Shapes, Patterns and Meanings in Indian Temple Architecture

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Abstract Art, in many contexts, is seen to have symbolic meanings, pertaining to the context and contributing to it positively. When the shapes and patterns used to create art, starts to acquire meaning contextually, it transcends into ‘symbolism’. Therefore art contributes in the overall understanding of the structure and ambience. Also, shape evolving into patterns is, more often than not, an algorithmic process. These patterns in consideration are characterised to be fractal in nature. Therefore a logical connection can be made between patterns and their meanings, that is, fractals and symbolism. In Hindu religious architecture, the shapes have a set of meanings, their combinations have certain meanings, and the patterns evolved from them have, either a higher metaphorical meaning or a totally new interpretation. In this paper, symbolic art has been considered in the context of Hindu religious architecture and attempts to link the independent disciplines of ‘symbolism’ and ‘fractals’ in this context.

Keywords: temple architecture, temple symbolism, fractal geometry, Laxman temple, Kandariya Mahadev temple


1. Introduction

"The Indian artist never tried to copy nature, because being a philosopher in the Indian sense of the word - a pure and harmonious man - he is nature, and thus he could create in parallel with nature, imitating only the organic impulse, the thirst for life and growth, the caprice of discovering new forms and new delights, while not imitating directly the forms of nature - i.e. forms already achieved - and thus in a sense, dead. The Indian artist imitated the gesture of nature and created on his own account, using however a different space and different forms from natural ones. The Indians offer a sentiment, full of harmony with nature, of equality with and love for all her innumerable creations. To want to describe or suggest aspects of nature is a sign of dissociation of nature from consciousness. But India lives in nature, thus she does not observe it, but realises it. The Indian artist in his work of creation coincides with nature - and his works are nothing but new forms of the same nature which creates rich and living flowers, lakes etc. This art expresses the organic continuum, the circulation of the vital juices, a rhythm of forms and volumes devoid of effort and hesitations.”

(Eliade, 1907)

Symbolism is an artistic and poetic movement using symbolic images and indirect suggestion to express mystical ideas, emotions, and states of mind. It is the use of symbols to represent meta-physical ideas or qualities.

When architectural forms become the vehicles of content—in plan, elevation, and ornamentation—they become symbolic. Their symbolism can be understood consciously or unconsciously, by association to a building one has seen before and by the fact that it suggests certain universal experiences. Symbolism was largely a reaction against naturalism and realism, anti-idealistic styles which were attempts to represent reality in its gritty particularity, and to elevate the humble and the ordinary over the ideal. Symbolism was a reaction in favour of spirituality, the imagination, and dreams (Wikipedia). Symbolism is a field where in a lot of ancient historical texts help in the basic understanding of the field but modern and recent texts have refrained from treading the path.

Fractal is a curve, 2D or 3D, geometrical figure, each part of which is said to have the same statistical character as the whole. These appear geometrically self similar in progressively smaller scales. The mathematical roots of the idea of fractals have been traced throughout the years as a formal path of published works, starting in the 17th century with notions of recursion, reiteration, repetition and on to the coining of the word fractal in the 20th century with a subsequent burgeoning of interest in fractals and computer-based modelling in the 20th century. The term "fractal" was first used by mathematician Benoît Mandelbrot in 1975. Mandelbrot based it on the Latin frāctus meaning "broken" or "fractured", and used it to extend the concept of theoretical fractional dimensions to geometric patterns in nature. (Wikipedia)

From Carl Bovill to Michael J. Ostwald, Nikos Salingaros, Kirti Trivedi, Sambit Dutta along with others,
have contributed significantly in the field of fractals and its applicability in architecture. They have paved the way for newer models and methods along with refining the methods involved in the analysis process. George Michell, Adam Hardy, Subhash Kak and Sambit Datta have contributed immensely to the field of temple architecture. Their contribution is not only limited to documentation of these beautiful structures, but also extend to the deeper understanding of its structural systems, geometry, and the symbolic meanings.

