Research

A Comparative Analysis of Geometry in Safavid Architecture and Grid Systems in Modernist Graphics

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Abstract

This study adopts an analytical–comparative approach to investigate the structural and philosophical foundations of geometry in Safavid architecture and the grid system in modernist graphic design. The primary objective of this research is to identify the shared principles underlying spatial organization and to explain the fundamental differences in the intellectual origins of these two visual systems. The findings indicate that despite the temporal and essential distinctions between these two approaches, both systems are grounded in mathematical logic, precise proportions, and grid-based structures. In Safavid architecture, the system known as Peymoun functions as a modular and constant unit responsible for establishing harmony between the whole and its constituent parts; in this respect, it demonstrates a significant structural similarity to the "modular grid" in modern design. Both systems employ stable mathematical proportions, such as root-two and root-three rectangles as well as the golden ratio, in order to achieve balance, equilibrium, and visual harmony. Nevertheless, the analytical results reveal fundamental differences in the intellectual and philosophical dimensions of these two approaches. Safavid geometry serves as a means for manifesting metaphysical concepts and expressing the movement from "multiplicity toward unity"; through intricate ornamentation and the symbolic representation of forms such as the dome, it guides the viewer's mind toward the sacred realm. In contrast, the modernist grid system emerged from a rationalist and industrial worldview that, through emphasizing objectivity, the elimination of ornamentation, and the prioritization of function, seeks the clear, rapid, and precise transmission of information within modern societies. Ultimately, this study demonstrates that geometry, as a universal language, constitutes the foundation of visual credibility and the enduring quality of works in both traditional and modern approaches.

Keywords: Safavid Architecture, Grid System, Applied Geometry, Modernist Graphic Design, Mathematical Proportions.

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1. Introduction

Geometry has long been a fundamental science, evolving from a practical tool for land measurement to a sophisticated intellectual discipline integral to mathematics, art, and architecture. Its roots in ancient civilizations like Egypt and Babylon laid the groundwork for its application in monumental constructions and spatial organization. With the advent of Islam and the translation movement, geometry was elevated to a theoretical and abstract science, intertwining with philosophy, music, and astronomy. In Islamic thought, geometry was not merely a technical device but a means to manifest divine order and cosmic harmony within material forms. This sacred dimension of geometry profoundly influenced Persian architecture, particularly during the Safavid era (1501-1736), a period celebrated for its artistic and architectural achievements. Concurrently, the rise of industrialization in the 20th century and the ensuing information explosion necessitated new systems for organizing visual communication. This led to the development of the grid system in modernist graphic design, a rational, mathematical framework for structuring text and images. The grid, championed by movements like the Bauhaus and the Swiss International Typographic Style, became a hallmark of objectivity, clarity, and efficiency in visual messaging. Despite their historical and philosophical chasm, both Safavid architecture and modernist graphic design rely on mathematical logic, precise proportions, and modular structures to achieve visual coherence. This research undertakes a comparative analysis to explore the fundamental structural and philosophical foundations of geometry in both systems. The primary aim is to identify commonalities in spatial organization while delineating their profound intellectual disparities. By examining the "Peymon" system in Safavid architecture alongside the modular grid in modern design, this study investigates how shared mathematical tools, such as root rectangles and the golden ratio, serve divergent ultimate purposes: one aiming for spiritual transcendence and the other for functional communication. Ultimately, this research posits that geometry, as a universal language, is the bedrock of visual validity and timelessness in both traditional and modern paradigms, bridging the temporal and conceptual distances between them.

2. Research Methodology

This study employs a descriptive-analytical strategy with a comparative approach to elucidate the relationship between two distinct visual systems within their historical contexts. The methodology is structured to systematically examine and contrast the structural and philosophical underpinnings of geometry in Safavid architecture and modernist graphic design. Data collection was conducted through comprehensive library research, including a review of ancient geometric treatises, traditional architectural sources, and seminal theoretical works on modern graphic design. This extensive textual and visual analysis provided the necessary foundation for a rigorous comparison. The analytical phase focused on extracting and scrutinizing common structural components, with a specific emphasis on mathematical and geometric proportions, including root rectangles and the golden ratio, to facilitate a precise cross-domain comparison. To enhance analytical objectivity, a case study method was employed, focusing on the geometric and decorative systems of the Sheikh Lotfollah Mosque in Isfahan for architecture, and the grid system principles of the Swiss School, particularly the theories of Josef Müller-Brockmann, for graphic design. The unit of analysis centered on comparing modular systems: the Peymon system in Safavid architecture and the modular grid in modern design. Data were analyzed through a qualitative approach to uncover the fundamental philosophical differences, revealing how identical mathematical instruments, when applied within different cultural and intellectual contexts, can lead to either sacred expression or functional objectivity.

3. Discussion

3.1. Shared Structural Foundations: The Universal Language of Geometry and Modularity

A central finding of this research is the remarkable structural affinity between the two systems. Both Safavid architecture and modernist graphic design are fundamentally organized around a modular logic and precise geometric proportions. In Safavid architecture, this principle is embodied in the "Peymon" system, a fixed modular unit that served as a master standard for coordinating all elements of a building, from overall dimensions to intricate decorative details. This system effectively prevented chaos and inconsistency in construction, ensuring a harmonious relationship between the parts and the whole. Similarly, the modernist grid functions as a modular framework, a two-dimensional network of intersecting lines that provides a rational structure for organizing text, images, and negative space on a page. In both cases, the modular unit acts as a foundational building block, creating a cohesive and unified visual field. Beyond modularity, both

systems rely heavily on the use of stable mathematical ratios, especially the golden ratio and root rectangles (such as root-two and root-three). These proportions, derived from geometric constructions, are employed to achieve balance, equilibrium, and visual serenity. The consistent application of these ratios, from the design of a mosque's dome to the layout of a poster, creates a sense of order and aesthetic validity that is deeply rooted in the laws of nature and perception.

