# 19MEP02 Innovation and Design Thinking

## UNIT-III
## DESIGN THINKING

# SCAMPER

- The SCAMPER method helps you generate ideas for **new products and services** by encouraging you to ask **seven different types of questions**, which will help you understand how you can innovate and **improve existing products, services**, **problems and ideas**.
- Here, you'll learn how to use the method.
- SCAMPER is surprisingly easy to start using and very **efficient** in innovation and ideations sessions.

# SCAMPER Method

- SCAMPER refers to a series of **thought sparkers** or provocations which help you to innovate on an **existing product**, **service** or **situation** by looking through **different lenses**. There are **seven** provocation **lenses** in the SCAMPER method:
- **S**ubstitute
- **C**ombine
- **A**dapt
- **M**odify (Also **M**agnify and **M**inify)
- **P**ut to another use
- **E**liminate
- **R**earrange

# SCAMPER

- **S** substitute something
- **C** combine it with something else
- **A** adapt something to it
- **M** modify or magnify it
- **P** put it to some other use
- **E** eliminate something
- **R** reverse or rearrange it

# How to Use SCAMPER

- First, take an **existing product or service**. It could be an existing product, service or idea which you want to improve or which could be a great starting point for future development.
- Then, simply go down the **list and ask questions** regarding each of the **seven elements**. Please see our step-by-step **guide below**.
- Apply the questions to values, benefits, services, touch points, product attributes, pricing, markets and essentially any other related aspect you might be able to think of that has relevance to your ideation needs.
- Look at the answers that you came up with. Do any of the answers stand out as viable solutions? Could you use any of them to create a new product, or develop an existing one?
- **Take** the **good ideas** and explore them further.

# SUBSTITUTE

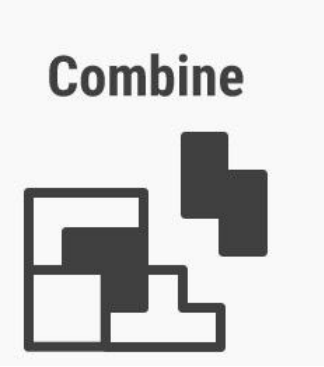

- The question to think about here is this: What can I substitute or change in my product, problem or process?
- You should think about substituting part(s) of your product or process for something *else*.

# SUBSTITUTE


**Guiding questions**

- What can I substitute so as to make an improvement?
- How can I substitute the **place, time, materials or people**?
- Can I substitute **one part** for another or change any parts?
- Can I replace someone involved?
- Can I change the **rules**?
- Should I change the **name**?
- Can I use other **ingredients** or **materials**?
- Can I use other **processes** or **procedures**?
- Can I change its **shape, colour, roughness, sound or smell**?
- Can I use this idea for other projects?
- Can I change my feelings or attitude towards it?

# COMBINE



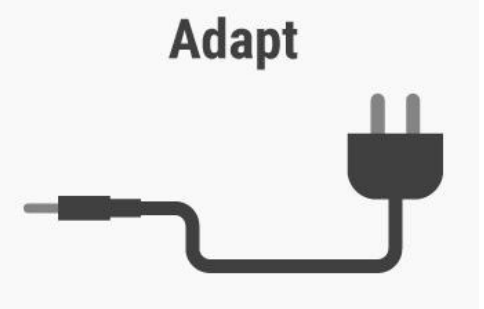

- The question to think about here is: How can I **combine two or more parts** of my product, problem, or process so as to achieve a *different* product, problem, or process to enhance synergy?
- Creative thinking involves combining previously unrelated ideas, products, or services in order to create something new and innovative.

# COMBINE

**Guiding questions**

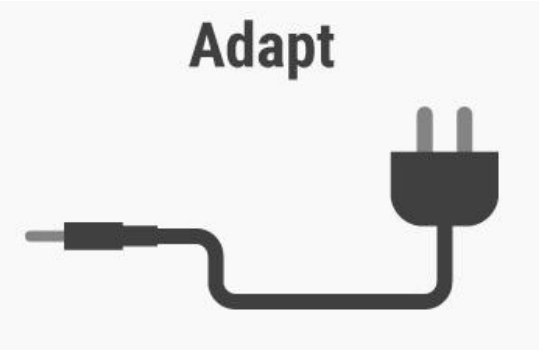
- What ideas, materials, features, processes, people, products, or components can I combine?
- Can I combine or merge this or that with other objects?
- What can I combine so as to maximize the number of uses?
- What can I combine in order to lower the costs of production?
- Which materials could I combine?
- Where can I build synergy?
- Which are the best elements I can bring together so as to achieve a particular result?

# ADAPT




- The question you need to think about is: What can I adapt in my product, problem, or process?
- Think about which parts of the product or process you could adapt so as to solve your problem.

# ADAPT




**Guiding questions**

- Which part of the product could I change?
- Could I change the characteristics of a component?
- Can I seek inspiration in other products or processes, but in a different context?
- Does the history offer any solutions?
- Which ideas could I adapt, copy, or borrow from other people’s products?
- What processes should I adapt?
- Can I adapt the context or target group?
- What can I adapt in this or that way in order to make this result?

# MODIFY (ALSO MAGNIFY AND MINIFY)

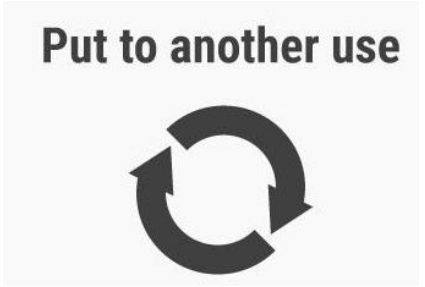

- The question you need to focus on is this: What can I modify or put more or less emphasis on in my product, problem, or process?
- Can I change the item in some way?
- Can I change meaning, colour, motion, sound, smell, form, or shape?
- It's time to magnify or exaggerate your idea, product, problem, or process—or to minify it.
- These questions will give you new insights about which components are the most important ones.
- Think about changing part or all of the current situation or product.
- Alternatively, distort the product in an unusual way.

# MODIFY (ALSO MAGNIFY AND MINIFY)


**Guiding questions**

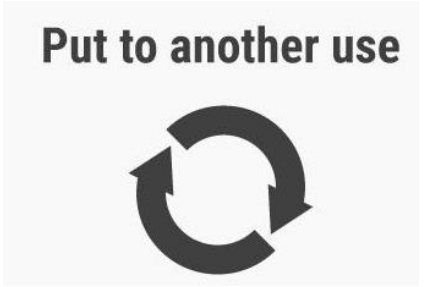
- What can I magnify or make larger?
- What can I tone down or delete?
- Could I exaggerate or overstate buttons, colours, size…?
- Could I grow the target group?
- What can be made higher, bigger, or stronger?
- Can I increase its speed or frequency?
- Can I add extra features?
- How can I add extra value?
- What can you remove or make smaller, condensed, lower, shorter or lighter—or streamline, split up or understate?
- What can I change in this way or that way so as to achieve such and such a result?

# PUT TO ANOTHER USE




- The question to consider here is this: How can I put the thing to other uses? What are new ways to use the product or service?
- Can I reach out to other users if I modify the product?
- Is there another market for the product?
- It’s time to work out *how* you may be able to put your current product or idea to other uses and purposes.

# PUT TO ANOTHER USE




**Guiding questions**

- What else can it be used for?
- How would a child use it?—an older person?
- How would people with different disabilities use it?
- Which other target group could benefit from this product?
- What other kind of user would need or want my product?
- Who or what else may be able to use it?
- Can it be used by people other than those it was originally intended for?
- Are there new ways to use it in its current shape or form?
- Would there be other possible uses if I were to modify the product?
- How can I reuse something in a certain way by doing what to it?

# ELIMINATE


- Question to consider here is:
- What can I eliminate or simplify in my product, design, or service?
- Think of what might happen if you were to eliminate, simplify, reduce, or minimise parts of your idea.
- If you continue to trim your idea, service, or process—you can gradually narrow your challenge down to that part or function that is most important.

# ELIMINATE


**Guiding questions:**

- What can I remove without altering its function?
- Can I reduce time or components?
- What would happen if I removed a component or part of it?
- Can I reduce effort?
- Can I cut costs?
- How can I simplify it?
- What’s non-essential or unnecessary?
- Can I eliminate the rules?
- Can I make it smaller?
- Can I split my product into different parts?
- I can eliminate what by doing what?

# REARRANGE


- You have to ask yourself this question:
- How can I **change**, **reorder**, or **reverse** the product or problem?
- What would I do if I had to do this process in reverse?

**Guiding questions:**

- What can I rearrange in some way – can I **interchange** components, the **pattern**, or the **layout**?
- Can I change the pace or **schedule**?
- What would I do if part of your problem, product or process worked in reverse?
- I can rearrange what in what way such that this happens?

# SCAMPER method

- The SCAMPER method is a creativity technique used to generate new ideas and innovative solutions by examining and modifying existing products, processes, or ideas.
- Each letter in the word "SCAMPER" represents a different aspect of the method that prompts you to ask specific questions to stimulate creative thinking.
- Here's how the SCAMPER method works, explained with a simple case study:

# Case Study: Improving a Backpack

Imagine you have been tasked with improving the design of a backpack. Let's apply the SCAMPER method step by step:

❑**Substitute**: Think about elements you could replace with something else.

1. What materials could you substitute to make the backpack lighter?
2. Can you substitute the traditional zipper with a more innovative closing mechanism?

❑**Combine**: Consider merging the backpack with other objects or features.

1. How about integrating a solar panel on the backpack to charge devices while on the go?
2. Can you combine a backpack with a folding chair for added convenience?

- **Adapt**: Modify the backpack to suit different environments or contexts.
    1. How could you adapt the design to make it suitable for outdoor adventures or urban commuting?
    2. Can you create a version that's more ergonomic for people with back problems?
- **Modify/Magnify**: Think about ways to alter the backpack's attributes or features.
    1. How could you modify the straps to make them more comfortable and adjustable?
    2. Can you magnify the storage capacity without making the backpack too bulky?

- **Put to Other Uses**: Explore alternative uses for the backpack.
  1. Can the backpack's compartments be repurposed for carrying groceries or as a pet carrier?
  2. How might the backpack serve as a mobile workstation for remote workers?
- **Eliminate**: Consider what elements you can remove or reduce.
  1. What components of the backpack are unnecessary and can be eliminated to streamline the design?
  2. Can you create a minimalistic version with fewer pockets and compartments?
- **Reverse/Rearrange**: Think about reversing or rearranging the existing features.
  1. How might the design change if the front of the backpack becomes the back?
  2. What if you reverse the order of pockets for easier access?

- **Example Idea Using SCAMPER:**
- Let's say you're working on the "Eliminate" aspect. You realize that some backpacks have multiple straps that serve various purposes, such as compression straps, shoulder straps, and waist straps. By eliminating these straps, you could create a more sleek and modern design that appeals to urban commuters looking for a stylish yet functional backpack.
- Remember, the SCAMPER method encourages you to explore each aspect in detail and **brainstorm a variety of ideas**. **Not all ideas** will be **feasible** or **suitable**, but the goal is to generate a range of **creative possibilities** that can lead to innovative solutions.

# Brainstorming

- Brainstorming is a group **problem-solving method** that involves the spontaneous contribution of **creative ideas** and **solutions**.
- This technique **requires intensive**, **freewheeling discussion** in which every member of the group is encouraged to think aloud and **suggest as many ideas** as possible based on their **diverse knowledge.**

# Brainstorming

- Brainstorming combines an informal approach to problem-solving with **lateral thinking**, which is a method for **developing new concepts** to **solve problems** by looking at them in **innovative ways**.
- Some of these ideas can be built into **original, creative solutions** to a problem, while others can generate **additional ideas**.

# Brainstorming

- Some experts believe that brainstorming is **better** than conventional group interaction, which might be hindered by group think.
- Group think is a phenomenon that occurs when the team's need for consensus overshadows the judgment of individual group members.

# Brainstorming

- Although **group brainstorming** is frequently **better for generating ideas** than normal group problem-solving, several studies have shown that individual brainstorming can produce better ideas than group brainstorming.
- This can occur because group members pay so much attention to others' ideas that they forget or do not create their own ideas.
- Also, groups do not always adhere to good brainstorming practices.

# Brainstorming

- During brainstorming sessions, participants should **avoid criticizing** or **rewarding ideas** in order to **explore new possibilities** and **break down incorrect answers**.
- Once the brainstorming session is over, the **evaluation session** (which includes analysis and discussion of the aired ideas) **begins**, and solutions can be crafted using conventional means.

# Brainstorming

- Common methods of brainstorming include **mind mapping**, (main idea-draw branches-keywords, colors, and images - **like a diagram of our thoughts**) which involves **creating a diagram** with a goal or key concept in the center with branches showing **subtopics** and **related ideas**; writing down the **steps needed** to get from Point A to Point B; "teleporting" yourself to a different time and place; putting yourself in other people's shoes to imagine how they might solve a problem; and "superstorming," or using a hypothetical superpower such as X-ray vision to solve a problem.

# Reverse Brainstorming

- Reverse brainstorming helps you to solve problems by **combining brainstorming** and **reversal techniques**.

- By combining these, you can extend your use of brainstorming to draw out even more creative ideas.

- Instead of thinking about **direct solutions to a problem**, reverse brainstorming works by identifying ways you could cause or **worsen a problem**.

# Reverse Brainstorming

- You then **reverse these ideas** to find solutions you hadn't thought of before.
- Reverse brainstorming is a **good technique** to try when it is difficult to **identify solutions** to the problem directly.
- It is often an engaging process, and can **highlight hidden faults** in a **process** or **product.**

# How to Use Reverse Brainstorming

To use this technique, you start with one of two "**reverse" questions:**

- Instead of asking, "**How do I solve or prevent this problem**?" ask, "**How could I possibly cause the problem**?" And instead of asking "**How do I achieve these results**?" ask, "**How could I possibly achieve the opposite effect**?"

- Then, brainstorm answers to generate reverse solution ideas. Allow the ideas to flow freely – do not reject anything at this stage.

# How to Use Reverse Brainstorming

- Once you have brainstormed all the ideas to create the problem, now reverse these into solution ideas for the original problem or challenge.
- Finally, **evaluate these solution ideas**. Can you see a potential solution? Can you see attributes of a potential solution?
- Like normal brainstorming, you can reverse brainstorm on your own but you will likely generate more varied ideas as part of a team.

