Architectonics and Ornamentation in Safavid Sacred Architecture: A Comparative Evaluation of Structural Design and Tile Aesthetics at the Sheikh Safi al-Din Ardabil Complex and the Sheikh Lotfollah Mosque

Pouyan Kashani[1, *] - Hamid Reza Kashani[2]
[1] Bachelor's Student in Interior Architecture, Faculty of Art, Architecture and Urban Planning, Islamic Azad University, Shahid Haj Ghasem Soleimani Branch (Kerman), Kerman, Iran
[2] M.A. Graduate in Painting, Faculty of Art and Architecture, Islamic Azad University, Yazd Branch, Yazd, Iran

* (Corresponding author: pouyankashani@gmail.com)

ABSTRACT

Safavid sacred architecture embodies a deliberate synthesis of structural intelligence and ornamental refinement, yet few comparative studies examine how architectonics and tile aesthetics operate in unison across different building types. This study focuses on two exemplary monuments—the Sheikh Safi al-Din Ardabil Complex, rooted in Sufi pilgrimage traditions, and the Sheikh Lotfollah Mosque in Isfahan, conceived as a private royal sanctuary—to evaluate their structural and decorative systems within a unified analytical framework. Using a systematic review of peer-reviewed scholarship, conservation reports, and authenticated architectural drawings, the research reconstructs geometric proportions, maps calligraphy, girih, and arabesque patterns onto structural lines, and classifies tile techniques including mosaic faience, cuerda seca, and haft-rangī. Analysis shows that spatial orientation strategies differ: the Ardabil complex employs sequential vestibules with slight reorientations of less than 15 degrees, while the Lotfollah Mosque resolves the urban-to-qibla misalignment with a 45-degree bent entrance. Proportional ratios also diverge, with the main portal at Ardabil approximating a 3:4 height-to-span relation compared to 3:2 at Lotfollah. Technical deployment reflects function and symbolism: Ardabil favors mosaic faience, covering more than half of its ornamental surfaces for inscriptions and girih clarity, while Lotfollah uses over 60% panel methods to achieve continuous chromatic fields in its immersive dome interior. Despite these divergences, both monuments align more than 90% of inscription bands with true structural horizons, confirming a shared discipline where ornament reinforces rather than obscures tectonic order. It is demonstrated in the study that Safavid architecture is operated as an embodied theology, offering guidance for conservation practice and serving as inspiration for contemporary architectural design.

Keywords: **Safavid architecture, architectonics, ornamentation, Sheikh Safi al-Din Ardabil Complex, Sheikh Lotfollah Mosque**

1. INTRODUCTION

Safavid architecture represents one of the most refined and symbolically charged traditions within the history of Islamic art, distinguished by its synthesis of structural innovation, ornamental richness, and profound theological meaning. Emerging in the sixteenth and seventeenth centuries, the Safavid dynasty not only consolidated political authority over vast territories of Iran but also established a powerful cultural and religious identity rooted in Shi 'a Islam. Architecture functioned as a central medium for expressing this new ideological and spiritual order, particularly through sacred monuments that simultaneously embodied religious devotion, political legitimacy, and aesthetic excellence [1]. Within this context, the architectural and decorative programs of mosques, shrines, and complexes transcended their utilitarian purposes to serve as semiotic systems, communicating the cosmological vision and socio-political aspirations of the Safavid state. The Sheikh Safi al-Din Ardabil Complex and the Sheikh Lotfollah Mosque in Isfahan stand as two exemplary monuments that illuminate the breadth and diversity of Safavid sacred architecture [2]. Although both were produced during

the same dynastic era, marked differences can be observed in function, location, and symbolic orientation. The Ardabil complex, rooted in the legacy of Sufi traditions, is a multifaceted sanctuary that integrates mausoleum, khanaqah, and pilgrimage spaces, serving as a center of spiritual authority and dynastic identity. In contrast, the Sheikh Lotfollah Mosque, situated on the monumental axis of Isfahan's Naqsh-e Jahan Square, was designed as a private royal mosque, lacking minarets and a congregational function, thereby embodying the intersection of imperial power and metaphysical symbolism [3]. A comparative study of these monuments thus provides a critical lens through which to explore the nuances of Safavid architectural practice. Central to such an investigation are two interrelated dimensions: architectonics and ornamentation. Architectonics, understood as the logic of structural design and spatial organization, reveals the conceptual frameworks that guided Safavid architects in the creation of sacred environments. Ornamentation, particularly manifested in tilework, calligraphy, and chromatic symbolism, operates not merely as surface decoration but as a visual theology that encodes metaphysical concepts and devotional ideals. Together, these aspects underscore the Safavid achievement of uniting form and meaning, material and spiritual, in architectural production [4]. This article seeks to conduct a comprehensive review of existing scholarship while advancing a comparative evaluation of the structural and ornamental strategies employed at the Sheikh Safi al-Din Ardabil Complex and the Sheikh Lotfollah Mosque. By situating these monuments within their historical, cultural, and theological contexts, the study aims to elucidate both their shared attributes as expressions of Safavid religiosity and their divergences as reflections of regional, functional, and political distinctions. The review further aspires to contribute to broader discourses on Islamic architectural theory, demonstrating how Safavid sacred architecture articulates a dynamic interplay between architectonics and ornamentation that continues to inform scholarly interpretations of space, aesthetics, and symbolism in the Islamic world.

2. Methodological Framework

2.1. Nature of the Study: Review and Comparative Analysis

This article adopts a protocolized narrative review with comparative analysis. The review synthesizes peer-reviewed scholarship, conservation reports, and authenticated measured drawings to construct an integrated account of architectonics and ornamentation in two Safavid monuments. The comparative component proceeds through a controlled set of variables, defined a priori, including structural system, spatial hierarchy, geometric ordering, and tile-based ornamental programs, so that inferences arise from commensurable evidence rather than impressionistic descriptions. The intent is not to propose a single causal narrative but to evaluate convergences and divergences under clearly specified analytical parameters [5].

2.2. Case Selection and Justification

The Sheikh Safi al-Din Ardabil Complex and the Sheikh Lotfollah Mosque are selected through purposive sampling to represent two poles within Safavid sacred production: a multi-functional Sufi-dynastic sanctuary in a regional context and a courtly mosque embedded in the imperial urban fabric of Isfahan. The inclusion criteria are historical authenticity, continuous scholarly documentation, the availability of reliable plans/elevations/sections, and a sufficiently documented ornamental program, especially tilework. Exclusion criteria eliminate structures with compromised attribution, insufficient documentation, or substantial post-Safavid reconstructions that obscure original fabric. This pairing enables controlled comparison across function, patronage, and setting while holding constant the broader dynastic and theological frame [6].

2.3. Sources and Data Collection

The evidence base comprises three tiers. The first tier includes peer-reviewed journal articles, academic monographs, and chapters in edited volumes published in English and Persian; these are searched through JSTOR, Scopus, Web of Science, ProQuest Dissertations & Theses, and major university presses using controlled descriptors such as "Safavid architecture," "Sheikh Safi Ardabil," "Sheikh Lotfollah Mosque," "tilework," "haft-rangi," "mosaic faience," "muqarnas," "spatial hierarchy," and "proportional systems." The second tier consists of conservation and condition reports issued by recognized cultural heritage authorities and museums, which often contain measured drawings, material analyses, and intervention histories. The third tier includes high-resolution photographic surveys and published architectural drawings that meet verifiability standards; only sources with traceable provenance and methodological transparency are retained [7]. For each

item, the study extracts bibliographic details, methodological approach, date and scope, availability and scale of drawings, statements on structural system and geometry, typology of ornament, tile techniques and palette, inscriptions and epigraphic content, and any reported restorations.

2.4. Operational Definitions and Analytical Parameters

Architectonics" denotes the ordered ensemble of structural and spatial decisions through which sacred meaning is materialized: bearing systems, shell and dome typologies, transitional devices from square to circle or octagon, load paths, and the hierarchical articulation of entrances, vestibules, courtyards, prayer halls, and sanctified enclosures. "Ornamentation" encompasses the design, technique, and placement of surface programs, tilework, calligraphy, vegetal and geometric arabesques, and chromatic strategies, treated as semantically charged rather than merely decorative. Geometric ordering refers to modular grids, proportional ratios, and constructive geometry evidenced in plans, sections, and elevations [8]. The tile program is analyzed along four axes: technique (for example, haft-rangi, mosaic faience, and, where documented, cuerda seca), motif taxonomy, inscriptional content, and chromatic range with its spatial deployment. Light and perception are treated as mediating variables that condition the legibility of both structure and ornament.

