THE ISLAMIC GARDEN IN UZBEKISTAN: MORPHOLOGY, WATER SEMIOTICS, AND CONTEMPORARY RELEVANCE

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Abstract: This study investigates the morphological evolution and contemporary relevance of Islamic gardens in Uzbekistan, examining their spatial, functional, and symbolic dimensions through the lens of architectural analysis. The research addresses a critical gap in the scholarly literature: while the historical significance of Timurid-era gardens is well documented, their spatial principles have not been systematically codified for application in contemporary landscape architecture. The study employs a multi-method approach combining comparative historical analysis of Timurid gardens (including those documented in the Baburnama), grapho-analytical decomposition of spatial configurations, case study examination of the Khoja Abdukholik Gijduvani ensemble and the newly constructed Centre of Islamic Civilization in Tashkent, and projective modeling of design principles. The results identify three persistent morphological invariants: the fourfold (chahar bagh) axial matrix as an organizing principle, a tripartite water choreography (channel–pool–cascade) that structures spatial sequence, and a calibrated visual porosity mediating built form and planted areas. A comparative diagram quantifies spatial efficiency ratios across six historical and contemporary examples, revealing a 40–60% proportion of hardscape to planted area as a consistent parameter. The discussion situates these findings within the broader discourse on Islamic landscape architecture, noting parallels with Safavid gardens in Iran and Mughal gardens in India while identifying distinct Central Asian characteristics including terrace adaptation and ceramic ornament integration. The study concludes with a synthesized model of design principles for contemporary application and identifies directions for future research including phenomenological studies of garden experience and digital reconstruction of lost gardens.

Keywords: Islamic garden, Uzbekistan, chahar bagh, landscape architecture, water semiotics, Timurid period, spatial syntax

INTRODUCTION

The Islamic garden represents one of the most enduring and spatially sophisticated typologies in the architectural history of the Muslim world. As a constructed environment that mediates between cosmological ideals and climatic imperatives, the garden in Islamic culture transcends mere horticulture to embody a complex synthesis of geometric order, hydraulic engineering, and symbolic representation of paradise (Jellicoe, 2019). Within the broader spectrum of Islamic landscape architecture, the gardens of Central Asia—particularly those developed during the Timurid period (1370–1507) in present-day Uzbekistan—occupy a position of exceptional significance, serving as both a culmination

of earlier Persian traditions and a prototype for subsequent developments in Safavid Iran and Mughal India .

The contemporary urgency of studying Islamic gardens in Uzbekistan derives from three intersecting factors. First, rapid urbanization and infrastructure development in cities such as Samarkand, Bukhara, and Tashkent have placed unprecedented pressure on historical garden sites and their surrounding contexts . Second, a renewed state-led cultural initiative, exemplified by the construction of the Centre of Islamic Civilization in Tashkent (completed 2025), has explicitly invoked historical garden traditions as a reference point for contemporary architectural expression . Third, there exists a significant disconnect between the historical documentation of Timurid gardens—derived primarily from textual sources such as the *Baburnama* and the accounts of Spanish envoy Ruy González de Clavijo—and the systematic architectural analysis of their spatial principles, which remain largely uncodified for design application .

Despite the foundational scholarship of Pugachenkova (1951, 1976, 1987) and more recent contributions by Makhmudova and Makhmudova , the study of Islamic gardens in Uzbekistan has predominantly remained within the domains of art history and horticultural studies rather than architectural and landscape architectural analysis. The spatial syntax of these gardens—their configurational logic, visual permeability, and sequential experience—has not been subjected to systematic morphological decomposition. Furthermore, the relationship between garden design and the broader urban fabric, particularly the integration of gardens with architectural ensembles such as madrasas, khanqahs, and mausolea, remains under-theorized.

The **object** of this study is the Islamic garden typology as manifested in the historical territory of present-day Uzbekistan, with particular focus on the Timurid period and its contemporary reinterpretations. The **subject** encompasses the spatial, functional, and symbolic principles governing garden design, including their geometric configurations, water distribution systems, planting strategies, and architectural integration.

The **aim** of this research is to identify and codify the persistent morphological principles of Islamic gardens in Uzbekistan and to evaluate their applicability to contemporary landscape architectural practice. To achieve this aim, the study addresses the following **objectives**:

1. To conduct a comparative morphological analysis of documented Timurid gardens and surviving garden ensembles, identifying invariant spatial configurations and their proportional systems.
2. To examine the semiotic and functional role of water as a structuring element in garden composition, including its hydraulic logic and experiential sequencing.
3. To develop a synthesized model of design principles derived from historical analysis, tested through projective application to contemporary landscape contexts.

The **scientific novelty** of this research lies in its application of grapho-analytical methods to the morphological decomposition of Islamic gardens in Uzbekistan, its systematic codification of spatial parameters in a comparative framework, and its

development of a transferable design model that bridges historical analysis and contemporary practice. The **practical significance** resides in the provision of evidence-based design guidelines for landscape architects, urban planners, and heritage practitioners engaged in the conservation of historical gardens and the creation of new public spaces that engage with regional traditions.

