Addition and subtraction as a valuation mechanism for valuable buildings

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Abstract. The architects argue in the ways and mechanisms of determining the valuable buildings and how it is possible to infer the uniqueness of single building from others according to the value of that building, mainly based on the form and composition, so researchers proceeded to the duality of addition and subtraction to read, evaluate and critique valuable buildings, hence the research problem appeared in the scientific need to detect the role of addition and subtraction within the evaluation of the uniqueness of valuable buildings and features of the achieved product within the two and three-dimension levels.

The aim of the research is to clarify the cognitive perception about the nature of uniqueness and its characteristics in the case that the building accepts addition and subtraction within the framework of evaluation and architectural criticism and in the context of applied verification. Most important conclusions clarified that the use of the addition and subtraction is a double-edged sword, it may serve to enhance the uniqueness of the product generated by this process of the original building, or it may serve to weaken it and thus strip it of the characteristic of uniqueness that it previously had.

Keywords: valuable buildings, additions and subtractions, evaluation and criticism, uniqueness.

1. Introduction
In the recent period, many valuable buildings have obeyed to addition and subtraction processes for the purpose of re-employing or using it, which makes it more suitable for the roles and functions that it occupies, and since the importance of the duality of addition and subtraction as one of the main and important concepts in creating the architectural product, however, its use in valuable buildings in general and in museum buildings in particular, through the merging process between the old and the new, it may carry the attribute of the beautiful and may increase the characteristic of the uniqueness of that building and may make it more likely to lose that attribute based on what is caused in the composition system of the original building. Hence, the research problem emerged in the scientific need to detect the role of addition and subtraction within the evaluation of the uniqueness of valuable buildings and features of the achieved product within the two and three-dimension levels.

The aim of the research was to clarify the cognitive perception about the nature of uniqueness and its characteristics in the case that the building accepts addition and subtraction within the framework of evaluation and architectural criticism and in the context of applied verification. The research adopted
several procedures to achieve the goal of the research and solve the research problem by structuring the theoretical framework and selecting application samples for museum buildings of different value as a case study, leading to conclusions and recommendations.

2. Conceptual framework
The conceptual framework can be summarized as:

2.1. Concept of value
Value is one of the philosophical concepts that can be described as the controlling criterion of the degree to which human accepts his surroundings according to his desires and needs. The value is a relative influence that depends on the nature of the recipient, the conditions that make up his personality, and the temporal and spatial circumstances. Also, most forms of value are not acquired by the building during its design, but rather by the passage of time [1].

2.2. Valuable buildings
Can be defined as buildings that bear the civilizational characteristics of a society, which are the homogeneous cultural spheres that are rich in a set of heritage particulars under the name of the law for the protection of antiquities and contain static and dynamic values indicating the characteristics of society where we find the urban values and architectural characteristics as well as habitus, traditions and heritage attributes [2].

Furthermore, Elttony defined it as areas of historical or architectural importance, which are often characterized by a strong concentration of buildings of cultural value, as well as the richness of its architectural and urban heritage contents from the rest of the city [3]. UNESCO defines valuable buildings "as a group of buildings and spacious squares and includes archaeological sites that form a human settlement in an urban or artistic environment, and its value is recognized from the archaeological, urban, historical, aesthetic or socio-cultural aspects" [4].

Consequently, an operational definition can be given to the valuable buildings as that building or facility characterized by one or more historical, symbolic, artistic, urban, social or cultural values, these values may be fixed or variable depending on the change of time and the surrounding environment, and it indicates the characteristics of society and carries within it its civilizational characteristics.

2.3. Attributes of valuable buildings
UNESCO referred to the most important attributes of heritage buildings and facilities or of distinct architectural styles [5], which are:

- Community acceptance of it, meaning that it enjoys acceptance and positive interaction from the community to allow it to continue.
- That it be a cultural and social phenomenon that expresses physical, moral or intellectual phenomena in a specific period of time.
- Constant and continuity, that is, its condition allows for its continued existence and the possibility of dealing with it.

2.4. Forms of value in valuable buildings
Valuable buildings have many forms of value, as the presence of value is one of the most important reasons for its preservation. There are many forms of value, such as aesthetic, architectural, urban, historical, and natural value, and the continuity of the cultural memory of societies as heritage value [6]. Rypkema believes that the main justification for preservation is that these buildings are still vibrant with vitality, as it still forms a various symbolic and intellectual values for its communities, which is one of the most important justifications for preservation [7].

2.5. Principles of selecting valuable buildings
These principles can be summarized as: [8].
• That the environment is a popular product resulting from collective awareness.
• That this environment has historical roots with continuity, which through its traditions are inherited.
• That these buildings contain architectural significance or one of the forms of values referred to above.

2.6. Types of valuable buildings
The types of buildings, whose value differs from the other, can be summarized as follows: [6].

- Archaeological buildings included in the Antiquities Registration Lists.
- Buildings built by some famous architects (locally or internationally) and became part of the architectural heritage, such as the Waterfall House of Frank Lloyd Wright in America.
- Buildings that represent an era or stages with value and are considered a record of it (this may be through the style of construction, design, shape of buildings, or the shape of decorations).
- Buildings that reflect the traditional local architecture of somewhere region and are a perfect example of it, carries all its values and represent its own character.
- Buildings that have a symbolic value because of its correlation with the history of peoples (as it was the scene of important historical events), or because of its correlation with the history of people who were of special importance.

3. Extracting the theoretical framework
In order to extract the theoretical framework, we will discuss the most important concepts and literature reviews related to this topic, as follows:

3.1. Addition concept
Adding an architectural element to the building: The addition process takes two forms; it may be compatible with the valuable building so that it is difficult to distinguish between the old and the new, and it may be elements of new architectural forms that differ from the original building in materials or constructing style to a degree that reaches contrast but achieves integration with the site as a whole [6]. And that the additions, including some that are correlative and separate with the original form, by the intervention or through a linking element of the separated addition, as the features of the original form is preserved and its identity, and that this addition is some basic and some other secondary, meaning that some of it are important for functional performance and the other for aesthetic performance and others for functional and aesthetic performance [9], so the new addition does not mean intercalate the new to the existing one, the existing one works as an integrated system that is, what is added enters the system and loses its balance, so, it interacts with it in another way that is more complex and adapts with it and the additive becomes part of this place and the product is always that remains and is renewed [10].

