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# Problem Framing, Interdisciplinary Problem-Solving Strategy

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**ABSTRACT**

The problem is a fundamental and initial part of the design process that results from the difference between the current situation and the desired situation. Designers employ a range of techniques to address problems, which are a key component of the design process. Apart from architecture, most tactics are multidisciplinary in nature. Problem-solving techniques have an impact on the effect of architecture as a product and a site of representation of design processes. As a result, studying the influence of strategies on architecture is crucial. Designers, on the other hand, have worked for decades to develop suitable techniques for solving problems in profitable professions like design.

The goal of this study is to examine problem-solving techniques from various backgrounds in order to better understand how they affect architecture. The essay attempts to investigate issue framing as an architectural technique as well as multidisciplinary problem-solving strategies. The first phase introduces and compares problem-solving techniques in a deductive manner, and then the problem-framing capacities have been treated as a design origin strategy inferentially. The information for this study was gathered through the use of library methods. Finally, problem framing appears to give interdisciplinary problem-solving capabilities to productive fields such as architecture as a problem-solving technique.

***Keywords**: Design process, Problem, Problem solving, Problem Framing*

## 1. INTRODUCTION

Design, in the opinion of the majority of experts, does not have a defined method. Because of this uncertainty, and because of the subjective character of the processes, it is impossible to talk with confidence about a precise hierarchy. In research, issue solving strategies are thought control tactics used at different phases of the journey, and there is no assurance that following them will result in positive outcomes [26]. Space, on the other hand, is a result of architectural design and evidence of a process in its development[i] [9].

Although some process researchers attempt to explore the issue of design using problem-solving approaches employed in other disciplines, certain viewpoints stress the inherent distinctions between the space design process and other science design processes. The issue of the difference in the architectural problem in terms of spatial, physical, functional, and semantic differences, according to this viewpoint, has rendered problem-solving techniques common in other disciplines ineffective. The use of spatial creative tools, such as drawing thinking, distinguishes the space design process from other design methods.

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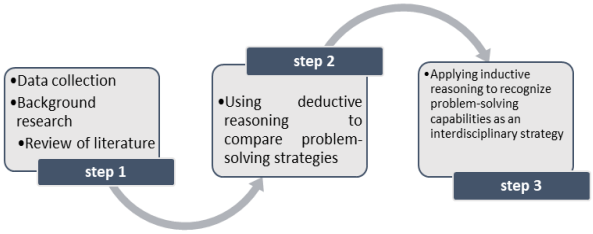
For many, these variances play a role in the design process, altering the final form and space result. Most process scholars, however, believe that there is at least a two-part pattern, which includes analysis and synthesis.
Design is a sort of creative activity that is linked to problem resolution in a variety of situations. The problem-solving process has been attempted to be defined as a sequence of steps. When comparing the definitions, it becomes obvious that the number of steps and the kind of movement varies, and that each description focuses on the most essential features, but virtually all of them share a common structure. All models obtained in the study of processes begin with the problem, regardless of the details. They then proceed to consider several options as a solution, assessing and selecting one of them as the best and final choice. After then, an attempt is made to broaden the final option. The following phase is a comprehensive description, followed by refining of the chosen choice, and eventually implementation of the plan [31]. Currents of thinking that affect knowledge domains likewise affect problem-solving in those domains influence problem-solving techniques. As a subject that crosses many disciplines, architecture is inevitably confronted with problem-solving techniques and their consequences. As a result, studying issue paradigms, which are the fundamental and driving force of design, is crucial. The impact of the problem-solving approach on the theme design process is evident in the final result.
The main study question is how problem-solving methods influence the architectural design process, and how issue framing, as an architectural problem-solving strategy, influences problem solving in other domains. The present study aims to see how issue-solving techniques affect architectural work quality and how problem framing, as a strategy developed from architecture, affects exposure to other fields of knowledge.

### 1.1 Research questions

1. How does the architectural problem-solving method influence the architectural design process?
2. In multidisciplinary disciplines, what is the capability for problem framing as a problem-solving strategy?

## 2. Research Methods

The researcher is challenged with a mental issue in this study, in which the way he/she deals with the subject is determined by its recognition. As a result, this study is an epistemological study that falls under the area of qualitative research. "Causal comparative" and "deductive-interpretive" research methods are used in this study. As a result, the research method and strategy are a blend of analogy and induction. By comparing two phenomena, deductive reasoning attempts to look for and examine the logic that controls them. Inductive reasoning attempts to reach a general conclusion by proceeding from the bottom up and controlling the order of events. It is vital to have access to the basic literature of the topic to offer an initial image of the subject in the first phase. Therefore, the deductive-causal segment is investigated first by analyzing the problem literature, including its definition and categories, as well as issue-solving methodologies and design problem elements. How to use problem-solving strategies in the search process is examined in the discussion section and a two-part order, and then, based on deductive-causal reasoning, the strategies used in problem-solving in terms of origin, goals, direction, characteristics, and process translation are compared, and their impact on architecture is analyzed. In the second portion, based on inductive reasoning, an attempt is made to address the interdisciplinary function of framing the problem, which is the research's second question. The researchers researched the library in the first phase of the study procedure




to gather data, and then logically assessed the findings. Following is a diagram of the research's overall structure, which is based on the research technique and steps.

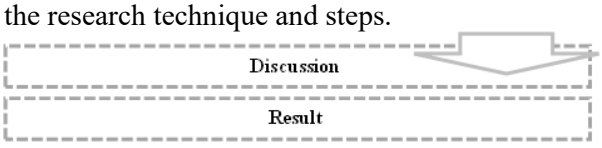



**Figure 1.** The diagram of the general structure of the research is based on the method and its course (authors).

## 3. Literature review

The topic is frequently researched outside of the field of design, and it focuses on challenges having a defined structure and semantically simple semantics. As part of the experimental sciences, such questions have a defined goal and evident starting locations. The study of the structure of the design problem space by Goel and Piroli (1992) is one of them [4]. Christopher Alexander and Archer, who established a logical and systematic approach to the design problem-solving process in the late 1950s and early 1960s, conducted the first study on design challenges and how they were structured. Their proposed solutions to the design challenge have received a lot of criticism. Design process studies with a focus on the product, as the primary pillar of the design, began, and was introduced as the "totality of issue solution" owing to the diversity of elements impacting it. The design process has been viewed as a problem-solving process in which the problem is broken down into sub-problems and solved [14].