2.5. Procedures for Architectural and Ornamental Analysis

Architectural analysis proceeds from the general to the specific. Plan morphology is examined to identify axiality, symmetry, or controlled asymmetry, and the sequencing of thresholds. Section and elevation are then read to characterize vertical hierarchies, dome geometry, and transitional devices, with particular attention to how structural necessities are expressed or concealed. Proportional assessment relies on published measured drawings and uses modular reconstruction to test for simple integer and root-based ratios that are well attested in Islamic architecture, without presupposing any singular canon. Ornament is studied through motif coding and spatial mapping. Each surface zone is identified, its technique and motif class recorded, and its semantic register interpreted in relation to adjacent architectural elements. When sources provide colorimetric data or standardized photography, chromatic relationships are discussed in terms of contrast, saturation, and gradation, always with reference to viewing distance and ambient light conditions documented by field researchers [9].

2.6. Comparative Strategy and Synthesis

Comparison is executed in two passes. The first pass is intra-monumental, establishing internal coherence by correlating structural choices with ornamental deployment inside each case. The second pass is inter-monumental, aligning like with like across the two cases under the pre-established variables. Findings are synthesized through a matrix that cross-relates functional program, structural articulation, geometric ordering, and tile aesthetics. Interpretations are advanced only where the evidentiary base converges; where sources diverge, the disagreement is stated explicitly and traced to methodological or documentary causes [10].

2.7. Quality Appraisal, Bias Management, and Reliability

All sources are appraised for methodological clarity, evidential sufficiency, and relevance to the defined parameters. Conservation reports are prioritized when primary measurements or material analyses are included, while popular or non-scholarly accounts are excluded unless unique primary data are transmitted that can be independently verified. To reduce selection bias, database searches are repeated with variant keywords and in both English and Persian. To enhance reliability in coding, the study employs a structured codebook. In the event of multiple coders, a double-coding check is conducted on a subset of sources to assess agreement, with discrepancies resolved through rule-based adjudication and recorded in an audit log. Interpretive claims remain tethered to explicitly cited observations rather than generalized period styles [11].

2.8. Limitations and Delimitations

The review depends on the fidelity of published drawings and the transparency of conservation documentation; undisclosed restoration campaigns or undocumented substitutions can limit certainty, particularly in chromatic reconstructions. Photographic evidence is subject to biases in lighting, lens, and post-

processing; accordingly, color discussions are framed as conditional unless instrumentally measured data are available. The study does not attempt new field measurements or material assays; it triangulates among high-quality secondary and primary sources to achieve a conservative, evidence-led synthesis [12].

2.9. Reproducibility and Data Management

Search strings, inclusion and exclusion criteria, the coding schema, and the comparative matrix are maintained in a structured archive, allowing the workflow to be replicated. All extracted variables are logged with source-level citations, and interpretive steps are documented to preserve an explicit chain of reasoning. Where permissions allow, plan overlays and motif maps derived from published drawings are prepared to visualize correspondences between structural articulation and ornamental placement; these graphics serve explanatory clarity without altering the underlying data [13].

3. Historical and Cultural Context of the Safavid Era

3.1 Political and Religious Foundations of the Safavid Dynasty

The Safavid state arose from the transformation of a Sufi lineage rooted in Ardabil into a dynastic sovereignty with imperial aspirations. Tracing its spiritual authority to Shaykh Ṣafī al-Dīn (d. 1334), the order accrued charismatic legitimacy that later rulers mobilized to forge political unity. In 1501, Ismāʿīl I proclaimed kingship in Tabriz and established Twelver Shiʿism as the state religion, a decision that reoriented ritual life, jurisprudence, and the symbolic vocabulary of public art and architecture. State formation unfolded amidst Ottoman and Uzbek pressures, which in turn shaped patterns of capital relocation, first from Tabriz to Qazvin under Ṭahmāsp I (r. 1524–1576), and later to Isfahan under ʿAbbās I (r. 1588–1629). The institutionalization of Shiʿi clerical authority, combined with royal control over strategic resources such as the silk trade, supplied the ideological and economic foundations for the monumental patronage that characterizes the mature Safavid period. Within this framework, sacred architecture became a privileged medium for articulating dynastic piety and political legitimacy through calibrated combinations of plan, elevation, inscription, and ornament [14].

3.2 Patronage of Architecture under Shah ʿAbbās I and Successors

The accession of ʿAbbās I marked a decisive consolidation of power and a corresponding intensification of architectural production. The relocation of the capital to Isfahan in 1598 enabled a comprehensive urban program that aligned the bazaar, palace, and mosque within an integrated ceremonial landscape. The state's atelier system, encompassing architects, master masons, calligraphers, tile makers, and painters, provided the organizational infrastructure for consistent stylistic execution across major commissions. Within this ecosystem, the court library–workshop (kitābkhāna) functioned as a design laboratory, mediating between manuscript arts and the monumental surface through transferable compositional grammars. Tile technology and construction practices benefited from this concentration of skilled labor, while endowed foundations (awqāf) stabilized the maintenance of key religious institutions. The continuity of patronage into the seventeenth century, despite periodic fiscal and military strains, sustained a high level of formal experimentation in dome construction, transitional devices, and the orchestration of light and color in interior space [15].

3.3 Urban and Spiritual Significance of Ardabil and Isfahan

Ardabil retained enduring prominence as the cradle of Safavid sanctity. The complex centered on the tomb of Shaykh Ṣafī al-Dīn developed into a pilgrimage node and dynastic mausoleum whose expansions mirrored the evolving relationship between Sufi charisma and royal authority. The spatial ensemble, incorporating khānaqāh functions, mausolea, and ritual circulation, embedded devotional practice within a carefully staged architectural itinerary. By contrast, Isfahan, reimagined as an imperial metropolis, projected a complementary vision of sacred order through urban form. The Maydān-i Naqsh-i Jahān operated simultaneously as a commercial hub, ceremonial stage, and architectural proscenium, aligning palace and mosques across axial vistas. Within this composition, the Sheikh Loṭfollāh Mosque, set on the eastern flank of the square, offered an introspective counterpart to the congregational monumentality of larger Friday mosques. Frequently interpreted as a court mosque designed for the royal household, its restricted access and measured scale allowed

for an exceptional degree of ornamental refinement and phenomenological control [16]. The dialogic relation between Ardabil's pilgrimage complex and Isfahan's courtly mosque encapsulates the Safavid negotiation between regional sanctity and imperial representation.

3.4 Role of Sufi Traditions and Shiʿi Identity in Architectural Expression

Safavid sacred architecture materializes a layered theological discourse in which Sufi inheritance and Twelver Shiʿi doctrine cohabit and sometimes recalibrate one another. The veneration of saints and the ritual centrality of the Imams, expressed through epigraphic programs, spatial hierarchies, and processional routes, inform the disposition of thresholds, domed sanctuaries, and zones of increasing sacral intensity. Architectural space thus becomes a didactic instrument: proportional systems and geometric ordering frames are deployed not merely for structural efficiency but to index ideals of harmony associated with metaphysical cosmology. Ornament operates as a disciplined language wherein calligraphy delivers Qurʾanic verses and invocations of the Imams, vegetal and geometric arabesques allude to paradisiacal fecundity and infinite order, and calibrated chromatic fields shape affective states appropriate to devotion and contemplation. These elements are not configured in isolation; coordination is established with the architectonics of enclosure, aperture, and shell, through which light, echo, and movement are employed to translate theological propositions into embodied experience. The Sheikh Ṣafī complex privileges a processional, relic-bearing spirituality consonant with Sufi and dynastic memory, whereas Sheikh Loṭfollāh distills Shiʿi imagery and courtly piety into a concentrated interior where structural clarity and surface eloquence converge [17]. Fig 1 highlights the historical and cultural context of the Safavid era, emphasizing its religious foundations, architectural patronage, spiritual centers, and the fusion of Sufi and Shi'i traditions in architectural expression.

