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Identification and Ranking of Concept Production Methods in Architectural Design, Using the Analytic Hierarchy Process (AHP)*

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ABSTRACT

The concept as an important section of the design process in the architecture industry has always been taken into consideration by domestic and foreign architecture research and literature. Therefore, the present study evaluated the process of creating a concept and its difference with synonyms, using a descriptive-analytical method and mathematical AHP, and identified the methods of creating concepts in architecture, using pairwise comparisons and a sample of 25 experts, and then determined the importance of each one through a field study. The results of research in the first phase of the study indicated eight methods for creating a concept. Therefore, creating a concept may be done using one of the following methods, analogy, metaphor, experience, symbolism, context, scheme, and scenario. The second phase of the study was conducted using paired comparisons and ranking analysis and indicated that, from the experts' views, there was almost a similarity in the importance of using concept methods in commercial and office complexes. Further, the three methods, analogy, metaphor, and theme, had higher weights and importance. Unlike concept creation in office and commercial complexes, the context method has the highest importance and weight in residential complexes. In these complexes, the metaphor method is as important as administrative and commercial complexes and among the first three most important methods.

Keywords: *Idea generation, Concept, Idea creation, Architecture, Analytic Hierarchy Process (AHP)*

Introduction

Design is essentially a mental prerequisite for any conscious activity. It is necessary to realize a conscious activity that can be transformed with different forms of imagination, rational categories (concept), and reasoning that allow it to change from a regulatory to a constructive nature (conditional and limited). The existence of concepts in design depends on the use of rules obtained from simple to complex relationships. This type of operation tends to organize events and data [1].

Visual thinkers seek to depict an imagination with the concept in their mind during the research stages, and thus it is vaguely evident that they develop the image and prepare its presentation. The present study evaluated the development and presentation of a concept that could be considered very crude or elementary in its initial stage. Design

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starts with a good or bad concept and is improved step by step by designers. Further, design and concept are elements of an inseparable whole that are combined. The design and construction of a special object and its experience by combining sensory, visual, and ultimately real concepts in different dimensions show a special shape. According to Susan Langer, "Design gives us forms of imagination and emotion altogether." [2].

The issue of concept also arises along with the design. The topic of concept or general idea, which is considered equivalent to initial volumes and etude models in the design process, generally refers to giving meaning to the architect's idea. In architectural design, an idea is a thought or notion that forms the basis of a design project and drives it forward. This idea defines the identity of a project and its constant development until the final stage.
Additionally, there was no study on the status and importance of each concept design method in different residential, administrative, or commercial buildings. Therefore, the innovation of the present study was to determine the importance and ranking of these methods in the buildings as they were not considered in previous studies.
To this end, attempts were made to answer the main question of what methods existed for creating and reproducing the concept in architectural design, while reviewing the existing literature and studies on the concept and its relationship with design. Moreover, determining the importance of different methods of concept production in designing offices, commercial, and residential complexes was also another objective of the present study.

2 -Literature review

2-1 -Concept and design

According to Kant, thoughts and concepts are formal and abstract tools by which we can arrange the concrete and material world [3].
Every creature has a form in the world. The face of creatures and their limitations determine their structures. These limitations have caused people to insist on shaping the objects that they produce, thereby enhancing their creativity. Nowadays, humans have reached a level of awareness and technology that can satisfy all of their needs over time. As Bilir states [4], it is accepted as the most advanced living organism in nature.
This act of creation or design, which we can also describe as a necessity, reflection, or human instinct, usually comes to the fore through needs and desire. In other words, design is an action that takes place to fulfill the requirements, and more importantly, it is a product that is obtained from an action. According to Çetinkaya [5], design is a problem-solving process.
There are many definitions for the word "design" in Persian dictionaries. In Dehkhoda's dictionary, design means drawing, planning, and the designer's job. In some Persian cultures, it is also defined as the concept of design by a designer. During the last half-century, there have been views and developments regarding the design methods and the process of architectural design, which can be introduced in three generations, analysis-combination, partnership methods, and design-test methods [6]. Despite changes in the design process models, idea generation and concept creation have always been considered the main parts of this process.

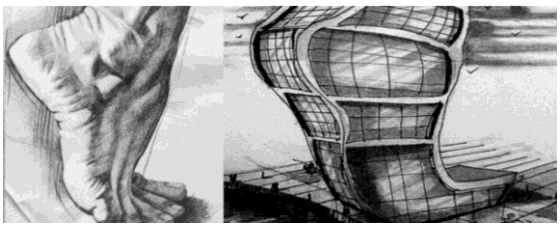

Figure 1: Concept and design

In terms of design, concepts prepare a suitable platform for the visual transition of abstract ideas. Therefore, this source creates the intellectual reference of architecture and is appropriate to clarify the concepts of image, theme, concept, and idea, and identify their differences and commonalities.

