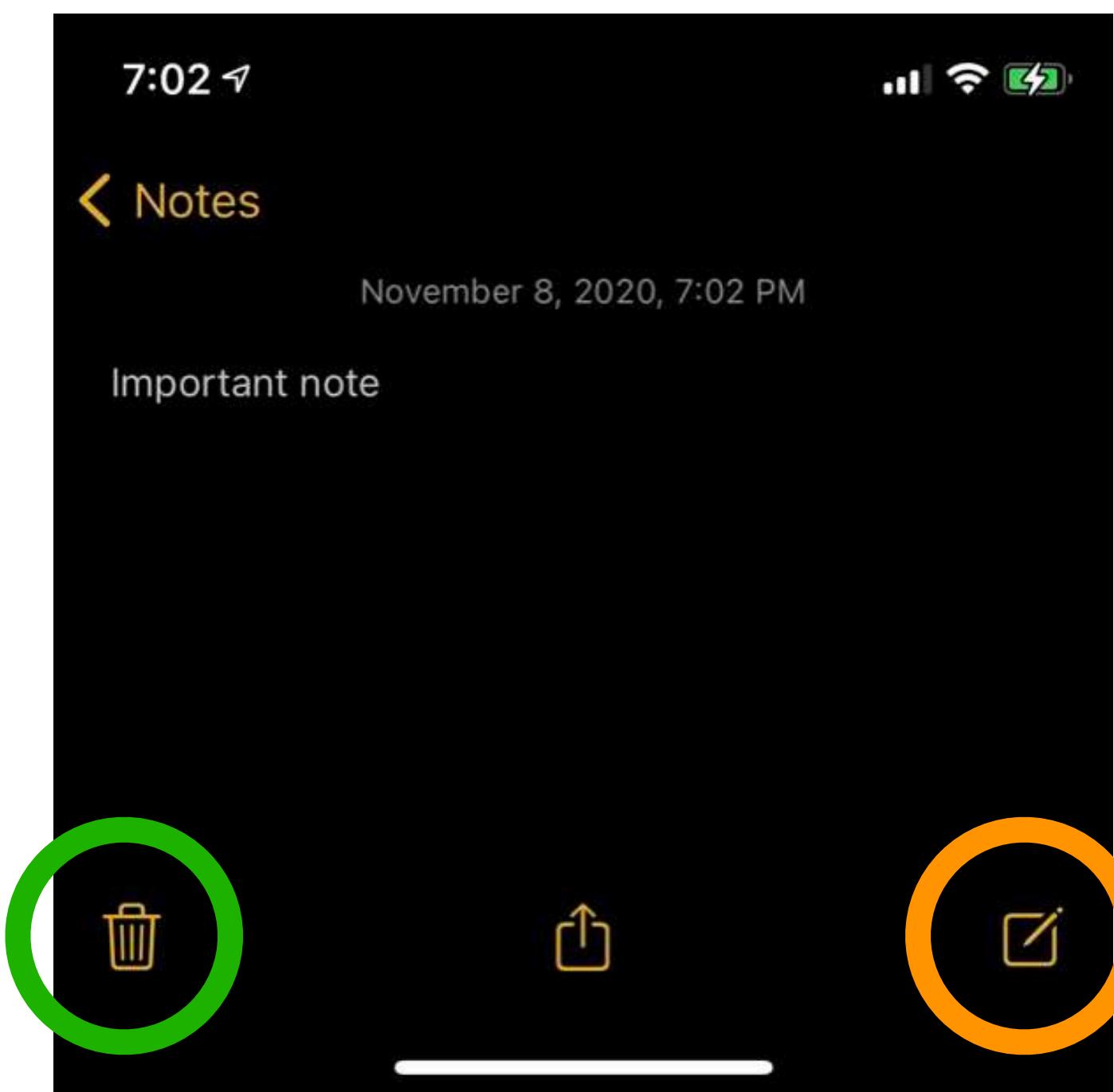