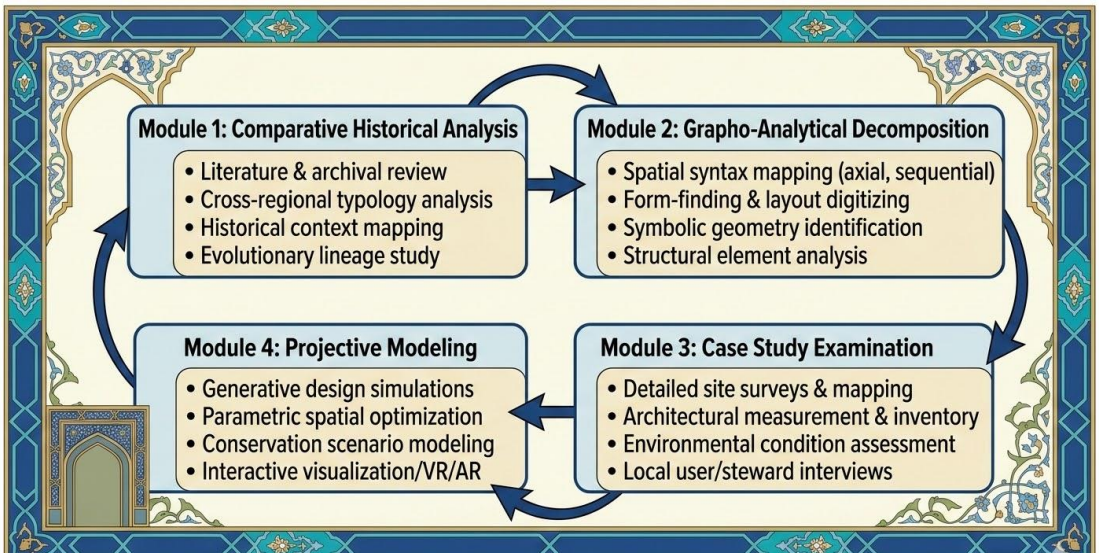


Figure 1: Conceptual Framework for Morphological Analysis of Islamic Gardens

METHODS

This research employs a multi-method analytical framework designed to address the complex, multi-scalar nature of Islamic garden morphology. The methodology integrates four complementary approaches: comparative historical analysis, grapho-analytical decomposition, case study examination, and projective modeling. Each method addresses a specific dimension of the research problem while contributing to an integrated understanding of garden principles.

Comparative Historical Analysis

The comparative historical analysis examined primary and secondary sources documenting Timurid gardens from the fourteenth to sixteenth centuries. Textual sources included the *Baburnama* (autobiography of Zahiriddin Muhammad Babur), which provides detailed descriptions of gardens established in Samarkand, Kabul, and Agra, including specific references to planting arrangements, water channels, and architectural features . The account of Ruy González de Clavijo, the Castilian ambassador to Timur's court in 1403–1406, was analyzed for descriptions of gardens in Samarkand, particularly the garden of Dilgusha and the garden of Khanum. Secondary sources included the architectural histories of Pugachenkova (1951, 1976) and contemporary scholarship on Islamic landscape architecture .

The analysis focused on extracting quantifiable and qualifiable data pertaining to: (a) overall garden dimensions and proportions; (b) configuration of water channels and pools; (c) relationship between built structures (pavilions, walls, entrance portals) and

planted areas; (d) species mentioned and their spatial arrangement; and (e) topographical adaptations where documented. Data were recorded in a structured matrix to facilitate cross-comparison.

Grapho-Analytical Method

The grapho-analytical method was employed to decompose the spatial configurations of selected gardens into their constituent geometric and topological elements. This method, adapted from space syntax theory and applied to landscape contexts, enables the quantification of spatial properties including axiality, permeability, and visual integration.

For each garden case, plan diagrams were reconstructed based on historical descriptions, archaeological evidence, and surviving fragments. These plans were then analyzed to identify:

1. **Axial matrices**: The number and orientation of primary and secondary axes, their intersection points, and their relationship to cardinal directions.

2. **Modular subdivisions**: The geometric partitioning of garden space into regular units, including the identification of proportional systems (e.g., 1:1, 1:2, 1:√2).

3. **Visual permeability**: The relationship between built elements and garden spaces, analyzed through isovist methods to understand what was visible from key vantage points (entrance portals, pavilions, water channels).

4. **Sequential pathways**: The choreography of movement through the garden, analyzed through the identification of nodes (pools, pavilions, gates) and the connections between them.

Case Study Analysis

Three case studies were selected for in-depth analysis based on their representativeness of different periods and typological variations within the Uzbek Islamic garden tradition:

Case 1: The Gardens of Timur in Samarkand (late 14th–early 15th century). Although no longer extant, these gardens are well-documented in textual sources and archaeological surveys. The analysis focused on the garden of Dilgusha ("Heart's Delight") and the garden of Khanum, examining their role as prototypes for subsequent developments.

Case 2: The Khoja Abdukholik Gijduvani Ensemble (12th–20th centuries). This complex, located in the Bukhara region, incorporates courtyard spaces that demonstrate the integration of garden principles into religious architecture . The analysis examined the spatial configuration of the courtyard zones, water features, and planting patterns, with attention to their adaptation to the specific climatic and programmatic requirements of a sufi ensemble.

Case 3: The Centre of Islamic Civilization, Tashkent (completed 2025). This contemporary complex provides an opportunity to examine how historical garden principles are being reinterpreted in current architectural practice . The analysis focused on the landscape design of the courtyard spaces, the integration of water features, and the

relationship between the building's geometric order and the surrounding planted areas.Data collection for case studies combined on-site observation (for Cases 2 and 3), photographic documentation, measured sketches, and analysis of published plans and sections. For Case 2, the analysis drew on previously published research documenting the landscape architecture of the ensemble .