# Example of Reverse Brainstorming

- Luciana is the manager of a **health clinic** and she has the task of improving **patient satisfaction**.
- There have been **various unsuccessful improvement initiatives in the past** and the team members have become rather skeptical about another meeting on the subject.
- So she decides to use some **creative problem solving techniques** she has learned. This, she hopes, will make the team meeting more interesting and engage people in a new way.
- Perhaps it will reveal something more than the usual "**good ideas**" that no one has time to act on.

# Example of Reverse Brainstorming

- To prepare for the team meeting, Luciana thinks carefully about the problem and writes down the **problem statement**:
- "**How do we improve patient satisfaction**?"
- Then she reverses the problem statement:
- "**How do we make patients more dissatisfied**?"

# Example of Reverse Brainstorming

- Already she starts to see how the **new angle** could reveal some surprising results.
- At the team meeting, everyone gets involved in an **enjoyable** and **productive** reverse brainstorming session.
- They draw on both their **work experience** with patients and also their **personal experience** of being patients and customers of other organizations.
- Luciana encourages the **free flow of ideas**, while ensuring that people do not pass judgment on even the most unlikely suggestions.

# Example of Reverse Brainstorming

Here are just a few of the "reverse" ideas:

- Double book appointments.
- Remove the chairs from the waiting room.
- Put patients who phone on hold (and forget about them).
- Have patients wait outside in the car park.
- Put patients who need an appointment on a six-week waiting list.

# Example of Reverse Brainstorming

When the brainstorming session runs dry, the team has a long list of the "reverse" solutions. Now it's time to look at each one in reverse to think about a potential solution.

- **Prevent double booking appointments** by investing in an improved booking system.
- **Add more chairs** so that no one has to stand while waiting.
- Aim to keep patients on **hold for no longer than three minutes**.
- Open the waiting room **10 minutes earlier**, so that patients don't have to queue outside in the mornings.
- Invest in **new software** so that patients can have **virtual appointments**, easing the backlog of patients waiting for an in-person appointment.

# Example of Reverse Brainstorming

- The reverse brainstorming session revealed many improvement ideas that the team could implement swiftly.
- The process was enlightening and fun for the team, and it helped them to become more patient-focused.
- It took a little longer than regular brainstorming would have, but it generated more innovative solutions.

# The benefits of reverse brainstorming

There are a few benefits of reverse brainstorming that have a positive impact on the team and its individual members.

1. **Encourages critical thinking**

- Reverse brainstorming serves as a **catalyst for critical thinking**, prompting participants to question assumptions and challenge the status quo.
- By shifting the focus from **solutions to problems**, individuals focus on exploring the **root causes** and underlying **factors**, leading to a more comprehensive understanding of the problem and challenge.
- Through critical thinking, new insights emerge, which can lead to innovative problem-solving.

# The benefits of reverse brainstorming

**Shifts perspective**

- One significant benefit of reverse brainstorming is its *capacity* to **change the perspective of the participants**.
- By deliberately ***focusing on*** the **negative aspects of a topic**, this technique ***breaks*** the **conventional pattern** and introduces fresh avenues for **creative thinking**.
- It *encourages* participants to venture **beyond** their **comfort zones**, urging them to examine the problem from **various angles** and explore unconventional approaches.
- Reverse brainstorming creates the **opportunity** for *finding* **new, innovative solutions** for problems.

# The benefits of reverse brainstorming

**Unleashes creativity**

- Creativity flourishes when limitations are embraced, and reverse brainstorming provides the perfect playground for imaginative thinking.
- By generating a list of "anti-solutions" or exploring the worst possible scenarios, participants are encouraged to think outside the box.
- In reverse brainstorming sessions, participants generate new and unique solutions that may have been overlooked in traditional brainstorming sessions.

# The benefits of reverse brainstorming

**Enhances collaboration**

- Reverse brainstorming fosters a collaborative environment where team members can freely contribute their thoughts and ideas.
- By focusing on identifying problems rather than proposing solutions, it creates an open and non-judgmental space that encourages active participation.
- The diverse perspectives that are exposed in collaborative reverse brainstorming sessions often lead to richer discussions, deeper insights, and more innovative outcomes.

# Applications of Reverse Brainstorming

- Reverse brainstorming finds widespread applicability across various domains as a go-to method for effectively tackling specific challenges and uncovering optimal solutions.
- Reverse brainstorming can be practiced either through an online brainstorming tool or in-person settings, such as conducting workshops with a team.

# Applications of Reverse Brainstorming

**Product and service innovation**

- Reverse brainstorming can be a valuable tool for **product** and **service innovation**.
- By pinpointing flaws, potential issues, or customer pain points, organizations can proactively address them, leading to improvements, refinements, and the development of new features.
- Reverse brainstorming helps in **identifying** potential pitfalls or **challenges** early on in the design or development process, ensuring a more **robust final product**.

# Applications of Reverse Brainstorming

**Process improvement**

- Efficiency and productivity are paramount in any organization.
- Reverse brainstorming can be applied to identify bottlenecks, inefficiencies, or outdated processes.
- By examining the obstacles and problems within existing workflows, reverse brainstorming enables teams to explore innovative ways to streamline operations, optimize resource allocation, and enhance overall productivity.

# Applications of Reverse Brainstorming

## Problem-solving in various fields

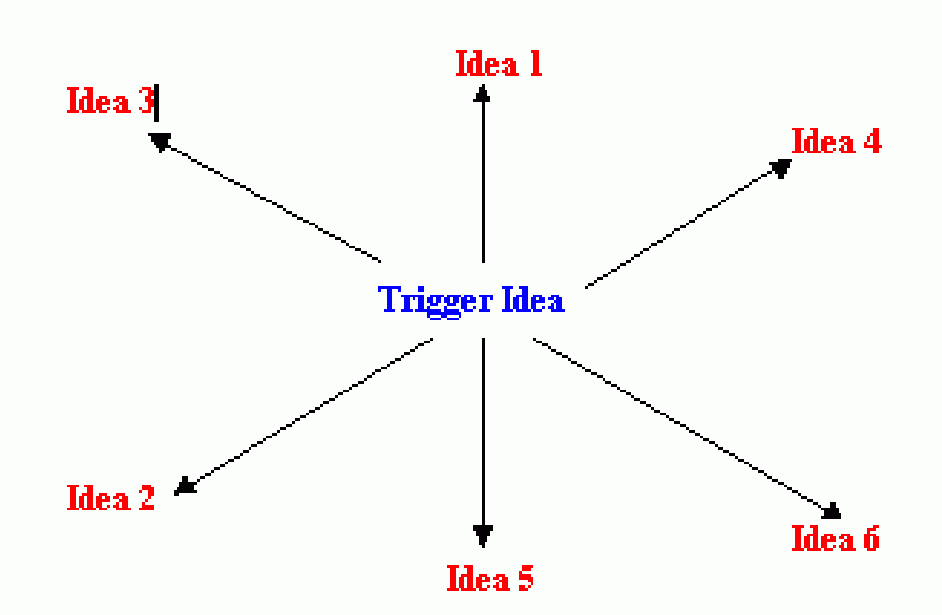
- The versatility of reverse brainstorming makes it applicable to diverse fields such as business, education, healthcare, and technology.
- By emphasizing problem identification, reverse brainstorming enables a deeper understanding of the issues at play, paving the way for more effective problem-solving

# Trigger method

- Trigger method is a way of brainstorming, where each idea creates many new ideas.
- Each of those ideas can also lead to new ones.
- The trigger method is analysis based on repetition.
- One idea triggers another and another and so on until as many thoughts as possible are generated.

# Trigger method

- Trigger Method. Brainstorm on as many ideas as possible.
- Then select the best ones and brainstorm on those ideas as ‘triggers’ for more ideas.
- Repeat until you find the best solution.



# Trigger method

- Different ideas for a trigger method brainstorming sessions include:
  - ❑Start the session by defining the problem or using **open-ended** questions and statements.
  - ❑"**Round robin**" variation can be used, where each person must take a turn and there are **no interruptions** and **no feedback** until each person takes a turn.
  - ❑Can use a **moderator** or **facilitator** to give questions and make sure each person shares ideas.
  - ❑Each person can **take notes** and write down their **ideas** and **triggers**, then share at the end of the session.
  - ❑The **best ideas** are selected, and the session continues until possible solutions are found.
- Trigger Sessions are a good way of getting lots of ideas down from untrained resources.

Remember when brainstorming:

- There are no bad ideas
- Do not criticize other ideas.
- Build on other people’s topics or ideas
- Quantity over quality

# Brainwriting, defined

- An idea generation technique in which participants independently write down their ideas—synchronously or asynchronously.
- Those ideas are then gathered, shared, and discussed in a group.
- **How to get started with brainwriting**
- Brainwriting starts with individual work, allowing time and space for people to think deeply and freely without fear of judgment or the influence of louder or more senior voices.

# Brainwriting

A step-by-step guide to brainwriting

**Step 1:** Ask colleagues to write down their ideas within a prescribed timeframe, conducted synchronously or asynchronously. Ideas can be captured in individual documents which are then shared and collated, or in a single document.

**Step 2**: Once ideas are captured in a single document, provide a feedback round for the group to weigh in with questions and comments (again either synchronously or asynchronously).

**Step 3**: Meet together, in person or virtually, to discuss.

# Benefits of brainwriting

- Separating the act of idea generation from the act of idea review creates more psychological safety for diverse teams, making space for more voices and averting groupthink.

# Brainwriting example

1. BrainWriting Pool
2. BrainWriting 6-3-5
3. Idea Card Method
4. BrainWriting Game
5. Constrained BrainWriting
6. Varying the level of constraint

# What is the 6-3-5 brainwriting technique?

- If you’re looking to try out brainwriting for your next idea generation exercise, the 6-3-5 brainwriting method is a simple and effective approach to get you started. This technique can work in both in-person and virtual settings.

- Led by a moderator and focused on a single question or problem statement, six participants each record three ideas in five-minute rounds in a shared document or worksheet.
- At the end of each round, the document is “passed” to another participant, who can then build upon their colleagues’ ideas.
- The result: 108 ideas generated in 30 minutes

# Brainwriting Pool

- There is no specified template for this method of brainwriting. Brainwriting pool can be done using post-it notes or small-sized cards.
- Each member of the team writes down their ideas and places them on the table. Then each member can pick a card or two to add more ideas.
- These ideas can be brand new or piggyback on existing ideas.

**Idea Card Brainwriting**

- In this brainwriting technique, each member of the team writes down his or her ideas on a small card and piles them up on the table.
- The neighbour member can take one or two idea cards from the pile for inspiration to create new ideas or build on the existing ideas.
- You can decide the number of rounds based on the problem and the number of participants in the team.

**Brainwriting Game**

- This is a fun way of conducting brainwriting sessions in the form of a game. This brings a more competitive approach to the session.
- To keep it a light-hearted game that everyone can enjoy, you have to ensure that there are no losers in this game and the winner will be decided by all the members.

# *Here are the steps to conduct a brainwriting game*

- Divide the members into two groups and distribute an equal number of cards to each member of both groups, for example, each team gets 20 cards.
- Announce the problem that you want a new creative solution to. Also, make it clear that the winner will be the one who comes up with the best idea.
- Set a fixed timeframe for the members to write down a certain number of ideas. The number of ideas you want from each member should be equal to the number of cards they have. So, if a team has 5 members, each of them has 4 cards. Each card should have only one idea.

- Now the moderator will sell a certain number of blank idea cards to each group member at a decided price. All the money that has been collected will be kept aside as the winning prize. After that, each member signs the cards so they can identify their cards at the end.
- After the given time of the first round, all members hand over their idea cards to be displayed on the board.
- Now another stipulated time is given to all members to read every idea on the displayed cards. At this time members can pick any idea card and amend it to make it a more relevant and meaningful solution to the problem.
- Now every member of the team will have two voting tokens (generally two stars). They can vote for the idea or card that they feel is the best solution to the problem. The idea card with the maximum number of votes wins the game and gets the pooled prize money.

# Constrained Brainwriting

- In this brainwriting method, the idea remains constrained to a predetermined focus.
- It doesn't allow for the off-the-wall creative thinking found in other brainwriting techniques.
- This technique is very similar to the brainwriting pool method but starts with the second round in which the existing ideas are filled to the cards.

# The steps for the constrained brainwriting method

- The moderator starts the process by placing stacks of brainwriting templates at the center of the table. Each template already has an idea written on it that explains the problem and the way it is expected to be solved.
- Now each member picks a template and silently goes through the idea written on them. He or she needs to add a variable to the idea or modify it to make the idea more relevant to the problem.
- If the member is unable to modify the pre-written idea then he or she can return the template to the pile on the table and pick another one to continue the process.

# The steps for the constrained brainwriting method

- After the predetermined amount of time, the first round is over. The members should place their templates on the table. Next, they will again pick the template at random from the first round or from the already stacked pile with only one idea written on the template and improve it.
- Several rounds should be conducted until all ideas are exhausted. Now the moderator will have all the ideas to review and decide which one offers the best creative solution to the problem. During the whole brainwriting process, there should not be a discussion of any kind amongst the members.

# Nature-inspired innovations: Applying design thinking to biomimicry

- Objective is to discuss the Design Thinking approach to solving problems for humans, and how it is being used to build a framework called Biomimicry Thinking, which guides the process of nature-inspired innovations.
- It further goes on to understand the Design Lens, a tool which helps in the merger of Design Thinking and Biomimicry, and highlights some of the most fascinating man-made inventions, built by applying nature’s tried and tested principles of life.

# Design Thinking

- It is the ability of a designer to match people’s needs with what is feasible and convert them into a market opportunity.
- the design thinking process is not a lightning strike moment of a lone genius.
- It is in fact a team-based approach to innovating, by blending in the expertise of art, craft, science and management, and finding the root cause of the problem.

# How does Design Thinking solve our problems?

- Rather than being a series of orderly steps, the entire process is a system of spaces.
- Design thinking can feel complex to those experiencing it for the first time.
- Thus this system helps interconnect the various related activities that ensure continuity in the process of innovation.
- For the creation of an idea and formation of a subsequent product, these 3 spaces and general activities can be stated

1. **Inspiration**: *Look at the world*: Observe what people do, how they think and what they want. Involve many disciplines here, from designing to engineering. Then organize information and synthesize opportunities.
2. **Ideation**: *Brainstorm*: Build creative frameworks, prototype and test your ideas with the targeted audience.
3. **Implementation**: *Execute the vision*: Spread the word and help the marketing team in building campaigns for the launch of your product.

