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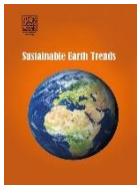

Studying and assessing the formation of geometric motifs in the architectural decorations of the second Pahlavi era with the Gestalt method

Sayeh Omidvari[a], Nigel Westbrook[b*]

[a] Department of Architecture, Faculty of Art and Architecture, Yazd University, Yazd, Iran
[b] School of UWA Design, Discipline of Architecture, University of Western Australia, Perth, Australia

ABSTRACT

The study of geometric patterns in the architectural decorations of the Second Pahlavi era underscores their pivotal role as symbols of Iran's cultural and historical identity, reflecting and reinforcing national pride. This research explores the intricate integration of Iran's cultural heritage with modernist movements, revealing how this synthesis influenced architectural design and identity during this period. Using a descriptive-historical method, it examines texts, documents, photographs, and architectural elements of 12 notable buildings from this era, applying the Gestalt method for detailed analysis. The findings demonstrate that geometric patterns served as decorative elements and powerful symbols of cultural identity. By merging traditional motifs with modernist principles, architects of the Second Pahlavi era achieved a harmonious balance in design, meeting functional needs while fostering a sense of cultural belonging. Influenced by Iran's architectural legacy and modern Western trends, they revitalized traditional forms, blending them with the International Style, notably the principles of the Bauhaus school and ideas from architects like Le Corbusier and Frank Lloyd Wright. This approach resulted in a unique semi-modernist Iranian style. Integrating modernist architecture with Iran's cultural heritage produced functional, aesthetically pleasing spaces that strengthened national identity. The architectural achievements of this period highlight the importance of maintaining a connection to historical traditions while adapting to contemporary demands. By leveraging modern technologies and knowledge, architects created innovative designs that resonate with modern sensibilities while showcasing Iran's rich cultural legacy. This research underscores the enduring significance of blending historical heritage with modernist innovation, offering valuable insights into contemporary architectural practices.

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*Corresponding author
E-mail address:
nigel.westbrook@uwa.edu.au
(N.Westbrook)

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1. Introduction

During the Second Pahlavi era, a relatively more liberal environment for cultural and artistic activities was established, and Iranian architecture experienced significant changes and transformations influenced by modernization and Westernization trends. Major transformations in social, cultural, and architectural fields were also observed (Ebnolreza et al., 2023). In the architecture of this period, geometric patterns were used not only as decorative elements but also as integral parts of building structures. The critical issue in formation of these geometric patterns was maintaining a balance between preserving artistic traditions and simultaneously responding to the needs of modern architecture (Abeddoost and Kazempour, 2016). During this period, geometric patterns were sometimes combined with innovative and creative approaches to depicting Iranian architecture in a contemporary language. These patterns were often inspired by the art and architecture of previous Iranian eras, such as the Sassanid and Achaemenid periods.

In the Second Pahlavi Era, contemporary Iranian architecture was reshaped under the influence of modernism and the return of Iranian graduates from abroad. This period witnessed a combination of traditional elements such as arches, vaults, and domes with contemporary functions (Mohammadi and Mansour, 2018). For example, the Azadi Tower, designed by Hossein Amanat, is an example of this combination. This structure, which employs geometric patterns in conjunction with traditional Iranian elements, has become one of the symbols of modern Iranian architecture (Ahmadnia and Goodarzi, 2020). However, the use of geometric patterns as one of the traditional and indigenous elements in architectural decorations continued. These patterns were employed not only as aesthetic elements but also as symbols of Iran's cultural and historical identity. To gain a better understanding of this subject, one can study and analyze the significant architectural works of the Second Pahlavi era and examine the application of geometric patterns in them. This endeavor can provide a deeper comprehension of the role of geometric patterns in architectural decorations and their cultural and social impacts during that period (Askarizad and Safari, 2020). The Table 1 provides a summary of studies related to the topic of "Geometric Patterns in Architectural Decorations of the Second Pahlavi Era". These studies include the year, methodology, and key findings of each study.

Table 1. A summary of research related to geometric motifs in architectural decorations of the Second Pahlavi Era.

Author	Year	Research Title	Methodology	Key results
Ahmadi and Maleki	2024	Geometric analysis of the architectural motifs of the Second Pahlavi	Geometric and historical analysis	A comparative study of geometric motifs and their effects on contemporary decorations
Mousavi and Rezaei	2023	The study of geometric role in the architectural decorations of the Second Pahlavi period	Descriptive and historical analysis	Identifying recurring patterns and the effects of Islamic art on Pahlavi geometric motifs
Karimi and Mohammadi	2023	The impact of Islamic art on the geometric motifs of Second Pahlavi architecture	Comparative and historical analysis	Comparison of the geometric motifs of the second Pahlavi architecture with the previous periods and their mutual effects
Salimi and SHikhi Mollashahi	2023	Study and analysis of residential architectural decorations of Qajar and Pahlavi periods in Bukan city	Historical and descriptive analysis	A comparative study of the decorations of the Pahlavi period with the Qajar period and their mutual effects
Afshari et al.	2021	A qualitative analysis of public buildings of contemporary Iranian architecture in the second Pahlavi period with a tectonic approach	Qualitative and descriptive analysis	Identification and analysis of the role of tectonic in geometric decoration
Hosseini and Abbasi	2021	A comparative analysis of the geometric motifs of Pahlavi and Qajar architecture	Comparative and historical analysis	Comparison and analysis of geometric motifs in the Pahlavi and Qajar periods and differences and similarities
Montasheri and Shahbazi Shiran	2021	A comparative study of "decorations of geometric motifs of knots" in Islamic architecture and the mystical rule of "modernity of proverbs"	Comparative and historical analysis	Comparison of the geometric motifs of Pahlavi architecture with mystical foundations
Hashemian	2020	A study of conical sections in the decorations of the second Pahlavi architecture	Geometric and descriptive analysis	Analysis of the application of conical sections in geometric motifs and its impact on the aesthetics of Pahlavi architecture
Rahmani and Najafi	2019	The study of geometric motifs in the second Pahlavi architecture	Descriptive and historical analysis	Identification and analysis of geometric motifs used in the landmark buildings of the second Pahlavi period

2. Material and methods

2.1. Problem description

The analysis of the formation of geometric patterns in the architecture of the Second Pahlavi era depends on several fundamental factors. This period, characterized by efforts towards modernization and urban development, witnessed significant changes in architectural styles. On one hand, architects aimed to preserve traditional patterns while meeting contemporary needs and international standards. On the other hand, cultural and social influences stemming from political and economic transformations also played a role in shaping these patterns (Sharifinia et al., 2013).

