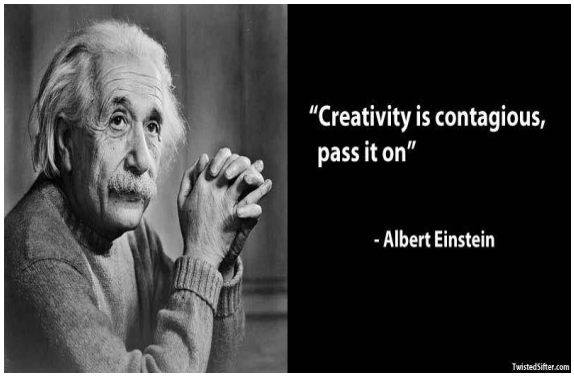
UNIT III

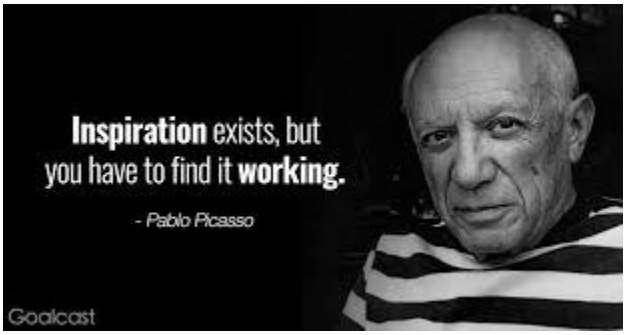
IDEATION, PROTOTYPING AND TESTING

Ideation methods:

" creativity is a journey, not a magic event".

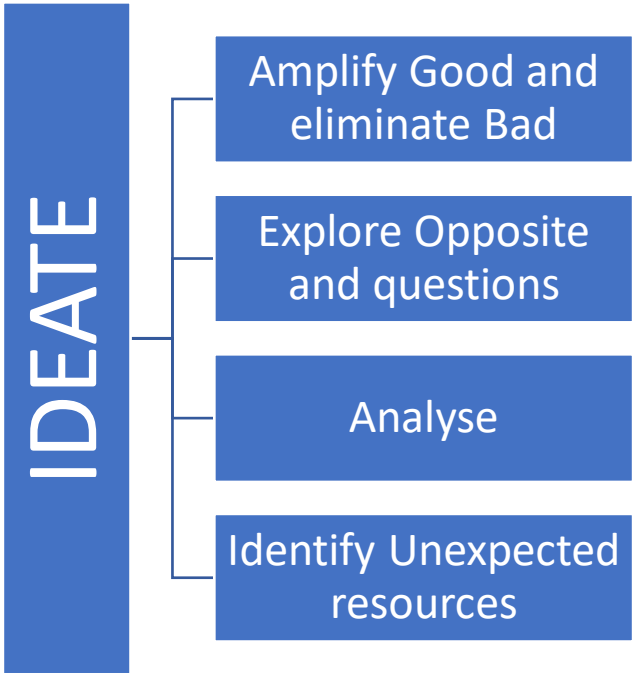


"Inspiration exists, but it has to find us working"



- In the ideate phase of the design thinking process that initial ideas for problem solving are developed.
- Ideally, Different techniques should be combined to get new in pulses for the generation of the ideas.
- Especially in this phase it is important to generate as many ideas as possible and to select one idea from them.
- In ideate phase the designer will start generating some rational concerts that seek to solve the problem by using the problem statement.
- Typically, these ideas are rough- those that it results from the brainstorming. The important thing hear is to " think outside the box" and generate and generate multiple ideas so that in the next stage draw some options for prototyping.
- The objective of the Idea generation phase is to find creative ideas that will solve the targets and challenges of users. This is the phase in which the design team's creativity and imagination should be at the top level.

- To be a good idea, it needs to be focused on the people, are how the idea fits the needs, problems, and their goals. That is why it is important to understand how the ideas gives values and the usefulness to the beautiful or feasible solution.
- This ideate phase of the design thinking processes is the most interesting and perhaps, the most rigorous as well.
- In this phase designer or designers supposed to bring to the table as many ideas as possible.



- The term "ideate" is just a fancy way of saying that designer want to come up with ideas, and there is no shortage of ways to accomplish that.
- When designers talking about the ideate stage, i.e it is the point in the design process where designers come up with a large volume of ideas to find and implement the most creative one.
- The purpose of the ideate stage is to push for the widest range of ideas that can be implemented in later stages.
- The ideate stage is important because it is when a design team moves from understanding and defining consumer/user/client/customer problems to coming up with solutions for those needs.
- Without the ideate stage the problem remains just the problem.
- Ideating allows a design team to consider creative ways to address the needs of the user have highlights in the empathize stage and more clearly outlines in the Define stage

- In this process, design thinkers also resort to use of boards, sticky notes, sketching, chart papers, mind maps etc.

The creative process and creative principles:

- creativity means thinking something new, whereas innovation means implementing something new.
- In this respect creativity is an integral part of every innovation project, regardless of whether it is aimed at it a new product, service, process, social/ organizational change, or business model.
- Creativity is not an event but can rather be understood as a Process. The design thinking approach takes up this creative process.
- Creativity is the ability to come up with ideas that are new, surprising, and valuable.
- To get such ideas, we need a way of looking at problems or situations from a fresh perspective that suggests unorthodox solutions (which may look unsettling at first) which is called Creative Thinking.

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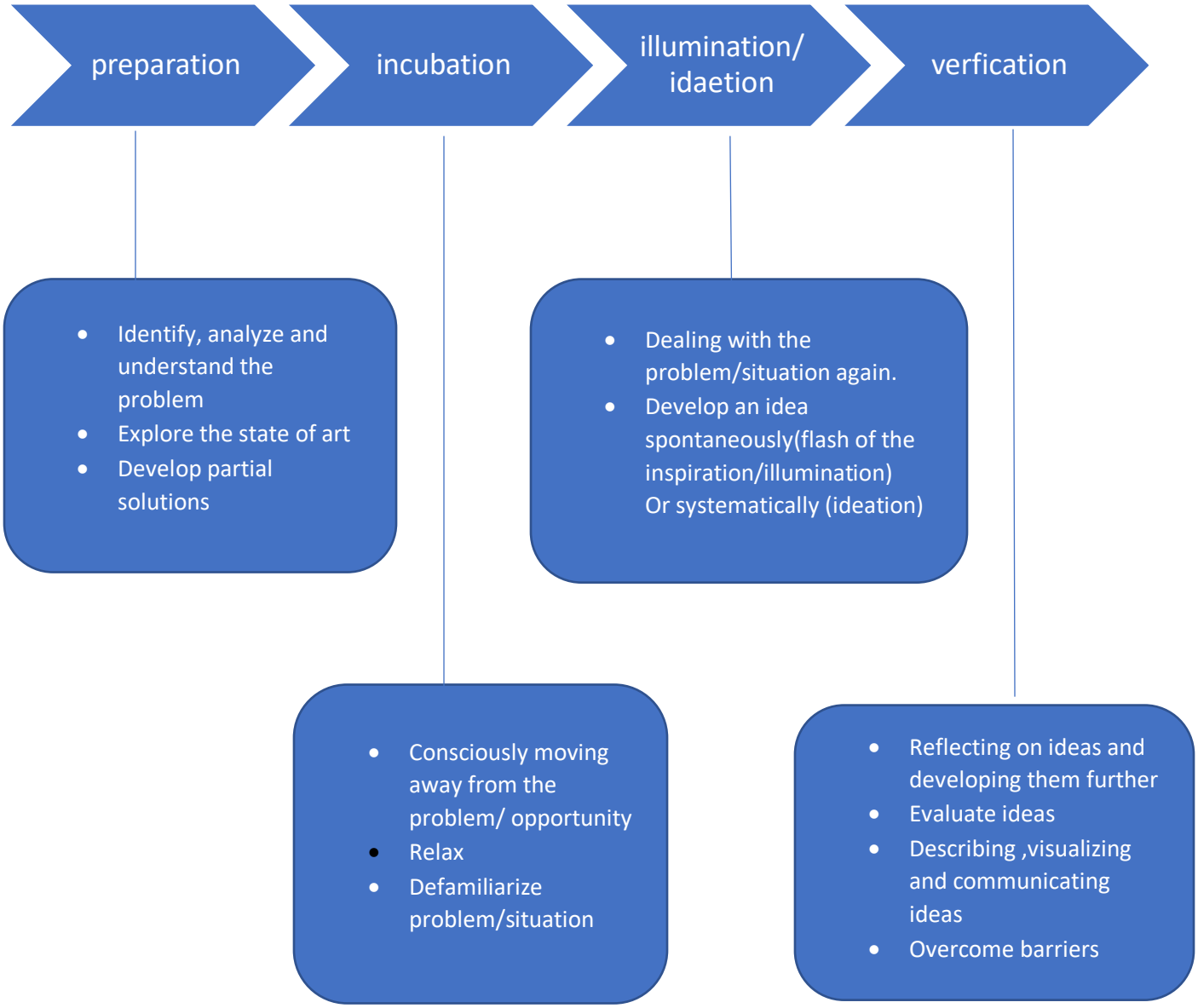
The creative process source: according to Walla's (1926)



Creative principles:

1. **Principle of decomposition:**
   The problem, the task, the process steps, or the product/service to be redesigned is broken down into its components and then these compounds are varied/ combined a new

2. **Principle of association**:
   By Association one understands the linking of ideas, information, perceptions, and emotions. In the sense of a free Association, brainstorming or brain writing are to be mentioned. The Walt Disney method and 6- thinking hats - technique can be understood as structured associations.