# Biomimicry

- Also known as Biomimetics, it is the interdisciplinary field of creating products by reverse engineering nature.
- Simply put, it helps researchers study natural phenomena to obtain ideas from nature and apply them to solve real world human problems.
- While nature has been a source of artistic inspiration since time immemorial, the field was only popularized in 1997 with the launch of the book by Janine Benyus, *Biomimicry: Innovation Inspired by Nature*.
- Thereafter came the emergence of AskNature.org, which now provides a web database of over 1700 publicly available biological strategies.


BIOLOGICAL STRATEGY
Cicada Wings Repel Water, Dirt, Bacteria, and Light
Cicada


BIOLOGICAL STRATEGY
Thinner Fur Keeps Numbats Warmer
Numbat


BIOLOGICAL STRATEGY
Maggots Eat the Dead, But Heal the Wounded
Green Bottle Fly


BIOLOGICAL STRATEGY
The Trojan Horse Chemical That Makes Bacteria Self-destruct


BIOLOGICAL STRATEGY
How Proteins Help Corals Build Rock-Hard Reefs


BIOLOGICAL STRATEGY
How a Camel's Fur Coat Keeps It Cool
Dromedary camel


BIOLOGICAL STRATEGY
Diatoms Build Glass Houses That Are Stable and Strong
Diatoms


BIOLOGICAL STRATEGY
Salt and Squeezing Turn Liquid to Spider Silk
Spiders


BIOLOGICAL STRATEGY
The Subterranean Web With Surprising Superpowers
Fungi


BIOLOGICAL STRATEGY
How Fungi Can Clean Up Pollution
Fungi

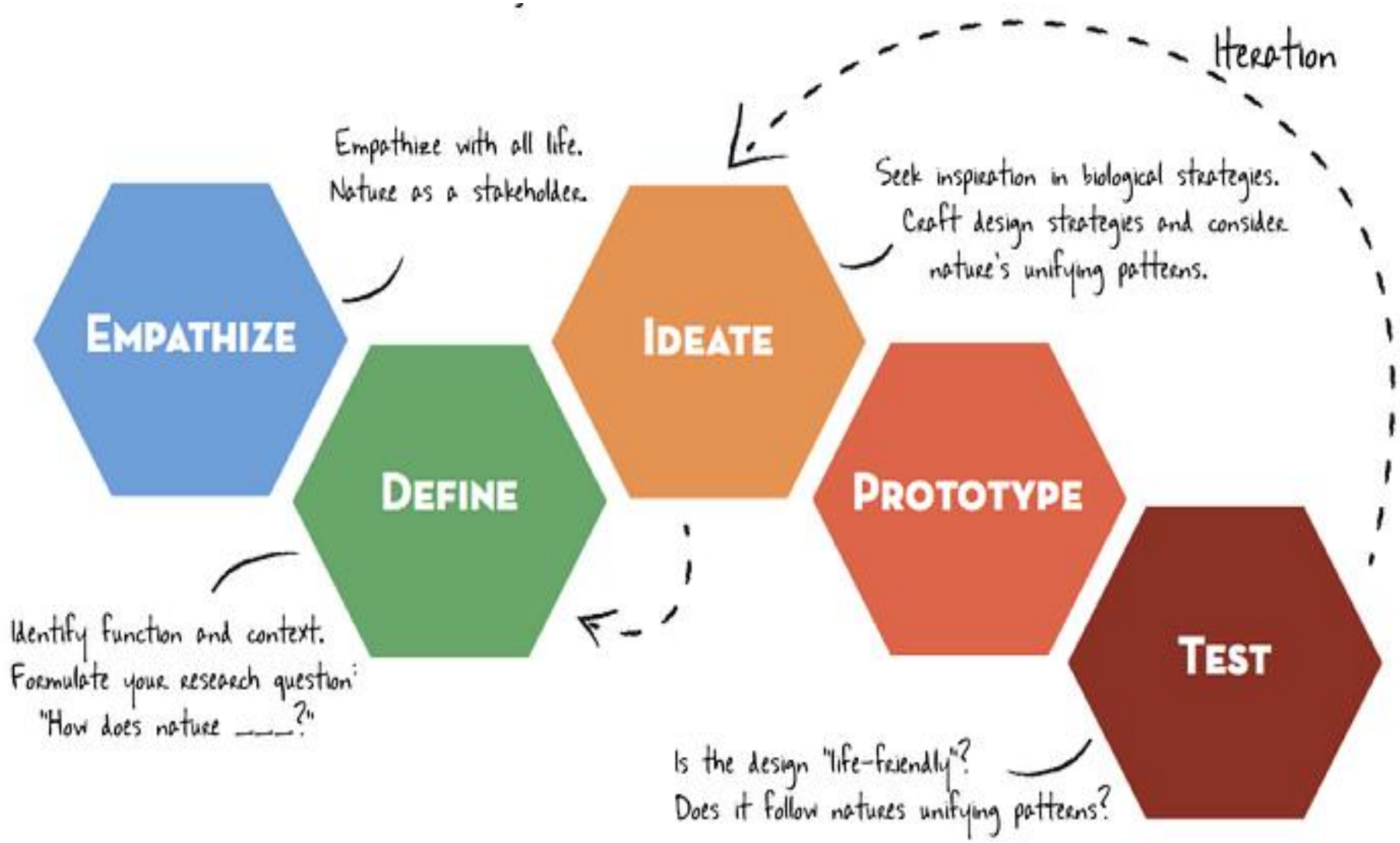

BIOLOGICAL STRATEGY
Microbes Strip Plant Fibers Clean
Bacteria


BIOLOGICAL STRATEGY
Mussels Hold On With Fancy Footwork
Common mussel

# The Design Thinking Process

- While Design Thinking emphasizes starting the design process with focus on empathy for human users, and biomimicry extends that concept to include all life forms.
- The “ideate” step depicted in the following figure searches nature for inspiration i.e translating strategies by considering nature’s unifying patterns, before implementing it in solutions and inventions.

# The process of Design Thinking inspired by Biomimicry

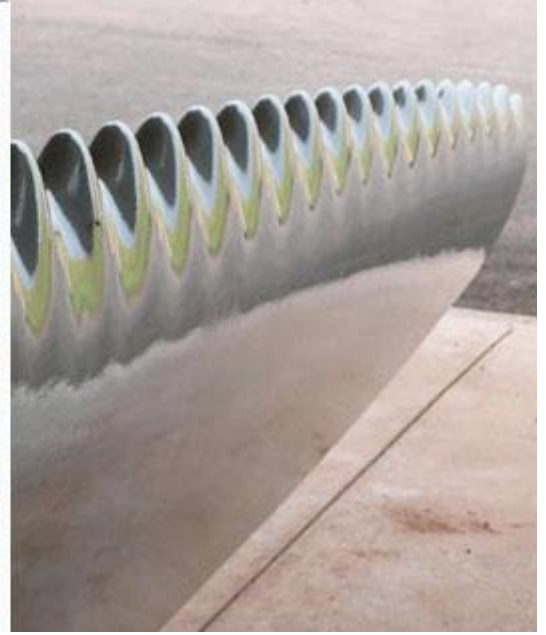


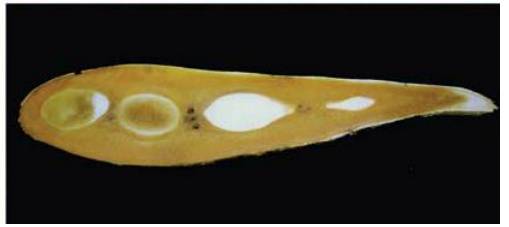
- Take for example, Japan’s early version of Shinkansen Bullet trains.
- They were making a loud boom on travelling through tunnels at nearly 186 mph, causing structural damage.
- The team of designers noticed that kingfisher birds have specialized beaks which allows them to dive into water to hunt and make a minimal splash.
- So the engineering team studied this bird’s head for understanding high-speed streamlining, and created the next generation 500 series trains.
- These trains were 10% faster, consumed 15% less electricity, and did not create any “tunnel boom”.

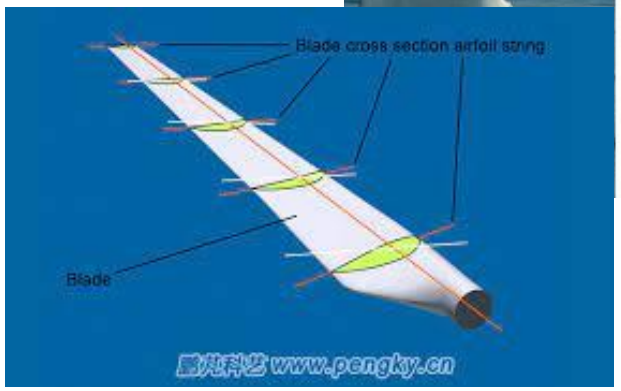
- Therefore Biomimicry Thinking helps transition from simply following the shape of a Kingfishers’ beak, to carrying out a decrease in the sound impact created by the trains.
- Here, the design lens depicts nature as a model that promotes learning from the best adapted models that inspire solutions to human challenges for long-term survival.

# Imitating Nature’s forms

- **Wind turbines inspired by Whales**: Whales are aerodynamic, and one of nature’s best swimmers.
- The swimming efficiency of humpback whales has inspired serrated-edge wind turbines, which are much quieter than the regular blades.

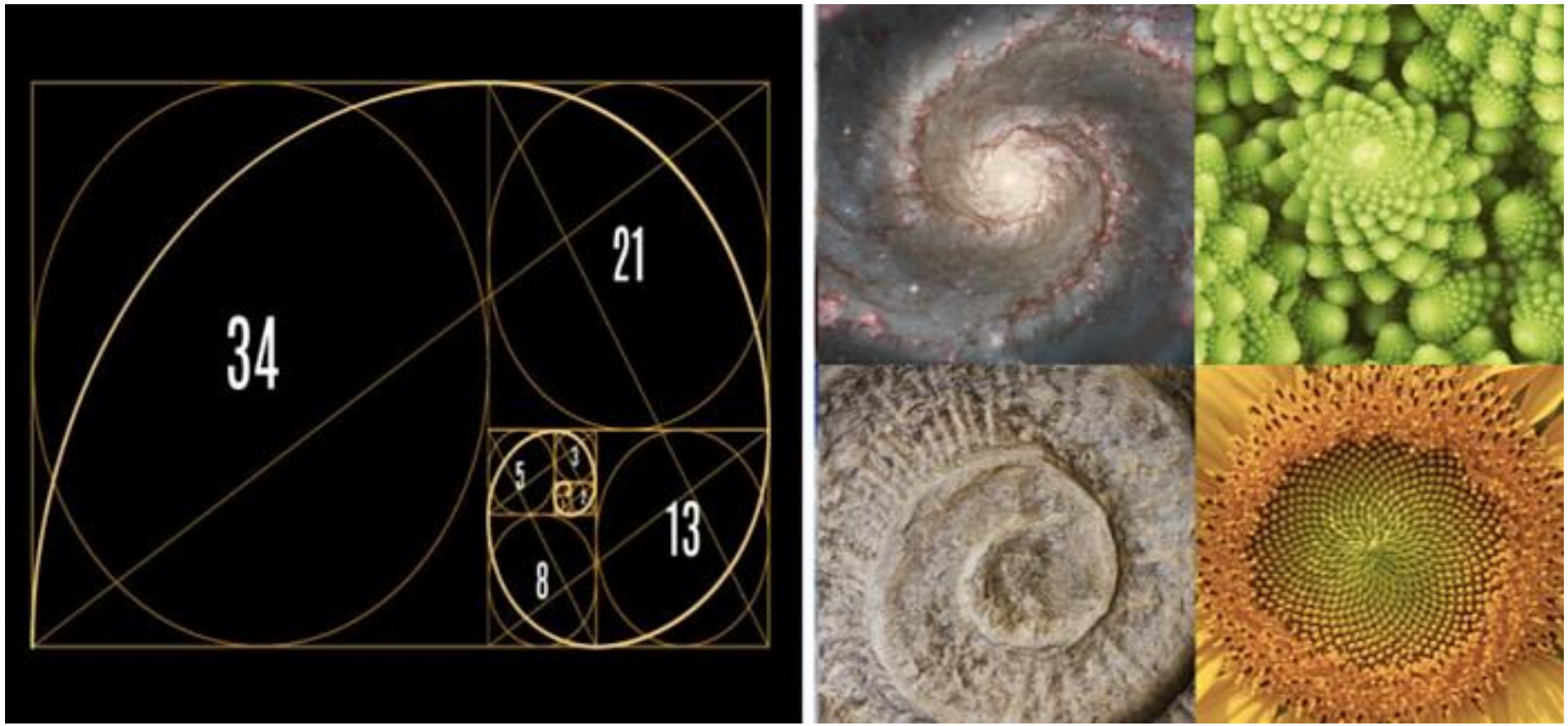






- **Daily usables like tape and velcro, inspired by a plant and a lizard** — Burdock Plant has seeds with tiny hooks to stick to things with loops like cotton fibers of pants.
- This led to the creation of “zipperless-zipper” or Velcro brand hook and loop.
- Similarly, Gecko Lizards stick to the surfaces without adhesives, due to hair on their toes.
- When the direction of the hair is changed, they are able to break the grip without any sticky residues.
- This led to the creation of Scotch tape.