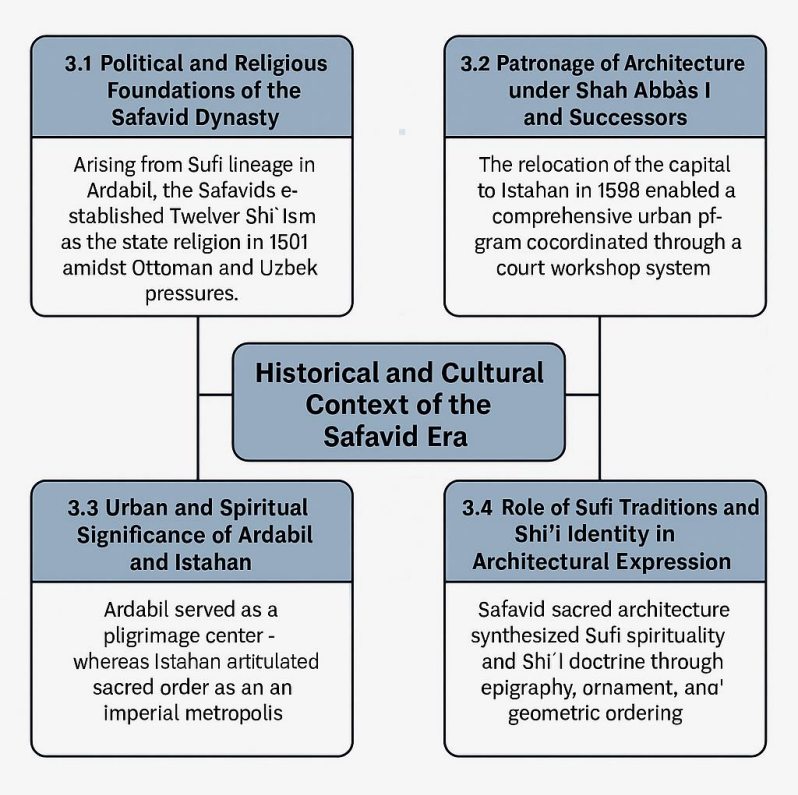

Fig. 1. *Historical and cultural foundations of the Safavid dynasty and architecture*

4. Concept of Architectonics in Safavid Sacred Architecture

4.1 Definition and Theoretical Approaches to Architectonics

In this study, architectonics denotes the intelligible order by which structure, space, and construction cohere to materialize sacred meaning. It extends beyond the mere presence of load-bearing walls, vaults, and domes to

include the legible articulation of support and span, the sequencing of thresholds, the calibration of mass and void, and the disciplined mediation between tectonic necessity and symbolic intent. Within Safavid sacred architecture, architectonics is apprehended through the reciprocity of stereotomic bodies, masonry masses that enclose and buttress, and tectonic assemblies, units, and joints that register span, curvature, and transition. The concept, therefore, encompasses the whole chain of decisions from site orientation and plan morphology to shell geometry and surface junctions. It is not reducible to structure alone, nor collapsible into ornament; rather, it is the rule-bound framework that renders ornament semantically anchored and spatial effects structurally plausible [18].

4.2 Spatial Hierarchy and Structural Logic

Safavid sacred buildings organize movement and meaning through a graded hierarchy of spaces that reconcile urban frontage, ritual itinerary, and qibla orientation. Entry is typically staged by a portal block whose height and depth announce a sacral threshold, followed by a vestibular inflection, often a bent or angled passage, that tactically realigns the body to the prayer axis while modulating acoustic and luminous conditions. Courtyard and iwan configurations, when present, furnish axial cues and scale transitions, but the hierarchy culminates in the domed sanctuary where structural clarity and devotional focus converge. The structural logic is legible in the way thrusts are gathered and resolved: pointed and four-centered arches conduct loads to robust piers; barrel and cross vaults span subsidiary bays; and the transition from prismatic supports to a circular or polygonal dome base is achieved by squinches or muqarnas-mediated pendentives. Buttressing is integrated into perimeter walls and corner masses, rather than relying on external flying members, thereby preserving continuous envelopes that support both static stability and interior acoustic resonance. Openings at the drum or upper wall zones are sized and placed to respect shell behavior, admitting controlled light without compromising hoop stresses. Throughout, the spatial sequence discloses, rather than conceals, the underlying load path, allowing processional movement to coincide with a didactic reading of the structure [19].

4.3 Symbolic Geometry and Proportional Systems

Geometric ordering in Safavid sacred architecture provides a cognitive scaffold that aligns structural measures with theological signification. Plans and elevations frequently reveal modular grids from which bay widths, pier thicknesses, and arch radii can be derived, allowing parsimonious construction while preserving consistent scale relations. Transitions from square to octagon to circle perform simultaneously as structural devices and cosmological figures, staging the ascent from terrestrial rectilinearity to celestial curvature. Proportional consonances, simple integer ratios, and root-based rectangles are encountered as governing relations rather than inviolable laws, guiding the relative dimensions of portal, iwan, and dome and enabling harmonic correspondences between horizontal spread and vertical rise. Muqarnas, in this register, operates as a discretized geometry that transforms angular corners into rotational continuity; it is not a gratuitous embellishment but a metrically regulated field that negotiates planimetric change while indexing the principle of gradation central to Islamic metaphysics. The resultant geometry allows ornament to lock onto structural modules, so that calligraphic bands, girih lattices, and medallion fields coincide with actual construction lines rather than floating across them.

4.4 Construction Materials and Techniques

Safavid sacred structures are fundamentally masonry architectures executed in fired brick with lime-rich mortars and gypsum plasters, often supplemented by timber ties embedded at critical courses to temper tensile deficits and seismic vulnerability. Brick units, laid in regulated bonds, develop shells whose curvature is set out with wooden centering and then self-sustains once the ring is closed; joints are sized to control creep and moisture migration. Transitional members at the dome base deploy squinch arches and muqarnas cells, constructed in brick and plaster, with their profiles trimmed to align with the load surface. Stone appears selectively in foundations, thresholds, and column bases where abrasion resistance is required, while metal cramps or tie-rods may be introduced locally to stabilize diaphragms. Finishing plasters prepare the substrate for tile cladding in zones designated for ornamental programs; elsewhere, the structural brick surface remains exposed as a calibrated texture that records coursing and curvature. Construction practice thus yields shells and

vaults that are economical in material yet generous in span, with the envelope's continuity serving thermal inertia, acoustic coherence, and the uninterrupted registration of light.

4.5 Integration of Function, Form, and Sacred Symbolism

The architectonic order achieves its fullest intelligibility where ritual function, spatial form, and symbolic discourse are reciprocally determined. Qibla orientation and liturgical focus organize the hierarchy of approach and enclosure, ensuring that the sanctuary's dome, the mihrab's niche, and the distribution of apertures are not merely formal decisions but programmatic necessities. The shell geometry and wall thickness are chosen to stabilize reverberation times suitable for recitation, ensuring that the acoustic image of the Qurʾan aligns with the visual cadence of the arches and shells. Daylight is choreographed as a hierophany rather than an indiscriminate flood: high-level fenestration and drum perforations produce gradated fields that differentiate between profane and sanctified space, while marking script bands and motif registers. Ornament adheres to the structural and geometric framework, amplifying rather than masking the reading of supports and spans; calligraphy tracks actual springing lines, arabesques fill the interstices defined by vault geometry, and chromatic intensities rise with spatial consecration. In this synthesis, the building does not oscillate between engineering and image but resolves them into a single, rule-bound language in which stability, procession, and devotion are mutually legible.

5. Ornamentation and Aesthetics in Safavid Architecture

5.1 Philosophical and Theological Underpinnings of Ornament

Safavid ornamental practice is grounded in a metaphysical horizon in which beauty is construed as a disclosure of order rather than an autonomous aesthetic category. The doctrinal centrality of tawḥīd provides a conceptual key: multiplicity is to be disciplined into unity through rule-based repetition, measured variation, and hierarchical framing. Within Twelver Shiʿi devotion, scriptural remembrance and the veneration of the Imams demand an epigraphic architecture; ornament therefore assumes a didactic function, translating recitation into visible form along cornices, portals, drums, and mihrab surrounds. Sufi inheritances further inflect this horizon by valuing gradual intensification, sulūk, rendered spatially as an ascent through successive registers of pattern density, chromatic saturation, and luminous contrast. In this framework, ornament is not an appliqué but a semantically charged system that stabilizes affect and cognition, aligning the worshipper's sensory field with a cosmology of measure, balance, and remembrance.