During this period, modern Iranian architecture was mainly supported by Iranian-educated architects, both those educated abroad and graduates of the University of Tehran. These architects, who were profoundly influenced by the intellectual currents of the 1960s and 1970s, sought to strike a balance between international styles and local vernaculars (Darskhan and Ardebili, 2019). The architecture of the Second Pahlavi Era can be divided into two groups: pioneering architects and later architects. The pioneers were those who conducted their activities before the Islamic Revolution, and the second group, the later architects, began their activities after the revolution and were generally students of the pioneering architects. This analysis indicates that Iranian architecture from the Second Pahlavi era was influenced by the impactful currents of modern architecture, resulting in an Iranian interpretation of this style, referred to as pseudo-modernism (Jalili and Mirzadeh Choubineh, 2015). Additionally, in the architectural perspective of the Second Pahlavi era, the elements that were utilized or imitated can be categorized into two types: distinct architectural elements in buildings such as columns, capitals, bases, windows, staircases, entrances, arches, and spans, and decorative elements such as relief carvings, sculptures, roof crenellations, and so on (Mohammadi and Ebrahimi, 2018). Moreover, the theoretical gap that may exist in examining the social and cultural impacts of geometric patterns during the Second Pahlavi era includes understanding how these patterns influenced national identity and urban living experiences in Iran, or their role in reflecting or opposing the political and cultural ideologies of the time. This involves comparing the predominant geometric patterns of this period and their interaction with modern architectural trends and examining their impact on the design processes of that era. The importance and necessity of this discussion from a practical perspective lie in the existing weaknesses and confusion in the interaction and functionality of advanced technology and structures in contemporary Iranian architecture, an issue that has not gone unnoticed by architectural researchers.

2.2. Main research objective

The main objective in examining the formation of geometric patterns in the architecture of the Second Pahlavi era is to understand how Iran's cultural heritage was integrated with modernist currents and its impact on contemporary Iranian architecture. These investigations enable us to comprehend how architects of this period, inspired by the past and utilizing contemporary technologies and knowledge, created spaces that meet functional needs while reinforcing a sense of cultural identity and belonging.
Moreover, studying geometric patterns in Pahlavi-era architecture helps us understand how these aesthetic elements acted as tools for expressing architectural concepts and ideas, and their role in shaping the visual and cultural identity of buildings and cities in Iran. These analyses can provide modern architects and designers with ideas for creating spaces that are culturally meaningful and meet contemporary needs.

2.3. Research questions

One of the key questions in examining the formation of geometric patterns in the architectural decorations of the Second Pahlavi era is how these patterns relate to previous architectural and artistic styles and what differences and similarities they have with them. Additionally, it is important to explore how these patterns have been symbols of the modern era and modernization in Iran while maintaining a connection to the past and contributing to innovation in Iranian art and architecture.
1. What cultural and historical influences can be observed in the selection and use of geometric patterns in the architectural decorations of the Second Pahlavi era?
2. What specific techniques and methods were employed to create these patterns? Have technological changes in this period affected decorative methods?
3. What new geometric patterns emerged in the architectural decorations of the Second Pahlavi era, and how do these patterns align with the concepts of modernity and modernization in Iran?
4. In which parts of architecture (such as facades, interior decorations, flooring, etc.) were geometric patterns used most frequently, and what roles did they play in the functionality and aesthetics of these buildings?
5. What methods and tools were used to draw geometric patterns in the architecture of the

Second Pahlavi era, and how have these methods evolved from previous periods?
By addressing these questions, the research aims to provide a comprehensive understanding of the role and impact of geometric patterns in the architecture of the Second Pahlavi era, thereby contributing to the field of architectural history and contemporary design practices.

2.4. Methodology

The research methodology is descriptive-historical. This approach involves collecting information and analyzing historical texts, documents, maps, photographs, and other historical sources related to architecture and geometric patterns during the Second Pahlavi era. This method allows the researcher to gain a deeper understanding of how Iran's cultural heritage was integrated with modernist trends and their impact on Iranian architecture. Subsequently, a detailed analysis and comparison of this information will be conducted using case studies and analyzed based on Gestalt theory. Gestalt is a psychological approach that posits that individuals tend to perceive patterns and shapes as cohesive and unified wholes rather than as separate components. Its main principles include similarity, proximity, continuity, closure, and figure-ground.

2.5. Theoretical foundations

2.5.1. Architecture of the Second Pahlavi Era

Methods of buildings' design in the Second Pahlavi Era are shown in Fig. 1. The Second Pahlavi Era (1941-1979) coincides with the late modern architecture period in the West (1945-1972). During this period, various modern architectural schools were introduced to Iran. With the return of architects educated in the West and the arrival of architecture graduates at the Faculty of Fine Arts, supporters of Bauhaus, Modernism, and International Style pursued different paths (Mohammadi, 2017). Renowned international architects also entered the Iranian architectural scene, raising professional standards to the extent that some have labeled this period as the era of professional awakening (Diba, 2001, Zarkesh, 2012). The modern architecture that emerged in this period was primarily influenced by the prevalent and sometimes pioneering thoughts of European architects such as Le Corbusier, Frank Lloyd Wright, Richard Neutra, and Alvar Aalto (Fallah and Movahed, 2017). This resulted in an Iranian form of modern architecture known as pseudo-modernism. Styles such as International Style, Art Deco, Brutalism, Minimalism, High-tech, and Organic Architecture, which are sub-branches of modern architecture in the West, also saw noteworthy examples constructed in Iran during this time.