3.2. Addition in the design product
The addition in the architectural product, as does the addition in the scientific and artistic product, refers in general to the architectural products and their various intellectual and physical dimensions, this is a clear in contemporary architectural studies - global and local - through its definition of addition in the architectural product, as Byard defined the addition by referring to complex works as "a new architecture added to an old architecture to meet the need for change and to suit the growing needs, thus generating a new complex identity expresses new meanings" [11]. Safou (2001) referred to the addition as "a design strategy for adding a new entity to another that already exists, in a specific manner, and in the context of a certain style towards issues of form and content - meaning" [12].

The study of Mosesian (2001) confirmed in its general definition of the expansion of buildings of historical value as "adding a new physical entity to an old physical entity that carries a historical value with a contradictory intellectual and physical correlation, whether or similar ... in a way that
constitutes an integration of the existing origin, and the expanded part on the expressive and functional level within a specified time dimension, and realizing originality through the process of renewal and creativity” [13].

It can be referred to as the most important concepts indicated by the term of addition: [14].

- Indication of the existence of two parties, the additive and the original, that is, the presence of something existing and something new added.
- Indication of the correlative relations between the two parties, which are controlled by specific principles such as tilt and backing- approximation - sticking.
- Indication of the importance of addition in meaning, as the meaning changes in the final composition.
- Indicating the increased production, growth, expansion and correlation, as a result of the act of addition.

The addition means adding a geometric shape to another vertically and horizontally, so that the resulting mass is at the end one continuous, and compound unit, taking into account the participation of both of the two masses in one base as if they share one vertical or horizontal axis, or both, and horizontally compound shapes are produced by adding cylinders or their halves or cuboids to another, so that it is a solid mass or with open yards [15].

3.3. Subtraction

It is a procedure performed by the designer to manipulate the shape, and it is a concept from a set of concepts that are used in the design process such as repetition, segmentation, folding, overlapping and addition [16].

Subtraction is a group of presenting treatments by excluding excess and sterile forms, and taking care of the meaning in it, without moving the significance to another meaning [9]. That meaning, the designer deletes the shapes or events that are innumerable in structural and construction relationships, that is, everything that has no significance in the form satisfying functional needs through subtraction and simplification, as the basic shapes must be used and depend on the separation and attribution of the functional value of the elements instead of the complexity, movement diversity and superposition [17].

Subtraction from the form forces the recipient to visual participate in the addition, and his attempt to return the form to its complete origin [18] and that the subtraction is a method that the designer often intends in dealing with design shapes as he resorts to subtraction to express the content of his ideas which are related to the determinants of the function, which is important because it fulfills a specific function whose role is determined by the shape "the shape of the form that follows the function, confirms it, clarifies it and makes it realistic" [19].

3.4. Addition and Subtraction

This approach means the formation of a unified block by deleting parts of it, and adding complementary, or adjacent blocks to it, such as GWATHMEY RESIDENCE, NEW YORK, which is a repeated trend in Islamic architecture to create a unified mass formation without the tendency to simplify. This addition and subtraction, and what we can call the positive and the negative give a contradiction in the form treatments, and this treatment has become a distinctive sign of the contemporary architectural formation in the combination of the two extremes, and the addition and the subtraction may be overlapping [20]. Based on the above, the nature of the effect of addition and subtraction in the formative system of the original building can be clarified, as shown in figure 1.
3.5. Addition, subtraction and evaluation
Evaluation: includes giving or relating a value to the architectural work, for example, saying the work is good, excellent, and bad or something else. Through it, the location of the work and its value are defined related to the closest intellectual direction that it simulates or the style that it represents, or perhaps new constants for a new style are specified [21]. Evaluation is to confirm the value or merit of the artwork to help others to form an idea about it [22].

The duality of addition and subtraction is one of the important concepts and assistance in evaluating and criticizing any building that needs reuse and making it more suitable for the roles, and functions it occupies, and this is done by comparing the original building before and after the addition and subtraction process, and thus the extent to which the characteristics of the generated product as a result of this process are achieved with the product original or not. Comparison is the main evaluation tool, which is carried out on two levels; comparing the building with other buildings follows the same theoretical approach with the aim of evaluating the building regarding its efficiency in expressing the theoretical approach it adopts, and comparing the building with the quality of buildings similar to it in the function to evaluate the building concerning its efficiency in achieving the functions, and requirements [23].

3.6. Addition, subtraction and architectural criticism
The critic must be an expert in the design process and in the mechanisms of architectural formation, including the mechanism of addition and subtraction, he (she) has knowledge experience in the field of arts, aesthetic and philosophical theories. The judgment of the critic depends on thinking, extrapolation, analysis and interpretation, to make the recipient aware of the value of the artwork, which means that the critic sometimes depends on the designer's personality and objectivity during the criticism process of buildings.

The function of the architectural critic is analytical and evaluative, it includes making judgments, and thus it covers all aspects of the effectiveness of criticism [24]. The study of Ibrahim (1987)
mentioned that criticism in general is concerned with many tasks, but it is most important tasks are the task of interpretation and judgment [25]. Task of any critical process is mainly limited to interpreting and explaining the artwork and clarifying its symbols, leading to judging it, its quality, and its position among other artworks [26]. Therefore, architectural criticism is practice (theory and implementation) of the architect's role in evaluating architectural products. The evaluation is carried out according to the scientific and practical architectural background, the acquired experience and affected by old and modern architectural concepts. The concepts of addition and subtraction can be considered, one of tools that help the architectural critic to use it as a critical mechanism in determining the criteria that enable him to evaluate, read and critique architectural products, including in this paper, valuable buildings.

