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ISLAMIC PALATIAL VOLUMETRIC SYSTEMS AS STRUCTURAL ELEMENTS

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ABSTRACT:

The Islamic palaces architecture is a highly advanced combination of space hierarchy, ritual order, and ecological sensitivity, which is attained by systematically elucidated volumetric systems. This paper analyses Islamic palaces volumetric buildings as structural and space aspects of monumental palaces in terms of how repeated architectural elements structure the functional, movement and symbolic power in a territory and time. By conducting a comparative study of five case studies, including Topkapi Palace (Ottoman), Lahore Fort (Mughal), Alhambra Palace (Nasrid), Ak-Saray Palace (Timurid) and Rohtas Fort (Suri), the research determines the following elements to be the central ones that create a common Islamic architectural vocabulary; courtyards, arcades, iwans, monumental gateways, axial planning and enclosure walls. Instead of taking these elements as the ornamental elements, the paper illustrates their functions as the leading regulators of the volumetric aspect of space hierarchy, mediators of the separation of the public and the private space, and responsiveness to the climatic and topographical conditions. Although the sizes and materialities differ, as well as the manifestations of the dynasty, the logic of volumetricity stays unchanged, indicating transregional persistence of Islamic palaces. These observations support the relevance of volumetric structure to the interpretation of the architecture of Islamic palaces and place these monuments in the context of unified space structures in which structural form, ritual use, and environmental adaptation cannot be separated.

KEYWORDS: Islamic architecture; palaces; volumetric systems; courtyards; iwans; arcades; masonry; structural challenges; monumental architecture

INTRODUCTION

Islamic palaces, which cover North Africa, as well as Central and South Asia, have a unique vocabulary of architecture which includes axial design, sequencing in hierarchy, modular courtyards, iwans, arcades, and monumental gates (Hillenbrand, 1994; Goodwin, 2003). All these aspects constitute a common vocabulary between dynasties, but the idea is interpreted by each palace depending on the climate, materials, topography and ideology of the dynasties. The axial design, such as, layout of space, is patterned by a processional course and arrangement of movement through narrowing areas and at the same time offering structural redundancy and definition of task (Ruggles, 2000). The courtyards are volumetric controllers, apportioning the loads between the perimeter walls, contributing to natural ventilation and illumination, and also marking out the areas of the public, semi-public, and private (Asher, 2005). In contrast to a mosque or a funerary monument, a palace is made up of residential, administrative, and ritual areas, and thus a volumetric harmony is needed to fill in the vast halls with smaller intimate chambers (Golombek and Wilber, 1988). They need a structural ingenuity because monumental spans, terraces on multi-levels and vaulted roofs apply complex compressive, tensile and lateral forces which have to be overcome using novel combinations of masonry, timber and stone (Michell, 1988). The transitional volumes are Iwans and great gateways which have a visual anchoring of facades as well as compression frames which effectively direct the structural loads (Petersen, 1996). Arcades and colonnades offer modularity to minimize the lengths of the spans and evenly share the weight and also form shaded circulation zones that are appropriate in hot climates (Ruggles, 2007). The enclosure walls, besides creating spatial hierarchy and power, also serve as volumetric stabilizers, which resist the forces applied on their sides in order to guard inner microclimates (Asher, 1992). This bilateral emphasis on both structural performance and symbolic representation make a point of the craftiness of Islamic palatial architecture. The aesthetic expression of the palaces coupled with engineering solutions has enabled the Islamic palaces to have a monumental size without the spatial hierarchy or the structural stability. The repetitive volumetric principles, which are marked by regional adaptation demonstrate the interaction of general architectural concept and the actual environmental, material and the local cultural conditions (Golombek, 2001; Michell and Dhaky, 1995).

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Architectural Component	Structural Role	Spatial / Volumetric Role	Environmental Role	Symbolic / Hierarchical Role
Courtyards	Interrupt continuous building mass, reduce roof spans, and transfer loads to perimeter walls and piers, enabling large halls without excessive masonry (Michell, 1988).	Act as primary volumetric regulators organizing surrounding halls, iwans, and wings into modular blocks (Ruggles, 2007).	Enable passive cooling through ventilation, daylight, and evaporative effects from water and gardens; moderate thermal movement and settlement (Petersen, 1996).	Establish ceremonial progression and access control, separating public, administrative, and private zones (Ruggles, 2007; Asher, 2005).
Iwans & Monumental Gateways	Compression-based masonry frames spanning wide openings; stabilize façades and distribute vertical loads to piers and walls (Goodwin, 2003).	Transitional volumes linking courtyards, halls, and wings, manipulating perception of scale along primary axes (Golombek & Wilber, 1988).	Recessed forms provide shaded buffer zones that reduce solar gain in hot climates (Petersen, 1996).	Mark thresholds of authority and procession, reinforcing hierarchy and ceremonial order (Hillenbrand, 1994).
Arcades & Colonnades	Divide roof loads into smaller bays, reducing span and dead load; assist lateral stability when paired with walls or vaults (Ruggles, 2000; Asher, 2005).	Create rhythmic spatial sequences around courtyards and circulation routes, ensuring structural regularity (Golombek & Wilber, 1988).	Shade circulation paths and channel airflow, acting as environmental buffers (Ruggles, 2000).	Reinforce axial order and visual hierarchy through repetition and proportional consistency (Golombek & Wilber, 1988).
Enclosure Walls	Resist lateral forces from roofs and vaults; integrate buttresses, bastions, and terraces responding to topography and seismic demands (Michell & Dhaky, 1995; Asher, 2005).	Define the palace's volumetric boundary and maintain axial continuity across large complexes (Hillenbrand, 1994).	Provide thermal mass that stabilizes interior temperatures and supports upper floors (Petersen, 1996).	Delineate authority, privacy, and functional segregation between public and restricted domains (Ruggles, 2007).
Axial Planning & Hierarchical Sequencing	Align columns, piers, and bays to simplify load paths and provide redundancy in force distribution (Petersen, 1996).	Organize spatial progression from public to private through courts, iwans, and halls along primary and subsidiary axes (Ruggles, 2000).	Support consistent daylighting and ventilation through ordered spatial alignment (Petersen, 1996).	Express political, social, and ceremonial hierarchy through controlled movement and visual focus (Golombek & Wilber, 1988).
Integrated Spatial–Structural System	Combines modular repetition and masonry logic to achieve monumentality without structural excess (Asher, 2005).	Unifies diverse components into a coherent volumetric framework adaptable across regions and periods (Golombek, 2001).	Coordinates microclimate control with large-scale enclosure through spatial integration (Petersen, 1996).	Reflects a shared cross-cultural architectural ethos underlying Islamic palatial design (Hillenbrand, 1994; Ruggles, 2007).

