

Geometry Of the Fort: Translating Ranthambore's Architectural Geometry into Contemporary Interior Design

Aditi Rohilla¹, Aeshita Sharma², Vaishnavi Gupta³, Sunakshi shokeen⁴

^{1,2,3}UG Scholar, Interior Architecture and Design (IAD), School of Design (SOD), World University of Design, Sonapat, Haryana, India.

⁴Assistant Professor, Interior Architecture and Design, World University of Design, Sonapat, Haryana, India.

Emails: aditirohilla.23@wud.ac.in¹, aeshitasharma.23@wud.ac.in², vaishnavigupta.23@wud.ac.in³,

sunakshi.shokeen@wud.ac.in⁴

Abstract

Ranthambore Fort embodies a complex relationship between geometry, topography, materiality, and spatial hierarchy, where architectural form responds to both defensive imperatives and the natural landscape. This research examines the fort as a spatial system governed by proportion, rhythm, repetition, enclosure, thresholds, axiality, and the interplay of mass and void. It explores how these underlying principles can be abstracted and translated into a contemporary interior design language without relying on literal historical replication. Adopting a qualitative and interpretive methodology, the study analyses architectural documentation, spatial mapping, visual references, and relevant literature to identify geometric relationships within gateways, fortified walls, courtyards, arches, stairways, openings, and circulation sequences. Particular emphasis is placed on the interplay between geometric order and organic irregularity created by the fort's adaptation to rugged terrain. The research proposes geometric abstraction as a framework for contemporary spatial translation through layered volumes, framed perspectives, rhythmic partitions, material transitions, controlled openings, and the manipulation of light and shadow. Ultimately, the study positions Ranthambore's geometry as a generative source of spatial knowledge, establishing a dialogue between heritage, context, and contemporary interior design practice.

Keywords: Architectural Geometry · Spatial Translation · Geometric Abstraction · Contemporary Interior Design · Heritage Interpretation · Spatial Hierarchy · Topography · Materiality · Contextual Design · Architectural Heritage · Form and Space · Light and Shadow

1. Introduction

Architecture reflects the cultural and environmental conditions of its time, with geometry shaping form, proportion, space, and movement. Ranthambore Fort demonstrates these principles through its walls, gateways, bastions, arches, courtyards, and terraces. This research studies its geometric and spatial characteristics and explores their reinterpretation in contemporary interiors. The focus is on abstracting historical elements rather than directly replicating them.

1.1.Aim

The aim is to study the geometry and spatial principles of Ranthambore Fort and explore their reinterpretation in contemporary interior design while maintaining a connection with its historical and cultural identity.

1.2.Objectives

- To study and analyse the geometric, spatial, and architectural characteristics of Ranthambore Fort, focusing on proportion, repetition, rhythm, hierarchy, symmetry, scale, solid-void relationships, and spatial sequencing.
- To examine the relationship between the fort's architectural geometry, materiality, construction techniques, topography, climate, and historical context, and understand how these factors shaped its spatial organisation.
- To explore and reinterpret the identified architectural principles into contemporary interior design strategies for spatial planning, circulation, furniture, partitions, flooring,

ceilings, materials, textures, screens, and lighting, adapting them to present-day needs rather than directly replicating the fort. Overall, the research aims to establish a connection between the architectural knowledge embedded in Ranthambore Fort and contemporary interior design, demonstrating how its geometric and spatial principles can inform meaningful, context-responsive design solutions for present-day users.

1.3. Need for Study

The study addresses the need to explore how historic architecture can inform contemporary interior design beyond direct visual replication. It focuses on the geometric principles, spatial relationships, and material qualities of Ranthambore Fort and their relevance to modern interiors. The research provides a contextual approach to connecting historical identity with contemporary design requirements.

1.4. Scope and Limitation

The study focuses on the architectural geometry and spatial characteristics of Ranthambore Fort. Elements such as form, proportion, rhythm, circulation, and materiality are examined to understand their relevance and application in contemporary interior spaces. The research is exploratory and primarily qualitative, based on observation, analysis, and secondary documentation. It focuses on conceptual design interpretation rather than detailed architectural or structural planning. The findings are limited to the selected characteristics of the fort.

2. Research Methodology

The research follows a qualitative approach aimed at understanding the architectural geometry and spatial character of Ranthambore Fort. It combines observation, literature review, case analysis, and visual documentation to identify geometric principles and their relevance to contemporary interior design. As shown in Figure 1 Tools Techniques and purpose of focus in model. As shown in Figure 1 Hierarchy and Spatial (The arches at Ranthambore Fort create a clear visual order. The larger central arch becomes the main focus, while the smaller arches and columns around it create repetition and depth. As you move through the space, the arches guide your view towards the centre.). Figure 2 Geometry and

Proportion (The fort architecture is defined by clear geometric forms and balanced proportion, which create sense of order and harmony[1 – 5].