Simon was the first to recognize the difference between excellent and terrible design issues. He thought that while addressing an issue, designers first convert a poorly organized problem into a well-formed problem before proceeding to solve it. The rationalist method, which places a greater emphasis on the designers' "problem-solving" talents in solving a well-formed problem, fails to address poorly organized problems, which need greater capacity to describe and comprehend the problem [34]. The "tame problem" and the "grumpy problem" were recognized by Rittel and Weber as two types of issues. They frequently classify design challenges as belonging to the second group. Others eventually backed up this assertion (ibid.).

Robertson's book "Issue Solving," which begins with the roots of epistemology and neurology, is another source in the subject of problem solving. In his book, Robertson seeks to explain how the mind works in order to solve the problem. Despite the fact that design is quite similar to issue solving in nature, problem solving is a more objective activity with a more clear aim than design. There are several sub-issues in design that must be addressed. Following study, it was discovered that architectural design challenges are far more complex than previously assumed. In Iran, one of the most overlooked concerns in the research process is this one. Farhad Shariat Rad and Hamid Nadimi's study "Problem framing, the design approach to cope with the problem" is one of the most important attempts in this subject, which, after proposing problem framing as a coping strategy, seeks to explain its internal mechanism. Another research, titled "Knowledge the problem of design in architectural education," was performed by Golrokh Daneshgar Moghaddam and looked at the factors that influence a sufficient understanding of the problem of design as a starting point for beginner designers.

## 4. Research Limitations

The current research has two structural constraints that awareness can help overcome:

1. The problem's mental character is limited: It is a practical design that takes place in the mind. This makes completing the activities that lead to the development of the work challenging.
2. Limitations on using the mind to study the mind: This is critical since the research instrument is linked with the subject of the investigation. This is a frequent occurrence in most studies of mind function, but it has an impact on design study since flaws that are assumed in the mind may be overlooked.

## 5. Literature review

### 5.1. Problem-oriented verses solution-oriented studies

There are two primary discourses in response to the problem: problem-solving and solution-oriented. The "problem / solution" pair is always examined simultaneously in design (common evolution). Some designers search for inspiration in the issue area, while others look for it in the solution space and design history. As a result, two techniques may be separated in the face of a problem: "problem-oriented" and "solution-oriented." In comparison to solution-oriented strategy, problem-oriented strategy is the most popular among experienced designers. Architects are in the same boat [34]. According to Akin's research, people forget their prior aims and ambitions as a result of getting solutions and making progress on project difficulties. As a result, the objectives must be changed. In actuality, the designer has the ability to alter and reinterpret these things, just as he or she has the option to read the issue and goals differently during the design process. In a portion of the process, freedom leads the designer to decide beyond the problem [2], implying that the

problem of form and space design is a separate problem and, as a result, the problem-solving technique is used in areas other than architecture. The topic is ineffective. Figure 2 recognizes that in order to solve a design challenge, it must first be well understood and evaluated, and then broken down into smaller problems for which solutions must be discovered, and finally the answers must be integrated. As a result, the focus is on the issue rather than the solution. Balbenti thinks that when confronted with a variety of needs, design alternatives, and a set of values and concepts, the designer diverges, then converges while choosing and visualizing the future system. In the solution space, a similar process of divergence and convergence happens. Convergence is achieved in any field of design by first developing numerous choices for each and then assessing and picking the best option [24].

### 5.2. Design steps and mechanisms

Studies of the design process are almost always, if not always, followed by some sort of generalization. Design processes are frequently described as an internal process that lacks a thorough understanding of all of the mechanisms that control it. Various viewpoints on the phases of the design process and the quality of mobility between them have been presented. The "analysis" and "composition" steps are shared by all of the models. In the research process, there are two primary streams: The first stream considers the design process to be a path that leads from analysis to composition, component to whole, and bottom to top. Another stream understands the entire process of space design from top to bottom. In addition to these two currents, there are intermediate currents in the design process that stress simultaneous convergence and divergence. The three steps of "analysis," "composition," and "assessment," according to John Chris Jones, are the foundation of every design process [31]. The first phase in the design process is introduced by Koberg and Begnal, who divide the problem into smaller sections and represent it as analysis. Then they mix these components once more, but the key element to remember is that the work's outcome is determined by the designer's knowledge of the analysis. They think that the basic notion is cornerstone analysis, and that design is the foundation of design.

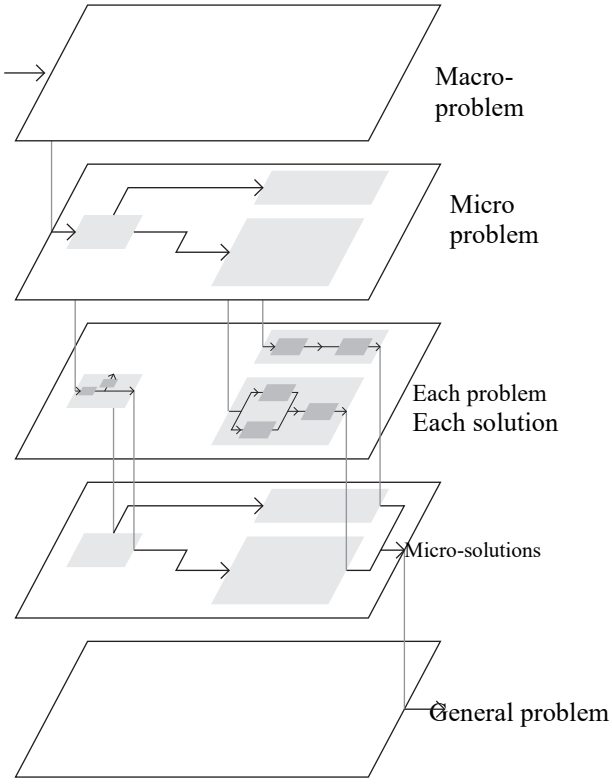



**Figure 2.** Opening and recombining (Dubberly, 2004)

Of course, throughout their research, Koberg and Begnal developed the design process from two to three phases, then five, and eventually seven stages, as shown in Figure 3 [6]. From analysis to composition, Alexander, Nigelcross, and Balbenti all believe in a type of garlic. In order to examine the issue, the problem analysis is a divergent and developing movement. The following phase is to reassemble the components in a different way, a convergent and addictive movement toward the product and the process's end outcome. During the procedure, Ballenti additionally highlights the dynamics of divergent and convergent motions, as well as their many repetitions [31]. The "writing program" and "design" models, according to William Pena and Steven Parshal, are unique to the architectural design process. They consider the project plan and the final plan to be problem-solving exercises. In other words, Pea & Parshall [24],[30] associate programming with "analysis" and design with "composition."

