

# The Role of Artificial Intelligence in Rejuvenating Culture in Local Architecture: Insights from Iraq

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## Abstract

It is now known that application of artificial intelligence (AI) is constantly evolving to assist in modeling the morphology of architectural design. Its applications are numerous and widely spread, from being applied to existing architecture, buildings built in the past as well as new designs. In this context, the transformations of local architecture that have taken place in Iraq can indeed benefit from the application of AI. This paper investigates the differences between local Iraqi architecture designed by architects in the past with the outcome of AI modeling in forming local Iraqi architecture in such a way that they can rejuvenate culture.

The research employs a digital method to extract data related to morphological indicators of existing local Iraqi architecture. It then uses AI to interpret this data and produce tangible results by comparing the AI generated architecture with the existing reality. It uses the 'Jaccard Similarity Method' to compare the similarity of the morphological aspects of the local Iraqi architecture of the sixties and seventies and the AI generated outcomes for the same years.

It reveals that local Iraqi architecture designed by the architects as well as those generated by AI have similarities at the morphological level. It thus concludes that there exists a significant role in employing AI in rooting local architecture at the morphological level so that they can rejuvenate local culture.

**Keywords:** Artificial intelligence (AI), Morphology, Rooting, Local architecture, Culture, Iraq.

## Introduction

Artificial Intelligence (AI) is rapidly transforming the field of architecture by providing new ways of designing and creating buildings. One of the areas where AI is making an impact is in the rooting of local architecture. AI is impacting the rooting of local architecture by providing new tools for architects to generate designs that are optimized for specific functions. However, the use of AI in architecture has also raised concerns about the potential loss of cultural and regional architectural identities. One way that AI can be used to address this

concern is through the process of indigenization, or the integration of local or regional cultural elements into architecture. AI can be programmed to analyze and understand the cultural and historical context of a particular region or community, and use this understanding to inform the design process.

It is now known that AI algorithms can generate designs that are tailored to specific environmental conditions, such as wind and sun exposure, and can incorporate cultural and historical references to create buildings that are rooted in the local context. For example, AI can be used to generate designs that incorporate traditional building materials and techniques, ensuring that the building is culturally relevant and respectful to local traditions.

In this context, this research examines the similarity or difference between morphological outcomes of buildings designed by architects or generated by AI. It aims to unravel the role of AI creations into how similar and close they can be on the morphological level with local Iraqi architecture. Its objective are as follows.

1. To extract significant indicators of morphological aspects from the sixties and seventies local Iraqi architecture
2. To compare them with the results generated by AI examples for the same period.
3. To establish the level of similarity and to identify if AI can produce architecture that is culturally relevant and expressive of a given local situation.

## Review of Literature

Only few research has examined the issue of AI and its role in facilitating the rejuvenation of cultural richness in architecture. Nevertheless, some of them that examine the social and cultural aspects of Iraqi architecture do exist. Among them, Al-Badri (2003), Ashour (2002), Hussein (2016), Bölek et al. (2023), Borglund (2022) and Ji (2023) are noteworthy because they have dealt with this issue in the context of Iraq. Following offers a review of their work.

Al-Badri (2003) examines the city of Baghdad by understanding the factors behind the formation of its architectural identity, highlighting the traditions and social norms as major aspects until the beginning of the twentieth century. He reviews the reasons for the absence of architectural identity in the city, and how architectural communication between the past and the present can be achieved, with a focus on re-demonstrating its architectural identity by focusing on laws and legislation. Similarly, Ashour (2002) examines the path of Iraqi architecture during the twentieth century until 2002. He has studied its path and has analyzed it by dividing it into five stages, according to the presence of important events in it, and the different characteristics of the resulted products of those stages. Each of these stages is focused on the two levels of indicators. They are as follows.

1. The level of the important events that have occurred in Iraq at each stage (political, economic, social), and
2. The level of analysis of the architectural product through the vocabulary (form, materials, function, scale).

In this regard, Hussein, 2016) examines the economic factors and confirms that the economic factors represented by its three elements (needs, goals, and resources) has a major role and direct influence on the quality of Iraqi architectural products. Indeed, they determine their morphological characteristics that distinguishes each stage. Resources also represent an incentive to create social and political changes, producing multiple intellectual viewpoints towards the issues raised at each stage of the transition from the year 1952 to 2015. As per the intellectual level, despite the changes that the economic factor witnessed in Iraqi architecture, one of the most important stages of the transformations was as a tool for achieving several goals other than satisfying needs and focusing on form. The priority is to satisfy symbolic needs that are linked to a renewed economic level.

This is comparable with Bölek et al. (2023) who present a descriptive and analytical review of the work on artificial intelligence applications in architecture. They identify and address the gaps in artificial intelligence and architecture. Indeed, this shows a growing interest in the relationship between artificial intelligence and architecture.