3. **Principle of analogy and confrontation**:
   Technology and confrontation are targeted changes of perspective and are based on the confirmation with the different areas.

4. **Principle of abstraction and imagination**:
   The basic principle of abstraction and imagination, the problem is solved on a higher or illusionary level.

5. **Challenge common wisdom and industry conventions:**
   Nothing is to be accepted as given ask questions why this is so, why this is not so, why this should be so not to be so and why this can also be different.

6. **Do mental exercise**:
   Demand a new number of new ideas from yourself. Under pressure and try to develop new ideas from one or more problems per day

7. **Change your habits:**
   Do something completely different: Changing habits and conventions is a success factor specially for radical innovation.

8. **Do experiment:**
   The trial under the approach is already given rise to countless innovation ideas.

9. **Do networking**:
   Search or promote Exchange with others example people from other disciplines, cultures, business areas, departments are extra partners.

10. **Overcome the barriers to creativity:**
    One of the essential success factors the creative process is overcoming the numerous and where did creative blockades.

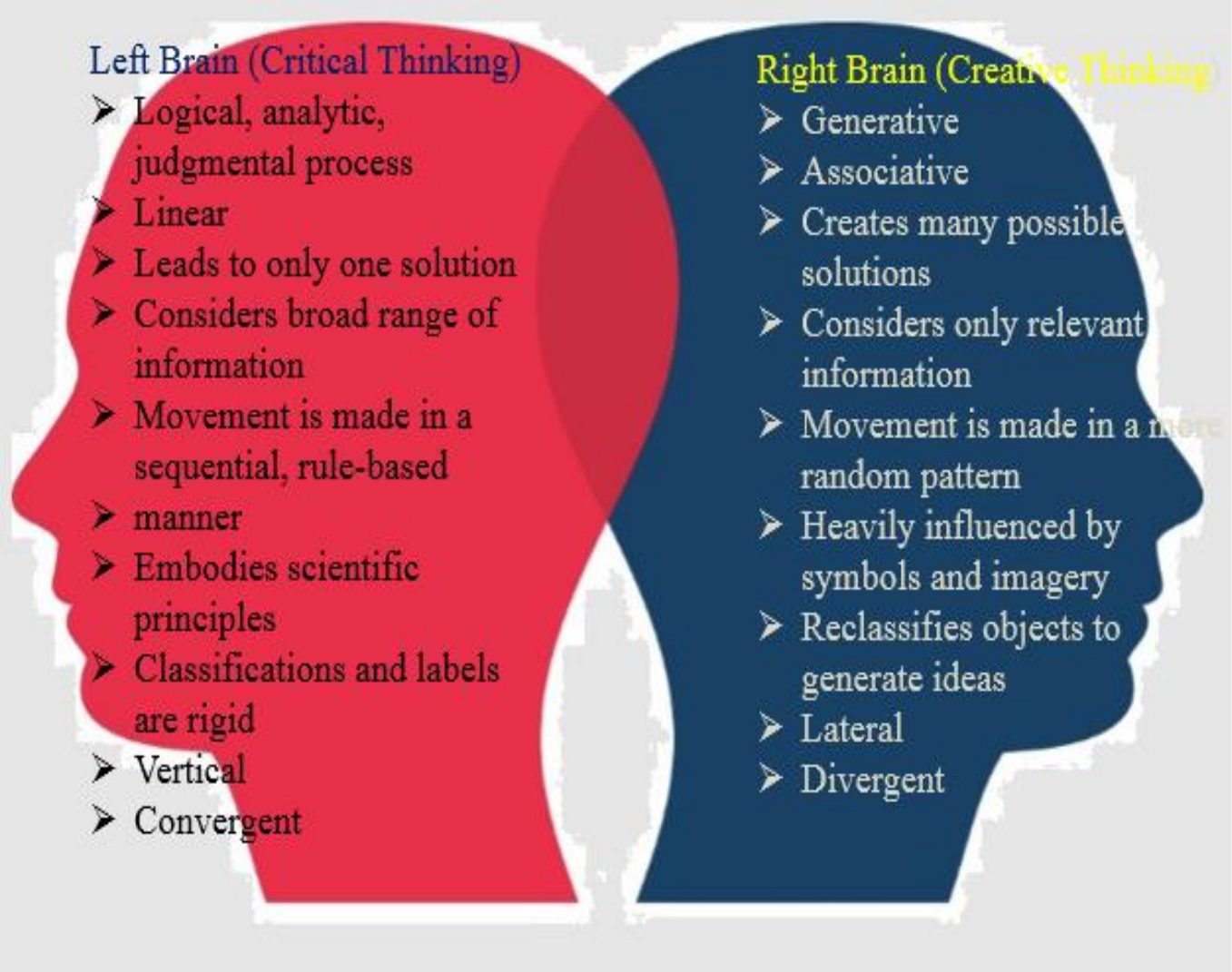
    Examples of create to blockades are the following.

    - Creativity disturbing environment
    - Stress
    - Lack of recognition/ no reward for creative work
    - Two rigid or strict institutional controls
    - Fear of change, risk aversion
    - Perfectionism, search for the right things
    - Pure logical thinking

- Self-satisfaction with what has been achieved so far.

Brain dominance theory:

- Gives relationship between right brain and left brain.
- Left brain handles information in analytical, rational, logical, sequential way.
- Right brain function by recognize relationships, observing information in intuitive way.
- Best creativity is achieved with good communication between these two.

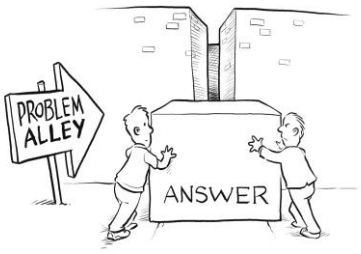
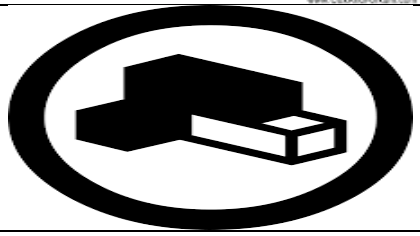


Steps to enhance creative thinking:

- Develop a creative attitude.
- Unlock your imagination.
- Be persistent.
- Develop an open mind.
- Suspend your judgment.
- Set problem boundaries.

Barriers to creative thinking (mental block):

J.L. ADAM's Mental Blocks:

1	Perpetual Block	• Stereotyping • Information overload • Limiting problem unnecessarily • Fixation • Provision of cues	
2	Emotional Block	• Fear of risk taking. • Unease with chaos • Unwilling to incubate • motivation	
3	Cultural Block	• Setting too formal • Often strong resistance to change. • Overlay analytical thinking	
4	Intellectual Block	• Poor choice of problem-solving language • Memory block • Insufficient knowledge	

5	Environment Block	• Physical environment • Criticism	

Creativity techniques:

- Creative techniques divided into intuitive creative methods and systematic analytical methods.
- The intuitive- creative techniques try mostly in a group to simulate spontaneous ideas, associations, and analogies to overcome blockades of thought in a rather free design.
- The principles of decomposition and abstraction are increasing the applied to systematic analytical techniques.
- It should be noted that not every creativity technique is a suitable for every question and for every team.
- Creativity is ultimately very individual, everyone has their own idea, experience habits, preferences as well as strengths and weaknesses.
- In this respect one should experiment with his creativity techniques

Ideating at Apple might include a variety of brainstorming methods to think of creative ideas for new headphones.

