2. DESIGN THINKING

2.0 INTRODUCTION

Designers think Design Thinking is the exclusive property of designers, but it is not. All great innovators in science, engineering, literature, art, music, and business have practiced it. If so many different people have practiced, why call it Design Thinking? What is special about Design Thinking? It is the designers' work processes that can help systematically extract, teach, learn and apply human-centered techniques of Design Thinking to solve problems creatively and innovatively in walks of like in science, engineering, and lives.

Some of the well-known brands, such as Apple, Google, Samsung, and GE, have rapidly adopted the Design Thinking approach in their product development and business

2.1 WHAT IS DESIGN THINKING?

Design Thinking is an iterative process seeking to understand the user requirements, challenge assumptions made in finding the solution to meet user requirements, and redefine problems in an attempt to identify alternative strategies and solutions that might not be seen with the initial level of understanding. Design Thinking provides a solution-based approach to solve problems. It is a way of thinking and working as well as a collection of hands-on methods.

It has evolved from a range of different fields: science, engineering, architecture, arts, literature, business, social like creative. Design Thinking can be applied to any field and does not necessarily have to be design-specific. Design Thinking is extremely user-centric seeking to understand people's needs and come up with effective solutions to meet those needs.

2.2 DESIGN THINKING DEFINED

Different experts explained Design Thinking as follows:

"The future has many names.

For the weak, it is the unattainable.

For the fearful it is the unknown.

For the brave it is the chance." ***– Victor Hugo, French poet and novelist***

Design Thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success ***– Tim Bown, Executive Chair of IDEO***

Thinking like a designer can transform the way organizations develop products, services, processes, and strategies. This approach, which is known as Design Thinking, brings together what is desirable from a human point of view with what is technologically feasible and economically viable. It also allows people who are not trained as designers to use creative tools to address a vast range of challenges.

"...the more I pondered the nature of design and reflected on my recent encounters with engineers, business people, and others who blindly solved the problems they thought they were facing without question or further study, I realized that these people could benefit from a good dose of design thinking. Designers have developed several techniques to avoid being captured by too facile a solution. They take the original problem as a suggestion, not as a final statement, then think broadly about what the real issues underlying this problem statement might be (for example by using the "Five Whys" approach to get at root causes). Most important of all is that the process is iterative and expansive. Designers resist the temptation to jump immediately to a solution to the stated problem. Instead, they first spend time determining what the basic, fundamental (root) issue is that needs to be addressed. They don't try to search for a solution until they have determined the real problem, and even then, instead of solving that problem, they stop to consider a wide range of potential solutions. Only then will they finally converge upon their proposal. This process is called "Design Thinking."

– Don Norman, Rethinking Design Thinking

- Design Thinking is an innovative problem-solving process rooted in a set of skills.
  (https://mitsloananit.edu/ideas-made-to-matter/design-thinking-explained)
- Design Thinking is a process for creative problem-solving.
  (https://www.ideou.com/blogs/inspiration/what-is-design-thinking)

- Human-centered design and the challenges of complex problem-solving. *(https://www.oreilly.com/radar/what-is-design-thinking/)*
- Design Thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success. *(https://designthinking.ideo.com/)*
- Design Thinking is both an ideology and a process, concerned with solving complex problems in a highly user-centric way. *(https://careerfoundly.com/en/blogh/ux-design/what-is-design-thinking-everything-you-need-to-know-to-get-started)*
- Design Thinking is a non-linear, iterative process that seeks to understand users, challenge assumptions, redefine problems, and create innovative solutions to prototype and test. *(https://www.interaction-design.orgaiteraturthopicsidesign-thinking)*

Design Thinking encourages organizations to focus on the people they are creating for which leads to better products, services, and internal processes. When you sit down to create a solution for a business need, the first question should always be what is the human need behind it?

In employing design thinking, three important considerations are (shown in Fig. 2.1)

i) what is desirable from a human point of view?
ii) what is technologically feasible?
iii) is it economically viable?

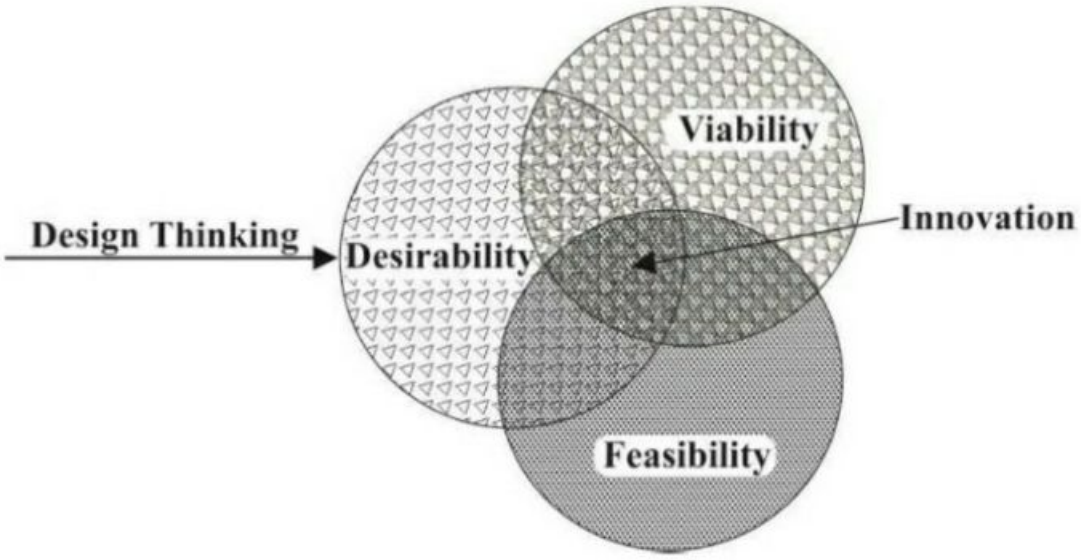

Fig. 2.1 Design Thinking and innovation

The process starts with taking action and understanding the right questions. It facilitates simple mindset shifts and addressing problems from a new direction. It also allows even untrained designers to use creative tools to address a vast range of challenges. The following are the advantages of Design Thinking:

- Design Thinking addresser design-specific cognitive activities that designers apply during the process of designing a new product or service.
- Design Thinking is a formal method for the practical, creative resolution of problems and the creation of solutions, with the intent of creating an improved future result.
- Design Thinking is a form of solution-based, or solution-focused thinking – starting with a goal(a better future situation) instead of solving a specific problem.
- By considering Design Thinking both present and future conditions and parameters of the problem, alternative solutions may be explored simultaneously.
- This approach differs from the analytical scientific method, which begins by thoroughly defining all parameters of a problem to create a solution.
- Because design thinking is iterative, intermediate "solutions" are also potential starting points of alternative paths, including redefining the initial problem.

