Original Research Article

Metaphor as an Extension of Deduction and Method of Architectural Design Reasoning*

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Abstract

Problem statement: Although the field of the research process is new, research in this area has advanced rapidly. This reflects the diversity of intellectual and theoretical methods governing the research process. The majority of studies have described design experiences using an analytical approach and point of view. The approach of thinking about design has often been overlooked in this research. The main concern of processes will be lost due to this detached viewpoint, yet the design process itself is a style of thinking. Regardless of the awareness gained from the research phase, the design process will invariably apply logical thinking processes to achieve its purpose. As a result, the goal of this study is to figure out the link between deduction and metaphor as a style of reasoning. Also, what influence can metaphor have as an argumentative approach in creating an architectural work?

Research objective: This study attempts to understand the link between deduction and metaphor as a core thinking tool in design methodologies and apply it logically.

Research method: Deductive and inferential reasoning was employed in two stages, the bibliographic method was used for data collection, and the logical reasoning method was used for data analysis.

Conclusion: This research aims to understand better the role and function of logical reasoning in the architectural design process and the impact of metaphor as an arguing tool. According to the conclusions of this study, deduction and metaphor are among the complete logical procedures that play a crucial role in the production of architectural works in a four-part mechanism. By keeping the features of deduction, metaphor is a type of deduction that leads to the uniqueness and twofold meaning in architecture.

Keywords: *Deduction, Metaphor, Reasoning, Design Process.*

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Introduction

Because of the variety of theoretical views and the mental nature of the design process, the field of vision has become more diversified and the process has become less regimented. As a result, a specific approach or phases in the production of shape and space are not specified in a precise and clear manner in design study (Rezaei, 2014a). The existence of a method and process of issue solving in the result of architectural design as a space demonstrates the existence of a method and process of problem-solving in it. Such a process, like the problem-solving technique in science, can be examined by certain process researchers (Chakrabarti & Blessing, 2014).

Design thinking is a type of nonverbal thinking, which is one of the qualities that is often missed. This is despite the fact that the majority of our cognitive experience is verbal. When speaking deliberately, verbal thinking is utilized (Brown, 2017). When creating, architects are continually presented with a type of nonverbal logic. We can notice the architect's major effect on the design process because of his role in this style of thinking (ibid.). Due to the dominance of verbal thinking, nonverbal thinking has been overlooked for millennia. On the other hand, using words to express a non-word-based method of thinking is challenging. Even though it appears to be contradictory at first, such a contradiction is not impossible. Design is a mode of thought; a kind of thought with its own mechanics (Lawson, 2013). The relevance of encouraging a different perspective on design stems from the fact that the subject of designers' thoughts and mental mechanisms without prior assumptions is fascinating to investigate. Many current theories seek to characterize motion in processes by describing process phases and motion patterns (linear, parallel, partial, cyclic, circular, or spiral processes). The fundamental two-part pattern, which is based on "analysis" and "composition," is the common denominator of all

these procedures. John Chris Jones is attempting to break this concept down into three steps. He defines the three steps of the design process as "analysis," "composition," and "assessment" (Kumar, 2003). Rezaei, according to Koberberg and Begnal, begins by splitting the problem into smaller sections, which he refers to as "analysis," and then merges the components. The design process was evolved from two steps to three stages, then five, and eventually seven stages in future research, as shown in Fig. 1, (Rezaei, 2014a).

The stages of the design process, according to Lawson (2016), are conscious effort, issue resolution, unconscious effort, the spontaneous appearance of ideas, and conscious development. The steady movement from "focus on analysis" to "emphasis on the composition" is noted by Bill Newark (Dubberly, 2004). Convergence and synthesis are more important than divergence and analysis, according to Cross (Cross, 1984). Kumar refers to the design process model as "innovation planning," and characterizes the state of the invention in design as "magic," "genius," and "intuition" (Rezaei, 2014b).

As known, the form of the research process, and its design approach used in conjunction with it, is variable. The multiple manifestations will be interpreted as fragmentation if studied without considering the reasoning logic of the methods. The processes of thinking that each notion is built on are represented. No thought, on the other hand, proves itself or refutes its all-encompassing concepts without employing logical reasoning. Essentially, the possibilities and constraints put on the process by using reasoning techniques account for a portion of the key elements of processes and the process of their evolution. It might be difficult to construct a cohesive picture of the whole subject due to the range of categories used by modern methodologists throughout the last several decades and the lack of common ground between them. What has arisen as a

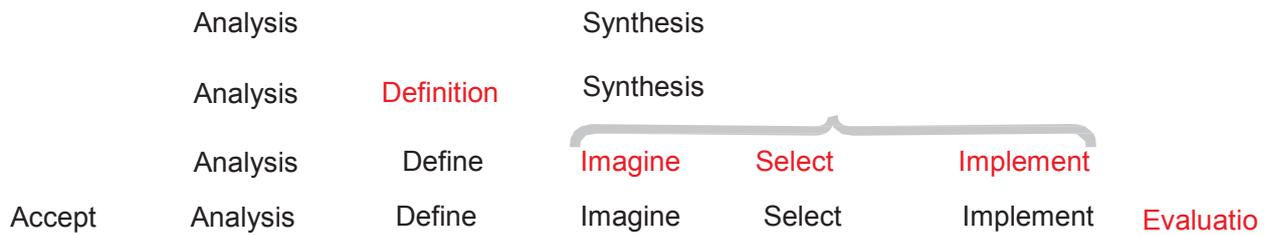| Analysis		Synthesis			
Analysis	Definition	Synthesis			
Analysis	Define	Imagine	Select	Implement	
Accept	Analysis	Define	Imagine	Select	Implement	Evaluatio

Fig. 1. Process evolution from two-stage to seven-stage. Source: Dubberly, 2004.

methodology is actually built on logical design thinking processes that will present themselves in a variety of ways. The logical cornerstone of design approaches, logical reasoning, may be thought of as a cohesive component between ways that leads to systematic procedures. Recognizing the logic of the arguments that underpin the approaches is essential to comprehend the design process. The objective of this research is to grasp the basic reasoning techniques in design approaches, how to utilize them in the method, and how metaphor as a reasoning method affects the task.

The technique of reasoning that underpins the formulation of design thinking extends to these categorizations. This research examines the link between metaphor and deduction, as well as the impact of metaphor as an argumentative tool in the creation of architectural works. The goal of this research is to determine the link between deduction and metaphor as a basic reasoning approach in design thinking, as well as to comprehend the capability of metaphor as a logical method in design. Less writing has been devoted to investigating the link between the design process and the logic of the ideas that guide architectural thought among process researchers. Researchers frequently attempt to establish disciplinary boundaries, but their efforts are less focused on comprehending the logic that underpins the processes. The vacuum created by this type of study appears to be successful in avoiding the construction of a structured image of the research process.

Research questions

1. What is the link between deduction and metaphor in architectural design thinking as an argumentative method?
2. How can metaphor act as an argumentation tool in the creation of an architectural work?

Research Method

Given the nature of the current investigation, The researcher encounters a mental dilemma that the researcher's way of dealing with the subject is the result of his / her knowledge of it. As a result, this study is an epistemological study that falls under the area of qualitative research. The study employs "causal analogy" and "interpretive interpretation" As a result, the research method includes inference and induction. The identified reasoning approaches were first investigated in the inference phase by studying the literature. The way of applying logical arguments in methods sought, and the reasoning methods employed in architectural design, as well as the role of logical reasoning in the design process, then examined using inductive reasoning. The researchers selected to analyze a case study in which two solutions to a problem exist in the same environment to refine the subject and detach themselves from the mental space controlling the research, as well as to show the contrasts between deduction and metaphor. Researchers objectively explored the subject to this aim by referring to two examples of the original design and the implemented design of the Valiasr Mosque in Tehran, which affords such an opportunity. The

research showed the applications of metaphor as the logic of its design and operation, as well as an understanding of metaphor as an arguing approach, in the following sections. To collect data, in the first step of the research process, researchers conducted library studies and in the next step, they analyzed the data in the process of logical analysis. In the following section, In Fig. 2 the general structure of the research drew based on the research method and steps.