5.2 Calligraphy, Arabesque, and Geometric Pattern as a Disciplined Language

Calligraphy constitutes the primum mobile of Safavid ornament. Large-scale Qurʾanic citations and invocatory formulas are commonly executed in thuluth for maximum legibility over curvature and distance. At the same time, continuous text passages and Qurʾanic suras are often set in naskh. Persian dedicatory poems, royal endowment notices, or moral maxims may appear in nastaʿlīq where appropriate, typically in framed panels or cartouches. These scripts are not placed arbitrarily; alignment is established with actual construction lines, springings, imposts, and drum horizons, thereby defining proportional horizons that regulate the distribution of adjacent motifs. The arabesque operates as a vegetal continuum, palmettes, split leaves, rumi scrolls, whose curling energy both fills and articulates interstitial fields. Its function is less mimetic than formal: it mediates between the rectilinear logic of masonry and the curvilinear logic of shells and niches, softening junctions without dissolving structural legibility. The geometric pattern (girih) provides a reciprocal discipline: strapwork lattices, star polygons, and rosette nets establish a modular grid whose periodicity supports both vegetal infill and script panels. Crucially, these three systems are coordinated. Script bands set the primary measure, girih fixes the modular cadence, and arabesque furnishes continuous transitions, so that the eye circulates through a coherent grammar rather than encountering isolated motifs.

5.3 Chromatic Symbolism and Glazed-Tile Techniques

Safavid color is neither applied arbitrarily nor used solely as emblem; it is engineered through material technology and calibrated to interior light. The canonical palette is constructed from cobalt blues ranging from deep lajvard to lighter azures, turquoise and green derived from copper-bearing glazes, creamy whites for field

relief and optical rest, manganese blacks and browns for outlines, and selective yellows that punctuate medallions and cornices. Reds are employed sparingly and executed with technical difficulty; when present, manifested more often as iron-rich or manganese tones than as saturated vermilions. Chromatic fields are typically graded so that cooler hues articulate the structural shell and warmer accents mark focal inscriptions or medallions; this strategy amplifies depth and stabilizes the viewer's orientation. Three principal techniques structure the Safavid tile revetment. Mosaic faience, inherited from Timurid practice, assembles pre-fired monochrome pieces cut to pattern and set like marquetry into gypsum beds. It yields razor-sharp edges, durable color, and exceptional precision in girih and script, but is labor-intensive. Cuerda seca utilizes a manganese-laden, greasy resist drawn on a biscuit-fired tile to create compartments that retain differently colored glazes during the subsequent firing; it is well-suited to intricate polychrome panels and curved surfaces. Haft-rangī ("seven-color") involves painting multiple glazes directly onto a standard square biscuit, often with a dark line incised or painted to separate hues, and firing once; it dramatically accelerates production and enables large narrative or cartouche panels with painterly transitions. Safavid ateliers deploy these methods strategically: mosaic faience for high-stress edges, script, and exacting geometry; cuerda seca and haft-rangī for expansive surfaces, vault intradoses, and complex figuration of vegetal scrolls. The choice of technique is not merely economic; it conditions line quality, reflectance, joint visibility, and thus the semiotics of the surface.

5.4 Aesthetic Principles: Unity, Harmony, and Illumination

Safavid ornament seeks unity through regulated repetition anchored to architectural modules. Harmony is achieved by consonance among scale, interval, and curvature: the span of a vault sets the beat for script cadence; the rise of a dome determines the radius of medallions and the pitch of muqarnas tiers; the thickness of piers informs the width of border bands. Symmetry is used instrumentally rather than dogmatically; controlled asymmetries, offset entrances, bent vestibules, are reconciled by pattern fields that reassert equilibrium across larger frames. Illumination functions as an aesthetic principle rather than a mere environmental condition. High-set apertures and drum perforations wash script with grazing light, intensify the glaze's depth through specular highlights, and stage temporal change as the sun rotates. In interiors, reflective glazes produce soft, layered luminosity that sustains legibility at devotional distances, while matte plasters or exposed brick provide contrast that prevents optical fatigue. The result is a measured alternation between density and calm, brightness and shadow, that guides attention from threshold to mihrab without theatrical excess.

5.5 Ornament as Spiritual Mediation and Liturgical Technology

In Safavid sacred buildings, ornament mediates between text and body, doctrine and perception. Epigraphy integrates the act of reading with the act of moving; as one advances, bands of text appear, align, and recede in a rhythm that mirrors liturgical progression. Geometric tessellations enact infinitude by implication rather than representation, allowing contemplation to unfold without violating aniconic constraints. Vegetal scrolls materialize the Qurʾanic garden motif in abstracted form, surrounding worshippers with a sign-system of fecundity and renewal. At the mihrab, the densification of calligraphy and the tightening of arabesque coils concentrate meaning, while chromatic intensification and precise shadow from muqarnas niches modulate reverberation and visual focus. Ornament thus operates as a liturgical technology, calibrating attention spans, managing proxemics, supporting recitational acoustics, and encoding theological hierarchies in a spatially legible form. Crucially, this mediatory work remains anchored to the architectonic order. Bands track real springings; medallions lock to true centers; muqarnas cells resolve geometric transitions. Because surface and structure concur, devotion is not distracted by dissonance between what is seen and what is built; the worshipper inhabits a coherent field in which stability, measure, and meaning converge. Fig 2 shows that Safavid sacred architecture was guided by a clear structural logic, symbolic geometry, spatial hierarchies, and theological meaning, blending proportional systems with construction techniques to create harmonious and spiritually significant designs.

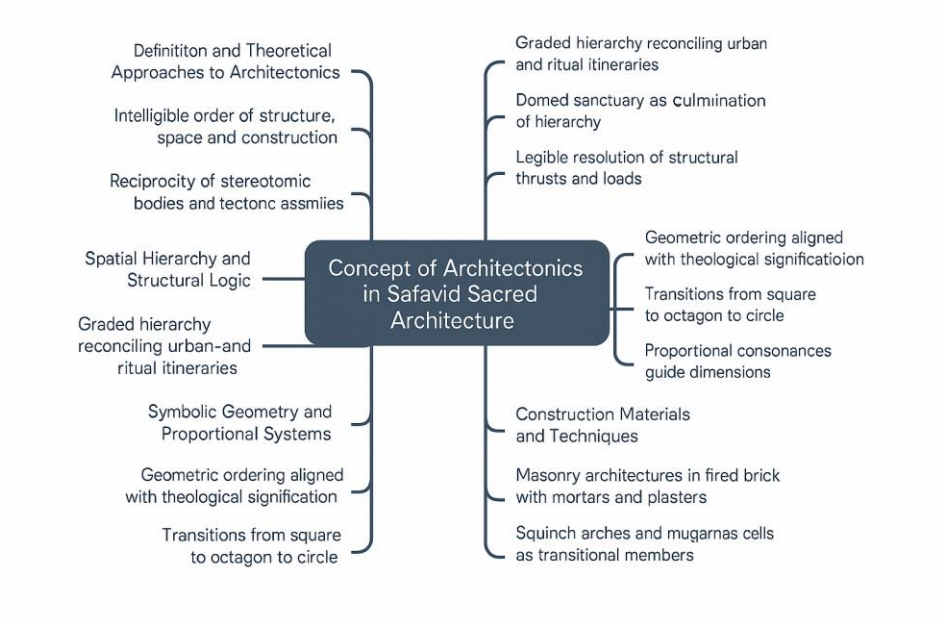

Fig. 2. *Concept of architectonics in Safavid sacred architecture*

6. Case Study I: Sheikh Safi al-Din Ardabil Complex

6.1 Historical Genesis and Developmental Phases

The complex at Ardabil originated as the funerary locus and institutional heart of a Sufi order centered on the figure of Shaykh Safi al-Din (d. 1334). Over the course of the sixteenth and seventeenth centuries, it was methodically expanded into a dynastic sanctuary, with endowments consolidating its ritual, educational, and charitable functions. Early fabric associated with the pre-Safavid order provided an anchor for subsequent interventions, while Safavid patronage regularized circulation, amplified the monumental profile of the tomb precinct, and integrated ancillary facilities to accommodate increasing numbers of devotees. Additions during the mature period rationalized the approach sequence, clarified the hierarchy of courts and halls, and extended ornamental programs in proportion to the site's elevated political and devotional status. Later restorations, where documented, tended to stabilize masonry shells and surface revetments rather than to reconfigure the underlying plan, so that the ensemble preserves a legible palimpsest in which Sufi origins and Safavid monumentalization remain mutually visible.