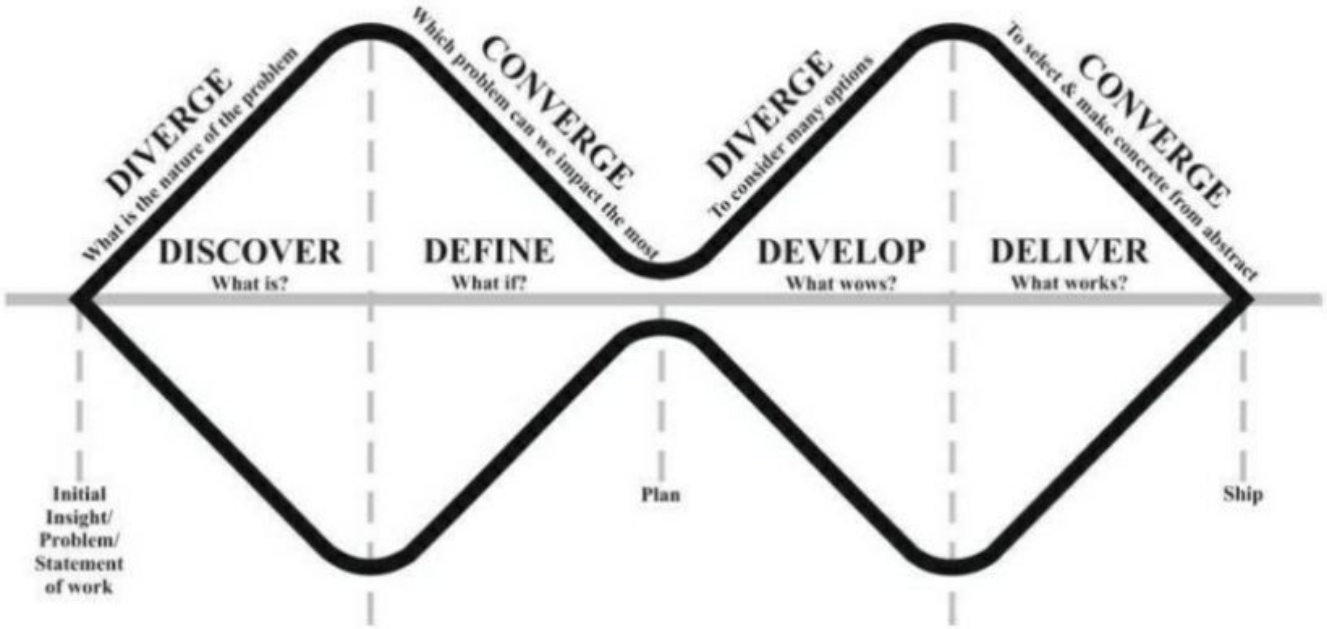

Fig. 2.2 Convergent divergence thinking

Source: Design Council, UK-2005

Table 2.1 Design thinking types

Discover	Define	Develop	Deliver
Initial ideas or inspiration & establishment of user needs	Interpretation & alignment of findings to project objectives	Design-led concepts & proposals iterated & assessed	Process outcomes(s)
Market research	Information analysis	Ideation	Finalized & implemented
User research	Synthesis & identification	Multi-disciplinary working	Final testing & approval
Design research	Project management	Visual management & progress	Production
Technology research	Project sign-off	Testing & prototyping	Launch of outcome(s)
Interviews & insights gathering		Review & improvement	Evaluation & further feedback
Observation & shadowing			Future work
Empathic modeling			
Information management			

Divergent thinking versus convergent thinking (Refer Fig. 2.2)

- Design thinking employs divergent thinking as a way to ensure that many possible solutions are explored in the first instance, and then convergent thinking as a way to narrow these solutions down to a final solution.
- Divergent thinking is the ability to offer different, unique, or variant ideas adherent to one theme while convergent thinking is the ability to find the single " correct" solution to the given problem.
- Design thinking encourages divergent thinking to ideate many solutions (possible or impossible) and then uses convergent thinking to prefer and realize the best /optimum solution.

Types of Design Thinking drawn from Fig. 2.2 are tabulated in Table 2.1

2.3 WHAT IS NOT DESIGN THINKING?

- Design Thinking is not a miracle cure to all problems in design. It can only help in the design
- Design Thinking is not design. It captures the qualities of designers and can help motivate and engage the designer and the design ecosystem
- Design Thinking is not a quick fix to the requirements. It takes time to find better solutions
- Design Thinking will not guarantee success, it is a complement to improve communication, collaboration, and consensus-building between various persons involved
- Design Thinking is a method and not a magic solution.

2.4 DESIGN THINKING OR 'OUT OF THE BOX' THINKING

Design Thinking is often referred to as 'out of the box' thinking, as designers are attempting to develop new ways of thinking that do not abide by common and well known problem-solving methods. Design Thinking intends

i) to improve products by analyzing and understanding how users interact with products and investigating the conditions in which they operate

ii) to challenge assumptions to falsify previous assumptions – i.e., to make it possible to prove whether they are valid or not.

Once conditions of a problem are investigated, the solution-generation process will help to produce ideas that reflect the genuine constraints and facets of that particular problem. Design Thinking offers us a means of digging that bit deeper; it helps us to do the right kind of research and to prototype and test products and services to uncover new ways of improving the product, service, or design.

2.5 DESIGN THINKING IS AN ESSENTIAL TOOL

Grand Old Man of User Experience, Don Norman, who also coined the very term User Experience, explains what Design Thinking is and what is so special about it:

The design process often involves a number of different groups of people in different departments; for this reason, developing, categorizing, and organizing ideas and problem solutions can be difficult. One way of keeping a design project on track and organizing the core ideas is using a Design Thinking approach.

2.6 SCIENCE AND RATIONALITY IN DESIGN THINKING

In some of the scientific studies and analysis how users interact with products and the conditions in which they operate are as follows

i) pooling experience from previous projects
ii) considering present and future conditions specific to the product
iii) testing the parameters of the problem
iv) testing the practical application of alternative problem solutions.

Unlike in the conventional approach, where the majority of known principles, characteristics, etc. of the problem are applied to arrive at a problem solution, Design Thinking investigations include ambiguous elements of the problem to reveal previously unknown parameters and uncover alternative strategies. After arriving at a number of potential problem solutions, the selection process is finalized by rationality. Designers are encouraged to analyze and falsify these problem solutions so that they can arrive at the best available option for each problem or obstacle identified during each phase of the design process.

"Design thinking begins with skills designers have learned over many decades in their quest to match human needs with available technical resources within the practical constraints of the business. By integrating what is desirable from a human point of view with what is technologically feasible and economically viable, designers have been able to create the products we enjoy today. Design thinking takes the next step, which is to put these tools into the hands of people who may have never thought of themselves as designers and apply them to a vastly greater range of problems."

(Tim Brown, Change by Design, Introduction)

2.7 PRINCIPLES OF DESIGN THINKING

Design Thinking is an integrative approach. This means that for problem-solving, the process of problem-solving is considered together with its framework conditions. The problem analysis and solution development are considered systematically and holistically in the form of a process. Various experts necessary for problem analysis and solution development are involved and enter into an exchange with each other.

The working environment for this process is designed to promote creativity. The **three Ps of Design Thinking** are: **People** (the human being), **Process** (the problem-solving process), and **Place** (the working spaces) must be considered for successful idea development. A fourth P can be **Partnerships** since a large number of partners must be involved in the development and implementation of ideas.

i) **Early customer orientation**: Design Thinking starts with people and not with a technology or a business goal. It is no longer sufficient to question customers about classic market research instruments. Traditional methods of (testing) market research often only deliver disappointing results in the search for innovations. The customer should have a decisive influence on the "go/stop" decisions in the process.

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

-David M. Kelley

Empathy is the foundation of a human-centered design process. It helps to understand how others are feeling about our design so that we can respond appropriately to the situation.

A design thinker must understand the people for whom the design is made. He should understand that he is not solving his problem and solving a problem of the users.

Observing and watching what people do and how they interact with their environment gives clues about what the user thinks and feels. It helps the designer to learn about what they need. By watching people, it is possible to capture the physical manifestations of their experience, what they do and say. This will allow the design to interpret the intangible meaning of those experiences to uncover insights. These insights will lead to innovative solutions. The best solutions come out of the best insights into human behavior.