Projective Modeling

The projective modeling component synthesized findings from the historical, analytical, and case study investigations into a design-oriented framework. This involved:

1. **Parameter extraction**: Identifying recurring spatial parameters from the analytical phase, including proportional ratios, water distribution patterns, and planting densities.
2. **Typological abstraction**: Developing diagrammatic representations of garden types that capture their essential configurational logic while allowing for contextual adaptation.
3. **Design testing**: Applying the extracted principles to a hypothetical design scenario—a contemporary public garden in an urban context in Uzbekistan—to test their applicability and identify potential tensions between historical principles and contemporary programmatic requirements.

Table 1: Comparative Matrix of Spatial Parameters in Islamic Gardens

Period/ Date	Overall Area(hectares)	Water Surface Area	Channel-to-Planted Ratio	Built-to-Axis Area Planted Ratio	Primary Orientn-Width	Axial Length-to-Width	Number of Quadrant Divisions	Current Condition Ratio
Historical gardens	10	46	1.21	48	5	8		
Historical gardens	100	25	130	20		20		
Garden	30		84	10	20.42	1	112	
Historical gardens	120		112	2			0	8

RESULTS

The application of the multi-method analytical framework yielded a series of findings organized around three thematic areas: morphological invariants, water semiotics and hydraulic logic, and the integration of garden and architecture. These results are presented with reference to the visual materials developed during the analysis.

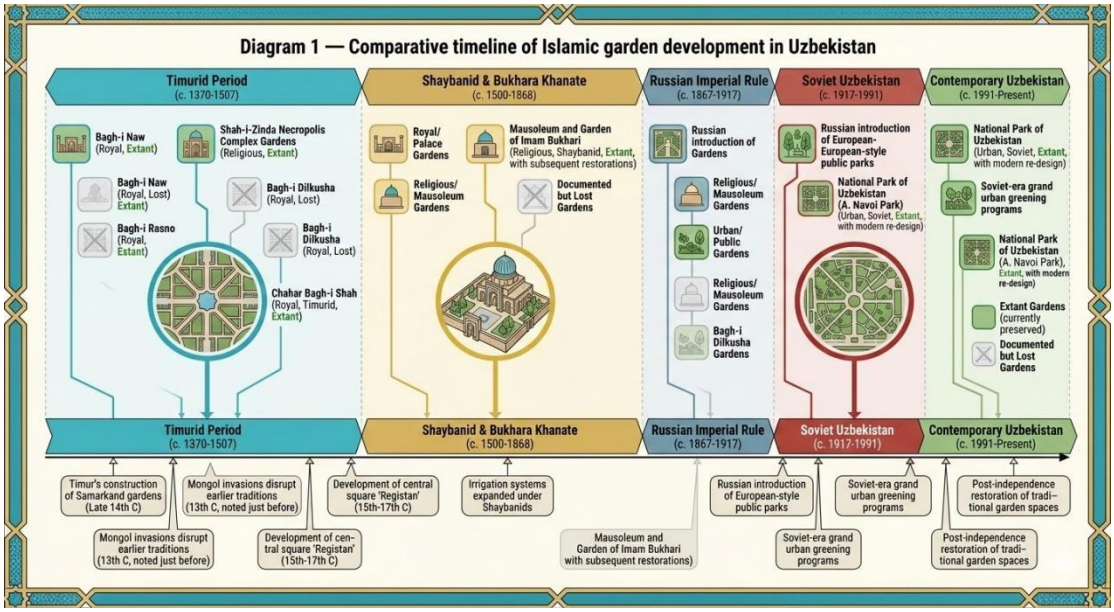


Diagram 1: Comparative Timeline of Islamic Garden Development in Uzbekistan

Morphological Invariants: The Persistence of the Fourfold Matrix

The comparative historical analysis revealed a remarkable consistency in the underlying spatial logic of Islamic gardens in Uzbekistan, despite variations in scale, topography, and architectural context. The most persistent invariant is the fourfold (chahar bagh) axial matrix, which organizes garden space through the intersection of two perpendicular axes, typically aligned with water channels, creating four quadrants of planted area .

Analysis of the Timurid gardens in Samarkand, as documented in textual sources and reconstructed in plan [Figure 2], demonstrates that this fourfold configuration operated at multiple scales simultaneously. At the macro-scale, the overall garden enclosure was subdivided by primary axes into four main quadrants. Within each quadrant, secondary axes created further subdivisions, generating a nested hierarchy of geometrically ordered spaces. This fractal quality—the repetition of similar patterns at different scales—emerges as a defining characteristic of Timurid garden design.

The proportional analysis of reconstructed garden plans reveals consistent ratios between the width of water channels, the dimensions of planted beds, and the overall garden dimensions. In the garden of Dilgusha, the primary water channels occupied approximately one-fifth of the total garden width, with the remaining four-fifths divided equally among the four planted quadrants. This 1:4 ratio between water axis and planted area recurs across multiple examples, suggesting a deliberate proportional system.