Creativity Techniques:

Institutive creative techniques	Systematic -analytical techniques
• Brainstorming	• Osborn Checklist (SCAMPER)
• Brain Writing	• Mind Mapping
• Random Word Techniques	• Synectic
• Semantic intuition/ the perfect prefix	• Bionics

• Forced Relationship	• Morphological box/sequential morphology's/Attribute Listing
• Provocation Technique	• HIT
• Walt-Disney Method	• Lotus Blossom
• Six Thinking Hats	• TRIZ
• Delphi Method	• SIT

Brainstorming

Brainstorming is, so to speak, the mother of all creativity techniques (linguistically from:" using the brain to storm the problem). Ideas about a question a solution to a problem should be Express spontaneously in a group.

- ❖ It is a group activity technique.
- ❖ It is designed to generate lots of ideas for solution of a problem.
- ❖ It is a commonly used tool by academicians, researchers, and business teams.
- ❖ The Value of brainstorming is not the ideas generated; it is the shared value/evaluation context created. The experience of brainstorming creates a group of people with a shared perspective, and an understand of each other's communication styles, who are then capable of providing a useful and powerful critique of future work on the topic.

Rules of brainstorming:

- No criticism: Each criticism a rating is postponed to a subsequent face the so-called killer phrases must be strictly prohibited. In this way it should be prevented that the flow of ideas is interpreted, or participants are blocked. Comment also forbidden.
- No copyright: The ideas of others can and should be taken up, changed, and further developed.
- Free expansion of ideas: The participant should give free rein to their imagination so that new and original ideas can be found. You are the craziest ideas are welcome.
- **Quantity over quality**: As many as possible should be produced in a short back. This rule insurance the spontaneity of the ideas presented.
  So, these rules should be written on the flip chart and visible to everyone doing the brainstorming session.

Tips for how to brainstorm:

- ❖ Take sufficient time to clarify define the problem or question in advance.
- ❖ The problem should be challenging to motivate.
- ❖ The question should be focus and not too abstract (what not too specific or even imply a solution)
- ❖ it should be customer- oriented question that is actively formulated.
- ❖ The question can also be communicated in advance with the invitation and is asked to already think about possible solution Idea as a kind of homework.
- ❖ The group size should lie between two and almost 12 persons Ideally 5 to 8.
- ❖ In case of heterogeneous group of participants who do not know yet know each other well, so organizer should insert a warmup phase beforehand.
- ❖ Always structure a creativity workshop with Fixed time phases. This means that brainstorming sessions must be limited in time.
- ❖ Use "yes" and instead of "yes, But.... In the introduction
- ❖ Number of Ideas
- ❖ Build on ideas of others and jump from Idea to Idea.
- ❖ Only one speak.
- ❖ always encourage the active participation of all the participants. The person should be informed at a fixed time what has become their idea.

Few tips on how to guarantee you destroy a brainstorming session.

- The boss talks first and sets the goal and the requirements.
- The contributions should be given in a sequence.
- Only experts can submit ideas.
- No silly ideas are allowed.
- Everything is written down.

Trigger-Questions for brainstorming

1. How might we...? Technique:

This is a similar questioning technique to the user story.

How could we (how might we)_____(product service offer)

For (persona)_____ develop/ offer/ create under the following conditions_____ (problems, legal regulations, environmental conditions changes)

2. Yes and- technique:

It must Not be started to comment with "yes, but".... But it only with "Yes, and.". This should support the ideas put forward by others in the sense of constructive feedback and further develop them.

3. What- if- technique:

With the question" what if we..."(what-if) is to be put into another person/ company) when finding a solution

4. Why- how laddering approach:

The questions why and how are asking alternately. With why questions the reason for the problem should be summarized and recapitulated with the subsequent how question. With how you get detailed answers

Variants of brainstorming

1. Step by step brainstorming:

After a first printing session, the most interesting idea is used as a starting point for another brainstorming session. This allows you to find ideas from a general solution to a special one.

2. Anonymous brainstorming:

The idea written by the participant in block letters on a card called brain cards. A moderator read the anonymous ideas aloud and, on this basis, they are brainstorm further or ideas are clustered and evaluate.

3. Visual brainstorming/ brain painting:

Recorded graphically with paper and pencil (or digitally). Discrete sketch like images in the form of spontaneous scribbles, which do not have to be perfect, these can be abstract later.

4. Blindstorming:

The brainstorming takes place using face mask or in a complete darkness so the participants or not distracted by visual stimuli or gestures /mimics of other participants.

5. brain Walking:

The spontaneous ideas for the participants are written on white board or posters distributed throughout the room.

6. Speed storming:

Participants exchange questions in pairs for a few minutes and then change chairs to talk to another persons.

7. Stop and go brainstorming:

The brainstorming session is deliberated interrupted at a fixed time and filled with the passes are other techniques in the meantime. alternatively, phases of Idea generation can be altered with the phases of valuation.

8. Body storming/ role storming:

During the brainstorming session, the participants to take on a certain role and Associate/ formulate their contributions/ ideas from the point of view. The roles can be specific customers/ user who have been characterized by the persona technique.

9. Brain station:

Groups of participants work on different questions at different stations (rooms without separate work areas) using brainstorming. The participants change stations after fixed period.

10. E-Brainstorming:

Ideas are communicated electronically via chat/ instant messaging systems so that people can participate at different locations.

11.Reverse Brainstorming:

There is also talked of reverse brainstorming and only negative aspects are sought. Here the different aspects of the question and problem can be considered. What is currently bad about the situation? Why can't the problem be solved? What should go wrong?

12. Headstand method:

The question is completely reversible also speaks of the headstand method. How can we make X worse? Make it as complicated as possible? Increase in price? To discourage customers as much as possible? in the next step all ideas can be turned back into positive.

Brainstorming Techniques:

1.Freewrıtıng:

- Write down whatever comes into mind.
- Do not judge the quality of writing.
- Do not worry about style, spelling, grammar, or punctuation.
- When you have finished your writing and have reached your goal,read back over the text,decide the solution.

2. Nomınal Group Technıque:

- Participants are asked to write their ideas anonymously.Then the moderator collects the ideas and each is voted on by the group.
- The best idea is chosen

3. Group Passıng Technıque:

- Each person in a circular group writes down one idea,and then passes the piece of paper to the next person in a clockwise direction,who adds some thoughts.
- This continues until everybody gets his or her original piece of paper back.By this time,participants will have examined each idea in detail

4. Individual Braınstormıng:

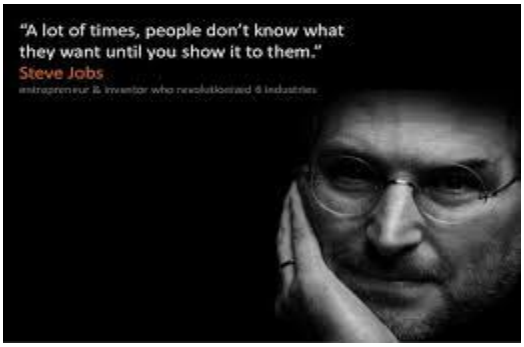
- It typically includes such techniques as free writing, free speaking, word association,and drawing a mind map . Individual brainstorming is useful method in creative wiriting

5. Question Braınstormıng:

- This process involves brainstorming the questions,rather than trying to come up with immediate answers and short term solutions
- Six Key Questions
    - ❖ Who?
    - ❖ What?
    - ❖ When?
    - ❖ Where?
    - ❖ How?
    - ❖ Why?