The following questions to the user will give some insight into the user thinking

- What are their motivators?
- What drives them?
- What upsets them?
- What are they looking for?
- What are their latent and stated needs?
- What they demonstrate such as behavior, feelings, and thoughts when interacting with products in a real-world setting?

iii) **Prototypes:** Strives to make ideas tangible at an early stage. Prototypes must be created as quickly as possible, which also applies to immaterial services. It is not a question of testing a quasi-finished (perfect) product, but quite the opposite: individual functions/features/characteristics or activities of the product/service offer are to be checked by the customer. The maxim

when creating or selecting a prototype is: as simple as possible, as meaningful as necessary.

iv) **Iteration loops:** Consists of frequent iteration loops between the development phases. The return to a previous phase is not a mistake but shows the learning success in this process. Failure is an integral part of this approach and should be tolerated, accepted, and even expected by all participants. The motto is: "Fail fast to succeed sooner".

v) **Diversity of the participants:** Pay attention to the diversity of participants. Design Thinking combines interdisciplinary breadth and technical depth: The knowledge, experience, and perspectives of a team of engineers, natural scientists, humanists, social scientists, and economists, etc., who have the ability for multidisciplinary cooperation, are put to good use. Furthermore, differences in age, gender, affiliation to the company (long-time/for the time being short in the company), experience with the topic (intensive, little, not at all) and/or personality type (introverted, extroverted, etc.) should be taken into account.

vi) **Team-oriented, creative working spaces**: "Me"-spaces (for individual work) and "We"-spaces (for group work) are flexible and inspiring to equip for individual, group, and plenary work. It is advisable to choose different locations, rooms, or furniture arrangements for the different Design Thinking phases to create new atmospheres (suitable for the respective work) again and again.

vii) **Analytical synthetic and problem phases:** Collected, organized, evaluated to arrive at the decision of the design and synthetic phases developed, tested, improved. In the first part, the problem is analysed in detail where the focus is on what? and why? (what is the problem? and why is it a problem?). Only in the second part concrete solutions are developed and tested (so-called solution space): Here the question is asked about the "how? (something can be solved)".

In addition, one can differentiate between divergent phases, which lead to an expansion of the perspective by collecting information or generating ideas, and convergent phases, which lead to a focusing of the field of vision by making decisions between alternatives.

These divergent and convergent phases alternate so that the Design Thinking process is framed by a double diamond (Design Council, UK (2005) as shown in Fig. 2.3.

2.8 THE PROCESS OF DESIGN THINKING

"*Some people think design means how it looks. But of course, if you dig deeper, it's really how it works.*" ***– Steve Jobs, Apple***

Design Thinking is a methodology that provides a solution-based approach to solving problems. It is extremely useful in tackling complex problems that are ill-defined or unknown, by understanding the human needs involved, by re-framing the problem in human-centric ways, by creating many ideas in brainstorming sessions, and by adopting an appropriate solution.

The Design Thinking process consists of six process steps with iteration loops: Understanding, observing, defining problems, finding ideas, developing prototypes, and testing. The initial three phases, called problem space, describe the problem and its causes (what is the problem and why is the problem there?). The subsequent three phases, called solution space, describe possible solutions and how these can be implemented. The process steps shown in Fig 2.3 are described briefly below and then explained in more detail step by step.

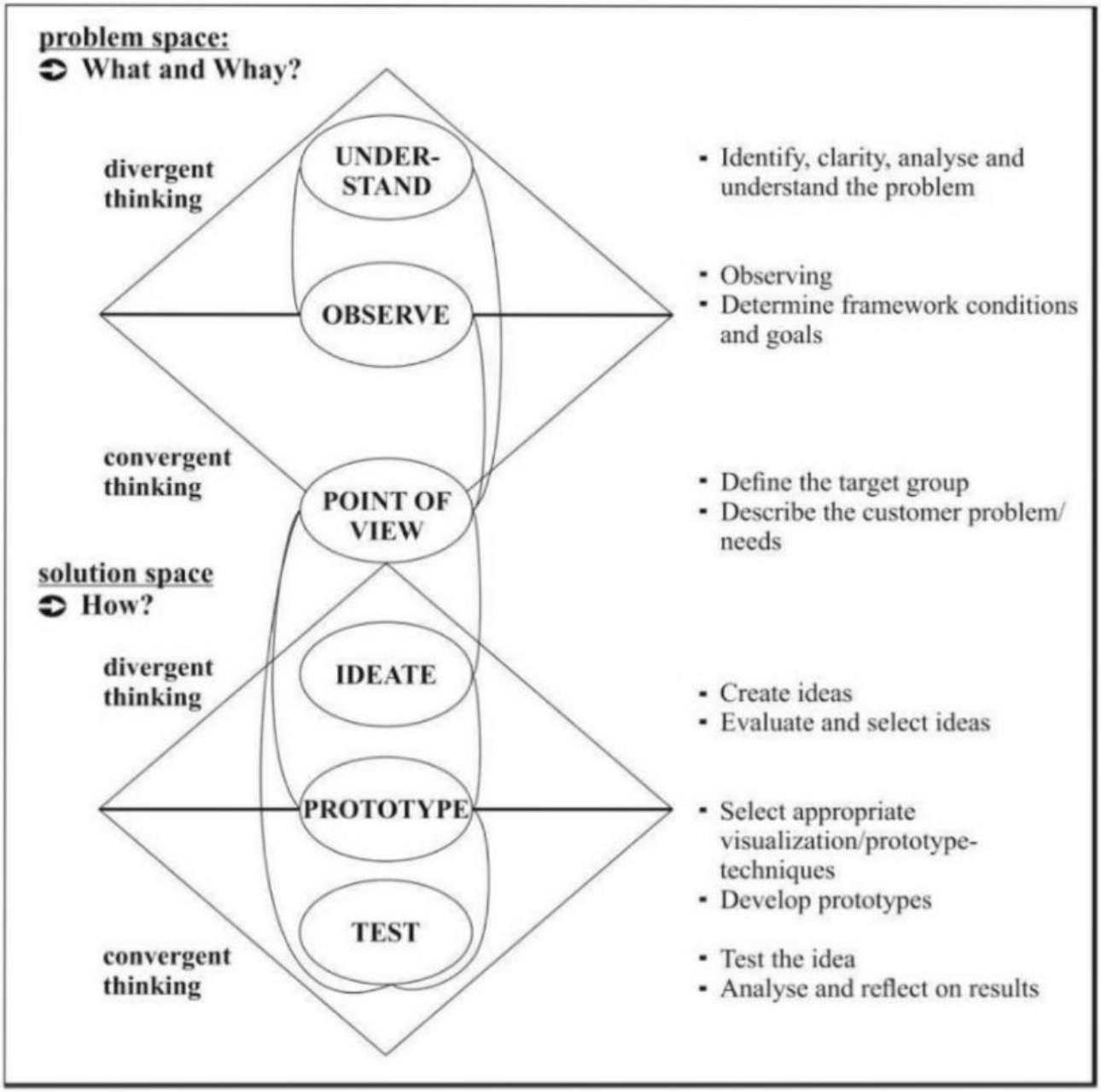

Fig 2.3 Process of Design Thinking supplemented with the Double-Diamond model

Source: Plattner/et al. (2009), Lindberg et al. (2010) and Design Council UK (2005)

Even if the process representation is shown sequentially, the process is strongly iterative, i.e. there are numerous feedbacks to the previous phases in each phase. The individual process steps should be completed quickly to learn fast through iteration loops according to the "fail early and often" principle or, if necessary, to be able to terminate the process completely. It is helpful to define concrete time budgets for the individual phases.

2.8.1 Understand Phase 1

Developing an understanding of the problem, the need or the requirements and challenges is the first phase. It cannot begin without a deeper understanding of the people whom the design is made. To gain those insights, it is important for a design thinker to empathize with the people for whom the designs are made, to understand their needs, thoughts, emotions and motivations. It must be clarified who has to be integrated into the process and, in particular, which technical perspective (process organization) is necessary. Finally, it must be clarified how the question can best be formulated so that the customer's need/problem is defined in concrete terms.

2.8.2 Observe Phase 2

In this phase, detailed research and on-site observations are carried out on the customer's need/problem. Numerous methods such as interviews, written surveys, observations with recordings through photos, or even videos can be used for this. The results are the clarification of the general conditions, the exact definition of the target group, and a comprehensive understanding of the customer and his needs and behavior.