Adding to this, Borglund (2022) delves into the role of creativity in the design process and the impact of artificial intelligence (AI) on this process. He offers insights into the current challenges in architecture and identifies areas where AI could offer solutions. He uniquely examines how AI intersects with the design process, considering aspects often overlooked in the integration of new technologies. In fact, he goes beyond assessing the potential of AI products to examine their influence on the users.

This contributes to a deeper understanding of how technologies like AI can shape creativity within the design process. Borglund (2022) investigates the existing structure of the creative process and anticipates the changes that AI implementation may bring. He also outlines the anticipated applications of AI in construction and how these might transform the future design processes.

On the other hand, Ji (2023) examines the application of the technologies of artificial intelligence in many aspects of architectural design that has played a role in architectural design, such as convenience, and accurate effect on its existing problems. He finds out the optimization scheme and compares it and finds that the optimization effect is obvious. Hence, there exists huge gaps in knowledge about the role of artificial intelligence in rejuvenating culture in local architecture.

Given this limited research, efforts should be made to conduct studies to evaluate the outcomes generated by AI and compare them with the morphological aspects of local Iraqi architecture in particular so that it can be ascertained if AI-generated architecture could realistically address the issues of local culture in architecture.

## **Theoretical Framework**

### **Artificial intelligence and architecture**

Until recently, the conventional definition of AI was that it sought to do what human minds can achieve, but that concept is clearly out of date. AI is already capable of outperforming people in a variety of ways. AI is indeed a field of study in computer science. It entails creating computer programs to perform things that would otherwise require human intelligence. AI algorithms can be used to solve problems in learning, perception, problem solving, language understanding, and/or logical reasoning.

Kaplan and Haenlein define AI as

“a system’s ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation”

Haenlein and Kaplan, 2019:8

Bartnek et al. point out that “AI is the study of [intelligent] agents that receive precepts from the environment and take action. Each such agent is implemented by a function that maps percepts to actions, and we cover different ways to represent these functions, such as production systems, reactive agents, logical planners, neural networks, and decision-theoretic systems”

Bartneck, et al., 2021:4

As AI advances in capability, today's architect is presented with a variety of potential sources of intelligence to deploy in the service of the craft as follows.

- 1) Having own talents, skills, and experience (as certified, for example, by their professional registration).

- 2) An array of hard-coded computer programs that achieve specific ends (such as energy analysis or structural engineering);
- 3) Machine learning systems (which may learn from data derived from their design projects, or even sensors within finished buildings and provide insight);
- 4) Ultimately the speculative prospect of cognitive systems that can reason within context (only seen in science fiction today) (Bernstein, 2022).

Adding to this, Borglund (2022) explains that in the fields of architecture and engineering, artificial intelligence and machine learning play a crucial role through a concept known as generative design. This technique primarily focuses on identifying optimal design solutions, diverging from traditional design simulation that relies heavily on extensive, result-oriented data. Generative designs elevate the simulation process by not merely responding to specific queries like functionality, alterations, or mechanisms. Instead, it offers solutions through an iterative process that refines its learning with each cycle, adhering to established parameters and guidelines. This approach shifts the designer's role from questioning to seeking solutions.

Indeed, researchers in design thinking recognize generative design tools as catalysts for creativity. They facilitate the exploration of numerous design possibilities in the early stages of design, thereby nurturing creative potential through divergent thinking, a key characteristic of creativity (Borglund, 2022).

### **Artificial intelligence hallucinates images**

According to Campo and Leach (2022), machine vision, also known as image recognition, is a notable achievement in the realm of machine learning. A more advanced development is the ability to 'hallucinate' images, a concept realized in 2015 by Google engineer Alexander Mordvintsev. He discovered how to reverse the function of neural networks from merely recognizing to generating images. This innovation led to the creation of Deep Dream, a computer vision program that garnered significant attention in artistic communities for its unique, dream-like images. It paved the way for style transfer techniques, such as overlaying zebra stripes onto a horse, or interpreting images through neural networks trained on specific art styles, like Van Gogh's paintings.

However, the landmark advancement in image generation came in 2014 with the invention of generative adversarial networks (GANs) by computer scientist Ian Goodfellow. GANs operate through the interaction of two neural networks: one generates images (the generator), while the other (the discriminator) evaluates these images against a training dataset. This process resembles an art forger attempting to deceive an art critic with a counterfeit work. The discriminator rejects images until they match the quality of the dataset. Once adequately trained, the discriminator can be removed, allowing the generator to autonomously produce convincing images.

### **The influence of artificial intelligence on architectural morphology**

As it is now known, AI is transforming the field of architecture by providing new ways of designing and creating buildings. One of the ways AI affects architecture is by influencing the morphology of buildings. AI algorithms can generate designs that are optimized for specific functions, such as energy efficiency or structural stability. These designs may feature shapes and forms that are not typically found in traditional architecture but are instead inspired by natural systems, such as the branching of trees or the flow of water.