Prototype

"People don't know what they want until you show it to them"- Steve Jobs



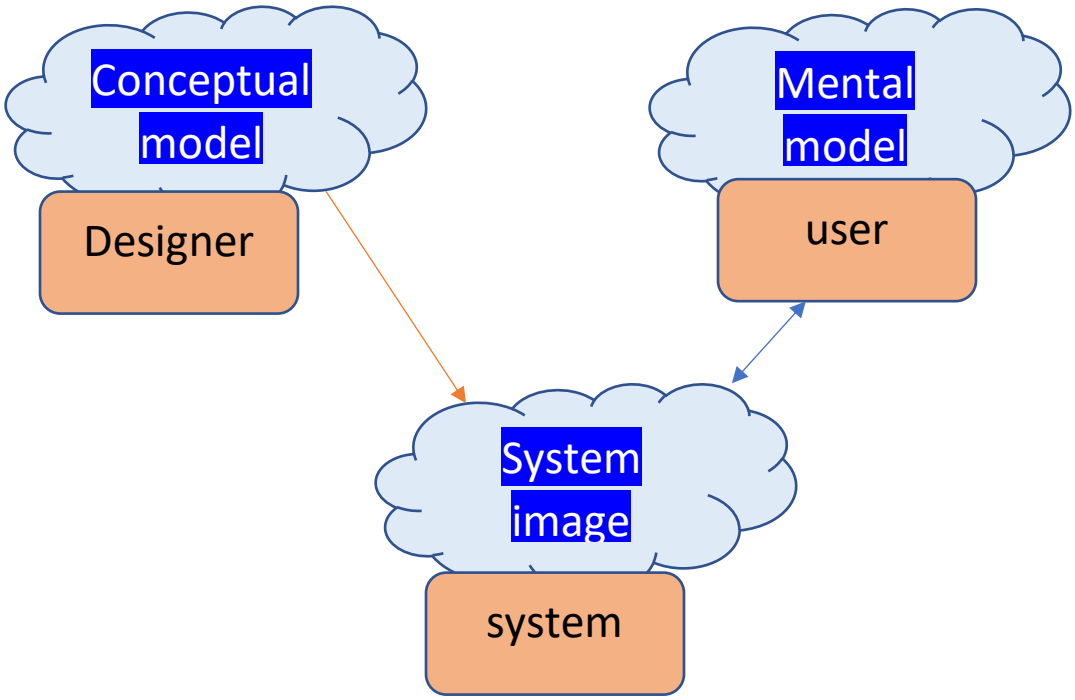
Prototyping is the shorthand of innovation.

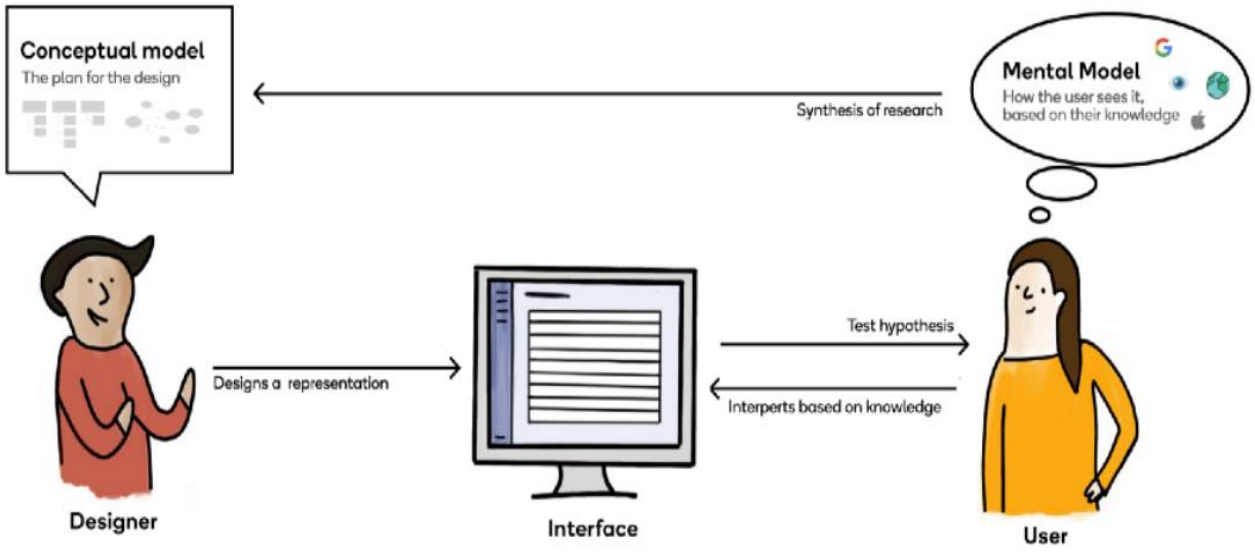
Conceptual model and conceptual design

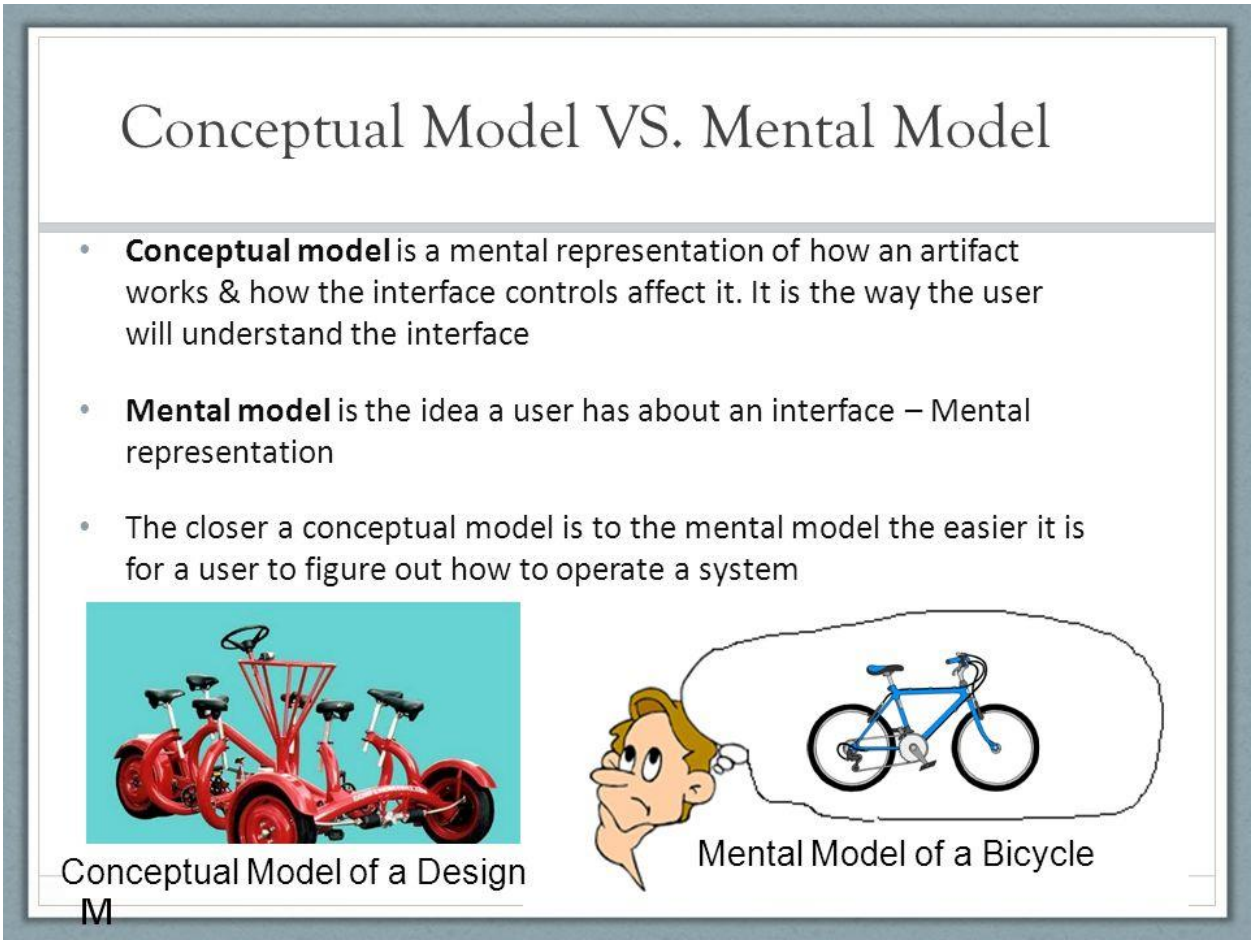
*******A conceptual model is created by the designer as a high-level plan for how the product/service will work and fit together*********

- Conceptual design is an early phase of design.it is the very first stage of the product/service process, where drawings and other illustrations or models are used.
- It serves to provide a description of the proposed product, in terms of set of integrated ideas and concepts about what it should do, behave, and look like in a way that is understandable for users.
- It is the design of interactions, experiences, processes, and strategies and is the point at which people, knowledge, product, services, processes and profitability meet vision and endless possibilities each acting as a distinct color on the canvas of the designer.
- It is grounded in more abstract thinking until a detailed design is ready to be created.