2. Methodology

Lot of work has been done in the area of temple structure measurement and proportions and their intricate relationship with each other. Recent (more modern) studies in the field of temple architecture address the aspects of digital analysis and geometric progression through digitisation or computer softwares.

It is strongly felt that the basic reason, for which the temples were built and such elaborate constructions taken up has been neglected. It has been mostly cited that the politics; and therefore the patronage pattern; had the most effect on the construction of these religious structures. Though these aspects played an important role in the construction of these temples, the religious beliefs and rituals had a more profound impact on their construction. Going further back in time, is it not more important to find out the reason for them to be constructed the way they were done?

It has been proved by more than one scholar like Dr. Kirti Trivedi and Md. Rian that fractal geometry exists in temple architecture of the medieval period. The practical application for this may be because of the necessity of depicting various concepts through certain metaphors. These metaphoric representations carry meanings with them, which the Euclidean geometric combinations are not able to depict and explain in their own right. Therefore, if a strong relationship is evolved between the symbolism in a Hindu temple context, and fractal geometry in this same context, then the reason behind the usage of this peculiar kind of geometry in this temple context may be justified. It has been adequately proved that the temple structures have fractal geometry. Also, it is known, that symbolism exists in the temple complexes to aid in man’s journey on the path of enlightenment. The only lack of connection in this trio is the relationship between fractal geometry and symbolism.

Therefore, the three legs of the tripod of this paper may be outlined as (i) Hindu Temple architecture, (ii) Fractal geometry and (iii) Symbolism. The inter-relationships of each of these pairs have already been talked about by various authors in many different ways, except the relationship between fractals and symbolism. The important feature in this project is this linkage and relationship between the various aspects of fractal geometry and symbolism in the higher Hindu temple context.

The paper aims to interpret the embedded symbolism of Hindu temple architecture through fractal geometry. The objectives are:

- to study symbolism with respect to Hindu temples.
- to study the influence of geometry in the symbolic representations.
- to integrate fractal geometry, symbolism and the inherent overall concept of a temple to understand their intricate relationship and influence on each other.

Figure 1. Rationale behind the methodology graphically

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Figure 2. Methodology

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The hypothesis here is that the application of fractal geometry is justified because, its usage gives the temple and its elements, the form and level of complexity that is needed to convey the deepest meanings of the part and the whole, to the visitor. There exists a rational base for the usage of fractal geometry in Hindu temple architecture.

The subject at hand is important as, when the rationale behind the usage of this kind of geometry is truly seen, its relevance will be understood in depicting the metaphoric physical manifestations. The hidden meanings in the temple structures and their higher order concept may be understood in clearer brighter light.

3. Symbolism

Ideas by their very nature are always changing. Knowledge is a dynamic, cultural and historic process. Symbolism, being subject to these aspects of culture, attains different meanings at different situations and with changing times. Hegel stressed that there can be no objective, stable facts or truths in a constantly changing dialectic ([11], 80). Michell [2] has lucidly mentioned that there exist many layers in spiritual search and ancient Indian texts like the Vedas, and they are open to interpretation at various levels. But Hegel believed that this constantly shifting dialectical process must culminate in a final stage in which human being would reach the ‘actual knowledge of what is’. This is where the ‘truth’, takes shape and standardizes the one final aim in the temple context. Human consciousness is never fixed but continually changing and developing new categories and concepts. These determine how we experience the world, so that knowledge is always contextually dependant and always the result of a series of conflicting positions ([11], 79). This mention of ‘conflicting positions’ is important. It means that one symbol or group of symbols can have differing resultant meanings with change in context. Also, with changing social situations, the consciousness creates heuristically different ambiences in the visitors’ minds. Artistic endeavour inspired by divine subject matter seeks to demonstrate the nature of God and his creations. It is an effort to depict both his form and his works. This impulse was often one of the sources of inspiration for religious architecture since it was thought that altars and sanctuaries represent an **imago mundi** – a miniature cosmos, and the cosmos is the supreme example of his works (Eliade, 1907).