2-2 -Image and imagination

One of the most important mistakes in providing different definitions for concept and image as a concept is the use of the same or similar meanings and functions for these two concepts. Therefore, providing precise definitions for these two concepts can be an important onset for a better understanding of these two terms.
Image is etymologically related to death. The word "imago", which can considered to be the equivalent of image, is derived from the Latin imago [7]. According to the thinker François Dagogne, the image is what remains when the object disappears. Therefore, the meaning of image forms the visual dimension of a previously-known object or concept as a result of which a mental organization is understood without that object or concept and remains in mind. Therefore, the image in its simplest definition is the clarification of emotions and thoughts [8].
An image of the object moves in the space between the object and subject and is separated from the object or is reflected in it. The quality of

consciousness increases when this image reaches the subject. Therefore, this knowledge begins with imagination in humans and develops in human consciousness with mental interpretations. Further, the imagination is the source of this information [9].

2-3- Concept and idea

The idea is the primary and dominant thought of a plan and strategy to deal with it, while the concept deals with the meaningfulness of the idea and its realizability and is considered a tactic. If the idea is called a strategy, it can be expected that the concept will be followed as a tactic, and if the idea is a desired goal, the effort and path in that direction will be presented as a concept. A concept without an idea is stagnant, static, or it will not be created even in some cases [10].

In architecture, the idea makes the concept move. The concept is presented based on a predetermined idea. The architects' ideas are always based on their inner ideals but such an idea only exists in a virtual world and the architect's mind, and the concept constitutes the method for achieving the goal [11].

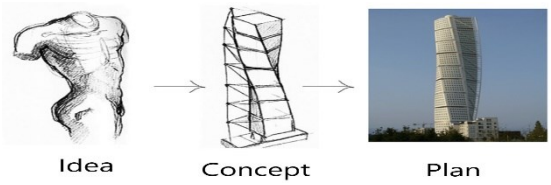

Figure 2: The relationship between concept, idea, and plan

2-4- The process of evolution in design methods

According to John Chris Jones, the evolution of design methods can be divided into four eras, technical and professional development, design with the help of drawing, systematic and systematic design, and design in the present era [12].

In a book by Wender and Vegan [13], the design was generally emphasized as a problem-solving activity in the first generation of models. In the second generation (second half of the 1960s to the middle of the 1970s), attention was paid to social solutions with the growing criticism of failures. During the third generation (the mid-1970s to 1980s), the design method movement was coming to an end. Alexander strongly opposed attaching the title of methodology to any idea. in the fourth generation since the 1990s, attention has been paid to information processing systems and decision support systems in design as a perspective. Therefore, in this new approach, the design process can include a hypothesis and its testing, but it cannot be expressed in a cause-effect relationship.

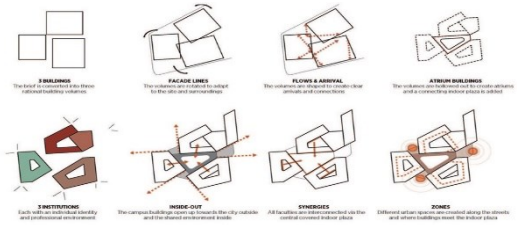

Figure 3: Types of design

3 -An overview of the research background

Cheraghi and Abedi [14] evaluated the idea and concept in design and examined the determinants of the creation of the "idea and concept" project. They theoretically evaluated the effects of the idea and concept on the architecture. Another descriptive-analytical study [10] explored the role of ideas and concepts in the knowledge process.

Naqipour [15] explored the design process in architecture from idea to concept and examined different types of concepts and their differences with ideas in the architectural design process after expressing different design methods in architecture and the design process in architecture. Ahmadi and Hadafi [16] evaluated the ideas and concepts in architecture, as well as the relationship between the design process and concepts. The results of this study proved that the idea was a primary and dominant thought of the project and a strategy to deal with it, while the concept dealt with making the idea meaningful and its realization and was considered a kind of method.

Eilouti [17] evaluated the concept in architectural design and defined it as "a mental map or internal blueprint" that determined meanings, connected components, increased creativity, and the design process to define a design-driven product. The relationship between design and concept is an important issue that was evaluated by Smith and Smith [18]. Interpreting various aspects of the design process and idea generation in design, they linked design activity to the concept formulation.