2.5.2. Major architectural styles in this period

1. Traditional Architecture and Traditionalism
2. Elevated and Late Modern Architecture (Art Deco, International Style, Sculptural Style, Brutalism, Minimalism)
3. Organic Architecture
4. Iranian Modernism
5. High-tech Architecture

2.5.3. Characteristics and contexts of Second Pahlavi Era architecture

- Growth in architecture and urban planning, along with increased presence of top-tier global architects in Iran.
- Diversity in the design and execution of public buildings during this period.
- Concurrent with the peak and golden age of late modern architecture in the West.
- Presence of both domestically and internationally educated architects.
- Political stability compared to the previous era, leading to further flourishing of architecture and construction.

2.5.4. Architectural insights of this period

Innovators: Innovators include those continuing the International Style and supporters of Bauhaus and Modernism. While not neglecting indigenous and historical architecture teachings, they often chose the International Style in their designs. Notable figures in this group include "Farmanfarmayan," "Seihoun," "Aftandilian," "Ghaiai," "Iraj Etesam," and "Yousef Shariat Zadeh." The presence of famous international architects in Iran during this period testifies to the alignment of Iranian modern and innovative architecture with global trends (Seyedian, 2014).

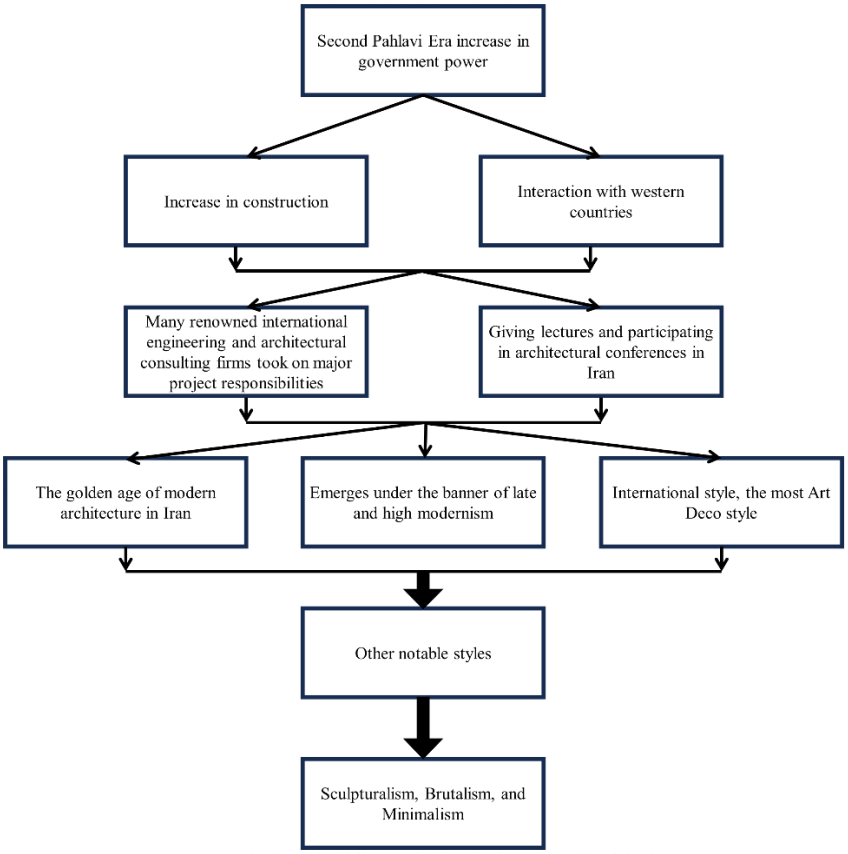


Fig. 1. Methods of buildings' design in the Second Pahlavi Era.

Neo-Traditionalists: Neo-traditionalists advocate for the revival and renaissance of indigenous and Iranian (pre-Islamic and post-Islamic) architectural values. Influenced by critiques of modern architecture in Europe during the 1960s, they seek to re-examine indigenous architectural values and employ the metaphorical essence of Iranian expression in their architectural creations. Prominent figures in this category include "Mohammad Amin Mirfenderski," "Nader Ardalan," "Kamran Diba," "Hossein Amanat," and "Latif Abolghasemi." Their works are among the first post-modern Iranian architectural projects focusing on ancient Iranian concepts (Hosseini Moghaddam and Kazemi, 2018).

Expressionists: Expressionists draw inspiration from contemporary global architecture and believe in making artistic expressionist statements through architecture. Housing construction by the private sector and prevalent construction speculation reflects an expressionist and eclectic approach in some architectural works of this period (Pour Etesami, 2020).

Geometric patterns in the architecture of the Second Pahlavi Era: Geometric patterns in architecture involve the use of regular and repetitive shapes and designs formed from basic elements like lines, circles, triangles, polygons, and other geometric shapes. These patterns can be utilized in tile work, stucco, and other decorative methods in both the interior and exterior architecture of buildings. Below are the key characteristics and influences of geometric patterns in the architecture of the Second Pahlavi Era (Afshari, 2020):

1. Redefining Iranian Traditions in a Modern Framework: During the Second Pahlavi era, the use of geometric patterns was a reinterpretation of Iranian traditions in a modern framework. Architects of this period employed traditional designs and modern technologies to create works that were both traditional and modern. This redefinition is evident in various projects, including public and cultural buildings.
2. Symbolism and Reinforcement of National Identity: Geometric patterns were used as symbols of national and cultural identity in this period. These patterns were employed in national buildings like the Azadi Tower and museums, demonstrating a deep connection with cultural heritage and efforts to reinforce national identity.