6.2 Overall Architectural Layout and Spatial Organization

Spatially, the complex operates as a choreographed itinerary that moves from urban fabric to sanctified enclosure through a measured alternation of compression and release. A portal block marks the passage from public street to threshold, typically followed by a vestibular inflection that reorients the body and modulates sound and light. Courtyard spaces structure the distributive logic of the ensemble, distinguishing flows destined for devotional access from those supporting institutional functions such as instruction, hospitality, or administration. The approach to the tomb chamber is articulated as a sequence of progressively specialized zones: transitional halls with controlled apertures give way to antechambers where the acoustic and luminous field tightens, culminating beneath the dome in a space of concentrated focus. The alignment of routes respects both qibla orientation and the axial claims of the sepulchral core; where these logics diverge, the plan mediates through bent passages and offset doors so that liturgical propriety and venerative movement coexist without collision. This layered organization permits simultaneous accommodation of pilgrimage circuits, daily prayer, and commemorative rites while preserving a clear legibility of thresholds and degrees of sanctity.

6.3 Mausoleum and Khanaqah Functions

The mausoleum constitutes the theological and ceremonial center of gravity. Its chamber, articulated by a domical canopy over a compact plan, provides a volumetrically intensified setting for visitation and recitation. Adjacent spaces sustain the institutional life of the order as transformed under Safavid sovereignty: assembly halls, study rooms, and service zones are calibrated to support cycles of dhikr, teaching, and hospitality. Circulation patterns separate circumambulation around the tomb from the more protracted stays associated with instruction and communal meals, minimizing cross-traffic at peak devotional periods. The khanaqah's architectural language, measured spans, acoustically sympathetic vaults, and restrained fenestration support orality and recollection, while the tomb's denser ornament and heightened luminosity register the affective and doctrinal intensification proper to veneration. The adjacency of these two programs embodies the synthesis of Sufi charisma and Safavid political identity: pedagogy, hospitality, and remembrance occur within earshot of the dynastic shrine, binding quotidian practice to paradigmatic sanctity.

6.4 Structural Features: Domes, Portals, and Transitional Devices

Constructively, the ensemble exemplifies Safavid mastery of brick-based stereotomy. Load paths are gathered by piers and thickened enclosure walls, with pointed and four-centered arches distributing thrust to create stable bays for assembly and passage. The transition from prismatic support to the dome base is mediated by squinches and muqarnas-inflected pendentives that both true the geometry and diffuse concentrated stresses. Drum apertures, where present, are dimensioned to admit high, grazing light without compromising the hoop action of the shell; openings at lower registers are restricted to maintain stiffness and to preserve the interior's acoustic envelope. Portals employ deep reveals and tiered muqarnas to negotiate the move from exterior glare to interior chiaroscuro while registering the structure's depth as a readable thickness rather than a mere surface. Timber ties and concealed iron cramps appear at strategic courses in the literature of Safavid practice and are consistent with the requirements of seismic moderation in brick shells; their role is to temper tensile deficits without interrupting the continuity of the masonry envelope. The net effect is a system in which tectonic clarity is preserved across scales: the visitor can intuit the thrust and counter-thrust of arches and domes even as decorative fields refine the perception of curvature and span.

6.5 Tile Decoration: Stylistic Characteristics and Technical Deployment

The ornamental program at Ardabil is distinguished by a disciplined coordination of script, geometric lattice, and vegetal scrolls, all of which are mapped to the architectonic grid. Epigraphic bands in monumental hands occupy structural horizons, portal imposts, drum bases, and cornices, so that textual content and load-bearing articulation coincide. Geometric strapwork establishes modular scaffolds across spandrels and lunettes, enabling precise registration of medallions and star-polygon fields that respect true centers and springing lines. Vegetal arabesques infill interstices with calibrated density, softening angular junctions without dissolving the legibility of the shell. Chromatically, a cobalt-to-turquoise spectrum predominates, punctuated by whites that reset the eye and by darker lines that sharpen motif edges; warmer notes appear in controlled accents to mark focal inscriptions or nodal medallions. Technically, the program combines high-precision mosaic faience in zones demanding exact edge control, calligraphy, girih frames, and border bands, with polychrome panel techniques on broader surfaces where painterly transitions and production efficiency are advantageous. This distribution of methods produces a readable stratigraphy of surface: sharp, high-contrast lines at structural and textual horizons and more atmospheric fields across vault intradoses and secondary walls. The result is an ornamental order that amplifies, rather than masks, the structural logic.

6.6 Symbolic and Devotional Dimensions

As a pilgrimage and dynastic site, the complex encodes doctrine in spatial practice. The gradation from outer court to domed tomb chamber stages an ascent from civic time to sacred time; thresholds and vestibules punctuate this ascent with deliberate pauses that align bodily movement with remembrance. Light functions as a medium of theological emphasis, concentrating on the upper registers of the sanctuary to suggest transcendence while leaving the lower walls in a temperate penumbra conducive to recitation. The distribution of inscriptions integrates Qur'anic verses with invocations central to Shi'i piety, binding textual memory to the very lines of construction. Geometric fields intimate infinitude through measured repetition, and vegetal scrolls abstract paradisiacal fecundity into a continuous, embracing ground. Because these sign systems are

synchronized with the building's load-bearing and proportional frames, their symbolism is not detached from the construction; it is materially anchored and therefore experientially persuasive. In this way, the Ardabil ensemble demonstrates how Safavid sacred architecture fuses Sufi inheritance and imperial articulation into a single, rule-governed language in which devotion, memory, and stability are mutually reinforcing.

7. Case Study II: Sheikh Lotfollah Mosque, Isfahan

7.1 Historical Patronage and Function as Royal Mosque

Commissioned by Shah ʿAbbās I as part of the Naqsh-e Jahan urban ensemble, the Sheikh Lotfollah Mosque was designed for private, courtly devotion rather than congregational worship. Construction began ca. 1602/03 and concluded by 1618/19, with the monument subsequently named (1622) for the scholar Shaykh Loṭf-Allāh al-ʿĀmilī, who taught in Isfahan but did not participate in the mosque's design or construction. The scholarly consensus situates the project within the Safavid program of aligning imperial representation, doctrinal identity, and controlled access to sanctified space. This logic explains both the mosque's reduced scale and its restricted liturgical role. Authoritative surveys describe it explicitly as a royal, non-Friday mosque, a status that underwrites its formal departures from the courtyard-centered, four-iwan typology typical of public congregational architecture.

7.2 Architectural Typology and Spatial Design

Spatially, the building is a compact, single-chamber sanctuary set behind a shallow portal on the east flank of the square. Unlike four-iwan mosques, it forgoes a sahn (courtyard) and the sequence of axial iwans, substituting a carefully choreographed entrance system that bends the approach to reconcile the square's urban alignment with the qibla. The portal aligns compositionally with the Maydān façade. Still, the sanctuary volume sits obliquely, nearly forty-five degrees, so that the visitor traverses a pair of turning corridors before emerging into the domed chamber. This planimetric torsion is not a mere curiosity; it is the geometric solution that preserves the square's urban order while securing correct liturgical orientation, and it produces the celebrated visual displacement in which the dome reads "off-axis" behind the portal when viewed from the square.

7.3 Structural Components: Dome, Portal, and the Significance of "No Minarets"

The mosque is constructed around a single domed sanctuary, supported by a sequence of squinches and kite-shaped panels that rise to a low drum, punctuated by paired grilles. Architectural documentation identifies the dome as a rare Safavid single-shell construction, whose three-tiered structural organization clarifies both the resolution of thrust and the fenestration strategy. The portal's deep reveal and muqarnas canopy perform the optical and acoustic transition from the glare of the square to the controlled penumbra of the approach, registering the envelope's actual thickness as one passes within. Equally diagnostic is what the building omits: there is no minaret and no courtyard. These absences are typological, not impoverishments, and follow from the mosque's private, non-congregational function, which required neither a call to public prayer nor the capacious circulation fields of a Friday mosque.

7.4 Ornamentation Program: Calligraphy, Floral Motifs, and Chromatic Palette

The surface program coordinates epigraphy, girih geometries, and vegetal arabesques with the architectonic grid. Inscriptions in monumental hands, associated in sources with court calligrapher ʿAlī Reżā (Reza) ʿAbbāsī, occupy actual construction lines at portal imposts, drum horizons, and mihrab frames; their placement ties textual meaning to structural articulation. The exterior dome's cream-to-ochre ground sets off an interlacing floral arabesque in blues, whites, and blacks. At the same time, the interior composes a calibrated sunburst that cascades into rings of lozenges whose scale diminishes toward the apex, intensifying centripetal focus. The chromatic regime, cobalt and turquoise balanced by whites and dark outline, reads as a disciplined orchestration rather than mere polychromy, and its registration on structural modules keeps the eye's movement consonant with the building's geometry.