2.8.3 Define Problem Phase 3

An integral part of the Design Thinking process is the definition of a meaningful and actionable problem statement, which the design thinker will focus on solving. This is perhaps the most challenging part of the Design Thinking process, as the definition of a problem (also called a design challenge) will require to synthesize the observations.

After the observations, the findings should next be condensed to a single prototypical user whose problem/need is to be summarized in a clearly defined question.

2.8.4 Ideate (Finding and Selecting Ideas) Phase 4

Ideation is the fourth stage in the Design Thinking process. In the Ideation stage, design thinkers spark off ideas in the form of questions and solutions through creative and curious activities such as Sketching, Prototyping, Brainstorming, Brainwriting, Worst Possible Idea, and a wealth of other ideation techniques.

2.8.5 Prototype Phase 5

One of the best ways to gain insights in a Design Thinking process is to carry out some form of prototyping. This method involves producing an early, inexpensive and scaled down version of the product in order to reveal any problems with the current design. Prototyping offers designers the opportunity to bring their ideas to life, test the product.

In this very important phase, ideas should be visualized as quickly as possible, made tangible, sketched, designed, modeled/simulated, etc. Following the technical field, one can speak here of "Rapid Prototyping", whereby the prototype development applies decidedly not only to products but also to services. A variety of methods for prototype development are available for this purpose.

2.8.6 Test Phase 6

In this final phase, the ideas are to be further developed and tested through experiments and customer feedback. Besides, important development, production, and market issues have to be clarified. The actual implementation phase with the development of the idea to a marketable product/service would only follow afterward.

2.9 TEN COMMANDMENTS OF DESIGN THINKING

When carrying out the Design Thinking process the following principles must be observed, "**Ten Commandments of Design Thinking**":

i) Hierarchy: There is no hierarchy during a Design Thinking workshop. Chief and other members are equal partners

ii) Encourage ideas: Let your imagination run wild. Any (supposedly) crazy idea and every idea should be treated equally.

iii) Quantity: Quantity before quality. Finalize the design of a product first by selecting from various options. It can be analyzed and evaluated later for improvement of the product.

iv) Build on Ideas of others: There is no copyright for the ideas. Ideas from others can be taken up, supplemented, or changed for a new product.

v) Think human-centered: Design Thinking is first and foremost thinking about people and not about technology or business goals. The customer is the ultimate decider.

vi) Be visual and make it tangible: Use drawings, illustrations, photos, videos, prototypes, etc. to explain about a new product or ideas in developing a new product.

vii) Avoid criticism: Idea generation and evaluation must be strictly separated. Ideas that come from different team members can be combined to a final design.

viii) Fail early and often: Failure means learning. Often failure means that you have learned a lot. Failure is the first step to success.

ix) Stay focused: Set yourself limits, stick to the concrete tasks in the Design Thinking process.

x) Have a fun: Developing new ideas in a team should be a fun. Creativity needs this fun. These principles (ten commandments) should be written in large letters on a flipchart in a Design Thinking workshop for all participants to see all the time. The participants are to be reminded of these principles again and again by a moderator.

The principle "Stay focused!" appears at first contradictory to the principle "Encourage wild ideas!". Experience with creative processes has shown that setting clear boundaries or limitations, in which the imagination should be given free rein.

It is a target-oriented approach for idea generation and, in particular, the development phase ("necessity makes invention!"). Such limits may include, but are not limited to, the broad direction set by the vision and corporate strategy, specific time and cost objectives (e.g. product/service offering to be launched within X months), a specific regional focus, number of new features, compliance with regulatory constraints or limited resources available.

In individual cases, a balance must be struck between, on the one hand, the danger of stifling unconventional ideas with potential and, on the other, pursuing utopian spinning.

Limits to a Design Thinking can mean setting clear time budgets for the individual phases or specifying for whom, how, and where the solution is to be used. Used to the right extent and communicated in a challenging way, these limitations can promote creativity and have a motivating and inspiring effect on the Design Thinking team.

2.10 WHY DESIGN THINKING WORKS?

Occasionally, a new way of organizing work leads to extraordinary improvements. Total quality management did that in manufacturing in the 1980s by combining a set of tools—kanban cards, quality circles, and so on—with the insight that people on the shop floor could do much higher level work than they usually were asked to. That blend of tools and insight, applied to a work process, can be thought of as a social technology. Another social technology, Design Thinking, has the potential to do for innovation exactly what Total Quality Management (TQM) did for manufacturing: unleash people's full creative energies, win their commitment, and radically improve processes.

2.10.1 Challenges of Innovation

To be successful, an innovation process must deliver three things: superior solutions, lower risks, and costs of change, employee buy-in. Over the years business, people have developed useful tactics for achieving those outcomes. But when trying to apply them, organizations frequently encounter new obstacles and trade-offs.

2.10.2 Superior Solutions

Defining problems is obvious, conventional ways, not surprisingly, often leads to obvious, conventional solutions. Asking a more interesting question can help teams to discover more-original ideas. The risk is that some teams may get indefinitely hung up exploring a problem, while action-oriented managers may be too impatient to take the time to figure out what question they should be asking.

It is also widely accepted that solutions are much better when they incorporate user-driven criteria. Market research can help companies understand those criteria, but the

hurdle here is that it is hard for customers to know they want something that does not yet exist.

Finally, bringing diverse voices into the process is also known to improve solutions. Sometimes it may be difficult to manage if diverge voices among people's views deteriorate into divisive debates.

2.10.3 Lower Risks and Costs

Uncertainty is unavoidable in innovation. That is why innovators often build a portfolio of options. The trade-off is that too many ideas dilute focus and resources. To manage this situation, innovators must be willing to let go of bad ideas—to "call the baby ugly," Unfortunately, people often find it easier to kill the creative (and arguably riskier) ideas than to kill the incremental ones.

2.11 INNOVATION IN DESIGN THINKING

Innovation is a key factor in the success of any new product or process. The following are the factors to consider for successful innovation.

2.11.1 Employee Buy-In

Innovation won't succeed unless the employees of a company get behind it. The surest route to winning their support is to involve them in the process of generating ideas. The danger is that the involvement of too many people with different perspectives will create chaos and incoherence.

Underlying the trade-offs associated with achieving these outcomes is a more fundamental problem. In a stable environment, efficiency is achieved by driving variation out of the organization. But in an unstable condition, variation becomes the organization's friend, because it opens new paths to success. However, we cannot blame leaders as they have to meet quarterly targets for doubling down on efficiency, rationality, and centralized control.

To manage all the trade-offs, organizations need a social technology that addresses these behavioral obstacles as well as the counterproductive biases of human beings. As explained later, design thinking fits that bill.

2.11.2 The Beauty of Structure

Experienced designers often complain that Design Thinking is too structured and linear. It may be true for them. But managers on innovation teams generally are not designers and also are not used to doing face-to-face research with customers, getting deeply immersed in their perspectives, co-creating with stakeholders, designing and executing experiments. Structure and linearity help managers try and adjust to these new behaviors.

"Anytime you're trying to change people's behavior, you need to start them off with a lot of structure, so they don't have to think. A lot of what we do is habit, and it's hard to change those habits, but having very clear guardrails can help us."

-Kaaren Hanson, Director, Facebook Design Product, Formerly Head, Design Innovation, Intuit

Organized processes keep people on track and curb the tendency to spend too long exploring a problem or to impatiently skip ahead. They also instill confidence. Most humans are driven by a fear of mistakes, so they focus more on preventing errors than on seizing opportunities. They opt for inaction rather than action when a choice risks failure. But there is no innovation without action—so psychological safety is essential. The physical props and highly formatted tools of Design Thinking deliver that sense of security, helping would-be innovators move more assuredly through the discovery of customer needs, idea generation, and idea testing.