4- Research methodology

In the present study, we investigated, identified, and determined the importance of concept production methods in interior architecture design in a two-stage process, using an analytical-descriptive mix-methods approach and the Analytic Hierarchy Process (AHP). To this end, the necessary data for this study were first collected and analyzed using the desk method and the file scanning tool. In the second phase, the experts' opinions were collected by preparing a

questionnaire for pairwise comparisons of the importance and use of concept generation methods and presenting it to the experts, and the final ranking was done using a sample selection of 25 experts and engineers from architectural consulting companies in Tehran, who were qualified as architects based on the diagnosis of the national management and planning organization. Their opinions were collected using the Expert Choice software, and the importance of concept production methods was measured using the analytic hierarchy process (AHP).

The analytic hierarchy process (AHP) is a powerful and useful tool for managing qualitative and quantitative multi-criteria elements and it was developed by Saaty [19]. The analytic hierarchy process (AHP) is based on a hierarchical structure. This procedure is capable of applying sensitivity analysis to the criteria and sub-criteria. Additionally, it easily makes judgments and calculations because of pairwise comparisons. Moreover, it demonstrates the compatibility and incompatibility decisions which are the recompense of multi-criteria decision-making [20]. this method formulates the problem as a hierarchical and considers a mixture of quantitative and qualitative criteria as well. The first step is to create a hierarchy of the problem. The second step is to give a nominal value to each level of the hierarchy and create a matrix of pairwise comparison judgment [21].

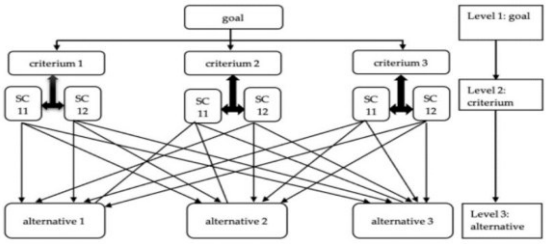

Figure 4: An example of a hierarchical tree

In the first stage, the issue and goal of decision-making are brought hierarchically into the scene of the relevant decision elements. Decision-making elements are decision indices and choices. The group established a hierarchy according to Figure 4 which reflects the problem.

In the second step, a questionnaire should be designed and distributed among the respondents (maybe managers, experts, users, etc.) to collect their opinions. It is noteworthy that each decision-maker enters the desired amount for each member, and then individual judgments (of each respondent) are converted into group judgments (for each pairwise comparison) using their geometrical mean. The scale ranges from one to nine in which one indicates that the two elements are the same or equally important. On the other hand, nine indicates that an element is extremely more important than the other in a pairwise matrix. The pairwise scale and the importance value attributed to each number are illustrated in Tables 2 and 3 as the samples of the questionnaire.

Table 1: A scale for pairwise comparison

Importance Intensity	Score	Description
Equal importance	1	Both activities equally contribute to the objective.
Moderate importance	3	Weak or slight importance over another – Experience and judgment slightly favor one activity over another
Strong importance	5	Greater or more essential importance when compared with another – Experience and judgment strongly favor one activity over another.
Very strong importance	**7**	Very high or demonstrated importance – An activity is favored very strongly over another; its dominance is demonstrated in practice.
Extreme importance	**9**	Extremely high importance – The evidence favors one activity over another with the highest level of certainty

Source: Adapted from [19] and [22]

The data analysis procedure involves the following steps: First, the pairwise comparison matrix, which is called matrix A, is extracted from the data collected from the interviews. The principal right eigenvector of the matrix A is computed as ‘w’.

The Eigenvector method is selected if aik. a kj=aij is not confirmed for all k, j, and I. The pairwise comparisons matrix cannot be used for normalizing columns to get Wi if the matrix is incompatible and in the case of incomplete

consistency. The eigenvector technique can be used for a positive and reversed matrix:

$$e^T = (1,1,\ldots,1)$$

$$W = \lim_{k\to\infty} \frac{A^k.e}{e^T.A^k.e}$$

To reach a convergence among the set of answers to the successive repetition of this process, the calculation should be repeated several times to make decisions while facing an incompatible matrix. Then, the following formula is applied to transform the raw data into meaningful absolute values and normalized weight w= (w1, w2, w3… wn):

$$Aw = \lambda_{max}\, w, \quad \lambda_{max} \geq n$$

$$\lambda_{max} = \frac{\sum a\,jwj - n}{w1}$$

$$A=\{a_{ij}\} \text{ with } a_{ij}=1/\,a_{ij}$$

A: Pairwise comparison
w: Normalized weight vector
λmax: Maximum eigenvalue of matrix A
aij: Numerical comparison between the values i and j
To validate the results of AHP, the consistency ratio (CR) is calculated using the formula, CR=CI/RI in which the consistency index (CI) is measured using the following equation [23].