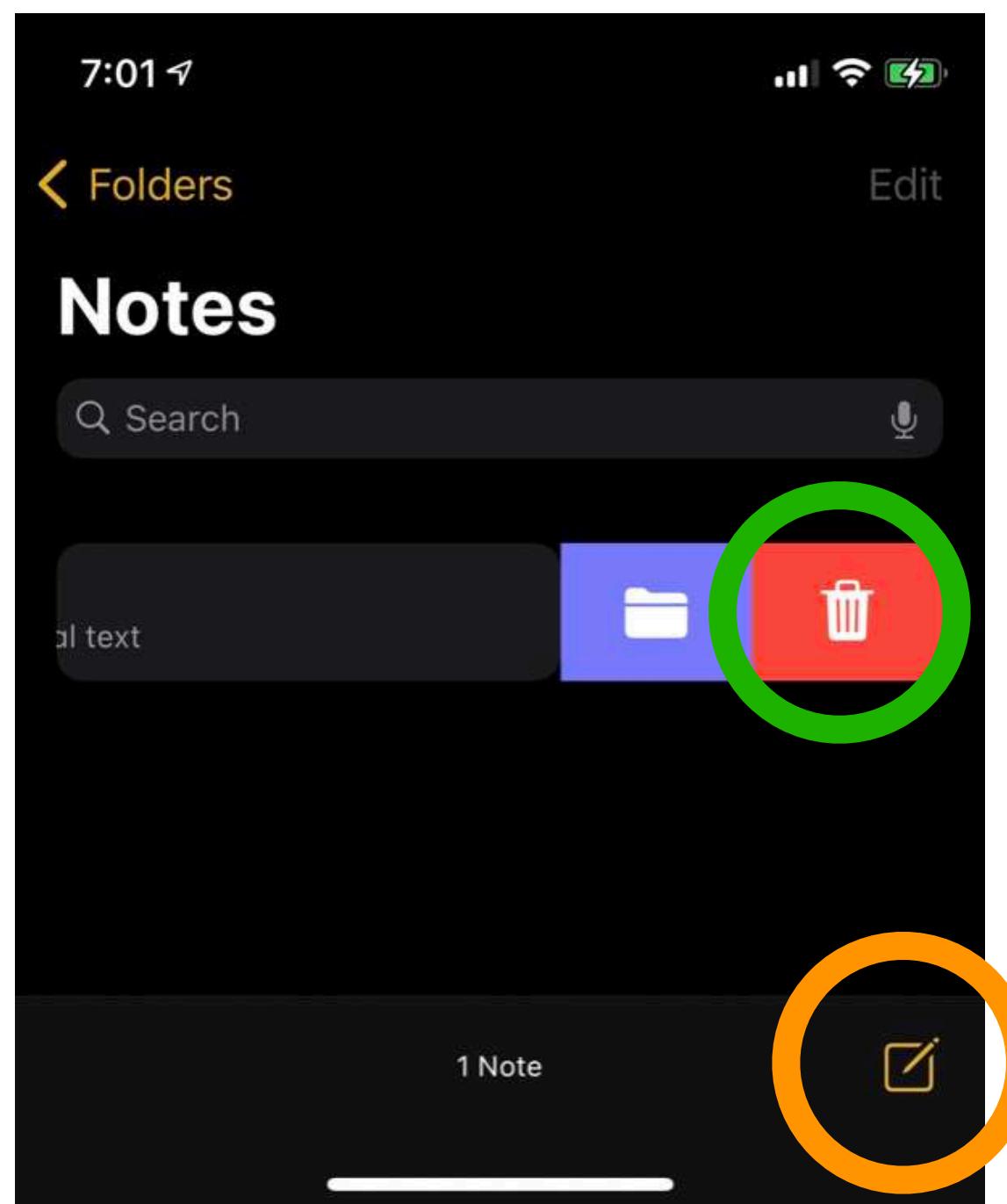
What We Want To Learn