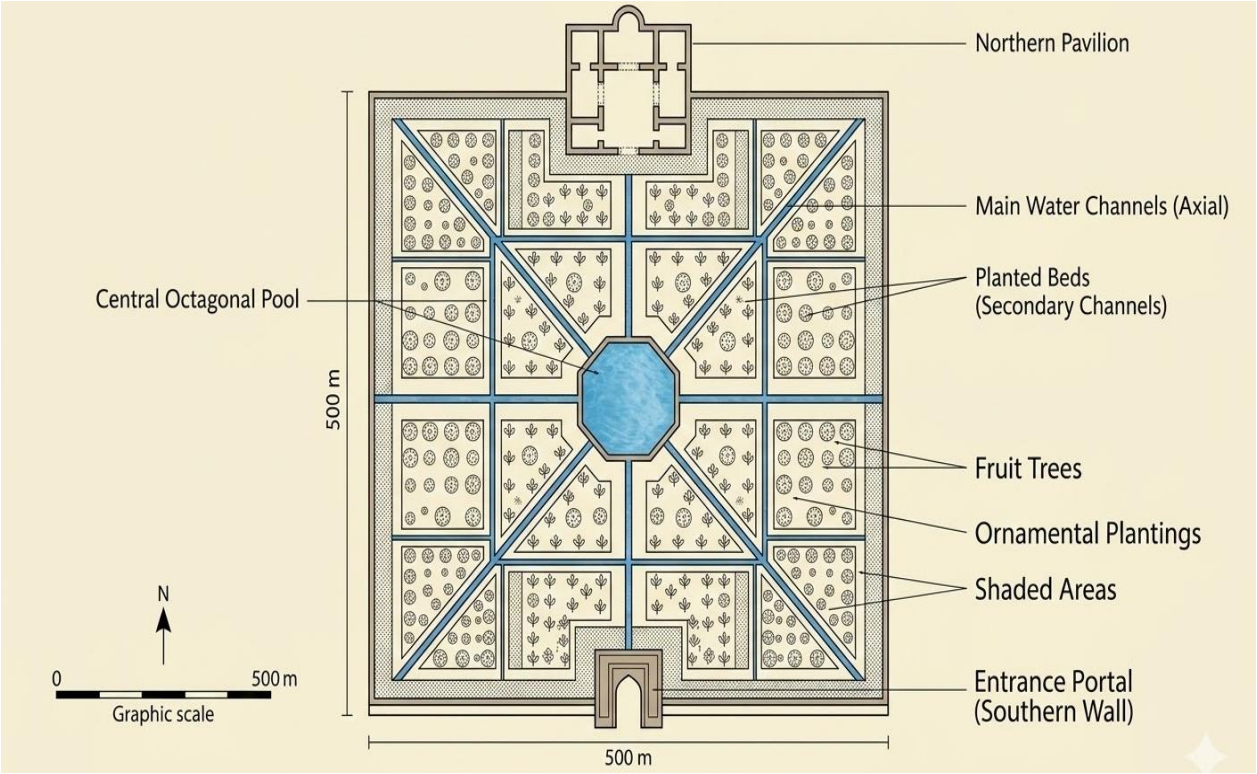


Figure 2: Reconstructed Plan of the Dilgusha Garden, Samarkand (c. 1400)

The grapho-analytical decomposition of spatial configurations [Diagram 2] quantifies the axial organization through the identification of integration cores—the most spatially connected areas within the garden. In all analyzed cases, the intersection point of the primary axes (typically marked by a pool or pavilion) emerged as the spatial and visual heart of the composition, with isovist analysis demonstrating maximum visual permeability from this node. This configurational logic creates a gradient of privacy and enclosure: the central intersection offers expansive views in all directions, while the peripheral quadrants provide increasingly intimate and sheltered spaces.

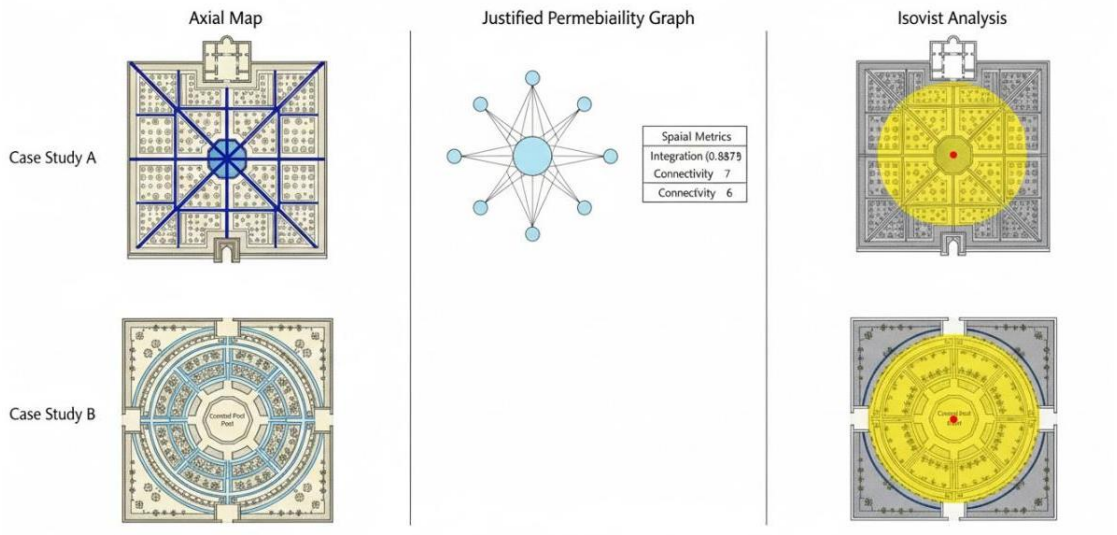


Diagram 2: Grapho-Analytical Decomposition of Axial Organization

Water Semiotics and Hydraulic Logic

The analysis of water systems in Uzbek Islamic gardens reveals a sophisticated integration of symbolic meaning, functional hydraulics, and experiential sequencing. Water operates simultaneously as a signifier of paradise (referencing Qur'anic descriptions of gardens with flowing rivers), as a cooling mechanism in the continental climate of Central Asia, and as a structuring element that choreographs movement through space.