Figure 1 Tools Techniques and purpose of focus in model

TOOLS AND TECHNIQUES	PURPOSE / FOCUS
Observation	Form, proportion, geometry, spatial relationships
Case Study Analysis	Ranthambore Fort and contemporary interior spaces
Literature Review	Architectural history, geometry, materials, context
Drawings & Visual Mapping	Spatial organization, circulation, geometric patterns

3. Theoretical Framework

Architecture is shaped by the interplay of form, space, light, material, and movement, creating experiences that extend beyond physical structure. This framework explores these relationships through geometry, proportion, symmetry, rhythm, hierarchy, and spatial sequence to interpret Ranthambore Fort and inform their contemporary interior expression.

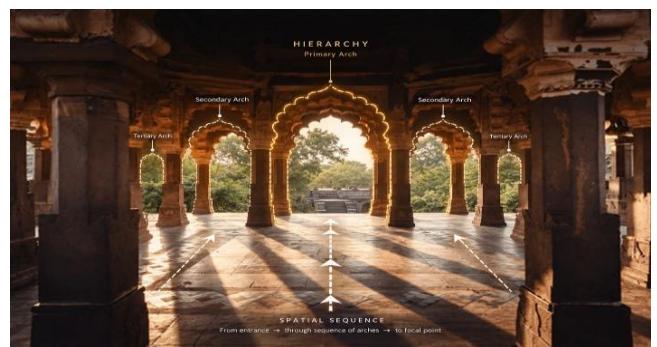


Figure 1 Hierarchy and Spatial (The arches at Ranthambore Fort create a clear visual order. The larger central arch becomes the main focus, while the smaller arches and columns around it create repetition and depth. As you move through the space, the arches guide your view towards the centre.)

3.1. Form

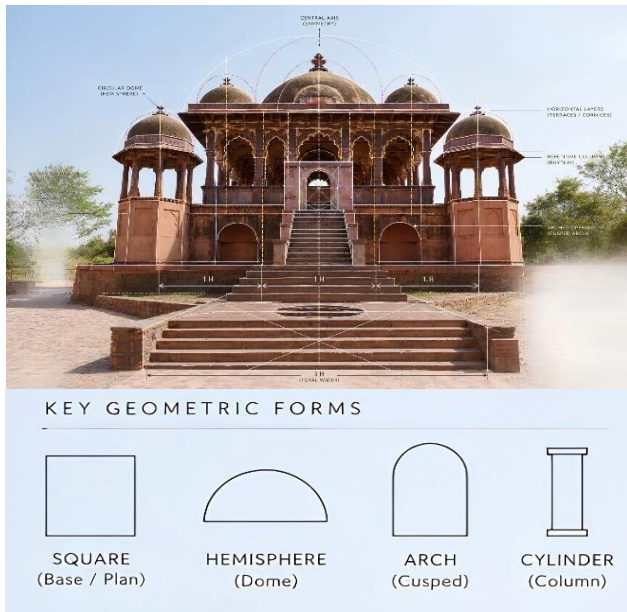


Figure 2 Geometry and Proportion (The fort architecture is defined by clear geometric forms and balanced proportion, which create sense of order and harmony)

Architectural form establishes the physical identity of a structure through the relationship between mass, proportion, scale, and spatial enclosure. In Ranthambore Fort, form is shaped by its defensive walls, gateways, bastions, palace remains, and integration with the rocky hill terrain. The fort's architectural mass demonstrates how structural requirements and topographical conditions influence the organisation of built space. This research examines form as a geometric and spatial system, exploring how solid volumes, openings, projections, and layered boundaries can be abstracted into contemporary interior elements. The study aims to reinterpret the fort's monumental character through spatial composition, partitions, furniture, and architectural surfaces without relying on literal historical replication[6 – 10].

3.2. Light

Light plays a fundamental role in defining architectural form, spatial depth, material perception, and emotional experience. Within the architectural context of Ranthambore Fort, the interaction of sunlight with stone surfaces, gateways, openings,

courtyards, and enclosed passages creates variations in illumination, shadow, and visual contrast. These relationships can be investigated as part of the fort's spatial experience, while specific lighting conditions would require site-based observation or documented analysis. The research explores how the principles of filtered light, controlled openings, shadow patterns, and contrast can be translated into contemporary interiors through skylights, screens, recessed lighting, and framed openings. Light is therefore considered not only as a functional requirement but also as a design medium that enhances geometric form and spatial hierarchy. As shown in Figure 3 Light and shadow emphasise form, create depth and enhance the spatial experience.