In his ‘Critique of Pure Reason’ (1781), Kant shows how the attempts to use reason to establish metaphysical ‘truths’ always produce impossible contradictions. He then demonstrates how we acquire knowledge of the world. The contradictions in the meanings of various shapes and patterns in the temple structures, form a part of the character of the society, and therefore part of the temple embellishments, as the temple is an image of the society. The human mind is an active, not a passive recipient of information. When we look at the world, we ‘constitute’ it, in order to make sense of it. The constantly changing nature is understood here also as the constant interaction of humans with these structures where their impact becomes part of their experience, subtly modulating it. Some of the concepts that we apply to our present experiences do indeed come from our past ones – but the most important ones precede experience ([11], 74).

Temple art, does not know perspective; it visualizes a scene from an analytic and qualitative viewpoint. The detail is always found in its place, but it is not represented in perspective - rather in conformity with its particular function. The function of these details and their real value, have a priority over their images. It always seeks and represents the object as such, in a space of its own; it does not copy the image of the object from exterior space, which is a quantitative space having a physical equilibrium and a harmony of volume and perspective. Here, aesthetics respects quality, spirit, interior life, and gesture; not volume. It is called classical art (**shastriya kala**), which does not create works of art, but spiritual models, images to be interiorized through meditation. Its action upon man does not conduce to aesthetic feeling, but to a sentiment of reconciliation and perfection, the point of departure of a spiritual ascent which far transcends profane art.

4. Fractal Geometry

After coining the term ‘fractal’ and setting up some mathematical formulae, it now has great possibility to experiment about the refining of conventional temple-form or searching for new form of complexity related with Hindu cosmology with the consideration of ritual guides. For searching the new, complex, fractal and chaotic forms in contemporary architecture, on the one hand, manual experiments of architectural elements with the fractal geometry are extensively practiced. On the other hand, by
adopting the theories of folds, fractals, chaos, complexity and algorithms, ‘computer architecture’ has been developed that translates the theories into architecture. Accordingly, fractal geometry not only analyzes old buildings and existing urban patterns and growth, but also helps to create countless unimaginable forms and patterns for finding new possibilities of space as well as aesthetics in contemporary architecture.

In fractal geometry, fractal dimension is the quantity which measures the fractal character of an object. For any fractal object fractal dimension is always non-integer, i.e., unlike integer-dimensional objects (Example: zero-dimensional point, one dimensional line, two dimensional square and three dimensional cube) fractal object is a fractional-dimensional which may be in between one dimensional and two dimensional object, or in between two dimensional and three dimensional object. For in between one-dimensional and two-dimensional fractal object fractal dimension ‘D’ is always more than 1 and less than 2, whereas for in between two- and three-dimensional fractal object the fractal dimension ‘D’ is always more than 2 and less than 3. There are various methods to evaluate the fractal dimension, among which the ‘box counting method’ is suitable for measuring the fractal dimension of the elevation of buildings, mountains, trees or any objects which are not true fractal. Albeit, ‘self-similarity dimension method’ is very common for calculating the fractal dimension, but the method is only applicable for true mathematical fractals where self-similar structures are found at all zooming scales. Fractal dimension calculated by ‘box counting method’ measures the fractal dimension of an image on the basis of roughness or quality of texture or the amount of details.

4.1. Box Counting Method

Images having fractal dimensions 1.1–1.5 indicate less roughness and details they have, whereas images having fractal dimension 1.6–1.9 but less than integer value 2, exhibit high texture and abundance of details. Roughness of the images having fractal dimensions 1.21–1.25 or the dimensions 1.81–1.86 are visually not so much distinguishable by naked eyes. But naked eyes can easily distinguish the images having fractal dimensions 1.1, 1.2, 1.3; 1.8 and 1.9, separately [3].