$$CI = \frac{\lambda_{max} - n}{n-1}$$

5-Results

5-1 -The final definition of the concept

The theoretical principles of the research indicated that several definitions of "concept" can be found in the literature. These definitions cover a wide range of meanings, such as idea, concept, design, outline, system, figure, symbol, prototype, paradigm, abstract object, mental representation, description, solution, proposal, and part. Among these definitions, we can also define the concept as "The shape of an object, along with other representations, such as the properties or functions of an object, that existed, exists, or is possible in the human mind as well as in the real world. [24]. In summary, we can define the concept according to Il Oti (2017), as "a mental map or an internal blueprint that determines meanings, connects components, and increases creativity.

5-2- Concept and design

The concept is often associated with design which also has a wide range of definitions. According to a definition, the design activity is introduced as "a process by an agent to create characteristics of an object based on factors such as the environment where the object will exist, the goals attributed to the object, and the structural and behavioral conditions of the object. This opinion is implemented: Object properties (requirements), a certain set of component types (initials), and constraints that limit acceptable solutions" [25]. In this definition, the agent uses concepts as a means to initially connect the design to its environment to produce specifications that meet the set of goals. In this way, it represents the concept of a bridge between a process and a solution.

5-3 -Concept and creativity

The concept is often associated with creativity in designs. For example, Taura and Nagai [24] describe design creativity as a degree of conceptualization of an ideal. These researchers discuss two types of creativity in this field. The former relates to the design process, while the latter relates to the products that represent the results of the former. Similarly, Sternberg and Lubart [26] define creativity as the ability to produce work with novelty and relevance regarding the link between a process and a product. In this description, "capability" can be associated with the process, while "innovation" is more related to the product. These researchers also consider both sides and define concept generation as a process of combining a desirable concept towards the future. In addition to the element proportionality, which is also considered by Runco and Jaeger [27], the element "surprise" is also related to creativity in design and has a great impact on designs [28].

5-4- Concept creation process

This field is related to the implications and association of concepts. However, the concept is more intrinsic. This highlights the great act of concept evolution. The main focus of this field is on derivative processes, methods, and techniques of selection and conversion into products. These components are discussed in the following sections.

5-4-1- Concept production

Regarding concept derivation, Taura and Nagai [24] classified concept generation into two main phases, i.e. problem-oriented and internal sense-oriented phases. Cross [29] described the relationship between the two stages by defining concept emergence as a perceptual act leading to a creative leap or as a bridge between the design problem and its solution. Taura and Nagai [24] classified the two factors, i.e. the basis of concept generation and the ability that enabled the continuation of concept generation. Furthermore, Taura et al. [30] studied creative concept generation in designing and analyzed the patterns in the process that led to creative design ideas, were interwoven together, and caused significant effects.

5-4-2- Concept production methods

There are numerous scientific studies on issues related to the concept generation methods. Taura and Nagai [24] described three of these methods as follows respectively: 1) Feature mapping from one object to another, 2) Combination of two or more concepts, and 3) Concept integration in Thematic relations.

5-4-3- Concept production techniques

Concept generation techniques were the main concerns of Jensen et al. [31] who described six concept generation techniques as follows:

1. A modified 5-3-6 technique, indicating the morphological analysis of guided brainstorming. In this technique, repeated rounds of brainstorming sessions are organized. In each meeting, a team of six people comes together to solve a problem. Each member is asked to create three concepts to solve in the text and/or sketch in a short time of 5-15 minutes. The results of the first session are replaced within the team and each member revises the previous solution. This replacement is repeated if needed until new concepts begin to emerge.
2. Transformative design using mind mapping: This method produces new products by changing the existing states to provide new functionality.
3. Designing with an analogy technique, using the WordNet-based search method as a technique for the systematic classification of analogies based on the semantic representation of functions.
4. Far-field analogies: Search for cross-domain or far-field analogies that may use designs in one discipline to provide solutions in another discipline.
5. Principles of historical innovators: the implementation of creative principles taken from extraordinary historical innovators to make the concept of producing new product designs more informed.
6. Innovative Problem-Solving Approach: This approach includes a set of principles that can be used to inspire creative solutions to conflicts in a design based on the study of thousands of prior patents.