- Concept model=the foundation of the interface, different users' interfaces could be built upon it.
- Interface design translates the concept models into things people can see and interact with.it involves design choices but must stay faithful to the concepts and terminology of the concept models.
- Conceptual design is:
  - Designing systems so users can understand them.
  - Assisting the user to build useful metal models.
- Interface Design is:
  - Representing the conceptual model to the user







********** the concepts that designers as word-sense are defined in terms of clear, typical, central cases called prototypes********

Definition:

A prototype is a draft version of a product that allows designers to explore ideas and show the intention behind a feature or the overall design concept to users before investing time and money into development.

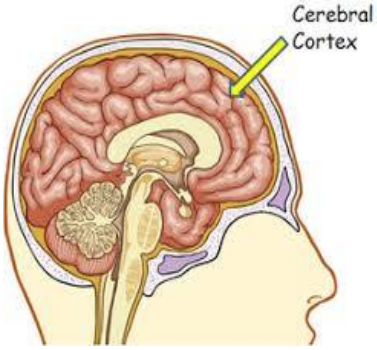
Or

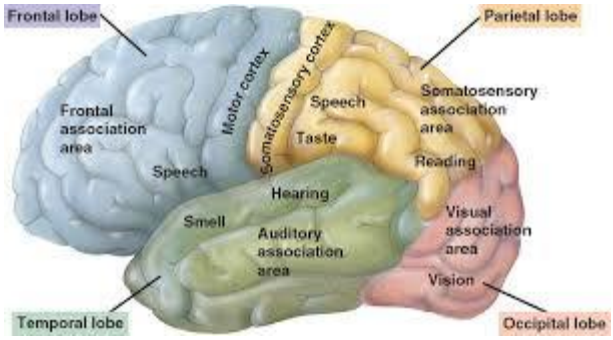
Representation of Conceptual design for users and designers, and other stakeholders to interact with

Or

A prototype in Design Thinking is **"A simulation or sample version of a final product, which is used for testing prior to launch."**

- The Goal of a prototype is the test products and services then its ideas before spending lots of time and money into creating the final version of the sellable product.
- The word "prototype" comes from the Greek Prototypos, a compound of protos("first") and typos ("mold, "pattern", "impression")
- Prototypes are one of the most important steps in the design process, yet it is very confusing to create and execute.
- A prototype can be almost anything from a series of sketches representing different screens of the final version of pixel-perfect product.
- Prototypes play a major role in solving the usability issues before the launch of the product.
- The prototype stage is when designer create a model designed to solve user's problems or validate ideas can test in the test phase of the process.
- Prototyping helps designers to unveil and explore these human needs, opening the door to insightful interaction and more empathetic design solutions.
- Human Beings are Highly Visual. in fact, 30 percent of human cerebral cortex is devoted purely to vision.





- When human being(user) can view the prototype, then it understood all the processes involved with the product, especially areas of contention for future testing, then prototype comes to life.
- In this phase, the idea selected at the best is expanded into a design concept.
- It must be clarified how the idea can be visualized and in a particular made tangible to test it and with the customer.
- According to the rules" **Be visual and make it to tangible**" and" **fail early and often**", the idea concepts are to be visualized as quickly as easily as possible are made tangible and comprehensible to test the effect of the customer and to learn from positive or in a particular negative feedback.
- Based on Idea concept, it must be clarified which visualization and prototyping techniques should be best be used
- As a first step it must be clear which goal is to be pursued.
  1. What do you want to learn from the customer/ users with the help of surveys interviews, observations, prototype test, pilot applications?
  2. How uncertain are the results?
  3. What can you not experience?
- The time and cost budget are also a factor to consider when selecting visualization and prototyping techniques.
- Even the most experienced design thinking teams cannot design the optimum solution on the first trial. Good design is a result of several iterations.
- Iteration is a cycle of doing something, testing it, improving it, and protecting it. The most efficient method of iterative design is prototyping.
- In general, the design teams have identified vetted solution concepts that are worth bringing farther along the design path.
- Solution concepts need stakeholder feedback as early and as often as possible in the design process.
- Prototypes are the most effective means by which stakeholders can understand what the design team intends.

- Prototyping as a creative tool requires the design team to clarify a solution concept's intentions and make decisions regarding what the concept is and is not.
- By being forced to shape the solution concept into something that can be experienced, constraints and dependencies of logical flow, time and space, human dynamics, and other principles and conventions force concepts to transform into designs.
- Prototyping causes the solution concept to evolve before the first stakeholder encounter.
- In prototyping stage three things are mainly taken care of
  1. Creation of experience
  2. Getting Feedback
  3. iteration

- The step of prototyping is the one in which the end user comes into picture. The end user is actively involved in this component of design thinking.
- All the feedback is taken from the customer, and based on the criticisms, suggestions, and appreciations received, the design thinkers create a better solution after iterating the process of design thinking's first three steps, viz. Empathize, Define, and Ideate.

- Prototyping requires thinkers to create tangible products, which can be small-scale models.
- One of the best ways to gain insights in a design thinking process is to carry out some form of prototyping.
- Prototyping involves producing an early, inexpensive, and scaled down version of the product to reveal any problems with the current design.
- Prototypes are often used in the final, Testing Phase in a design Thinking process to determine how the users behave with the prototype, to reveal new solutions to problems, or to find out whether the implemented solutions have been successful.
- In prototype stage the design team produces several inexpensive, scaled down versions of the solution.
- In this stage it is recommended to share prototype within the design team and if possible, with a wider audience.
- In this stage designers accept, improve, and re-examine or reject solutions based on the user's experience. Though this process, the design team will be

better able to tell how a real user would behave, think, and feel when interacting with the learning solution.

- In this stage, designers move from the abstract idea to a more tangible product.
- Think about prototypes as primitive forms of what you envision the final product to be.
- A drawing something pulled together on paper, a digital representation or even a prototype printed by a 3D printer can all serve as an adequate example of the product that designer imagined.
- Think of open questions that the user can shoot towards designer when he experiences the prototype.

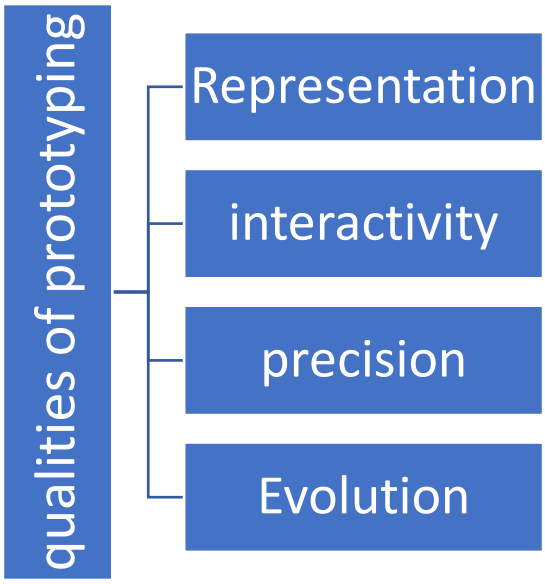
Why prototype:

- Communication &discuss ideas with stakeholders.
- Develop requirements and /or specifications.
- Learning and problem solving
- Evaluate interface effectiveness for communicating conceptual models.
- Further Develop conceptual and physical design
- Save time and money.

Four Qualities of Prototyping:

The Qualities of prototyping are:

Representation	This form of the prototype is mainly structured for presentation and keynote uses. That may be a paper-pen, digital or code
precision	The fidelity of the prototype is defined here. It explains the level of details, realism, and final design. Such as Low-fidelity and high-fidelity.
Interactivity	The functionality opens for the user. i.e fully functional, partially functional or no interactions at all
Evolution	The life cycle of the prototype. some are built to re iterate and re-iterate until it is precisely done, and some are just designed and thrown it away after the certain outcome is made.



- A prototype is one manifestation of Design that allows stakeholders (users and designers) to interact with it and to explore its suitability.
- "A prototype is an early sample, model or release of a product built to test a concept or process.it is a term used in a variety of contexts, including semantics, design, electronics, and software programming----Wikipedia.

Primary Guidelines for Prototyping:

- ❖ Take the first step and start to build the prototype. Do not procrastinate.
- ❖ Do not waste too much of time on building a single prototype.
- ❖ The prototypes must be built with the end user in mind.
- ❖ The prototype must not be a mere piece of trash; it must create an experience for the user.