- **Robotics inspired by Swarm Intelligence** — It is the collective behaviour displayed by living organisms, to effectively coordinate their activities via decentralized control.
- This includes ant and bee colonies, hawks hunting, bird flocking, animal herding and fish schooling.
- This concept is being used by NASA in deploying swarms of tiny spacecrafts for space exploration, and by the medical community in deploying swarms of nanobots for precision delivery of drugs.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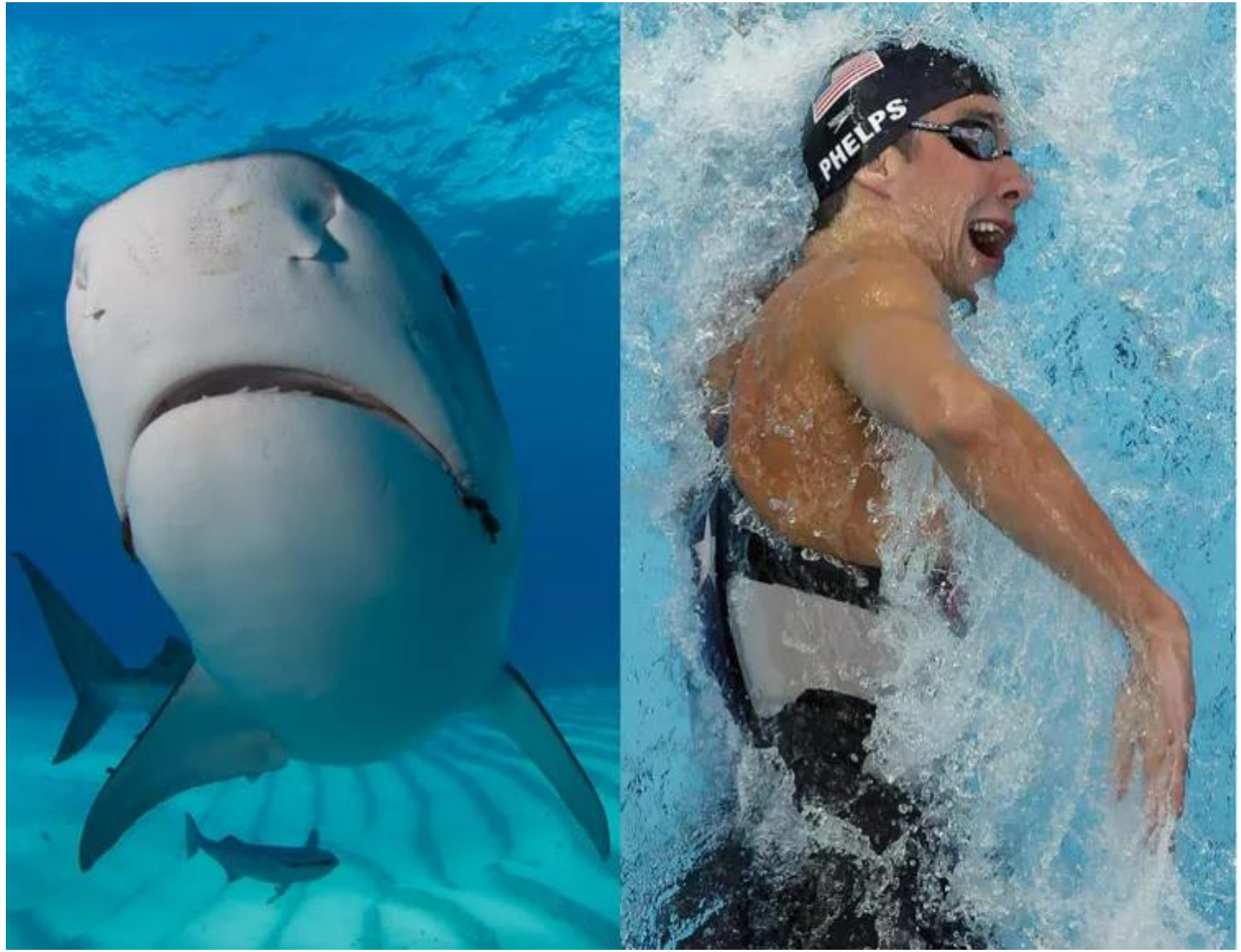
# Amazing Examples of Biomimicry

- Biomimicry looks to nature and natural systems for inspiration, using nature-inspired strategies for improving design.
- Through adaptation and evolution, nature spends millions of years tinkering its way out of problems, ending up with some mind-boggling innovations.
- Inefficiency doesn't last long in nature, and human engineers and designers often look there for solutions to modern problems.

- Sharkskin-inspired swimsuits received a lot of media attention during the 2008 Summer Olympics when the spotlight was shining on Michael Phelps.
- Seen under an electron microscope, sharkskin is made up of countless overlapping scales called dermal denticles (or "little skin teeth").
- The denticles have grooves running down their length in alignment with water flow.
- These grooves disrupt the formation of eddies, or turbulent swirls of slower water, making the water pass by faster.
- The rough shape also discourages parasitic growth such as algae and barnacles.

- Scientists have been able to replicate dermal denticles in swimsuits (which are now banned in major competition) and the bottom of boats.
- When cargo ships can squeeze out even a single percent in efficiency, they burn less bunker oil and don't require cleaning chemicals for their hulls.
- Scientists are applying the technique to create surfaces in hospitals that resist bacteria growth — the bacteria can't catch hold on the rough surface.

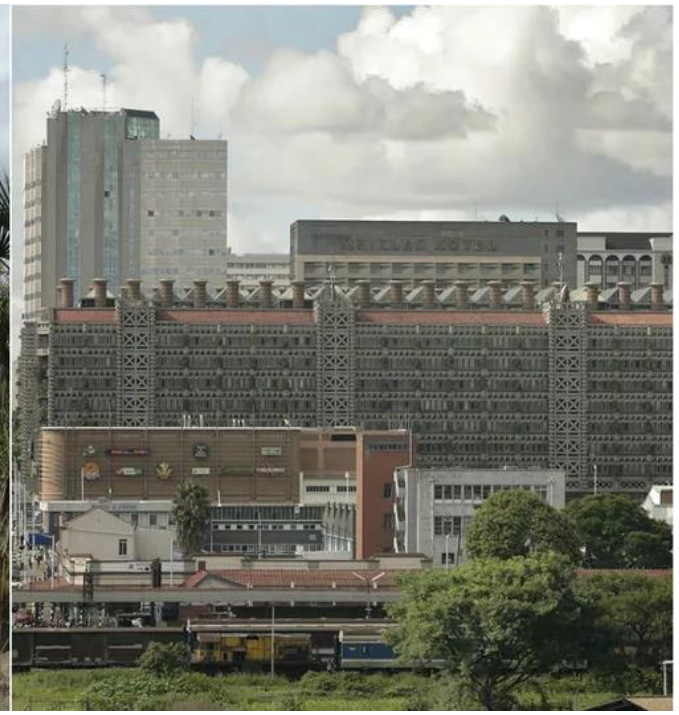

PHELPS

# Beaver = Wetsuit

- Beavers have a thick layer of blubber that keeps them warm while they're diving and swimming in their water environments.
- But they have another trick up their sleeves for staying toasty.
- Their fur is so dense that it traps warm pockets of air in between the layers, keeping these aquatic mammals not only warm, but dry.

- “We are particularly interested in wetsuits for surfing, where the athlete moves frequently between air and water environments,” says Anette (Peko) Hosoi, a professor of mechanical engineering and associate head of the department at MIT. “We can control the length, spacing, and arrangement of hairs, which allows us to design textures to match certain dive speeds and maximize the wetsuit's dry region.”

# Termite Den = Office building



- Termite dens look otherworldly, but they are surprisingly comfortable places to live.
- While the temperature outside swings wildly throughout the day from lows in the 30s to highs over 100, the inside of a termite den holds steady at a comfortable (to a termite) 87 degrees.
- Mick Pearce, architect of Eastgate Centre in Harare, Zimbabwe, studied the cooling chimneys and tunnels of termite dens.
- He applied those lessons to the 333,000 square-foot Eastgate Centre, which uses 90 percent less energy to heat and cool than traditional buildings.

- The building has large chimneys that naturally draw in cool air at night to lower the temperature of the floor slabs, just like termite dens.
- During the day, these slabs retain the coolness, greatly reducing the need for supplemental air conditioning.

# Burr = Velcro

- Velcro was invented by Swiss engineer George de Mestral in 1941 after he removed burrs from his dog and decided to take a closer look at how they worked.
- The small hooks found at the end of the burr needles inspired him to create the now ubiquitous Velcro.
- Think about it: without this material, the world wouldn't know Velcro jumping — a sport in which people dressed in full suits of Velcro attempt to throw their bodies as high up on a wall as possible.

# Whale = Turbine

- Scientists at Duke University, West Chester University and the U.S. Naval Academy discovered that the bumps at the front edge of a whale fin greatly increase its efficiency, reducing drag by 32 percent and increasing lift by 8 percent.
- Companies are applying the idea to wind turbine blades, cooling fans, airplane wings and propellers.

# Birds = Jets

- Birds have been able to boost the distance they're able to fly by more than 70 percent though the use of the V-shape.
- Scientists have discovered that when a flocks takes on the familiar V-formation, when one bird flaps its wings it creates a small updraft that lifts the bird behind.
- As each bird passes, they add their own energy to the stroke helping all the birds maintain flight.
- By rotating their order through the stack, they spread out the exertion.
- A group of researchers at Stanford University thinks passenger airlines could realize fuel savings by taking the same tactic.
- The team, lead by Professor Ilan Kroo, envisions scenarios where jets from West Coast airports meet up and fly in formation en route to their East Coast destinations.
- By traveling in a V-shape with planes taking turns in front as birds do, Kroo and his researchers think aircraft could use 15 percent less fuel compared to flying solo

# Lotus = Paint

- The lotus flower is sort of like the sharkskin of dry land.
- The flower's micro-rough surface naturally repels dust and dirt particles, keeping its petals sparkling clean.
- If you've ever looked at a lotus leaf under a microscope, you've seen a sea of tiny nail-like protuberances that can fend off specks of dust.
- When water rolls over a lotus leaf, it collects anything on the surface, leaving a clean leaf behind.
- A German company, Ispo, spent four years researching this phenomenon and has developed a paint with similar properties.
- The micro-rough surface of the paint pushes away dust and dirt, diminishing the need to wash the outside of a house

# CUSTOMER JOURNEY MAPPING

- Customer journey mapping is a *strategic tool* used by businesses and organizations to better *understand* and *visualize* the *experiences of their customers* as they interact with their products, services, or brand over time.
- It involves creating a *visual representation or map* of the various *touchpoints* and interactions that customers have with a business, from initial awareness through the entire *customer lifecycle*.

- **Customer Perspective**: It focuses on the customer's perspective, helping businesses see their products or services through the *eyes of their customers*. This includes *understanding their needs, motivations, pain points, and emotions at each touchpoint*.

- **Touchpoints:** A customer journey map identifies all the *touchpoints* where *customers interact* with a business. These touchpoints can include *website visits, social media engagement, customer support calls, product usage*, and more.

- **Stages**: The customer journey is typically divided into various stages, such as awareness, consideration, purchase, onboarding, and retention. Each stage represents a different phase of the customer's relationship with the business.
- **Emotions and Pain Points**: Effective customer journey maps often include insights into the emotions and pain points experienced by customers at each touchpoint. This helps businesses prioritize improvements and create more positive experiences.

- **Personas**: Customer journey maps often incorporate customer personas, which are fictional representations of different customer segments. These personas help businesses understand the unique needs and preferences of various customer groups.
- **Goals and Objectives**: Businesses use customer journey mapping to align their goals and objectives with the customer's needs and expectations at each stage of the journey.

- **Improvement Opportunities**: By analyzing the customer journey map, businesses can identify areas where they can make improvements to enhance the overall customer experience. This might involve optimizing a website, streamlining a purchase process, or improving customer service interactions.
- **Cross-Functional Collaboration**: Customer journey mapping often involves collaboration across different departments within a business, including marketing, sales, customer service, and product development. It helps break down silos and ensures a unified approach to customer experience.

- **Continuous Iteration**: Customer journey maps are not static documents. They should be regularly updated and refined as customer behaviors and preferences change, or as the business evolves.
- Overall, customer journey mapping is a valuable tool for businesses to gain insights into their customers' experiences, improve customer satisfaction, and drive growth by delivering more personalized and seamless interactions. It's a holistic approach to understanding and enhancing the customer experience throughout their entire journey with a company.

- Case Study: Online Retailer "EcoTrends"

- Background: "EcoTrends" is an online retailer specializing in eco-friendly and sustainable products such as clothing, home goods, and accessories. They have noticed a recent decline in sales and want to understand their customers' journey better to identify areas for improvement.

- **Customer Journey Mapping Process:**
- **Step 1**: Define Customer Personas EcoTrends starts by defining three customer personas:
- Sarah - A young environmentalist looking for eco-friendly clothing.
- David - A homeowner interested in sustainable home products.
- Emma - A gift shopper seeking unique and eco-conscious presents.

- **Step 2:** Identify Touchpoints Next, EcoTrends identifies various touchpoints in the customer journey for each persona:
- Awareness: Social media ads, blog posts, and word-of-mouth.
- Consideration: Website visits, product browsing, and reading reviews.
- Purchase: Adding products to the cart and completing the checkout.
- Post-Purchase: Order tracking, delivery, and follow-up emails.

- **Step 3**: Understand Customer Emotions and Pain Points Through surveys and customer feedback, EcoTrends identifies emotions and pain points at each touchpoint:
- Sarah feels excited when discovering new eco-friendly brands but frustrated with slow website loading times.
- David is delighted by product variety but confused by the complex checkout process.
- Emma values gift recommendations but dislikes receiving irrelevant promotional emails.

- **Step 4**: Create Customer Journey Maps EcoTrends creates separate journey maps for each persona, highlighting their experiences, emotions, and pain points at each stage. These maps visualize the customer journey for Sarah, David, and Emma.
- **Step 5:** Analyze and Prioritize Improvements By reviewing the customer journey maps, EcoTrends identifies key areas for improvement:
- Improve website speed to reduce Sarah's frustration during product browsing.
- Simplify the checkout process to address David's confusion.
- Segment email marketing to provide Emma with more relevant content.

- **Step 6**: Implement Changes EcoTrends implements the suggested improvements:
- Optimizes website performance for faster loading times.
- Streamlines the checkout process with a guest checkout option.
- Personalizes email marketing based on customer preferences.
- **Step 7**: Monitor and Iterate EcoTrends continuously monitors customer feedback, sales data, and website analytics to assess the impact of the changes. They update the customer journey maps regularly and make further adjustments based on customer behavior and evolving needs.

- **Results:** After implementing the improvements, EcoTrends experiences a significant boost in customer satisfaction and sales. Sarah finds the website more user-friendly, David completes purchases more smoothly, and Emma appreciates the tailored emails. By continually refining their customer journey maps, EcoTrends maintains a positive customer experience and sustains business growth.
- This simplified case study demonstrates how customer journey mapping can help businesses understand their customers better, identify pain points, and make strategic improvements to enhance the overall customer experience.

- Let's create a customer journey mapping case study for a bank, focusing on the experience of a customer named John who wants to open a new savings account. This example will help illustrate the process of customer journey mapping within a banking context.
- Case Study: "John's Journey to Open a Savings Account at XYZ Bank"
- Background: John is a potential customer interested in opening a savings account at XYZ Bank, a traditional brick-and-mortar bank. He's heard about the bank's competitive interest rates and decides to explore the bank's offerings.