In most organizations, the application of Design Thinking involves seven activities. Each generates a clear output that the next activity converts to another output until the organization arrives at an implementable innovation. But at a deeper level, something else that executives generally are not aware of may be happening. Though ostensibly geared to understanding and molding the experiences of customers, each Design Thinking activity also reshapes the experiences of the innovators themselves in profound ways.

2.11.3 Customer Discovery

Many of the best-known methods of the Design Thinking discovery process relate to identifying the "job to be done". Adapted from the fields of ethnography and sociology, these methods concentrate on examining what makes for a meaningful customer journey rather than on the collection and analysis of data. Customer discovery and its primary objective are to identify the first customers. This is done by taking main assumptions about who the customer is, the exact problem solved for the customer, and how the customer will buy. Turning those assumptions into hypotheses which will then be tested, mainly through interviews with potential customers.

The four phases of the customer discovery step (process) include:

- *State your hypotheses:* Write down your core business assumptions in a set of briefs. These form the basis for subsequent testing.
- *Test your hypotheses:* Seek validation for your hypotheses. Speak to those in and around your target market, including potential customers, analysts, and the media. These should not be sales-oriented conversations.
- *Test your product concept:* Once you have a deeper understanding of the customer problem, test your product idea to get a sense of the relevance and attractiveness of your product solution and its features. Do this by engaging potential customers and sharing information with your product development team.
- *Evaluate customer feedback and determine the next steps:* Reflect on the information obtained in phases 2 and 3. Are you ready to move forward with what you have? If not, you may need to conduct another iteration of problem/solution validation or halt the project.

2.11.4 Immersion

Traditionally, customer research has been an impersonal exercise. An expert, who may well have pre-existing theories about customer preferences, reviews feedback from focus groups, surveys, and, if available, data on current behavior, and draws inferences about needs. The better the data, the better the inferences. The trouble is, this grounds

people in the already articulated needs that the data reflects. They see the data through the lens of their own biases and do not recognize needs people have not expressed.

Design Thinking takes a different approach: Identify hidden needs by having the innovator live the customer's experience. Consider the case at the Kingwood Trust, a UK charity helping adults with autism and Asperger's syndrome. One design team member, Katie Gaudion, got to know Pete, a nonverbal adult with autism. The first time she observed him at his home, she saw him engaged in seemingly damaging acts—like picking at a leather sofa and rubbing indents in a wall. She started by documenting Pete's behavior and defined the problem as to how to prevent such destructiveness.

But on her second visit to Pete's home, she asked herself: What if Pete's actions were motivated by something other than a destructive impulse? Putting her perspective aside, she mirrored his behavior and discovered how satisfying his activities felt. "Instead of a ruined sofa, I now perceived Pete's sofa as an object wrapped in fabric that is fun to pick," she explained. "Pressing my ear against the wall and feeling the vibrations of the music above, I felt a slight tickle in my ear whilst rubbing the smooth and beautiful indentation. Hence, instead of a damaged wall, I perceived it as a pleasant and relaxing audio-tactile experience."

Katie's immersion in Pete's world not only produced a deeper understanding of his challenges but called into question an unexamined bias about the residents, who had been perceived as disability sufferers that needed to be kept safe. Her experience caused her to ask herself another new question: Instead of designing just for residents' disabilities and safety, how could the innovation team design for their strengths and pleasures? That led to the creation of living spaces, gardens, and new activities aimed at enabling people with autism to live fuller and more pleasurable lives.

2.11.5 Sense-Making

Immersion in user experiences provides the raw material for deeper insights. But finding patterns and making sense of the mass of qualitative data collected is a challenge. Time and again, it is seen that initial enthusiasm about the results of ethnographic tools fade as non-designers become overwhelmed by the volume of

information and the messiness of searching for deeper insights. It is here that the structure of design thinking comes into its own.

One of the most effective ways to make sense of the knowledge generated by immersion is a design-thinking exercise called the Gallery Walk. The core innovation team selects the most important data gathered during the discovery process and writes it down on large posters. Often these posters showcase individuals who have been interviewed, complete with their photos, and quotations capturing their perspectives. The posters are hung around a room, and key stakeholders are invited to tour this gallery and write down on Post-it notes the bits of data they consider essential to new designs. The stakeholders then form small teams, and in a carefully orchestrated process, their Post-it observations are shared, combined, and sorted by theme into clusters that the group mines for insights. This process overcomes the danger that innovators will be unduly influenced by their own biases and see only what they want to see because it makes the people who were interviewed feel vivid and real to those browsing the gallery. It creates a common database and facilitates collaborators' ability to interact, reach shared insights together, and challenge one another's individual takeaways—another critical guard against biased interpretations.

2.11.6 Alignment

The final stage in the discovery process is a series of workshops and seminar discussions that ask in some form of the question if anything were possible, what job would the design do well? The focus on possibilities, rather than on the constraints imposed by the status quo, helps diverse teams have more-collaborative and creative discussions about the design criteria or the set of key features that an ideal innovation should have. Establishing a spirit of inquiry deepens dissatisfaction with the status quo and makes it easier for teams to reach consensus throughout the innovation process. And down the road, when the portfolio of ideas is winnowed, agreement on the design criteria will give novel ideas a fighting chance against safer incremental ones.

Consider what happened at Monash Health, an integrated hospital and health care system in Melbourne, Australia. Mental health clinicians there had long been concerned about the frequency of patient relapses—usually in the form of drug overdoses and

suicide attempts—but consensus on how to address this problem eluded them. To get to the bottom of it, clinicians traced the experiences of specific patients through the treatment process. One patient, Tom, emerged as emblematic in their study. His experience included three face-to-face visits with different clinicians, 70 touchpoints, 13 different case managers, and 18 handoffs during the interval between his initial visit and his relapse.

The team members held a series of workshops in which they asked clinicians this question: Did Tom's current care exemplify why they had entered health care? As people discussed their motivations for becoming doctors and nurses, they came to realize that improving Tom's outcome might depend as much on their sense of duty to Tom himself as it did on their clinical activity. Everyone bought into this conclusion, which made designing a new treatment process—centered on the patient's needs rather than perceived best practices—proceed smoothly and successfully. After its implementation, patient-relapse rates fell by 60%.

2.11.7 Emergence

The first step here is to set up a dialogue about potential solutions, carefully planning who will participate, what challenges they will be given, and how the conversation will be structured. After using the design criteria to do some individual brainstorming, participants gather to share ideas and build on them creatively—as opposed to simply negotiating compromises when differences arise.

When Children's Health System of Texas, the sixth-largest pediatric medical center in the United States, identified the need for a new strategy, the organization, led by the vice president of population health, Peter Roberts, applied design thinking to reimagine its business model. During the discovery process, clinicians set aside their bias that what mattered most was a medical intervention. They came to understand that intervention alone wouldn't work if the local population in Dallas didn't have the time or ability to seek out medical knowledge and didn't have strong support networks—something few families in the area enjoyed. The clinicians also realized that the medical center couldn't successfully address problems on its own; the community would need to be central to any solution. So Children's Health invited its community partners to codesign a new

wellness ecosystem whose boundaries (and resources) would stretch far beyond the medical center. Deciding to start small and tackle a single condition, the team gathered to create a new model for managing asthma.

The session brought together hospital administrators, physicians, nurses, social workers, parents of patients, and staff from Dallas's school districts, housing authority, YMCA, and faith-based organizations. First, the core innovation team shared learning from the discovery process. Next, each attendee thought independently about the capabilities that his or her institution might contribute toward addressing the children's problems, jotting down ideas on sticky notes. Then each attendee was invited to join a small group at one of five tables, where the participants shared individual ideas, grouped them into common themes, and envisioned what an ideal experience would look like for the young patients and their families.