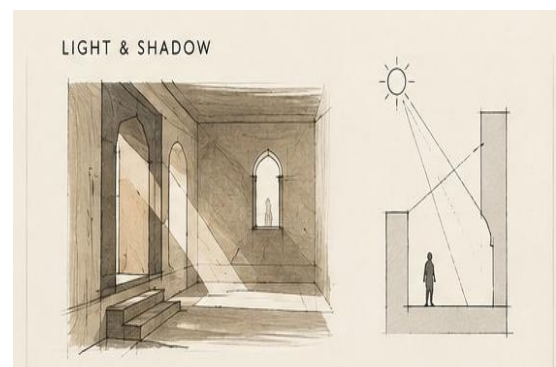


Figure 3 Light and shadow emphasise form, create depth and enhance the spatial experience

3.3. Colour

Colour contributes to the perception of architectural identity by influencing the relationship between material, light, texture, and surrounding environment. In the context of Ranthambore Fort, the study can examine the visual qualities of its masonry surfaces, weathering, natural stone tones, and relationship with the surrounding landscape. Rather than assigning a fixed colour palette without documentation, the research proposes analysing observed material colours and their changing appearance under different lighting conditions. These findings can inform a contemporary interior palette based on material authenticity, tonal balance, and contextual interpretation. The translation may include earthy stone tones, muted mineral colours, and restrained natural finishes, provided that the selected palette is supported by visual documentation and material

analysis[11].

3.4.Movement

Movement is an essential component of architectural experience, shaping how individuals perceive space through circulation, transition, direction, and changing spatial conditions. Ranthambore Fort's location on a rocky hill and its fortified architectural organisation provide a context for examining movement through gateways, stairways, pathways, enclosed passages, and open spaces. UNESCO describes Ranthambore as a forest hill fort whose defensive planning responds to its natural landscape.

3.5.Environment

The relationship between architecture and environment is central to understanding Ranthambore Fort's spatial and geometric character. The fort is situated within a forested hill landscape, and its defensive organisation reflects the significance of natural terrain in the development of the site. The UNESCO World Heritage documentation identifies the use of natural defences, including dense forests and hill terrain, as a defining characteristic of the Hill Forts of Rajasthan. The research examines how topography, landscape, enclosure, climatic exposure, and material conditions contribute to the fort's architectural expression. This environmental perspective can inform contemporary interior design through the integration of natural materials, visual connections to landscape, daylight strategies, and spatial arrangements that respond to their context rather than applying a generic design language[12].

3.6.Shapes and Geometric Relationships

Geometric shapes form the basis of architectural composition, influencing proportion, rhythm, repetition, symmetry, and spatial hierarchy. Ranthambore Fort can be studied through the geometric relationships expressed in its walls, gateways, openings, bastions, palace structures, and circulation patterns. However, the research distinguishes between geometries that can be directly documented and interpretations developed through visual analysis. The study focuses on identifying linear, angular, curved, repetitive, and volumetric relationships, examining how they contribute to architectural character. These principles can subsequently be abstracted into contemporary

interior applications, including modular partitions, ceiling patterns, furniture profiles, wall panelling, and spatial volumes. The objective is to retain the organisational logic of geometry while adapting its expression to modern functional requirements[13].

3.7.Story and the Past

Architecture functions as a repository of historical narratives, cultural memory, and collective identity. Ranthambore Fort represents a significant component of Rajasthan's fortified architectural heritage, reflecting the historical development of Rajput power, defensive planning, and the relationship between built form and landscape. UNESCO recognises the Hill Forts of Rajasthan as architectural manifestations of Rajput cultural traditions and historical development[14] between the eighth and eighteenth centuries. Rather than reproducing historical motifs, the study explores how narrative and memory can inform contemporary interior experiences through material selection, framed views, spatial transitions, and abstracted geometric compositions. This approach seeks to maintain a meaningful connection between historical identity and contemporary design expression.

4. Gap in Literature

Existing heritage documentation establishes the historical, architectural, and landscape significance of Ranthambore Fort, while broader studies of the Hill Forts of Rajasthan address their defensive systems, cultural value, and adaptation to varied geographical conditions. However, a potential research gap lies in developing a systematic framework that connects the documented architectural characteristics of Ranthambore Fort with contemporary interior design through geometric abstraction. This proposed gap requires verification through a structured review of scholarly publications, conservation studies, and relevant contemporary design projects. The present research seeks to address this area by examining form, proportion, movement, materiality, light, and spatial hierarchy as interconnected design principles. It aims to contribute a context-sensitive method for translating architectural heritage into contemporary interior applications without reducing historic identity to decorative imitation[15].