3. Technical Innovations and Use of New Materials: New technologies and materials, such as concrete and lightweight metals, enabled the precise and complex execution of geometric patterns. These innovations allowed architects to implement traditional patterns with high accuracy and on a larger scale, resulting in technically and aesthetically remarkable buildings.
4. International Influences and Alignment with Modern Global Architecture: The geometric patterns of this period were not only rooted in Iranian traditions but were also influenced by international modern architectural styles. Iranian architects, inspired by Western modernist movements, utilized geometric patterns in ways that aligned with modern concepts while preserving their Iranian authenticity.
5. Emphasis on Functionality and Aesthetics: Geometric patterns in the architecture of the Second Pahlavi era were designed to be both aesthetically pleasing and functional. These patterns were used in the interior and exterior design of buildings, enhancing the decorative and aesthetic aspects while also addressing the efficiency and functionality of the spaces.
Geometric patterns in Second Pahlavi Era architecture: Geometric patterns in the Second Pahlavi era reflect efforts to modernize while preserving national identity through a return to traditional arts and their integration with modernism. These patterns are visible in the architecture of significant buildings from this period and play a crucial role in redefining Iranian architectural art and identity. Architects of this era employed new techniques and materials to use geometric patterns in ways that ensured both beauty and optimal functionality (Mehrdad and Roshan, 2019). The influencing factors on geometric patterns during this period are outlined below:
Integration of tradition and modernity: In the Second Pahlavi era, geometric patterns served as a bridge between traditional Iranian architecture and Western modernism. Architects drew inspiration from traditional patterns and reimagined them using modern materials and techniques.
Major national projects: Large architectural projects during this period, such as the University of Tehran and royal palaces, utilized geometric patterns in their decorations. These projects not only emphasized aesthetic aspects but also reinforced national identity. Important buildings like the Azadi Tower and the Azadi Sports Complex used geometric patterns in their facade and interior design. These buildings symbolized national identity and Iranian culture, inspired by traditional arts but built with a modern approach.

2.6. Application in public and urban architecture

Geometric patterns were used in the decoration of public and urban buildings such as universities, libraries, and museums. This widespread application highlights the profound impact of these patterns on the architecture and urban planning of the Second Pahlavi Era. Examples of geometric patterns used in the architecture of the Second Pahlavi era include decorative elements such as relief carvings, sculptures, and roof crenellations are presented in Fig. 2. These patterns are not only aesthetically significant but also hold cultural and historical importance.

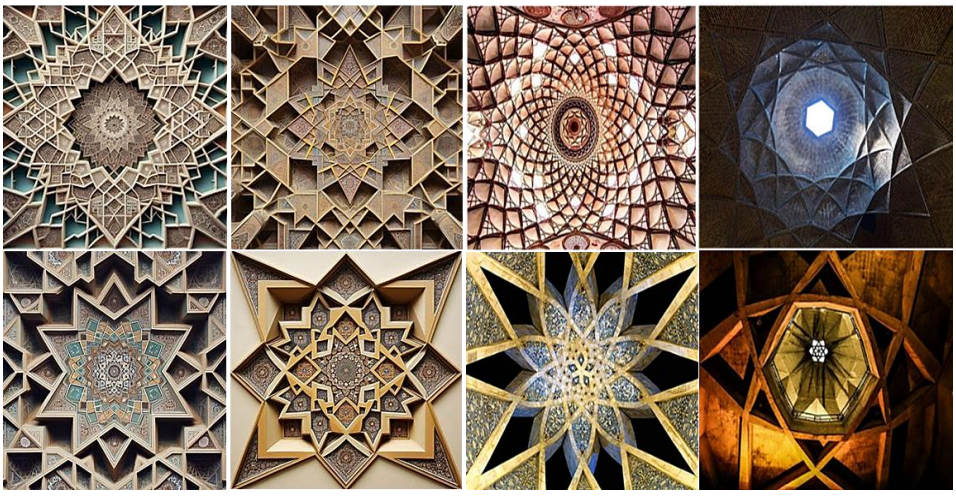


Fig. 2. An example of geometric motifs in the decorations of the second Pahlavi architecture.

2.7. Techniques of construction and decorative patterns in the architecture of the Second Pahlavi Era

During the Second Pahlavi Era (1941-1979), construction techniques and decorations in architecture were significantly influenced by modernism and global architectural trends Simultaneously, efforts were made by Iranian architects to preserve and revive traditional and indigenous elements within these techniques. Below, some of the construction and decorative techniques of this period are examined.