Champions of change usually emerge from these kinds of conversations, which greatly improves the chances of successful implementation. Many times, good ideas die on the vine in the absence of people with a personal commitment to making them happen. At Children's Health, the partners invited into the project galvanized the community to act and forged and maintained the relationships in their institutions required to realize the new vision. Housing authority representatives drove changes in housing codes, charging inspectors with incorporating children's health issues (like the presence of mold) into their assessments. Local pediatricians adopted a set of standard asthma protocols, and parents of children with asthma took on a significant role as peer counselors providing intensive education to other families through home visits.

2.11.8 Articulation

Typically, emergence activities generate a number of competing ideas, more or less attractive and more or less feasible. In the next step, articulation, innovators surface and question their implicit assumptions. Managers are often bad at this, because of many behavioral biases, such as over-optimism, confirmation bias, and fixation on first solutions. When assumptions are not challenged, discussions around what will or won't work become deadlocked, with each person advocating from his or her understanding of how the world works.

In contrast, design thinking frames the discussion as an inquiry into what would have to be true about the world for an idea to be feasible. (Ref "Management Is Much More Than a Science", Roger L. Martin and Tony Golsby-Smith, HBR, 2017.) An example of this comes from the Ignite Accelerator program of the U.S. Department of Health and Human Services. At the Whiteriver Indian reservation hospital in Arizona, a team led by Marliza Rivera, a young quality control officer, sought to reduce wait times in the hospital's emergency room, which were sometimes as long as six hours.

The team's initial concept, borrowed from John Hopkins Hospital in Baltimore, was to install an electronic kiosk for check-in. As team members began to apply design thinking, however, they were asked to surface their assumptions about why the idea would work. It was realized that their patients, many of whom were elderly Apache speakers, were unlikely to be comfortable with computer technology. Approaches that worked in urban Baltimore would not work in Whiteriver, so this idea could be safely set aside.

At the end of the idea generation process, innovators will have a portfolio of well-thought-through, though possibly quite different ideas. The assumptions underlying them will have been carefully vetted, and the conditions necessary for their success will be achievable. The ideas will also have the support of committed teams, who will be prepared to take on the responsibility of bringing them to market.

2.11.9 The Testing Experience

Companies often regard prototyping as a process of fine-tuning a product or service that has already largely been developed. But in design thinking, prototyping is carried out on far-from-finished products. It's about users' iterative experiences with a work in progress. This means that quite radical changes—including complete redesigns—can occur along the way.

2.11.10 Pre-Experience

Neuroscience research indicates that helping people "pre-experience" something novel or to put it another way, *imagine* it incredibly vividly results in more-accurate assessments of the novelty's value. That's why design thinking calls for the creation of

basic, low-cost artifacts that will capture the essential features of the proposed user experience. These are not literal prototypes and they are often much rougher than the "minimum viable products" that lean start-ups test with customers. But what these artifacts lose in fidelity, they gain in flexibility, because they can easily be altered in response to what is learned by exposing users to them. And their incompleteness invites interaction.

Such artifacts can take many forms. The layout of a new medical office building at Kaiser Permanente, for example, was tested by hanging bedsheets from the ceiling to mark future walls. Nurses and physicians were invited to interact with staffers who were playing the role of patients and to suggest how spaces could be adjusted to better facilitate treatment. At Monash Health, a program called Monash Watch aimed at using telemedicine to keep vulnerable populations healthy at home and reduce their hospitalization rates used detailed storyboards to help hospital administrators and government policymakers envision this new approach in practice, without building a digital prototype.

2.11.11 Learning in Action

Real-world experiments are an essential way to assess new ideas and identify the changes needed to make them workable. But such tests offer another, less obvious kind of value: They help reduce employees and customers quite normal fear of change.

Consider an idea proposed by Don Campbell, a professor of medicine, and Keith Stockman, a manager of operations research at Monash Health. As part of Monash Watch, they suggested hiring laypeople to be "telecare" guides who would act as "professional neighbors," keeping in frequent telephone contact with patients at high risk of multiple hospital admissions. Campbell and Stockman hypothesized that lower-wage laypeople who were carefully selected, trained in health literacy and empathy skills, and backed by a decision support system and professional coaches they could involve as needed could help keep the at-risk patients healthy at home.

Their proposal was met with skepticism. Many of their colleagues held a strong bias against letting anyone besides a health professional perform such a service for patients with complex issues, but using health professionals in the role would have been

unaffordable. Rather than debating this point, however, the innovation team members acknowledged the concerns and engaged their colleagues in the codesign of an experiment testing that assumption. Three hundred patients later, the results were in: Overwhelmingly positive patient feedback, and a demonstrated reduction in bed use and emergency room visits, corroborated by independent consultants, quelled the fears of the skeptics.

2.11.12 Co-Evolution of Problem and Solution

In the process of designing the designer's attention typically oscillates between their understanding of the problematic context and their ideas for a solution in a process of co-evolution of problem and solution. New solution ideas can lead to a deeper or alternative understanding of the problematic context, which in turn triggers more solution ideas.

2.11.13 Representations and Modelling

Conventionally, designers communicate mostly in visual or object languages to translate abstract requirements into concrete objects. These 'languages' include traditional sketches and drawings but also extend to computer models and physical prototypes. The use of representations and models is closely associated with features of design thinking such as the generation and exploration of tentative solution concepts, the identification of what needs to be known about the developing concept, and the recognition of emergent features and properties within the representations.

2.11.14 Inspiration

Generally, the design innovation process starts with the inspiration phase: understanding the problem or the opportunity. This understanding can be documented in a brief which includes constraints that give the project team a framework from which to begin, benchmarks by which they can measure progress, and a set of objectives to be realized—such as price point, available technology, and market segment.

Empathy

Empathy is the ability to sense other people's emotions, coupled with the ability to imagine what someone else might be thinking or feeling. It is important because it helps us to understand how others are feeling so that we can respond to the needs appropriately.

Empathy with clients, users, and customers is very important as a basis for innovative design. Designers approach users intending to understand their wants and needs, which might make their life easier and more enjoyable, and how technology can be useful for them. Empathic design transcends physical ergonomics to include understanding the psychological and emotional needs of people—the way they do things, why and how they think and feel about the world, and what is meaningful to them.

2.11.15 Ideation: Divergent and Convergent Thinking

Ideation is idea generation. The process is characterized by the alternation of divergent and convergent thinking, typical of the design thinking process.

To achieve divergent thinking, it may be important to have a diverse group of people involved in the process. Design teams typically begin with a structured brainstorming process of "thinking outside the box." Convergent thinking, on the other hand, aims for zooming and focusing on the different proposals to select the best choice, which permits the continuation of the design thinking process to achieve the final goals.

After collecting and sorting lots of ideas, a team goes through a process of pattern finding and synthesis in which it has to translate ideas into insights that can lead to solutions or opportunities for change. These might be either vision of new product offerings or choices among various ways of creating new experiences.

2.11.16 Implementation and Prototyping

The third space of the design thinking innovation process is implementation when the best ideas generated during ideation are turned into something concrete. At the core of the implementation process is prototyping: turning ideas into actual products and

services that are then tested, evaluated, iterated, and refined. Prototyping has the following advantages:

i. **A better understanding of the design intent**: Prototyping presents a strong visualization of the design to understand the look and feel of the final product. It also helps the team to comprehend better why they are designing, what they are designing, and for whom they are designing.

ii. **Early feedback**: One of the most important aspects of the product building process is to gather feedback. Prototyping can collect reviews at every stage of developing the product such as adding new features or redesigning parts of the product. Exchange design information with the team members, management teams, external stakeholders, SMEs, etc. to arrive at the best collective decision.

iii. **Early changes save time and cost**: Any changes at the end would cost time and resources. With a preliminary model ready, it is always possible to make the desired changes early, because at that point no investment or effort has gone into creating the full product. Therefore, early changes help you achieve your goals faster.

iv. **Validation before development**: Prototyping allows for multiple discussions and iterations before getting into final development. This iterative process makes it easier to make surety in what is being built is actually what is needed.

v. **User research and user testing**: Users are supreme. Prototyping helps to collect ideas from users to serve them better. It helps to gain inputs and insights about how users would use the product and improve by addressing their pain points.