Table 1 Shared Architectural Components in Islamic Palatial Design: Roles and Functions, Drawn byAuthor

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CASE STUDY 1: TOPKAPI PALACE, ISTANBUL (OTTOMAN EMPIRE)

Topkapi Palace was built in 1459 under the order of Sultan Mehmed II, and it was the political, administrative, and residential center of the Ottoman Empire during the period of approximately 400 years. The palace, being strategically placed on a neighborhood on the tip of a promontory between the Bosphorus and the Golden Horn, coordinates a complex space hierarchy in a sequence of courtyards, pavilions, and ritual halls. All the courtyards follow a longitudinal axis and move towards the public reception space gradually to the domestic spaces of the Sultan. The palace combines both ceremonial, administrative, and residential purposes, which is a reflection of the Ottoman art of hierarchy and volumetric organization of space and follows the rules of Islamic architectural organization (Necipoglu, 1990; Goodwin, 2003). Topkapi Palace consists of four large courtyards with different functions and symbolism:

Courtyard	Volumetric Role in Palatial System	Functional and Symbolic Significance
First Courtyard (Outer Courtyard)	Operates as the primary public volumetric interface of the palace	Accommodates visiting dignitaries, palace guards, and service functions; establishes the initial ceremonial hierarchy and provides visual orientation toward the inner palace complex
Second Courtyard (Divan Courtyard)	Acts as an intermediary volumetric threshold between public and restricted zones	Houses the Divan (Imperial Council) and administrative offices; spatially separates governance and ceremonial activity from the Sultan's private residential domain
Third Courtyard (Enderun Courtyard)	Represents a controlled inner volumetric enclosure emphasizing restricted access	Contains the Sultan's private chambers, the Enderun school, and select ceremonial spaces; balances openness with privacy through layered spatial sequencing
Fourth Courtyard (Garden Courtyard)	Integrates outdoor volumetric systems within the palace hierarchy	Comprises terraced gardens, pavilions such as the Baghdad Pavilion, and leisure spaces for the royal household, demonstrating the fusion of garden landscapes with palatial architecture

Table 2Hierarchical Courtyard System in Topkapi Palace, Istanbul (Ottoman Empire), Adapted from Necipoğlu (2005); Goodwin (2003).

Key Islamic Architectural Components

- **Courtyards as Volumetric Regulators:**Topkapi Palace consists of a volumetric structure that consists of courtyards. They control spatial circulation, delineate societal ranks, and arbitrate the conditions of the environment. Open central areas can be ventilated naturally, sunlight can penetrate, and the pavilions can be seen. Framed by

arcades and colonnades, each of the couryards spreads the volumetric stress through the palace forming a pattern of open and semi-enclosed spaces typical of Ottoman palaces (Hillenbrand, 1994).

- **Arcades and Colonnades**: The boundaries of the courtyards are characterized by repetitive arcades and colonnades which are used for aesthetic and structural functions. They subdivide large open spaces into manageable spans to form shaded areas of circulation connecting the significant parts of the palace. The columns and piers are always positioned in line with the axis of the palace to enhance continuity of the visual perception and the logic of proportions over the modules of the courtyard (Ruggles, 2000). The arcades also give a buffer zone between the exterior courtyards and the inner halls with focus on the Islamic idea of the spatial progression.

- **Axial Progression:**The palace has a distinct axial structure, which directs flow of people in and out of the open courtyards through to the inner chambers which are private. The sequencing in this hierarchy guarantees the functional transparency and strengthens the ritual logic of access. Axial alignment can also be observed through the structure of the colonnades, gateways and the location of pavilions creating a uniform grid of volume throughout the palace. The repetition of axial axes gives the possibility to combine various volumetric scales, such as spacious courtyards and small rooms, which are examples of Islamic concepts of space hierarchy (Golombek and Wilber, 1988).

- **Monumental Gateways and Iwans:**The monumental gates, such as Imperial Gate (Bab-iHumayun), and thresholds, which follow one another, are volumetric anchors of the axis, which define Topkapi Palace. These portals merely serve as rites of passage, as they represent the boundaries between working areas. They focus on the architecture by highlighting the grandeur of approach, and framing the visual experience without losing harmonious proportions between the courtyards and adjoining halls. The volumetric rhythm of the palace is expressed by the use of iwans and gateway halls which give the palace points of focus (Goodwin, 2003).

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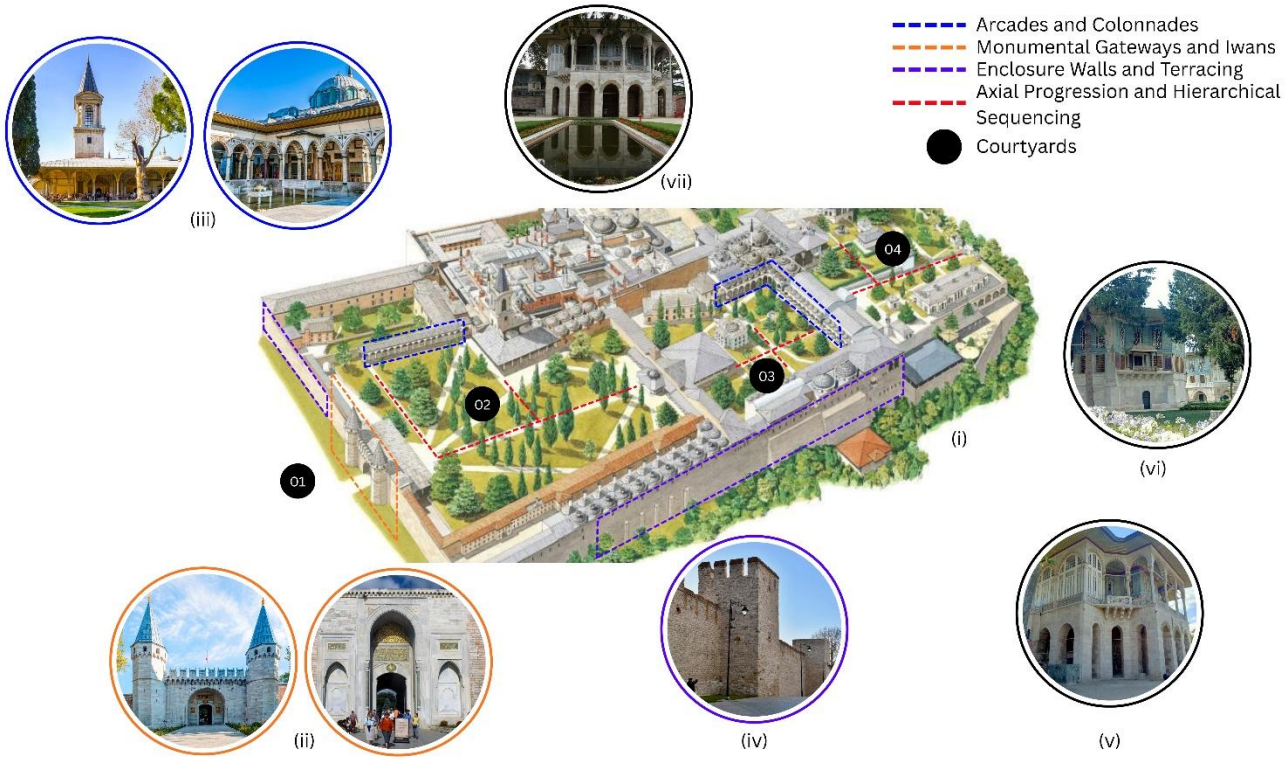
- **Perimeter Walls and Enclosure:**The palace is surrounded by huge masonry walls that outline the boundary of the palace with the incorporation of terraced landscapes. Enclosure walls offer framing to the entire complex of the whole court and increase axial clarity. The way they are tall and thick brings in a feeling of division between the world of the people, and the world of the administration and the world of the people whereas they contain gateways and corner pavilions in order to strengthen the geometric composition of the palace (Asher, 2005).