Difference Between Sketches and prototypes:

Sketch	prototype
suggest	Describe
Explore	Refine
Question	Answer
Evocative	Didactic
propose	Test
Provoke	Resolve

tentative	Specific
Non-committal	Depiction

Prototypes take many forms:

- Paper
- Cardboard
- Foam
- Software
- Video
- Clay
- Website
- Sketches
- Scripts
- index cards

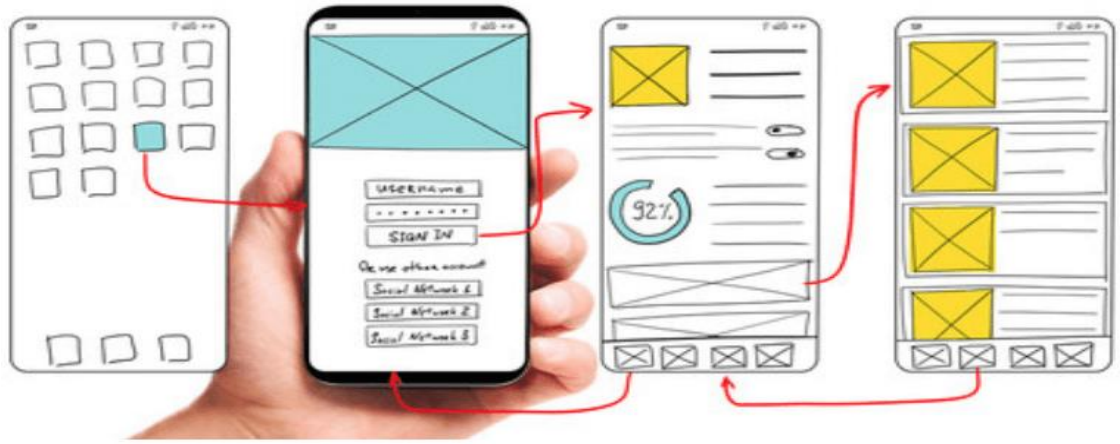
Types of Prototyping:

- Prototyping does not have to be time-consuming, expensive, or difficult.
- Different fidelity levels allow designers to come up with solutions quickly.
- Fidelity means the level of details, functionality, or interactivity that a prototype has.
- "Fidelity" can be a defined (according to Oxford Dictionary) as "the Degree of exactness with which something is reproduced."
- In other words, a prototype's level of fidelity answers the question, how precisely does this present the final solution.
- Prototypes are of two types.
  (i) Low- Fidelity prototype
  (ii) High-Fidelity prototype
  (iii)

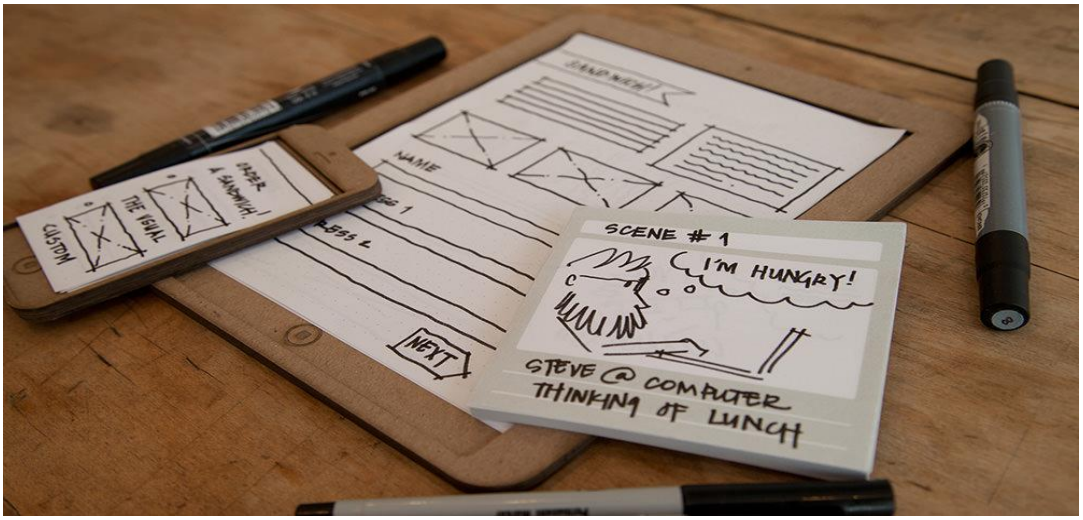
Low-Fidelity Prototyping:

- Low-Fidelity prototyping is intended to provide designers with Basic model or example of the product that requires testing.
- With a low-Fidelity prototype, it is likely going to be incomplete or utilize a limited number of its intended features.
- The low-fidelity prototype-Known as **low-tech**, **low-fi** or **lo-fi** prototype, is a semi-finished prototype that focus on function, structure, process, and provides the simplest framework and elements of web/app.

- It can even be constructed using materials such as **wood**, **paper**, and **metal** that are not intended to be used for the finished article.
- Low -Fidelity prototypes are usually simple and in-expensive ways to communicate, explore and modify ideas in the early stages of developments and their purpose is to support and provide answer to the question of the designers.
- Low -Fidelity prototyping is used generally show the overall shape of the design idea and the primary functionalities, which are required to work fully but rather serve as the proof of concept and to help generate insight about the final look.



- Typically speaking, when design a low-fidelity prototype it can be inexpensive, quick, and simplified version of what the final product will be.
- Low-Fidelity means that the prototype does not have a lot of detail, no images, or colors.
- Instead, it uses placeholders for images and text, but shows the flow and functionality of a solution.
- It is often used to translate design ideas into testable and tangible artifacts for collecting and analyzing the user demands at early stage.



- Building a low-fidelity prototype is very helpful for exposing the idea for user feedback and finding major issues that need to be fixed the early stages of design when re-designing cane be cheaper and quicker

<u>Advantages of low fidelity prototypes:</u>

- **Low cost**: The cost of low Fidelity prototype is extremely low.
- **Fast:** Without focusing on every interface detail, designers can just follow their design ideas and create a simple and testing product within a few minutes
- **Easy to demonstrate, co-operate and iterate**: Without too many details, hello why prototype does not require money professional skills. And more people can join and collaborate on the same project it is also easy for designers to make changes and iterate the prototype during the calibration.
- **Easy to get feedback**: Since a low fertility easy to carry and demonstrate designers can also directly share it with other people to collect design feedback.

- **Easy to detect and tackle potential issues**: A low Fidelity prototype also allows designers to test use flows, interactions. It is good for designer to detect and tackle potential issues quickly.

Disadvantages of low-fidelity prototyping:

- **Uncertainty during testing.** With a low-fidelity prototype, it might be unclear to test participants what is supposed to work and what isn't. A low-fidelity prototype can often require some imagination from the user, typically based on a scenario that the research team has written in advance, limiting the outcome of user testing.

- **Limited interactivity.** It is impossible to convey complex animations or transitions using this type of prototype.

High-Fidelity Prototyping:

- The fidelity of the prototype refers to the level of details and functionality built into a prototype.
- In this sense, a high-fidelity (sometimes referred as high-fi or hi-fi) prototype is a computer-based interactive representation of the product in its closest resemblance to the final design in terms of details and functionality.
- The high in high-fidelity refers to the level of comprehensiveness that allows designers to examine usability question in detail and make conclusions about the user behaviour.
- High-fidelity prototypes appear and function as similarly as possible to the actual product.
- Teams usually create high-fidelity prototypes when they have a solid understanding of what they are going to build, and they need to either test it with real users or get final-design approval from stakeholders.

High-fidelity prototypes are designed to look and operate similarly to the finished product

Characteristics of high-fidelity prototypes:

Visual design	Realistic and detailed design — all interface elements, spacing, and graphics look just like the real version of the product
Content	Designers use real or similar-to-real content. The prototype includes most or all the content that will appear in the final design
Interactivity	Prototypes are highly realistic in their interactions

Advantages of high-fidelity prototype:

- **Meaningful feedback during usability testing*:*** High-fidelity prototypes often look like real products to users. This means that during usability testing sessions, test participants will be more likely to behave naturally — as if they were interacting with the real product.

- **Testability of specific UI elements or interactions*:*** With high-fidelity interactivity, it's possible to test graphical elements like affordance or specific interactions, such as animated transitions and micro interactions.