- Can people use it?
- Do they enjoy using it?
- Does the user form a correct mental model of the system?

Mental Model



- A mental model is an explanation of someone's thought process about how something works in the real world.*
- It enables a person to extend knowledge in one area to another



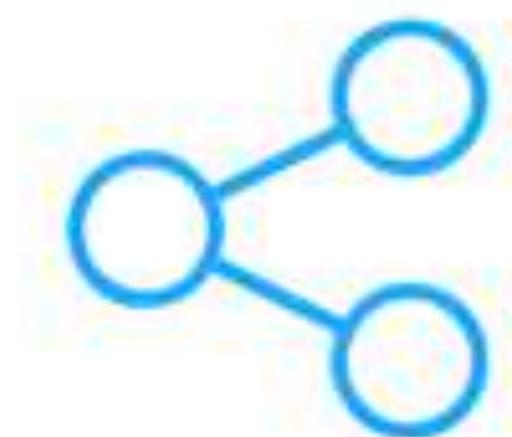
1



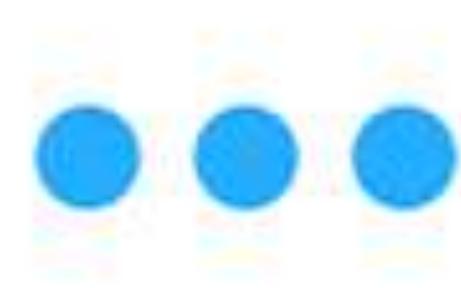
2



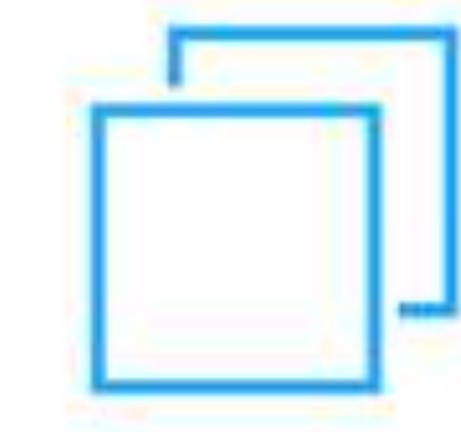
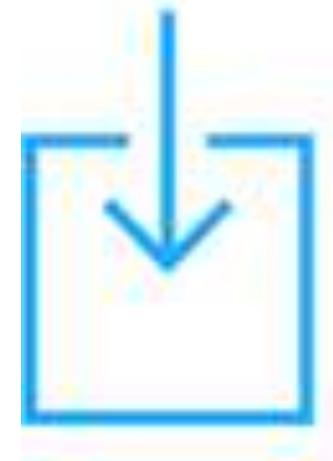
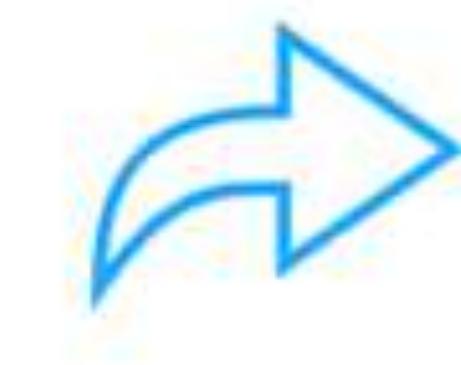
3



4



5



6

7

8

9

10



How To Talk on the Telephone

When You Answer the Telephone

1. Pick up the handset. Hold the receiver part of it close against your ear and hold the mouthpiece about an inch in front of your mouth.

2. Say "Hello" or say your telephone number. Speak clearly, but don't shout. Talk into the telephone the way you would talk to someone face to face. Be polite and pleasant.

3. Sometimes the person who calls wants to speak to someone else at your house. Let's pretend you are Janie Allen, and Mr. Wright calls to talk to your Daddy. You and Mr. Wright know each other.

Mr. Wright says "Hello, Janie. May I speak to your Daddy?"

You say "Yes, Mr. Wright. I'll call him." Then you lay the handset down beside the base of the telephone. **Don't put it back in the cradle.** Next, you go find your Daddy and tell him that Mr. Wright wants him on the telephone. Don't stand close to the telephone and yell "Daddy!" That would hurt Mr. Wright's ear.

4. When someone calls you, let the person who called end the talk. Of course, if someone talks on, and on, and on, you

may have to say "I'm sorry, but I have to stop now. Thank you for calling."

When You Call Someone on the Telephone

1. Try to be sure you are calling the right number.

2. When someone answers, tell your name right away.

3. Perhaps the person who answers the telephone is not the one you are calling. Let's pretend you are Howard Allen and you want to talk to Bill Wright. Bill's mother answers the telephone, and you know her voice.

Mrs. Wright says "Sunnyside 5-3757."

You say "Hello, Mrs. Wright. This is Howard Allen. May I speak to Bill, please?"

4. If Mrs. Wright says "I'm sorry, Howard. Bill isn't in," don't say "Oh" and hang up. Say "Thank you, Mrs. Wright. I'll call again. Goodby."

5. When you call someone, you are supposed to close the conversation when you are through. Then you say "Goodby." And remember: don't talk on, and on, and on!



Usability Report Format

Issue #	Description	UX Severity (1-5)	Complexity to Fix (1-5)	Resolution

Usability Report Format

Issue #	Description	UX Severity (1-5)	Complexity to Fix (1-5)	Resolution
1	User didn't see the the "next" button, said they expected a button to be at the bottom "like the Continue button on the previous page"	4 (high)	1 (low)	consider changing the button color, or moving the position of the button
2	User expected that the system would know amount in their bank account, but didn't need it to complete task	1	5	(?) not sure we can attach those account data

The Stapler Usability Test



The Stapler Usability Test

- What questions do you ask on the pre-test questionnaire?
- What task do you have them perform?
- What do you ask on the post-test questionnaire?