Problem analysis and comprehension in architecture, according to Brian Lawson, are a consequence of product composition and manufacturing. According to him, the coherence between composition and analysis is essentially more crucial for architects than for

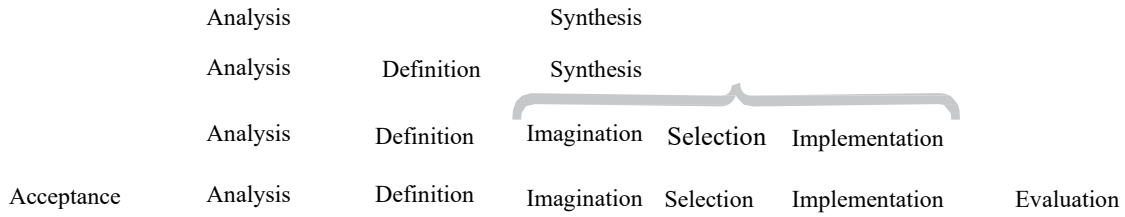



**Figure 3.** Process evolution from two-stage to seven-stage (Dubberly, 2004)

others, because the creativity stage might occasionally surpass the analysis stage. He establishes the phases of the design process that correlate to issue solving, conscious attempt to solve the problem, unconscious effort, sudden appearance of ideas, and conscious development by comparing the creative and design processes [26]. The endeavor to break down the design into components and connections in order to decrease the unknown extent of the design process is a common denominator across most design studies. Parts of the process transcend beyond cognition using approaches that aim to break down the topic into components and relationships because part of the process is generated in the activity between the components. Design appears to be an analytical process in the area of architecture, focused on analysis, analysis, selection, and selection. Although process researchers have described the process using a number of models with various phases, the design thinking of the three mental mechanisms that explain the nature of these steps and play a significant role is as follows:

1. Goal explanation mechanism: The goal explanation mechanism establishes the problem's principal approach, leading to the creation of purposeful thinking. This method aims to examine and assess the problems, characteristics, and issues that the designer faces, resulting in the designer's understanding of the problem's goals and the creation of his position in it [17].

2. Problem-Solving Mechanism: One form of problem-solving is architectural design [10]. In two levels of general or partial views of the problem's solution, the problem-solving method comprises working towards finding the answer or developing possibilities and finding the answer. Such a system is frequently subjective, relying on the creative and expressive analytical processes' imagination and perceptive capacities. Furthermore, it is linked to intuitive and evaluative processes that are governed by a specific system. As a result, design thinking has never been purpose-free and is always self-evaluating [17]. There is no agreed-upon definition of problem-solving among theorists. Regardless of the changes, the problem may be defined as follows: "A person is said to be confronting the difficulty when he or she is confronted with a circumstance or task to which he or she is unable to respond promptly via the application of the information and abilities available at the moment." [33]. As a result, many theorists regard the problem-solving process to be a kind of learning, and the features of learning to be linked to this process [17]. In the explanation of design thought, there are two primary paradigms: 1. Simon's "rational problem solving," in which design is a systematic process for finding a solution to a problem, and 2. Donald Sean's "reflection in action," in which design is introduced as experience and reflection. He suggested new epistemologies for the practice of design, which was created using a "constructivist" perspective, after criticizing positivist epistemology and scientific technique [34]. Alternative methods to problem-solving centered on the local or place-specific problem rather than the "generic" problem, which is something abstract, after criticizing the rationalist approach's inadequacy in dealing with poorly organized situations. When dealing with complicated situations, "the only way a person can grasp a complex subject is to understand it locally at any given time," as the saying goes [29].

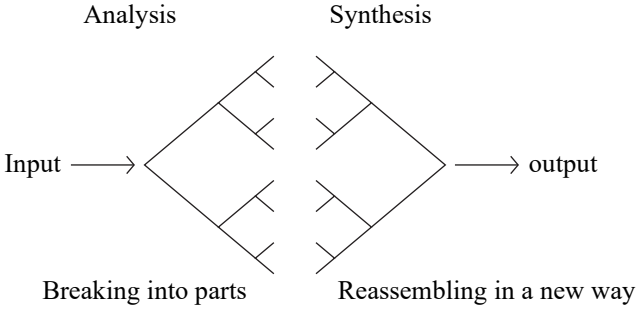



**Figure 5** Divergence and convergence versus limitation and expansion (Dubberly, 2004)

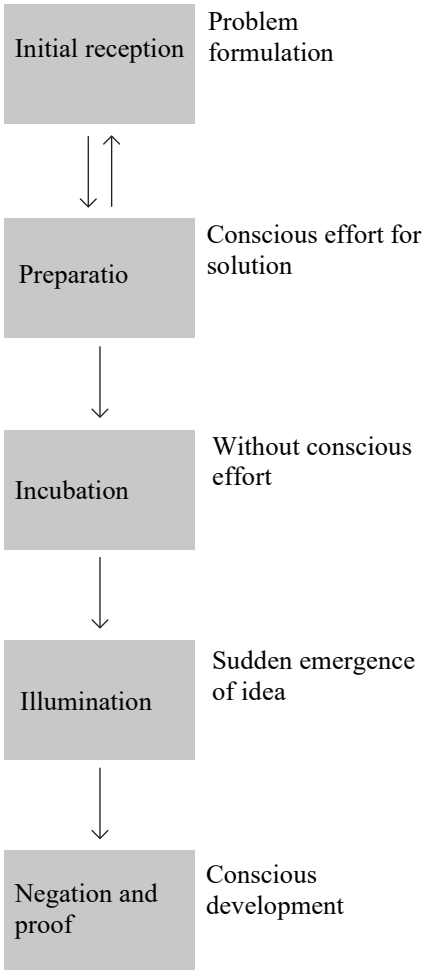



**Figure 4:** Lawson's Creativity Process and Design Process (Dubberly, 2004)

In other techniques, the design challenge lacks an objective identity and is made up of many elements of the problem given in the program that the designer produces. The cognitive method also better characterizes the reflective design activity, according to real-world experience. Designers, in fact, encourage design that is founded on "reflection in practice" [34]. Sean (1983) dismisses the architectural constraint as a minor issue. The architect, he claims, is the one who decides on the design. Every design challenge is a "single universe" from a contemplative perspective, and no two problems are similar. As a result, how to deal with such a unique problem has long been a key worry for designers, which is frequently credited to the masters of the word's secret wisdom. Designers are often confronted with ambiguous and complicated circumstances. The ambiguity of the design problem appears to exist at the very early stages of design, while more structure is imposed on it as the process advances. "Conceptual stage," "introductory stage," "evaluating the indefinite space of the problem," "identifying and clarifying the design challenge," "problem solving," "clarifying the design job," and "defining the problem" are some of the terms used to describe the stages [34].