## Customer Journey Mapping Process:

- **Step 1**: Define Customer Persona John represents a typical persona: a middle-aged individual seeking a simple savings account with good interest rates and easy access to funds.

- **Step 2**: Identify Touchpoints John's journey involves several touchpoints, including:
- Awareness: Seeing an advertisement for XYZ Bank on social media.
- Research: Visiting the bank's website to learn more about savings account options.
- Application: Initiating the application process online.
- Verification: Visiting a bank branch to complete identity verification.
- Account Setup: Setting up the savings account, including depositing an initial sum.
- Ongoing Usage: Managing the account, accessing funds, and receiving statements.
- Customer Support: Contacting the bank's customer service for assistance.
- Feedback: Providing feedback or reviews about the bank's services.

- Step 3: Understand Customer Emotions and Pain Points Through surveys, interviews, and feedback analysis, XYZ Bank identifies emotions and pain points:
- John feels *excited* about *earning interest* but *frustrated* by the *lengthy application process*.
- He is *anxious* about the *security of his personal information* during *verification*.
- John *appreciates helpful and courteous* staff during his branch visit.
- He finds the online account management *portal user-friendly* but *struggles* with *account statements.*
- John values prompt and knowledgeable customer support.

- **Step 4**: Create Customer Journey Map XYZ Bank creates a visual customer journey map for John, *highlighting* each *touchpoint* and his emotional experiences *at each stage*.
- The map illustrates John's interactions and thoughts throughout the process.

- **Step 5**: Analyze and Prioritize Improvements After reviewing the customer journey map, XYZ Bank identifies areas for improvement:
- Streamline the online application process to reduce frustration.
- Enhance online security measures and communication during identity verification.
- Provide better guidance for using the online account management portal.
- Offer clearer explanations of account statements.
- Invest in training for customer support staff to improve service quality.

- **Step 6**: Implement Changes XYZ Bank implements these improvements:
- Simplifies the online application forms and provides real-time status updates.
- Strengthens online security measures and sends clear verification instructions.
- Updates the online portal with user-friendly features.
- Enhances account statement clarity and accessibility.
- Conducts customer service training to improve staff knowledge and courtesy.

- **Step 7**: Monitor and Iterate The bank continually monitors John's journey and solicits feedback. They use data analytics to measure the impact of the changes and make further refinements as needed to ensure a seamless customer experience.
- Results: As a result of these improvements, John's experience with XYZ Bank is more positive and efficient. He successfully opens a savings account with ease, finds online banking more intuitive, and receives excellent customer support when needed. The bank's efforts lead to increased customer satisfaction and retention.
- This case study illustrates how customer journey mapping can be applied to a bank's customer experience to identify pain points, improve processes, and enhance overall customer satisfaction.

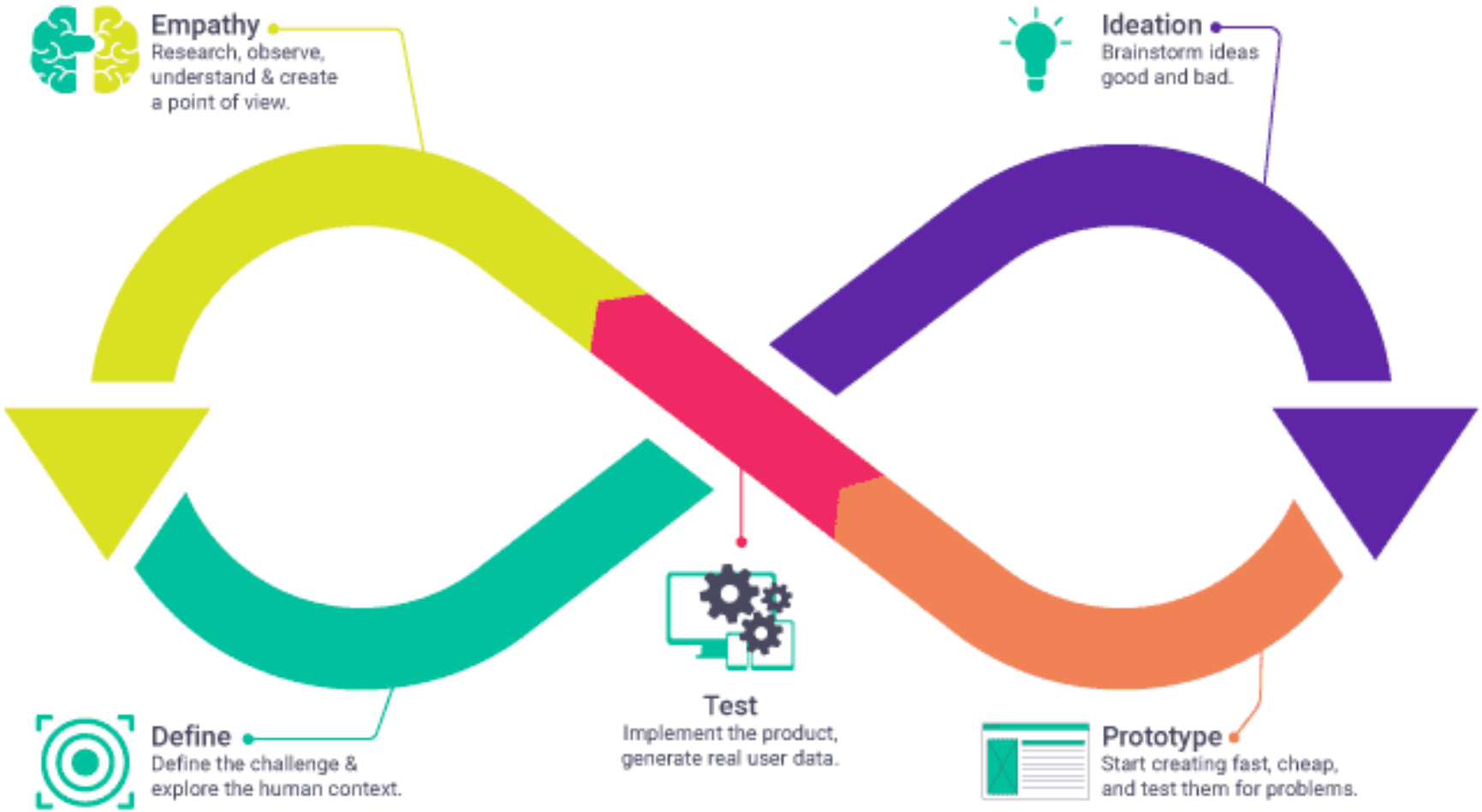
# The 5 Stages of the Design Thinking Process

- Design thinking is a user-centric approach to problem-solving and is often employed by companies to overcome complex challenges in innovative ways.
- It’s especially effective when applied to problems that are ill-defined or unknown.

# What Is the Design Thinking Process?

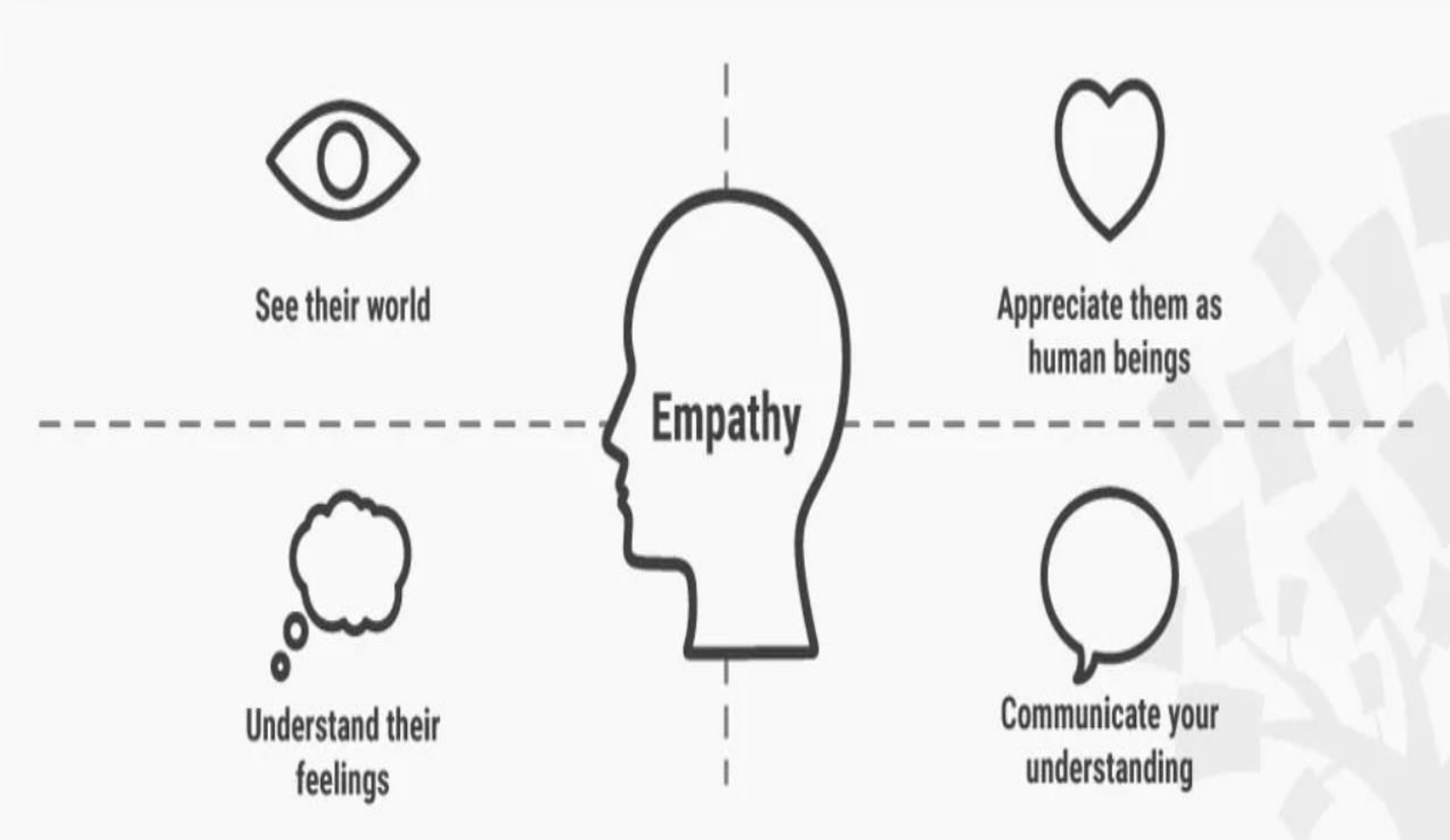
- There are five key steps in the design thinking process: empathize, define, ideate, prototype, and test.
- One thing to keep in mind is that the process isn't always linear: any one of the five stages of the design thinking process could spark an idea or outcome that leads to repeating an earlier stage.
- For this reason, the design thinking approach is often referred to as a non-linear, iterative process.

# 5 Stages of Design Thinking




Springboard

# Stage 1: Empathy



# Empathy

- The first stage of the design thinking process is empathy.
- During this stage, design teams set aside their own biases and work to gain a deeper understanding of real users and their needs—often through direct observation and engagement.
- Empathy is one of the most crucial phases of design thinking.
- After all, how can you hope to solve a user's problem if you don't understand who the user is and what they want?
- Empathy creates an emotional bridge between designers and target users, one that facilitates the kind of deep user insights at the heart of human-based design thinking.

# Empathy

- Some tools and methods commonly used to conduct this user research are:
- **User Interviews:** Talk to users directly to gain insight into their challenges and understand their points of view.
- **Surveys and Questionnaires:** Help identify who your users are, what they currently think about your product, what problems they face, and what their needs are.
- **Observation:** View how users interact with the product and their environment. Observe their behaviors to gain insight into their thoughts and feelings.
- **Empathy Map:** A visualization tool that summarizes a user's thoughts, actions, and feelings.
- **Color Psychology**: Different color palettes and uses of brand colors unlock different psychological effects that can influence how consumers use and interact with your designs.

# Stage 2: Define

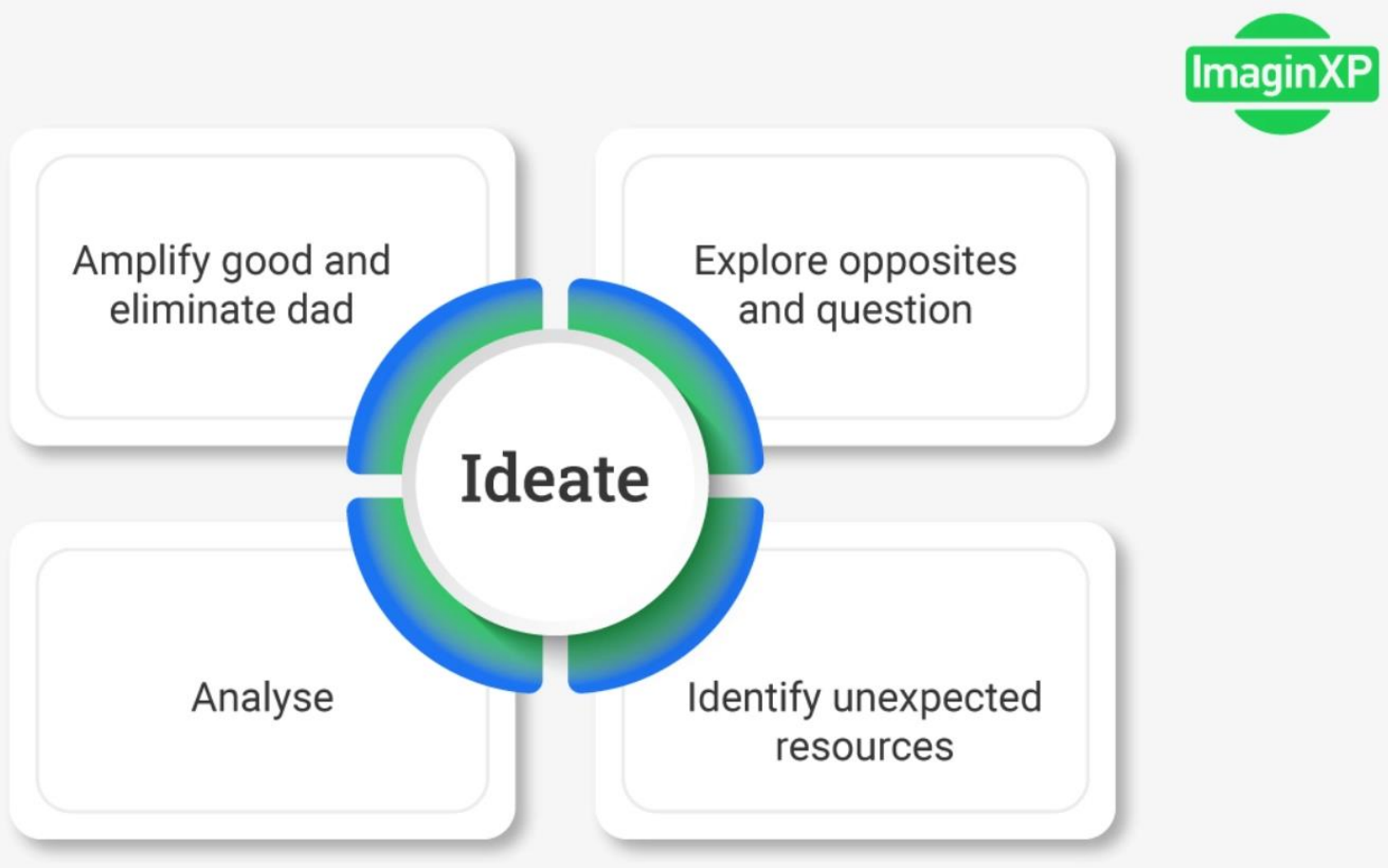
# Stage 2: Define

- The second step is to define the problem.
- In this phase, designers analyze the data gathered during the previous stage to identify and define the issue with a clear and concise problem statement.
- Problem statements are particularly important because they outline the challenges the target audience faces and how those challenges can be resolved.
- Doing so ensures the user's perspective remains in focus (as opposed to the company's) and that a human-centered approach is used throughout the design process.