1. Use of Reinforced Concrete: Reinforced concrete became one of the primary materials in the construction of buildings during the Second Pahlavi era. This material, with its high capabilities in creating complex and robust forms, allowed architects to execute large modern designs. Reinforced concrete was used in major structures such as towers, bridges, and public buildings.
2. Geometric Decorations: Geometric patterns were a key element in the decorations of this era's architecture. These patterns, rooted in Islamic art, were reimagined in a more modern and abstract manner and used in various parts of buildings such as facades, ceilings, and walls. The use of tilework with geometric designs and intricate mosaics was also common.
3. Application of Glass and Metal: The use of glass and metal in building facades increased dramatically. Large panes of glass and extensive windows combined with metal frames gave buildings a modern appearance and also allowed more natural light to enter the interiors.
4. Prefabrication and Modular Construction: Prefabrication techniques and the use of modular components in buildings received attention. These techniques enabled architects to construct their buildings more quickly and with higher quality. Modular components were factory-made and assembled on-site.
5. Use of Indigenous Materials: Despite modern trends, architects of the Second Pahlavi era endeavored to use indigenous materials such as brick, tile, and plaster in both interior and exterior decorations. These materials, combined with traditional patterns and designs, bestowed a national identity upon the buildings.
6. Use of Geometric and Islamic Patterns: The use of geometric patterns rooted in Islamic art continued in the decoration of public and religious buildings. These patterns were applied through tilework, plasterwork, and mosaics on facades and interior spaces.
7. Tilework and Mosaics: Tilework with geometric patterns and vibrant colors remained one of the primary decorative techniques. Additionally, colorful mosaics were used to decorate walls and floors.
8. Lighting: Lighting was used as both a decorative and functional element in architecture. The use of recessed lights and indirect lighting gave spaces a special ambiance and helped emphasize architectural details.
9. Integrative Techniques: The integration of modern and traditional elements was visible in the architecture of the Second Pahlavi era. Architects created buildings with a national identity while using modern techniques such as concrete casting and metalwork alongside traditional decorations like tilework and plasterwork. Decorative plasterwork inspired by traditional and Islamic designs was especially common in the ceilings and interior walls of buildings.

2.8. Cultural and historical influences on the decorative forms of Second Pahlavi Era architecture

The cultural and historical influences on the decorations of the architecture of the Second Pahlavi era were dependent on numerous factors, including social, political, and economic changes as well as international influences. During this period, architects aimed to create architecture that aligned with global trends while preserving Iran’s national identity. Below, some of these influences are highlighted:

1. Cultural Influences: Modernism and Globalization: The Second Pahlavi era was marked by the promotion of modernism and a desire to align with Western architecture. These influences were transferred through the educational travels of Iranian architects to Europe and the United States, as well as the employment of foreign architects in Iran.

Return to National Identity: Alongside the inclination towards modernism, there was a movement to return to national identity and use traditional elements of Iranian architecture. This return aimed to preserve Iran’s cultural and historical identity (Zad-Ghanad, 2014).

2. Historical Influences: Political and Economic Transformations: Political and economic changes also had significant impacts on the architecture of this period. Particularly, the Shah's economic development programs and land reforms led to increased investment in infrastructure and large-scale construction projects (Kabir Saber, 2015; Karbasian and Eman Talab, 2015).
3. International Influences: International Relations: Iran's international relations with Western countries, especially the United States and Europe, played a crucial role in the transfer of modern technologies and architectural styles to Iran (Beheshti Nejad et al., 2017).

2.9. The Influence of various civilizations on Geometric patterns in the architecture of the Second Pahlavi Era

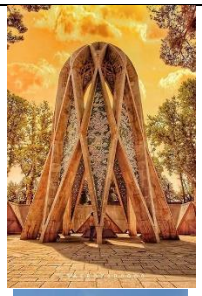
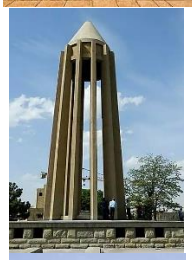
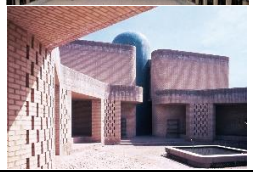
During the Second Pahlavi era, Iranian architects and designers, by drawing from Iran's rich cultural and civilizational past and utilizing principles and aesthetics of modern architecture, innovatively applied geometric patterns in architecture. The influences of Mesopotamian, Egyptian, and ancient Iranian civilizations are visible in these geometric patterns. Below is a detailed examination of these influences:
Mesopotamian civilization: Mesopotamia, one of the oldest human civilizations, had profound impacts on the art and architecture of the Middle East, including Iran.
1. Repetitive and Regular Patterns: The repetitive and regular patterns seen in Mesopotamian architecture were adopted in Second Pahlavi architecture as well. These patterns often included simple geometric shapes such as rectangles, squares, and triangles that were repetitively used in building facades.
2. Use of Staircases and Platforms: Architects of the Second Pahlavi era utilized the design of staircases and platforms in their buildings, a design rooted in the architecture of Mesopotamian ziggurats. These influences are particularly evident in tall towers and government buildings (Rais Zadeh and Mofid, 2012; Ansari, 2016).
Ancient Egyptian civilization: Ancient Egypt, with its grand architecture and precise geometric patterns, had significant influences on the designs of the Second Pahlavi Era.
1. Precision in Lines and Geometric Shapes: Architects of the Second Pahlavi era were inspired by the precision and geometry of ancient Egyptian architecture. The straight and precise lines and orderly geometric shapes in the facades of buildings of this period are clear examples. This precision and geometric order enhanced the sense of solidity and visual beauty in the buildings.
2. Inspiration from Pyramids and Obelisks: The geometric structures of Egyptian pyramids and obelisks inspired the design of towers such as the Azadi Tower. The use of pyramid shapes and tall, slender columns in Second Pahlavi architecture reflects these ancient Egyptian influences.
Ancient Iranian civilization: The ancient Iranian civilization, especially during the Achaemenid and Sassanian periods, had deep influences on the art and architecture of the Second Pahlavi Era.
1. Traditional Iranian Motifs and Patterns: Traditional Iranian motifs such as Boteh (paisley), arabesques, and geometric interlaces, which were used during the Achaemenid and Sassanian periods, were revived in Second Pahlavi architecture. These motifs were used as decorative details on facades and interior spaces, conveying a sense of connection with Iranian history and culture.
2. Inspiration from Persepolis and Other Achaemenid Structures: The grand architecture and geometric patterns of Persepolis served as significant sources of inspiration for architects of the Second Pahlavi era. Tall columns and decorative capitals seen in Persepolis were used in public and government buildings of this period. For example, the design of the Azadi Tower's facade was inspired by elements of Achaemenid architecture (Zarei, 2015).