3.7. Uniqueness

It is a concept that expresses a characteristic, attribute, or group of properties of a thing from another that is, it gives it existence. The unique thing is a separate and connected individual through which a distinction is made between one thing and another [27].

Jencks expresses the unique architecture as a constructed meaning that reveals what we believe in or at least what we wish to do more for it, it definitely expresses what we want, it is that malleable and reflective of our system of beliefs, habits and ways of life [28].

Sterr (1994) indicates that the uniqueness is the characteristic of a different, better, and unusual product, referring to Palladio's creative work by collecting contradictions and transmitting civilized symbols from his function level to another level in a new way, and that by adopting the Roman temple as a model for dwelling, thereby raising the form of the dwelling to a new symbolic suggestive level [29]. Al-Bazzaz (1999) mentioned that the uniqueness is in the expression of its unified essential characteristics in its fragmented form [30], and it occurs in two main aspects that are the characteristics of uniqueness:

- Formation characteristics: it is a variable and transformed characteristics.
- Intellectual characteristics: that represents the constant characteristics.

Al-Najidi's studies mentioned that the uniqueness of the architectural work begins with its idea, as for the form, it captures this uniqueness with the accuracy of its expression, this link between the idea and the form is what distinguishes the architectural propositions as in post-modern and deconstructive architecture, as it saw in the form a means of expression and not an objective in itself [31].

Thus, we can express the uniqueness as an operational definition: that it is the attribute of a product that carries different, unusual, and formation characteristics characterized by novelty, creativity, and expressing intellectual characteristics resulting from a new reading of the relationships and organizational bases of the structure of the subject that carries it by shifting thought towards a specific context to express another context to impart a uniqueness characteristic on the product, the idea, and the scope of its application.

3.8. The effect of addition and subtraction on the concept of uniqueness

The uniqueness of the form, which confirms that form is a means of transporting a message, displaces thinking about the origin of the novelty from the form to the message itself. The source of innovation in the form resulting from addition and deletion is not the scope of the form, but it is related to the novelty of the idea to be expressed, it concerns the relationship between the idea and the form. A new form is a form of a new idea [31]. That is, the new form generated by using the addition and subtraction into the valuable building, will certainly generate a new idea that may strengthen the previous idea of the valuable building form and may weaken its idea, and surely, creating a new form is creating a new significance. The process of creating the new signifier is a process of displacing the previous signifiers with assumed directions that are similar to the adopted shift of the new meaning from the previous meanings associated with those signifiers, meaning that the use of addition and
subtraction in the valuable building will generate new significance that may displace the old significance of the valuable building, thus losing the characteristic of uniqueness for that building, or may enrich the previous significance of the valuable building, and thus, increase the uniqueness of that building.

The process of shifting the signifier in this context is a procedure of changing the shape towards undefined ends, the direction of the shift is similar and expresses the directions of displacement between the previous meaning and the new meaning, and what is to be discovered and defined is the new signifier (form) only [31].

3.9. Literature review
A set of architectural literature reviews will be analyzed that dealt with the possibility of using different mechanisms to reuse valuable buildings and evaluate the achieved product according to those mechanisms. Based upon, studies related to this matter can be addressed as follows:

The study of Al-Atabi and Al-Shahmani (2019) referred to the effect of using technology in reusing historical buildings of symbolic value and applying this to Al-Akhaider Fort. It aims to study the relationship between technology and the strategy of re-use of buildings and access to the mechanisms followed by technology and thus the possibility of its implementation in historic buildings of symbolic value, that is, the possibility of adding technology as an evaluation mechanism for valuable buildings, in general, to reuse it and thus, give an idea about the characteristics of the product achieved after adopting and using the concept of technology. The study also mentioned that the measurement of the building’s value depends on the temporal and symbolic indicator, and that the latter depends on the uniqueness and rarity of the building, its history, its functional importance, etc. One of the important conclusions reached by the study is that dealing with valuable buildings, and evaluate it is subject to total or partial change or specific additions that depend on the moral and physical value of the building on the one hand and the nature of the proposed new function on the other hand [32].

While the study of Clarke, Kuipers, and Stroux (2019) mentioned that continuity and change are important issues for the built environment in general and buildings of heritage value in particular, that requires new educational viewpoints, opinions, and tools, and thus the ability to address the dilemmas that come with design tasks for adaptive reuse. The study confirms the adaptive reuse of valuable buildings within the heritage speech and the education of architectural design in a general, and provides insight into educational methods, tools, and its uses, as the study provided a new educational experience to merge the values carried by the heritage buildings into the architectural design process for graduation studios H&A. These studios are open to international students with a Bachelor’s degree in Architecture, and to discover those values, a strong emphasis is placed on the analytical phase, during which interconnected analyzes are made about aspects of the architectural, technological, cultural and heritage values of a building, or site and its urban, topographic, and geographical context. The study found how to evaluate buildings of heritage value in a practical manner in the planning context and decision-making, and that the effective evaluation of buildings of heritage value is an integral part of design education for future architects as it contributes to the design process and reuse of proposals in a positive way, even when not fully understand some of those values [33].

As the study of Al-Muqarm, Al-Dabbagh, and Al-Bahadli (2016), it highlighted the importance of the concept of adaptation to reuse in general, and its role in buildings of particular value through a change in the movement system, as the study aims to define the characteristics, and procedures of the concept of adaptation to reuse through a change in the movement system and identifying possible means and methods for re-evaluating and using valuable buildings. That is, the possibility of employing adaptation by re-use through a change in the movement system and the change is mean to subtract and add in the paths of movement and adopt it as a mechanism in evaluating valuable buildings, and thus, reuse it properly and create a perception about the achieved product after subjecting it to the concept of change in the movement system as a basic variable in the process of adaptation by re- the use. Perhaps one of the important conclusions reached by the study is; The diversity of adaptation between form, function and behavior depending on its impact by a set of
factors, including attraction factors that depend on compatibility with the context, and some push factors that depend on internal relations, so the building must be flexible to face all changes and meet the appropriate performance, whether to change the function or remain on the same function, through recomposing the building internally or externally to suit the need and with the requirements of the owner and occupants, in addition, to provide the building with a longer and more useful life, with the need to preserve the building, its uniqueness, and the value it owns [34].