3. Critical thinking evaluation mechanism: This mechanism is concerned with critical thinking. The offered solutions are reviewed and assessed in this activity. At this point, the capacity to predict and critically assess options is required. In recent years, design academics have viewed design concerns as indeterminate and unexpressive, including subjective / personal judgments and without a clear hierarchy. They've also deemed the replies to these questions to be various and countless, with the lack of definitive solutions and the usage of broad responses as distinguishing features.

### 5.3 problem

#### 5.3.1 Questioning and problem, riddle and concern

Heidegger, unlike many other philosophers, did not seek conclusive answers to philosophical issues. Philosophy, in his opinion, opens the door to an infinite number of questions. Any solution that emerges in this manner is just temporary, and it sets in motion a chain of many more questions, making any endeavor to find the final answer futile. He claims that the worth of a response resides in the avenues it opens up for the questioner, like a skeptic who, while knowing that no answer is full and correct, does not weary of asking. Every idea is only valid to the extent that it allows the thoughtless to enter [1]. This concept manifests itself in the architectural design process known as "problem." In the minds of the problem, the problem is conceived. The capacity to grasp the problem is created during the design process by problem-solving within the context of the subject. In reality, the designer's major issue in the face of a design problem is determining what the problem is. The designer must first characterize the issue before attempting to fix it. When a designer approaches a design challenge in order to reproduce it, he interprets it for himself, attempting to discover its key dimensions and giving it a shape that directs the search for an answer along a clearer route.

Architecture is the result of a process known as design, and no design is complete without a flaw. The research on problem-solving in people and machines reveals a wide collection

of techniques that operate in different ways. The capacity to solve novel issues is a hallmark of human intellect and, as a result, a desirable trait in any cognitive system. The solution to the problem is a conceptual one. When confronted with it, a designer who has examined all parts of the job will be able to come up with a solution. The technique of dealing with the problem is solution-oriented, regardless of the solution that is developed via the solution of the revenue problem. It may be claimed that knowledge of goodness (which is issue solving here) correlates with practice in the context of problem solving since the problem is solely impacted by itself and unanticipated occurrences (accidental causes) do not interfere with its progress. The distinction between a problem and a riddle is this. The issue is one of solutions, and an appropriate solution may be discovered by weighing the many elements of the situation. The dilemma, on the other hand, necessitates a single, definitive answer due to the lack of unexpected features to Aristotle's idea of "random causes" to assist us in dealing with it. It's also important to notice the minor linguistic and conceptual distinctions between the problem and the worry. Issue and problem are sometimes interchangeably translated as "problem" in specialist literature; however, the two words are distinct. The terms "problem" and "worry" are used to distinguish between the two. The issue or worry is restricted to broad concerns, while the problem has a more particular connotation. The issue is a notion for which there exist answers, but the worry is centered on public perception; the entire is undefined and unpredictable, and it focuses more on public wants and interests. The worry also lasts a long time.

### 5.3.2 Redefining the problem nature

Dealing with problems necessitates a significant amount of mental resources owing to their unpredictability and complexity. When action alone isn't enough to get from one circumstance to the next, one must resort to thinking. The goal of this type of thinking is to create a practice that bridges the gap between current and desired circumstances [23]. As a result, the problem is identifying and using an individual's knowledge and abilities to arrive at the proper response in a scenario [33]. The issue is usually defined by Newell and Simon as involving a starting state of solutions, as well as beginning locations and conditions. The goal scenario is when the problem has been solved. The transition from the starting state to the goal state is treated as a series of changes in the issue-solving process, and it is modeled sequentially from the problem states [10]. In the mind, "problem" is sometimes thought of as "problem" based on a misunderstanding. According to Morgan, Daneshgar Moghaddam (2009) views the issue as a conflict or discrepancy between the current state and a future scenario. However, in the realm of science, the problem is comparable to a problem and has greater meaning.

When negative semantic load characteristics (awkward and malformed or pathological) are applied to design issues, it becomes obvious that design problems are unexpected from the start and must be regulated and managed. The underlying structure, aims, and ways of attaining goals are unclear in complicated design challenges. Given the ambiguity of the situation, the methods for dealing with it must be adequately secure. The most difficult part of fixing the problem is making it comprehensible. To accomplish so, the designer must employ certain techniques with the objective of better understanding and accurately interpreting the situation [34]. The designer confronts the challenge, and the process continues until the design product is attained. The designer must first assess the problem before coming up with a solution. From the very beginning of the designer's interpretation of the issue statement, the designer's activity is crucial. Every designer has their own worldview and a collection of ideas, values, and attitudes that they refer to as "guiding principles." In reality, guiding principles aid the designer in successfully comprehending the problem, and the influence of these principles on the design process and effective knowledge of the problem is significant [25]. These concepts offer a unified approach to dealing with a variety of design challenges. The road to the solution to the problem is not a one-way, linear one. Frequently, the designer starts forward based on a certain interpretation of the problem and then realizes along the road that he or she has to rethink the problem and give it a new shape [27].

Another characteristic of the link between design issues and their solutions is that they do not match in any rational, predictable, or understandable way.

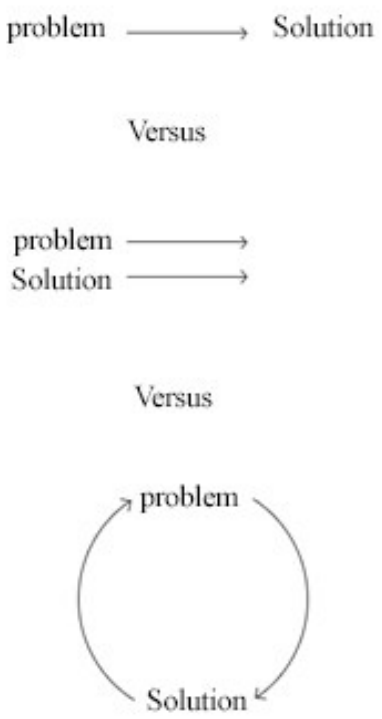



**Figure 5:** Divergence and convergence versus limitation and expansion (Dubberly, 2004)

### 5.3.3 Problems categorization

In a broad sense, there are many different sorts of issues. Problems with "open end" and "closed end" can be classified as "open end" and "closed end" in general classifications. The closed-ended issue, often known as a "closed-ended problem," is a type of problem in the experimental and natural sciences that has a clear final destination and a limited number of correct and erroneous responses. The open-ended problem, on the other hand, provides excellent and poor solutions rather than right and incorrect ones, and there is no limit to the number of suitable alternatives. End-of-life difficulties are design challenges that lie within the scope of designers' work. Rittman originally described them as "indeterminate difficulty" and "poor structure," and Simon went on to describe them as "problems with an indefinite structure" in the realm of design [34]. It is vital to consider the interwoven duality of "design issues" and "design solutions," as well as to outline some key characteristics of both. These considerations provide a broad picture of the current state of design.