# Stage 2: Define

- Tools commonly used to achieve in the define phase are:
- **Data Analysis:** Using the data gathered during the empathy stage to identify and define the user's problem.
- **The "5 Whys" Method:** An iterative, interrogative technique used to discover the root cause of a specific problem.
- **Build User Personas:** Using data gathered about users during the empathy stage to build an archetype that represents the needs of your target audience.

# Stage 3: Ideate



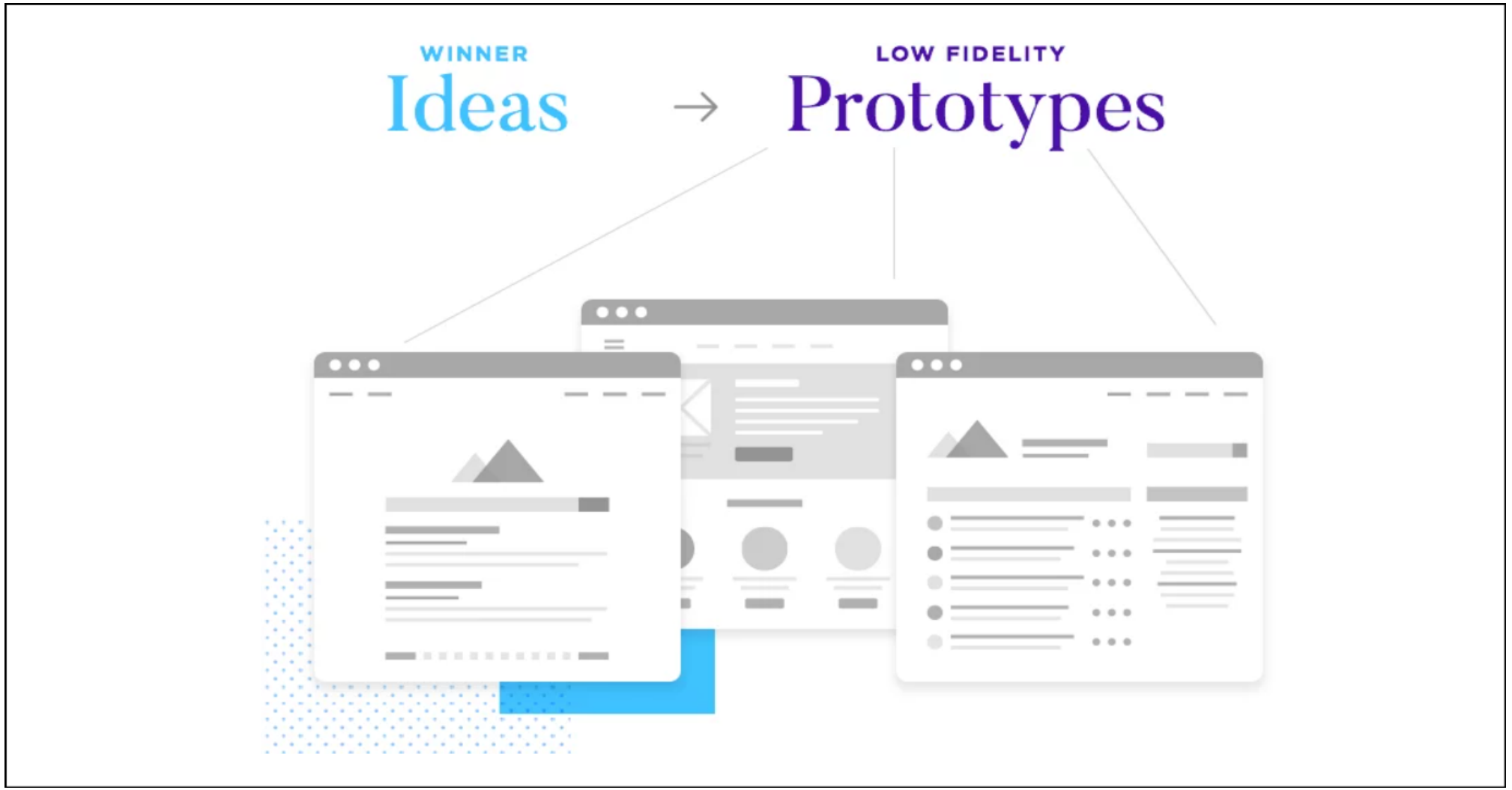
# Stage 3: Ideate

- The ideation stage is where designers start to explore solutions.
- Ideas in this stage will ultimately become prototypes that can be tested with your target audience.
- One thing to remember about the ideation phase: leave judgments behind.
- Design teams shouldn’t concern themselves with technical details like budgetary constraints or feasibility.
- Use creative, outside-the-box thinking to develop as many creative solutions as possible.
- There are no wrong ideas.

# Stage 3: Ideate

- Commonly used ideation techniques include:
- **Brainwriting:** Write down all your ideas on a sheet of paper, then pass the paper on. Whomever you pass it to develops your ideas further, then passes the paper on. This continues until a certain time limit is reached, then the entire team gathers.
- **Sketches:** This is a quick way to visualize ideas without expending much time. If your sketch can communicate your ideas to other team members, it can be an effective ideation tool.
- **Round-Robin Brainstorming:** A collective, two-step approach to brainstorming that begins by soliciting a solution using the "How Might We" prompt, then developing that idea further using an iterative circular process similar to brainwriting.
- **Mind Maps and Flow Chars:** A diagram and visualization tool that shows how ideas are linked, making it easier to classify them and detects patterns.
- **SWOT Analysis:** Used to identify the strengths, weaknesses, external opportunities, and threats (SWOT) of an idea.

# Stage 4: Prototype



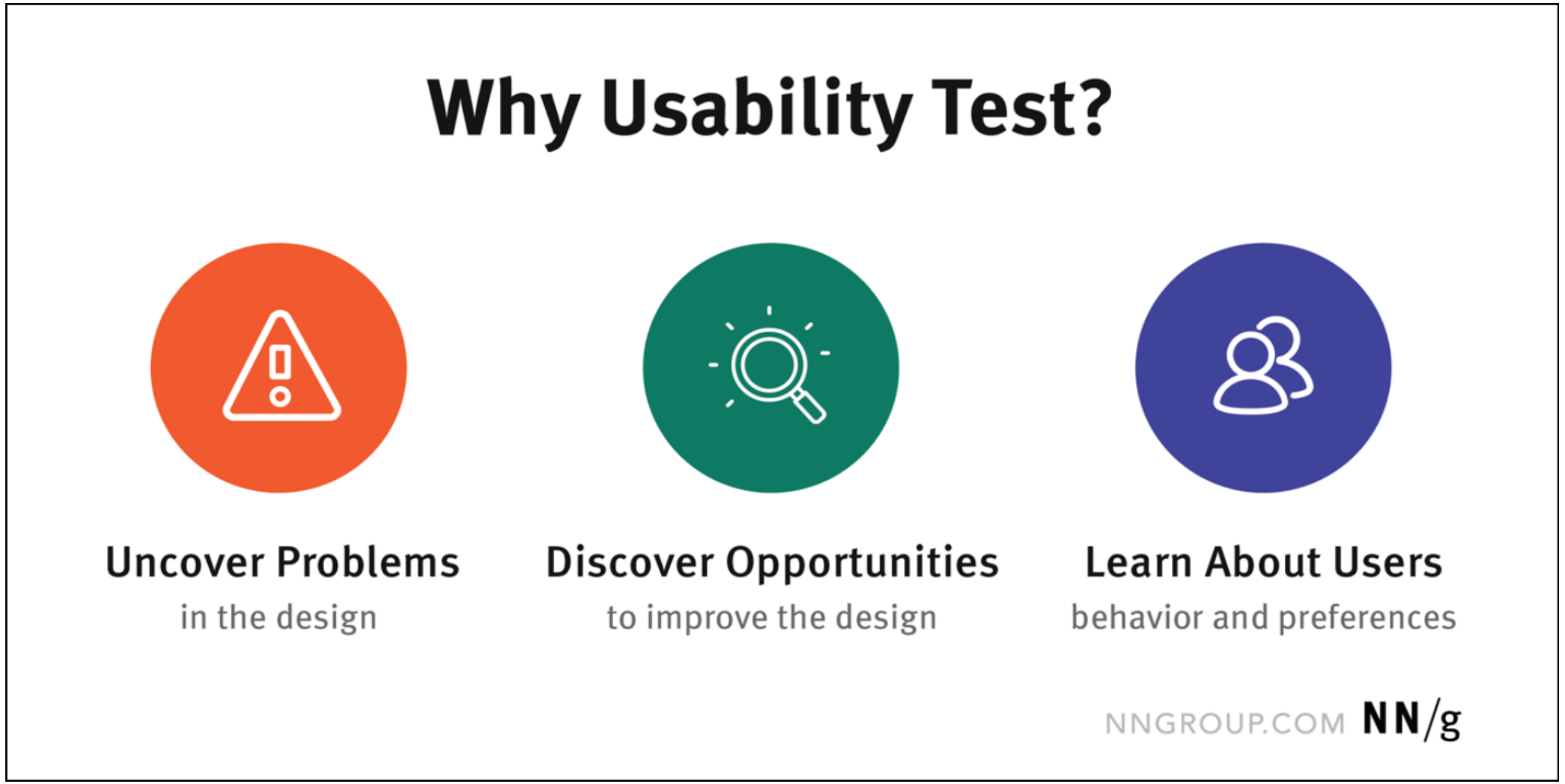
# Stage 4: Prototype

- During this phase of design thinking, teams will create prototypes of the ideas they generated in the previous stage.
- Prototypes don’t need to be finished products.
- They are meant to convey a possible solution, not deliver it. Sketches, models, and digital renders are all examples of prototypes: scaled-down versions of the product created during the ideation stage.
- With minimal effort, prototyping can reveal whether the proposed product will work, whether it’s technically feasible, and what challenges you will face bringing it to life.

# Stage 4: Prototype

- Common tools and ideation techniques include:
- **Wireframes:** Low-fidelity prototype that represents the basic visual layout of an interface or product.
- **Low-Fidelity Prototypes:** These are cheap, quick, relatively simple, and can be used to express broad concepts or ideas. Low-fidelity prototypes require little design skills to produce.
- **High-Fidelity Prototypes:** Realistic designs that look and operate close to the final product.
- **Walk-Through:** A task-specific approach to determine the usability of a prototype.

# Stage 5: Test


Why Usability Test?
Uncover Problems
in the design
Discover Opportunities
to improve the design
Learn About Users
behavior and preferences
NNGROUP.COM NN/g

# Stage 5: Test

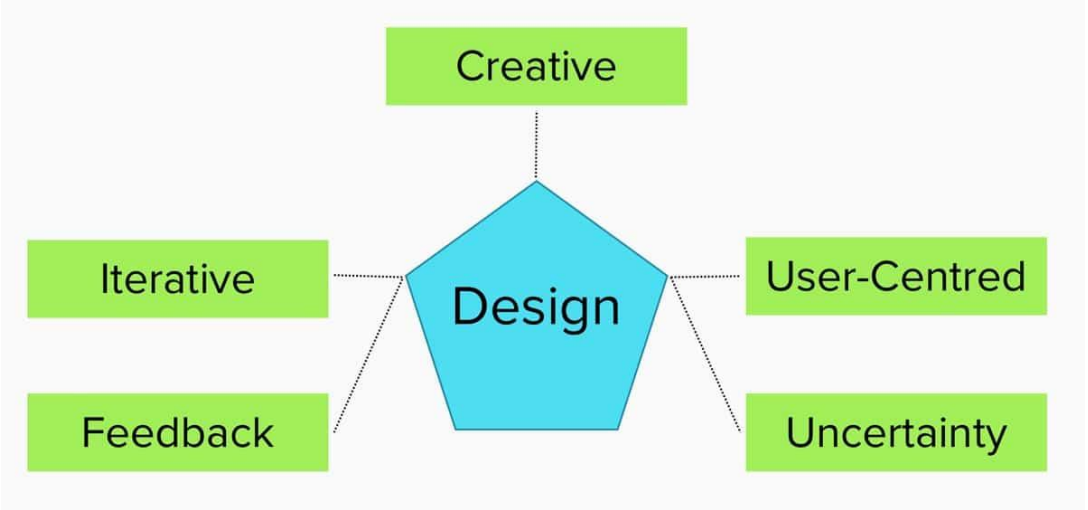
- The testing phase of the design thinking process involves real users and real user feedback. During this phase, prototypes are given to participants to try out. Design teams observe how participants interact with the prototype and gather feedback about the experience.
- Testing reveals what is or isn’t working. Don’t forget: design thinking is an iterative and non-linear process—that goes for testing, too. Depending on user feedback, changes to the product might be required. These changes might require you to restart the testing phase or revisit past stages. Feedback from user testing might also inspire new potential solutions or actionable insights.