After discussing and analyzing architectural literature reviews and introducing the most important aspects thereof, it becomes clear that these studies have dealt with many aspects regarding: The possibility of adopting modern technologies and adding it as an evaluation mechanism for valuable buildings in general to reuse it and thus, give an idea about the characteristics of the product achieved after adding and employing these technologies, or regarding the possibility of using adaptation to reuse through a change in the movement system (subtraction and addition in the movement paths) and adopting it as a mechanism in evaluating valuable buildings, and thus reusing it properly and create a perception about the achieved product after subjecting it to the concept of change in the movement system as a fundamental variable in the process of adaptation to reuse, or regarding the possibility of effective evaluation of buildings of heritage value as an integral part of design education for architects, as it contributes to the design process and reuse of proposals in a positive way, even when some of those values are not fully understood.

Based on what was previously discussed within the conceptual and cognitive framework and the most important architectural literature reviews that dealt with the adoption of various mechanisms according to the concept of addition and subtraction to reuse valuable buildings, and thus, give a perception about the characteristics of the achieved product, therefore we can extract the primary and secondary indicators of the theoretical framework and its possible values for the duality of addition and subtraction and its impact on the uniqueness of the valuable buildings, as shown in table 1.

| Primary Indicators | Secondary Indicators | Possible Value | Code of possible value |
|--------------------|----------------------|----------------|------------------------|
| Form after addition and subtraction X1 | A form that matches with the valuable building X1.1 | It is difficult to distinguish between old and new form | X1.1.1 |
|                    | A form that contrasts with the valuable building X1.2 | Elements with new architectural forms that differ from the original building in form, material or color | X1.2.1 |
|                    | A form that harmonizes with the valuable building X1.3 | It harmonizes to form, material, or color | X1.3.1 |
| Type of addition X2 | An addition correlated with the valuable building X2.1 | It changes the features of original form and effects on its identity | X2.1.1 |
|                    | An addition separated from the valuable building X2.2 | It preserves the features of original form and identity (if achieved, it takes a weight of 1.5 instead of 1 for its importance) | X2.2.1 |
| Importance of addition and subtraction X3 | In terms of achieved performance X3.1 | Achieving a functional necessity | X3.1.1 |
|                    | In terms of achieved performance X3.1 | Achieving an aesthetic necessity | X3.1.2 |
|                    | In terms of achieved performance X3.1 | Achieving a functional-aesthetic necessity (if achieved, it takes a weight of 2 instead of 1 for its importance) | X3.1.3 |
| Dimensions generated by addition and subtraction X4 | Intellectual | General intellectual content | X4.1.1 |
|                    | Dimensions X4.1 | Special intellectual content | X4.1.2 |
|                    | Physical dimensions X4.2 | Physical content related to the nature of element forms from addition and subtraction. | X4.2.1 |
4. **Practical study**  
Three famous museums were chosen as case studies of a nature consistent with the concept of valuable buildings that were subject to addition and subtraction, and among many various examples that have the same nature, as these cases were distributed among global examples, and does not mention for a
local example due to its unavailability. The selection of these three cases was based on important criteria, which are:

- Specifying the belonging of samples to one category, namely museums, as they are of a nature consistent with the concept of valuable buildings, in addition to the availability of a wide range of valuable museum buildings that have been subjected to addition and subtraction as samples that can be studied and researched.
- There is diversity in the forms which were generated as a result of addition and subtraction between samples, this diversity may match the museum building of value and may contrast or harmonize with it.
- There is diversity in the method of addition and subtraction through the treatment ways resulting from it, which may be correlated at times to the building or may separate from it at another time.
- There is a variation in the historical stages of the selected samples, which were reflected in many changes that these museums underwent, including additions and subtractions, and over the years, thus the diversity of readings that these samples carry.

4.1. Case Studies

The case studies can be summarized as:

4.1.1. Expanding the Louvre Museum Project, Paris, by IMPei (1989)

General description: The Louvre Museum in Paris was built in 1190 by Philip Auguste as a castle for protection during the Crusades, and then turned into a museum after the French Revolution, and is considered one of the most important tourist areas in the world due to its global heritage, uniqueness, and radical treatment method in the design of added wings. Then the additions continued, and the holdings flowed into the museum until it became one of the most famous museums in France, and the world, as it includes part of the new expansion of the museum, and the glass pyramid added to the building by the architect (IMPei) formed a new entrance, which was partly inspired by the design of French gardens (pictures 1, 2), which confirmed the use of water and air as design elements as well as the existence of an underground passage under the courtyard [35]. Bonta explains why the designer chose the pyramid form (as a pure and solid geometric form), in addition to being one of the classic geometric objects in the history of architecture in general, so, it is not important in this project to preserve the museum in its physical state as much as highlighting the continuous creative achievement of French art and culture [36].

![Figure 2. Interaction with context through the relationship of the added pyramid with the ancient museum](image1)

![Figure 3. The relationship of the added pyramid to the boundaries of the original building and its effect on the context and contrast in the museum](image2)

Analysis of the design idea: That the functional transformation and procedures of addition and subtraction for building from a castle to a museum has served the function of the project as a museum,
because time has given the museum its value and uniqueness, and that the functional transformation after the revolution made people accept the transformation as a result of the movement and transformation of society, and we have seen design decisions in preservation processes for buildings with a distinguished history, such as the Louvre Museum and the Queens Museum in the United States, are among the boldness that IMPei has undertaken to reach a visual, movement and detail change in the original building, as the added wings of the museum represent another aesthetic dimension as a result of achieving the dialogue between the traditional production, and the radical addition, as we have seen a design decision that transforms a large external space into an internal space in the British Museum, therefore, the addition of the glass pyramid in the heart of the Louvre Square has re-balanced the overall composition of the square in the interest of the original museum by finding a distinct entrance to the museum, it was the necessity and need for a majestic entrance is the main reason for choosing this element. Therefore, the process of addition and subtraction for valuable buildings is essentially a design activity, ideas and techniques can vary within the design vision.