MUSIC



6.910A/2.723A/16.662A /6.9101/2.7231/16.6621

D-TILE Problem Definition, Launch-Refine-Stop

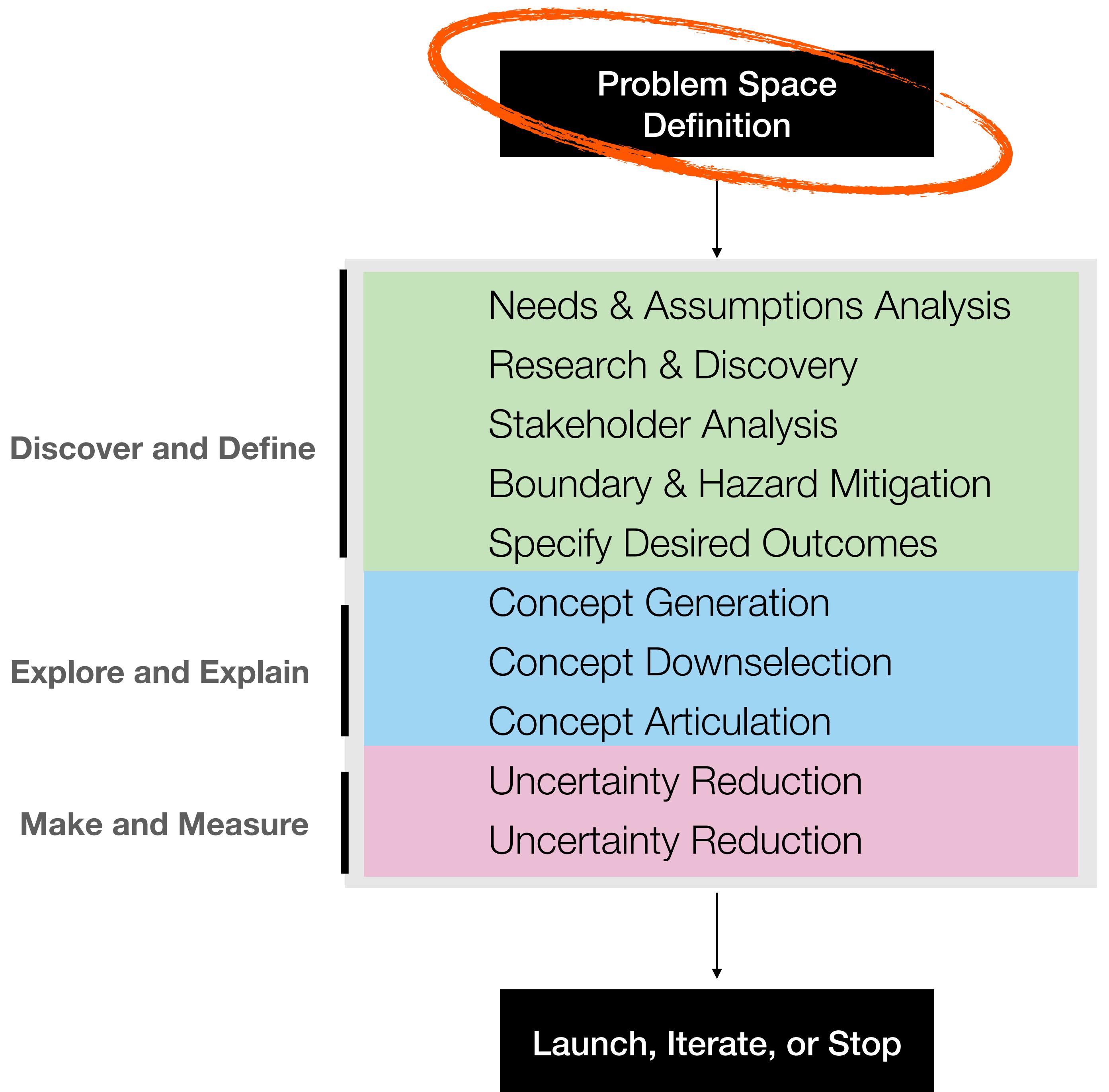
“A problem well
stated is a problem
half-solved”



Charles Kettering, 1876-1958



Step 1: Problem Space Definition



A Well-Defined Problem

- A well-defined problem makes **it easy for you to better understand how to solve the problem**
- A well-defined problem makes **it easy for others** to understand the problem and the value of solving it
- Good problem definitions **motivate people** to help you create value from solving the problem, it in ways you can not do alone
- A well-defined problem statement is hard to make

Typical Problem Definition, Example

Susan , who runs the warehouse
needs to make the warehouse go faster
because the warehouse was designed to serve 1000 warfighters
but now needs to serve 3000

Bad because

- 1) Susan doesn't have the problem, the warfighters do
- 2) "Make the warehouse go faster" defines the solution space
- 3) "now needs to serve 3000" doesn't motivate or show consequence of not solving the problem

Kotelly Problem Definition Structure

Focus the reader on the right group

<affected group, “who?”> currently <way they currently address or approach the situation, or how they currently solve the problem>.