5. Case study

5.1.Primary case study



Figure 4 Peeli Kothi (Khurja, Uttar Pradesh)

Peeli Kothi is a contemporary building designed by ARGO DesignLab that explores the architectural qualities of local fort architecture through a modern design approach. The project responds to the client's interest in regional forts and focuses on understanding their spatial depth, materiality, and architectural character rather than directly replicating traditional construction methods. Its design integrates residential and clinical functions, creating a relationship between functional requirements and fort-inspired spatial expression. The project explores architectural geometry through the organization of solid volumes, framed openings, layered spaces, and controlled circulation. Its design approach demonstrates how the visual and spatial qualities associated with fort architecture can be reinterpreted into a contemporary architectural language. The use of substantial wall forms, carefully positioned openings, and geometric interventions establishes a relationship between enclosure and openness. Material choices, including stone and other regional finishes, contribute to the building's contextual character. These elements provide a basis for examining how proportion, mass, rhythm, and spatial hierarchy can be abstracted from historic architectural references. Peeli Kothi provides a relevant reference for understanding the translation of historical architectural principles into contemporary design. Its approach can inform the interpretation of fort-inspired geometry through interior partitions, framed entrances, material transitions, lighting, and spatial sequencing. Rather than reproducing historical forms, the case study supports an approach in which architectural principles are adapted to contemporary functional and aesthetic requirements.

5.2.Research significance

The case study contributes to the research by establishing a comparative relationship between historic fort architecture and contemporary

architectural interpretation. It provides a framework for examining how mass, enclosure, materiality, and geometric abstraction can influence contemporary spatial design. However, the project should be analysed as a comparative architectural reference, rather than as direct evidence of Ranthambore Fort's specific geometric principles. As shown in Figure 5 Six Sences Fort (Madhopur, Rajasthan).

5.3.Secondary case study



Figure 5 Six Sences Fort (Madhopur, Rajasthan)

Six Senses Fort Barwara is a 14th-century heritage fort located in Chauth ka Barwara, Rajasthan, near Ranthambore National Park. The project involved the restoration and adaptive reuse of the historic fort into a contemporary hospitality and wellness destination. Led architecturally by Panika, the conservation process extended over a decade and incorporated two original palaces and two temples within the fortified complex. The project demonstrates an approach in which existing architectural structures, traditional materials, and contemporary hospitality requirements are integrated while retaining the historical character of the site. The architectural organisation of Fort Barwara is characterised by its relationship between fortified walls, palace structures, courtyards, colonnades, and circulation routes. The restoration process retained existing structures and incorporated contemporary interventions within the historic framework. Courtyards and colonnades function as important spatial organising elements, while the fort's varying levels and staircases respond to the contours of the site. These characteristics provide a basis for analysing spatial hierarchy, enclosure, thresholds, movement, and the relationship between built mass and open space.

5.4 Research significance

Six Senses Fort Barwara provides a relevant comparative case study for the research “Geometry of the Fort: Translating Ranthambore’s Architectural Geometry into Contemporary Interior Design.” Its adaptive reuse approach enables the study of how historic spatial organization, geometric relationships, materiality, movement, and environmental context can inform contemporary interior design. The case study supports the research's emphasis on geometric abstraction by demonstrating the potential to integrate heritage characteristics with modern functions without relying exclusively on literal replication. However, the architectural principles identified at Fort Barwara must be critically compared with documented characteristics of Ranthambore Fort rather than assumed to be identical.

6. Literature review

Existing studies and case studies show different ways of bringing traditional Indian architecture into contemporary design. Peeli Kothi by ARGO DesignLab shows how regional architectural character can be reinterpreted through materials, spaces, and simple contemporary elements. Similarly, Six Senses Fort Barwara shows how a historic fort can be adapted for modern use while keeping its original character.

These two case studies help understand how elements such as materiality, spatial sequence, proportion, thresholds, and enclosure can be used in contemporary design. However, there is limited study on how the specific geometry of Ranthambore Fort can be translated into interior spaces. Therefore, this research focuses on using the fort's architectural character as inspiration for contemporary interior elements without directly copying its historic forms.

7. Conclusion

This research explores how the architectural geometry of Ranthambore Fort can be translated into contemporary interior design through abstraction rather than direct replication. The study identifies principles such as proportion, rhythm, repetition,

enclosure, movement, materiality, and spatial hierarchy as important characteristics of the fort’s architecture. These principles can be reinterpreted through contemporary elements such as partitions, framed openings, layered volumes, material transitions, lighting, and spatial sequencing.

The study also highlights the relationship between the fort, its natural landscape, light, and material character. The case studies demonstrate how historical architectural qualities can be adapted to contemporary requirements while maintaining a connection with cultural identity. Overall, Ranthambore Fort can serve as a source of geometric and spatial principles that allow contemporary interiors to express heritage through a contextual and contemporary design approach.

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