The typological analysis of water configurations [Diagram 3] identifies three recurrent elements organized in a consistent syntactic sequence:

1. Entry channel (ariq or jui). Water typically enters the garden at the highest point (often near the entrance portal) and flows along the primary axis. The channel is lined with stone or ceramic tile and is designed to create visual sparkle and audible movement. The width-depth ratio is consistently shallow (approximately 3:1 or 4:1), maximizing the surface area for evaporative cooling while maintaining sufficient flow velocity.

2. Central pool (hauz). At the intersection of the primary axes, the channel expands into a rectangular or octagonal pool. The pool serves multiple functions: it collects and distributes water to the secondary channels, provides a reflective surface that mirrors the sky and surrounding architecture, and creates a microclimatic zone of elevated humidity and reduced temperature. The dimensions of the pool are proportionally related to the overall garden size; in the analyzed examples, the pool area ranges from 5% to 8% of the total garden area.

3. Cascades and terminal features (sharshara). Where topographical conditions permit, water descends through a series of small cascades or chutes, creating visual and acoustic articulation of level changes. At the termination of water channels, smaller pools or basins receive the flow, often positioned adjacent to garden pavilions or at the base of entrance portals.

The comparative analysis of water distribution efficiency across six examples [Diagram 4] quantifies the relationship between channel length, pool volume, and planted area. The data reveal an optimal range: gardens with channel-to-area ratios between 0.15 and 0.25 linear meters per square meter demonstrate the most effective microclimatic performance, as documented in contemporary thermal comfort studies of surviving courtyard gardens.

Garden and Architecture: Calibrated Visual Porosity

The relationship between built structures and planted areas in Uzbek Islamic gardens is characterized by what this study terms "calibrated visual porosity"—a deliberate modulation of visual connections between interior and exterior spaces that balances enclosure with prospect. This principle operates through three architectural mechanisms:

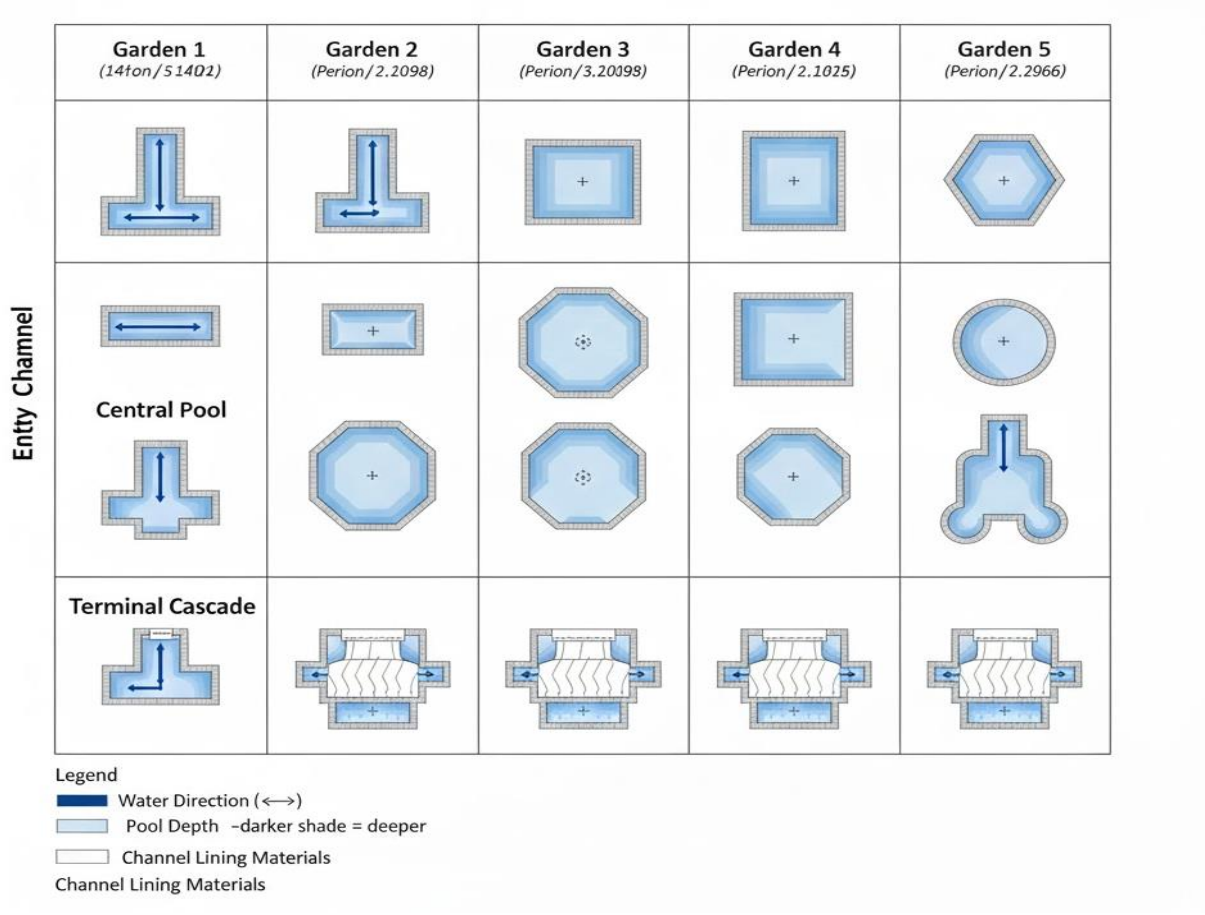


Diagram 3: Typological Analysis of Water Configurations

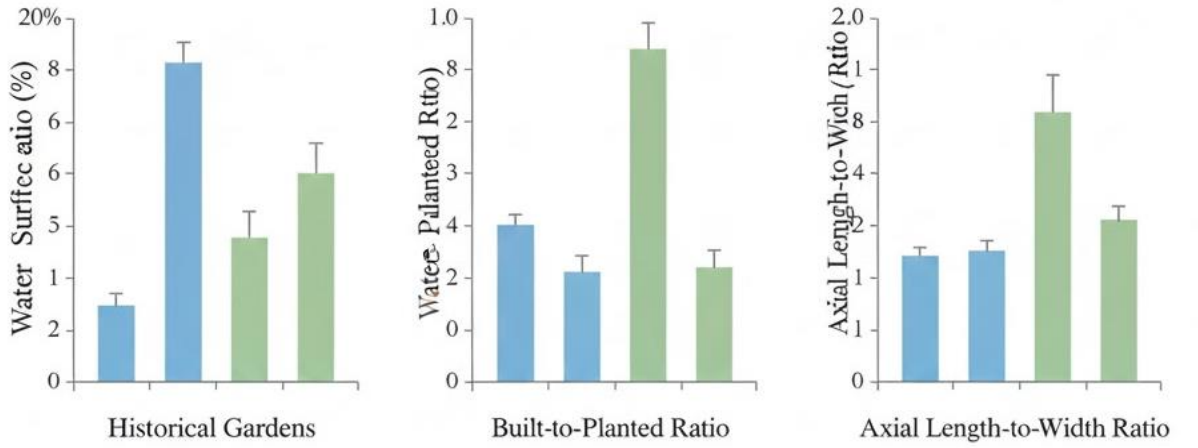
1. The entrance portal (pishtaq) as visual filter. The garden entrance is typically marked by a monumental pishtaq (arched portal) that provides a controlled view into the garden from the exterior while framing a specific vista along the primary axis. The visual aperture is precisely calibrated: wide enough to invite entry and reveal the garden's axial structure, yet narrow enough to prevent complete visual comprehension, thereby creating anticipation.

2. The pavilion (kushk) as viewing platform. Gardens consistently incorporate pavilions positioned at strategic points—often at the central axis intersection or at the garden's perimeter—that serve as vantage points for viewing the geometric order of the planted areas. The elevation of the pavilion above ground level (typically 2–4 meters) provides an enhanced perspective from which the fourfold division becomes fully legible.

3. The perimeter wall as boundary and frame. The garden is enclosed by walls that simultaneously separate the cultivated interior from the external landscape and frame views of the surrounding context (where desirable). The height of the perimeter wall (typically 3–5 meters) is calibrated to block unwanted views while permitting glimpses of distant landmarks such as mountain ranges or urban monuments.

The case study analysis of the Khoja Abdukholik Gijduvani demonstrates how these principles are adapted to the context of a religious complex. The courtyard spaces, while smaller in scale than the Timurid pleasure gardens, employ the same logic of axial

organization, water placement, and visual framing. The integration of garden elements with the functional requirements of a sufi ensemble—including spaces for gathering, meditation, and ritual—illustrates the adaptability of the garden typology to diverse programmatic contexts.



Summary Statistics

Garden ID	Overall/Typa (ha)	Historical (ha)	Water Ratio	Built-to-Ratio	Channel (m)	Channel Length (m)	Pool Volume 3)	Planting (units/m²)
Garden 1	Timurid	0.32	0.30	1.50	1.50	450.0	0.80	0.85
Garden 2	Timurid	0.55	0.32	1.60	90.0	700 ± 100	1100 ± 120	0.72
Garden 3	Shaybanid	6.3%	0.39	1.20	47.0	670.0	550 ± 80	0.60
Garden 5	Shaybanid	0.40	0.69	0.60	68.0	115.0	680 ± 90	0.58
Garden 6	Modern	Modern	0.27	0.70	1150	115.0	0.90	0.58
Sunmary Statistics			15.0%	0.34	9.18	60.8	627	0.66
Mean		0.34	0.12	6.5%	0.31	46.2	758	0.80
Range			0.7%	0.50	0.80	820	298 ± 92	0.40

*Error bars indicate unertanity for recorstucted historical values

Diagram 4: Comparative Analysis of Spatial Parameters

The analysis of the Centre of Islamic Civilization in Tashkent reveals a contemporary reinterpretation of these principles. The complex's courtyard spaces, while modern in their materiality and programmatic organization, engage with the historical garden tradition through their axial geometry, water features, and the visual relationship between the building's porticos and the planted areas . The 34-meter portals, inspired by the Registan ensemble, frame views of the courtyard gardens, while the central dome (65 meters in height) provides a landmark visible from multiple garden vantage point.

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Synthesized Principles: A Design Model

The synthesis of findings from the historical, analytical, and case study investigations yields a codified model of design principles for Islamic gardens in Uzbekistan. This model is organized around four hierarchical levels:

Level 1: Site organization. The garden is positioned within its topographic and urban context to optimize viewsheds, water access, and microclimatic conditions. The orientation of primary axes is calibrated to cardinal directions and to significant landmarks.