3. Results and discussion

Initially, the formation of geometric patterns in the architectural works of the Second Pahlavi era is examined, followed by an analysis of significant works based on the principles of Gestalt theory. Geometric patterns during the Second Pahlavi era played a crucial role in beautifying and harmonizing spaces. These patterns were used not only as decorative elements but also as symbols of Iranian culture and art. Below is an analysis of geometric patterns in selected architectural works from

this period. The detailed study of geometric patterns in the Second Pahlavi architecture reveals how these designs, inspired by various ancient civilizations, were adapted to create a unique architectural identity that blends modernism with traditional Iranian aesthetics. The formation of geometric motifs in the architectural works of the Second Pahlavi Era is shown in Table 2.

Table 2. The formation of geometric motifs in the architectural works of the Second Pahlavi Era.

Pictures	Building Name	How geometric motifs are formed	Description
	Tomb of Khayyam Neyshaburi	Polygonal patterns and curved lines	The use of regular polygonal patterns and curved lines in the design of the building enhances the sense of harmony and beauty. Geometric motifs can be seen in architectural tiles and decorations.
	Tomb of Bu Ali Sina	Recurring columns and patterns	The geometric motifs are formed using the repetition of numerous columns and regular patterns in the exterior and interior. These patterns create visual continuity and a sense of robustness.
	Tomb of Nader Shah	Symmetry and simple geometric patterns	The design of the dome and exterior has been done using symmetry and simple and symmetrical geometric patterns that give the building a sense of balance and strength.
	Tomb of Kamal-ol-Molk	Straight lines and gentle curves	The use of simple geometric patterns with straight lines and gentle curves in the design of the building enhances the sense of calm and harmony. Geometric motifs can be seen in the decorations of the walls and ceilings.
	Carpet Museu	Complex and repetitive motifs	Geometric motifs in this museum have been used in the design of carpets and walls using complex and repetitive patterns. These patterns showcase visual diversity and richness.
	Tehran Museum of Contemporary Art	Combining modern geometric forms	The use of various and repetitive geometric forms can be seen in the interior and exterior design of the museum. These combinations add a sense of movement and dynamism to the space.
	Jundishapur University Mosque	Islamic geometric patterns and tiling	The use of Islamic geometric patterns such as muqarnas and symmetrical tiles can be seen in the design of the mosque. These patterns help to beautify and strengthen the sense of spirituality.

	Azerbaijan Museum in Tabriz	Local motifs and recurring patterns	The use of local geometric motifs and recurring patterns in the interior and exterior design of the museum helps to strengthen the local and cultural identity of the building.
	Islamic Consultative Assembly Building	Symmetry and formal geometric patterns	Geometric motifs have been used in the design of the building using symmetry and formal and simple patterns. These patterns reinforce the sense of power and formality of the space.
	Isfahan Sepah Bank Central Branch Building	Combining straight and curved lines	The use of a combination of straight and curved lines in the design of geometric motifs gives a sense of dynamism and movement to the space. These patterns help create a modern and elegant design.
	Azadi Tower	Complex and polygonal patterns	The use of complex and polygonal patterns in the design of the exterior and interior facades gives the building a sense of grandeur and strength. Geometric motifs have been widely used in the design of the tower.
	Vahdat Hall	Combining traditional and modern patterns	The use of a combination of traditional Iranian patterns with modern forms in the design of geometric motifs gives a sense of harmony and balance to the space. These patterns help to beautify and create a rich cultural atmosphere.

Also, the principles of Gestalt theory have been used to know and understand the formation of geometric motifs in these works. Gestalt is a psychological approach based on the premise that people tend to perceive patterns and shapes as coherent and integrated wholes, rather than as separate parts. This approach was developed by German psychologists such as Max Wertheimer, Wolfgang Köhler, and Kurt Koffka in the early 20th century. The main principles of Gestalt include similarity, contiguity, continuity, closure, and form-ground. Analyzing the architectural works of the second Pahlavi period based on Gestalt theory is an interesting and accurate way to investigate these buildings. Gestalt theory in different artistic and visual fields analyzes how humans perceive forms and patterns and can help to understand the design and composition of architecture more deeply. The analysis of these works based on Gestalt principles is shown in Table 3. As a result, the use of Gestalt principles in the design of geometric motifs in the architecture of the second Pahlavi period allows architects to create patterns that are not only aesthetically outstanding but also psychologically pleasant and effective. These motifs in the important buildings mentioned above are a symbol of the effort to revive the national identity and accept modernity. To answer the main question of the research, which seeks to investigate the relationship between geometric motifs and previous architectural and artistic styles, find the differences and similarities they have with them, and investigate how these motifs have become symbols of the modern era and modernism in Iran, qualitative analysis of this the works have been analyzed by the method of content analysis (Table 4).

Table 3. Analysis of the architectural works of the Second Pahlavi period based on Gestalt theory.