A prototype or even a rough mock-up helps to gather feedback and improve the idea.

2.12 WHAT IS THE DIFFERENCE BETWEEN SOLUTION-BASED AND PROBLEM-BASED THINKING?

As the name suggests, solution-based thinking focuses on finding solutions; coming up with something constructive to effectively tackle a certain problem. This is the opposite of problem-based thinking, which tends to fix on obstacles and limitations.

A good example of these two approaches in action is an empirical study on how a group of designers and a group of scientists would approach a particular problem. Each group was set the task of creating one-layer structures from a set of colored blocks. The perimeter of the structure had to use either as many red bricks or as many blue bricks as possible (we can think of this is as the solution, the desired outcome), but there were unspecified rules regarding the placement and relationship of some of the blocks (the problem or limitation). It is observed that the scientists focused on identifying the problem (problem-based thinking) whilst the designers prioritized the need to find the right solution.

The scientists adopted a technique of trying out a series of designs that used as many different blocks and combinations of blocks as possible as quickly as possible. Thus they tried to maximize the information available to them about the allowed combinations. If they could discover the rule governing which combinations of blocks were allowed, they could then search for an arrangement that would optimize the required color around the layout.

The designers, on the other hand, are selected their blocks to achieve the appropriately colored perimeter. If this proved not to be an acceptable combination, then the next most favorably colored block combination would be substituted and so on until an acceptable solution was discovered.

Lawson, How Designers Thinking

Lawson's findings go to the heart of what Design Thinking is all about: it's an iterative process that favors ongoing experimentation until the right solution is found.

2.13 IS DESIGN THINKING A LINEAR PROCESS?

No! You might look at these clearly defined steps and see a very logical sequence with a set order. However, the Design Thinking process is not linear; it is flexible and fluid, looping back around and in on itself! With each new discovery that a certain phase brings, you will need to rethink and redefine what you have done before — you'll never be moving in a straight line!

2.14 WHAT IS A WICKED PROBLEM IN DESIGN THINKING?

Design Thinking is especially useful when it comes to solving wicked problems. The term "wicked problem" was coined by design theorist Horst Rittel (1970s) to describe particularly tricky problems that are highly ambiguous in nature. With wicked problems, there are many unknown factors; unlike "tame" problems, there is no definitive solution. In fact, solving one aspect of a wicked problem is likely to reveal or give rise to further challenges. Another key characteristic of wicked problems is that they have no stopping point; as the nature of the problem changes over time, so must the solution. Solving wicked problems is therefore an ongoing process that requires Design Thinking. Some examples of wicked problems in our society today include things like poverty, hunger, and climate change.

Having known what Design Thinking is, let us consider how it fits into the overall product design process. The terms "lean" and "agile" and, as a UX are widely used in the design. Hence, it is important to understand how these three approaches work together.

2.15 WHAT ARE LEAN, AGILE, AND UX?

Based on the principles of lean manufacturing, lean UX (user experience) focuses on streamlining the design process as much as possible—minimizing waste and maximizing value. Some core tenets of lean UX are:

- Cross-functional collaboration between designers, engineers, and product managers.
- Gathering feedback quickly and continuously, ensuring that you're constantly learning and adapting as you go.

- Deciding as late as possible and delivering fast, with less focus on long-term deliverables.
- A strong emphasis on how the team operates as a whole.

Lean UX is a technique that works in conjunction with agile development methods. Agile is a development process that works in iterative, incremental cycles known as sprints. Unlike traditional development methods, agile is flexible and adaptive. Based on the agile development manifesto created in 2001, agile adheres to the following principles:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

2.16 COMBINING DESIGN THINKING WITH LEAN AND AGILE

Design Thinking, lean, and agile are often seen as three separate approaches. Companies and teams will ask themselves whether to use lean *or* agile *or* Design Thinking—but in practice, they can be merged for optimal results.

Applying Design Thinking in a lean, agile environment helps to create a product development process that is not only user-centric but also highly efficient from a business perspective. While it is true that each approach has its own modus operandi, there is also a significant overlap. Combining principles from each can be crucial in keeping cross-functional teams on the same page—ensuring that designers, developers, product managers, and business stakeholders are all collaborating on one common vision.

2.17 HOW DO DESIGN THINKING, LEAN, AND AGILE WORK TOGETHER?

"Design Thinking is how we explore and solve problems; Lean is our framework for testing our beliefs and learning our way to the right outcomes; Agile is how we adapt to changing conditions with software." ***-Jonny Schneider***

It is well and good to combine the three, but what does it look like in practice?

As we have learned, Design Thinking is a solution-based approach to exploring and solving problems. It focuses on generating ideas with a specific problem in mind, keeping the user at the heart of the process throughout. Once you have established and designed a suitable solution, you will start to incorporate lean principles—testing your ideas, gathering quick and ongoing feedback to see what works—with particular emphasis on cross-team collaboration and overcoming departmental silos. Agile ties all of this into short sprint cycles, allowing for adaptability in the face of change. In an agile environment, products are improved and built upon incrementally. Again, cross-team collaboration plays a crucial role; agile is all about delivering value that benefits both the end-user and the business as a whole.

2.18 UX AND UI DESIGN

UX design refers to the term User Experience Design, while UI Design stands for User Interface Design. Both elements are crucial to a product and work closely together. But despite their professional relationship, the roles themselves are quite different, referring to very different parts of the process and the design discipline. User experience (UX) refers to any interaction a user has with a product or service. UX design considers every element that shapes this experience, how it makes the user feel, and how easy it is for the user to accomplish their desired tasks. UX is all about making a product functional and useful. User Interface (UI) design focus on look and feel, the presentation, and the interactivity of a product. UI is making a product beautiful and interactive. UI elements are the parts used to build apps or websites. They add interactivity to a user interface, providing touchpoints for the user as they navigate their way around; think buttons, scrollbars, menu items, and checkboxes.

UX designers need to from the user's perspective and it's more about the understanding user. UI designers need to be creative to design a product or webpage. On the other hand, UX is all about making a product functional and useful. The difference between UX and UI Design is shown in Table 2.1

Table 2.1 Difference between UX and UI Design

UX	UI
Interaction Design	Visual Design
Wireframes and Prototypes	Colors
Information Architect	Graphic Designer
User Research	Layouts
Scenarios	Typography

2.19 PLANNING A DESIGN THINKING PROJECT

The goals for the Design Thinking project have to be defined from the strategy of the company and the expectations of all stakeholders.

The following questions should be posed:

- Should new ideas be found?
- Should concrete customer needs be found in a specific subject area?
- Which goal is to be achieved by when?
- What are the priorities to be set in terms of content and time for the achievement of the goal?
- Who are all the people to be involved and disciplines?
- Who will be responsible for project management or moderation?
- What are the interfaces between the required disciplines?
- What is the source of the budget for Design Thinking?

Once the goals have been identified, it is necessary to critically review if the method is suitable for achieving the goals.

The main factor for the success of the Design Thinking project is the project organization. In the vast majority of cases, internal staff, as well as external participants from different disciplines, are involved. The project team is usually six to a maximum of nine representatives from different departments such as R&D, production, marketing, and sales.

The support of top management is an essential success factor in any Design Thinking project. The support in the following activities will help for the success of the Design Thinking project.

- Sufficient resources for the project.
- Patronage for the Design Thinking project
- Continuous reporting on the progress of the project
- Continuous internal and external communication about the strategic importance of Design Thinking
- Personal participation in workshops by stakeholders
- Recognition of the employees involved.