7.5 The Iconic Dome Interior: Light, Color, and Symbolism

Phenomenologically, the bent approach amplifies the sanctuary's reveal: compressed, dimly lit corridors open into a chamber where high-set apertures and glazed revetments generate a luminous field. Descriptions by authoritative repositories emphasize the interior "sunburst" schema, in which nested medallions guide perception upward and inward, staging a legible correspondence between geometric concentration and devotional focus. Modern accounts often describe a "peacock" effect at the apex, in which incident light reads as a spread tail when viewed from the entrance; whether taken as an optical metaphor or a literal phenomenon, the interpretive point remains that light and pattern are composed to heighten anagogy without compromising structural clarity. Table 1 present Sheikh Safi al-Din Ardabil Complex vs. Sheikh Lotfollah Mosque.

7.6 Devotional and Political Messaging in Ornamentation

The mosque's inscriptions and spatial rhetoric enunciate a program of Shiʿi devotion articulated within an imperial urban theater. Text bands include Qurʾanic selections and invocatory formulas aligned with Safavid piety. At the same time, the building's very placement, opposite ʿAlī Qāpū and along the continuous arcades of the Maydān, stages a dialog between royal presence and sanctified privacy. In this reading, the mosque's small scale, absence of minarets, and concentrated interior are interpreted not as deficits but as instruments of message: sacred space is domesticated for the court while simultaneously embedded within the city's most public prospect. The result is a monument where architectonics and ornamentation converge to visualize sovereignty as measured devotion, producing a carefully delimited sanctum whose theological and political eloquence is inseparable from its structural and urban intelligence.

Table 1: Sheikh Safi al-Din Ardabil Complex vs. Sheikh Lotfollah Mosque

Aspect	Sheikh Safi al-Din Ardabil Complex (Ardabil)	Sheikh Lotfollah Mosque (Isfahan)
History & Function	Began as khanaqah + mausoleum (14th c.); expanded under Safavids into a ritual and educational center.	Built by Shah ʿAbbās I (1602–1619) for private royal devotion; non-Friday Mosque.
Usage	Mausoleum + khanaqah: pilgrimage, teaching, hospitality.	Royal private mosque: devotion, symbol of Safavid piety and sovereignty.
Architectural Layout	Sequential spaces: street → entrance → courtyards → halls → domed tomb.	No courtyard; bent entrance aligns Maydān façade with qibla; single domed chamber.
Structural Features	Brickwork with pointed arches, squinches, muqarnas; domes with seismic reinforcements.	Single-shell dome with squinches; no minarets or courtyard.
Decoration	Qur'anic + Shiʿi inscriptions, geometric and vegetal motifs; cobalt–turquoise palette; mosaic faience + polychrome tiles.	Inscriptions by ʿAlī Reżā ʿAbbāsī; outer dome with floral arabesques; interior sunburst design; cobalt–turquoise palette.
Symbolism	Gradual transition from civic to sacred; light, inscriptions, and ornament express Shiʿi-Safavid identity.	Light + geometry intensify devotion; compact scale conveys royal privacy and authority.

8. Comparative Evaluation

8.1 Similarities in Structural Principles and Sacred Symbolism

Both monuments operate within a Safavid discipline that fuses brick-based stereotomy, modular geometry, and the liturgical demands of Shiʿi devotion. In each case, the domed sanctuary serves as the culmination of a graded spatial sequence in which thresholds, vestibules, and transitional bays modulate light, sound, and orientation before release into a volumetrically intensified core. The structural vocabulary, pointed and four-centered arches, squinch-to-drum transitions often refined by muqarnas, and continuous enclosure walls that absorb lateral thrust, yields shells whose stability is legible to the moving observer. Geometric ordering, particularly the progression from square to octagon to circle, is not merely constructive; it encodes a

cosmological ascent that aligns with devotional practice. Epigraphic bands occupy true construction horizons, binding doctrinal text to the tectonic armature. In both, daylight is instrumentalized rather than incidental: high-set apertures produce gradated illumination that heightens the sacral register at the upper zones while preserving a contemplative penumbra below. The result is a shared Safavid poetics in which architectonics carries theological meaning and ornament clarifies, rather than obscures, the structural story.

8.2 Divergences in Spatial Layout and Functional Orientation

The Ardabil ensemble is a composite institution, mausoleum, khānaqāh, and ancillary functions, organized as a pilgrimage itinerary with multiple courts and specialized chambers. Movement is centripetal but circuitous, accommodating circumambulation, visitation, instruction, and hospitality; spatial redundancy is a feature rather than a flaw because flows must be separated at moments of ritual intensity. By contrast, the Sheikh Lotfollah Mosque condenses sacred space into a single-cell sanctuary reached through a deliberately bent approach that reconciles the Maydān's urban alignment with the qibla. The absence of sahn and minarets and the restriction of access index a courtly, non-congregational function. Where Ardabil's plan negotiates between a sepulchral axis and liturgical orientation across a dispersed precinct, Sheikh Lotfollah achieves a precise, interiorized focus in which the entirety of the architectural argument is staged within one chamber. These distinct programmatic mandates —pilgrimage complex versus royal oratory —explain the contrast between Ardabil's layered spatial field and Lotfollah's concentrated, phenomenologically choreographed sequence.

8.3 Contrasts in Ornamentation: Mystical Austerity and Courtly Refinement

Script, girih geometry, and vegetal arabesque are coordinated with architectural modules in both monuments, yet this coordination is directed toward different rhetorical ends. Ardabil's program privileges structural horizons and epigraphic clarity, with geometric strapwork and carefully weighted arabesque fields reinforcing the legibility of piers, arches, and drums. The chromatic spectrum tends toward disciplined blues and turquoises punctuated by whites that reset the eye; accents are used to mark nodal inscriptions rather than to generate continuous chromatic spectacle. Sheikh Lotfollah, while equally rule-bound, presses ornament toward a heightened interior experience: the dome's interior deploys a centripetal schema of diminishing units that intensifies focus at the apex, and the coloristic orchestration reads as a continuous luminous field. Inscriptions remain anchored to construction lines, but the aggregate effect is more painterly, designed to sustain prolonged, contemplative looking within a controlled acoustic and luminous envelope. Thus, Ardabil articulates devotion through measured, processional clarity; Lotfollah concentrates it through immersive chromatic and geometric convergence.

8.4 Tilework Techniques: Regional Calibrations and Technical Consequences

The two programs exemplify different but overlapping economies of technique. At Ardabil, precision-demanding zones, monumental calligraphy, border bands, and girih frames are typically articulated in methods that deliver crisp edge control and high durability, allowing inscriptions to register unambiguously across curvature and distance. Broader surfaces admit panel-based polychromy where production speed and painterly transitions are advantageous. Still, the hierarchy of technique remains legible: the viewer can read where exactitude is prioritized and where atmospheric continuity is sought. Sheikh Lotfollah's surfaces, especially within the dome, rely extensively on panel methods capable of continuous tonality and fine gradation across large fields; this supports the sanctuary's phenomenological program but entails different maintenance profiles and edge behaviors than cut-piece systems. In both monuments, technique conditions semiotics: sharp, joint-expressive methods foreground textual authority and geometric measure; painterly methods sustain chromatic immersion and controlled optical depth.

8.5 Architectural Identity: Provincial Pilgrimage Complex and Imperial Urban Mosque

Ardabil's identity is anchored in regional sanctity and dynastic memory. Its spatial and institutional breadth conveys hospitality, instruction, intercession, and remembrance within one ensemble, and its urban stance reflects incremental growth around a central relic. Sheikh Lotfollah, embedded in the choreographed theater of the Maydān, performs a different identity: an inward royal sanctum that nonetheless participates in the city's

most public façade. The dialogue is instructive. Ardabil exerts authority by aggregating functions around a saintly tomb; Lotfollah asserts authority by refining a single function to exemplary intensity within an imperial set-piece. Both are Safavid, yet one projects charisma through accommodating multiplicity, the other through distilled exclusivity.