# Stage 5: Test

- Commonly used testing tools include:
- **Usability Testing:** A testing tool that gauges the usability of a design with a group of target users.
- **Beta Launch:** Releasing your prototype to a limited pool of users to determine usability, detect bugs, and test whether your product addresses users' needs.

# The Design Thinking Characteristics

- The main aim of design thinking is to guide the application of this strategy in real-life scenarios.
- And through this application, the characteristics of the design thinking mindset bubble out of practice.
- It helps people who don’t have this design mindset to achieve its benefits, and by repeating the practice the design thinking practice gets improved.



# The Design Thinking Characteristics

– **Creative**: The design process appreciates ideas and explores them in an inclusive environment. The diversity of ideas presents the primary source of innovative outcomes.

– **User-Centred Design**: design thinking aims to solve people's problems and address their needs. Therefore, user needs are at the heart of the design process, reflecting the nature of the starting point in any design thinking process, which explores the problem and depends on qualitative data.

# The Design Thinking Characteristics

– **Uncertainty:** Every design task starts with uncertainty. In comparison, other processes, such as the stage-gate innovation process, jump directly to defining the problem. The design process is inclusive, so *the ideation process* acknowledges *different filtered ideas* as the team moves from one step to another.

– **Iterative**: At the core of the lean characteristics of the *design process* is its dependence on *iteration and testing* more than detailed requirements. Testing and improving *prototypes* with the involvement of the user helps to build user-centred solutions.

– **Feedback**: The user *feedback from real-life* usage of the product or the service presents the critical element that designers use to improve the product in the future.

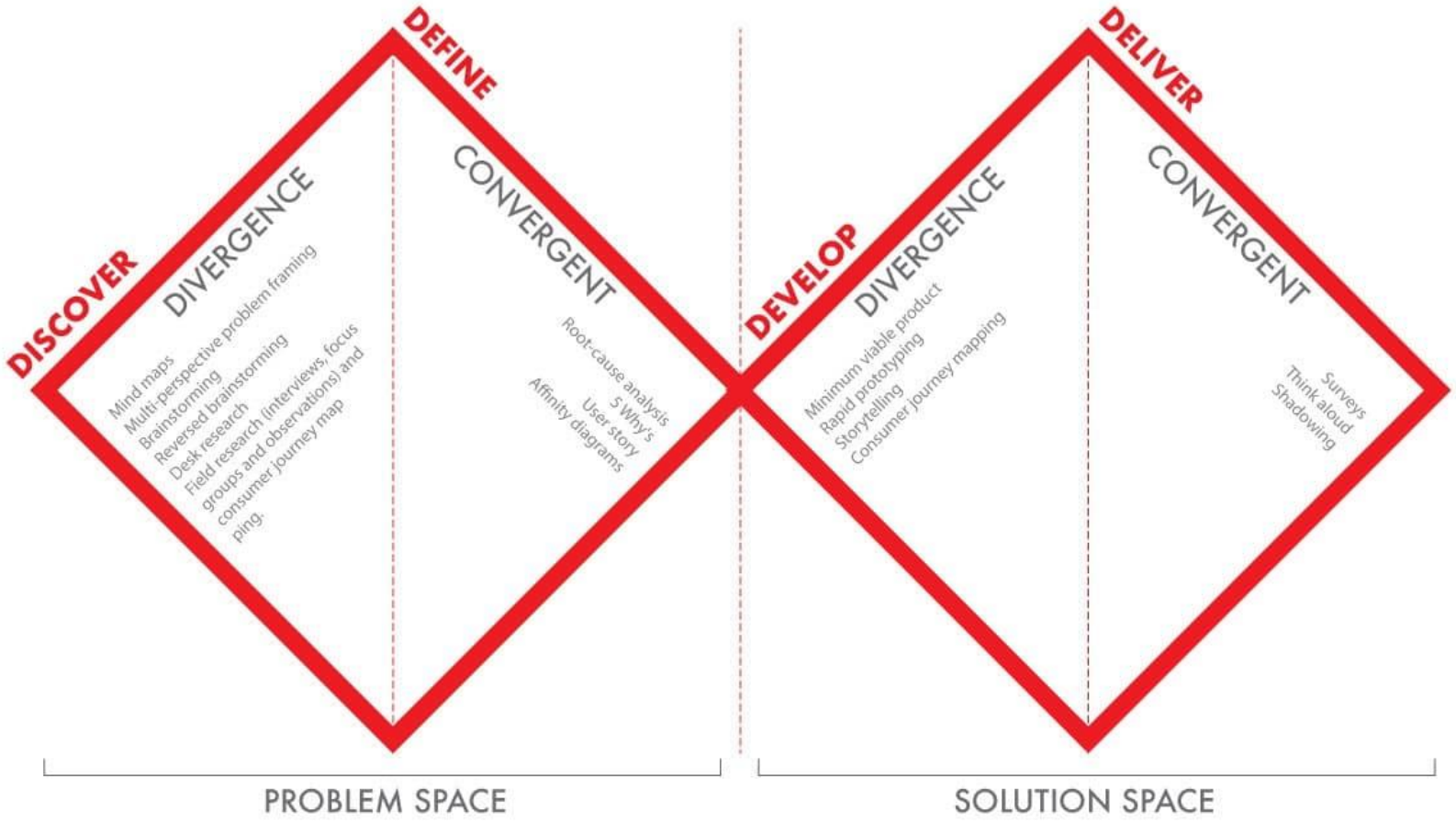
# What is the Double Diamond?

- The *Design Council* introduced the Double Diamond in *2004*.
- It presents a framework that allows companies to apply design characteristics to find creative solutions and innovative ideas.
- It includes four steps: Discover, Define, Develop and Deliver.
- Many companies adopted the Double Diamond design process, such as Apple, Microsoft, Starbucks and others.
- An updated version of the Double Diamond was introduced in 2019, which is agile and visualises how it can fit inside the organisation.

# What is the Double Diamond?

- The double diamond is based on the frame innovation approach *coined* by *Kees Dorst,* Professor of Design Innovation at the University of Technology.
- In his approach, the design process can be divided into *problem space* and *solution space*.
- The problem space is when designers *explore the problem*, including its complex nature, and end with a *clear definition of the problem*.
- It is where the majority of the unique design characteristics and value lay, including creativity and uncertainty.
- The second stage is the *solution space*, where *ideas are generated*, *visualised, and tested prototypes.*
- At the *end* of this stage, the *final product* is created and *delivered* to the *end user*.

# The Double Diamond design thinking process (Adopted from the Design Council).



# The Double Diamond design thinking process

- The frame innovation is applied to the Double Diamond framework as the first two steps (Discover and Define) present the first stage (problem space), and the third and fourth steps (Develop and Deliver) represent the second stage (solution space).
- We will explore the four steps of the Double Diamond design process as they remain unchanged between the 2004 and 2019 versions of the framework.
- Then we will overview the changes that were applied to the 2019 version.

# Pre-Process Preparation

- The Double Diamond design process is a highly *collaborative team practice* that requires complete understanding and integration between the team members.
- Accordingly, an effective selection of the team and place is essential.
- The *team members* should *represent different areas* where they are relevant to the project.
- Considering this factor ensures that the team members address different areas, especially in *complex design projects*.

# A meeting room with space for sticky notes.

# Pre-Process Preparation

- In terms of the practice location, own experience is to run all the meetings in one place which is comfortable and has *enough empty wall pace* or *target whiteboard* is always beneficial because of two main reasons:
- 1- There will be many *brainstorming drafts* and *sticky notes* to visualise in front of the team through the process to keep in mind all the aspects of the design challenge at hand
- 2- Returning to the *meeting room every morning* and *review* the work done ensures the focus and *continuity o*f the ideas as the team moves from one step to another.

# Step 1: Discover


The first stage is the exploration stage, as the team explores problems or the target project, such as exploring the root cause of the problem and applying field research to understand the target challenge.

- Mind maps
- Multi-perspective problem framing
- Brainstorming
- Reversed brainstorming
- Desk research
- Field research (interviews, focus groups and observations) and consumer journey map ping.

# Discover

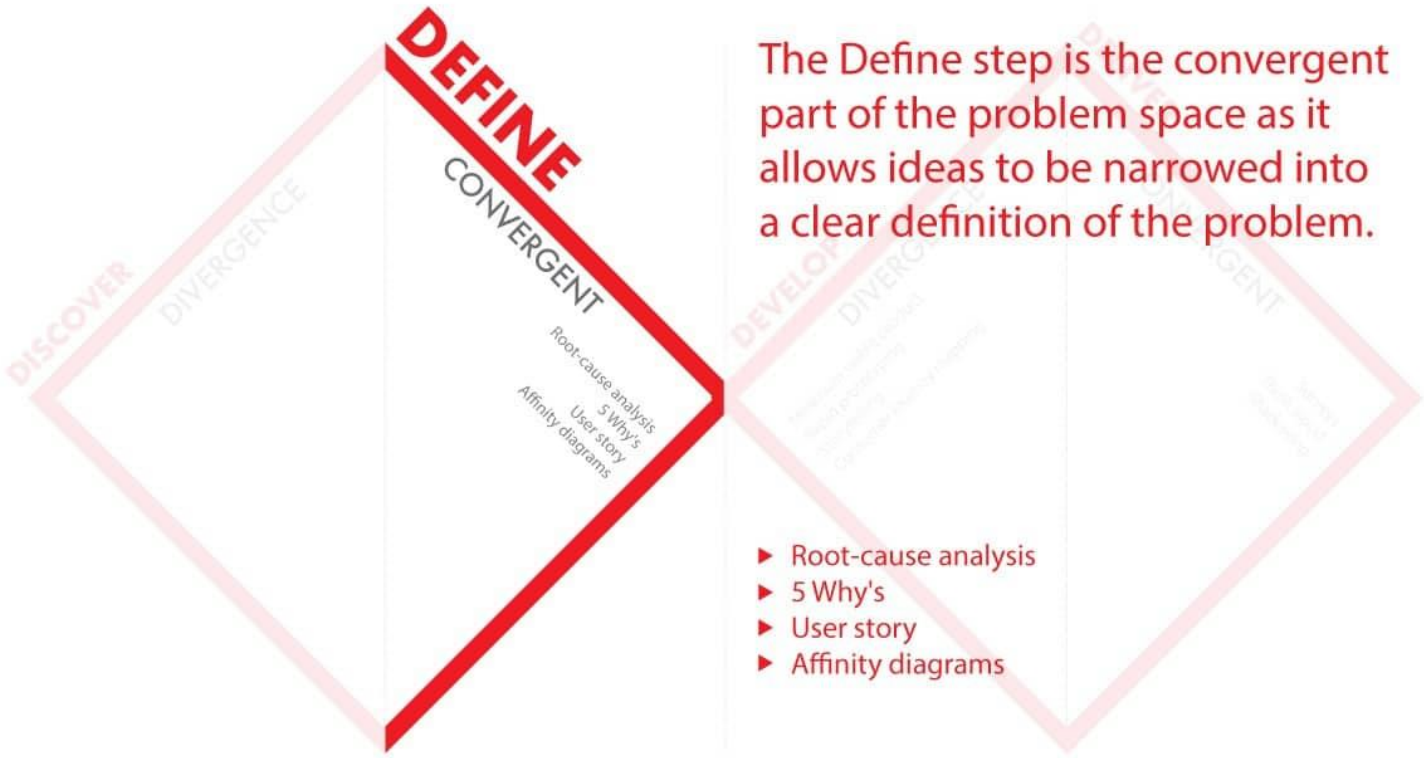
- The first stage is the *exploration stage*, as the team explores problems or the target project, such as *exploring the root cause of the problem* and applying field research to understand the target challenge.
- The target of this step is to *examine and collect information* about the design challenge.
- The Discover step is divergent, which means that all ideas and information are considered and included.
- This step appreciates uncertainty as the team doesn’t have a clear idea about the problem, similar to the agile and lean processes.
- The support of creativity is applied based on the tools used to conduct this step.

- Examples of these tools are below:
- **Mind Maps:** This tool is used to explore different ideas about a core problem. So, the main topic or issue is written in the centre and expanded and connected. The mind mapping can be drawn on paper, whiteboards or using online mind mapping tools.
- **Multi-Perspective Problem Framing (MPPF):** The MPPF is coined by Dr Stuart English at the School of Design, Northumbria University. The method is based on the problem/solution framing aspect we explored earlier. The process is based on integrated mind maps where six cornerstones are explored to understand the problem. Click on the MPPF link above to access the published paper about the application of the method.
- **Brainstorming and Reversed Brainstorming:** Brainstorming is a group meeting that aims to explore ideas based on group discussion and using different ideas. In contrast, the reversed brainstorming is used when the team feels out of ideas. In this tool, the team worsens the problem to shift the views toward opportunities that can ignite solutions.

- **Desk research:** The first step in exploring problems is to review the existing resources and publications about the topic to expand our knowledge.
- **Field research:** The field research (primary research) has different methods that can be used to explore the problem, such as interviews, focus groups, and observation.
- **Interviews**: you can hold an online or face-to-face meeting with the target people involved in the problem investigated. It can be either structured, semi-structured or unstructured based on restricted with the questions. The semi-structured involves having pre-defined questions, but you can extend those questions based on the discussion with the person for more information.

- **Focus groups:** It is similar to interviews, but it is a group discussion rather than one-by-one. It can be cheaper and easier than the interviews. However, it has some drawbacks such as people can be influenced by each other ideas or sometimes being too shy to share their own.
- **Observation:** For me, this is the core of any design practice (or human practice). In this method, you can observe people in their lives, see how they interact with the problem, and document this in notes that will be analysed later.
- **Consumer Journey Mapping:** In this method, the design team observes the user experience while using the product or the service. For example, the team can observe the user while making online booking tickets or shopping experience.