Research Literature
• Designing logic
It is feasible to set away from the complicated explanations of design with an analytical approach and try to establish a conceptual framework to reach the basic rules of logic in design thinking[1]. In reality, depending on the structure of the problem in design practice, a range of logical reasoning methodologies are used to form the essence of design (Dorst, 2010). As a result, the three fundamental processes of logical reasoning, namely inference, induction, and deduction, must be described as the basic ways of reasoning for establishing the foundation of discourse. Pierce's work, which illustrates the pattern of basic arguments via comparison in equations of the known and unknown, is described by Rosenberg. As can be seen in Fig. 3 to develop this equation, it appears required to establish the foundation of the logical argument that arises from the combination of "what" and "how," and the argument patterns are detailed based on it: Fig. 4 shows how Inferential

reasoning focuses on the "what" and "actors" that are necessary for a specific circumstance. There is also information about "how" the actors interact in this scenario. The actors' awareness of one another and how they interact leads to predictable outcomes. In induction, the "what" in the "what circumstance" is known, and the consequence can be seen, but the rules that control these motions are unknown (Fig. 5) Proposing working principles to explain observed behavior (referred to as a hypothesis) should be viewed as a creative endeavor. The generalization of facts beyond their mere ideas is known as induction. This is a report on the flaws in the generalization of its use (ibid.). This has two implications: first, induction is related to probability, and probabilistic statements are never as strong as a necessity; second, induction is more useful when it has explanatory capacity for a broader reality than what has been seen (Grout & Wang, 2005). Every logical system is a delicate balance between inferred requirements and inductive predictions. A small number of observed events are used to draw definitive conclusions. A more general logical framework develops from these observed patterns, which can be described with more force than the reported cases. The inductive part of logical reasoning is this (ibid.). Everything in the world may be predicted and explained using these two types of analytical thinking. The last basic method of logical reasoning is Deduvtion, whose structure is illustrated in Fig. 6.
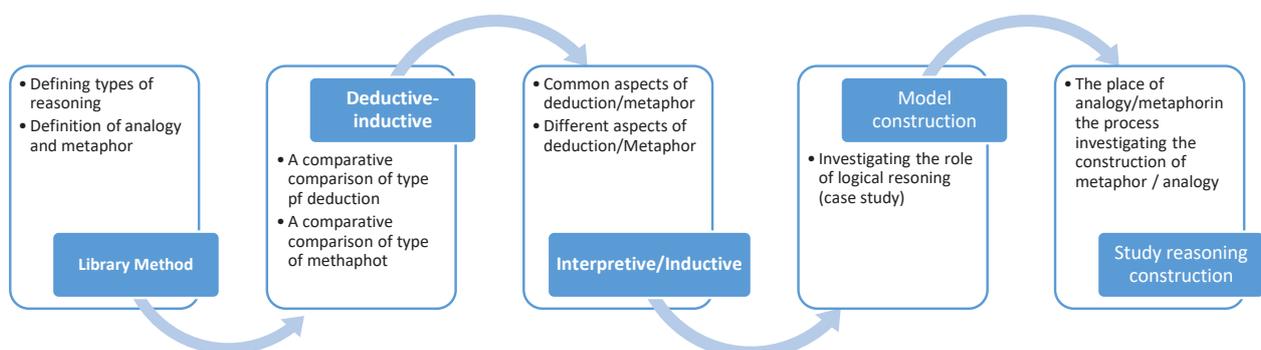
In deduction as can be seen in Figs. 7 and 8,

Fig. 2. Diagram of research steps based on methodology. Source: Authors.

What	+	How	Being guided to	؟؟؟

Fig. 3. Basic model in constructing logical reasoning. Source: Dorst, 2010.

What	+	How	Being guided to	؟؟؟

Fig. 4. Pattern of making inferential logical reasoning. Source: Dorst, 2010.

What	+	؟؟؟	Being guided to	Value
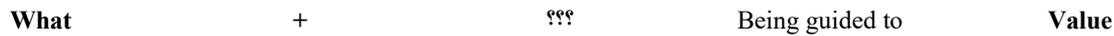
Fig. 5. Pattern of constructing inductive logical reasoning. Source: Dorst, 2010.

What (things)	+	How (rules)	Being guided to	Outcome (observed)
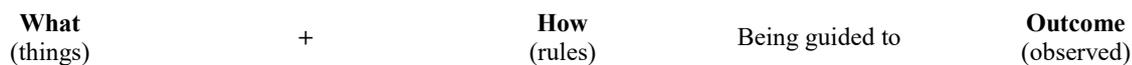
Fig. 6. Basic model for constructing analogical logical reasoning. Source: Dorst, 2010.

؟؟؟	+	How	Being guided to	Value

Fig. 7. The first model of deductive reasoning construction. Source: Dorst, 2010.

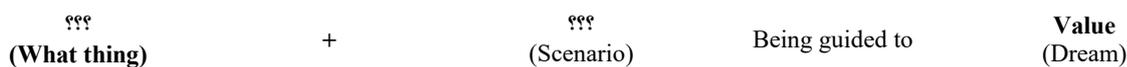| ؟؟؟ (What thing)	+	؟؟؟ (Scenario)	Being guided to	Value (Dream)

Fig. 8. The second model of deductive reasoning construction. Source: Ibid.

"what" is ambiguous, while "how" is equivocal in some circumstances, in addition to "what." As a result, with this style of thinking, using the trial and error approach, an attempt is made to try to reach the intended value by experimenting with various "things" and "methods (means)" and progressively improving and developing things based on the results achieved and the manner in which it is compensated. The reason is that the designer employs trial and error to generate ideas regarding "things" and "hows" and according to the outcome of the case, Dorset feels that "deduction" is a model of fundamental thinking in design among the three ways mentioned above. In feedback and reform procedures, his viewpoint assesses and corrects problems. This procedure is repeated until adequate solutions to the problems are found and the disagreement between them is addressed (Goldschmidt, 1991). There are two versions of the deduction. Their similarity is the designer's goal of achieving a certain level of value. The first type of comparison is always problem-solving, assisting designers in identifying the "hows" and "principles of work" required to attain the desired outcomes, but the "what" remains a mystery. This is a logical procedure used by designers to produce a "thing" in a pre-defined workflow and context. Only the final value that one wishes to attain is in the sphere of awareness in the second example.

Therefore, considering that for designers, the design principle is not well-known or chosen to allow it to be led to values, understanding "what" will be a challenge. This means that "working principles" must be developed using inductive reasoning, while "things" (things, services, and systems) must be developed by deductive reasoning. This entails the creation or implementation of a new "frame"[2] (Dorst, 2010; Schon, 1983), (Fig. 9).

The concern of design thinking is frequently believed to be the design of the complicated creative set of generating one thing (item, service, system) and the way it functions in tandem. This two-stage creative process necessitates the designer submitting a proposal for "what" and
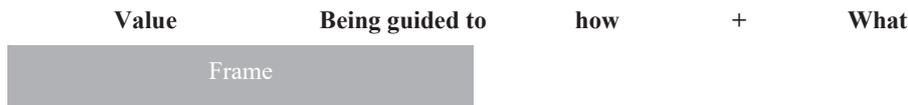
Value	Being guided to	how	+	What
	Frame			

Fig.9. The role of the frame in the model for constructing analogical logical reasoning. Source: Do rst, 2010.

"how" and putting it to the test (Lawson, 2013). At all stages of design, strategies for providing solutions, analyzing, assessing, improving, and upgrading them will continue as long as they are satisfactory. One of the most important aspects of design skill is the capacity to think creatively (Dorst, 2010).

This distinguishes design disciplines and professions as thinking professions from basic analysis (deductive-inductive) and problem solution disciplines (deductive). Although the distinction between the two is not quite obvious, design is a blend of solution-focused thinking (deduction) that incorporates issue solving and a sort of design that is involved in an evolutionary process that represents the state of the problem (ibid.).

• **Deduction, the logical basis of design**

Deduction and deductive reasoning are powerful reasoning mechanisms that lead to cognition. Dennis Scott Brown is quoted by Lawson as saying, "Deduction has always

been in our thoughts" (Antoniades, 2007; Lawson, 2013). The deduction of the transfer of concepts, principles, and qualities from the source to the recipient is characterized by the likeness or similarity of communication. Problem-solving psychology considers thinking based on similarity to be a key metric. Many designers feel that deduction is the most prevalent logical way for developing architectural design based on visual design thinking, according to many professionals in the industry (Azimi, 2016).

