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Mathematics and Aesthetics in Islamic Architecture: Reference to Fatehpur Sikri

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Abstract. The thesis of this article is that Islamic architecture establishes a clearly recognizable mathematical order and has a special concern for aesthetics. One complements the other.

This is exemplified by taking an analytical study and in tracing out certain unknown facts about the design of Fatehpur Sikri, an imperial city built around 1570 near Agra in India. A product of creative imagination, it is unquestionably the most ambitious architectural project of the third Mughal Emperor Akbar's reign and after the Taj Mahal, the most notable building achievement of the Mughal empire. With Islamic art, so rich, delicate and fragile here, the city is an artistic legacy. Its brief but brilliant story is alive. It evokes in our mind the spell of a historic past and the charm of an exotic legend that piques our imagination.

The architecture and spatial planning of Fatehpur Sikri, incredible as it is, carries a message for the contemporary sensitive designers. A search for this message, the springboard of our future accomplishments, is the theme of this article.

India at Akbar's reign
(1556 – 1607)

Introduction

The Mughal empire, extending over three centuries (1525-1843) of rule in India, has given rise to several magnificent buildings, monuments and noble cities, portraying a rich Islamic culture and distinctive architecture with mosque as a major outlet for Islamic artistic design and craftsmanship.

Agra, about 200 Km from Delhi, was the honored seat of the Mughal empire and location of two of the greatest masterpieces of early Mughal architecture. One is the Taj Mahal, a shimmering elegy in marble built by emperor Shahjahan (1632-52). And some four hundred years ago, renouncing luxury and comfort, Akbar, the Great Mughal emperor, set out bare footed walking miles and miles unmindful of the burning sand to take blessings from Salim Chisti, a Muslim philosopher, to be blessed with a son. The next year, Jodha Bai, his Rajput wife, gave birth at Sikri to Prince Salim, later the emperor Jahangir. Akbar then vowed to build a city there, about 38 Km from Agra (Fig. 1) named Fatehpur Sikri (built around 1570). He scrawled a bold signature across a landscape; nature and intention converged on a point and a noble city was born. 'Sikri' literally means 'Shukran' (the Arabic term for thanks or to express gratitude) and 'Fateh' means victory.

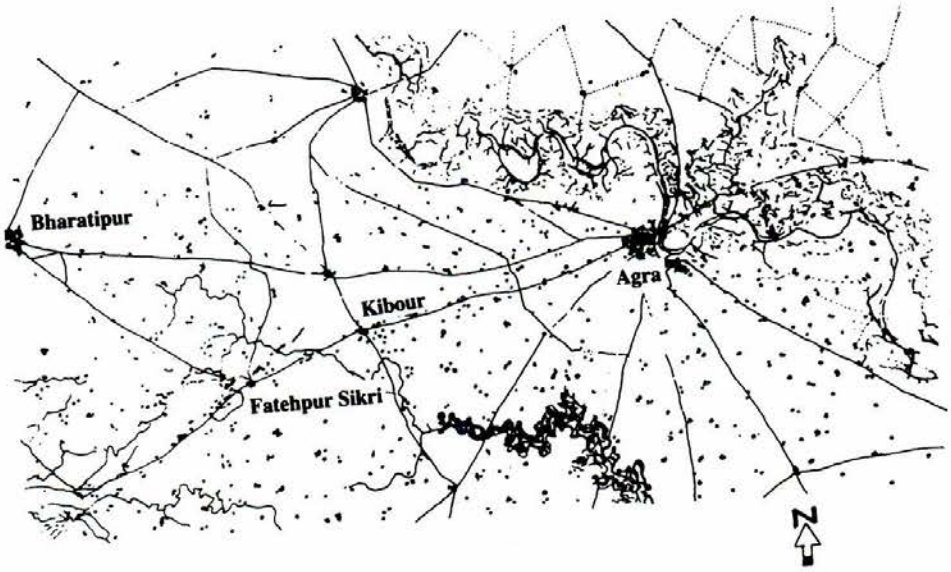

Fig. 1. Location of Fatehpur Sikri (about 38 km from Agra).

To Akbar, the building of this city was an act of devotion. He always advocated love and unity amongst his people. This high thinking – the notion of universality and brotherhood - gave rise to a bold new imperial style. The heritage of Arab land and Central Asia merged with Indo-Islamic traditional forms to produce a masterpiece of Mughal architecture.

The location of Fatehpur Sikri corresponds to the demands of nature. The city is built on a flat terrain of a rocky sandstone ridge rising some 30 m to 45 m above the surrounding plain (Fig. 2). The ridge is oriented northeast-southwest, bounded on the north by an artificial lake now drained, and enclosed by the city walls (Fig. 3) which even today remain in relatively good condition. Stone for construction was quarried from the ridge which remains a source of building material till today.

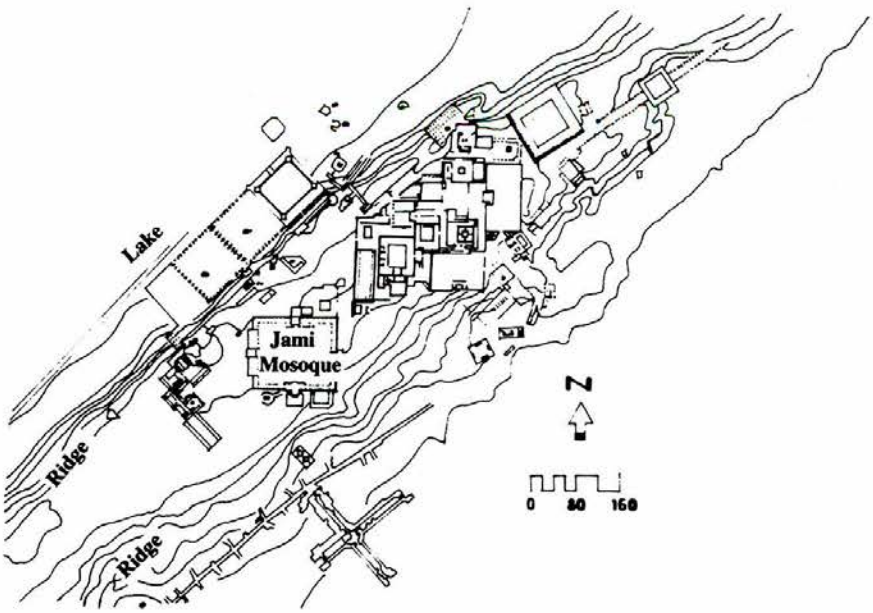

Fig. 2. The city is built on a flat terrain of a rocky sandstone ridge

The palace buildings which consist mainly of the royal residences, pavilions, halls and meeting areas were laid out on the central but comparatively flat terrain of the ridge (Fig. 2 & 4). The topography necessitated in creating levels within the Royal complex with the result that the courts are staggered one behind the other