5-4-4- Concept evaluation and selection

Several studies have highlighted the concept evaluation and selection phase as a core design activity. Meanwhile, Toh and Miller suggested that the concept could be developed by brainstorming, selecting, and producing evaluation tasks. They found that improved quality resulted when concepts were produced by teams compared to individual products [32]. The concept selection process, which is based on the fulfillment of design goals and criteria, has been considered by several researchers as one of the most unavoidable and challenging tasks in designing for architectural engineers [33] Concept selection is described as a convergent process that includes evaluating proposals and selecting candidate ideas [34]. Even though several selection methods are primarily based on informal processes of concept evaluation and selection, other methods help designers make informed decisions during this process. A number of these concept selection methods are based on assigning feature values to each generated concept and then comparing and contrasting the concepts to reach an "optimal" solution to the design problem.

5-5 -Concept extraction methods

The production of a design concept represents the main motivation that guides the entire design process and affects different aspects and stages of the design. Therefore, it is recommended to start our work by extracting a concept parallel to the functional analysis of the problem in the design process. A concept can be extracted using the following one or more eight methods [35].

5-5-1 -Theme
This method starts by choosing a novel, story, film, painting, poem, or song to start and develop a concept. Subsequently, the subject elements are used to organize a topological layout of spaces and the aesthetic morphology of the building masses. For example, the entire plot may be based on "The Voyages of Sinbad" in which the sequence of voyages may be used to inform the order of spaces.

5-5-2 -Analogy
In this extraction method, a designer is asked to list keywords related to the typology, function, or philosophy of the project. Then, the designer is asked to think of shapes or forms related to the most inspiring keywords in the list and present his design. For example, if the project is a library, inspiration may come from things like different paper shapes, books, pens, or colorful magazines.

5-5-3 -Metaphor
Like the previous method, a list of keywords is required in this step. Analogy focuses on external appearance and forms, but metaphor focuses on meanings, implications, emotions, and implications. For example, users' definition of knowledge may evoke thoughts of enlightenment, exploration, or discovery in designing a library. Therefore, a concept may be first based on providing a lot of indirect light throughout the project to express knowledge as a source of light for minds. In the second and third stages, the design may combine linear paths of search/exploration and central spaces of discovery or finding. Consequently, the design should provide a strong contrast between elements that express mystery and elements, indicating the discovery. An example of design to model meanings was introduced in an experiment in which a chair was designed to represent sadness [36].

5-5-4- Experience
This approach emphasizes the experience that potential users of the building expect or want to live in. For example, a concept might highlight the transition from reality to dream after users enter the designated building. In another example, a design may be created, representing a journey into the future and taking users in a time machine to a future world of the next 100 years.

5-5-5 -Symbolism
In this method, a design links its elements to traditional, conventional, or cultural symbols. It uses memory language. For example, a library might use design elements of a temple to symbolize the sacredness of knowledge. Similarly, it may use domes, minarets, and/or religious decorations associated with sacred buildings to convey a sense of holiness. In some cases, the number of elements such as the number of galleries and minarets of Sulaymaniyah Mosque is used to symbolize certain people [37].

5-5-6- Context
Design ideas may be taken from direct or indirect design contexts to harmonize or contrast with the surrounding environment. Context can be geographical, temporal, or cultural. For example, if the desired building is in a historic district, a design plan may take its cues from the historical background of the project's urban environment or present a style that is completely different from the plan as a stand-alone plan with a unique identity.

5-5-7- Scheme
In this method, the main driver behind the design curtain is based on geometry, materials, technology, landscape, or a combination of different concepts, for example, a design that manipulates, triangles, or circles in various transformations, i.e. scales, translations, and rotations. Second, it may create compounds that are completely made of clay or recycled materials. Third, a project may be based on the interaction between users and space by providing responsive views that use technology and artificial intelligence to interact with users. Fourth, the entire project may use interior landscaping elements such as vegetation and water to define spaces and connect constituents. Fifth, two or more existing concepts may be merged to produce a new combination [38].

5-5-8- Scenario
The scenario is considered a "what if" simulation method. The design may begin by

envisioning a major event that occurs in the building. For example, in the design of a shopping center, a scenario can be interpreted as an annual shopping festival with competitions and prizes. This scenario requires the design of fields that accommodate community and social interaction. It also requires efficient design of easy access, smooth circulation, clear output, and memorable direct solutions.