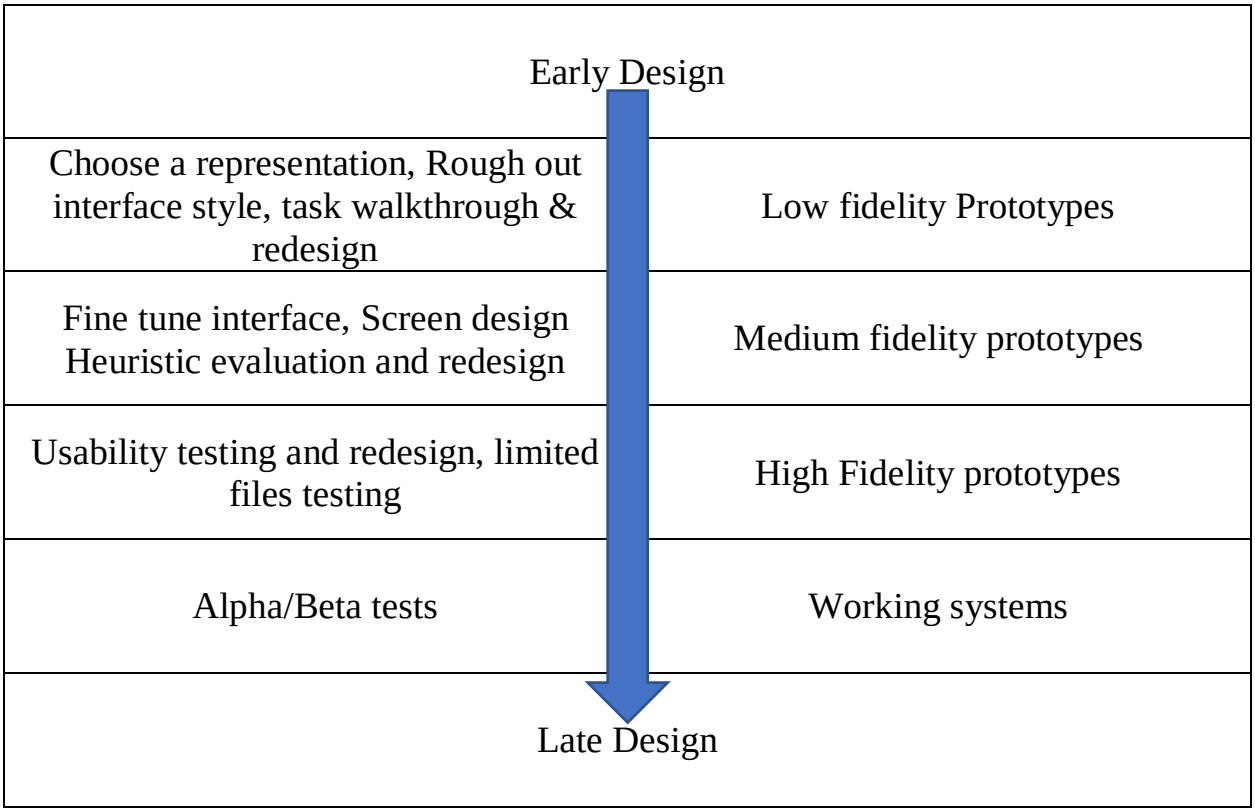
- **Easy buy-in from clients and stakeholders:** This type of prototype is also good for demonstrations to stakeholders. It gives clients and potential investors a clear idea of how a product is supposed to work. A well-crafted high-fidelity prototype gets people excited about your design in ways a low-fidelity, bare-bones prototype cannot.

Disadvantages of high-fidelity prototypes:

- **Higher costs.** In comparison with low-fidelity prototypes, creating high-fidelity prototypes implies higher costs, both temporal and financial.

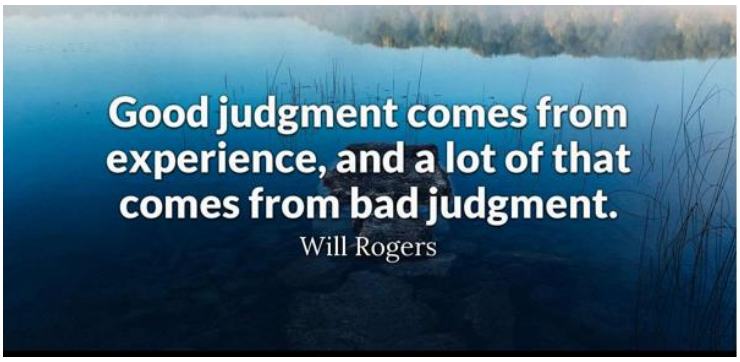
- **Timing and misunderstanding.** Presenting or demonstrating high-fidelity prototypes early in the design process can sometimes become a distraction for stakeholders. A discussion on functionality can quickly derail into an argument about a missing period, so it is important to consider where the team is in the design process.

When to use Different types of prototypes?



Testing

"Good judgement comes from experience. Experience comes from bad judgement".



- The testing phase allows the designers to gain the feedback and insights that may not be possible without testing their prototypes.
- Through these tests, designers will be able to identify aspects of their prototype that did not work well, or the end user did not find the functional or pleasing.
- These failures give the designers the opportunity to fix and improve the aspects of their prototypes.
- However, failing can be difficult to accept for most of the designers. Not only does it make uncomfortable and insecure, failing can also be embarrassing, painful, and annoying and sometimes even anger.
- Despite, these designers overcome their fear of failure and embrace it as a learning opportunity.
- Time to try out new things, and innovate, even if this means pursuing the unconventional.
- In the testing phase, Design thinking teams tests prototyped solution with users representing the target personas.
- Update the solution in an iterative manner until the solution in an iterative manner until the solution satisfies the user needs and overcomes the challenges that is defined in the initial phase of the project.
- Design thinking team members should always appreciate user's Critiques of the solution.
- The critique is natural part of any effort, including Design.
- Design Thinking teams should regard the critiques of their solution positively and constructively.
- "The Customer is not always right but always having a point."
- In the testing, users have a bias towards evaluating a new solution according to its similarity to existing products with which they are familiar

- When designers asked to comment on the new solution, end users say "The old one was Better. I don't Know why, but it was better" -----Baby-duck Syndrome

- In human psychology, Baby duck syndrome is called the effect when a person, studying a particular area, considers the first object encountered from this area to be the best, and the subsequent ones to be the worst.
- Once the prototype is ready, test that with the users and let them go through the prototype.
- If it is the prototype of a product then let the users use the prototype.
- If it is a service prototype, then show the design of the new service /modification.
- It is to be cautious that the users should use the prototype on their own without any guidance.
- The user test is performed by the users or the representatives of the users testing by the users /customers will give us feedback about the working of the improved component that is added to the product.
- Testing a prototype is saving the cost significantly.
- There are multiple levels of testing among that usability is one of the tests.
- Usability is defined as the effort required to use any feature of product or service.
- e.g A vending machine or coffee machine is to make a cup of coffee.

- users have to put more effort to operate the buttons, familiar people will use it with ease, whereas the non-frequent users will struggle to operate the machine to get a cup of coffee.
- If more effort is required to use a feature, then the usability score will be very less.
- Feedback from this stage would be fed back to the define the stage to redefine the problem.
- The test report is especially important as this gives the input for corrections.
- The test report should have the following fields.
    - Feature code
    - Test data
    - Test case number
    - The proficiency level of the user
    - Result test case wise
- When selecting the appropriate prototype test methods for the hypotheses, designers should always ask which the simplest test is to perform to arrive at a certain conclusion.
- Before the designer start testing the prototype, think about the recording ways (voice recorder, camera etc) of the customer feedback. And which criteria want to use to analyze the feedback?
- The customer's statements on the following basic question are to be analyzed.
    - What was positively evaluated?
    - What concerns arose
    - What was a surprising message/action from the customer?
    - Did emotions come up with the customer, if so what kind of emotions?
    - What suggestions were made?
    - What insights and feedback do designer get for the idea concept?
    - What can be learned from this?
- Prioritize the feedback. try to implement the feedback in the improved prototype.
- In addition to the improvement (or rejection) of the prototype or idea, customer feedback also results in possibilities for variants of the product or service ideas.