It is necessary to understand the problem. A questionnaire on the clarification for stakeholders is given in Table 2.2

Table 2.2 Questionnaire to clarify the problem (Source: Andler-2016)

	problem	non-problem	solution
Who	has the problem? is indirectly affected? believes that they are affected? makes decisions?	is not affected by the problem?	could use the solution as well? can contribute to solving the problem? does not want the solution? could stand in the way of the solution?
Where	does the problem occur?	does not the problem occur	has something similar already been successfully resolved? is the best place to solve it? could the solution also be used?
When	did the problem start? does the problem occur? does it become an even bigger problem?	does not the problem occur?	should the solution be available? will it improve?
What	is the problem? do you know or don't know about the problem? is not understood about the problem? is different than it should be? is particularly noticeable? annoys you about the problem? are the individual aspects of the problem?	is not the problem?	has been made the solution so far? should the solution necessarily be able to do? are the constants that must not/cannot be changed? is needed for the solution? will be different in the future? is (or is not) important for the solution? are your goals for the solution? do you have to discover?
How	does not problem manifest itself? is it related to another problem? can it be formulated differently?	is it usually going?	should the solution look like? is it tried to be solved so far? could the problem be an opportunity?
Why	is it a problem? is the problem unusual?	isn't it a problem for others?	is the solution needed? do we want to solve it? won't it just solve itself? can it be solved? is it difficult to solve?

Based on the questions in Table 2.2, the problem should not arise in finding a solution to a problem. After systematic analysis, hypothesis are developed and tested on the cause of a missing problem in the comparison.

Table 2.3 is filled systematically with problem clarification. A competitive case is considered so that the problem does not occur. The case under consideration can be very similar or can come from other fields or industries.

Table 2.3 Problem clarification (Kipper/Trego)

	problem	non-problem	discrepancy	Cause (why is there a discrepancy?)
Who	has the problem?	has not the problem?	differences?	assumption about cause
Where	does the problem occur?	doesn't occur the problem	differences?	assumption about cause
When	does the problem occur?	does the problem not occur?	differences?	assumption about cause
What	is the problem?	isn't the problem?	differences?	assumption about cause
How	does the problem emerge? extensive is the problem?	is it usually going? Many parts/areas are not affected?	differences?	assumption about cause

From Tables 2.2 and 2.3, initial insists on possible solutions can be gained by answering the following questions.

i) What is permitted?

ii) What is possible?

iii) What is available?

iv) Why existing solutions are not sufficient?

v) What are the limitations of existing solutions?

vi) Why are no adequate solutions so far?

2.20 WHAT IS THE RELATIONSHIP BETWEEN DESIGN THINKING AND UX DESIGN?

In the previous section, the similarities between Design Thinking and user experience design are discussed. Now, let us address how they relate to one another. Both are extremely user-centric and driven by empathy, and UX designers will use many of the steps laid out in the Design Thinking process, such as user research, prototyping, and testing.

Despite these similarities, certain distinctions can be made between the two. For one, the impact of Design Thinking is often felt on a more strategic level; it explores a problem space-in the context of understanding users, technological feasibility, and business requirements-to discover possible solutions.

2.21 WHAT ARE THE BENEFITS OF DESIGN THINKING AT WORK?

Designers have a pivotal role to play in shaping the products and experiences that your company puts to market. Integrating Design Thinking into the design your process can add huge business value, ultimately ensuring that the products designed are not only desirable for customers but also viable in terms of company budget and resources. Considering the above, some of the main benefits of using Design Thinking at work are

- **Significantly reduces time-to-market:** With its emphasis on problem-solving and finding viable solutions, Design Thinking can significantly reduce the amount of time spent on design and development—especially in combination with lean and agile.
- **Cost savings and a great ROI:** Getting successful products to market faster ultimately saves the business money. Design Thinking has been proved to yield a significant return on investment; for example, teams that are applying Design Thinking practices in IBM, have calculated an ROI of up to 300% as a result.

- **Improves customer retention and loyalty:** Design Thinking ensures a user-centric approach, which ultimately boosts user engagement and customer retention in the long term.
- **Fosters innovation:** Design Thinking is all about challenging assumptions and established beliefs, encouraging all stakeholders to think outside the box. This fosters a culture of innovation that extends well beyond the design team.
- **Can be applied company-wide:** The great thing about Design Thinking is that it is not just for designers. It leverages group thinking and encourages cross-team collaboration. It can be applied to virtually any team in any industry.

  Whether a Design Thinking culture is established on a company-wide scale, or simply trying to improve the approach to user-centric design, Design Thinking will help to innovate, focus on the user, and ultimately design products that solve real user problems.

2.22 DESIGN THINKING METHODOLOGY IN ACTION: A CASE STUDY

The theory behind Design Thinking and the processes involved is presented in detail. A case study where Design Thinking has made a huge real-world impact is presented.

Healthcare Case Study: How Design Thinking transformed the Rotterdam Eye Hospital ***(A Harvard Business Review: Website)***

Executives at the Rotterdam Eye Hospital wanted to transform the patient experience from the typically grim, anxiety-riddled affair into something much more pleasant and personal. To do this, they incorporated Design Thinking and design principles into their planning process. Here's how they did it:

1. They used the Design Thinking process is used to understand the end-users' experience.
2. They addressed hygienity of corridors, waiting rooms. Transformed human repair shop into a bright and comforting place.
3. Scheduling from the just in the practice to achieve the operational excellence.

4. Improved hospital information and communication structure.
5. Use of Eyepad, an iPad app for an individual patient to track his/her progress through the procedure that reduced the patient's anxiety.

Now patients have a more positive experience with the hospital.

REVISION QUESTIONS

1. What is Design Thinking?
2. Why is Design Thinking useful?
3. What are the phases in Design Thinking? Explain in detail.
4. Explain the difference between divergent thinking and convergent thinking?
5. Explain what is not a Design Thinking?
6. Explain the principles of Design Thinking?
7. What are the important considerations employing Design Thinking?
8. What is convergent-divergent thinking?
9. Explain the process of Design Thinking?
10. What are the 3Ps of Design Thinking?
11. What is a wicked problem in Design Thinking?
12. How do Design Thinking, lean and agile work together?
13. Explain the process of Design Thinking with the double-diamond model.
14. What are ten commandments of Design Thinking?
15. Why Design Thinking works?
16. What is immersion?
17. What is gallery work?
18. Explain articulation.
19. What is the difference between solution-based and problem-based solutions.
20. How lean, agile, and Design Thinking work together.
21. What is UX & UI design?
22. What is the difference between UX and UI design?
23. What are the benefits of Design Thinking?

DESIGN PROBLEMS FOR PRACTICE

1. Every student in an university must get a high package job or admission to top universities for higher education.

   Discuss the considerations made by employers to offer a high package or a good university for admitting students. Apply Design Thinking principles to achieve better results.

2. Mahatma Gandhi rural employment guarantee scheme in a program by the Government of India for guaranteed rural employment and development of villages. Studies show the rural development is not to the level of funds utilized: *Apply Design Thinking and suggest ways to achieve better results.*

3. According to official statistics, the knowledge of students in government schools is not to the expected level. Make a study of the reports available on government websites and apply Design Thinking to suggest ways to improve the academic standards.

ACTIVITY

1. Refer 5 step Stanford Model using YouTube. Write your observations on
   i) Empathize (search for stories)
   ii) Define (needs of use and insights of their point of view)
   iii) Ideate (list out the ideas and discuss pros and cons on each of the idea)
2. Search YouTube for empathy as an individual. Share the observation with your classmates. Make the support of your understanding of how to empathize.
3. Study the transport system in your university/workplace. Use Design Thinking principles in groups of 4 and come out with a report on improving the existing system.
4. Study the functioning of your hostel mess/college canteen. Use Design Thinking and discuss in a group of 4 members applying relevant Design Thinking methods. Come out with concrete suggestions to improve the functioning.

5. Consider one of your friends not able to focus on studies. You merge with him to find the reason for his distraction. Come out with a solution to get him back into studies.

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