Moreover, AI can analyze and interpret data to inform design decisions, allowing architects to make informed decisions about the forms and functions of their buildings, (<https://www.dezeen.com/2022/11/16/ai-design-architecture-product/16> November 2022 ). According to Bernstein (2022), AI tools, however, are distinct from their automated counterparts in that they process and generate results without the direct interventions of the designers, operating autonomously.

In this connection, Maltret and Zoller (1996) propose that understanding architectural morphology is akin to grasping a structured cosmos of elements. These elements are defined as generic, identifiable objects capable of generating specific objects through filiation. In their conceptual framework, the knowledge systems comprise the following.

- Physical objects and architectural components,
- Connections linking these elements.

However, in the real world, elements are distinguished by the following.

- Attributes, which include morphological, architectonic, or positional aspects,
- Their constituent parts,
- Graphical depictions.

As a result, there are two primary types of inter-object relationships:

- Filiation, which involves specialization,
- Composition, encompassing aggregation.

As Maltret & Zoller (1996) point out, composition relationships organize objects according to a rule set. They highlight that while AI has the potential to shape the future of architectural design and construction, it cannot match the creativity and adaptability of the human mind. Nevertheless, AI can enhance work efficiency and should be utilized to expand design boundaries (Agha, 2019). Maltret and Zoller (1996) describe attributes at the root level for architectural objects, including:

- A 3D morphology, essentially a geometrical primitive from the modeler, representing a 3D geometrical volume or a combination of volumes, each defined by their attributes and performances.
- A 2D morphology, illustrating the planar projection of the 3D form.
- A typology, defaulting to 'Notype' if unspecified.
- An owner, representing a composition relationship.
- A list of elements, also a composition relationship, defaulting to an empty set if not specified.
- Dimensions, such as height, width, and length.

### **Rooting morphological aspects in architecture**

Based on the Oxford dictionary the word root is defined as 'establish deeply and firmly', or 'have as an origin or cause' (Oxford Languages <https://languages.oup.com/google-dictionary-en/>). In a broad definition of rooting the term 'root architecture' is used in the biological field referring to distinct aspects of the shape and the spatial configuration of the root systems (Lynch, 1995).

In architecture, rooting refers to the way a building is anchored or rooted to the earth. According to a Quizlet article, architecture can be rooted in the earth's rich resources, allowing buildings to act as a 'natural symbolism.' The site is the place where a building rests, with its submission to gravity, its raw materials, and centrality in the outer space. The way a building is rooted to the earth can have a significant impact on its design and function. For example, buildings that are rooted more firmly to the earth may be more stable and better able to withstand natural disasters such as earthquakes (<https://quizlet.com/37844860/humanities-ch-6-flash-cards/>).

### **Rooting morphology of local Iraqi Architecture**

Contemporary Iraqi architecture dates back to the beginning of the twentieth century, at the end of Ottoman rule and the beginning of the British occupation, with the coronation of King Faisal I as the King of Iraq in 1921 (the establishment of the Iraqi state). Thus, Iraqi architecture has gone through many stages, numerous political events, and economic, social, and other changes. With the existence of these variables and events, it is noted that new

architectural styles entered the local arena, accompanied by the emergence of clear architectural trends or styles that could generally be classified accordingly (Al-Assadi, et al., 2022).

- The first stage: Represents the period of the twenties and thirties.
- The second stage: Represents the period of the forties and fifties.
- The third stage: Represents the sixties and seventies.
- The fourth stage: Represents the eighties and nineties, when Iraqi architecture began to deviate from its path that was drawn in the previous period because of multiple wars and economic blockades that led to the isolation of Iraq from the world during that period.

Only the first three phases are investigated for their importance in determining the course of contemporary Iraqi architecture (Al-Assadi, 2022).

### The first stage

This was characterized by the quality of the buildings constructed during this period, including the dominance of the British classic style, with the use of brick as a basic construction material within the architectural formations of a classic character. Since these architects designed in India with the British Army, the most prominent influences on the orientations and ideas of these architects were:

- 1- Prevailing architectural trends in Britain (conservative classicism).
- 2- Local traditional architecture of Iraq and neighboring Arab countries.

Among the most prominent buildings executed during that period is the General Ports Directorate building in Basra 1927 designed by Wilson and the Al-Zuhur Palace 1932, as shown in the Figure 1.