5-6- Prioritizing the importance of concept production methods in commercial, office, and residential complexes from the perspective of Iranian designers

According to the findings of the first research stage on eight methods of concept extraction, the results of the second phase are presented based on AHP. According to the results of a pairwise comparison of experts' opinions, the pairwise comparison matrix of concept extraction and production methods is presented separately for office, commercial, and residential complexes according to the following table.

Table 2: A pairwise comparison matrix of the importance of concept extraction methods in administrative complexes

Methods	Theme	Analogy	Metaphor	Experience	Symbolism	Context	Scheme	Scenario
Theme	1	17.2	2.21	2.38	2.46	1.45	1.12	2.34
Analogy	0.815	1	1.20	2.29	1.77	1.23	2.28	2.78
Metaphor	0.904	0.579	1	1.39	2.68	1.19	0.760	1.99
Experience	0.771	0.408	0.240	1	1.45	1.29	1.06	1.60
Symbolism	0.722	0.505	0.389	0.917	1	0.112	0.580	0.890
Context	0.616	0.537	0.469	0.651	0.840	1	0.531	0.690
Scheme	0.868	0.561	0.329	0.369	0.727	0.401	1	0.793
Scenario	0.669	0.102	0.290	0.419	0.698	0.619	0.102	1
Sum	6.415	6.402	6.127	9.416	11.625	7.292	7.433	11.983

Source: Research findings

Table 3: The normalized matrix of importance of concept extraction methods in administrative complexes

Methods	Theme	Analogy	Metaphor	Experience	Symbolism	Context	Scheme	Scenario	Weight	Rank
Theme	0.248	0.138	0.230	0.276	0.190	0.176	0.278	0.320	0.21%	**3**
Analogy	**0.287**	**0.249**	**0.289**	**0.239**	**0.189**	**0.218**	**0.290**	**0.329**	**0.27%**	2
Metaphor	0.358	0.238	0.330	0.376	0.290	0.276	0.379	0.189	0.31%	**1**
Experience	**0.219**	**0.161**	**0.183**	**0.191**	**0.172**	**0.148**	**0.219**	**0.180**	**0.12%**	6
Symbolism	0.269	0.129	0.160	0.159	0.193	0.150	0.139	0.168	0.08%	**7**
Context	**0.220**	**0.190**	**0.170**	**0.230**	**0.182**	**0.219**	**0.199**	**0.279**	**0.19%**	4
Scheme	0.195	0.181	0.213	0.182	0.191	0.159	0.179	0.212	0.16%	**5**
Scenario	**0.212**	**0.133**	**0.140**	**0.139**	**0.179**	**0.145**	**0.148**	**0.123**	**0.06%**	8

Source: Research findings

According to Table 3, among the methods, the metaphor method (with a weight of 0.31%), analogy (with a weight of 0.27%), theme (with a weight of 0.21%), context (with a weight of 0.19%), scheme (with a weight of 0.16), experience (with a weight of 0.12%), symbolism (with a weight of 0.8%), and scenario (with a weight of 0.06%) are respectively the most important methods used in concept generation methods in office complexes.

Table 4: A pairwise comparison matrix of the importance of concept extraction methods in commercial complexes

Methods	Theme	Analogy	Metaphor	Experience	Symbolism	Context	Scheme	Scenario
Theme	1	2.321	2.47	2.169	2.69	2.93	2.791	**2.99**
Analogy	0.981	1	0.784	0.783	0.790	0.857	0.834	**0.948**
Metaphor	0.852	0.539	1	0.654	0.934	0.918	0.967	**0.978**
Experience	0.912	0.428	0.898	1	0.856	0.885	0.799	**0.852**
Symbolism	0.878	0.561	0.931	0.861	1	0.923	0.971	**0.830**
Context	0.859	0.412	0.779	0.511	0.812	1	0.865	**0.996**
Scheme	0.799	0.546	0.839	0.567	0.804	0.860	1	**0.858**
Scenario	0.882	0.419	0.890	0.379	0.799	0.919	0.849	**1**
Sum	7.163	6.222	8.591	6.924	8.685	9.292	9.076	**9.452**

Source: research findings

Table 5: The normalized matrix of the importance of concept extraction methods in business complexes