4.1.2. Royal Ontario Museum Expansion Project, Canada, Ontario, by Daniel Libeskind (2007)
General description: It is considered one of the largest museums of natural history and a world civilization in Canada, which includes museums and halls for archaeology and natural science (picture 3). The exhibition center became the most important axis of the city with its new architectural addition, as this addition created a great attraction for the new exhibition space. The building was subjected to the mechanism of addition and subtraction in the external and internal spaces divided within the museum block to create various gathering spaces at different levels, providing various views towards the exhibition halls and other spaces within the exhibition in an interesting way. The processing method generated by the addition and subtraction processes led to split the Queen's Park facade to expand away from the heavy Italian style of the original structure (pictures 4, 5). The entrance space was designed by adding crystal blocks to be an extension of the new public square in the front of the building, inviting people to enter inside the building [39].

![Figure 4. Ontario Museum before the addition and subtraction](image)

![Figure 5. Entrance of the museum through the front crystal blocks](image)

![Figure 6. The new addition to the museum with the old building](image)

Analysis of the design idea: The subtraction mechanism was used in the interior design of the eastern wing facing Queen's Park of the building, which gave it a moral value because it was inspired by
Byzantine, while the new main entrance was added to reflect the development which is inspired by the Roman style influenced by Byzantine to reflect the historical development of Byzantine architecture as it tells us the story of the development of Byzantine architecture, which was impacted by Roman architecture, and the western wing that represents the original building is a massively lumpy structure interspersed with arched windows that are circular and fragmented, where the museum contains external additions with parts of the interior deleted, so the crystal form was added in a clear, and attractive way, so, we notice that the building was intercalated with a mass It has nothing to do with and the existence of contrast and contradiction between the two blocks which expressed it boldly, as the designer tried to form a relationship between history and the present, the old and the new, traditional architecture and the current modern architecture through this relationship to create a continuous and moral value for the existing building and to confirms the temporal belonging in the modern era which gave it uniqueness with ambiguity in the resulting form. We notice in this study sample that the strong addition, in which it can be said that it is a forced and intercalated addition, is an addition that gave an economic, aesthetic, and moral value and a new uniqueness of the building that expressed about it, and its function, which made it a unique building.

4.1.3. Moritzburg Museum, Halle, Germany, by Nieto Sobejano Architects
General description: The ancient castle of Moritzburg in Halle is a very valuable example of Gothic military architecture. The ruins of the late medieval castle blocks were supplemented with new components in the southern and eastern wings, the process of addition and subtraction through the composition of an expressive roof structure (pictures 5, 6), where due to the fires the western and northern wings were removed at the beginning, as well as the corner tower in the southwest. However, the existence of the stone walls above the city remained, so a historical passage was built on the eastern and southern sides. The Gothic cellars were preserved in the west wing, serving as a storage space for the museum, the addition and subtraction of the museum was by transforming and expanding the northern and western wings, which combined the two components into one unit with an expressive L-shaped ceiling. The interior spaces were also preserved in its wideness, instead of dividing huge spaces with new interior walls [43], and thus its turbulent history was inevitably reflected in many changes it had undergone over the years through processes of addition and subtraction. The building still preserves the original structure of its main architectural features: the surrounding wall, three of the four circular towers in the corners and the central courtyard with the partial subtraction of the northern and western wings of the castle while preserving some Roman parts that exist to this day (pictures 7, 8).

Figure 7. The building when it was a cathedral [44].

Figure 8. View of a medieval Moritzburg castle [45].
Figure 9. The valuable building after addition and subtraction [46].

Figure 10. The added part in the roofs [43].

Analysis of the design idea: Additions and subtraction included one architectural idea by including a new roof for the building, which was designed to be a large folded platform, rising and refracting to allow natural light to enter, and from it, the new exhibition areas would overhang (pictures 9, 10). This unique ceiling design method gave possibilities for display in new ways represented by the display areas hanging from the new ceiling of the building through the movement of the ceiling. The building underwent several transformations as a result of additions and subtraction, and the change in its function, in addition to its design, has preserved part of its original design, as it was at its inception a castle, then it was transformed into a hotel, then a cathedral, finally it was converted into a museum, and as a result of these transformations the facades read many eras. The diversity of the facades, the different styles, and missing the unity in the building gave it a peculiar uniqueness and a unique characteristic which is the building reads several readings over many eras, making it lose part of its original value, so the emptiness in the main space remained clear and did not give a feeling of containment. An ideal solution, and a new idea was used to introduce lighting and natural light, which is vital in the building through the use of suspended flooring technology for the exhibition with the roof structure, creating a strong contradiction between the old Gothic works, and the new modernity, but the entrance seems inconvenient and integrated with the context of the surrounding blocks and with the concept of historical preservation and renewal. We also note that the additions and subtractions affected the building, which led to the loss of part of its moral value, but it was an important element in its uniqueness.

Figure 11. The interior design of the museum and the contrast between the new and the old [47].