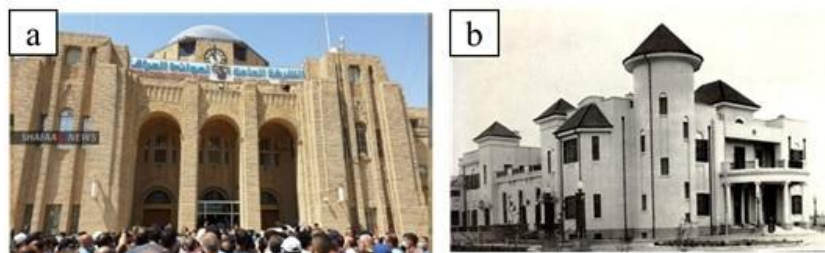


Fig. 1: (a) Al-Zuhur Palace building, (b) General Ports Directorate building.  
Source: Al-Sultani, 2014

### The second stage

The most significant characteristic of the architecture in this period is represented in its artistic language that approached the propositions of what is known as ‘modern architecture’. Architecture of this phase widely employed modern construction methods and materials. It is noted that Baghdad skyline began to change through the emergence of multi-story buildings, such as the administrative building of the Sofer Building in Al-Rashid Street in 1946, designed by Medhat Ali Mazloun, followed by the construction of the Damerchi Building, which was implemented by Niazi Fatou in 1948 and consisted of six floors, as shown in the Figure 2 (Al-Sultani, 2014).



**Fig. 2:** (a) Damarchi building, (b) Sofair building.  
Source: Al-Sultani, 2014

### The third stage

The sixties marked the beginning of heritage-oriented stage. It witnessed a trend towards the concept of architectural heritage and adhere to it. Later in the seventies it expanded and prevailed. It was for the works of Muhammad Makiya and his trends that were reflected in the buildings of the Caliphs Mosque 1964, Al-Rafidain Bank 1968 and the Endowments Library. He used the heritage vocabulary and adapted it to coexist with contemporary ideas at the time. Thus, it was the beginning of an architectural movement that adhered to the local identity and led it in a prominent outcome towards creating an Iraqi school. According to Al-Assadi and Al-Dewachi (2020), the most important features of this approach are as follows.

- This trend affected the building shapes and the use of heritage elements and details such as arches, shanasheel, inner courtyard and others. Indeed, there was a return to the use of bricks again in many buildings constructed during this stage in addition to the presence of concrete materials, as in the projects of Rifaat Aljaderji as shown in the Figure 3.
- The existence of human scale in buildings and the use of simple heights and brick details, in addition to the attempt to achieve traditional local character. Tall buildings came into being at this stage such as communication centers and some ministries and administrative buildings, but the material and the details that were used in facades mitigate the massiveness and height of its construction (Amer, 2010).
- Iraqi architects adapted modern architecture in a local style through the use of treatments, details, and building materials such as lifting buildings on columns or using screens in the facades, as in Al-Foun Institute by Saeed Ali Mazloun, and Al-Mustansiriya University by Qahtan Awni that was distinguished by Iraqi modernity through the employment of heritage in a contemporary style. The designers resorted to using brick screens with inscriptions from Iraqi heritage, fixed on concrete structures.
- Scientific as well as artistic tendencies emerged in the field of environment. However, this concept was limited to the microbiological perspective on the local Baghdadi heritage environment or the folklore forms as metaphorical units. These were seen in the exploitation of the folklore form of the Iraqi carpets in the facade of the University of Al-Mustansiriya or the use of artistic elements in the design.



**Fig. 3:** (a) Scientific complex building  
Source: Al-Sultani, 2014



**Fig. 3:** (b) Industrial union building  
Source: Author

**Table 1:** Most important phases and the characteristics of architectural production.  
Source: Authors

Phase	Morphological level	Materialistic level	Scale level
<b>First</b>	British classical architecture and some features of local traditional architecture	The use of brick material, limited as the main finishing material	Characterized by proportionality and exclusivity
<b>Second</b>	Modern architecture and global style	Iron and concrete	Enormity in scale both horizontally and vertically
<b>Third</b>	Orientation towards traditional forms	Back to bricks	Human scale

### Characteristics of the formal structure of Iraqi architecture

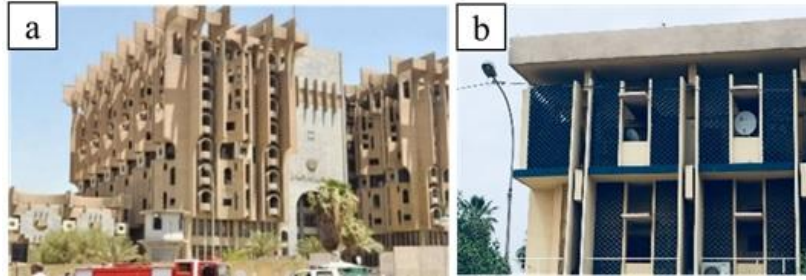
Local Iraqi architecture features' manifested as a result of the circumstances and the interactions that include many factors and variables, both physical and non-physical. As such, what was left of this architecture is a fraction of these overlaps. Al-Saffar and Musa (2010) point out that eventually, some features and characteristics can be extracted to compare Iraqi architecture with other civilizations: The characteristic of the human dimension.

- Harmony with the content
- Emphasis on the principle of enclosed space (inner courtyard), whether it is solo or within a group.
- Use of local material (bricks).
- Utilization of stylistic details such as (arch, portico, the system of fluting and protrusions, brick screens, semicircular towers, shanasheel etc.)