Figure 1. Spatial organization and architectural hierarchy of Topkapi Palace, Istanbul.



i) Palace Master Plan Murdock, R. (2022, January 4). The palace at the centre of Ottoman power. Ryan Murdock. Retrieved June 23, 2026, from https://ryanmurdock.com/2022/01/the-palace-at-the-centre-of-ottoman-power/ ii) Arcade in Harem and Tower of Justice, Advantour. (n.d.). Topkapi Palace Museum Istanbul – Topkapı Sarayı. Advantour. Retrieved June 23, 2023, from https://www.advantour.com/turkey/istanbul/topkapi-palace.html iii) Gate Salutation and Imperial Gate, Advantour. (n.d.). Topkapi Palace Museum Istanbul – Topkapı Sarayı. Advantour. Retrieved June 23, 2023, from https://www.advantour.com/turkey/istanbul/topkapi-palace.html. iv) Boundary Wall, Dunlop, D. (2022, September 16). Topkapi Palace – An Istanbul wonder. The Maritime Explorer. Retrieved June 23, 2023, from https://themaritimeexplorer.ca/2022/09/16/topkapi-palace/ v) Baghdad Pavilion, Clicked by Author vi) Courtyard Clicked by Author vii) Caner Cangül (Editor), Fatih Yasin Köroğlu, Ali Osman Dilekoğlu, & Contributors. (2025, December 9). Topkapı Sarayı Dördüncü Avlu Havuzu 3. Kültür Envanteri. Retrieved June 27, 2023, from https://kulturenvanteri.com/yer/topkapi-sarayi-dorduncu-avlu-havuzu-3/vii) Daily Sabah. (2024, June 8). Concubines' quarters of Topkapı Palace welcomes visitors for first time. Daily Sabah. Retrieved January 26, 2026, from https://www.dailysabah.com/arts/heritage/concubines-quarters-of-topkapi-palace-welcomes-visitors-for-first-time

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CASE STUDY 2: LAHORE FORT, LAHORE (MUGHAL EMPIRE)

The Lahore Fort, much of which was built during the reigns of the Mughal emperors, especially Akbar (r. 15561605), Jahangir (r. 16051627), Shah Jahan (r. 16281658) and Aurangzeb (r. 16581707), is one of the most sophisticated manifestations of Mughal palaces in South Asia. The fort was a political, administrative, and ritual centre of the Mughal Empire in the western subcontinent, and it was strategically located on the river of Ravi. The Lahore Fort, in contrast to strictly military citadels, incorporates into its structure fortification based on enclosure with an internally elaborate palatial structure consisting of courtyards, ceremonial halls, gardens, axial orientations and highly expressed pavilions. Its architecture is a synthesis of Persian, Timurid and local culture in an Islamic spatial system where emphasis is placed on hierarchy, procession and controlled access (Asher, 2005; Tillotson, 1990). Its main components include:

Courtyard	Volumetric Role in Palatial System	Reference
Alamgiri Gate Forecourt	Serves as the primary ceremonial entrance to the fort, regulating public access and establishing the main longitudinal axis. The forecourt mediates between the fortified exterior and the internal palatial hierarchy, emphasizing controlled transition and imperial authority.	Asher (2005); Tillotson (1990)
Diwan-i-Aam Courtyard	Houses the Hall of Public Audience, functioning as a semi-public administrative space where imperial governance was enacted. This courtyard marks the transition from publicly accessible zones to more restricted ceremonial spaces.	Asher (2005)
Diwan-i-Khas Courtyard	Contains the Hall of Private Audience and adjoining elite chambers, representing the apex of spatial, ceremonial, and political hierarchy within the fort. Access is highly controlled, reinforcing exclusivity and imperial power.	Tillotson (1990); Asher (2005)
Sheesh Mahal and Shah Jahan Quadrangle	Integrate private residential, ceremonial, and leisure functions through a refined arrangement of pavilions, terraces, and gardens. These spaces blend enclosed halls with open courts, emphasizing intimacy, ornamentation, and climatic comfort	Tillotson (1990); Asher (2005)
Moti Masjid Precinct	Incorporates the royal mosque within the inner palace zone, reinforcing the integration of devotional, residential, and ceremonial functions characteristic of Mughal palatial planning.	Asher (2005); Tillotson (1990)

Table 3 Hierarchical Courtyard System in Lahore Fort, Lahore (Mughal Empire) Adapted from Tillotson (1990); Asher (2005).

Key Islamic Architectural Components

- **Courtyards as Organizing Volumes**: Courtyards are the main volumetric controllers of the Lahore Fort, organization of space hierarchy and ceremony movement. Large open spaces like Jahangir Quadrangle and the court of Shah Jahan serve as mediating spaces that surround halls, pavilions and galleries. This venue of landscaping enables a visual orientation, climatic regulation and social segregation by placing the administrative

functions apart the residential and ceremonial areas. Axial orientation is further strengthened by water features, terraces, and garden features that add to the comfort of the environment in accordance with the Islamic principles of planning a palace (Hillenbrand, 1994).

- **Arcades and Colonnades**: Courtyards are bordered by arcades and colonnaded galleries linking the key elements of the palace, which form modules of structures to be repeated and form cohesive fronts. These colored circulation lines are especially noticeable in the Shah Jahan constructions, in which marble mullions and cusped arches define the continuity of halls within the structure and between interior halls and exterior courts. This repetition of arcades also creates the modular order and also balances the light, ventilation, and mobility, which are the main features of the Islamic design of palaces (Ruggles, 2000).

- **Axial Alignment and Hierarchical Progression**: The spatial logic of the Lahore Fort revolves around the axial planning. Movement is directed toward more and more narrow imperial spaces by ritual axes, the Diwan-i-Aam (Hall of Public Audience) and Diwan-i-Khas (Hall of Private Audience). This is a planned advancement that ensures a strong political power as well as the volumetric lucidity. Subsidiary courtyards, gardens and other service spaces connect to form a logical network of the space without breaking up the main ceremonial procession (Asher, 2005).