### 5.3.4 Problem and design solutions features

One of the most distinguishing characteristics of design issues is that they are not well defined but must be identified. In reality, initial descriptions of design difficulties are frequently deceptive. The nature of design challenges leaves a lot of room for interpretation [25]. Design challenges are frequently multifaceted and interactive. As previously stated, it is rare that every component of a design serves only one purpose (ibid.). The problem statement gives the solver a set of instructions. In light of this information, you must take action in order to achieve the desired state. The original state of the problem is the beginning point. The solution process is the collection of activities that are carried out to arrive to the desired state [32]. The following are some of the most essential characteristics of the issue and solution (Table1)

### 5.3.5 Complexity of design problems

Designers are confronted with ambiguous, ill-structured, and nefarious challenges. As a result, their problem-solving[ii] techniques contradict traditional problem-solving research findings. One of the most significant distinctions is that design, as it relates to "problem solving," is concerned with "identifying the appropriate issues," rather than "accepting the given problem," and requires significant effort in organizing the problem (Shariat Rad and Nadimi, 2016, quoted by Cross). In general, the aim of the design process is to deal with complicated challenges, according to the characteristics of problems in design thinking. In his book "Problems in a General Theory of Planning," Horst Rittel (1930) created the phrase "evil problem" (1973). He enumerates the features that characterize the evil problem:

People may or may not accept ideas proposed through design thinking. The user accepts design thinking solutions only if the designer is pleased with them, and rejects them with greater logic if the designer is not. Solutions must be carefully crafted in order for the user to be entirely satisfied (Table2).

**Table 1.** A review of issue characteristics and architectural design solutions based on Lawson's (authors') perspectives

| Problem feature | Explanation | Solution feature | Explanation |
|---|---|---|---|
| **Lack of comprehensive expression** | • It is impossible to know when all parts of the problem have been defined throughout the design phase.<br>• Various parties and persons (such as the employer, lawmaker, and designer) having some role in the decision-making process raise the problem of design.<br>• In design, the difficulty is frequently caused by the employer; someone who is in need of assistance is unable to solve or even completely comprehend the problem.<br>• When the employer is not the plan's end user, the issue becomes more serious.<br>Both in terms of goals and priorities, design challenges are frequently unclear.<br>• As the impacts of the solutions become clearer, goals and objectives may shift during the design process.<br>• Designers may come up with a variety of solutions.<br>• The designer's knowledge of design issues and the information required to address them is influenced in part by the designer's ideas for solving the difficulties.<br>• Quantitative design evaluations encounter several challenges, and unavoidable difficulties are valued. Design issues, like their solutions, are nevertheless vulnerable to mental perception and interpretation in this way. | **Countless solutions** | • It is impossible to build a full list of all conceivable solutions for such issues.<br>• Some authors, such as Alexander, discuss the need of establishing a variety of alternative answers. This interpretation is obviously founded on the premise that design issues may be explained.<br>• The majority of design flaws are confusing and unclear. |
| **The need to form a mental interpretation** | | **Lack of optimal solution** | • Compromise and coping are nearly always a part of design. Sometimes the objectives are diametrically opposed to one another.<br>• Skillful judgment is required for compromise and balance.<br>• The design challenge has no ideal solution, but it does have a range of acceptable options. It is a question of judgment when it comes to critiquing and evaluating solutions, such as design decision-making.<br>• There is no set technique for determining which solutions are excellent and which are poor, but the best test of any strategy is to wait and watch the outcome in action.<br>Design solutions are never flawless, and criticizing them is frequently simpler than creating them. |

| | | | |
|---|---|---|---|
| Tendency to hierarchical order | • Design problems are frequently a symptom of larger problems.<br>• There is no rational or objective means of determining the appropriate level at which such concerns should be handled.<br>• The majority of decisions are still made pragmatically. This flow is determined by the designer's power, time, and resources. Of course, it appears acceptable to begin at the greatest level, which is realistic and feasible. | The solution of general answers | • Part of the design solution is rarely the exact response to the problem's recognized components. Every concept in a solution is frequently a logical and broad response to a variety of issues.<br>• The design solution is seldom degradable, and adapting it to the problem rarely allows you to specify which element of the solution is the response to which aspect of the problem. |
| - | - | Solutions serving knowledge and cognition | • Other designers and critics are interested in studying design solutions. Their relationship to design is similar to how hypotheses and theories are related to science. They are the foundation for design science advancement. |
| - | - | **Partial solution to the problem** | • Design solutions often have the same negative consequences as positive ones. |

**Table 2:** Characteristics of Evil and Structural Problems (Authors)

| | |
|---|---|
| **Characteristics of evil problems** | There is no one-size-fits-all solution to the evil problem. Because evil problems are so complex, they may be approached from a variety of angles. |
| | There is no static rule for evil issues since there is no way to predict the eventual answer. |
| | There are no right or incorrect answers to wicked problems; only good or terrible options exist. |
| | To address evil problems, there is no quick or ultimate examination. |
| | A "sudden action" is any remedy to the bad dilemma. There is no way to learn via trial and error. Every attempt is significant. |
| | There is no set amount of possible solutions or acceptable reaction limitations when it comes to evil concerns. |
| | Every evil problem is a symptom of a larger problem. |
| | The character of the remedy is decided by how the evil problem is explained. |
| | There is an intrinsic unity to evil concerns. |
| | Because explanations differ from person to person, there is always more than one explanation for a bad situation. |
| | The planner/designer has no right to make errors and must accept full responsibility for their activities. |

### 5.4 Approaches to the study of problem solving

For more than a century, philosophical traditions have been used to explain problem-solving behavior. This has resulted in the usage of various terms to explain identical occurrences in some situations [32]. The ideas and behavior of designers must be examined in order to better understand the techniques that designers employ in dealing with the design challenge. These researches are classified as design expert studies[iii]. The use of each approach will change the results due to differences in origin, degree of performance, actions, and phases of effect. As a result, after examining the problem-solving techniques, it is important to examine them.