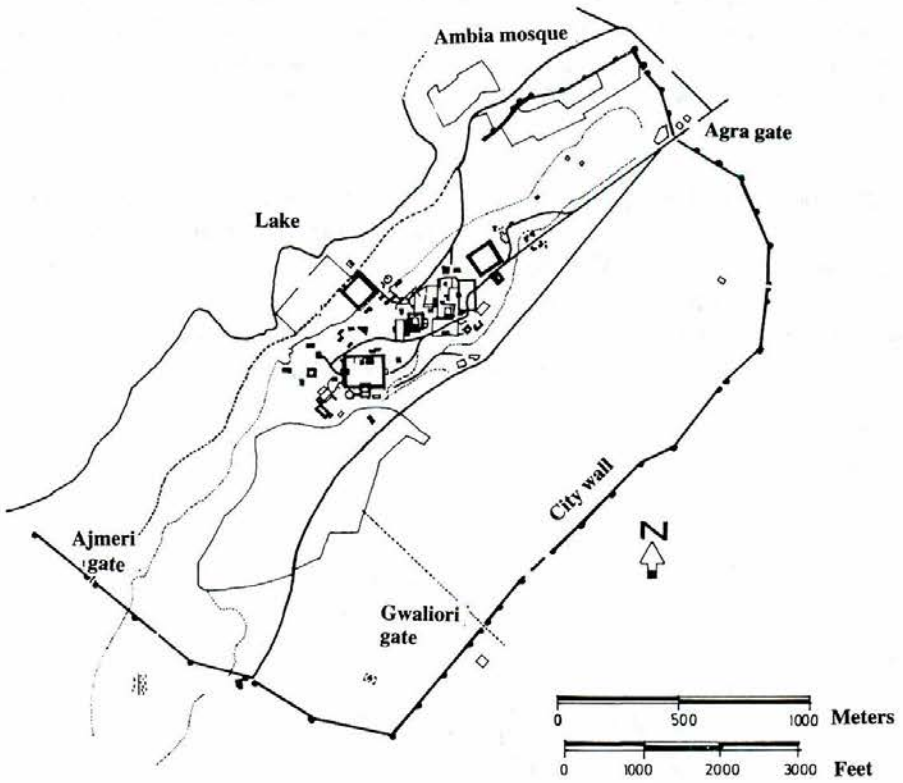

Fig. 3. The city and its walls

oriented in the cardinal directions. The Jami Mosque, located on the very summit of the ridge, faces westwards towards Makkah, and is in the same geometric alignment as the Royal complex. However, the orientation of buildings having other functions and mostly located around the Royal complex, is governed by the topography of the site which is generally steep on the periphery.

Fatehpur Sikri was a flourishing city with a population of about 50,000 persons soon after its completion in 1572. "It was reported tha t both Agra and Fatehpur Sikri were very great cities, either of them greater than London. Besides, the city was a great resort of merchants from Persia and out of India with merchandise of silk, cloth and of precious stones, rubies, diamonds and pearls" [1]. One might imagine the life and spirit of this royal city "without streets but with broad terraces and stately courtyards, numerous palaces and pavilions, each one rivalling the other in the elegance

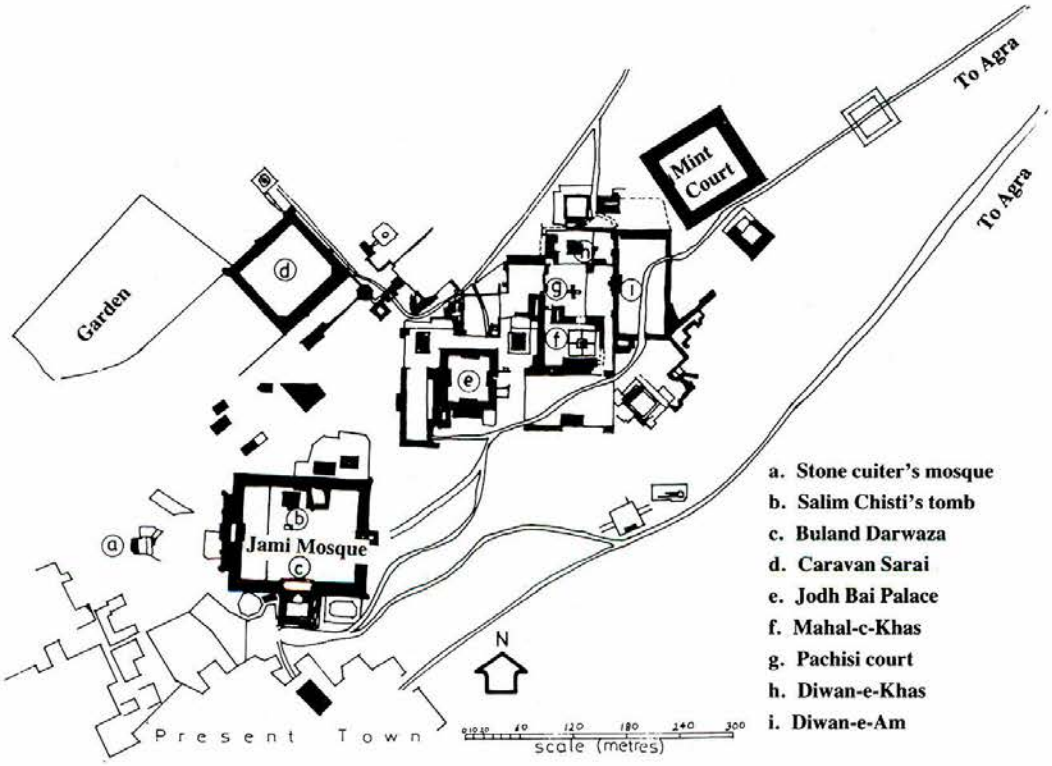

Fig. 4. Layout plan of Fatehpur Sikri.

and richness of its architectural treatment" [2, p. 94]; the emperor himself in residence surrounded by a throng of nobles and high officials and, above all, in the midst of his people whom he adored most.