To evaluate the fractal dimension of an image by ‘box counting method’, firstly a square grid is overlaid on the image where the size ‘S’ of each grid box, determines the scale of the grid. Then the number of boxes ‘N’, having any mark or line or part of the image within it, is counted. After repeating the same process on the same image by changing the box size (reducing to half each time), fractal dimension ‘D’ of that image can be obtained by transforming the results of ‘S’ and ‘N’ into a log–log graph. The slope of the resulting line of the log–log graph determines the fractal dimension of the image.

4.2. Matlab

There are various softwares that can directly calculate the fractal dimension of an image by following the basic process of ‘box counting method’. In this paper, the software ‘MATLAB’ has been employed for counting the marked boxes. For the analyses, all parts of the temple have been taken as two-dimensional images by comparing the information about image sizes and their resolutions. The reasoning behind the usage of the perspective views of the temple structures as the visitor approaches, sees and experiences it, is that these are the views which one encounters. As symbolism acquires meaning only in the mind of a human being, the mind becomes a vehicle, and therefore, how it perceives the view is of utmost importance. This logic diminishes the importance of plans and elevations and their fractal dimensions. It advocates the author’s view that the experience of the visitor is directly derived from the perspective views formed in his mind from the human standing point, and the plans and elevations impact only indirectly.
5. Laxman and Kandariya Mahadev Temple and Symbolism

The abundance of details in the temples of Laxman and Kandariya Mahadev not only make the temples highly fractal in terms of roughness, but also displays the characteristics of Gods who are very important in Hindu cosmology and philosophy. Various natural elements and number of figures displaying sexual gestures on the temple fabrics symbolizes creation among other metaphors. In other words, the smallest details of the temple carry the concept of creation. Naked eyes go to the tiniest details up to some level, but the story or the images of the gods makes a passage of spiritual journey for the power of imagination to perceive further to infinity. Though geometrically the details are not the exact repetitions of its parent body of the temple, but it repeats the same concept/theme of the body. Tiniest figures give the impression of paramanu (atom), the smallest time unit, the consciousness which acts as the microcosm of the largest time unit, cosmos. Like the exterior, the interior of Kandariya Mahadev temple is also full of figures and floral details in which these figural details protect the sanctuary from demons and floral details depict the cosmic events.

On the ceiling of this temple, the floral pattern of panels is most noteworthy for depicting the cosmos where, again, fractal assumes the main role for depiction. Here the combination of some ceiling panels makes the pattern such that it seems the flowers are blossomed from buds recursively. From each bud four petals are bloomed then from four petals eight petals are generated and again from this 8-petal flower a 12-petal bloom is born. Here the bloom depicts the creation of universe from the lotus bud sprouting from the navel of Vishnu.

Figure 5. Laxman and Kandariya Mahadev Temple

Figure 6. Fractal dimension of plan of Laxman Temple as generated from MATLAB.
Figure 7. Fractal dimension of edge line diagram of shikhara of Laxman Temple as generated from MATLAB

Figure 8. Fractal dimension of side elevation of Kandariya Mahadev Temple as generated from MATLAB
Each bloom from a single bud is stratified by making the level difference. These differences of levels and concentric floral patterns make a passage for the spiritual journey to the unity of infinity and thus help the man to practice for getting the ultimate liberation. The ceiling panels are also finely detailed which maintain the degree of skilful roughness in the whole complex. Fractal pattern of the plan of Kandariya Mahadev temple, replicas of detailed towers, and rhythmic growth of horizontal friezes, create a harmony of fractal characters in the whole complex. High level of details everywhere in the temple adds fractal flavour of roughness throughout the structure.