#### 5.4.1 Neo-behavioral approach

The first behavioral method to problem solving is based on a cause-and-effect model, which comprises a stimulus (S) and a subsequent reaction (R) (R). Watson's (1920) definition of

problem-solving, which he defines as a type of vocal and generally quiet action that analyzes acquired patterns, is confirmed by problem-solving and learning. Watson argues that the term "thinking" may be used to describe all silent actions. As a result, he proposes that novel issues need verbal and experimental conduct, which should be repeated until the proper response is obtained. He claims that thinking is a catch-all phrase for all sub-behaviors [36],[32].

Unfamiliar problems necessitate "experimental linguistic conduct," according to Watson [36]. Thorndike's notion of testing and explaining mistake was challenged by Skinner, who said that his findings "reveal no meaningful characteristic of behavior." He regarded problem-solving based on two forms of behavioral control: the first, the use of reinforcement (reward patterns based on living behavior) alone or in combination with culturally established standards. The problem solver looks for clues that lead to reactions that provide "distinguishing stimuli." This procedure is repeated until the proper answer is found. Neo-behaviorists have recently discovered that they do not completely comprehend how to handle a complicated problem using simple stimulus response (S-R) probabilities. As a result, the novel behaviors imply hypothetical chains of SR intermediate connections in which an initial stimulus (matching to the problem's starting state) stimulates the reaction (hidden), which then generates a new stimulus that leads to the response. It spreads and finally results in (obvious) conduct. This concept is founded on the hierarchy of habit, which states that a stimulus causes multiple forces to respond via experience. Similarly, a variety of stimuli might elicit a certain response. Each of these mechanisms is linked together by a hierarchy of chains linked to various forces to form a composite mechanism. This hierarchy, according to Maltzman (1995), can be combined in a sequence. When a person is confronted with a difficulty, he responds based on "force of habit," and if it doesn't work, he moves up the hierarchy. The idea of this method is that no "thinking" or mental processes are revised [32].

### 5.4.2 Gestalt approach

Gestalt psychology arose alongside behaviorism and in opposition to it. Gestalt psychologists were interested in how people see events and difficulties in their daily lives, as well as how they view the world. They were particularly fascinated by the relationship between the parts or components of experience, as well as the separation of things from their constituents (gestalt formation). In reality, components will only make sense if the "whole" is understood or known. The concept states that "the totality of a thing" is greater than the sum of its parts, defined as "from top to bottom" (ibid.). The Gestalt hypothesis states that there is a context in which everything that happens in the whole does not arise from the qualities of the individual components, but rather everything that happens is a part of the entire, whose basic internal structure is governed by rules in some situations. Wertheimer (1959) suggested that rather than mindlessly following taught techniques, issues might be handled by comprehending their whole state, which he dubbed "reproductive" thinking. The issue solver is not required to comprehend why the problem is solved in this manner using the statistical technique. Cognition, on the other hand, necessitates knowledge of the problem's structure. As a consequence, a whole gestalt is formed, which is referred to as constructive thinking. Gestalt psychologists are interested in things that keep individuals from solving issues, such as what they've already learned that gets in the way. Problem-solving and problem context are particularly essential, according to Wertheimer, since problem-solving takes place "in the entire process of knowledge and insight through historical (past) experience, social position, and personal existence." Many problem-solving techniques are based on this viewpoint [32].

### 5.4.3 Problem framing

To respond to the challenge and go on in the design process, the designer requires a fundamental (but not necessarily full) grasp of the problem. As a result, a definition is required in order to comprehend the situation. As a result, it self-defines the problem and provides it a logical framework. The most difficult part of the design problem-solving process is defining and articulating the badly designed design problem. Because the design problem is inadequately organized, it must first be "structured" before "problem resolution" can begin. As a result, design research is more concerned with "problem definition" as a

component of the design process than with the problem itself, goals, and design outcomes. The designer must describe the problem for himself and interpret it in his head in order to come up with criteria for creating and selecting solutions. The similar tendency of designers in dealing with design challenges is represented with "problem framing" [iv] [34]. The military design process is a never-ending cycle. The designer recognizes and defines the problem at the start of the problem-solving process [18]. The difficulty here is resolving complicated difficulties. During issue solving, complexity indicates that the current condition and goal of the challenge, as well as the difficulties it will face along the road, are varied, dynamic, interconnected, and opaque [11]. The designer defines the problem's boundaries and chooses and identifies the elements in the problem space, then regulates the problem's space by taking those variables into account in order to decrease the problem's complexity and make it clear and manageable. The issue statement serves as a "launch pad" for the search design. Lawson refers to this scenario as "formulating," and Sean uses it to represent the designer's mental process of redefining and comprehending what the difficulty of "framing" is. The basic acts of naming or identifying and framing are used by both to convey their ideas. Each problem-solving approach employed by professional designers appears to be distinct from those employed by other problem-solvers. Many studies of expert design behavior reveal that designers rush to early solution conjectures and utilize them to jointly identify and define an issue and a solution [12].

Designers frequently combine top-down and bottom-up techniques to reinterpret the notion of design in order to address a design challenge. Furthermore, prior research shows that "composition analysis-evaluation" is a design technique that has been addressed extensively in the literature in the context of design thinking. "Analysis" refers to breaking down a problem into sub-problems; "combining" refers to recombining sub-problems in new ways; and "evaluation" refers to putting new structures to the test (same). In the designer's initial interaction with the problem, the basic framework of the problem is to identify the most significant parts of the problem as the designer's first mental representation of the problem. The usage of "position definition" and "meaning" framing is indicated in the fundamental definitions. By mentally visualizing the issue's key aspects, "Meaning" helps the designer to comprehend the problem. Decision-making and action are facilitated as a result. The first stage in a designer's contact with a design challenge is framing. By utilizing it, the designer interprets and comprehends the complicated issue.