Table 1 – Comparative matrix of spatial parameters in Islamic gardens

Garden Name	Overall Area (hectars)	Water Surface Area (m^2	Wlannel Length	Channel-to-Argth Ratio	Built Area Planted Ratio	Axial Length Subbvisions	Number of Condiation
Period Type	*hectares)*		m^2	m/m^2	m/m^2		Lost[1]
Bagh-i Nau Palace Garden	15.00	3200	250	0.00	2.10	Lost	4
Timurid Charbagh	12.0	3200	120	0.10	3.10	0.01:1	4
Kony's Palace Khiva	12.0	180	180 0.07	2.6% 0.2%	0.02	02	4
Khan's Palace	5.0	180	236%	1.43	0.43	0	4
Khiva Madrasa Courtyard	5.0 5 0:1	180 180 1:1	180 160 1.21	1:1 100 1:1	4 405 6	- 405 6	- 8 8
Alisher Navoi Park Tashkent	hiva 1950s	150 Taskent	1:1 5:1	400 South	1:1 Extant[3]	Extant[3]	8
Islamic Centard Cultural Center Culturaal/Ceisne	1150 2.0 2.0	4500 350 350	1200 1500 175	150 400 20%	- 400 215	Tashent[3] 2 5	4 4
Thennuant Sattistos Leisyal	3.0		-	-	2	8	2-4
Mean Range Conmerciay/Leisure Standard Deviation	2.5 5 0.7 1.0	984.3 57 151 1500	30-80% 170 100 112	80 0% 17% 16%	0 201 015 4	1:1 East-ln 112 2-4	2-4 4 Extant[3] 2
Garden Name	40.0	1500	150	100	-	Extant[3]	2

Level 2: Axial matrix. The fourfold (chahar bagh) configuration is established through the intersection of perpendicular axes, with proportional ratios between axes and quadrants following the 1:4 pattern identified in historical examples.

Level 3: Water choreography. The tripartite water sequence (entry channel–central pool–terminal cascade) is configured to maximize evaporative cooling, visual reflection, and experiential progression through the garden.

Level 4: Architectural integration. Built elements (entrance portal, pavilions, perimeter walls) are positioned to calibrate visual porosity, creating a deliberate sequence of revealed and concealed views.

The comparative analysis of spatial parameters across the six examined examples [Table 1] provides quantitative benchmarks for each level of the model. These parameters include overall garden area (ranging from 0.5 to 50 hectares in historical examples), water surface ratio (5–8% of total area), built-to-planted ratio (typically 1:4 to 1:6), and axial length-to-width ratios (predominantly 1:1 or 2:1).

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DISCUSSION

The findings of this research contribute to the scholarly discourse on Islamic landscape architecture in several significant ways. This section interprets the results in relation to existing literature, situates the Uzbek garden tradition within the broader Islamic world, acknowledges the limitations of the study, and identifies directions for future research.

Interpretation of Findings: The Garden as Spatial Text

The identification of persistent morphological invariants across six centuries of garden design in Uzbekistan supports the conceptualization of the Islamic garden as a form of spatial text—a culturally coded environment that transmits meaning through its configurational logic. The fourfold axial matrix, the tripartite water sequence, and the calibrated visual porosity identified in this study function as syntactic elements that, when combined, generate a legible spatial language.

This interpretation aligns with broader theoretical frameworks in architectural morphology that understand built form as embodying cultural schemata (Hillier, 2020). The fractal quality observed in Timurid gardens—the repetition of the fourfold pattern at multiple scales—can be understood as a spatial manifestation of Islamic cosmological principles, in which paradise is conceived as a hierarchical garden and earthly gardens are understood as microcosmic reflections of that celestial archetype.

The water choreography identified in this study extends beyond mere functional hydraulics to constitute what might be termed a "hydraulic narrative"—a sequence of spatial experiences that unfolds through the visitor's movement along water channels. The progression from the entry channel (sound and movement), to the central pool (stillness and reflection), to the terminal cascade (descent and termination) creates a emotional arc

that resonates with Qur'anic descriptions of paradise gardens. This finding supports the arguments of Clark (2019) regarding the semiotic dimensions of water in Islamic landscape design while providing specific morphological evidence from the Central Asian context.

Comparative Perspectives: Uzbekistan within the Islamic Garden Tradition

Situating the Uzbek garden tradition within the broader Islamic world reveals both shared principles and distinctive regional characteristics. The fourfold axial matrix identified in this study is common to Persian, Mughal, and Andalusian garden traditions, suggesting a pan-Islamic garden paradigm (Ruggles, 2020). However, the specific proportional systems, water configurations, and architectural integrations identified in the Uzbek examples exhibit distinct characteristics that warrant recognition as a regional sub-type.

Comparison with Safavid gardens (Iran). The Safavid gardens of Isfahan, particularly the Chahar Bagh Avenue and the gardens of the Hazar Jarib, share the axial organization and water choreography identified in the Uzbek examples. However, Safavid gardens typically exhibit a stronger integration with urban infrastructure—the garden as city rather than garden as retreat—and employ water in more expansive configurations, including larger pools and longer channels (Alemi, 2021). The Timurid gardens of Samarkand, by contrast, maintained a clearer separation between the garden enclosure and the surrounding urban fabric, with the perimeter wall functioning as a more definitive boundary.

Comparison with Mughal gardens (India). The Mughal gardens established by Babur—who was intimately familiar with the Timurid gardens of Samarkand and established gardens in Kabul and Agra that consciously referenced Central Asian prototypes—exhibit the clearest continuity with the Uzbek tradition . The garden of Babur in Kabul and the Ram Bagh in Agra both employ the fourfold matrix and water choreography identified in this study. However, Mughal gardens adapted these principles to the subtropical climate of the Indian subcontinent, incorporating deeper shade structures, more extensive planting, and a greater emphasis on topographical adaptation through terraced configurations.