8.6 Interplay of Architectonics and Ornamentation in Both Monuments

In each case, ornament takes its cue from structure and reciprocates by making the structure intelligible. At Ardabil, the mapping is didactic: inscriptional bands track imposts and drum bases, girih modules lock to bay measures, and vegetal infill mediates sharp junctions, so that processional movement reads as a sequence of structurally and theologically annotated stations. At Sheikh Lotfollah, the reciprocity is phenomenological: the bent approach heightens the surprise of the sanctuary, while the dome's interior pattern compresses scale toward the apex, translating shell geometry into a luminous centripetal gradient. In both buildings, misalignment between surface and support is systematically avoided; medallions sit on true centers, bands ride real springings, and fenestration respects shell behavior. This congruence explains the persuasive power of each monument: believers encounter not a collage of effects but a single rule-governed language in which stability, measure, and meaning are coextensive.

9. Theoretical and Interpretative Perspectives

9.1 Sacred Geometry and Cosmological Symbolism in Both Cases

In both monuments, geometry functions less as an abstract mathematics than as a liturgical instrument that renders cosmological propositions spatially legible. The progression from square to octagon to circle organizes the ascent from terrestrial rectilinearity to celestial curvature, aligning structural transition with a metaphysical horizon without presuming a single, rigid proportional canon. Modular grids stabilize bay widths, arch radii, and shell curvature, allowing measures to be repeated, compared, and read across scales, thereby transforming the building into a system of correspondences. As one moves toward the sanctum, around a tomb in Ardabil and into a single domed cell in Isfahan, unit size diminishes and curvature intensifies, producing a controlled centripetal pull. The effect is not merely optical. Load paths, surface curvature, and light gradients converge to stage a pedagogy of ascent, in which the intelligibility of the geometry becomes a means of orienting devotion. Geometry thus mediates between the quantifiable and the sacramental: it is exact enough to build and flexible enough to signify.

9.2 Ornamentation as a Language of Devotion and Power

Ornament in the Safavid sacred register is a disciplined language whose grammar is supplied by architectonics. Epigraphy provides propositional content, Qurʾanic verses, invocations, dedicatory formulae, while girih lattices and arabesques supply syntax and prosody, regulating intervals, joins, and transitions. In Ardabil, the language is deployed to broadcast the authority of saintly memory and dynastic continuity; textual bands sit on structural horizons and read as covenants inscribed into the fabric. In Isfahan, the same language is modulated to articulate courtly piety within an imperial urban theater; the restrained scale, controlled access, and highly orchestrated dome interior domesticate sovereignty as measured devotion. In both settings, ornament negotiates the boundary between personal piety and public authority, universalizing doctrine through repeated forms. It localizes power by anchoring text and motif to specific architectural thresholds.

9.3 Sufi Mysticism and Safavid Political Ideology: A Productive Dialectic

The monuments materialize a dialectic rather than a synthesis between Sufi inheritance and Twelver Shiʿi statecraft. Ardabil foregrounds the charismatic economy of relic, visitation, and hospitality; its itinerary distributes sanctity through a sequence of approach, circumambulation, and focused veneration. Sheikh Lotfollah, by contrast, condenses Shiʿi devotional imagery into a controlled interior aligned with court ritual, where liturgical concentration becomes a figure for political containment. The two poles are mutually illuminating. Where Sufi practice emphasizes gradual intensification, the architecture responds with serial thresholds and modulated acoustic fields; where state ideology emphasizes doctrinal clarity and decorum, the

architecture responds with axial precision, calibrated light, and textual exactitude. The result is a reciprocal recalibration in which mysticism gains civic legibility and sovereignty gains spiritual intelligibility.

9.4 Architectonics as Embodied Theology

Structural choices in these buildings are not neutral engineering solutions but embodiments of theological commitments. The legibility of thrust and counter-thrust, the disciplined use of muqarnas to negotiate geometric change, and the continuity of the masonry envelope communicate order and reliability consonant with the doctrinal emphasis on unity and justice. Acoustic volumes are tuned to sustain recitation without muddle, aligning reverberation time with the cadence of liturgy. Daylight is admitted from elevated registers to preserve the sanctity of the lower wall while illuminating script and medallions where instruction and contemplation converge. Even the management of access, bent corridors, compressed vestibules, and measured reveals enacts an ethics of approach, staging humility before disclosure. Thus, architectonics functions as an embodied theology: the structure teaches by how it bears, the plan by how it guides, and the shell by how it gathers and distributes light and sound.

9.5 Ornamentation as Semiotic System

Interpreted semiotically, Safavid ornament exhibits a threefold articulation. At the level of syntax, modules, bands, and lattices establish repeatable combinatory rules that ensure local variations never compromise global coherence. At the level of semantics, content-bearing signs, especially script, anchor meaning to doctrine, while vegetal and geometric fields operate as non-discursive analogues for infinity, fecundity, and equilibrium. At the level of pragmatics, placement, scale, and chromatic intensity are calibrated to the viewer's route and stance, so that meaning is released progressively as the body advances and the gaze rises. Because these levels are indexed to architectonic facts, springing lines, drum horizons, and shell centers, the sign-system does not float free of material constraints; it is guaranteed by construction. This anchoring accounts for the persistent persuasive power of both monuments: what is communicated is rendered inseparable from the manner of making, and the intelligibility of the structure serves to vouch for the truth-claims of the surfaces.

10. Critical Review of Scholarship

10.1 Existing Literature on Safavid Architecture

Scholarship on Safavid sacred architecture has developed along three partly overlapping trajectories. The first is a classic art-historical line that established the dynastic narrative, mapped typologies of mosques and shrine-complexes, and described ornamental grammars within a broadly formalist frame. Foundational surveys in this tradition provided essential corpora, including plans, elevations, and photographic plates, which stabilized the descriptive vocabulary for domes, iwans, muqarnas, and tile techniques. Their syntheses remain indispensable for baseline orientation and attribution. The second trajectory, consolidated from the late twentieth century onward, situates architecture within the nexus of patronage, urbanism, and court culture. Isfahan's Maydān ensemble is read in these studies as a coordinated project of image-making and political theology, while shrine complexes such as the Ardabil ensemble are re-contextualized within evolving regimes of devotional practice, endowment, and dynastic memory. A third, increasingly technical literature emerges from conservation and heritage sciences. It focuses on materials, construction, and performance: glaze chemistry and stratigraphy, mortar characterization, brick stereotomy, seismic behavior of shells, acoustic and daylight simulations, and the documentation of restoration campaigns. Together, these literatures have moved the field from typological description to multi-scalar analysis that integrates theology, politics, urbanism, and building science.

10.2 Contributions of Art Historians, Architectural Theorists, and Conservation Scientists

Art historians have clarified the semantic load of ornament by associating calligraphy, girih strapwork, and arabesque with programmatic placement and by demonstrating how epigraphic content mediates between doctrine and space. Architectural historians have explicated the planimetric and volumetric strategies, bent vestibules that reconcile urban alignment with qibla, graded thresholds that script ritual comportment, and dome transitions that make square-to-circle transformations both legible and structurally efficient. Theorists of

Islamic ornament have supplied a language for understanding repetition, modularity, and hierarchical frames as cognitive scaffolds rather than surface play, thereby validating the analytical pairing of architectonics and ornamentation adopted in this article. Conservation scientists have, in turn, brought laboratory and in-situ methods to bear on long-standing assumptions: pigment and glaze analyses nuance the chronology and workshop attributions of tile revetments; petrographic and mechanical testing explain why particular vault and shell geometries recur; non-destructive evaluation and archival archaeology have exposed the extent and character of modern interventions, allowing scholars to distinguish original fabric from later substitutions. Digital humanities and computational geometry have offered parametric reconstructions of proportional systems and muqarnas arrays, while acoustic and daylight modeling have tested claims about liturgical audibility and luminous hierophany. Each of these contributions thickens interpretation by anchoring claims to measurable properties and reproducible procedures.