On this basis, the research concludes that the most important stage that characterized contemporary Iraqi architecture in terms of production is the third stage that existed in the sixties and seventies. Indeed, it led to the emergence of an Iraqi architectural school. Al-Tameemi (2020) points out that this stage can be considered as the distinction of the 'heritage' concept on the intellectual scene to a wide extent, coinciding with the emergence of the post-modernism trend, which calls for returning to the past and history and for inspiration. In fact, this period witnessed a widespread interest in 'heritage' and the means to reflect it in architectural production.

Architectural experiments emerged to embody inspiration from the materialistic aspect and its presence through traditional heritage elements, while the other experiments considered that the issue of inspiration from heritage means reviving the spiritual and historical aspects. Despite the evolution of the heritage notion at this stage, modernist thoughts were still represented as a contemporary conception that must be followed, but with a heritage vision related to the place, to create a global yet regionalized architecture. With this trend, reflections of the architectural concept of heritage began to appear through attempts to draw inspiration from some heritage details such as arches, decoration, in addition to the use of brick material

and the inner courtyard. etc. (Al-Tameemi and Toma, 2020). These are shown in the Figures 4 to 13.



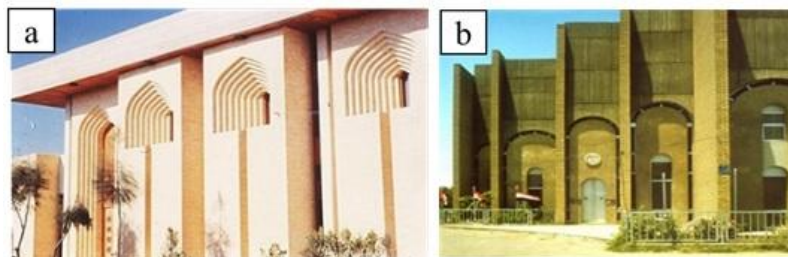
**Fig. 4:** Use of bricks and concrete,  
(a) Ministry of Industry (Bricks) <https://www.iqiraq.news/economy/26904-iq.html>  
(b) Awqaf Library (Concrete) Source: Author



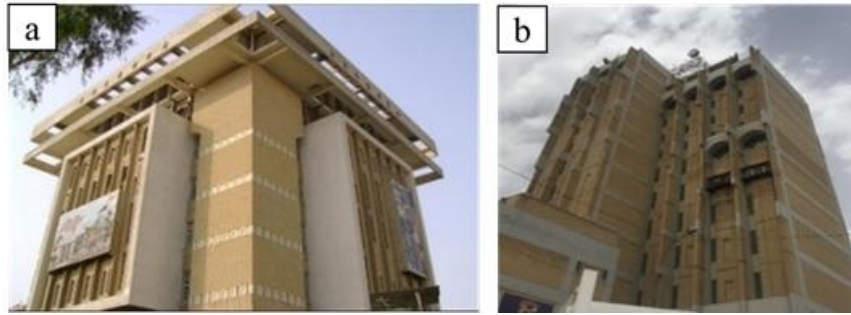
**Fig. 5:** Use of folkloric forms.  
Source: Author



**Fig. 6:** Use of ceramic (greenish blue)  
(a) Liquefied water building Source: Author  
(b) Scientific Complex Source: Al-Sultani 2014



**Fig. 7:** Use of arches  
(a) Al-Rafidain Bank/Kufa <https://alzarraapaper.com/content.php?id=330589&print=>  
(b) Al-Rafidain Bank/Baghdad Source: Al Chalabi, 2018



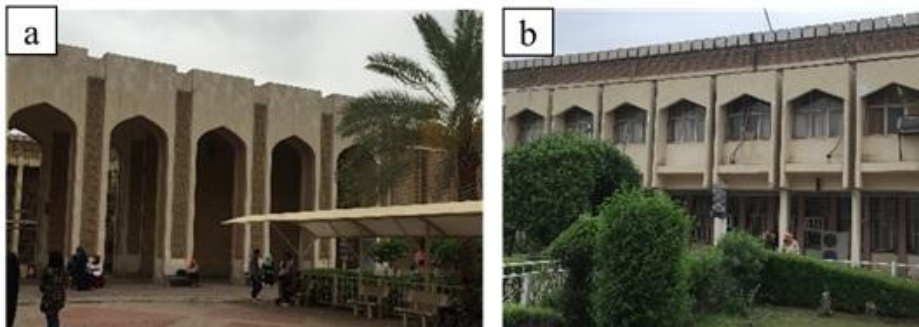
**Fig. 8:** Use of local material (bricks)