# Step 2: Define

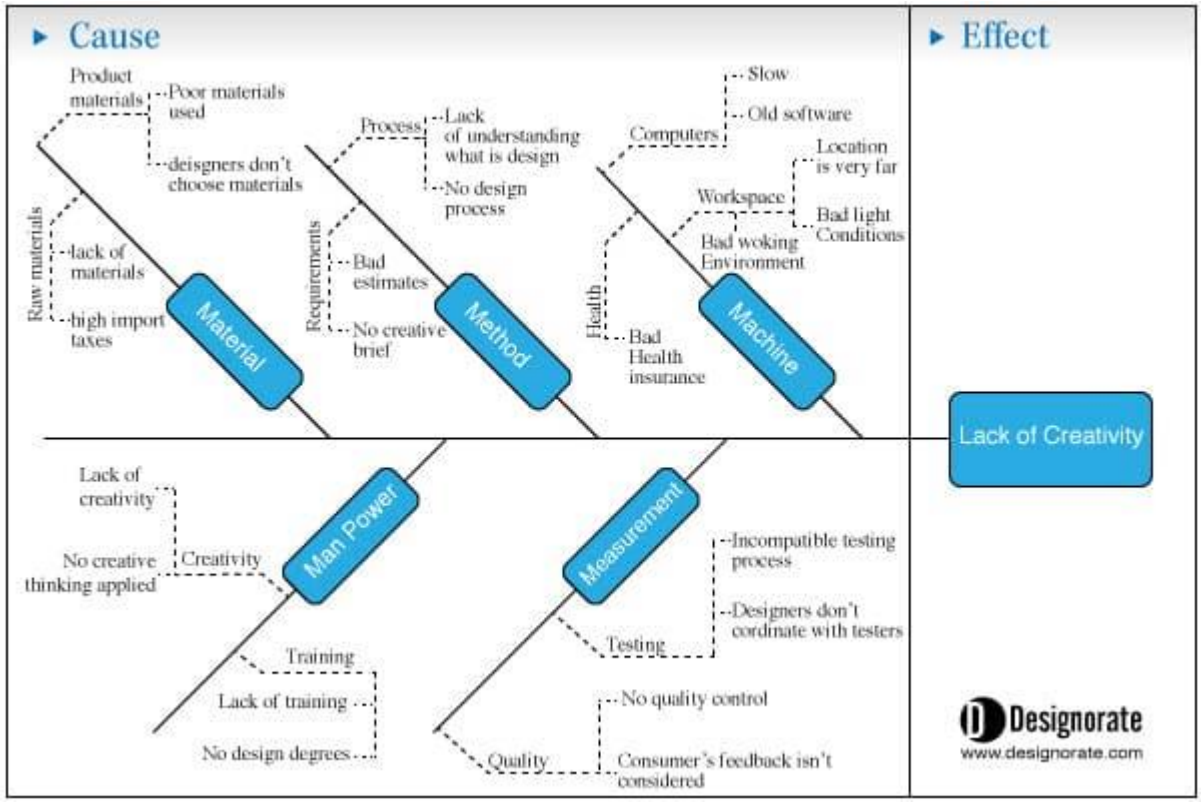



Deliver step in the Double Diamond.

# Define

- The Define step is the convergent part of the problem space as it allows ideas to be narrowed into a clear definition of the problem.
- This definition is the one that will lead the team into the following prototyping and testing steps.
- This convergent step involves analysing evidence and filtering ideas to reach a workable clear brief.
- The tools below are examples of tools that could be used in this step:

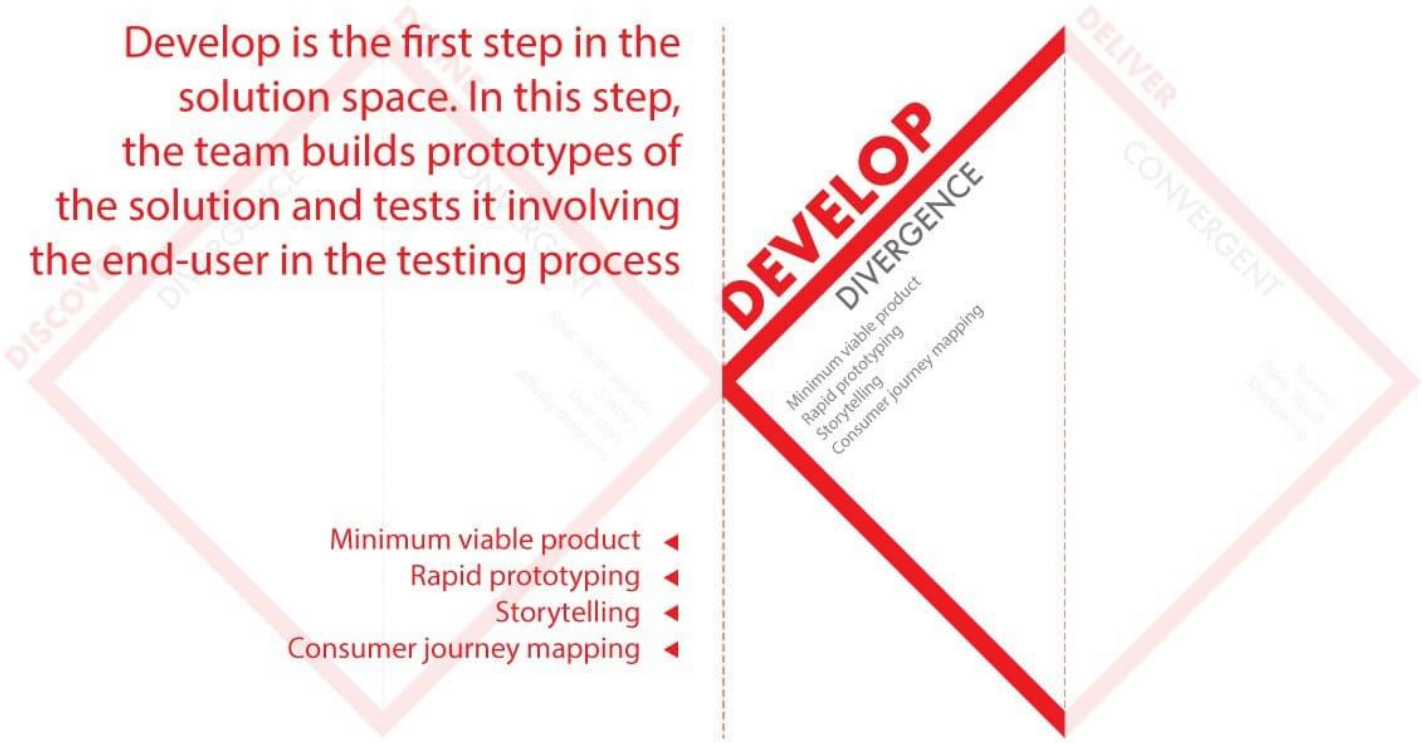
- **Root-cause analysis (AKA fish-bone analysis and Ishikawa diagram):** After collecting sufficient information about the problems, you can analyse the data to understand the actual cause (root problem) to find a sustainable solution.
- The tool aims to investigate six main areas that can be the root cause of any problem (measurements, materials, personnel, environment, methods and machines).




Cause effect diagram step 3

- **5 Whys:** Another method for the root cause analysis is the 5 Whys. It simply asks “why” five times until you reach the root cause of the problem. Then, this root cause becomes the main cornerstone of the problem definition.
- **User story:** This tool is commonly used in UX research as it reflects the type of the target user, the user’s practice and his or her final goal. An example of the user story can be: *As [description of the user], I want to [function] so that [benefit].*
- **Affinity diagrams:** The affinity diagram is a tool that works similar to Card Sorting. Furthermore, it allows you to organise the data and prioritise these data based on its importance. Then, you can set your problem description based on the data priority recorded.

# Step 3: Develop




The Develop step in the Double Diamond.

# Develop

- Develop is the first step in the solution space. In this step, the team builds prototypes of the solution and tests it involving the end-user in the testing process through a divergent approach, which means that all types of solutions as prototypes.
- First, the team need to clearly illustrate the target users by creating a persona for each target user. Persona is a virtual character representing the user and helps the design team consider the user’s characteristics during the prototype and development process. Several tools are used in this process:

# Develop

- **Rapid prototyping:** Technologies such as 3D printing can create a sample of the product that allows the team to see a virtual example of the product and evaluate the product ideas.
- **Storytelling:** Storytelling can be used in both the Discover and the Develop steps. The storytelling allows the team to explore the prototypes and share their experience as a story.
- **Consumer Journey Mapping:** Like the previous usage of the consumer journey mapping, the team can use it to test the service and evaluate it.

# Step 4: Deliver


The Define step in the Double Diamond.

# Deliver

- The relation between the designer the product doesn’t end here. Once the product is delivered, the team starts to collect user feedback and expertise evaluation. These commons and feedback are used to improve the future versions of the product. The Deliver is a conversion step where ideas are narrowed to one final product. Examples of the tools that could be used in this step include:
- **Surveys:** They are the most common tool designers, and marketers use to get feedback through rating or simple questionnaires to collect details about the users’ comments and opinions about the product.
- **Think Aloud:** In this tool, the consumer uses the product while describing the experience loudly. The designers take notes or recording of the consumer experience.
- **Shadowing:** Another testing tool is where one design team follows the user (as a shadow) and takes notes as the user uses the product.

# “TRIZ”

A Russian acronym:

**T**heoria **R**esheneyva **I**sobretatelskehuh **Z**adach

ТЕОРИЯ РЕШЕНИЯ ИЗОБРЕТАТЕЛЬСКИХ ЗАДАЧ

**(Theory of Inventive Problem Solving)** Problems)

**What are these?**

# TRIZ

- One can think of TRIZ as another way of Lateral Thinking.
- TRIZ is based on two basic principles

--Somebody, sometime, somewhere has already solved your problem or one similar to it. Creativity means finding that solution and adapting it to the current problem.

--Don’t accept contradictions. Resolve them.

# I TRIZ

- I-TRIZ is an abbreviation for Ideation TRIZ, which is a restructuring and enhancement of classical TRIZ methodology based on modern research and practice. It is a guided set of step-by-step questions and instructions that aid teams in approaching, thinking, and dealing with systems targeted for innovation.
- I-TRIZ can be used by an individual who needs some quick, out-of-the box ideas. However, this methodology is most effective when used with a cross-functional team composed of people with different knowledge and perspectives of the system and issues.

# 39 TRIZ Features

| | | |
|---|---|---|
| 1: Weight of moving object | 14: Strength | 27: Reliability |
| 2: Weight of stationary object | 15: Durability of moving object | 28: Measurement accuracy |
| 3: Length of moving object | 16: Durability of non moving object | 29: Manufacturing precision |
| 4: Length of stationary object | 17: Temperature | 30: Object-affected harmful |
| 5: Area of moving object | 18: Illumination intensity | 31: Object-generated harmful |
| 6: Area of stationary object | 19: Use of energy by moving object | 32: Ease of manufacture |
| 7: Volume of moving object | 20: Use of energy by stationary object | 33: Ease of operation |
| 8: Volume of stationary object | 21: Power | 34: Ease of repair |
| 9: Speed of object | 22: Loss of Energy | 35: Adaptability or versatility |
| 10: Force (Intensity) | 23: Loss of substance | 36: Device complexity |
| 11: Stress or pressure | 24: Loss of Information | 37: Difficulty of detecting |
| 12: Shape | 25: Loss of Time | 38: Extent of automation |
| 13: Stability of the object | 26: Quantity of substance | 39: Productivity |

# Altshuller's 40 Principles of TRIZ

1. Segmentation
2. Taking out
3. Local Quality
4. Asymmetry
5. Merging
6. Universality
7. "Nested doll"
8. Anti-weight
9. Preliminary anti-action
10. Preliminary action
11. Beforehand cushioning
12. Equipotentiality
13. The other way around
14. Spheroidality
15. Dynamics
16. Partial or excessive actions
17. Another dimension
18. Mechanical vibration
19. Periodic action
20. Continuity of useful action
21. Skipping
22. "Blessing in disguise"
23. Feedback
24. 'Intermediary'
25. Self-service
26. Copying
27. Cheap short-living
28. Mechanics substitution
29. Pneumatics and hydraulics
30. Flexible shells and thin films
31. Porous materials
32. Color changes
33. Homogeneity
34. Discarding and recovering
35. Parameter changes
36. Phase transitions
37. Thermal expansion
38. Strong oxidants
39. Inert atmosphere
40. Composite material films

# TRIZ Everyday Examples

- Automobile air bags deploy quickly to protect the passenger (good),

  but the more rapidly they deploy, the more likely they are to injure or kill small or out-of-position people (bad).

# TRIZ Everyday Examples
con’t

- Cell phone networks should have excellent coverage so users have strong signals (good),

but

cell phone towers are not very nice to look at (bad).

# TRIZ Everyday Examples con't

- The email spam filter should be efficient enough to remove all my junk emails (good),

but

then it is more likely to screen some emails that I actually want to receive (bad).

# Example Application of TRIZ

A New Structural Material for Bullet Proof Garment

- ***Statement:*** Bullet proof vests should be strong, but not heavy.

# Example Application of TRIZ

A New Structural Material for Bullet Proof Garment

***Statement:* *Bullet proof vests should be strong, but not heavy*.**

Step 1 – Identify the contradiction(s)

Strength (improves) versus Weight (worsens)

# Example Application of TRIZ

A New Structural Material for Bullet Proof Garment

***Statement:*** Bullet proof vests should be strong, but not heavy.

Step 1 – Identify the contradiction(s)

Strength (improves) versus
Weight (worsens)

Step 2 – Look at the list of features and identify those important to your contradiction.

Strength – #14

Weight – #2

# Example Application of TRIZ

A New Structural Material for Bullet Proof Garment

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Weight (worsens)

Step 2 – Look at the list of features and identify those important to your contradiction.

Strength – #14

Weight – #2

Step 3 Identify Which Are Improving Features and Which Are Worsening Features

Strength (feature 14) improves

Weight (feature 2) worsens

| | 2: Weight of stationary object |
|---|---|
| 1: Weight of moving object | * |
| 2: Weight of stationary object | - |
| 3: Length of moving object | 8, 15<br>29, 34 |
| 4: Length of stationary object | - |
| 5: Area of moving object | 2, 17<br>29, 4 |
| 6: Area of stationary object | - |
| 7: Volume of moving object | 2, 26<br>29, 40 |
| 8: Volume of stationary object | - |
| 9: Speed of object | 2, 28<br>13, 38 |
| 10: Force (Intensity) | 8 1<br>37 18 |
| 11: Stress or pressure | 10 36<br>37 40 |
| 12: Shape | 8 10<br>29 40 |
| 13: Stability of the object | 21 35<br>2 39 |
| 14: Strength | 40,26<br>27,1 |

# Example Application of TRIZ

## A New Structural Material for Bullet Proof Garment

Step 4 –

Refer to the TRIZ Contradiction Matrix to learn which of Altshuller's Principles may be useful for this problem.

The intersection of Column 2 and Row 14 gives the following principles

1

26

27

40