3.2. Philosophical Divergence: Spiritual Transcendence versus Rational Objectivity

Despite their structural parallels, the philosophical foundations and ultimate aims of the two systems are profoundly divergent. For Safavid architects, geometry was primarily an instrument for expressing metaphysical concepts and facilitating spiritual experience. Geometry was a sacred science, a means to manifest divine unity and cosmic order in the material world. The architectural and decorative elements, such as the transformation of a square plan (symbolizing the earthly realm) into a circular dome (symbolizing the heavens), were designed as metaphors for a spiritual journey from multiplicity to unity, from the temporal to the eternal. The intricate geometric patterns, arabesques, and "Shamsa" (sunburst) motifs were not mere ornamentation but symbolic devices intended to guide the viewer's mind from material existence towards divine perfection and transcendental contemplation. In stark contrast, the modernist grid is a product of industrial, rational, and objectivist thought. As articulated by theorists like Josef Müller-Brockmann, the grid represents a conscious effort to establish order, clarity, and objective logic in visual communication. It is designed to eliminate ambiguity and subjective interpretation, serving a democratic and communicative function by transmitting information in the most direct, precise, and legible manner possible. The primary aim is not spiritual awakening but efficient functionality, ensuring clear communication in a rapidly modernizing world. Thus, Safavid geometry is introspective and metaphysical, while modernist grid is extroverted and utilitarian.

3.3. Aesthetics and Decoration: Ornament as Essence versus Ornament as Crime

The role and treatment of ornament in the two systems further highlight their divergent philosophies. In Safavid aesthetics, decoration is an inseparable and essential part of the geometric structure. Complex arabesques, intricate "girih" (geometric star patterns), and rich tilework are integral to the building's identity and expressive power. These patterns are not applied as superficial additions but are generated from the very same geometric principles that define the building's structure. They serve to reinforce structural unity, create rhythm and harmony, and enrich the symbolic vocabulary of the architecture. The use of color, particularly in the Sheikh Lotfollah Mosque, is also symbolic, with shades like turquoise and lapis lazuli carrying specific spiritual meanings. This approach embodies a worldview where beauty is a reflection of truth, and visual richness facilitates a deeper spiritual connection. In direct opposition, modernism, guided by the principle that "form follows function," adopted a minimalist aesthetic that rejected superfluous ornamentation. The grid system itself was a tool for achieving this purity, stripping away the decorative in favor of clean geometry and rational clarity. Modernist design values the active use of negative space (white space) as a structural element, allowing visual elements to breathe and enhancing overall legibility. In this context, beauty is found in structural simplicity, formal purity, and the direct expression of content, making ornament not an enhancement but a distraction from the grid's primary communicative function.

3.4. Shared Legacy: Geometry as the Foundation of Visual Validity

Despite their different intellectual and aesthetic trajectories, both approaches demonstrate the enduring power of geometry as the ultimate guarantor of visual validity. In both Safavid architecture and modernist graphic design, geometry is not an optional aesthetic choice but the foundational language for organizing space and creating meaning. The "Shamsa" in the dome of the Sheikh Lotfollah Mosque and a well-structured modernist poster both generate a profound sense of order, harmony, and visual integrity that is universally recognized as aesthetically and intellectually valid. This shared reliance on geometry transcends time and culture, pointing to a universal human appreciation for structure and proportion. The legacy of geometry in both systems provides a powerful lesson: enduring and significant works of visual art and design are almost always built upon a robust, coherent, and logically structured geometric foundation, whether their ultimate goal is to inspire divine contemplation or to facilitate clear communication.

4. Conclusion

This comparative analysis reveals that geometry, as a universal language, serves as the foundational bedrock for both Safavid architecture and modernist graphic design, albeit with fundamentally different

philosophical objectives. Structurally, both systems rely on a modular logic and the application of precise mathematical proportions, such as the Peymon system and the modular grid, to create order, balance, and visual cohesion. However, their convergence is purely structural. Their intellectual and spiritual underpinnings are starkly opposed: Safavid geometry is a sacred tool for expressing metaphysical unity and guiding the viewer from multiplicity to a state of divine contemplation, as exemplified in the intricate designs of the Sheikh Lotfollah Mosque. Conversely, the modernist grid is a product of the industrial age, a rational system designed to achieve objectivity, clarity, and the efficient transmission of information. This difference is further manifested in their treatment of ornamentation, where the former embraces it as an integral, symbolic element, and the latter condemns it in favor of minimalism and functional purity. Ultimately, this study concludes that while their goals are distinct and their philosophical contexts are incomparable, both systems depend on a deep, structural understanding of geometry to attain lasting visual authority. The research underscores that a thorough understanding of geometry's universal principles remains crucial for creating coherent, meaningful, and enduring works across all visual disciplines.