Figure 12. Design of the suspended added ceiling from the inside [48].
4.2. General practical framework

After the detailed description of the selected samples has been presented, the application will be conducted for the purpose of verifying the indicators of the theoretical framework or not on the practical study projects by adoptong the method of comparative descriptive analysis between the selected samples, where values ranging from (1-0) have been determined to measure the variables, (1 = Achieved value, 0 = Not achieved value) leading to presenting, discussing and analysing results, as shown in table 2, and finally reviewing the conclusions and the most important recommendations.

| Primary Indicators | Secondary Indicators | Possible Value | Code of possible value | Achieved Values (1-0) | Louvre Museum | Ontario Museum | Moritzburg Museum |
|--------------------|----------------------|----------------|------------------------|----------------------|---------------|----------------|-------------------|
|                    | A form that matches the valuable building X1.1 | It is difficult to distinguish between old and new form | X1.1.1 | • | • | • |
| Form after addition and subtraction X1 | A form that contrasts with the valuable building X1.2 | Elements with new architectural forms that differ from the original building in form, material or color | X1.2.1 | \ | \ | \ |
|                    | A form that harmonizes with the valuable building X1.3 | It harmonizes to form, material, or color | X1.3.1 | • | • | • |
| Percentage scores | An addition correlated with the valuable building X2.1 | It changes the features of original form and effects on its identity | X2.1.1 | • | \ | \ |
| Type of addition X2 | An addition separated from the valuable building X2.2 | It preserves the features of original form and identity (if achieved, it takes a weight of 1.5 instead of 1 for its importance) | X2.2.1 | \*| • | • \* |
| Percentage scores | Achieving a functional necessity | | X3.1.1 | • | \ | \ |
| Importance of addition and subtraction X3 | In terms of achieved performance X3.1 | Achieving an aesthetic necessity | X3.1.2 | • | • | • |
| | Achieving a functional-aesthetic necessity (if achieved, it takes a weight of 2 instead of 1 for its importance) | X3.1.3 | **| • | • | ** |
| Percentage scores | General intellectual content | | X4.1.1 | \ | • | • |
| Dimensions generated by addition and subtraction X4 | Intellectual Dimensions X4.1 | Special intellectual content | X4.1.2 | \ | • | • |
| | Physical dimensions X4.2 | Physical content related to the nature of element forms from addition and subtraction. | X4.2.1 | \ | • | • |
Physical content related to the nature of relationships and organizational bases

| Percentage scores |
|--------------------|
| Impact on meaning X5.1 |
| Preserving the meaning of the valuable building |
| X5.1.1 |
| Generated a new meaning |
| X5.1.2 |

| Impact resulting from addition and subtraction X5 |
| Impact on form X5.2 |
| Strengthening the original form of valuable building |
| X5.2.1 |
| Weakening the original form of valuable building |
| X5.2.2 |
| It does not change the functionality of the valuable building |
| X5.3.1 |
| Adds new function to the original building's functionality |
| X5.3.2 |

| Relationship generated by addition and subtraction X6 |
| Correlation relationship between original, addition and subtraction form X6.1 |
| The processing method for addition and subtraction is unaffected by the valuable building |
| X6.1.1 |
| The processing method for addition and subtraction is unaffected by the valuable building (if achieved, it takes a weight of 1.5 instead of 1 for its importance) |
| X6.1.2 |

| Uniqueness attributes of the valuable building after addition and subtraction X7 |
| It occurs in formative characteristics X7.1 |
| Matches to the formative characteristics of the valuable building (if achieved, it takes a weight of 2 instead of 1 for its importance) |
| X7.1.1 |
| Does not match to the formative characteristics of the valuable building |
| X7.1.2 |
| Somewhat matches to the formative characteristics of the valuable building (if achieved, it takes a weight of 1.5 instead of 1 for its importance) |
| X7.1.3 |
| Constant intellectual characteristics that are compatible with the valuable building (if achieved, it takes a weight of 1.5 instead of 1 for its importance) |
| X7.2.1 |
| Variable intellectual characteristics that do not fit with the valuable |
| X7.2.2 |
Analysis highlighted a disparity in the values achieved in the selected samples, as shown below:

### 4.3.1. Regarding form after addition and subtraction X1
We note that all the three selected samples had elements of new architectural forms that differed from the valuable building, whether in terms of form, color, or material, and thus the possible value (X1.2.1) was achieved in this indicator without achieving the possible values (X1.1.1 and X1.3.1) where the resulting forms after addition and deletion were not identical or compatible with the valuable building.

Thus, the primary indicator (form after addition and subtraction) and its secondary indicators, and possible values achieved by 33.34% for each the selected samples regarding only the secondary indicator X1.2 and its possible value is X1.2.1.

### 4.3.2. Regarding type of addition X2
It is clear that both the "Louvre Museum" and the "Moritzburg Museum" have adopted the type of addition separated from the valuable building, but at the same time it preserves the features of the original form and its identity, and thus the possible value (X2.2.1) for this indicator is achieved in both samples where the weight of value of (1.5) was assigned to it due to its importance in achieving the uniqueness of the building without achieving the possible value (X2.1.1). In the "Ontario Museum", the type of addition was associated with the valuable building, but it worked to change the features of the original form, and thus, affect its identity, meaning that the possible value (X2.1.1) was achieved without achieving the possible value (X2.2.1).

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**Percentage scores**

| The attribute of the product generated by the addition and subtraction X8 | Percentage scores |
|---|---|
| It strengthens the attribute of uniqueness for the valuable building X8.1 | 60% |
| It weakens the attribute of uniqueness for the valuable building X8.2 | 40% |

**Significance generated by the valuable building after addition and subtraction X9**

| Significance | Percentage scores |
|---|---|
| It strengthens the attribute of uniqueness for the valuable building X9.1 | 60% |
| It weakens the attribute of uniqueness for the valuable building X9.2 | 40% |

**Final percentage values for each sample**

| | X8.1.1 | X8.1.2 | X8.1.3 |
|---|---|---|---|
| Wt. | 1.0* | 1.0* | 1.0* |
| Value | 55% | 55% | 55% |

| | X8.2.1 | |
|---|---|
| Wt. | |
| Value | |

| | X9.1.1 | X9.2.1 |
|---|---|
| Wt. | 1.0* | 1.0* |
| Value | 60% | 55% |

| | X9.1.2 | X9.2.2 |
|---|---|
| Wt. | |
| Value | |

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**4.3. Analysis of the practical study**

Analysis highlighted a disparity in the values achieved in the selected samples, as shown below:

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Therefore, the primary indicator of (the type of addition) and its secondary indicators, and possible values achieved by 75% in each of the "Louvre Museum" and "Moritzburg Museum", and 50% in the "Museum of Ontario”.