(a) Real estate Bank

(b) Al-Sinak call center

Source: <https://economy-news.net/content.php?id=34121>

Source: Author

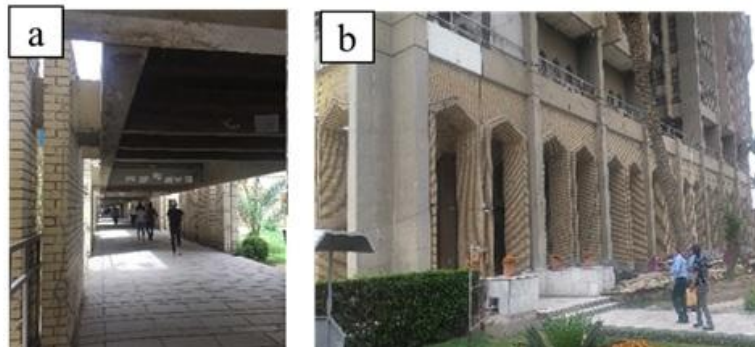


**Fig. 9:** Use of Abbasid arch in College of Education building, (a) Real Abbasid arch, (b) Abstract arc to triangle. Source: Author



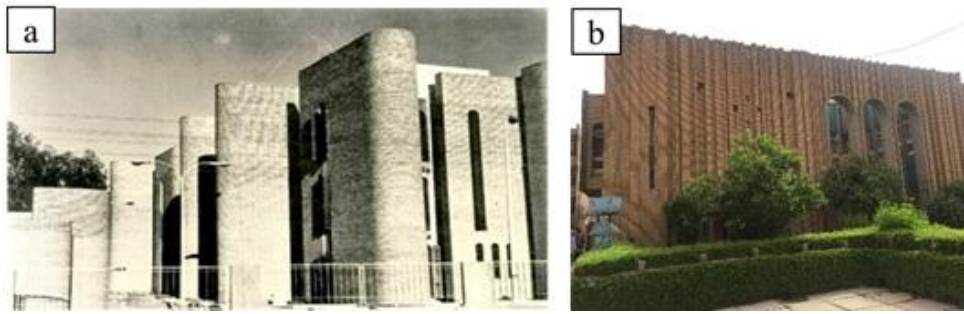
**Fig. 10:** Use of shanasheel, (a) Liquefied water building, (b) Industries union building.

Source: Author



**Fig. 11:** Use of portico, (a) Al-Mustansiriya University, (b) Baghdad Municipality Building.

Source: Author



**Fig. 12:** Use of Mesopotamian forms

(a) Semicircular towers

Source: Al Chalabi, 2019

(b) The system of fluting and protrusions

Source: Author



**Fig. 13:** Use of (hat) on top of buildings, (a) Ministry of Interior, (b) Baghdad Municipality Building.

Source: Author

Based on that, the research concludes the most significant indicators of the theoretical framework of Iraqi architecture for the third stage (the sixties and seventies), (Table 2).

**Table 2:** The most significant indicators of the theoretical framework of Iraqi architecture for the third stage (the sixties and seventies)

Source: Authors

Third stage	Form level	Material level	Scale level	Detail level
The sixties and seventies	Orientation towards traditional forms	Focusing on the material (brick) as well as concrete and iron	Human scale	<ul style="list-style-type: none"> <li>• Abbasid quadrilateral arch</li> <li>• The abstract arc of the triangular shape</li> <li>• Using brick material as:               <ul style="list-style-type: none"> <li>- Brick decoration</li> <li>- Brick screens</li> </ul> </li> <li>• Use of shanasheel (explicit or abstract form)</li> <li>• Using ceramic material in the facades and the details</li> <li>• Use of the inner courtyard</li> <li>• Using the porticos</li> <li>• The cubic or rectangular shape of the building block</li> <li>• Use a concrete crown or hat at the top of the building</li> <li>• Focus on the design of the corner of the building (smashing, grading, or deletion)</li> </ul>

				<ul style="list-style-type: none"> <li>• The use of concrete and bricks in the details of the facades (in arches, shanasheel, etc.)</li> <li>• Use of Mesopotamian details such as: <ul style="list-style-type: none"> <li>- System of fluting and protrusions.</li> <li>- Use of square or semicircular towers.</li> </ul> </li> </ul>
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### Research Methodology

This study employs mixed-methods. First, using data from the survey of buildings presented above, AI was instructed to create architecture that fits into the characteristics of the buildings.

Afterwards, a descriptive qualitative method was employed to investigate the similarity of the morphological representation of the indicators that can be found in local Iraqi architecture and the AI-generated examples. Then a quantitative method that relied on using the 'Jaccard Similarity Method' was employed to compare the results. Every variable with the value 1 which is considered positive represents the visual morphological representation of the indicator, and the value 0 represents the negative i.e. the absence of the visual depiction of the indicator. It then adopted a numerical scale by calculating the Jaccard coefficient index ratio of the size of the intersection between each AI model and the Iraqi local architecture indicators to obtain a solid base to be able to draw a clear conclusion.

The researcher carried out this task and has set the following rules in order to consider the results as an acceptable or unacceptable role of AI towards rooting local Iraqi architecture.