This magnificent city, which has given such distinction to Islamic architecture and the Mughal regime, was left by Akbar some 20 years after it was built, probably because of an inadequate water supply. Today, Fatehpur Sikri is protected, restored, cared for and even improved for the pleasure and admiration of all. The city remains a source of inspiration to architects the world over.

This article is a search for the design philosophy and the intellectual system which have given architectural excellence to the city and produced its unique physical form. There certainly are lessons to be learned from Fatehpur Sikri. What those les-

sons are, how these could be applied and, more imprtantly, how could we rationalise our own thinking are the main concerns of this article.

The article also attempts to trace several new aspects of the design of Fatehpur Sikri, particularly the spatial qualities, not fully known to many of us. Several observations made and conclusions drawn are based on the author's recent visits to Fatehpur Sikri and his personal experience of the city. In including discussion on several new issues and by drawing practical conclusions regarding the design of Fatehpur Sikri, it is hoped that the article would provide fresh inspiration to contemporary architects and planners.

Urban structures and the city form

Before we begin to search for the design philosophy of Fatehpur Sikri, it seems necessary to acquaint the reader with some main structures and the city form, in general. The objective is not to trace out the history of these structures, or to undertake an archaeological investigation of the city. However, it is of interest to note, as pointed out by Lowry that "of the 118 structures of medieval date within and around the walls of the city, only 52 can be assigned a specific function, not to mention a proper name, and of these, 15 are gates, 8 are mosques, and another 8 are baths. The Imperial complex itself has more than 60 structures, out of which the function of only 13 has been unquestionably established" [3].

Designed as a city within a city, the core of the city are the two main rectangular courts called the Imperial complex or the 'Mahal-i-Khas' (the gathering place of the court), and the 'Diwan-i-Am' (the gathering place of the people). The first court, one of the city's first structures to be completed, measures approximately 175 m x 90 m. Somewhat larger than the Piazza San Marco in Venice, it served as the residence of the emperor besides his administrative center, where he sought the Council of Ministers.

'Mahal-i-Khas' consists of a number of important structures to serve a variety of purposes. A small pool, almost 30 m square, is located in the smaller southern division in front of the private palace quarters of the emperor himself. A raised square platform in the center of the pool is approached by four narrow gangways (1 in Fig. 5). It is from here, in a serene and subtle atmosphere, that the emperor would enjoy listening to the music played by Tansen, the famous singer in the court. "The larger northern division is dominated by a bold, almost cubical structure, solid and yet transparent (i in Fig. 5), and surrounded with turrets which funnel cool air down to

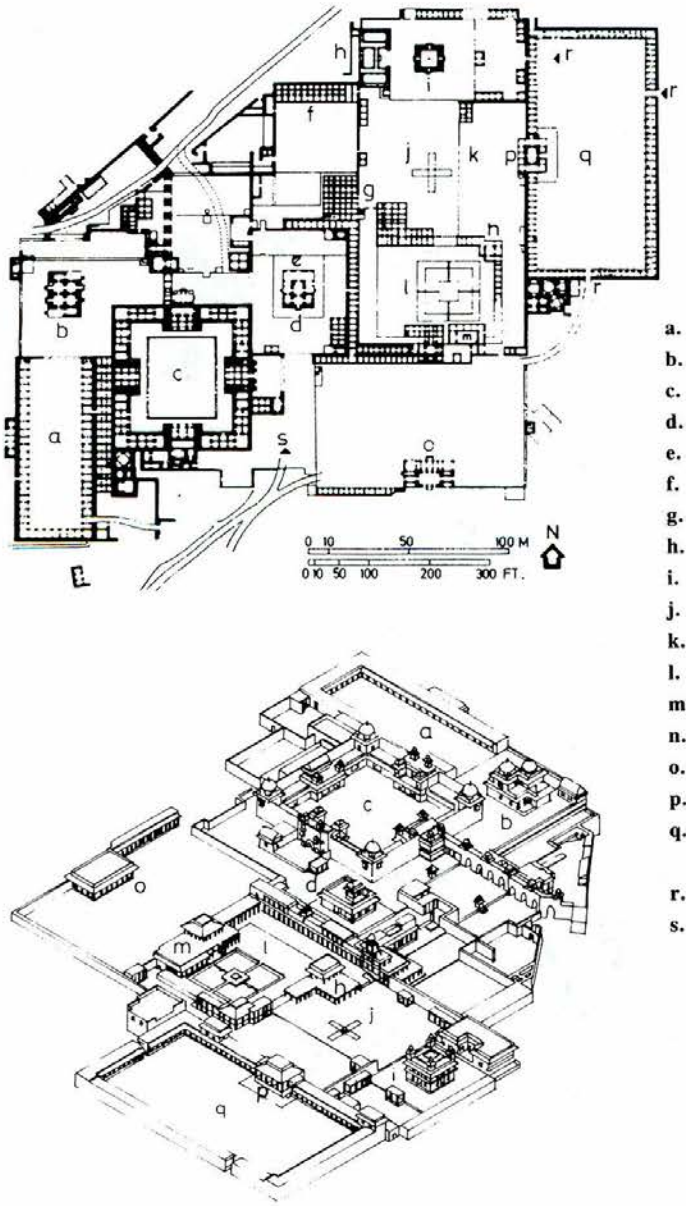

Fig. 5. (a) Plan of palace complex; (b) Bird's eye ivew of the palace complex

the Hall of Private Assembly, and is "probably the most interesting and popular of the buildings remaining on the site" [4]. An original conception with artistic merit, its interior arrangement is unique. An elaborately carved and substantial pillar, almost one meter in diameter, which mushrooms into a giagantic capital, stands in the center to support a circular stone tray linked to galleries around the walls by four radiating gangways (Fig. 6). Here Akbar is said to discuss the affairs of the state with his Ministers who sat around the gallery.