Methods	Theme	Analogy	Metaphor	Experience	Symbolism	Context	Scheme	Scenario	Weight	Rank
Theme	0.266	0.230	0.253	0.188	0.157	0.250	0.241	0.166	0.27%	**3**
Analogy	0.289	0.251	0.279	0.197	0.179	0.278	0.280	0.198	0.34%	**1**
Metaphor	0.255	0.212	0.249	0.155	0.141	0.232	0.220	0.151	0.22%	**4**
Experience	0.279	0.249	0.268	0.195	0.168	0.266	0.259	0.185	0.29%	**2**
Symbolism	0.240	0.189	0.220	0.161	0.130	0.212	0.189	0.156	0.17%	**5**
Context	0.201	0.191	0.156	0.162	0.127	0.178	0.120	0.09	0.09%	**7**
Scheme	0.220	0.172	0.210	0.171	0.146	0.158	0.174	0.112	0.11%	**6**
Scenario	0.19	0.09	0.142	0.11	0.08	0.21	0.07	0.11	0.05%	**8**

Source: Research findings

According to Table 5, among the methods, the analogy method (with a weight of 0.34 %), experience (with a weight of 0.29%), theme (with a weight of 0.27%), metaphor (with a weight of 0.22%), symbolism (with a weight of 0.17%), scheme (with a weight of 0.11), context (with a weight of 0.9%), and finally scenario (with a weight of 0.5%) were the most important methods used in extraction and production of concept for commercial complexes. A comparison of the results with the findings in Table 3 indicates a great overlap in methods for concept design in office and commercial complexes and three methods of analogy, theme, and metaphor with different weights, but they are used almost together. In addition, the scenario method is ranked last

(eighth) from the point of view of usage in every type of concept design.

Table 6: A pairwise comparison matrix of the importance of concept extraction methods in residential complexes

Methods	Context	Analogy	Metaphor	Experience	Symbolism	Theme	Scheme	Scenario
Context	1	4.91	2.572	2.97	2.62	2.77	3.12	**3.31**
Analogy	0.818	1	1.850	2.61	1.869	2.49	2.47	**2.78**
Metaphor	0.910	0.984	1	1.95	2.01	2.22	1.56	**1.99**
Experience	0.778	0.781	0.899	1	1.12	1.55	1.05	**1.69**
Symbolism	0.823	0.895	0.889	0.925	1	1.78	0.79	**1.89**
Theme	0.590	0.899	0.967	0.634	0.899	1	0.739	**0.79**
Scheme	0.789	0.895	0.729	0.762	0.789	0.889	1	**0.88**
Scenario	0.672	0.911	0.671	0.891	0.697	0.912	0.893	**1**
sum of columns	6.380	11.275	9.577	11.742	11.004	13.611	11.622	**14.33**

Source: Research findings

Table 7: A normalized matrix of the importance of concept extraction methods in residential complexes

Methods	Context	Analogy	Metaphor	Experience	Symbolism	Theme	Scheme	Scenario	Weight	Rank
Context	0.19	0.11	0.09	0.105	0.141	0.181	0.05	0.14	0.06%	**8**
Analogy	0.261	0.188	0.168	0.173	0.142	0.187	0.156	0.149	0.19%	**4**
Metaphor	0.281	0.209	0.191	0.197	0.167	0.251	0.151	0.160	0.27%	**2**
Experience	0.19	0.156	0.143	0.151	0.129	0.161	0.123	0.09	0.09%	**6**
Symbolism	0.270	0.191	0.176	0.182	0.151	0.211	0.130	0.152	0.22%	**3**
Theme	0.296	0.219	0.220	0.182	0.179	0.267	0.169	0.171	0.30%	**1**
Scheme	0.21	0.168	0.169	0.160	0.194	0.158	0.111	0.148	0.11%	**5**
Scenario	0.15	0.122	0.119	0.129	0.140	0.171	0.07	0.16	0.07%	**7**

Source: Research findings

The results of Table 7 also indicate that among the desired methods, the theme method (with a weight of 0.30), metaphor (with a weight of 0.27%), symbolism (with a weight of 0.22%), analogy (with a weight of 0.19%), scheme (with a weight of 0.11%), experience (with a weight of 0.09%), scenario (with a weight of 0.07%) and finally the experience (with a weight of 0.06%) are the most important methods in extracting and producing concepts respectively in residential complexes. A comparison of these results with findings of the methods in concept design in office and commercial complexes indicates that metaphor is the only method among the first three methods. In residential complexes, the importance of concept production methods is almost noticeably similar to the previous two approaches. For example, the metaphor method ranks second in concept design in residential complexes, and first in designing office complexes. Similarly, the design and scenario methods are almost the same and ranked seventh or eighth in the concept design of all the complexes. Despite these similarities, a closer look indicates that the importance of concept design methods in office and commercial complexes is closer to each other. Despite the similarity in their importance and ranking, concept design in residential complexes due to the type of use and

necessary spaces are somewhat different from office and commercial complexes.