States the current situation, and makes the status-quo clear to the reader

The reason we need to make a change is because
<motivating reason why the status quo is a problem>.

Makes this reader care about the problem and understand the consequence of not solving it

Therefore, we will create a solution that enables <affected group> to <experience a desired outcome>.

Focuses the reader on the OUTCOME, NOT the solution, which provides many more solution opportunities

BAD (And Typical) Problem Definition Example

Susan , who runs the warehouse needs to make the
warehouse go faster because the warehouse was designed to
serve 1000 warfighters but now needs to serve 3000

Bad because

- 1) Susan doesn't have the problem, the warfighters do
- 2) "Make the warehouse go faster" defines the solution space
- 3) "now needs to serve 3000" doesn't motivate or show consequence of not solving the problem

Good Problem Definition Example

warfighters currently fill out forms on line for the equipment they need from the warehouse, then pick up the equipment when they are alerted by email that it is available.

The reason we need to make a change is because the warehouse often doesn't provide the equipment warfighters need before they deploy, and sometimes the equipment they receive is wrong, which results in missions not being completed on time, completed at all, and the death of some warfighters.

Therefore, we will create a solution that enables warfighters to get their equipment before they need it.

6 Common Mistakes

Mistakes with logic

1. Incorrectly identified affected group

Did you state a group that's simply part of the system but not the end-user group?

2. Not stating the root problem (stating a downstream problem instead)

Did you identify the core problem, or did you identify a problem that is a result of the core issue?

3. Specifying the solution instead of a desired outcome

Does your outcome enable multiple different non-technical methods to address the problem? Or is there only 1 kind of way to solve the problem, ergo specifying the solution.

Mistakes with articulation

4. Not stating the current approach/solution/ method neutrally

5. Not creating clarity about why the problem should be addressed

6. Not stating the magnitude and impact of not solving the problem

A close-up photograph of a person's hands playing the wooden block game Jenga. The hands are shown from the side, with one hand firmly gripping a light-colored wooden block and the other hand reaching up to stabilize or remove a block from the top of the tower. The tower itself is composed of numerous Jenga blocks, all of which have the word "Jenga" printed on them in a stylized font. The background is dark and out of focus, making the light-colored wood stand out.

You Try

David, Military Veteran

David, like many military veterans, lives in a 2 floor house, but he's in a wheelchair. And while he has a way to go to the second floor using a chair-lift, the process can take more than 3 minutes to change floors. David's children often leave the lights or TVs on their room upstairs and forget to turn off the heat when they leave the house. Every time this happens, David has to wait for the lift to slowly take him to the other floor, and in our interview, he highlighted increased lift speed as something that would be very helpful to remedy the issue. David loses a lot of time trying to take care of this but he wants to save money on electricity that's wasted from the lights that stay on, and wasted heat.

What's The Problem Statement?

<affected group, "who?">
currently <way they currently address the issue or solve the problem>.

The reason we need to make a change is because <reason why this is a problem>.

Therefore, we will create a solution that enables <affected group> to <desired outcome>.

David, Military Veteran

David, like many military veterans, lives in a 2 floor house, but he's in a wheelchair. And while he has a way to go to the second floor using a chair-lift, the process can take more than 3 minutes to change floors. David's children often leave the lights or TVs on their room upstairs and forget to turn off the heat when they leave the house. Every time this happens, David has to wait for the lift to slowly take him to the other floor, and in our interview, he highlighted increased lift speed as something that would be very helpful to remedy the issue. David loses a lot of time trying to take care of this but he wants to save money on electricity that's wasted from the lights that stay on, and wasted heat.

Disabled military veterans who live in multi-level homes currently use chair-lifts to get from floor-to-floor in order to take care of common household tasks such as turning lights off on various floors.

The reason we need to make a change is because not being able to change floors quickly and easily results in wasted electricity which causes them to spend more needlessly, and creates a feeling of loss-of-control of their environment which results in further feelings of depression.

Therefore, we will create a solution that enables disabled military veterans to easily understand the status of all electronic devices in their home and control them remotely.



Step 12: Launch, Iterate, or Stop