Certain carvings seem to show supernatural beings enacting parts of their histories, now obscure to us: a magical gesture, a dance, a ritual, or some act essential for prolonging life, and in general there are more easily comprehensible references to hunting, gathering of harvest or sexuality (Eliade, 1907). Even when a divine history is not being recounted directly, one may assume that forms and iconographic systems which tend to reveal some aspect of the world or of the fundamental interplay between cosmic life and human existence are intimately related to the personality and creative activity of the God. There sometimes arises a complex problem of the relationships between divinities and their symbols. Eliade rightly points out it should not be forgotten that in some parts of India, symbols precede any actual figures of the gods. Such cosmic symbols have magico-religious potency, sufficient to preserve their autonomy even when they are incorporated into the personality of the god. Nevertheless, all these figures not only manifest the irreducible quality of the gods – the fact that they do not belong to the world of humans – but underline their strangeness, their extravagance and their freedom to assume any form whatsoever (Eliade, 1907).

To sum up, Hindu temple is not the abode of God but the form of God and since it was strictly suggested to be the microcosm of cosmos, all Hindu temples have the common basic characteristics along with some unique features [4]. These unique features of Hindu temples, exhibited fractal properties and complex form, act as the signature of Hindu art and architecture. This paper has presented Kandariya Mahadev temple at Khajuraho as the icon of Hindu temples.

An important consequence from this cosmological valence of symbolism is that one who understands symbolism not only opens themselves to the objective world, but at the same time succeeds in leaving their unique condition and ascending to the comprehension of the universal. The world being a divine artwork, all understanding bearing these deep structures is accompanied by a religious experience (Eliade, 1907). Here, the religious man is confronted with the sacred character of the cosmos, that is, he discovers that the world has a sacred significance in its very structure (Eliade, 1907).

6. Interpretation & Observations

Religion is an organizing system of knowledge (real and imagined) about the universe, which has proven essential for humankind to maintain itself [5]. The vehicle for transmitting this knowledge is the temple structure. The temple structure is supposed to act at various levels for explaining the concept of spiritual journey, morale in daily life and concept of human beings and his environment, from the macro to the micro scale.

Human beings project their own unrealized perfection onto an imagined non-human entity, God ([1], 90).

There is a value and meaning in the highest of human creations as opposed to their raw information content [5]. The temple structure portrays meanings on the subconscious and conscious sides of our mind. The basic desire of humans, drives them to construct according to a similar algorithm, which makes them feel at ease with their environment naturally. Each pattern is presented as a process of resolving a recurring architectural problem: the
relationship between a certain context, the forces that recur in this context, and a spatial configuration that permits these forces to resolve themselves (Alexander, 1979). It can therefore be concluded from this, that the application of these basic parameters can contribute immensely in the analyses of temple architecture on more than physical terms. The physical manifestation of the temple is merely a path towards understanding of the concept. The concept of proliferation and multiplication, with self-similarity, is equally explainable through fractals. Fractal geometry is hence proved to be satisfying the parametric requirements in the formal analysis of temples.

Figure 10. Scales distinguished on the side elevation of the Kandariya Mahadev temple

Figure 11. An example of small scale elements being paired and balanced
The Indian artist never tried to copy nature because; being a philosopher in the Indian sense of the word: a pure and harmonious mind; his is nature, and thus he could create in parallel with nature, imitating only the organic impulse, the thirst for life and growth, the caprice of discovering new forms and new delights, while not imitating directly the creations of nature, the forms already achieves and thus, in a sense, dead. The Indian artist imitated the gesture of nature and created on his own account, using however, a different space and different forms from natural ones. Thus, Indian artisans offer a sentiment full of harmony with nature, of equality with and love for all her innumerable creations. Finally, to want to describe or suggest aspects of nature is a sign of dissociation of nature from consciousness. But India lives in nature, and thus does not observe it, but realizes it (Eliade, 1907).