Table 8: A comparison of ranking the importance of concept production methods in designing office, commercial, and residential complexes

The main methods	Office complexes		Commercial complexes		Residential complexes	
	Weight	Rank	Weight	Rank	Weight	Rank
Theme	0.21%	3	0.27%	3	0.06%	**8**
Analogy	0.27%	2	0.34%	1	0.19%	**4**
Metaphor	0.31%	1	0.22%	4	0.27%	**2**
Experience	0.12%	6	0.29%	2	0.09%	**6**
Symbolism	0.08%	7	0.17%	5	0.22%	**3**
Context	0.19%	4	0.09%	7	0.30%	**1**
Scheme	0.16%	5	0.11%	6	0.11%	**5**
Scenario	0.06%	8	0.05%	8	0.07%	**7**

Source: Research findings

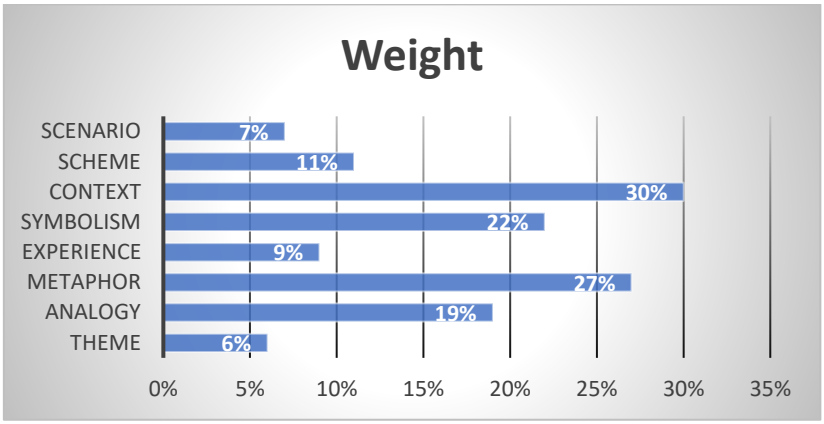

Diagram 1: Prioritization of concept production methods in terms of application rate in Iran using AHP

Finally, the compatibility rate is calculated to ensure the results of this method. The compatibility rate is a measure that shows how much the priorities resulting from pairwise comparisons of experts can be trusted. If this rate is smaller than 0.1, the compatibility rate is acceptable, otherwise, the comparisons should be repeated and revised. Table 9 presents the results of these calculations. According to the results, the CR rates are less than 0.10 in all three administrative, commercial, and residential complexes. Therefore, the pairwise comparison matrix of the importance of concept design methods in the triple complexes is completely compatible with the experts' opinions.

Table 9: Compatibility rate of experts' judgments

The importance of concept production methods in complexes	CR	CI	λ max
Office complexes	0.0120	0.0021	**3.59**
Commercial complexes	0.0171	0.0019	**3.80**
Residential complexes	0.0138	0.0069	**3.06**

Source: Research findings

6 -Discussion and conclusion

Understanding the process of creating a concept in architectural works is a subject that sometimes confuses those interested due to the

confusion of concepts arising from multiple perspectives. The results of the investigation in the first phase of this study indicated that design referred to the process of creative thinking along with the product. In other words, it is not only the result but also the meaning of a process. In short, design is a problem-solving process. Regarding design, the concepts prepare a suitable platform for the visual transition of abstract ideas. Therefore, this source forms the intellectual reference of architecture. The use of the same meanings and functions for similar words is an important mistake in providing different definitions for concepts and these words as a concept. However, there is an important difference between them. Examining the available sources indicates that the creation of a concept may be done using one or more of the eight main methods, theme, analogy, metaphor, experience, symbolism, context, scheme, and scenario.

The results of the second stage of this research also indicate that there is almost a close similarity in terms of the importance of using concept methods in administrative and commercial complexes from the experts' point of view on design and architecture. Among the eight main methods of concept design, three methods (analogy, metaphor, and theme) have more importance and weight. In residential complexes, unlike concept production in office and commercial complexes, the context method has the highest importance and weight. In these complexes, the metaphor method is also as important as administrative and commercial complexes and is among the first three most important methods.

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