Visual deduction is highly useful in understanding the problem and attaining the design solution in the early phases of the process. When solving design challenges, designers frequently utilize visual expression-

rich groupings and classifications, demonstrating the potential capability of their analogies in problem resolution. Goldschmidt (1994; 1995) indicates that when using visual deduction in design, designers search for indications in visual expression that may be identified as the source of comparison. The majority of the instances in the literature are in the design of subsequent reports. This is because there is no empirical proof regarding visual deduction's function in problem-solving design, it is impossible to verify that it was employed (Casakin & Goldschmidt, 2000).

- Types of analogies in design thinking

Only "argument" is persuasive among the deduction kinds since it employs and returns to the basic axioms and consciences (Khakzand, Muzaffar, Faizi & Azimi, 2009). Various categories have been proposed in the study of analogies, the most thorough of which being Gentner's two-part categorization. The two types of deduction, according to Gentner's theory, are surface deduction and deep (structural) deduction. The term "superficial deduction" relates to readily available or superficial topic matter notions. Structural deduction, on the other hand, is based on a system of higher-order relationships. These sorts of analogies have a significant influence on the solution's quality (ibid.). The first theory is that the source of "structural mapping theory," which deals with structural deduction, is correctly understood. Instead of transmitting component attributes, structural deduction deals with transferring communication properties and, at a higher level, the systematic transmission of specific communications (Faizi, Alipour, & Mohammad Moradi, 2017).

The linkages and transitions between the components of the source of inspiration

(structural characteristics) must be summarized, and the transfer activity must be accompanied by transformation, to establish structural similarity. Transitioning between components and component relationships is insufficient; transformation is required. To meet the intended environment, the designer must make adjustments. Emphasizing the importance of summarizing the functions in the environment, Nakhtigal et al. propose searching, summarizing, transforming, and applying changes in understanding environmental phenomena (ibid.). In other divisions that are somehow more accurate, the approaches of applying deduction in design fall into three categories: superficial, structural, and conceptual or metaphorical. The conceptual or metaphorical deduction, which refers to the indirect connection to ideas in phenomena, is the defining feature of this group. It is worth noting that it is not always feasible to identify the physical aspects and functional structure of the phenomena when using the assessment technique in three categories: superficial, structural, and conceptual (metaphorical). Both structural and surface characteristics are present in the shape. As a result, it will only be considered in the category of superficial perception if the repetition of the form has just a surface and superficial aspect and does not contain the structural relations of the phenomenon. To determine the kind of deduction, consider whether any aspect of the phenomenon (apparent or structural) (adaptation to the demands of the architectural challenge) demonstrates that the deductive technique is a subset of the architectural creative methods (ibid.). Researchers differentiate four types of unusual, superficial, copying, and structural perception in other categories. There is no superficial or structural relationship between the source and the design in the unusual rendition. Many visual and structural similarities are visible at the same moment while copying (ibid.). Hatta Kapinen identifies another group by merging McGinty's

and Wayne Otto's perspectives. Table 1 shows another categorization proposed by Peter Collins and Frampton in their book Transformation of Ideals in Modern Architecture (1750–1950). (Rezaei, 2014a). In addition, William Garden identifies four parallels: symbolism, frankness, individuality, and imagination (Azimi, 2016).

• **Metaphor**

Metaphor[3] in Persian literature refers to the use of one word instead of another (Batoei & Rezaei, 2016). Metaphor is a language process in which adjectives are "moved" or transferred from one thing to another as though the second item were the first. Metaphors appear in a variety of shapes and sizes, with varying numbers of "things" involved, but the overall pattern of "transfer" stays consistent. Metaphor has long been regarded as the most important type of virtual language. The disparity between what it means and what it says is referred to as virtual language. Virtual language is often descriptive, with transitions leading to what appears to be a "picture" or "image" (Lakov & Johnson, 2008). It is a concise metaphor in the classic sense that is responsible for communicating meaning (Hemmatyar, Mohajernia & Bastani, 2015). For the first time, Aristotle defined metaphor as an elliptical simile. Traditional philosophers' view of "simile" indicates that before the creation of metaphor, the two compared entities shared common features and metaphor may be expressed literally without losing its cognitive value (the information that metaphor conveys).

Metaphor is utilized as a literary tool in the institution of tradition. Contemporary literary academics, such as Shamisa, have dubbed a certain form of permissible, namely "permissible in the sake of likeness," as "metaphor" and the sole permissible type in the literary language (Bayat & Moghaddasi, 2014).

Metaphor, as the earliest modern theory, makes two fundamental claims: first, metaphors contain

Table 1. Comparing the division of Leduk and Antoniadis. Source: Authors.

Scholar	Division	Deduction base
Chris Abel	Formal: spiritual model, classical, military, utopia, organic, artistic, linguistic, commercial, identity, self-made Procedural: scientific model, systems, stigmatic, regulatory	Process / Product
Heta Cabinen	Mathematical deduction Objective deduction Eclectic deduction	Product
Collins and Frampton Action	Biological deduction Mechanical deduction Linguistic deduction	Product
Gentner theory	Superficial deduction In-depth deduction (structural)	Process/ Product
Mohsen Feizi	Superficial Structural Conceptual (metaphorical)	Process/ Product
Mahmoud Rezaei.	Subjective Objective Direct Indirect Internal External	Process
William Gordon	Symbolic Clarity Being personal Imagination	Product
Others	Unusual impression Superficial Copying Structural	Process/ Product

independent cognitive content; and second, cognitive content (meaning) is formed by the interplay of multiple cognitive systems (Batoei & Rezaei, 2016). Metaphor permits a type of experience to be comprehended differently by imagining a similarity between two occurrences that aren't inherently equal (ibid.). In a dissertation on semantics, linguists such as Yeral

and Bloomfield believe metaphor to be one of the most essential variables in modifying meaning. Ullmann, Agden, Richards, and Jacobsen are among many who have explored metaphor with a similar mindset. Metaphor, according to Lacan and Derrida, is a game of signals. By creating conceptual metaphors, Lakov and Johnson play a unique role in the study of metaphors (Bayat & Moghaddasi, 2014). According to Lakoff and Johnson, metaphor not only improves the clarity and understanding of our ideas, but it also influences the structure of human perceptions and perceptions of the outside world in the practical stage. In its most basic form, the everyday conceptual system is metaphorical. The "Contemporary Theory of Metaphor" was coined by Lakoff and Johnson. Metaphor, according to current philosopher Max Black, is a separate mental act. The metaphor establishes a likeness between two objects rather than expressing a pre-existing relationship. He says that metaphor not only aids in reality detection but also produces a new reality or meaning. To put it another way, metaphor is a notion (Batoei & Rezaei, 2016).

As previously stated, a priori readings of metaphor place a greater emphasis on literary purposes and classical speech, but current methods have elevated metaphor to a type of argument with cognitive functions (Bayat & Moghaddasi, 2014).

- Types of metaphors in design thinking

The presence of a variety of parallels in the design scenario leads to the development of various routes. To illustrate the power of the mind in the realms of reality and fiction, the metaphor "permissible" is imaginatively connected to "truth." As a result, metaphor is believed to begin beyond simile at a point called "intuition." To put it another way, metaphor is a symbol of the mind's emancipation from the constraints of words and the unconscious path of meaning. The origin of the formation of philosophical theories about metaphor is literature .The" classical", "romantic ",and" twentieth-century "perspectives

can be used to investigate discourses regulating all types of metaphors .The most prominent thinker of the classical approach ,Aristotle, views metaphor to be distinct from "conventional" ways, believing that there is a distinction between "conventional" and "poetic" uses of words, with the birth of metaphor (Davoodi & Ayatollahi, 2008). Plato's ideas impacted the "romantic" viewpoint. This viewpoint emphasizes metaphor's unifying significance as a way of connecting mental operations. With the arrival of the cognitive school, the classical view, which saw metaphor as only a decorative object exclusive to language and literature, gave way to the current approach. Metaphor is always flowing in action and thinking, according to modern theory. From a conceptual standpoint, there are two sorts of metaphors in the literature: near and remote. It is separated into four graphic schemas in terms of cognition, encompassing metaphors for space, volume, movement, and power (Batoei & Rezaei, 2016). Metaphor is a type of "linguistic process" that includes the interplay of "similar" and "similar" in the twentieth century. As a result of this process, meaning is created that encompasses not just both words, but also goes beyond and replaces them. Because one word can't be substituted by another if it just has one meaning, this interaction necessitates that each word has distinct semantic layers. This feature contributes to the metaphorical process's richness. In modern perspectives, metaphor is described based on interaction or "two-way communication," which leads to the production of new meanings and contains levels with varied layers, beyond its literal meaning, which is a sort of "transmission" and "one-way" relationship (Davoodi & Ayatollahi, 2008).