Every iconographic theme – being connected with a certain meditation, a certain experience – has its own separate key. This is the symbolism of Indian iconography, and it is nothing but the algebraic formulations – that is, in terms that are sacred and easily understood by those who know the alphabets of this language. But in each ritual, i.e., in each schema of meditation, of experimentation, the color changes and combines, the gesture is modified, the symbols are varied. But iconography is only the algebra of this drama; the heretic formulations of the states of the soul which must be experienced before becoming perfectly harmonious, perfectly free and perfectly serene. (Eliade, 1907).

7. Integrated View: Theory

‘Thought Behind Form’

- Hindu temple architecture has sustained the test of time and retained its specific character imparting spiritual knowledge to the visitor and guiding them towards enlightenment and unity with the divine.

- The qualitative characteristic evaluation of the form of the temple exhibits the fact that the formal characteristics and the symbolic meanings are both subject to the existence of fractal geometry in the temple structure. The implementation of fractal geometry in the physical manifestation of the spiritual concepts is not a deliberate one, but rather more of stumbling upon fractal geometry accidentally, where the higher goal was to get the spiritual meanings conveyed. As the symbolic concept was applied to geometry, Euclidean geometry gradually gave birth to fractal geometry (though not by this name).

- In this study, the third leg of the tripod is ‘Symbolism’. This forms the link between fractal geometry and Hindu temples. Unknowingly, the concept employed to verify the existence of fractal geometry in a temple context is supported by the symbolic concept of the temple, along with the apparent as well as the subtle metaphoric meaning of the individual symbols. These individual symbols are not listed monotonously on a flat surface. Rather, they are intertwined with the structure of the temple to create a whole new meaning and a higher order metaphor which suits the intention of construction.

- The use of fractal geometry in architecture was not one of implementation due to superficial reasons. The strong relationship between fractal geometry and temple symbolism, depicts an inherent understanding of both these fractal and symbolic concepts.

- Hindu mythology and spiritual philosophy believes that the structure of the smallest entity or an atom is congruent to the structure of the whole universe or cosmos. Basing this thought, the architects and sthapatis developed a structure which would be an intermediate scale to both these extremes. As both these extreme scales are not visible to the naked eye and therefore not possible to visualize, it was important for human beings to give it a form which resembles the underlying concept of these extremely scaled entities; not by literally copying the physical structure, but by following the underlying algorithm of its construction.

As the Hindu mythology glorifies the almighty as all encompassing and also being present in the smallest building block, it was almost mandatory for the architects of the temple to depict the form of God along with creating an abode for God. The construction of the temple entailed an important aim of providing a point of concentration for human and be able to rely on the almighty.

The physical manifestation of this concept exhibits various subjects from living to non-living things and real to abstract. It includes repetition at various scales, reinforcing the idea of the almighty being omnipresent in every scale and shape at the same time being all encompassing.

- If fractal geometry is geometry of nature or natural objects (Mandelbrot, 1979); then the concept in Hindu philosophy that the building blocks of everything present in the universe is God Himself or the Cosmos; is further reinforced.

- The above concepts are clearly fractal concepts, and when applied to a structure, results into fractal geometry. The outward appearance, the structural organization, and the plan and elevation in 2-dimensions, all exhibit fractal geometry at varying but very high fractal dimensions with the basic aim of showing the structure of the cosmos and God to the human visitors.

- It is therefore, the most impartial mix of order and surprise including scenes/panels from the mundane world and everyday life to the highest philosophy for attaining moksha.

- Michell rightly pointed out that this form of symbolism has various layers of meanings to it and is open to interpretation at various levels. It is therefore, subject to change from one person to another, with changing times and changing contexts.

- The above discussion points towards a mutually symbiotic relationship between fractal geometry and symbolism, aiding and supporting the other. Fractal geometry is the physical manifestation of the most basic concept in symbolism and without the need for symbolic depictions, fractals (natural
inspiration) would not have been seen in architecture. Temple architecture is definitely the best playground for such a bond, as this concept is the underlying reason behind its construction.

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