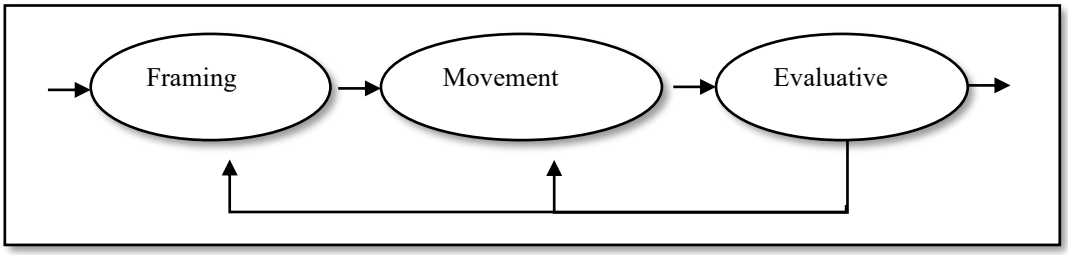
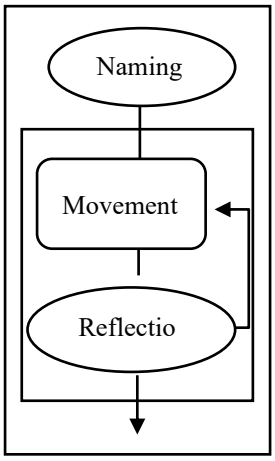



**Figure 9:** Completed Model of Reflective Action, Framework Model of Evaluation (Shariat Rad and Nadimi)

The creation of motion or hypothesis, in Schon's opinion, is dependent on the normative framing of the situation and the setting of specific issues to be solved. In their words, "movement" refers to the creation of a solution, while "normative" alludes to the fact that frames are descriptive rather than rigid and predefined. The capacity to produce and alter frames is crucial to how the skill process progresses. In theory, frames shape the designer's perceptions by giving meaning to the problem through "selective simplification," creating a field of vision for the problem in which only a few parts of the problem are possible [34]. Based on their idea of reflective action, Valkenberg and Dorset devised a descriptive approach. They offer Donald Sean's reflective activity in the form and sequence of the four primary design activities, including naming, framing, movement, and reflection, and then split the statement into pieces. Each segment represents a cross-section across which an action occurs. They encrypt actions with keys. When the design team believes a portion of the job (problem form) to

be particularly essential, they code it as "supply." They also engage in framing activities that have an impact on future actions and offer a framework for them. Valkenberg and Dorset believe the frame to be the box in which other actions take place since it dictates following activities (ibid.). Three major actions characterize their perspectives on the design process, which Lawson and Dorset both endorse. Sean presents problem-solving, including naming and framing, in his initial allusions, but later characterizes problem-solving as situation-framing.



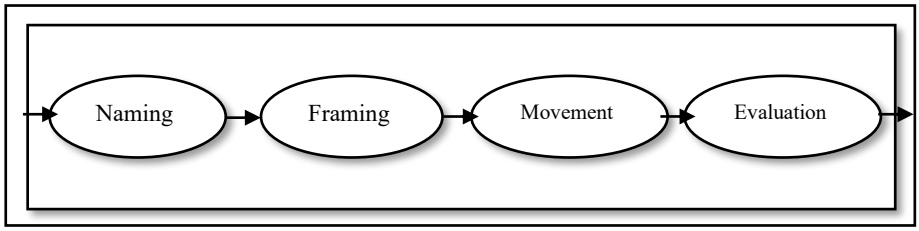




**Figure 7:** Reflective Practice Mechanism, Adapted from: Valkenburg & Dorst, "The Reflective Practice of Design Team" (Shariat Rad and Nadimi, 2016)

**Figure 8:** Reflective practice model, adapted from: Roozenburg & Dorst, "Describing Design as a Reflectice Practice" (Shariat Rad and Nadimi, 2016)

## 6. Discussion

In this section, a causal-comparative analysis is used to analyze the three methodologies outlined above. Two research concerns will be addressed in the next two sections: the process role of the problem-solving approach and the interdisciplinary stance of problem framing.

### 6.1 Comparison of problem-solving strategies

Following an examination of the definitions, methods, and activities required when employing problem-solving techniques, it is vital to investigate the capacities that the designer will engage while employing each of them. Table 3 compares different techniques to acquire a more systematic understanding of their function. Researchers looked studied the progression of three techniques from their conceptual origins to their final destination to acquire a better knowledge of the issue (procedural interpretation). As a result, an attempt has been made to investigate the five features of the strategy's genesis, purpose, trajectory, strategy characteristics, and formal translation of all three strategies. It should not be overlooked that by examining the strategy's trajectory, one may gain systematic knowledge of their performance when confronted with a challenge. Another essential consideration is where each of these tactics should be used in the problem-solving process. All three tactics may have been applied at the level or part of the problem in the case study of each of these strategies.

When comparing the three issue-solving techniques and taking structural and origin distinctions into account, it appears that problem framing has several essential characteristics that may be used as an interdisciplinary strategy:

1. Its expert dimensions are one of the structural elements of framing. This is significant because it allows elites to tackle an issue in the field of transdisciplinary and interdisciplinary research, as well as a platform for facing a variety of viewpoints.
2. Framing allows the solver to narrow the problem down to a certain topic and position, allowing for more accurate, in-depth, and interdisciplinary solutions.
3. Completion of the framing process in such a way that it is repeated indefinitely and in reverse to gain a better knowledge of the problem and bring the solver closer to the desired answer.
4. The "test frame" function allows you to analyze and quantify frames. The quality of the answers is questioned again in this mechanism, and the framing process will continue until the desired outcome is attained, if required, using an analytical-critical viewpoint.
5. The ability to solve problems that are difficult to solve, because of the analytical character of frames and the emphasis on analysis in framing, this problem-solving method can handle complicated situations.

**Table 3.** Comparison of three problem solving strategies with three different origins (authors)

| Strategy | Origin | Objectives | Orientation | Strategy features | Procedural interpretation |
|---|---|---|---|---|---|
| **Neo-behaviorism** | Behavioral | Atomistic | Bottom-up | • Cause-and-effect model<br>• Learning<br>• Verbal formal<br>• Verbal -Experimental behavior<br>• trial and error<br>• Behavior based on learned habits<br>• Our general term for all sub-behaviors | Addressing the arena<br>Behavior zoning<br>Process reversals<br>Dialogue-oriented<br>Duplication of solutions<br>Process without review |
| **Gestalt** | Psychological | Macro-oriented | Top-down | • Formed in opposition to behaviorism.<br>• The relationship between the elements or components of the experience<br>• Seeing objects separately from components<br>• The meaning of the components in the group of total perception<br>• A whole is more than the sum of its components.<br>• A holistic view of issues<br>• The problem solver is valid and important.<br>• The context of the problem is part of the problem. | The relationship of the whole and the part<br>Integration between author and work<br>Correlation between effect and context<br>Relying on the relationship of components<br>Creativity of the process |
| **Framing** | Cognitive | Hierarchical | Bilateral | • Experts' thoughts and behavior are effective in solving the problem<br>• Expert studies<br>• Needs a basic understanding, not necessarily a complete one<br>• Defines and structures the problem solver<br>• Suitable for complex issues<br>• Effective on a variety of issues, dynamic,<br>• Suitable for interconnected, non-transparent issues<br>• Reproducibility of the framing process<br>• Continuation of the problem solving process | Crushing the issue<br>Problem solving at various levels<br>Repeating the problem solving process<br>Evaluation by re-framing<br>The importance of the author's role in problem configuration |

**6.2 Framing as an interdisciplinary strategy**

Framing the problem as an architectural problem-solving technique has the potential to lead to the development of architectural literature in collaboration with other disciplines. The necessity for this development in meaning must be explained, and a systematic knowledge of framing capability must be supplied in order to apply framing in other domains.