Metaphorical connections, according to Lakoff and Johnson, form a large part of our mental framework (Khakzand et al., 2009). The most suitable and possibly only method to express concepts is to use irony, metaphor, punishment, code, and symbol (Borhanifar, Mousavi, Talischi, & Mazhari, 2017). Leduc demonstrated the significance of metaphor for the first time in architecture. Machine, organ, and crystal are the three categories he uses to categorize metaphor. Two machines, one geometrically regular and the other erratic, are developed from human culture and the other from nature. The crystal metaphor, according to Leduc, stresses features with an abstract structure. Transparency, the most crucial qualities and traits of this metaphor are semi-transparency and geometric structure vs bulk and opaque structure.

The machine metaphor is based on industrial and processed materials, as well as technology-based procedures, though the body metaphor is based on organic geometry and is not restricted to people. Organ metaphor, like machine metaphor, creates a precise combination of components to obtain a result, but it goes beyond that. Separate components are joined in the machine metaphor, but the organ's composition has more integration, coherence, and coordination, and it is not evident where each organ stops and where it starts (Hearn, 2003; Rezaei, 2014a). In terms of origin and perception, Antoniadis divides metaphors into three categories: ethereal, tangible, and blended.

The potential potency of metaphor in perceptual metaphor is determined by the degree to which visual characteristics are detectable. Metaphorical terms are available as examples. "Superficiality" is undesirable since it diverts the architect's attention away from the metaphor's objective as well as the appropriate development of the work, resulting in no one doing what he planned in the end. The new invention must always have anything more than superficial resemblances to the metaphor's source. A compound metaphor is certainly the most accessible, the most demanding, yet, at the same time, the most efficient sort of metaphor.

This is especially true when the generated work, although being disconnected from the source of the

metaphor's visual and objective memory, keeps and even improves its core traits (Antoniades, 2007). The capacity to fulfill critical evaluation or achieve design goals distinguishes all three sorts of metaphors more precisely. Table 4 clearly illustrates the distinctions. Bergren examined a variety of metaphors based on Antoniadis' divide, each of which occurs at a different position on the spectrum. First, as the name indicates, an abstract metaphor of an image is a direct semantic relationship between diverse visual pictures that falls halfway between the two poles of the spectrum since it comprises both objective and emotional components. As a result, the three species take on three distinct personalities: logical, lyrical, and aesthetically perceptive. The second type of metaphor is the contextual metaphor, which is based on frustrations and emotional intuitions about similarities and differences between concepts and, in most cases, includes the connection of the indirect meaning of mental pictures represented in words. In the range of definitions, this usage of metaphor tends to characterize it as a decorative definition. The third type of metaphor is a structural metaphor, which entails an abstract link between structures by deduction and is thus at the rational end of the continuum (Khodaei, Talischi & Daneshgar Moghaddam, 2013). As can be observed from a comparison of Antoniadis, Leduc, and Bergren's perspectives, Leduk's classification in Table 2 focuses more on architectural work and its objective dimension, whereas Antoniadis' classification is based on metaphorical division, though he emphasizes the extent of metaphorical output once more. And it places metaphor at the heart of the work's construction. Most studies try to analyze metaphor from the study of objective works in the work, so Leduk's encounter with metaphor appears to be widespread during the study of the dominant methodology. At the same time, paying attention to metaphor and its function in the problem's process and source

Table 2. Comparing the division of Leduk and Antoniadis. Source: Authors.

Scholar	Types	Definition
Antoniadis	Subjective	It happens when a concept, idea, human situation, or a specific feature, such as individuality, naturalness, generality, tradition, or culture is the original source of a work.
	Objective	When the original source of creation is the work of a visible or material feature, it is generated.
	Hybrid	It is immediate in the sense that it contains both of these sources at the same time. In this metaphor, the visual-material attribute serves as a pretext for displaying the visual format's benefits, traits, and characteristics.
Leduc	Machine	Qualities associated with abstract/ transparent structures - semi-transparency and geometric structure vs. bulk and opaque structure.
	Bodily	Industrial and processed materials, as well as technology-based procedures, were used in the design.
	Crystal	It is not confined to humans and is based on biological geometry.
D. Bergren	Visual abstract	It is a direct semantic link between diverse visual pictures that falls midway between the two poles of the spectrum since it comprises both objective and emotional components. As a result, the three species take on three distinct personalities: logical, lyrical, and aesthetically perceptive.
	Contextual metaphor	Similarities and differences between concepts are often dependent on the connection of indirect meanings of mental pictures represented in words and are based on sharpness and emotional intuition.
	Structural metaphor	It is at the rationalistic end of the spectrum since it involves an abstract analogous relationship between structures.

contributes to the growth of literary works. From another perspective, metaphor serves a variety of purposes (Ghorbani, 2018). The classification

of metaphor based on function was established in research titled "The influence of metaphor in improving students' creativity in teaching architectural design." The result of which can be seen in Table 3.

Discussion

The commonalities of metaphor and deduction Metaphor's meaning has evolved with time and has evolved into a manner of thinking. They are referred to by Hemmatyar et al. (2015), who understand metaphor as a type of mental process that introduces new meanings to ideas and occurrences. Both deduction and metaphor have a process origin, and the first time you use them is when you're confronted with a problem and a cognitive field. In his imagination, the designer sees parallels between the present problem and earlier difficulties and conjures the former solution in the new situation while creating an objective link (deduction). The other scenario involves a mental transition from one issue to another. In this situation, a metaphor is expressed through an abstract connection. The link between deduction and metaphor, as the most basic logical structure, has to be explained. Some assertions highlight the metaphorical element that growth is comparable, while others focus on the common structure between the two logical arguments.

• The majority of research on deduction and metaphor concentrates on architectural work, attempting to extract a reference to an objective topic from the architectural subtext, although metaphor as a logical possibility plays a role in problem-solving and cognition (analytical position of deduction and metaphor).

• The structure of deduction, according to Dorset, is generated in the absence of "what" or the simultaneous lack of "what" and "how" (Dorset, 2010). The co-construction with deduction is what presents metaphor as an extension of deduction. The common denominator of the two logics will be "how," but it will be up to the metaphorical

Table 3. Functional metaphor classification. Source: Ghorbani, 2018.

The function of metaphor	How to use
Motivational function	Metaphor creates twofold excitement and motivation in the audience by enriching and highlighting the text and subject, as well as by powerful processing of the text of meaning in the audience's mind.
Heuristic function	Metaphor reveals abstract and intangible things through revealing some objects and concepts, as well as ineffable and objective experiences. This is a two-way learning experience for both the speaker and the listener.
Interpretation function	Objective matter recognizes mental conceptions and intangibles, and perception of the visible to the hidden
Cognitive function	The metaphor of ubiquitous existence stimulates human beings' emotional, psychomotor, and cognitive domains in connection to one another and to attain cognition, and draws on multidisciplinary research and conclusions to address issues.
The function of creating and expanding the meaning	By transferring meaning from one domain to another, metaphor expands meaning. Imagination is not the reconstruction or re-creation of something absent, but the creation of something in the proper meaning of the word.
The function of emphasizing meaning and highlighting	Because metaphor draws attention to a specific meaning and goal, the viewer understands the designer's aim faster, more thoroughly, and clearly.
occult function	Metaphor stimulates the mind by encouraging research and interpretation, as well as revealing certain unusual topics that are difficult to express clearly in specific situations.

audience to figure out what it is by deleting a part of the comparison that leads to increased argument complexity. The spectator is confronted with a metaphorical constriction and expansion. The phenomena become more succinct when the deduction of "what" is eliminated, and the bill is written in the form of a metaphor; yet, the

audience is confronted with a type of expansion while reading the metaphor, due to its mental nature and feature of being conceptual. One of the most fundamental reasons that metaphor should be regarded as an extension of the deduction is because they have a similar structure (common construction between deduction and metaphor).