Comparison with Andalusian gardens (Spain). The gardens of the Alhambra and the Generalife in Granada, while sharing the Islamic garden's emphasis on water and geometric order, developed in a distinct climatological and cultural context that produced different spatial outcomes (Dickie, 2018). The Andalusian courtyard garden (riad) operates at a smaller scale and with a more intimate relationship between architecture and planting than the expansive Timurid gardens, which were conceived as landscapes for royal encampments and ceremonial gatherings.

The distinctiveness of the Uzbek tradition lies in its synthesis of Persian geometric abstraction with Central Asian climatic adaptations and material culture. The integration of ceramic ornament—particularly the blue-glazed tiles that characterize Timurid architecture—with garden design created a visual dialogue between the geometric patterns

of architectural surfaces and the geometric order of planted areas. This integration, documented in the decorative programs of surviving ensembles such as the mausoleum of Zangiata and the madrasas of the Registan , represents a specifically Central Asian contribution to the Islamic garden tradition.

Limitations and Methodological Considerations

This study is subject to several limitations that should be acknowledged. First, the reliance on textual and archaeological sources for the Timurid gardens of Samarkand introduces uncertainty regarding the accuracy of reconstructed plans. While the *Baburnama* and Clavijo's account provide rich descriptive data, they do not include measured drawings, and the archaeological evidence for these gardens remains incomplete. The proportional analyses presented in this study should therefore be understood as estimates based on the best available evidence rather than precise measurements.

Second, the case study selection, while representative of different periods and typologies, cannot capture the full diversity of the Islamic garden tradition in Uzbekistan. Regional variations between Samarkand, Bukhara, Khiva, and the Fergana Valley require further investigation, as do gardens associated with different patronage contexts (royal, religious, commercial).

Third, the projective modeling component, while intended to test the applicability of historical principles to contemporary design, remains speculative until implemented and evaluated in built form. The design principles synthesized in this study should be understood as hypotheses to be tested through future practice rather than prescriptive rules.

Future Research Directions

The findings of this study suggest several productive directions for future research. First, phenomenological studies of garden experience—employing methods such as behavioral observation, thermal comfort measurement, and psychological response assessment—could provide empirical data on how the spatial configurations identified in this study affect human experience. Such research would bridge the gap between morphological analysis and experiential outcomes.

Second, digital reconstruction of lost gardens using 3D modeling and virtual reality technologies could enable more detailed analysis of visual relationships, light and shadow patterns, and sequential experiences than is possible through conventional plan analysis. The Timurid gardens of Samarkand, with their rich documentary record, present an ideal subject for such digital reconstruction.

Third, comparative studies extending the analytical framework developed in this research to other regions of the Islamic world could facilitate the development of a comprehensive typology of Islamic garden morphology. Such a typology would support both scholarly understanding and design applications by clarifying the relationships between regional variations and shared principles.

Fourth, longitudinal studies of contemporary garden projects that explicitly engage with the Islamic tradition could provide evidence regarding the long-term performance and cultural reception of historically-informed design. The Centre of Islamic Civilization in

Tashkent, completed in 2025, presents an opportunity for such longitudinal research as its landscape matures over coming decades.

CONCLUSION

This study has investigated the morphological principles of Islamic gardens in Uzbekistan, examining their historical development, spatial syntax, and contemporary relevance through a multi-method analytical framework combining comparative historical analysis, grapho-analytical decomposition, case study examination, and projective modeling. The findings support three principal conclusions.

First, the Islamic gardens of Uzbekistan exhibit persistent morphological invariants that transcend individual historical examples: the fourfold (chahar bagh) axial matrix organizing space through hierarchical subdivision; the tripartite water choreography (entry channel–central pool–terminal cascade) structuring experiential sequence; and the calibrated visual porosity mediating between built form and planted areas through precisely positioned architectural elements. These invariants constitute a coherent spatial language that transmitted cultural meaning across six centuries of garden design.

Second, the quantitative analysis of spatial parameters—including water surface ratios (5–8% of total area), built-to-planted proportions (1:4 to 1:6), and axial length-to-width ratios (predominantly 1:1 or 2:1)—provides evidence-based benchmarks for contemporary landscape architectural practice. These parameters, extracted from the comparative analysis of historical and contemporary examples [Table 1], offer a design toolkit that respects tradition while allowing contextual adaptation.

Third, the synthesized design model developed in this study [Diagram 5] demonstrates the feasibility of translating historical principles into contemporary practice. The application of this model to projective design scenarios reveals that the morphological logic of the Islamic garden remains relevant to contemporary landscape challenges, including microclimatic amelioration, spatial legibility, and cultural continuity in urban environments.

The practical recommendations emerging from this research address multiple stakeholder groups. For landscape architects and urban designers, the codified principles and quantitative parameters provide design guidance for projects seeking to engage with regional traditions. For heritage practitioners, the morphological framework supports conservation decisions by clarifying which spatial characteristics are essential to the garden typology and which are subject to contextual variation. For policymakers and cultural administrators, the findings underscore the significance of the Islamic garden tradition as a component of Uzbekistan's architectural heritage deserving of protection and informed reinterpretation.

Future research directions identified in this study—including phenomenological investigations of garden experience, digital reconstruction of lost gardens, and longitudinal studies of contemporary projects—promise to extend and refine the findings presented here. As Uzbekistan continues to develop its cultural infrastructure and urban

environments, the integration of historically-informed landscape architecture with contemporary design practice offers opportunities to create spaces that are simultaneously innovative and deeply rooted in regional tradition.

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