- The Jaccard coefficient index under 0.5 is considered an unacceptable result.
- The Jaccard coefficient index 0.5 and above is considered as an acceptable result.

### Practical application

The application was carried by using a set of keywords extracted by the indicators derived from the theoretical framework as shown in the Table 2. This represents the morphological aspects expressing the local aspect of Iraqi architecture. It was applied in two different prompts and used in several artificial intelligence sites to obtain the following results.

#### Keywords:

Contemporary, traditional styles, 1960s and 1970s architecture, brick screens, concrete, iron elements, central four-arch Abbasid arch, ceramic facades, inner courtyards, semi-circular towers, Mesopotamian-inspired recesses, square towers, traditional and modern fusion, Iraq's architectural identity.

#### Prompts:

Create a contemporary architectural design inspired by Iraqi traditional styles from the 1960s and 1970s. Incorporate brick, concrete, and iron elements along with the central four-arch Abbasid arch, ceramic facades, inner courtyards, and semi-circular towers. Integrate modern materials while preserving the essence of Mesopotamian-inspired recesses, projections, and square towers. Emphasize traditional and modern fusion, reflecting Iraq's architectural identity with a fresh perspective.



Fig. 14: AI simulation model A (predicted)  
Source: <https://gencraft.com/>



Fig. 15: AI simulation model B (predicted)  
Source: <https://lexica.art/>



Fig. 16: AI simulation model C (predicted)  
Source: <https://www.bluewillow.ai/>

**Table 3:** Jaccard Similarity for AI models A, B and C  
Source: Authors

Indicators		Iraqi Architecture (Actual)	AI simulation model A (predicted)	AI simulation model B (predicted)	AI simulation model C (predicted)
Orientation towards traditional forms		1	1	1	1
Focusing on material (brick)		1	1	0	1
Focusing on concrete material and iron.		1	0	1	1
Human scale		1	1	1	1
Morphological Details	Abbasid quadrilateral arch	1	1	1	1
	The abstract arc of the triangular shape	1	0	0	0
	Use of shanasheel (explicit or abstract form)	1	0	0	1
	Using ceramic material in the facades and the details	1	0	0	0
	Use of the inner courtyard	1	0	1	1
	Using the porticos	1	0	0	0
	The cubic or rectangular shape of the building block	1	1	1	1
	Use a concrete crown or hat at the top of the building	1	0	0	0
	Focus on the design of the corner of the building (smashing, grading, or deletion)	1	1	1	0
	The use of concrete and bricks in the details of the facades (in arches, shanasheel, etc.)	1	1	0	1
	Use of Mesopotamian system of fluting and protrusions.	1	0	0	0
	Use of Mesopotamian square or semicircular towers.	1	1	1	1

**Table 4:** Jaccard values for AI models A,B and C  
Source: Authors

		AI simulation model A		AI simulation model B		AI simulation model C	
		negative	positive	negative	positive	negative	positive
actual	negative	0	0	0	0	0	0
	positive	8	8	8	8	6	10

Jaccard Similarity for model A

$$\frac{\text{Overlapping positives}}{\text{total positives}} = \frac{8}{16} = 0.5$$

Jaccard Similarity for model B

$$\frac{\text{Overlapping positives}}{\text{total positives}} = \frac{8}{16} = 0.5$$

Jaccard Similarity for model C

$$\frac{\text{Overlapping positives}}{\text{total positives}} = \frac{10}{16} = 0.625$$

### Provisional Conclusion

Since these values are all 0.5 and above, this means that the AI models can be considered acceptable as an approach to depict Iraqi architecture. However, to another experiment was conducting using the same method generating images through AI.

### Keywords

Contemporary, traditional styles, 1960s and 1970s architecture, brick screens, concrete, iron elements, ceramic facades, semi-circular towers, Mesopotamian-inspired recesses, square towers, traditional and modern fusion, Iraq's architectural identity.

### Prompts

A contemporary architectural design inspired by Iraqi traditional styles from the 1960s and 1970s. brick screens, concrete, and iron elements, ceramic facades, and semi-circular towers. Integrate modern materials while preserving the essence of Mesopotamian-inspired recesses, projections, and square towers. Emphasize traditional and modern fusion, reflecting Iraq's architectural identity. Get inspiration from Mustansiriya university building design, Iraqi industrials union building, Mohammed Makkiya work, modern style.