The following sections aim to describe seven structural characteristics that highlight the potential for using framing as an interdisciplinary problem-solving strategy:

1. Through his different experiences and assessments, the designer is practically building a theoretical viewpoint. This is the foundation of his theoretical universe, and it is inside it that he develops unique structures. Frames are not set and predetermined by their maker, but rather may be positioned and are dependent on the designer. Framing allows for a human interaction with the problem and is a representation of the solver's reality in the workplace (the importance of an individual reading of the problem).

2. Design is inherently forward-thinking. The design process necessitates the use of prediction. But, like any other prediction, the portion of design that looks to the future is inherently unpredictable and value-based. The designers' proposed solutions are primarily dependent on their original perceptions of the problem and value system. Frames are created in design based on "beliefs," "values," and "experiences" (representation of the theoretical apparatus in the solution).

3. In productive professions where a more prescriptive approach is prevalent, the primary objective is to add value and benefit to others. The designer is aware of the intended value in

the early phases, but the primary difficulty is that there are no clear and dependable work instructions or rules for producing that value, as well as the equipment and raw materials required to accomplish that value. Dorset thinks that the development and usage of frames has a design background, with the emphasis on framing a specific achievement that design brings to other complicated and open-ended issue areas. As a result, according to Shariat Rad and Nadimi (2016), framing is the essential core of design thinking (the core frame of design thinking with a prescriptive nature).

4. Design issues, for example, are not permanent but may be changed [26]. Design concerns can be hazy at times, and they're frequently riddled with internal inconsistencies and infinite interpretations. During the framing phase, the process of interpretation and reinterpretation is a distinguishing aspect of creative design that accompanies the design until it goes into a new domain (the framework of the strategy for catching and penetrating the problem).

5. One of the reasons for the problem's slow growth is that the scenarios that must be integrated throughout the design process are unrealistic and must be transformed into actual issues in the process. By restricting the problem both in depth and field, as well as by the nature of the reciprocating motion during framing, framing, together with the first proposed solutions that promote the evolution of the problem, leads to the formation of practical solutions. (Reducing the problem to its simplest form gets it closer to reality).

6. In addition to the "how" that leads to the "value" under which an organization has functioned, ambiguous circumstances arise when an equation with a "what" structure is no longer applicable. It's difficult to figure out where the issue arises in the equation. Solvers (individuals or organizations) frequently reply in the least expensive method possible. They strive to make a new "thing" utilizing the problem-solving technique, which seeks to keep the frames' nature and the values' stability. This frequently reveals the nature of the design predicament to the problem solver that the audience has framed for the first time. In order to adopt a helpful approach, the solution must determine if the level at which the audience has received and comprehended the fundamental design challenge is ambiguous. The suggested problem must first be "decomposed" or opened up in order to do so [19]. (Stability and stability in the problem-solving process).

7. Expert solvers ask themselves what has made the problem difficult to solve by looking for the primary "contradiction," and then recognize the fundamental nature of the "contradiction" and begin to develop a solution [22]. The primary inconsistency is a clash of viewpoints or needs that necessitates a creative design solution or a re-frame of the confusing situation. This generic framework emerges to answer an analytical issue in a closed environment, where there is no way to characterize the ambiguous condition due to its unattainable nature [19]. Framing has the capability to cope with complicated and confusing situations due of its separatist character (the ability to deal with complex problems).

## 7. Conclusion

As previously stated, problem-solving techniques have an impact on the quality of the answer produced by the solver. The performance of the solutions is influenced by factors such as the problem-solving procedure's direction. Top-down methods' answers are comprehensive and may overlook the micro-issues at hand, in addition to being prescriptive. Bottom-up techniques, on the other hand, may not lead to structured solutions due to the partial view's dominance, and the solutions may have a discontinuity. The chance to investigate all elements of the problem is provided by strategies that adopt a reciprocal and cohesive approach to the problem and continually seek to confine the problem-solving difficulty. As a result, problem framing has a greater potential ability to address particular difficulties.

Sean suggested that the framing and mechanism of issue framing as a problem-solving approach had an interdisciplinary ability that may be utilized to address problems in other productive fields. The significance of this issue is shown by the fact that the majority of problem-solving techniques employed in architectural design have a non-design origin. It is efficient in productive professions, such as environmental design professions and works in interdisciplinary fields with creative aspects, because it has two-way movement from top to bottom and vice versa, a hierarchical view, and the ability to apply problem-solving strategy at different levels of the problem and its expertise.

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i Until Rowe's book, the phrase "design thinking" was part of the collective design awareness of academics. The inaugural DTRS conference was an experimental research in the subject of design process and methodology, with a focus on design thinking. Efforts were made during the second DTRS conference to develop a multidimensional understanding of design thinking based on variations in how design scenarios were observed. As a result, during the course of twenty years of research, the application of ideas and models of methodology, psychology, and education evolved. Such a study frenzy resulted in a wide range of perspectives on this extremely complicated human reality. Later on, design thinking became a popular and inventive model for solving issues in a variety of fields. This was seen as a difficult issue for design communities that were ashamed of design thinking's simplicity and prized a rich, varied, and visual perspective.

ii Rather than fixing inconvenient and unstructured problems, one may anticipate more from their management, and in reality, greater openness rather than solutions. As a result, a well-formed term "problem" may be chosen in the face of the problem, and "problem-solving" design can be used to refer to the process of confronting the designer with a poorly constructed problem [34].

iii Expert study in design does not have a long history, but in this short time many people have made efforts to better understand the mental mechanism of designers, including: Omar Akin [3],[4], Hernan Casakin (2004) [7], Hernan Casakin and Gabriella Goldschmidt [8], Nigel Cross [12],[13], Nigel Cross, Henry Christianokis Dorset [16], Nigel Cross and Anita Claiborne Cross [15], Brian Lawson [27], Brian Lawson and Case Dorst [28], Tseng Ball (2011) [35], and Yilmaz Darley, Seifert and Gonzalez [38].

iv He also used terms such as "problem formulation", "problem-finding" and "problem-shaping", "implicit problem analysis", "problem domain", "problem-structuring", "mental representation of the problem", and "problem-solving" instead of "frame".