10.3 Gaps and Debates in Current Research

Despite these advances, significant lacunae remain. Primary documentation is uneven: measured drawings of many Safavid monuments vary in accuracy and scale, and restrictions on access have left key structural zones, including the dome intrados/extrados, drum cavities, and tie-rod courses, insufficiently documented. Chronologies of tile programs, especially where mosaic faience and panel techniques overlap, are occasionally inferred from style rather than secured by stratigraphic or archival evidence, which can blur the line between Safavid work and later restorations. Interpretive debates persist over the relative prevalence and sequencing of specific glazed-tile techniques across the seventeenth century; the absence of systematic glaze and body sampling across comparable loci makes workshop attribution tentative. Questions also endure concerning shell typologies in selected domes and the extent to which apparent single- or double-shell configurations reflect original intent versus later modifications; conclusions sometimes rest on exterior readings or anecdotal site reports rather than complete sectional documentation. On the interpretive side, the relationship between Sufi devotional practice and Shiʿi court ideology is sometimes reduced to a teleological synthesis; more granular studies of ritual use, processional choreography, and patronage networks would refine the picture. Finally, while urban readings of Isfahan are robust, provincial and regional centers, Ardabil among them, still warrant integrated studies that braid together building archaeology, material analysis, and socio-religious history at the scale of the ensemble rather than the single monument.

10.4 Methodological Limitations of Previous Studies

Three methodological constraints recur in the literature. First, a reliance on photographic evidence, often under uncontrolled lighting and lens conditions, can skew chromatic interpretation and exaggerate or flatten curvature; this is especially consequential for interior domes where specular highlights and glaze translucencies change over the day. Second, stylistic typologies sometimes substitute for structural analysis: muqarnas fields are classified morphologically without tracing their load-bearing implications or their relation to transitional geometries, and plan comparisons are made without explicit proportional reconstruction from measured baselines. Third, restoration reports, when accessible, are not always methodologically transparent: the rationale for material substitutions, the extent of tile replacement, and the treatment of bedding plasters can be under-described, making it difficult to assess what current surfaces actually represent. These constraints contribute to circular reasoning in which formal readings validate themselves. To mitigate these problems, recent best practices triangulate between high-fidelity measured drawings, laboratory or at least instrumented in-situ data, and explicitly framed historical interpretations. Where such triangulation is impossible, interpretive claims should be qualified and presented as hypotheses correlated to specific evidentiary gaps rather than as definitive conclusions.

11. Conclusion

The comparative evaluation of the Sheikh Safi al-Din Ardabil Complex and the Sheikh Lotfollah Mosque has demonstrated that Safavid sacred architecture is best understood not as a series of isolated stylistic achievements but as a coherent system in which structure and surface, function and meaning, are interdependent. Both monuments reveal an architectural language grounded in the reciprocity of architectonics and ornamentation: in each case, geometry, proportion, and construction techniques provide a disciplined

framework upon which calligraphy, arabesque, and chromatic fields are anchored. Reciprocity accounts for the continued capacity of Safavid sacred buildings to exert both scholarly fascination and devotional affect; such monuments are neither reducible to functional shelters for ritual nor to decorative spectacles, but are configured as rule-bound compositions in which stability, intelligibility, and symbolism converge. The Ardabil complex, with its layered accretions surrounding a saintly tomb, exemplifies the transformation of Sufi charisma into a dynastic shrine through Safavid patronage, accommodating the practicalities of pilgrimage, pedagogy, and hospitality while preserving doctrinal clarity. Its architectural itinerary courtyards, vestibules, and domed sanctum enacts a gradual intensification of sacred presence, with ornamentation calibrated to articulate thresholds and reinforce structural horizons. In contrast, the Sheikh Lotfollah Mosque condenses sanctity into a single domed chamber conceived for courtly devotion. Its bent vestibule, off-axis dome, and orchestrated interior patterning translate urban alignment and liturgical orientation into a phenomenological experience of surprise and concentration. Ornament in this case is immersive and painterly, sustaining prolonged contemplation within a controlled luminous and acoustic environment. Placed in dialogue, the two monuments reveal the range of Safavid sacred production: Ardabil projects authority through multiplicity, binding tomb, khānaqāh, and ancillary functions into a unified itinerary, whereas Sheikh Lotfollah projects authority through exclusivity, distilling sanctity into a single chamber embedded in an imperial urban theater. Both nevertheless adhere to the same architectonic and ornamental discipline, ensuring that text follows true springings, medallions correspond to real centers, and chromatic gradients align with structural curvature. This congruence between what is seen and what is built constitutes the hallmark of Safavid sacred architecture and accounts for the preservation of integrity and interpretive power despite the passage of centuries and the vicissitudes of restoration. Beyond individual merits, these case studies contribute to broader understandings of Islamic architectural theory. Demonstrated is the manner in which sacred geometry and proportional systems function not as abstract exercises but as embodied theologies; how ornament operates as a semiotic language encoding both doctrine and political messaging; and how the interplay of mysticism and sovereignty is negotiated materially through plan, shell, and surface. The comparative approach adopted here reveals that it is precisely in the differences, regional pilgrimage complex versus imperial court mosque, that the unity of Safavid architectural principles becomes most evident. Future research will benefit from integrating high-resolution material analysis, acoustic and luminous simulations, and more granular studies of ritual practice and patronage networks. Such interdisciplinary work promises to refine understanding of how Safavid architecture mediated between body and doctrine, between dynastic ambition and devotional life. For now, the lesson of Ardabil and Isfahan is that architecture, when disciplined by geometry and animated by ornament, can become a persuasive medium of both faith and power, articulating a vision of sacred order that remains legible across time.

References

1. Askarizad, R. and H. Saremi, *Semiology of Art and Mysticism in Persian Architecture: Mysticism and Its Impact on Safavid Dynasty Architecture (Case: Sheikh Lotf-Allah Mosque).* Religions, 2022.
2. Babaie, S., *Isfahan and Its Palaces: Statecraft, Shiʿism and the Architecture of Conviviality in Early Modern Iran*. 2008: De Gruyter Brill.
3. Blake, S.P., *Half the World: The Social Architecture of Safavid Isfahan, 1590–1722*. 1999: Internet Archive.
4. Centre, U.W.H., *Sheikh Safi al-din Khānegāh and Shrine Ensemble in Ardabil , Nomination Dossier*. 2010.
5. Dahar, A., *Geometrical Analysis of Architecture of Sheikh Lotfollah Mosque in Isfahan.* Bāgh-e Nazar, 2013.
6. Ekrami, M.S., *Text Recognition and Identification of the Calligrapher of a Lost Inscription in the Sheikh Lotfollah Mosque.* Journal of Islamic Art Studies (Kashan Univ.), 2022.
7. Encyclopaedia, I., *EPIGRAPHY III: Arabic Inscriptions in Persia*. 1998.
8. Encyclopaedia, I., *EPIGRAPHY IV: Safavid and Later Inscriptions*. 1998.
9. Holakooei, P., *Haft rang or cuerda seca? Spectroscopic Approaches to the Study of Overglaze Polychrome Tiles from Seventeenth-Century Persia.* Journal of Archaeological Science, 2014.
10. Journal of Research on, A., *Technical and Comparative Study: Monochrome Turquoise Nare Tile of the Ilkhanid and Safavid Eras (Case Study: Soltaniyeh Dome and Sheikh Safi Al-Din Ardabili's Shrine).* 2020.

11. Mammadova, I., *Archaeology, Art and Architecture "Chini Khaneh" and "Haram Khana": Two Important Buildings in the Sheikh Safi al-Din Ardabili Complex.* JMEST, 2014.
12. Mazidi Sharafabadi, M. and M. Vakili Dehkordi, *A Comparative Study of the Decorative Motifs of the Domes of Sheikh Lotfollah Mosque and the Kaboud Mosque.* 2023.
13. Melville, C., *Shah ʿAbbas's Patronage of the Dynastic Shrine at Ardabil.* Muqarnas, 2020. **37**.
14. Necipoğlu, G., *The Topkapi Scroll: Geometry and Ornament in Islamic Architecture*. 1996: Getty.
15. O'Kane, B., *Tiles of Many Hues: The Development of Iranian Cuerda Seca Tiles and the Transfer of Tilework Technology*. 2011.
16. Rezazadeh, M., *Design Management Methods in the Vicinity of Religious Places: The Seven-Step Design Process Around the Mausoleum of Sheikh Safi.* Bāgh-e Nazar, 2013.
17. Shahani, M., *Sheikh Lotfollah Mosque: A Story of Daylight in Sequential Spaces.* Space and Culture, 2021.
18. Shiran, H.S., *Archeology and Architectural Aesthetics of Jannat-Sara and Haram-Khana in Sheikh Safi al-Din Ardabili Complex*. 2013, ISCA.
19. Yousefi, H., *Reconsidering the Architecture of Shaikh Safi al-Din Ardabili's Shrine*. 2013.