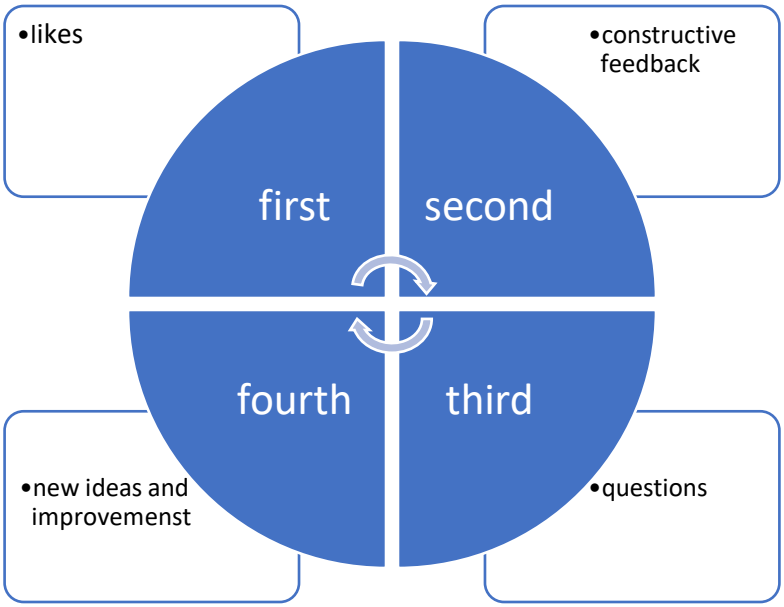
Tips for prototype testing:

- offer multiple prototypes for comparsion.in addition to the very promising ideas, designer can also deliberately create prototype for an idea that would exclude inefficiency.

- ask for feedback without comment. Each evaluation on designer part can influence the assessment of the customer.
- ask the customer to suggest or implement changes to the prototype.

Testing with End users:

- when designers test with end users, it is another chance for them to empathize and learn something new that could be used to refine their prototypes.
- Testing brings the focus back to end users to reveal hidden insights that the designers would have never foreseen without the end users experiencing their prototype.
- According to d.school there are four aspects that designers need to consider when testing with end users
    1. The prototype
    2. Context and scenario
    3. The interaction between the user and designer
    4. The process and method used to observe, capture feedback, and reflect.
- Before testing session, it was important to prepare the users for their interaction so that designers proceeded in in the right testing mindset.
- The testing phase requires designers to not get defensive about the feedback they receive about their prototype or justify the reasoning behind their design, but instead to be attentive to feedback and surprising insights.
- One of the methods the designers captured their observational findings and user feedback through a simple tool called FEEDBACK CAPTURE GRID.
- This grid consists of four quadrants.
- In the first quadrant, designers wrote down their users' feedback on what they liked about the prototype.
- The second quadrant contains the user's constructive feedback.
- The third quadrant contained the questions that arose during the testing.
- The fourth quadrant contained new ideas or improvements that emerged from the tests.



- This feedback tool helped designers be more intentional in what they were observing and the information they were looking to record.
- Using what complied in feedback capture grid, designers proceed back to the prototype phase to refine and improve their prototypes.

Classical Test Methods are:

1. Contextual Interview/ inquiry of Customer
2. User Observation techniques
3. Interviews on neutral location
4. Phone interviews
5. Video charts
6. Instant messaging
7. E-mails
8. Online survey
9. Focus groups/ customer Clinics/Usability-Test/Live testing
10. Eye-Tracking systems

Contextual interview:

- since most of the products or services are used individually, one-on-one interviews are usually more effective.
    - Tips for interviews

❖ where and how to find customer for the experiments?

- First try for physical meeting for eye-to-eye contact for understanding the customer emotions and thoughts
- Use social network (contact on Facebook, twitter, phone LinkedIn,) for the survey.
- Ask for recommendations for friends to friends (so called second-degree connections) to do this create redirectable mails with request.
- If designer do not have a clear idea of the exact target customers, start broadly, but focus on the potential target group as quickly as possible.
- Search for studies, news articles, reports about the target group, and collect statements, contacts data or other relevant information.
- With already existing, similar products or predecessor products, designer can address existing customers directly.

❖ <u>How to formulate the right questions?</u>

- avoid technical terms! speak in customer's language. Better something more colloquial than incompressible or misleading
- always concentrate on certain activities, events, or decisions in the past or present
- good questions are about the current situation of the customer and his previous experiences.
- Never accept or take anything for granted: Ask also if designer know the supposed reason or take something for granted.

❖ <u>How to conduct interviews correctly:</u>

- make the focus of the interview clear in advance so that designer can concentrate on it.
- Each interview should focus on the following aspects:
  (a) Statements on the concrete hypotheses (either in the sense of confirmation or nonconfirmation)
  (b) Surprising statements
  (c) Emotional statements (emotions expressed by content, choice of words, vocal pitch, gestures, or facial expressions. Emotions can show anger, worry, frustration, curiosity, or excitement)
- Do not conduct group interviews even if this seems very efficient.
- Avoid the concrete business ideas at the beginning.

- Pay attention to speech.
- Recorders should not be used for interviews with strangers.
- After the interview designer should always allow a little time for follow up to note down the most important results
- Designer can enter the notes electronically (excel, googledoc, notepads, index cards etc)
- If there are no clear answer patterns even in many interviews, then designer should take another critical look at the customer segment or revise the questions.
-

❖ Template for interview protocol for testing:
Source: according to Alvarez (2014) and with the addition of pauck/owen (2013)

Interview protocol				
Hypothesis(assumptions)				
Interview conducted by:			At	
Information about the interviewee:				
Name:			position	
Gender:	Male	Female	Age:	
Other characteristics traits: (work experience, leisure activities, usage habits etc)				
Keywords of the key message:	Notes:			
Summary:				

Observation Techniques:

1. Drawings and design of models
2. Storyboarding
3. Storytelling/comics/Lego serious games
4. Body storming
5. Wireframes/Mockups
6. Website/Landing Page
7. Videos
8. Concierge MVP (Minimum Viable Product)
9. Wizard-of-Oz MVP
10. Open-source Prototypes
11. 3D-Rapid prototyping
12. Crowd Funding

Storyboarding:

- Storyboarding is a method, initially used by Walt Disney for cinema film production, which schematically visualize scenes of an action (hence also called visual storytelling) and summarizes dialogues or activities of person in a situation in a keyword manner.
- Storyboards can be used in Design Thinking to visualize customer activities during problem identification on the hand, and as a kind of prototype during the solution finding phase on the other, to obtain customer feedback.
- For the development of service offerings, storyboarding is a good opportunity for visualization.

Storytelling:

- Storytelling describes in a narrative form as a real (but also fictitious) story the vision/strategy, the benefits or use of an innovation or the success (best practices) or typical mistakes in innovation activities.
- Storytelling can be used as a kind of prototype test to illustrate an innovate idea to customers and to ask for feedback.
- The procedure for the creation of a story is like the creation of a communication concept in marketing or can be part of such a concept.
- First, the central message of the story (goal) should be defined, or the target group determined in amazingly simple words.
- the following questions need to be answered to create a central message.
    1. who is the target group for the message?

2. why should this story be told?
3. what should the reader /listeners/ viewers take with them?
4. How will the reader/listeners/viewers benefit from the story?
5. Is the message relevant?
6. what can the reader /listeners/viewers learn from it?
7. what should be the reader /listener/viewer think, feel of do after the story?

- To prepare the storytelling, relevant background information on these elements e.g interviews with the people involved in the story, must be researched, which is relevant in the broadest sense.
- Quotations of the personality can incorporate in the story.
- To better understand the role of the characters, the persona method or the empathy map can be used to prepare the story.
- The realization of the story can be realized as text, radio play or video or as a combination of these possibilities of various multimedia.

Supporting points on testing techniques:

- ❖ Most products /services are used individually, one -on -one interviews are usually more effective than focus group sessions.
- ❖ People/end-users are affecting each other's opinion during focus-group sessions, and this may undermine the testing results.
- ❖ It is beneficial to conduct focus group session after the interviews.
- ❖ During interviews and focus groups, some users may not provide complete, clear, and objective feedback about the solution.
- ❖ Some of the users will not want to criticize the solution, and they will hesitate to make negative comments.
- ❖ To mitigate this risk, user observations should also be conducted following interviews and focus group sessions.
- ❖ User observation Techniques consists of observing users while they use the prototyped solution.
- ❖ Testing a solution with limited number of users who represents the target personas is much better than testing with many random users.
- ❖ The optimum number of users that should be included in the testing phase is eight or ten per persona.
- ❖ Finding the users who represent the target personas is one of the most challenging parts of the testing phase.

- Sometimes design thinking teams hesitate to allocate a specific time and budget for testing sessions, because a fully equipped test laboratory is mandatory for testing.
- Observing users while they interact with the solution can be sufficient to detect and analyze most of the problems with the solutions.