- **Gateways and Iwans**: Compression-based volumetric gateways in the form of monumental gateways, especially the Alamgiri Gate built during the reign of Aurangzeb, are gateways that control the entry and exit and denote transitional ceremonies. These gateways bound axial perspectives, hierarchy and anchor long facades to the fortified enclosure. Arched portals and or recessed entrance bays work as Islamic iwans that mediate on the outward defenses and inward palace interiors spatially and visually (Tillotson, 1990).

- **Perimeter Walls and Enclosure**: The Lahore Fort is surrounded by huge masonry walls supported by bastions and projecting towers, which stand as some kind of boundary to

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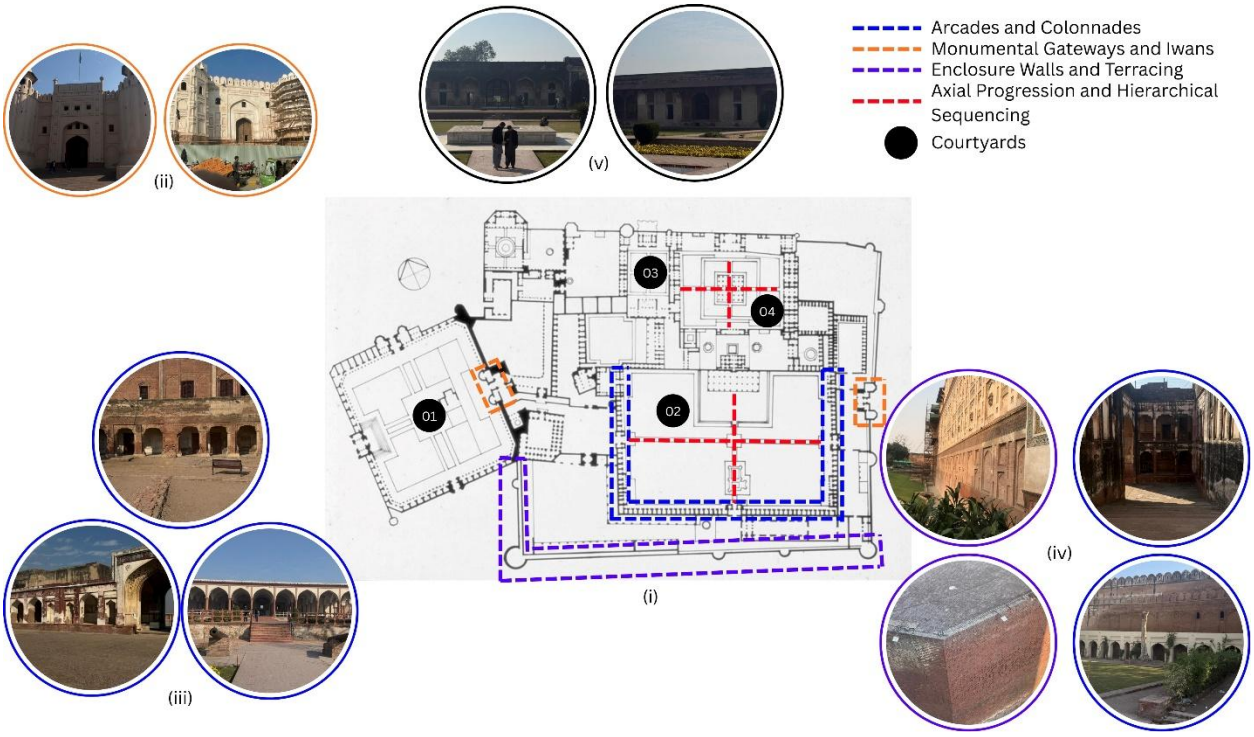
the palaces and which also provided stabilization to the inner volumes. These enclosure walls are defensive and symbolic, with a hierarchic order of courtyards and halls being enclosed in a controlled boundary. Scale, light and enclosure are modulated by terraced platforms and wall projections to strengthen the connection between solid bulk and open volume of Islamic palatial volumetric systems (Asher, 2005).

Figure 2. Spatial organization and architectural hierarchy of Lahore Fort, Lahore.

i) Palace Master Plan Turner, K. (plan by). (n.d.). Plan of Shahi Qila with Badshahi Mosque [Drawing]. Aga Khan Visual Archive, MIT Libraries. http://hdl.handle.net/1721.3/50294 ii) Entrances Gates Clicked by Author iii) Arches and Arcades Clicked by Author iv) Boundary wall and Steps Clicked by Author v) Greenery and Courtyard Clicked by Author



CASE STUDY 3: ROHTAS FORT, PAKISTAN (GURKANI / AFGHAN INFLUENCE)

Rohtas Fort, which is situated close to Jhelum in Pakistan, was built in 1541 by Sher Shah Suri, who was an Afghan emperor of Sur Empire. In contrast to traditional palaces, Rohtas Fort is a blend of defensive and palaces roles, and it incorporates monumental gateways and courtyards, residential areas inside the palace, and fortified perimeter. The fort is an occupational hilltop site where the military role is predominant, but the interiors of the palaces have shown an orchestration of Islamic principles of volumetric designs of planning, courts, arcades and

monumental gateways- typical of Afghan and early Mughal palaces (Asher, 1992; Khan, 2006). The internal palatial structure of Rohtas Fort is based on three large axial courts and some marginal pavilions:

Table 4Hierarchical Courtyard System in Rohtas Fort, Pakistan (Gurkani / Afghan Influence) Adapted from Khan (2006); Ahmed & Ahmad (2019).

Courtyard	Volumetric Role in Palatial System	Functional and Symbolic Significance
Shahi Gate Courtyard	Acts as the primary ceremonial volumetric threshold	Marks the formal entrance to the fort and organizes initial visitor circulation, reinforcing imperial authority through controlled spatial entry.
Khilwat Khana Complex	Functions as a semi-restricted inner volumetric zone	Houses private chambers and administrative halls; demonstrates axial planning and spatial hierarchy through progressive enclosure
Diwan-i-Khas Courtyard	Serves as an internal audience and transitional volumetric space	Links residential quarters with open terraces and gardens, balancing ceremonial functions with private imperial life

Although Rohtas Fort has a militarized and defensive surface, these interior spaces are disclosed as a conscious Islamic palatial spatial system. The arrangement of courtyards and closed halls is geared towards balancing ceremonial presentation, residential privacy and visual control and also addressing the local climatic conditions by means of enclosure, shading and controlled openness.