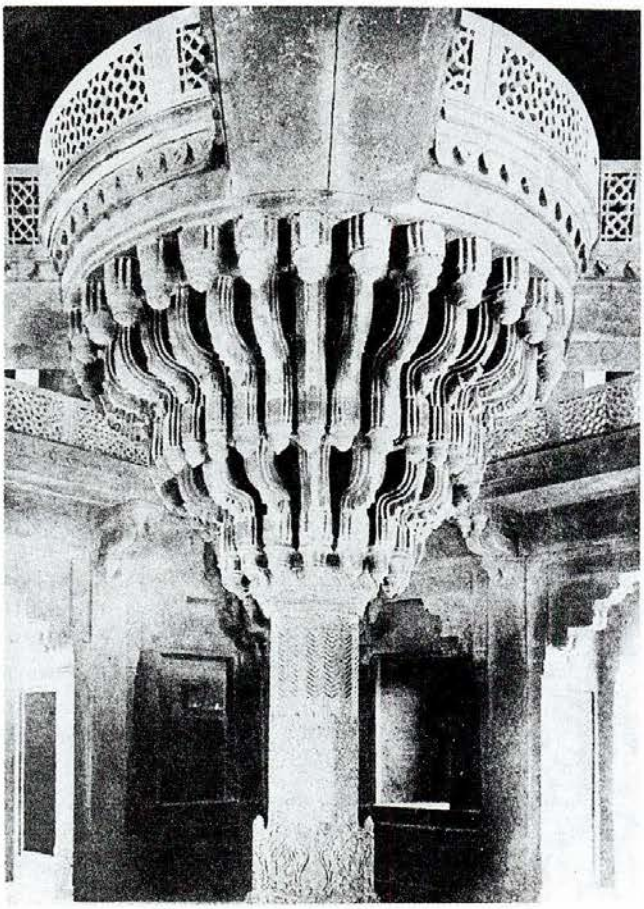

Fig. 6. Diwan-e-Khas (Central pillar)

One of the most innovative designs almost central along the western wall of the Mahal-i-Khas, is the 'Panch Mahal' or the 'House of Winds' (g in Fig. 5) so named

because its rooms are open to cooling breezes while still providing shade for Akbar and his court. It is a superimposed five storey pavilion of 170 columns. The first storey is supported on 84 columns, with each storey above reduced sharply in size in comparison to the previous storey. The top storey is crowned with a domed roof which is suppported on just 4 columns. Its asymmetrical structural design and playful and free composition greatly enhances the rich profile of the Mahal-i-Khas. From its terraces, once enclosed by decorative 'stone jalis' screen ('Mashrabi' in Arabic), the ladies of the court would have had the best views possible of the various activities in the court of the Mahal-i-Khas.

Adjacent to the 'Mahal-i-Khas' is the second main rectangular court (q in Fig. 5), called the 'Diwan-i-Am'. "In use by 1573, this great rectangular court was one of the city's first structures to be completed. It served a variety of purposes: it was where Akbar held his daily public audiences and where numerous court activities took place, including the celeberation of major festivals" [3, p. 33]. Besides Diwan-i-Am was also used as a public prayer space. Projecting from the west wall of this court is a simple red sandstone pavilion of five bays (p in Fig. 5), from which the emperor would listen to public grievences.

A significant private square court called 'Maryam's Garden' (d in Fig. 5), of about 45 m on each side, is located to the west of 'Mahal-i-Khas'. Maryam's palace, an important structure in the palace complex, is located in the middle of the court. Another private square court called 'Jodh Bai's palace' (e in Fig. 5), is located to the west-east of Maryam's garden. The style and construction techniques have given a unified appearance to both palaces.

The form of the Imperial complex therefore basically consists of rectangular and square courts, measured and proportioned, which interlock like a wood-joint, a bolt and a nut, showing that a structural stability exists in the form (Fig. 7).

Although there are several other courts with numerous buildings and structures both of a religious and secular character, these will not be listed or described in this article. However, among the most impressive parts of Fatehpur Sikri is the immense courtyard of Jami Masjid of approximately 165m × 133m (Figs. 8 and 9) which contains a group of religious structures.

A 'Mosque and its Pigeon' is an Arabic phrase implying beauty, peace and tranquility. The expression refers to consistency as well. The Jami Masjid in its grandeur appears to live up to the phrase.

Fig. 7. Overall plan of Fatehpur Sikri - interrelationship of courts. [Layout responds to functional requirements]

1) Meeting place with the common people and the soldiers – Diwan-e-Am
2) Meeting place with the ministers, privileged noblemen, and high officials – Diwan-e-Khas.
3) King's day palace and sleeping quarters – Khwabagh.
4) Enclosure for imperial ladies (private and strictly guarded) – Maryam and Jodh Bai palaces.

This elegantly designed mosque, an expression of architectural grace and perfection, stands witness to Islamic artistic design and craftsmanship. It is one of India's finest and largest mosques built in the traditional 'maqsura' pattern (Fig. 10). It can accommodate at least 10,000 persons at a time and is surrounded by an arcade decorated atop with small kiosks. Its general design is purely Islamic, excelling in its rich decoration of carving.

How could Akbar ever forget Salim Chisti, the saint who foretold correctly the birth of his long-awaited heir? The exceptionally beautiful tomb of Salim Chisti thus occupies a vital position within the courtyard of the Jami Mosque (Fig. 11). It consists

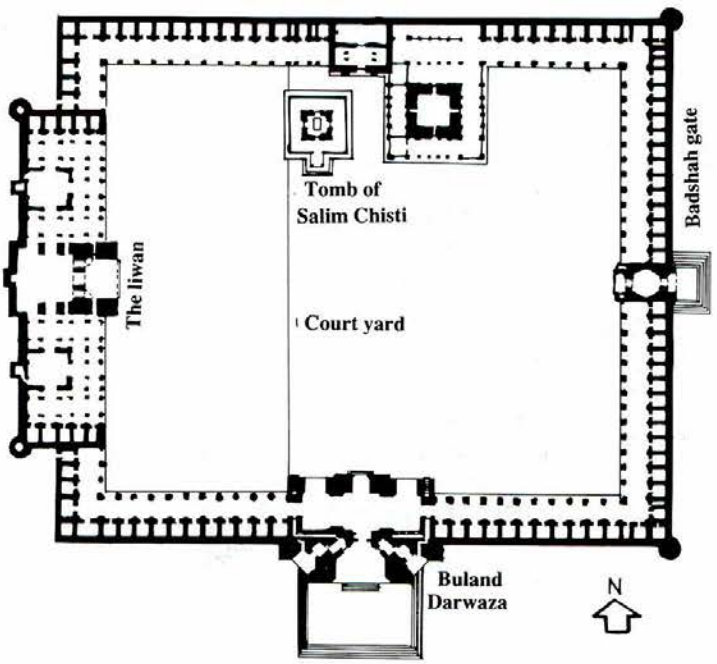

Fig. 8. Jami mosque: an expression of architectural grace and perfection.