Fig. 17: AI simulation model D (predicted)

Source: <https://gencraft.com/>



Fig. 18: AI simulation model E (predicted)  
Source: <https://lexica.art/>



Fig. 19: AI simulation model F (predicted)  
Source: <https://www.bluewillow.ai/>

Table 5: Jaccard Similarity for AI models D,E and F  
Source: Authors

Indicators	Iraqi Architecture (Actual)	AI simulation model D (predicted)	AI simulation model E (predicted)	AI simulation model F (predicted)
Orientation towards traditional forms	1	1	0	1
Focusing on material (brick)	1	1	0	1
Focusing on concrete material and iron.	1	0	1	1
Human scale	1	0	0	1
Modern Abbasid quadrilateral arch	1	0	0	1

	The abstract arc of the triangular shape	1	0	0	0
	Use of shanasheel (explicit or abstract form)	1	0	0	0
	Using ceramic material in the facades and the details	1	0	0	0
	Use of the inner courtyard	1	0	0	1
	Using the porticos	1	1	0	1
	The cubic or rectangular shape of the building block	1	1	1	1
	Use a concrete crown or hat at the top of the building	1	0	0	0
	Focus on the design of the corner of the building (smashing, grading, or deletion)	1	1	0	0
	The use of concrete and bricks in the details of the facades (in arches, shanasheel, etc.)	1	1	0	1
	Use of Mesopotamian system of fluting and protrusions.	1	1	0	1
	Use of Mesopotamian square or semicircular towers.	1	1	0	1

**Table 6:** Jaccard values for AI models D,E and F

Source: Authors

		AI simulation model D		AI simulation model E		AI simulation model F	
		negative	positive	negative	positive	negative	positive
actual	negative	0	0	0	0	0	0
	positive	8	8	14	2	5	11

Jaccard Similarity for model D

$$\frac{\text{Overlapping positives}}{\text{total positives}} = \frac{8}{16} = 0.5$$

Jaccard Similarity for model E

$$\frac{\text{Overlapping positives}}{\text{total positives}} = \frac{2}{16} = 0.125$$

Jaccard Similarity for model F

$$\frac{\text{Overlapping positives}}{\text{total positives}} = \frac{11}{16} = 0.6875$$

**Provisional Conclusion**

It is noted that models D and F have a value of 0.5 and 0.6875 respectively so we can only assume that the results generated by AI are acceptable for impersonating local Iraqi architecture. However, for the model E, the result was 0.125 which is considered as a low value and therefore, it cannot be acceptable as a representation of local Iraqi architecture. The Table 7 presents the final results for all the AI models.

**Table 7:** The final results for all AI models.

Source: Authors

	AI simulation model A	AI simulation model B	AI simulation model C	AI simulation model D	AI simulation model E	AI simulation model F
Jaccard coefficient index	0.5	0.5	0.625	0.5	0.125	0.6875

### Final Conclusion

To sum up, as shown in the Table 7, the five models out of the six reached scores of 0.5 and above. Therefore, it is justifiable to deduce that the AI generated models are suitable in rooting local Iraqi architecture. While AI has the capacity to optimize and even innovate, the human element in traditional architecture imbues designs with cultural and emotional significance that is not easily replicated by algorithms. The Table 8 presents a comparison in applications between local architectural elements and the AI-generated elements.

**Table 8:** Comparison in application between local architectural elements and AI-generated elements

Source: Authors

Local architectural elements	Traditional	AI-generated
Abbasid Quadrilateral Arch	Stands as a significant feature in Islamic architecture, often created with detailed craftsmanship.	Could replicate and optimize the design but may lack the human emotional touch.
Abstract Arc of Triangular Shape	These arcs are usually designed considering aesthetics and cultural values.	AI could produce similar shapes, but optimized for material use and structural integrity.
Using Brick Material	Bricks are often used for decoration and screens with human artistry involved.	AI could optimize the brick layout for maximum structural efficiency and reduced cost.
Use of Shanasheel	Used both explicitly and abstractly, reflecting local cultural influences.	Could design efficient shanasheel but may miss cultural nuances.
Using Ceramic Material	Ceramics in facades offer a visual and tactile aesthetic.	AI can select ceramics based on properties like thermal conductivity but may overlook aesthetics.
Inner Courtyard	Often designed with social and cultural aspects in mind.	Could optimize for sunlight and air flow, but may overlook communal utility.
Using Porticos	Designed considering the aesthetic and spatial factors.	Could optimize for shelter and space usage, neglecting aesthetic considerations.
Building Shape	Cubic or rectangular shapes reflect architectural styles.	May favor shapes with improved thermal and structural efficiencies.
Concrete Crown or Hat	Often decorative and culturally resonant.	Likely to focus on the functional benefits, such as water runoff.
Building Corner Design	Manually designed, often with artistic flair.	May favor structural integrity over design elegance.
Material Use in Facades	Choice based on aesthetic and historical factors.	Would choose materials based on objective data, possibly compromising aesthetic richness.
Mesopotamian Details	Intricacies like fluting are manually crafted.	Could replicate but may not capture the essence or historical context.

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## Ethical Conduct

This research was conducted in accordance with the standard ethical practices. However, it did not involve any interactions with people.

## Availability of Data:

The data supporting this study are derived from various archival sources, and literature. They are available from the author upon reasonable request.

**Conflict of Interest:** The author declares no conflict of interest.

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