• The designer's understanding of the design challenge is a requirement for problem-solving and a factor of coherence in the design process. The core rationale of architectural design methodologies is a deduction (Rezaei, 2014a). Metaphor is effective in systematizing the mind by matching familiar notions, offering chances for discovery and growth of the topic, and adding to the logical depth of the reasoning technique since it is a sort of deduction in issue construction (metaphor has functional reasoning).

• Lakov and Johnson argue that metaphor is not only a linguistic term for a word used for artistic or rhetorical purposes but a process of knowing a person through which he or she gains significant experience and meaning, proving that spatial experiences are at the foundation of the metaphorical structure. In this empirical meaning, metaphor is a process of deduction and deduction through which one field of experience is understood and developed in the context of other domains of experience (metaphor as a cognitive tool).

• Metaphorical design is an important instrument for conceptual structure, and it serves as a potent method for adding meaning to architectural work. The expansion metaphor denotes that it has evolved as a communicative medium through time and has undergone formal and substantive modifications. As a result, metaphor is a type of deduction that is constructed with meaning in mind (Borhanifar et al., 2016) (metaphor as the creator of conceptual structure).

• "Theology" is linked to the creative comprehension of the problem in the construction of metaphor in its source, literature. As a result,

the listener must ponder on the speaker's words to discover the truth through virtual meaning similarity. This creates a two-way contact between the audience and the work, allowing them to realize the truth in the sphere of cognition and, eventually, to construct and grow the notion. This makes the work and the audience more involved and encourages the audience's rationality and comprehension of the piece (ibid.). Metaphor generates a "semantic" architectural effect over several levels while also elevating the architectural impact above its regular level (metaphor creates an active relationship and double semantic layers).

Means of differentiation of metaphor and deduction Metaphor is founded on a logical action that the mind might evoke as a result. Therefore, in the process of increasing the designer's awareness (Miller & Casakin, 2005). After the shared origins of deduction and logic have been established to some extent, it is required to describe the difference between the two to elucidate the issue:

• Metaphor avoids the "actual" level and the lexicon of "things." Metaphor creates a mental, rather than an actual, link between two "things." In deduction, on the other hand, "things" are used in their real sense. The audience is confronted with a kind of finished thing in which sensory effects are often the final benchmark for measuring the degree of success, and the description of the two phenomena is the most accurate that comes from the real "things," and the audience is faced with a kind of finished thing in which sensory effects are often the final benchmark for measuring the degree of success (Bayat & Moghaddasi, 2014). Because the metaphor is less comprehensive than the comparison, it becomes part of the meaning of the work being read by the audience. This is viewed as the audience's participation and the work's metaphorical interpretability (audience action in metaphor).

• It is believed that when "anything" is used

electronically, a type of "imaginary link" would emerge with other "things" utilized in the same way. In this sense, metaphor encourages the audience to connect with the "goal" of its meaning but does not "destroy" or predetermine it. The sheer resemblance of two words does not imply that they are interchangeable, and cognitive processes play a crucial role. Individuals' daily experiences, ethnic and national beliefs, and linguistic culture shape a cognitive pattern, many of which may lack a solid rational, scientific, or rational basis but still overshadow individuals' intellectual and linguistic concepts (the logical relationship of metaphor to context).

• The use of "something" metaphorically rather than "something" literally is not in a different sense, but this choice is made by maintaining the semantic relationship between the two units; conditions known as "double meaning," in which the main meaning and the metaphorical unit are active simultaneously and in parallel with each other and appear to be integrated (Bayat & Moghaddasi, 2014).

• The "transformations" that have occurred in the structure of metaphor are what distinguishes the production of deduction from metaphor (Figs. 10 & 11). In reality, the metamorphic character of metaphor is its mental nature, as opposed to deduction's objectivism, as well as the absence of part of the structure and its conciseness. Injury to the deduction's body causes difficulty in communicating the message, as well as the need to try to find and understand the metaphor's source (the mental nature of metaphor - complexity versus deduction).

• In deduction, what is generated frequently moves from object to mind and then back to object. As a result, the deductive process's output is frequently accompanied by a degree of explicitness. However, in metaphorical frameworks, the object/mind is frequently pictured and, as a result, psychologically in front of the audience after the action in which semantic
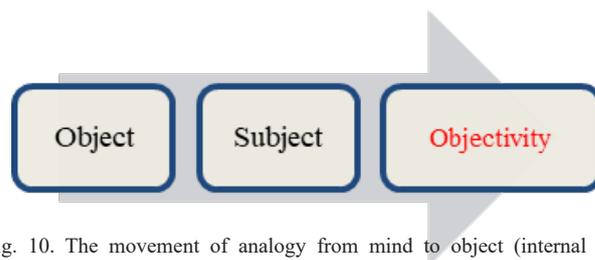

Fig. 10. The movement of analogy from mind to object (internal / external relationship). Source: Authors.

Fig. 11. The movement of metaphor from mind to object (internal / external relationship). Source: Authors.

and virtual layers are generated in the process. Consequently, in addition to activating the work, the audience causes the problem to grow and evolve in the audience's consciousness, and the problem is repeated at many levels (a different outcome of the process of metaphorical reasoning - problem development).

• Metaphor is instrumental in achieving "new" horizons (from the design to the construction process) through the double meaning it creates. It may greatly help to create the "originality" of the building. The originality of the general identity of the building is metaphorical; especially when the concept of substitution is used. A mental or objective scenario, setting, or even another work might be used to replace notions (Table 4) (Antoniades, 2007). The expert has discovered in recent research that metaphor develops individuality, a sense of originality, and redefines wants and objectives. Mental purity vs objectivity, as well as its emancipation from linguistic restrictions, will lead to labor purity (metaphor leads to the creation of originality in the work).

• In architectural design, there are two techniques for retrieving the picture in the design: "reminder" and "perception." "Reminder" might be a visual cue. The issue solver benefits immediately from his or her mental visual references when a thought remembers a challenge in constructing a reference form. Visual references, on the

Table 4. The importance of the hierarchical metaphor for design and critique purposes Source: Antoniades, 2007

	Present	Absent	Detectable	Non-detectable
Hidden superficiality		Superficial and superficial presence of metaphorical interpretation in plan or cut	"	"
The transcendent expression of		The superficial presence of change / Presence of existential advantages / Absence of superficial change / Presence of existential advantages	"	"

Quality improvement (vertical axis) — Quality improvement (horizontal axis)

other hand, may be the designer's mindset or perspective of the subject matter, and the design is related to the notion or concept of the reference design, which in this instance is done indirectly or figuratively and with a current approach to the mental picture. Patterns are altered (Khakzand et al., 2009). Although there is a link between mental resources and the final design, in this case, the designer's creativity also emerges. The quality of the solutions that are the result of the design process will be used to determine whether or not deduction was successful (reminder or perception).

• In humans, metaphor is the most visible embodiment of thought. All linguistic creations, on the other hand, contain a metaphorical structure, therefore metaphor is not confined to words. What is referred to as a "conceptual metaphor" consists of two conceptual realms in which one mental domain can assist another conceptual domain (Bayat & Moghaddasi, 2014). One of the most significant ideas in cognitive linguistics is conceptual metaphor theory. Lakov and Johnson accept that metaphor is a fundamentally metaphorical concept as

well as an aesthetic and stylistic technique in language. Adaptation between domains organizes conceptual structure, which is then preserved in long-term memory. Some adaptations are the result of pre-conceptualized experiences, while others are the result of more complicated conceptual systems (Hemmatyar et al., 2015). The mechanism of metaphor, according to Lakoff and Johnson, is a contractual relationship across realms, and what distinguishes it from linguistic metaphors is that there is adequate reason for metaphor at the conceptual level. To put it another way, a man not only talks but also thinks in metaphorical terms. Therefore, the association is referred to as a mental metaphor. Metaphor, in general, is defined by cognitive semantics as a mental relationship between the realms of destination and origin (Lakov & Johnson, 2008). From this perspective, metaphorical language terms merely reflect underlying mental linkages; the topic that underpins the production of every piece of art. Metaphors highlight the links between "things," but these ties are abstract rather than objective. Metaphors are also metaphors that express these relationships using terms like "like" and "like." As a result, similes and metaphors aid in the recognition of pattern relationships (Hemmatyar et al., 2015). (The vast linguistic field of metaphor - the creation of virtual language).