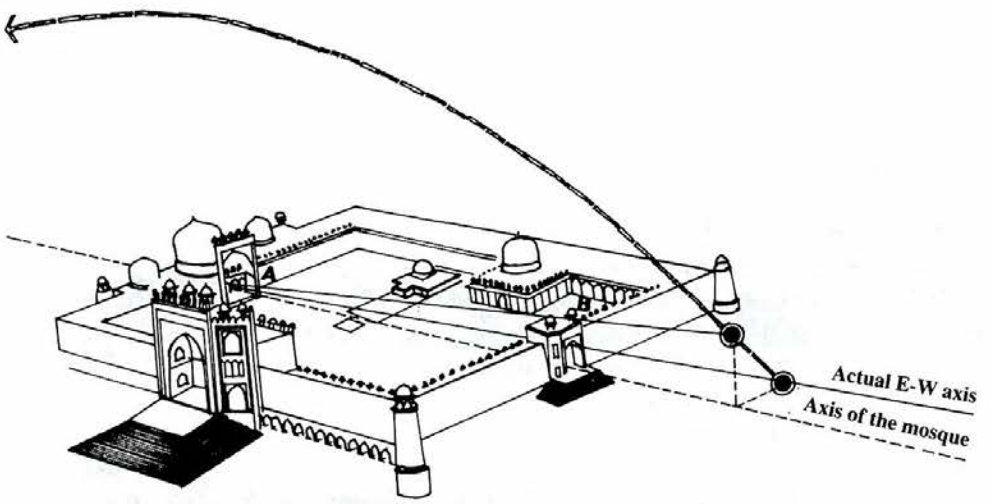

Fig. 9: In the Jami Mosque, the actual East-West orientation is a few degrees North to the axis of the mosque. As a result of this at sunrise and during a specific period of the year, the sun moves into a particular position over the axis of the mosque. It reaches the required altitude and strikes the central Mihrab (A) from in between the two Kiosks (B) i.e., Chatris over the Badshahi gate.

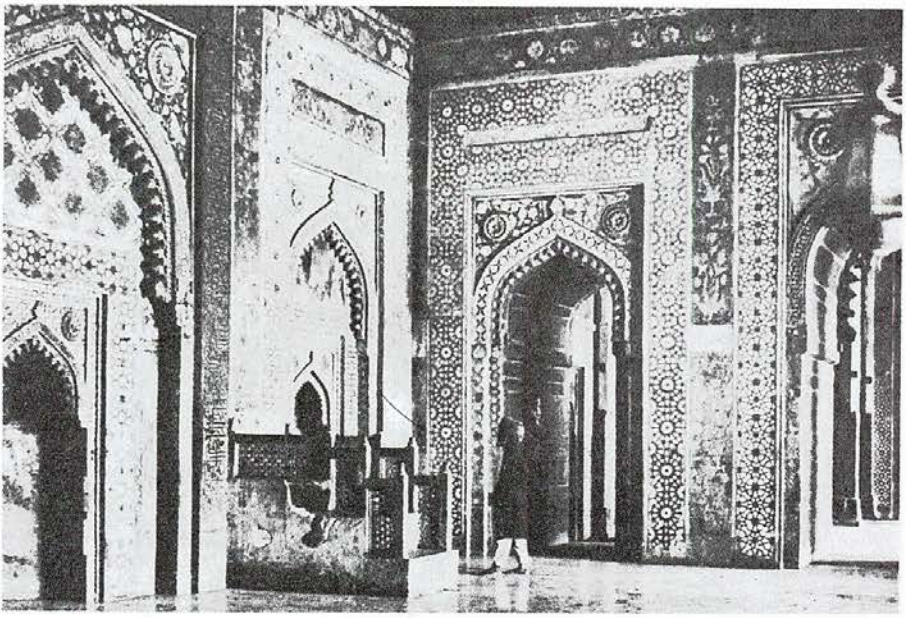

Fig. 10. Jami Masjid – interior of sanctuary

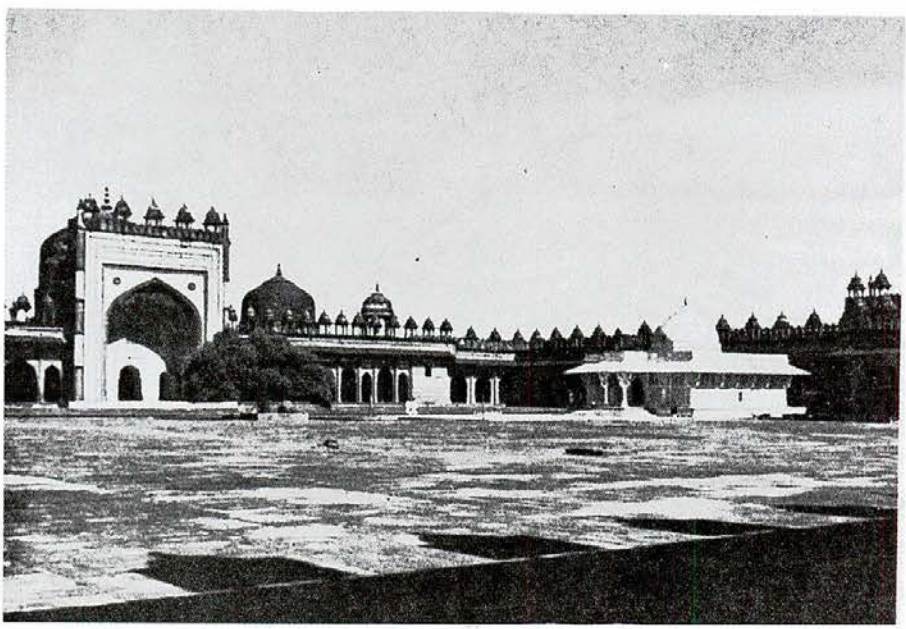

Fig. 11. Salim Chisti's tomb in the courtyard of the Jami Masjid.

of a square exterior of about 8 m on each side and is built in white marble, complete with intricate carving and exquisite features such as honeycomb capitals and brackets (Fig. 12). The use of white marble produces in strong sunlight a wonderfully luminous sheen. Together, the Jami Mosque and the Salim Chisti's tomb "combine the warmth of red sandstone with the grace of white marble, each showing off the qualities of the other to perfection" [5].