Key Islamic Architectural Components

- **Courtyards as Spatial Regulators**: The Courtyards at Rohtas Fort serve two purposes: to mediate defense mass and habitable space as well as to mitigate climatic issues such as light, ventilation and temperature. The courtyards are surrounded by arcades and halls which define hierarchy, as well as allocating the spatial load within the interior. The series of courtyards brings out a thrust of the symbolism of space of the Islamic world with the social order of entry to the individual or semi-individual space (Hillenbrand, 1994).

- **Arcades and Colonnades**: There are arcades along great courts, which offer shaded circulation and visual rhythm. As compared to a more decorative Mughal precedent, the Afghan-inspired arcades focus on healthy volumetric articulation, in which heavy piers and arches define structural robustness and proportionalism. The recurrence of the arches

gives a feeling of a modular continuity and disintegrates long walls into visual manageable units (Asher, 1992).

- **Axial Progression and Hierarchical Sequencing**: The inner palaces in the fort take an axial design with the connection of the gateways, courtyards and halls. Axiality supports functional and ceremonial hierarchy, with movement passing through the space of diminishing accessibility to the general population. The aligned doorways, arches and gateways create visual corridors that result in a volumetric continuity which enhances the sense of depth within space (Khan, 2006).

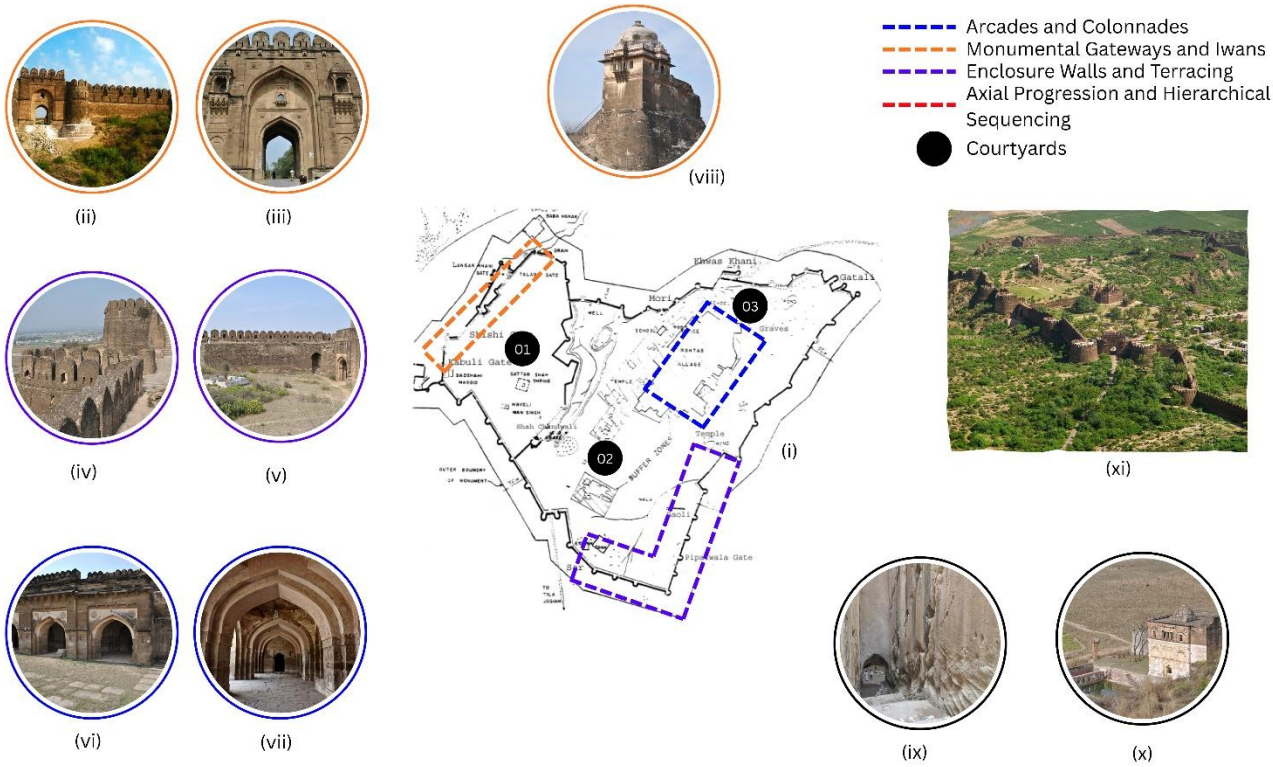
- **Monumental Gateways and Iwans**: Rohtas Fort has several gateways which include Shahi Gate and Diwan-i-Aam portal, which act as volumetric gateways, between outside fortifications and ceremonial and residential areas. These iwans are huge, recessed arches, frequently used with geometrical motives, which is the Afghan aesthetic restraint combined with the strengthening of volumetric hierarchy (Asher, 1992).

- **Enclosure Walls and Terracing**: The inner palatial precincts of the fort are enclosed by walls, and they form volumetric barriers around the courtyards and halls. The hill top slope is built with terraced foundations, which combine site topography and volumetric hierarchy. Thickness and continuity of the walls help to articulate the visual rhythm which compliments interior volumes of the courtyards preserving the symbolic authority and coherence of space (Khan, 2006).

Figure 3. Spatial organization and architectural hierarchy of Rohtas Fort, Pakistan

i) Site Plan of ruins of Rohtas Fort, HERITAGE OF PAKISTAN. (n.d.). Rohtas Fort – Naqoosh-e-Javidan. HERITAGE OF PAKISTAN. Retrieved July 01, 2023, from https://pakheritage.org/rf/ ii) Kabuli Gate of Rohtas Fort, HERITAGE OF PAKISTAN. (n.d.). Rohtas Fort – Naqoosh-e-Javidan. HERITAGE OF PAKISTAN. Retrieved July 01, 2023, from https://pakheritage.org/rf/ iii) Shah Chandwali Gate of Rohtas Fort, HERITAGE OF PAKISTAN. (n.d.). Rohtas Fort – Naqoosh-e-Javidan. HERITAGE OF PAKISTAN. Retrieved July 01, 2023, from https://pakheritage.org/rf/ . iv) Oriental Architecture. (n.d.). Rohtas Fort: Western Wall, Jhelum, Pakistan. Retrieved July 01, 2023, from https://www.orientalarchitecture.com/sid/1025/pakistan/jhelum/rohtas-fort-western-wall v) Oriental Architecture. (n.d.). Rohtas Fort: Langar Khana Gate, Jhelum, Pakistan. Retrieved July 01, 2023, https://www.orientalarchitecture.com/sid/1018/pakistan/jhelum/rohtas-fort-langar-khana-gate vi) and vii) Oriental Architecture. (n.d.). Rohtas Fort: Shahi Masjid, Jhelum, Pakistan. Retrieved July 01, 2023, from https://www.orientalarchitecture.com/sid/1017/pakistan/jhelum/rohtas-fort-shahi-masjid vi) and vii) Oriental Architecture. (n.d.). Rohtas Fort: Shahi Masjid, Jhelum, Pakistan. Retrieved July 01, 2023, from https://www.orientalarchitecture.com/sid/1017/pakistan/jhelum/rohtas-fort-shahi-masjid ix) Oriental Architecture. (n.d.). Rohtas Fort: Baoli, Jhelum, Pakistan. Retrieved July 01, 2023, from https://www.orientalarchitecture.com/sid/1021/pakistan/jhelum/rohtas-fort-baoli x) Oriental Architecture. (n.d.). Rohtas Fort:

Talaqi Gate, Jhelum, Pakistan. Retrieved July 01, 2023, from https://www.orientalarchitecture.com/sid/1019/pakistan/jhelum/rohtas-fort-talaqi-gaten xi) Aerial View of Rohtas Fort, HERITAGE OF PAKISTAN. (n.d.). Rohtas Fort – Naqoosh-e-Javidan. HERITAGE OF PAKISTAN. Retrieved July 01, 2023, from https://pakheritage.org/rf/



CASE STUDY 4: AK-SARAY PALACE, SHAKHRISABZ, UZBEKISTAN (TIMURID EMPIRE)

A monumental example of Timurid palaces architecture is the Ak-Saray Palace commissioned by Timur (Tamerlane) in the late 14th century, in Shakhrisabz, Uzbekistan. It is currently partly ruined, but historical records and still standing buildings show its great size and symbolic power, having both ceremonial, residential and administrative purposes. The palace focuses on Islamic tendencies in the organization of volumetric systems of palaces through the use of axial planning, monumental gateways, courtyards, and iwans in conveying a sense of hierarchy in space and imperial power and cultural identity (Golombek and Wilber, 1988; Blair and Bloom, 1995). Ak-Saray Palace had a highly axial central plan, which was towards the major ceremonial entrance, which was crowned by the majestic Diwan Hall. Its internal plan consisted of:

Table 5Hierarchical Courtyard System in Ak-Saray Palace, Shakhrisabz, Uzbekistan (Timurid Empire)

Courtyard	Volumetric Role in Palatial System	Reference
Monumental Entrance Courtyard	Flanked by high walls and adorned with the famous, blue-tiled portal, establishing a ceremonial threshold and guiding visitor circulation.	Blair & Bloom, 1995
Residential Courtyards	Smaller courtyards framed by iwans and arcades, providing private and semi-private zones for royal activities and daily life.	Blair & Bloom, 1995
Audience Halls and Terraces	Grand halls are integrated with external terraces, linking interior volumetric sequences to the surrounding landscape and creating a visual and ceremonial continuity.	Blair & Bloom, 1995

The volumetric definition of the palace balanced the huge masonry components with the empty spaces of the courtyard areas, providing a feeling of enclosure and monumental openness..

Key Islamic Architectural Components

- **Courtyards as Primary Regulators**: The courtyards of Ak-Saray provided spatial and volumetric intermediaries, which established the order of the public, semi-public, and personal spaces. Huge empty areas offered light, air space and relief on the huge walls made of masonry. Spatial symmetry and ceremonialism were strengthened in the arrangement of gardens and water features in courtyards and internal microclimates were tamed (Golombek and Wilber, 1988).

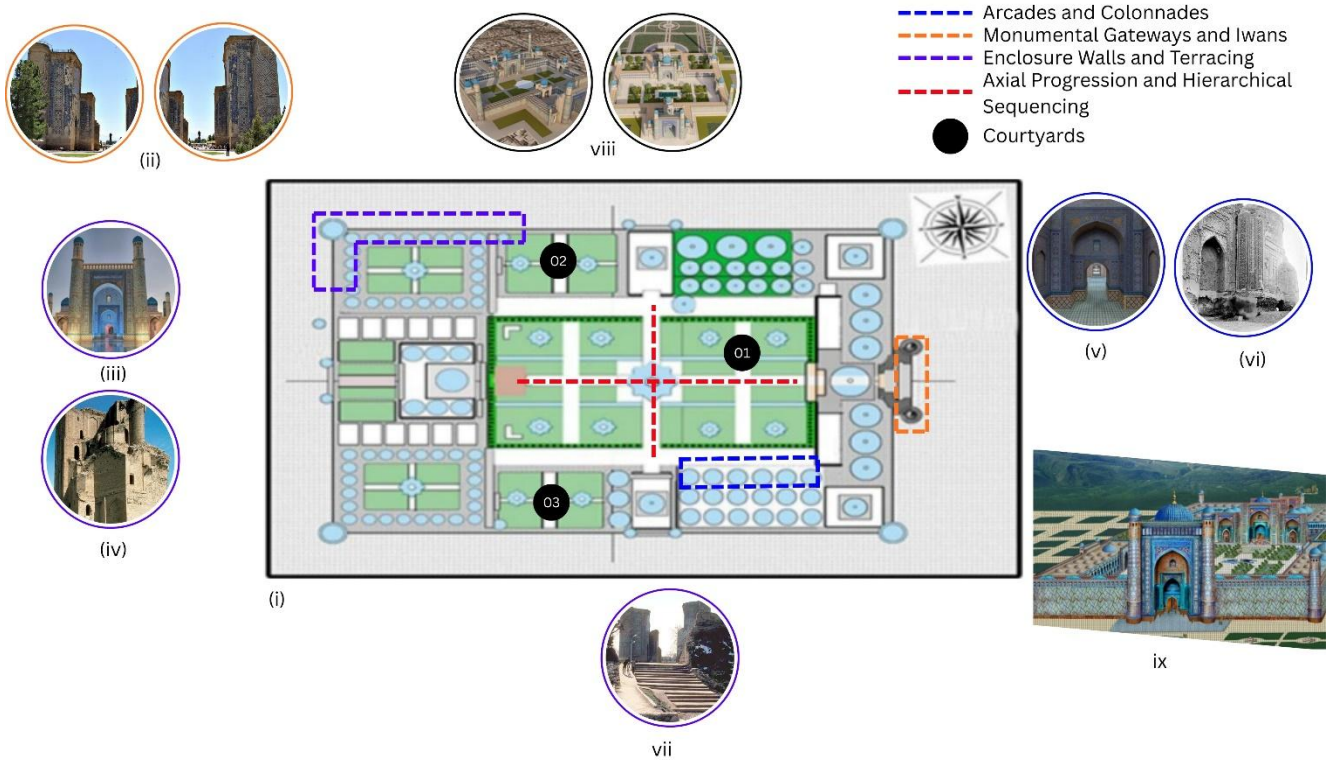
- **Monumental Gateways & Iwans**: The portal of the palace was known as a compression-based structural frame and ceremonial marker which was the monumental and blue-tiled portal. The use of Iwans along the courtyards gave transitional volumes that highlighted the hierarchy and gave a feeling of depth in moving forward along an axis. These iwans also served to anchor the volumetric loads on the massive walls and help control the movement through the palace as well as provide them a visual guide (Blair and Bloom, 1995).