Model construction: A study of the logical construction of Vali-e-Asr Grand Mosque

The significance of metaphor, as a type of deduction with which it shares a common structure, is in the removal of some of the parts of deduction, which increases the difficulty of reading the work. The mechanism of applying deduction and metaphor in the design process is investigated in this section of the research after defining the forms of logical reasoning in architectural design and the link between

metaphor and logical reasoning approaches. The Vali-e-Asr Mosque in Tehran, which is located at the Vali-e-Asr crossroads, was chosen as a study sample for this purpose to gain a better knowledge of the contrasts between deduction and metaphor. The reason for this decision was twofold: According to Fig. 12 first, the designers' documentation and talks about their work have been disclosed throughout time, resulting in the architectural community having an adequate understanding of the project, and second, the chance to compare two distinct methods. In a setting and with a problem related to this project, in architectural design. A model was created to explore the features of crystallization of the reasoning technique in architecture for this goal. The model's geometry is the product of two similarities and contrasts between the two reasoning approaches. When the process features of the work in this model are examined, it becomes obvious that the work tends to use the deductive approach in a logical fashion or metaphorical thinking.

First design

Second design
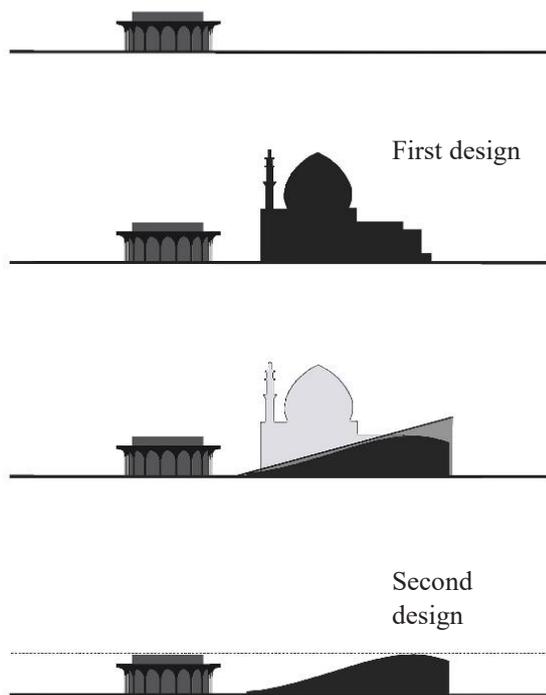
Fig. 12. Picture of sections of two designs in the vicinity of Shahr Theater. Source: Authors' archive.

Design number 1 is the original design, whereas design number 2 is the alternative one. The two designs in Tables 5 and 6 have been evaluated in terms of logical reasoning using the components retrieved from the previous two sections.

The emphasis on the commonalities of the two deductive and metaphorical logical logics was defined as the basis for moving the work towards deductive logic. Moving towards the differential aspects of these two methods of reasoning was defined as the basis for moving the work towards metaphorical reasoning in the structure designed for the study of the two mosques.

Constructing deduction and metaphor

Previously, we covered logical thinking processes and the importance of deduction in architectural design, as well as its differentiation and relationship to metaphor. However, describing the fundamental distinctions in their creation is the final step in comprehending the nature of each of these two techniques of reasoning. As a result, an attempt has been made in this section of the research to focus on the differences in the building of these two techniques of reasoning, taking into account the amount of knowledge about the methods and the application of their logical reasoning. The first point to consider is where these two kinds of reasoning fit into the process. The second point to consider is their internal structure and behaviors. It's crucial to discuss the role of deductive and metaphorical reasoning in resolving misunderstandings in deduction analysis, which frequently considers the manifestation of deduction or metaphor in the product, even though these two logical methods are also cognitive tools, in addition to their development in the reasoning literature. Following the explanation of the reasoning method's viewpoint, the internal structure of the two will be highlighted.

• The place of deduction and metaphor in the design process

Designers guess and present their recommended

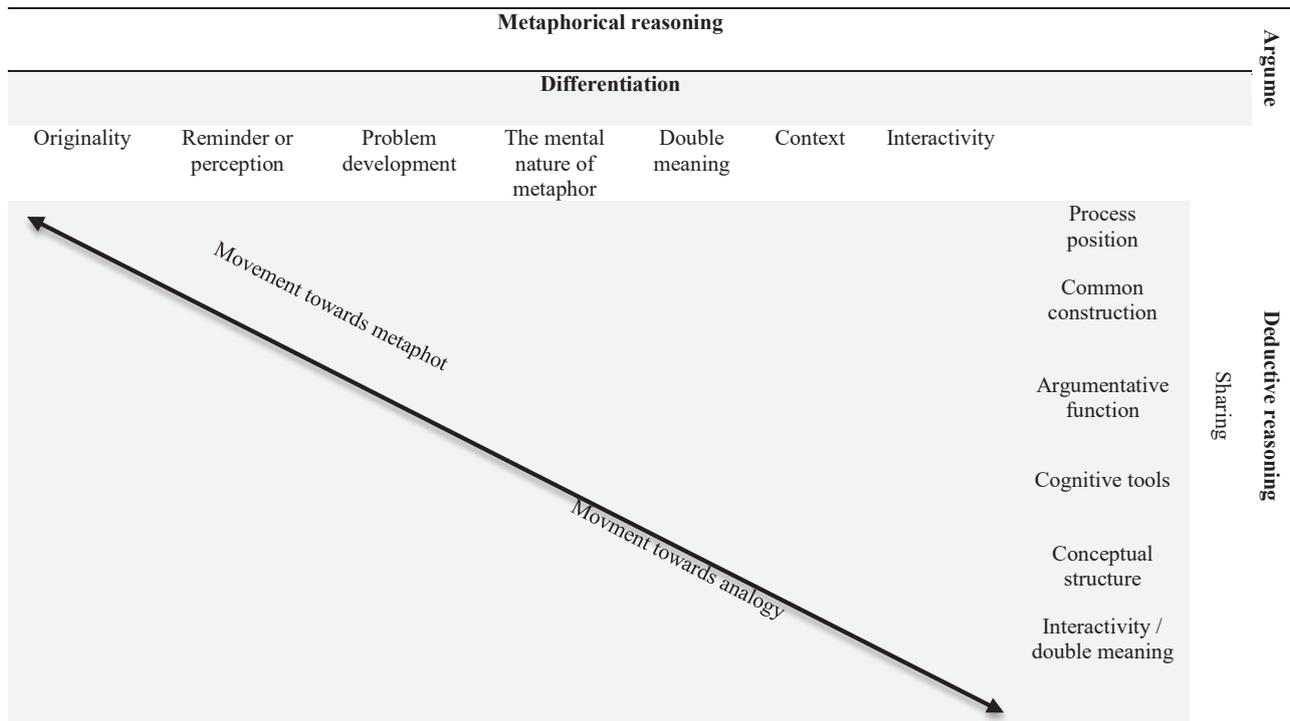Table 5. The model of the movement of logical reasoning from deduction to metaphor. Source: Authors.

Metaphorical reasoning							Argume
Differentiation							
Originality	Reminder or perception	Problem development	The mental nature of metaphor	Double meaning	Context	Interactivity	

(Diagram content: "Movement towards metaphot" and "Movment towards analogy" arrows; right column labeled **Deductive reasoning** / Sharing with items: Process position, Common construction, Argumentative function, Cognitive tools, Conceptual structure, Interactivity / double meaning)

Table 6. Studying the two designs number one and two in terms of reasoning method using the model of studying the movement of logical reasoning from deduction to metaphor. Source: Authors.