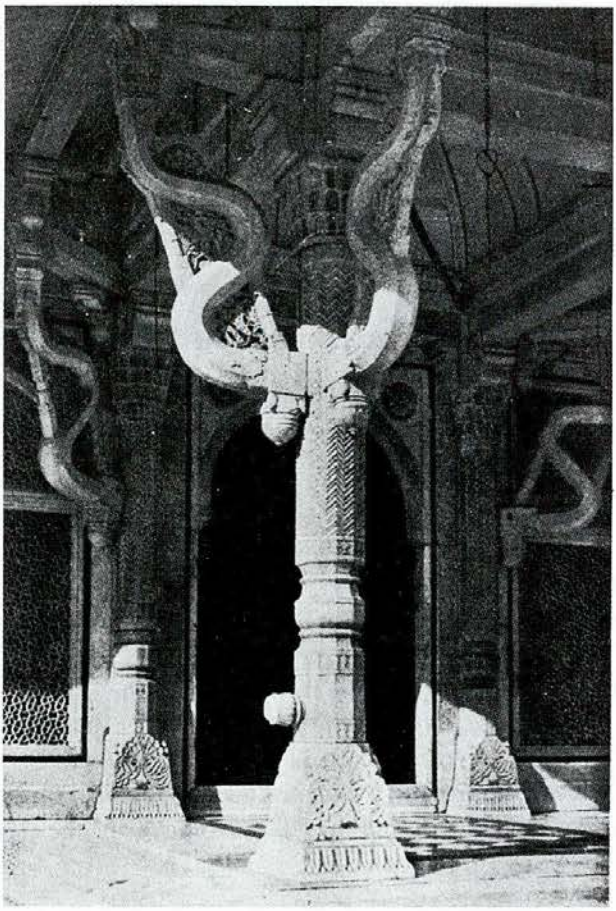

Fig. 12. Salim Chisti's tomb: pillar of portico:

Finally, turning to some other notable structures of Fatehpur Sikri associated with the Jami Mosque, 'Buland Darwaza' (Gate of Magnificence) deserves special mention (Figs. 8, 13-16). Facing the Holy Makkah, it is the main gateway to the cour-

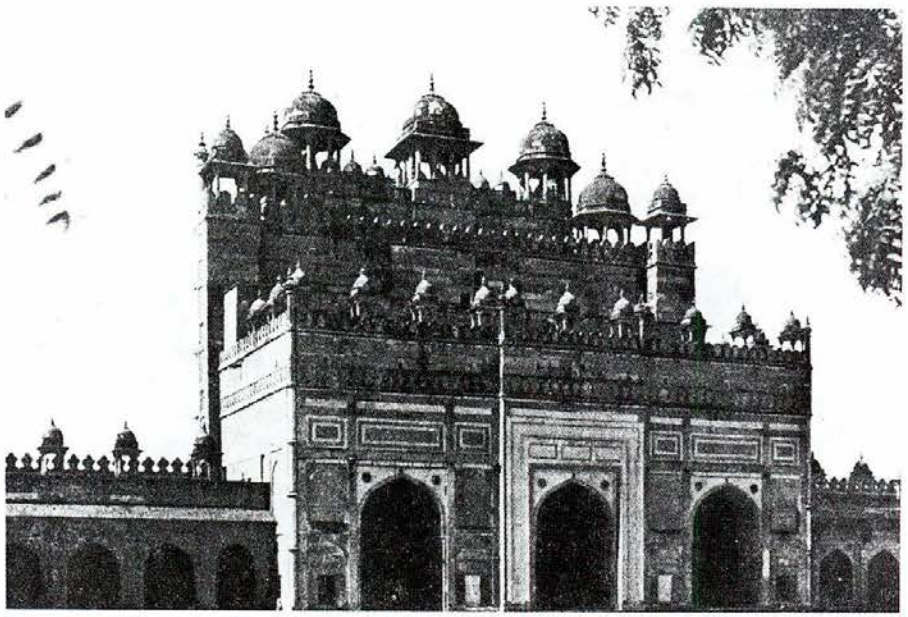

Fig. 13. Interior facade, Buland Darwaza facing North

tyard of the Mosque and was erected to commemorate Akbar's conquests. It is a most imposing structure of immense proportions "with a height of 40 m and a front of 39 m approached by a steep flight of steps almost 14 m high so that it rises 54 m from the road level" [2, p. 97]. It represents the building art in a grandiose mood, majestic and purposeful. Its basic form is semi-octagonal (plan in Fig. 15), projecting beyond the wall of the courtyard (the octagon symbolizes Islamic civilization).

The ornamentation throughout the front facade of the Buland Darwaza is rich and varied, consisting of patterns in white marble inlay. The majestic facade is an invitation to all, living in the town near and far, to walk along its steps until you arrive at the huge entrance platform. You are invited here by an elegantly designed mosque set in a courtyard of great dignity and spaciousness conveying the message 'here you enter the House of God'.

Mathematical system in Islamic architecture

The system of measurement based on a constant awareness of the proportions of the human body and on principles of geometry are the key factors applied in Islamic architecture, in fact in all their creative work. Besides, of no less significance

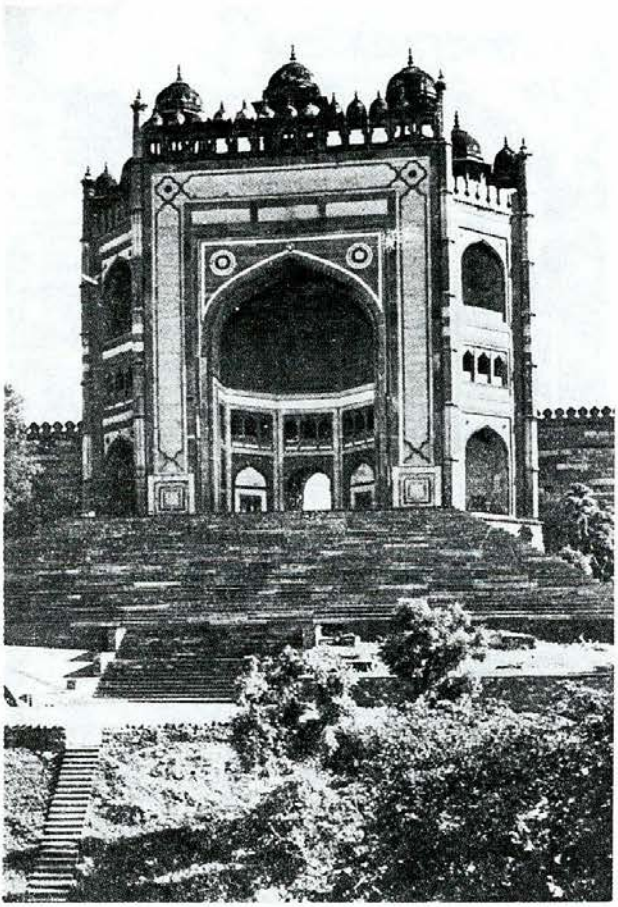

Fig. 14. Exterior facade, Buland Darwaza, facing south

is beauty (aesthetics) in architecture, which comes essentially from proportioning, and proportioning also results from geometry.