The name of the building	Gestalt principle	Description
Tomb of Khayyam Neyshaburi	Symmetry and balance	The design of the mausoleum uses regular geometric forms and symmetry in different parts to give the audience a sense of balance and solidity.
Tomb of Bu Ali Sina	Proximity	The use of numerous and close columns that are visually related to each other distinguishes this building from the Gestalt view.
Tomb of Nader Shah	Closure	The complete geometric shape of the tomb, especially in the dome section, makes the eye of the beholder tend to close and complete the open forms.
Tomb of Kamal-ol-Molk	Shape and context	Focusing on the geometric forms in the main structure and combining them with the surrounding open space creates a strong contrast between the shape and the background.
Carpet Museum	Continuum	Repeated lines and forms in the interior and exterior design of the museum instill a sense of continuity and continuity in the mind of the viewer.
Tehran Museum of Contemporary Art	Repeat	The use of similar and repetitive forms in interior and exterior architecture helps to strengthen the visual structure.
Jundishapur University Mosque	Symmetry and balance	The use of symmetrical geometric patterns in the design of the mosque enhances the feeling of solidity and balance.
Azerbaijan Museum in Tabriz	Proximity	The use of closely related components in the design of this museum helps to create visual integrity.
Islamic Consultative Assembly Building	Closure	The sturdy and closed design of the building facilitates the creation of a complete and defined form in the viewer's mind.
Isfahan Sepah Bank Central Branch Building	Shape and context	The contrast between the building and the surrounding environment focuses the viewer's focus on the architectural forms of the building.
Azadi Tower	Symmetry and balance/shape and context	By using symmetry in its design, the Azadi Tower instills a sense of balance and solidity in the viewer. Symmetrical vertical and horizontal lines are visible in different parts of the tower, which helps to create a balanced visual structure. The Azadi Tower stands as a prominent form in front of the sky and Azadi Square, making it easier for the viewer to focus on the tower as the main figure in front of the background.
Vahdat Hall	Compare and equalize/continue	Vahdat Hall instills a sense of harmony and balance by using symmetry in the design of the façade and interior. Symmetry is seen in geometric patterns and spatial divisions. Recurring lines and patterns in the interior design of the hall, such as ceilings and walls, create a sense of continuity and continuity in the viewer's mind. This continuity contributes to a seamless visual experience.

Table 4. Differences and similarities between the architecture of the previous period and the Second Pahlavi architecture.

Similarities	The difference between the geometric motifs of the second Pahlavi period	Differences between previous geometric motifs	aspect
Continued use of geometric patterns with more complex compositions	Modern geometric motifs with more complex combinations, the use of new technologies for greater precision in decorations	Traditional motifs with repetitive patterns and muqarnas work, tile work, and murals	Motifs and decorations
Using similar geometric techniques	Laser Cutting, Metal Molding, CNC Machines, CAD	Hand tools such as a Pregar and ruler	Tools & Techniques
Use of natural materials	Concrete, Metal, Glass	Tiles, wood, bricks	Materials
Connection with cultural Identity	Symbols of modernity and modernism	Reflecting cultural and religious identity	Cultural concepts
Continuing the construction of mosques and mausoleums with new styles and materials	Design of public and governmental spaces, cultural and artistic centers, office and commercial buildings	Focus on religious spaces and mosques, markets, and traditional houses	Implications
Decorative and symbolic motif	Combining traditional Iranian styles with modern elements, using simple and minimalist forms	Traditional Iranian architecture includes extensive use of porches, domes, muqarnas, and geometric repetitive patterns	Style & Form
Continued emphasis on national and cultural identity in light of social changes	Efforts to reconstruct national identity with an emphasis on modernity and the creation of new symbols such as the Azadi Tower	Religious and National Identity Using Traditional and Historical Elements	Identity and Symbolism

According to the above works, below is a qualitative content analysis Table 5 for the connection of geometric motifs in the architecture of the Second Pahlavi period with previous architectural and artistic styles, as well as their role in displaying the values of modernity and modernism.

Table 5. Analysis of Second Pahlavi architectural works based on (Patterns, motifs, materials, concepts, applications).

Works	Geometric patterns and motifs	Tools and techniques	Materials	Cultural concepts	Applications
Tomb of Khayyam Neyshaburi	Traditional and repeating geometric patterns	Compass, ruler	Tiles, wood	Reflection of cultural and religious identity	Literary and cultural architecture
Tomb of Bu Ali Sina	Geometric motifs of Islamic art with symmetry and geometric combinations	Compass, ruler	Stone, Marble	Philosophical and scientific symbols	Religious and religious architecture
Tomb of Nader Shah	Complex and repetitive geometric patterns	Compass, ruler	Stone, Marble	Combining with imperial and Iranian values	Commemorative and historical architecture
Tomb of Kamal-ol-Molk	Geometric patterns using complex motifs	Compass, ruler	Stone, Marble	Symbolizing state and royal values	Commemorative and historical architecture
Carpet Museum	Geometric patterns by repeating geometric shapes such as crescents	Laser cut, CAD	Fabric, Carpet	Cultural and artistic symbolism	Museum and cultural architecture
Tehran Museum of Contemporary Art	Modern geometric patterns using modern technologies	laser cut, CAD	Metal, Glass	Displaying symbols of modernity and contemporary art	Museum and art architecture
Jundishapur University Mosque	Islamic geometric motifs with complex geometric combinations	Compass, ruler	Stone, Marble	Cultural and spiritual symbolism	Religious and educational architecture
Azerbaijan Museum in Tabriz	Traditional geometric patterns and imitation of ancient Iranian motifs	Compass, ruler	Stone, Marble	Reflection of regional cultural identity	Museum and cultural architecture
Islamic Consultative Assembly Building	Modern geometric patterns with modern technologies	laser cut, CAD	Stone, concrete, metal	Display of symbols of modernity and political	State and political architecture
Isfahan Sepah Bank Central Branch Building	Modern geometric patterns using modern technologies	laser cut, CAD	Metal, Glass	Display of symbols of modernity and economics	Modern and economical architecture
Azadi Tower	Geometric motifs with complex geometric combinations	laser cut, CAD	Metal, Glass	Displaying symbols of modernity and national values	Symbolic architecture and urbanism
Vahdat Hall	Geometric patterns with the repetition of simple and complex geometric shapes	laser cut, CAD	Metal, Glass	Display of symbols of modernity and culture	Recreational and cultural architecture

Geometric motifs in the architecture of the second Pahlavi period, by using modern models and tools, not only helped to preserve and value Iranian traditional and cultural works but also greatly contributed to innovation in Iranian art and architecture by displaying the values of modernity and modernism. These motifs were displayed as symbols of Iran's cultural and historical identity during different historical periods and played a key role in creating interaction between past and present.