Design	Logic	Reasoning	Description
First plan (basic plan)	Deduction	Non-interactivity Interpretability	Applying deduction and the elements of the institution of tradition and the institutionalized patterns in the form of the mosque as a source of deduction leads to the loss of the opportunity for different readings.
		Relationship with the context	The relationship between source and purpose is analogous. The designer refers to known cognitive patterns and establishes similarities between the work and the patterns.
		Double meaning	Direct references to known patterns are limited opportunities for meaning development.
		Mental nature / complexity	The designer has tried to make a clear reference by preserving the reference language of the template.
		Problem development	Realization is an objective aspect of the patterns of the institution of tradition.
		Originality	Direct references to the past and efforts to give them objectivity. The effect is a continuation of a historical process.
		Reminder or imagination	Reference is made to historical and jurisprudential examples in the cultural context and attempts are made to represent them.
		Creating a virtual language	Based on the linguistic rule of architecture, it exploits prefabricated linguistic combinations in designs and establishes an interdisciplinary correspondence between the field of architecture and the field of architecture.
Second plan (implemented plan)	Metaphor	Interactability/ Interpretability	The sources of the design, according to the designers, are historical, but one-on-one references have been avoided.
		Relationship with the context	The relationship has gone to the subtext of the work and an attempt has been made to create a new pattern.
		Double meaning	Providing the opportunity for different readings and maintaining the semantic relationship provides the basis for creating a double meaning in the work, despite the posterior references.
		Mental nature / complexity	The metamorphosis in the patterns has taken their objective aspect and turned them into subjectivity. The second plan should be considered an a priori mosque that tries to create a new mentality from the concept of a mosque with a historical background.
		Problem development	The designer has achieved his/her goal by creating a mentality from a historical concept.
		Originality	It represents an independent identity with a different reading of past patterns.
		Reminder or imagination	Attempts are made to create a relationship with an idea or concept of context in an indirect and metaphorical way.
		Virtual language	The compounds used during the process are new and created.

solution by organizing the problem at the start of the design process. The logical arguments in methods and processes are crucial as one of the process pillars due to the process-oriented character of architecture. Even though the processes differ in terms of steps or modes of motion, their logical channels of motion are the same at all phases. Gentner and Medina have demonstrated that reasoning focused on similarity is an effective strategy. By finding and recalling similarities between prospective relationships at the target and known relationships at the source, deductive thinking allows you to grasp a new situation based on a comparable circumstance (Goldschmidt, 1994). Meanwhile, deduction and metaphor that allude to similarity have a particular role since they incorporate structural linkages in addition to similarity in surface aspects (Rezaei, 2014a).

In the model presented by Azimi (2016) (Fig. 13), deduction and metaphor are considered following the stage of obtaining data (conscious, unconscious, and imagination surrounding them) and pre-creation, and they are introduced across. In another study, metaphor's contribution to the creation of unconventional solutions in the early stages of the design process is visible, and metaphor's utilization in the latter phases of the design process becomes more comprehensive. Metaphor makes it simpler to separate and comprehend unexpected situations in familiar

settings since it makes it easier to discover sources to distinguish and understand the unknown. The designer's conceptual framework is a precondition for advancing toward a solution because it creates unity and coherence between the numerous variables in the design process. Metaphor unifies fragmented processes and influences the creative effort of the designer's mind to govern the issue of design and the birth of the design with the assistance of reasoning logic (Hemmatyar et al., 2015).

Design concerns are related to metaphor as a cognitive technique. Metaphorical reasoning is a component of the conceptual paradigm that underpins design thinking. The transition from one metaphorical concept to the next allows for the discovery of previously unseen design concepts. Redefining and identifying designs in new situations becomes possible by linking them with new metaphors (Khodaei et al., 2013). Metaphor has an impact on how we see the world, how we classify our experiences, and how we organize our ideas. This pushes designers to look outside the box and try new things when tackling design difficulties. Individual interpretation is required when it comes to metaphor. As a result, metaphor is always the outcome of a mental detour of notions impacted by personal experience. Three key phases determine the relationship of metaphor to a problem's solution: The first phase is extracting unknown ideas from
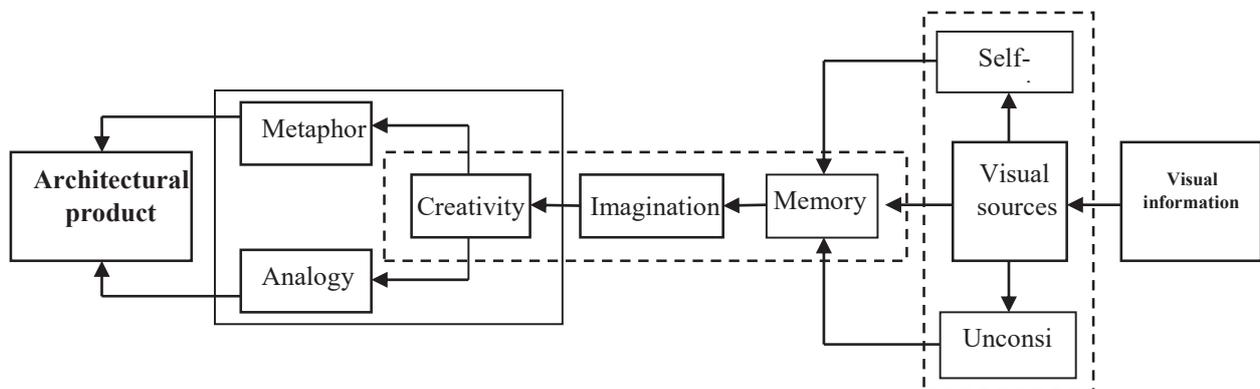

Fig. 13. The place of metaphor and analogy in the creative design process. Source: Azimi, 2016.

diverse domains that are closely linked to yet unclear to the present situation; The second phase is creating a strong link between the metaphorical notion and the problem; the last step entails translating and applying structural similarities between the metaphorical source and the situation at hand, which usually results in a novel solution (Ghorbani, 2018).

• **Application of deduction**

Deduction, according to Khakzand et al. (2009), entails two steps: "identification and retrieval" and "drawing and transfer." This is significant since these two activities are mental in origin and supervise the mind's deductive function. Another point of view is that deduction is made up of two steps: moving from sample to summary design and from summary design to an objective. By drawing a framework from the source, experiences from many sectors aid in achieving the aim. This model's defining trait, which has been cited in several places, is its objectivity, which indicates that it considers both the source and the output of the deductive process.

As shown in Fig. 14 In this part, we combine two models that attempt to represent analogies to create a more efficient model. The following are the phases of deductive reasoning:

Identification and retrieval: This process determines the issues about which there is information based on subject specifications; specifications that contain possible coordinates of solutions. As a result of these features, the problem is mentally represented. This strategy necessitates resources with appropriate keyword or visual cue instructions. Visual clues, such as geometric forms, keep the core challenges as the principles of solution. When difficulties aren't explicitly addressed and visual materials aren't linked to specific issues, Geek and Heliuk say they have trouble retrieving information and can't use deduction concepts.

Drawing and Transmitting: When a deduction is recovered from a prospective source, the context establishes a link between "cause and effect" and "source and topic." In reality, there are analogies to build deductive reasoning of the two categories
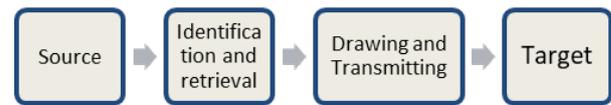

Fig. 14. Steps in reasoning by anology. Source: Authors.

of purpose and source as destination and origin, and the path of the product is the two activities of "identification and retrieval" and "drawing and transmission" in the development of the two models described.

"Architects utilize sketching to return to the patterns noticed (in their brains) as a distinctive method of perceiving and understanding a source in a particular direction," Fraser and Henmi think (Khakzand et al., 2009). The significance of this problem is that in the previous viewpoints, one application had evaluated the similarity with a wholly objective and product-oriented approach, while the other had analyzed the deduction with a subjective view and observation of internal behaviors. These two models are generated independently of one another, but they do not appear to operate alone and, when combined, better represent the application of deduction. In another study, Goldschmidt looks at visual pictures, specifically how they are captured and used in the logical design argument.

In visual deduction, he argues that: 1. the picture is recovered based on visual similarities; 2. abstract diagrams are produced to link images to them; and 3. the target image from the available collection is matched with comparable diagrams (Goldschmidt, 1994; Khakzand et al., 2009). The original design of the Vali-Asr crossroads mosque is an example of this style. The designer uses religious notions and instances of tradition in the creation of Iranian architectural mosques as a source of deduction, attempting to solve the bed problem using the criteria of a traditional mosque in the process of transfer. The product becomes strongly tied to historical forms through the application of deductive thinking in the design process, and there is even the potential of recurrence.