"The square and the circle, and their immediately related shapes are the simplest, most perfect and stable geometrical forms found in nature. These symbolize the perfection of God and His Universe" [6, p. 74]. Therefore, in Islamic architecture, the mathematical system, based on geometry, is established by the application of square and an axis, besides the concept of centerality.

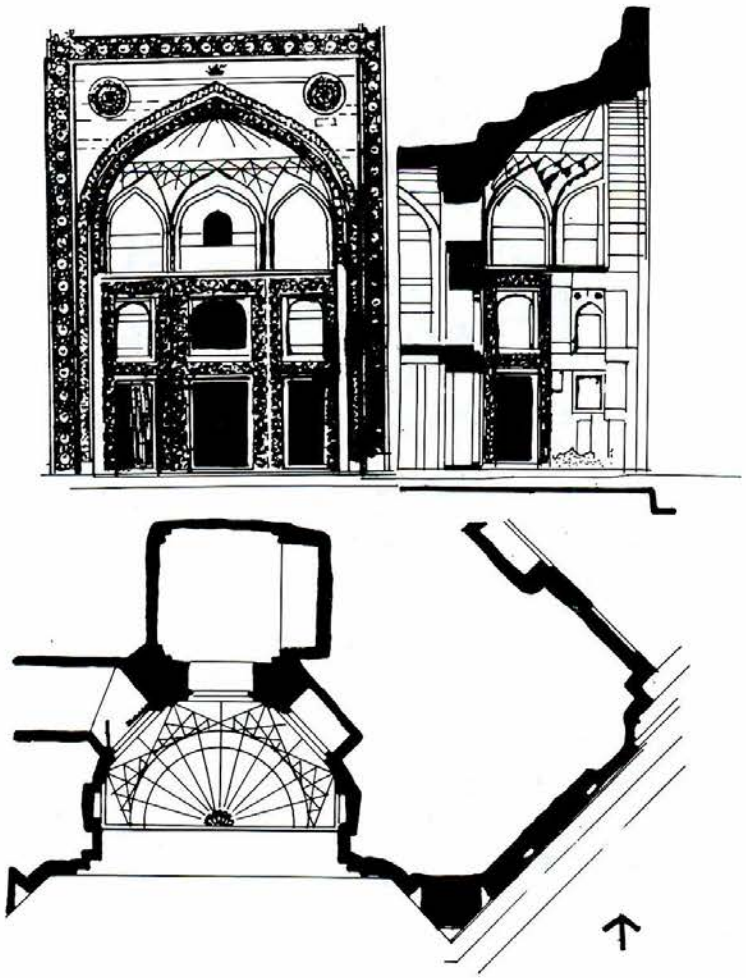

Fig. 15. Buland Darwaza (main gate to the Mosque) : A masterpiece in Islamic architecture

The application of square as a generic unit brings the relationship between all parts, from the smallest to the biggest dimension. It regulates not only totality, but also achieves unity in the overall composition. "In three dimensional space, six squares form a cube and become the space enclosing elements. A dome resting on the cube is the space covering element. Therefore, the dome over a cube is a typical generic unit in Islamic architecture" [7].

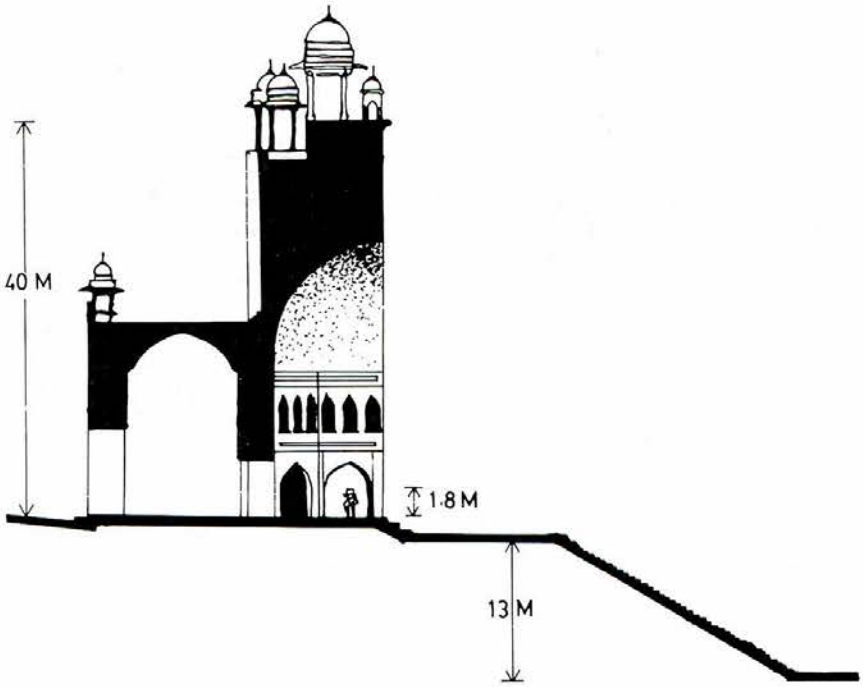

Fig. 16. Enlarged section through Buland Darwaza showing relationship between "man height passage-way" and the "great alcove above"

The following two plans of the Jami Mosque complex in Mandu, and in Ahamdabad, India exemplifies application of the square as a generic unit (Fig. 17).

Mathematical system in the design of Fatehpur Sikri

The spirit and guiding force of the design of Fatehpur Sikri was in the tireless efforts of Akbar and his architects to bring to light once more the beauty and purity of Islamic artistic wisdom. The design rationalism was developed on the basis of a mathematical system–proportions, rules and measures - in which the use of the axis and the square predominates.