- **Arcades and Colonnades**: The sides of courtyards and terraces had arcades to diminish the spans of length into modular units. Colonnades were also used to hold covering walkways, as well as produce rhythmic space series linking halls, courtyards, and gardens. The recurrence of the arches helped in creating aesthetic unity as well as the volumetric unity, which was a typical characteristic of Timurid palaces and palaces (Golombek and Wilber, 1988).

- **Enclosure Walls and Perimeter Definition**: The walls of the palace precincts were monumental masonry which defined courtlyards and halls and delineated volumetric difference between solid and vacuity. These walls stressed on the hierarchy of space, directing the movement along the main line and offering an adequate division of ceremonial and personal space. The palace was also built into the topography as terraced foundations to strengthen the coherence of volumes and stability (Blair and Bloom, 1995).

- **Axiality and Hierarchical Sequencing**: The palace uses a strict axial design that linked entrance, courtyards, audience halls and terraces. This pattern coordinates ritualized motion and creates a volumetric pattern throughout the complex. Axial alignment unites courtyards, iwans as well as colonnades creating a continuous space flow that balances monumental mass and open spaces (Golombek and Wilber, 1988).

Figure 4. Spatial organization and architectural hierarchy of Ak-Saray Palace, Shakhrisabz, Uzbekistan



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CASE STUDY 5: ALHAMBRA PALACE, GRANADA (NASRID DYNASTY, ISLAMIC SPAIN)

The Alhambra Palace, built mainly between the 13th -15th centuries under the reign of Nasrid dynasty in Granada, Spain, is a very sophisticated manifestation of Islamic palaces architecture in the western Islamic world. The Alhambra expresses power in terms of restrained volumetric composition, hierarchy in space and experience, as opposed to later imperial palaces which do so through a mass and scale to monumentality. It represents a fortified enclosure incorporating ceremonial, administrative, and residential purposes, using the main elements of Islam architecture core elements; courtyards, axial sequencing, arcades, recessed halls, and enclosure walls, modified to the climatic and topographic environment of the Al-Andalus (Hillenbrand, 1994; Ruggles, 2000). The palace form is intended to be arranged in the form of a series of related courtyards and pavilions instead of one major axis. Spatial circulation is directed by framed views, transition spaces and proportional changes, which create the effect of gradual passage of semi-public reception spaces to very intimate royal spaces. The key components of the complex are:

Table 6 Hierarchical Courtyard System in Alhambra Palace, Granada (Nasrid Dynasty, Islamic Spain)

Courtyard	Volumetric Role in Palatial System	Reference
Court of the Lions (Patio de los Leones)	The residential core of the palace, surrounded by royal chambers and reception halls; serves as the private and semi-private volumetric nucleus.	Blair & Bloom, 1995; Golombek & Wilber, 1988
Arcaded Galleries and Porticoes	Structural and spatial mediators linking courtyards with enclosed halls; provide shaded circulation and rhythmically break long spans.	Goodwin, 2003; Ruggles, 2000
Court of the Myrtles (Patio de los Arrayanes)	A formal ceremonial courtyard used for administrative and reception functions; organizes processional circulation and reinforces hierarchy.	Ruggles, 2000; Hillenbrand, 1994
Monumental Gateways and Transitional Passages	Controlled thresholds regulating access and reinforcing spatial hierarchy; act as symbolic and volumetric markers	Hillenbrand, 1994; Blair & Bloom, 1995
Enclosure Walls and Terraced Platforms	Define the palace boundary, provide volumetric stability, and integrate the complex with sloping terrain; combine privacy with ceremonial emphasis.	Golombek & Wilber, 1988; Ruggles, 2000

Key Islamic Architectural Components

- **Courtyards as Volumetric Regulators**: Courtyards are the main organizing volumes of the Alhambra, which control hierarchy, circulation, and comfort of the environment. The Court of the Myrtles creates an official, long spatial axis with a central reflecting pool, which focuses on a visual amplification of a building bulk and accentuates symmetry. The Court of the Lions, by contrast, is a smaller scale, which is more residential and ceremonial, its proportional refinement as opposed to monumentality. Such courtyards allow natural ventilation, penetration of daylight and moderation of climatic conditions besides organizing the spatial sequencing between public and private (Ruggles, 2000) spaces.

- **Arcades and Colonnades**: The volumetric modules that create repetitions around the courtyards are made up of arcaded porticoes which offer shaded circulation and continuity. Thin columns and light arches make up the enclosing structures, which make them look less massive, and they produce porosity between the inside and outside of the buildings. This repetitive articulation provides better spatial coherence as well as strengthens the principle of Islamic architecture of modular repetition (Golombek and Wilber, 1988; Hillenbrand, 1994).

- **Axiality and Hierarchical Sequencing**: Instead of using one ceremonial axis, the Alhambra uses overlaid axial relationships, which are characterized by frames, door placements, and courtyard ratios. There is a possibility of controlled movement and visual access, which serves to enforce the hierarchy based on spatial experience, as

opposed to the blatant monumentality. The development of administrative courts to residential homes is based on an Islamic vision of power in terms of spatial regulation and deliberate revelation (Goodwin, 2003; Ruggles, 2000).

- **Iwans and Monumental Gateways**: The classical typology of four-iwan is not present, but deep recessed halls, framed portals, and transitional vestibules are used in the Alhambra, which serve similarly to iwans. These are volumetric anchors, which focus on thresholds and guide movement between courtyards and halls. An ornamental rich surface articulation, muqarnas, calligraphy and geometric ornament are added to volumetric depth without diminishing structural clarity (Hillenbrand, 1994).

- **Enclosure Walls and Perimeter Definition**: Walls of the palace complex are fortified that fulfill defensive, symbolic and volumetric purposes. The functions that these walls serve are to mark royal boundaries, to shield internal palatial microclimate and to combine both the architecture and the landscape of the Sabika hill by terraced platforms and retaining structures. The topic of hierarchy and privacy is enhanced by the enclosure system, and the palace is bound to the natural and urban setting (Ruggles, 2000).