• Application of metaphors

The visual link between two things is frequently expressed using superficial metaphors. By transcending surface similarities, structural metaphors frequently contain layers or levels that are both semantically and aesthetically valuable. In general, the strategy of removing oneself from the issue and dealing with another subject is employed for three purposes: a better grasp of the problem, a chance to notice and find new aspects anew, and a change of viewpoint and broadening the subject to utilize metaphor (Davoodi & Ayatollahi, 2008). Metaphor is the consequence of two transverse and longitudinal motions. The longitudinal motion indicates imaginative thought by moving from one subject to another in the realm, whereas transverse motion reflects creative thought by moving from one realm to another. Although As shown in Fig. 15 both motions produce new meanings, it is important to recognize that the metaphorical process is multi-layered. If movement occurs simply on the surface layers, the metaphor will be shallow, and if the meaning is created by study and meditation on the semantic levels of the subjects, the core metaphors will be revealed (ibid).

Two models are discussed in the study of metaphor: the first one stresses the act of making a metaphorical argument, while the second emphasizes the process of developing and interpreting metaphor. Metaphor-building research is epistemic in nature. Problem resolution may be broken down into three parts, each of which has a practical application: According to what can be seen in Fig. 16 the first phase is extracting a group of unknown ideas from other domains that have a well-established link with the current situation, but that relationship is not sufficiently evident; The following phase is to create a strong link between the metaphorical notion and the problem; the final step is to translate and apply structural similarities to the metaphorical source of the current problem, which usually leads to a new solution (Casakin, 2007; Azimi, 2016).

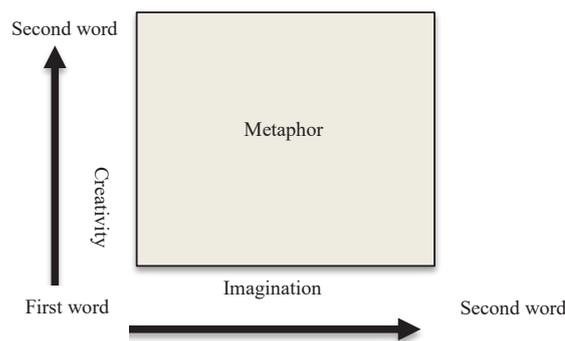As indicated in Fig. 17, creating and interpreting

Fig. 15. The movement of meaning in the creation of metaphor. Source: Davoodi & Ayatollahi, 2008.
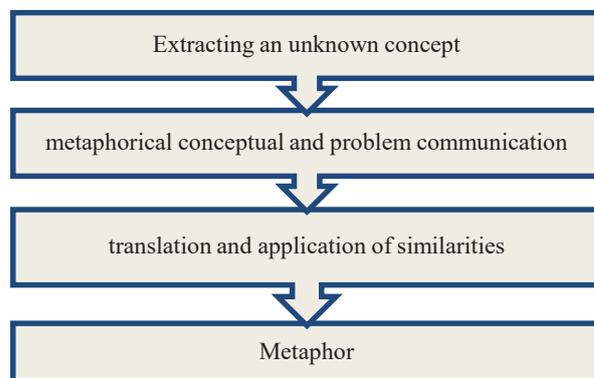

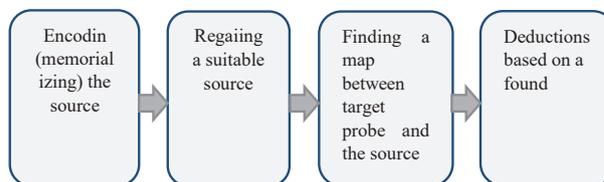Fig. 16. Using metaphors in designing based on Kasakin's views. Source: Authors.

Fig. 17. Using metaphors in designing based on psychological approach. Source: Khodaei et al., 2013.

metaphors from a psychological standpoint begins when one learns something unrelated to science. The individual will meet a new difficulty in the future and will need to discover the correct source of ideas to overcome it. It's a challenging cognitive stage to find the correct metaphor. A resource is remembered, and a link is established between the resource and the target's new state. New insights are made as the number of patterns grows (Khodaei et al., 2013). The process of developing and interpreting metaphors is explained by the model presented by Khodai and his colleagues in the second example, which is covered in this article. Despite referring to the first mosques and other historical

precedents, the designer uses metaphorical thinking to comprehend the structures of the metaphorical source. It transforms from an objective to a conceptual phenomenon throughout this phase. He next attempts to portray the linkages he has made in the previous stage in the solution by forming a relationship between the issue of context and the mindset emerging from the source. At the end of the discussion on the use of metaphorical and deductive reasoning, it is crucial to note that, while the two are similar and metaphorical reasoning is a type of deductive reasoning, a key element of metaphorical reasoning is that it is a type of deduction or simile. It's unknown and hidden. The depth of the metaphor and the requirement of some form of discovery is due to the lack of direct connection to metaphor in a sense of deduction. A topic like this not only engages the audience of the work of art but also contributes to its originality and creates a strong two-way interaction between the audience and the work.

Conclusion

Processes have the same validity as the rational grounds on which they are built (Fig. 18). According to what mentioned above, it is concluded that:

• The three ways of reasoning utilized to solve the problem are inference, induction, and deduction. In design methodologies, deduction is the most common form of reasoning. Metaphor is a refined kind of deductive reasoning, as it is a type of deduction. Reasoning logic is the driving force behind design thinking at the design level. In reality, the causal mechanism utilized in the process ensures some of the work's uniqueness.

• Extracting multiple sources and concepts based on design and source similarities, linking the resulting pictures and concepts to the design subject, and translating and adapting them to the design case are all processes in the usage of metaphor and deduction. The architect maintains
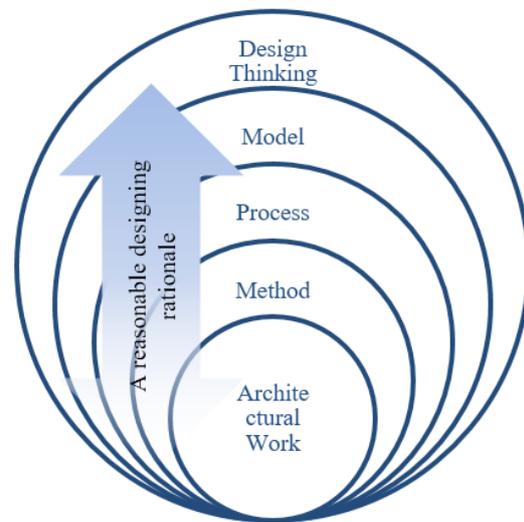

Fig. 18. Argument as a conduit for the spread of design thinking in design layers. Source: Authors.

continual contact with sources of inspiration throughout the process. Deduction includes goal and source, as well as the two activities of identification and retrieval in the first phase and drawing and transfer in the second stage, according to what has been mentioned about deduction. The two operations of identification, retrieval, drawing, and transmission should be seen as actions that will lead to the goal with a mental character, and the aim and source should be treated as the objective destination and origin.

• The complexity of the work of art, the construction of virtual language, and the production of double meaning when reading the work is due to the unique structure of metaphor, which arises from the elimination of part of the parts of deduction. Furthermore, the more abstract the extracted resources are, the more unique solutions are predicted. Deduction and metaphor arise throughout the process of creating a work, and depending on the methods utilized, they distinguish the work by using metaphorical or analogical references to develop fundamental elements of the work that make it valuable. The obscurity of reference, in the sense that the audience of the work needs some type of discovery to comprehend the causal link between

the work and the reference, leads to a form of uniqueness in metaphor. According to interactive theory, this causes the audience to take action. Although the manner of reasoning is important in the study of design processes, it has received less attention. The most significant accomplishment of this study is that it has elevated the argumentative approach from the fringes to the center of attention. This problem may be used to investigate the ways of representation and transfer of information from other domains of knowledge to architectural difficulties, which could lead to future studies.

Endnotes

1. Logic provides a unit of core concepts that describes reasoning in design and other professions.
2. Applying a specific agenda that creates special value is called "frame" in the design literature.
3. Metaphor is derived from the Greek word metaphora, which itself is derived from meta, meaning "beyond," and pherein, meaning "to win."

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