4. Conclusion

The integration of Iran's cultural heritage with modernist trends in contemporary Iranian architecture, particularly during the Second Pahlavi era, played a significant role in shaping geometric patterns and the architectural identity of buildings. During this period, architects such as Louis Kahn and Hasan Fathi revitalized traditional architecture with a nostalgic perspective, drawing inspiration from the values and historical experiences of Iranian architecture1. Moreover, many contemporary buildings in Tehran adopted formal imitations of Iran's past architecture alongside Western modernist architecture (Hashemian, 2020). The architecture of the Second Pahlavi era can be defined within the framework of a triangle comprising Western cultural influences, Iran's historical heritage, and pre- and post-Islamic architecture. This period is recognized as the golden age of modern architecture in Iran,

where modernist architecture emerged with influences from the International Style, Bauhaus school, works of Le Corbusier, Frank Lloyd Wright, and others. These influences led to the creation of a quasi-modernist Iranian architecture where geometric patterns and traditional forms were innovatively adapted to contemporary needs (Goodarzi et al., 2022). Therefore, it can be said that the fusion of Iran's cultural heritage with modernist movements has been influential not only in the formation of geometric patterns but also in the overall design and architectural identity of the Second Pahlavi era. This fusion, while preserving connections to the past, contributed to the creation of flexible spaces suited to modern life.

1. Cultural and historical influences on the selection and use of geometric patterns in architectural ornamentation during the Second Pahlavi Era. During the Second Pahlavi Era, geometric patterns in architecture were often influenced by a combination of Iranian artistic traditions and modernist trends. These patterns draw on Islamic art traditions and the rich history of mathematics and geometry in Iranian culture on one hand12, and on the other hand, reflect efforts to innovate and internationalize Iranian architecture in line with the modernization and Westernization ideologies of the Pahlavi era. The cultural policies of Reza Shah and Mohammad Reza Shah Pahlavi, which emphasized modernization and the revival of Iran's national identity, played a significant role in the use of these patterns. Western modernist architectural influences are also clearly evident in this period, as architects endeavored to blend traditional patterns with modern forms and motifs, a feature observed in many buildings of this era.

2. What specific techniques and methods were used to create these patterns? Have technological changes during this period influenced decorative approaches significantly? During the Second Pahlavi era, a variety of techniques and methods were employed to create geometric patterns in architectural decorations. Techniques such as tile work, stucco work, and brickwork with intricate geometric patterns were common, and rooted in Iran's traditional arts. However, technological changes and the introduction of new techniques also had a considerable impact on decorative approaches. The use of new materials like concrete and metals, coupled with modern construction technologies, enabled the creation of more complex and precise designs. This combination of traditional methods and modern technologies allowed architects of this era to implement geometric patterns with greater accuracy and beauty. The integration of these techniques and modern technologies led to the evolution and enhancement of architectural decorations during the Second Pahlavi era.

3. In the architectural decorations of the Second Pahlavi era, what new geometric patterns emerged and how do these patterns resonate with modernity and modernization concepts in Iran? In the architectural decorations of the Second Pahlavi era, new geometric patterns emerged. These patterns included more abstract and intricate designs that utilized new materials such as concrete and metal, adapted to modern construction technologies. Patterns such as intricate mesh networks, repetitive patterns with angular and straight lines, and innovative blends of traditional and modern motifs are evident in many buildings of this period. These patterns reflect an effort to blend Iran's national and cultural identity with modernity and modernization concepts, simultaneously preserving cultural heritage while addressing the needs of contemporary architecture. These new patterns have guided Iranian architecture towards a contemporary and innovative identity, where the fusion of tradition and modernity achieves harmony and coherence.

4. In which sections of architecture (such as facades, interior decorations, flooring, etc.) were geometric patterns mostly used, and what role did they play in the functionality and aesthetics of these buildings? During the Second Pahlavi era, geometric patterns were extensively utilized in various sections of architecture, including facades, interior decorations, flooring, ceilings, and even windows. These patterns were used prominently on facades as decorative elements that imparted a distinctive visual identity to the buildings and created dynamic effects through a play of light and shadow. In interior decorations, geometric patterns adorned walls, ceilings, and even furniture, enhancing a sense of order and beauty by creating regular and harmonious patterns. In flooring, these patterns, using diverse materials such as tiles and ceramics, added depth and dimension to interior spaces. The role of these patterns was crucial in both the functionality and aesthetics of the buildings, as they not only embellished and

beautified but also contributed to establishing a sense of national and cultural identity, showcasing the harmony between traditional and modern elements in design. The extensive use of geometric patterns not only had aesthetic implications but also aided in optimizing spatial functionality and achieving coherence and unity in architectural designs of this period.

5. What methods and tools were employed for drawing geometric patterns in the architecture of the Second Pahlavi era, and how did these methods evolve from previous eras? In the architecture of the Second Pahlavi era, a variety of advanced and diverse methods and tools were employed for drawing geometric patterns, which had evolved significantly from previous eras. Traditional tools such as compasses, rulers, and wooden templates were used for creating precise patterns, but with the advent of new technologies, more modern tools such as laser cutting, metal molds, and CNC machines came into use. These advanced tools facilitated the creation of more intricate and precise patterns executed with greater accuracy. Additionally, the use of computer-aided design (CAD) software played a significant role in drawing and planning geometric patterns. These software programs enabled architects to design and simulate geometric patterns with high precision, which could then be realized using modern tools. This shift from traditional methods to modern techniques not only enhanced accuracy and efficiency but also significantly contributed to creativity and innovation in architectural design.

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