Figure 5. Spatial organization and architectural hierarchy of Alhambra Palace, Granada

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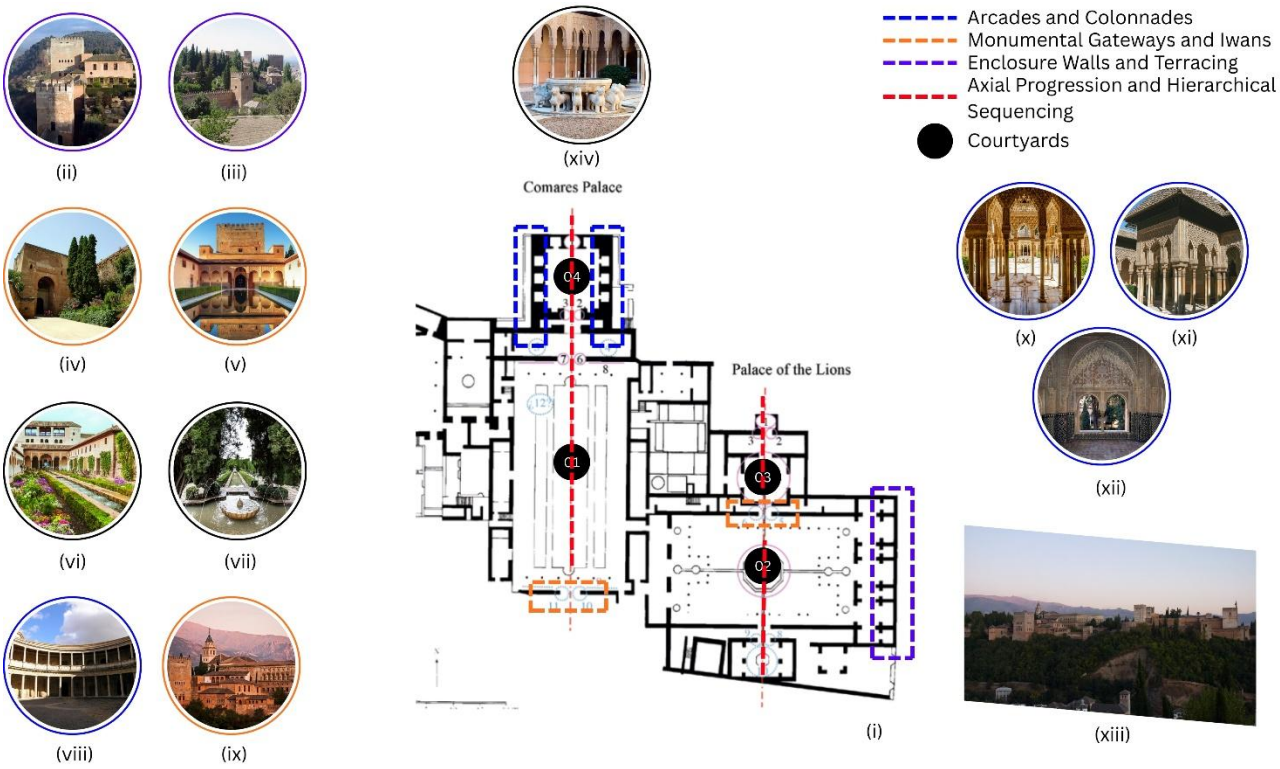

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COMPARATIVE ANALYSIS OF VOLUMETRIC COMPONENTS

Despite the differences in the geography, dynastic aspiration, and cultural expression, the five case studies show unity in the volumetric grammar that is based on the Islamic architectural traditions. As can be seen in the table above all the complexes are based on the same basic spatial elements, which are courtyards, arcades, gateways, axes, and perimeter walls, but the arrangement and focus varies depending on the political role, landscape conditions, and defensive needs. Courtyards become the most widespread organizing tool, which serves as points of space structuring of the circulation, controlling climatic conditions and expressing the successive levels. Organized either in a series, at right angles, or on terraces, these open courts determine the logic of any interior of every palace or fort, so as to guarantee legibility and restricted accessibility in ceremonial, administrative, and residential areas. The use of arcades and colonnades also supports this rationale by balancing the closed-in hallways with open areas. Their visual consistency through rhythmic repetition creates a visual coherence and gives them a shaded circulation, which enables the movement to occur not in a sudden way. Arcades in palaces like Topkapi, Lahore Fort and the Alhambra blend continuality and allow the continuity of space whereas in Ak-Saray and Rohtas Fort, they also contribute to monumentality and clarity of structure. Axial planning is not always uniformly dominant, although it occurs in most examples. There are complexes based on powerful linear axes to support imperial authority and processional movement and complexes based on stratified or dislocated spaces, focusing on vision experience rather than being so strict with symmetry. The monumental gateways and iwans are essential at distinguishing the doorways and strengthening the order. These features serve as volumetric period points, indicating access and status transitions, and defining important vistas and ceremonials. They are large-scale and articulate power and authority, especially when the gateways also act as symbolic representations and defense mechanisms. The volumetric system is finalized with the help of enclosure walls used to demarcate boundaries, privacy and project authority. Walls, ramparts and bastions in fortified contexts are part of the spatial organization and in palaces also promote terracing, circulation and blending into the wider landscape. Together, the analysis and the table indicate that the architectural meaning of the case studies is not in particular stylistic elements but in the similar use of common volumetric elements. These components are a system of interdependence, which is adjusted to regional

conditions but shares a common logic of space that determines Islamic monumental architecture in all geographical areas and historical eras.

No.	Volumetric/Architectural Component	Topkapi Palace (Ottoman)	Lahore Fort (Mughal)	Alhambra Palace (Nasrid)	Ak-Saray Palace (Timurid)	Rohtas Fort (Afghan)
1.	Hierarchical Courtyard System	✓	✓	✓	✓	✓
2.	Multiple Successive Courtyards	✓	✓	✓	✓	✓
3.	Charbagh / Garden Integration	✗	✓	✓	✓	✗
4.	Axial Ceremonial Planning	✓	✓	✗	✓	✓
5.	Terraced Spatial Organization	✗	✓	✓	✓	✓
6.	Arcades / Colonnaded Galleries	✓	✓	✓	✓	✓
7.	Modular Structural Repetition	✓	✓	✓	✓	✓
8.	Monumental Gateways	✓	✓	✓	✓	✓
9.	Classical Iwan Typology	✗	✗	✗	✓	✓
10.	Iwan-like Recessed Transitional Halls	✓	✓	✓	✓	✓
11.	Enclosure / Fortified Perimeter Walls	✓	✓	✓	✓	✓
12.	Defensive–Ceremonial Hybrid Character	✗	✗	✗	✗	✓
13.	Strong Residential–Ceremonial Zoning	✓	✓	✓	✓	✓

Table 7 Comparative Presence of Volumetric Elements in Selected Case Studies

CONCLUSION

This comparative study shows that Islamic palatial volumetric arrangements invariably use the main architectural elements such as courtyards, arcades, axis lines, iwans, and enclosure walls no matter the empire, geography, or time. The variations in ornamentation, size, materiality and topography are a result of local climate, dynastic identity and technological inventions. Mass, hierarchy and environmental conditions are controlled by courtyards universally. The arcades and colonnades are used to mediate circulation and the structural rhythm and also to visually connect the interior and exterior spaces. Axial planning organizes procession and hierarchy, which makes volumetric elements to be in line. Iwans and gateways are volumetric barriers, focused on ceremony and visual attention. Enclosure walls stabilize volumes, outline symbolic authority and combine architecture and landscape.

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