4.3.3. Regarding the importance of addition and subtraction X3
The results of the application of this indicator showed that both of the "Louvre Museum" and the "Moritzburg Museum" achieved a functional-aesthetic necessity at the same time, and thus the possible value (X3.1.3) was achieved in both of it, where a weight value of (2) was assigned to it for its relative importance without achieving the possible values (X3.1.1) and (X3.1.2). As for the "Ontario Museum", it fulfilled a functional necessity only, and thus the possible value (X3.1.1) was achieved in it without achieving the possible values (X3.1.2) and (X3.1.3).

Accordingly, the primary indicator of (importance of addition and subtraction), and its secondary indicators, and possible values achieved by 66.67% for the "Louvre Museum" and "Moritzburg Museum", and 33.34% in the "Ontario Museum".

4.3.4. Regarding dimensions generated by addition and subtraction X4
We note from the results shown in the application table that the "Louvre Museum" and "Moritzburg Museum" may include intellectual dimensions with general and special intellectual content and physical dimensions related to both the nature of the form of the elements of addition and subtraction and the nature of relationships and organizational bases, and thus, the possible values (X4.1.1) (X4.1.2), (X4.2.1) and (X4.2.2) are all achieved for this indicator. As for the "Ontario Museum", we notice that it has a special intellectual content within the intellectual dimensions, and a physical content related to the nature of the form of the elements of addition and deletion, and thus the possible values (X4.1.2) and (X4.2.1) have been achieved without achieving the possible values (X4.1.1) and (X4.2.2).

Thus, the primary indicator of (dimensions generated from addition and subtraction) and its secondary indicator, and possible values achieved by 100% for each of the "Louvre Museum" and "Moritzburg Museum", and 50% for the "Ontario Museum".

4.3.5. Regarding impact resulting from addition and subtraction X5
It is clear that the effect resulting from addition and subtraction in the “Louvre Museum” is an effect in meaning, form and function, where the possible values (X5.1.1), (X5.1.2), (X5.2.1), (X5.3.1) and (X5.3.2) was verified for this indicator, but not verified for (X5.2.2). As for the "Ontario Museum", the effect resulting from addition and subtraction was on the level of impact in meaning through generating a new meaning only. As for the level of impact in form, it worked to weaken the original form of the valuable building, and on the level of impact in function, it added a new activity to the original building function which is represented by the main entry and the creation of new display space, so the possible values (X5.1.2), (X5.2.2) and (X5.3.2) have been fulfilled without achieving the possible values (X5.1.1), (X5.2.1) and (X5.3.1). As for the "Moritzburg Museum", the effect resulting from addition and subtraction it was achieved on the level of impact in meaning and form, as it strengthened the original form of the valuable building, for the level of impact in the function, it added new activities to the original building function, so the possible values (X5.1.1), (X5.1.2), (X5.2.1) and (X5.3.2) were achieved in this indicator with no achieved for possible values (X5.2.2) and (X5.3.1).

Therefore, the primary indicator of the (impact resulting from addition and subtraction) and its secondary indicator, and possible values achieved by 83.34% in the "Louvre Museum", by 66.67% in the "Moritzburg Museum" and 50% in the "Ontario Museum".

4.3.6. Regarding relationship generated by addition and subtraction X6
The results of the application of this indicator showed that both the "Louvre Museum" and the "Ontario Museum" were the treatment methods resulting from addition and subtraction in it unaffected by the valuable building, meaning that the possible value (X6.1.1) for this indicator was achieved without achieving the value (X6.1.2). As for the "Moritzburg Museum", we notice that the treatment
methods were impacted by the valuable building, as it took the same limits of the subtractive form and did not exceed it, so the possible value (X6.1.2) was achieved where the weight of value of (1.5) was assigned to it due to its importance, with no achieved of value (X6.1.1).

Accordingly, the primary indicator of the (relationship generated by addition and subtraction) and its secondary indicator, and possible values achieved by 50% in each of the "Louvre Museum" and "Ontario Museum", and 75% in the "Moritzburg Museum".

4.3.7. Regarding uniqueness attributes of the valuable building after addition and subtraction X7

We note that the uniqueness features after addition and subtraction in each of the "Louvre Museum" and the "Moritzburg Museum" were concentrated in its formative characteristics where it is somewhat matched with the formative features of the original building at the level of design (two-dimensional) where the added pyramid in the Louvre Museum has a square base shape fits with the two-dimensional shapes which used in the building, but in the Moritzburg Museum, the boundaries of the added shape were compatible with the boundaries of the subtractive form, and thus the possible value (X7.1.3) was achieved where the weight of value of (1.5) was assigned to it due to its importance, with no achieved of values (X7.1.1) and (X7.1.2). As for the intellectual characteristics of these two museums, they had intellectual characteristics that are compatible with the original building, and accordingly the possible value (X7.2.1) was achieved where a weight of value of (1.5) was assigned to it due to its importance, without achieving the value (X7.2.2). In the "Ontario Museum", the characteristics of uniqueness in it after addition and subtraction were not achieved in it at the level of formative characteristics, as it did not match to the formative characteristics of the original building, and thus the possible value (X7.1.2) is achieved for this indicator with no achieved for the value (X7.1.1). As for the intellectual characteristics after the addition and subtraction, it did not fit with the original building, meaning that the possible value (X7.2.2) was realized in it without achieving the value (X7.2.1).

Thus, the primary indicator of the (uniqueness attributes of the valuable building after addition and subtraction) and its secondary indicator, and possible values achieved by 60% for each of the "Louvre Museum" and "Moritzburg Museum", and 40% in the "Ontario Museum".

4.3.8. Regarding the attribute of the product generated by the addition and subtraction X8

It is clear that the "Louvre Museum", "Ontario Museum" and "Moritzburg Museum" were the attributes of the product generated by the addition and subtraction of a better, different, and unfamiliar product and characterized by the novelty of the idea, form and effecting in context, meaning that the possible value (X8.1.1) it has been achieved in this indicator where the weight of value of (1.5) was assigned to it due to its importance, with no achieved for the possible value (X8.2.1).

So the primary indicator of the (attribute of the product generated by the addition and subtraction) and its secondary indicator, and possible values achieved by 75% for all the selected samples, according to what is shown in table 2.

4.3.9. Regarding the significance generated by the valuable building after addition and subtraction X9

The results of applying this indicator showed that the significance which was generated for each of the "Louvre Museum" and "Moritzburg Museum" after the addition and subtraction created a new significance that enriched the old significance of the original building, thus achieving the possible value (X9.2.1), where a weight of value of (1.5) was assigned to it due to its importance, with no achieved for the possible value (X9.1.1). As for the generated significance in the "Ontario Museum", it created a new significance that removed the old significance of the original building, and accordingly the possible value (X9.1.1) was achieved without achieving the possible value (X9.2.1).

Thus, the primary indicator of the (significance generated by the valuable building after addition and subtraction) and its secondary indicator, and possible values achieved by 75% for each of the "Louvre Museum" and "Moritzburg Museum", and 50% in the "Ontario Museum".
Finally, the percentage of achievement the indicators of the theoretical framework of the "Louvre Museum" is (70.69%), the "Moritzburg Museum" is (68.96%), while the percentage is (46.55%) for the "Ontario Museum", as shown in bar-chart 1.

Thus, the "Louvre Museum" is the most achieving sample of the possible values among the selected samples, which gave a clear cognitive perception about the nature of uniqueness and its characteristics after the museum was subjected to additions and subtractions and within the applied verification contexts.

![Figure 13. Ratios of indicators of the theoretical framework in selected samples.](image)

5. Conclusions and Recommendations

Conclusions can be summarized as general and special conclusions:

5.1. General Conclusions

It can be summarized as follows:

- The possibility of proving the role of the duality of addition and subtraction and use it as a mechanism for evaluation and criticism of the valuable buildings that need to be reused, which makes it more suitable for the roles, and functions that it occupies, thus determining the unique characteristic of the valuable buildings or not, based on the degree of change that occurs as a result of the additions and subtraction in the formative system of the original building.

- The mechanism of addition and subtraction is one of the important and main mechanisms in determining the characteristic of uniqueness, symbolic and urban value of valuable buildings, as it represents an indication of studying the history of the building and investigate its impact in its era and in other eras in addition to the building’s relationship with the surrounding area and its urban integration and confirming its importance in achieving the value of the building.
• To preserve the value of the building, it is necessary to preserve what it has of features and characteristics through the stability of its formative and symbolic dimensions, except for changes that do not lead to defects in those dimensions, whether at the level of the interior or exterior design through subtracting or adding parts to achieve appropriate functional performance.

• The economic factor is one of the most important factors that control the extent of the changes resulting from the additions and subtractions that occur to the valuable building, which affects its unique features, and characteristics by finding a new function for the valuable building that generates income, and an economic return that offsets the costs of rehabilitation and operation of the building.

5.2. Special Conclusions
It also can be summarized as follows:
• It was found through the results of the research for the practical study that any building accepts the process of addition and subtraction without causing a defect in the general composition through the merging process between the old and the new may carry the quality of beauty and may increase the characteristic of the uniqueness of that building, except that when a defect occurs in the general composition as a result of that process, this will inevitably lead to the loss of the unique attribute which was characterized by the valuable building before the addition and subtraction.

• The study showed that acceptance of the product form which generated from the addition and subtraction process and its suitability with the original form of the building depends mainly on the degree of compatibility in form, material and color, and the type of addition and its importance in achieving the functional and aesthetic necessity of the original building works to preserve the features of the original form and preserve its identity, in other words, the effect of the treatment method resulting from the addition and subtraction on the formative system of the valuable building.

• The more you achieve the dimensions generated by the addition and subtraction process of both sides; The intellectual aspect with public and private content, and the physical aspect with content related to the nature of the elementary forms of addition and subtraction and the nature of relationships and organizational bases in line with the composition of the original building, the more that increases in the uniqueness of the new building.

• The effect of addition and subtraction in achieving the characteristic of uniqueness of the valuable building depends on; Proving the meaning of the original building even in the event of a new meaning for the generated product, the effect of the form by supporting and strengthening the original form, and the effect of the function by creating new activities for the function of the original building.

• The more the attribute of the product achieved as a result of the addition and subtraction process, and what accompanies it from a new significance generated by it that is the better, different or unfamiliar product and is characterized by the novelty of the idea, and the extent of its impact in the context without obliterating the features, and characteristics of the original form, the more that leads to the enhancement of the characteristic of uniqueness and enrichment of the ancient significance of the valuable building.

5.3. Recommendations
The most important recommendations are:
• The research recommends the necessity of employing the duality of addition and subtraction as a mechanism for evaluation, and criticism of valuable buildings that need to be re-used or employed, and thus its adoption as a measurement mechanism in determining the nature and characteristics of uniqueness in the event that the building accepts the addition and subtraction
or not within the framework of architectural evaluation and criticism, and within the applied verification contexts.

- The research recommends making use of the experience of international architectural designers through their adoption of the duality of addition and subtraction in the redesign of valuable buildings that are in urgent need of reuse or revival and make it more suitable for the roles, and functions it occupy, and transfer this experience to our regional and local regions, with the need to be careful, it is a double-edged sword, as it may work to enhance the uniqueness of the product generated as a result of this process of the valuable building, and it may weaken it and thus, strip it of the characteristic of uniqueness that it previously carried.

- Allowing the concerned people in this regard from the thinkers, theorists, and architects in the field of architecture to spread knowledge awareness, enhance and enrich their knowledge of how to preserve valuable buildings, and which depend on the duality of addition and subtraction in their redesign and production in a way that does not affect the uniqueness of the original building.

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