It is important to realize presence of the two mosques, the 'Salim Chisti's mosque' and the 'centeric mosque' (a & b respectively in Fig. 18). The first mosque was constructed by the local stone-cutters around the little cave of Salim Chisti, as a grateful gesture to the saint. The second mosque (centeric mosque) was already in

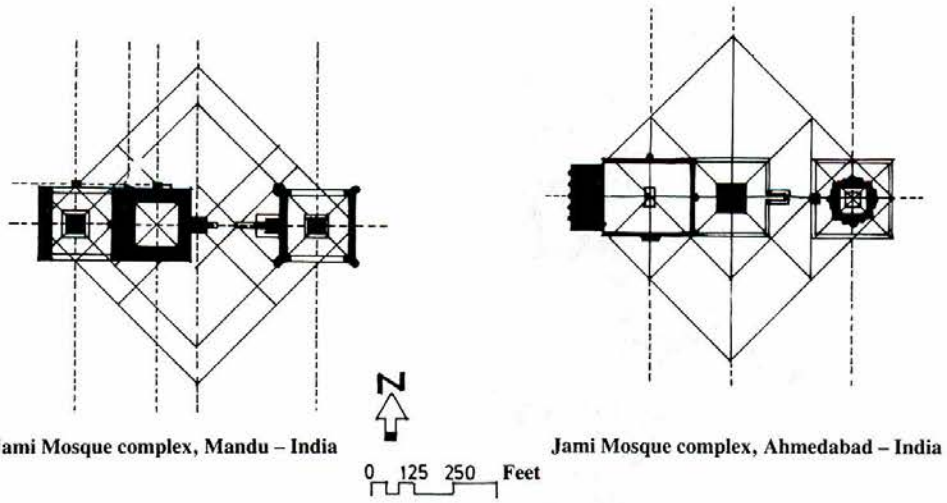

Fig. 17. Application of axes and square as a generic unit in Islamic architecture

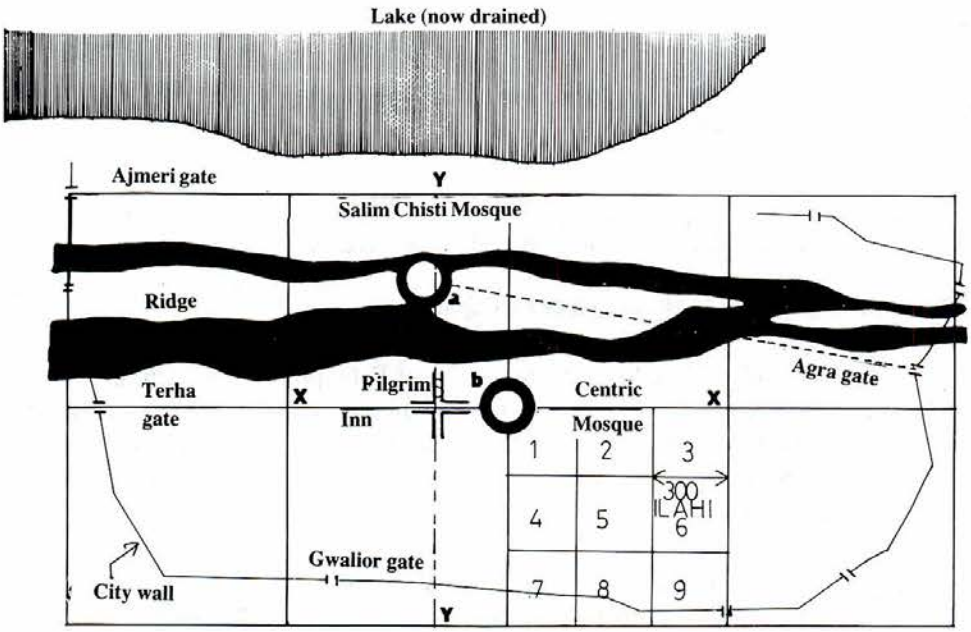

Fig. 18. Layout based on modular grid as derived from position of the two Mosques

existence, not very far away from the days of Salim Chisti. This mosque as the focal point of the city (Fig. 19), together with the Salim Chisti's mosque marked the beginning of a rational design approach of Fatehpur Sikri.

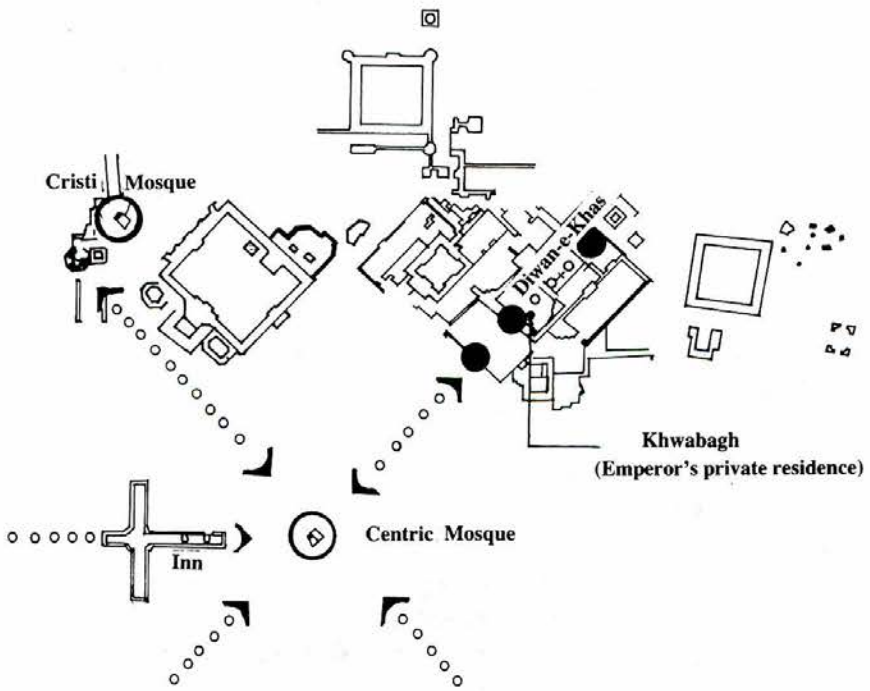

Fig. 19. The centric mosque also provided a visual focus and guided the location of several important buildings. For example, Diwan-e-Khas and Khwabagh (Emperor's private residence) and centric mosque are all in one axis

The city form was geometrized with the introduction of an axis xx [Fig. 18] from the Centric Mosque parallel to the axis of the ridge. A second axis yy, was introduced from the Chisti's Mosque at right angles to the first axis in order to determine the location of a cross - shaped 'Caravan Sarai', an inn or resting place for pilgrims consisting of rows of rooms with open terrace built around a square courtyard. The axes therefore generated a comprehensive relationship of the three structures with one another. The distance of the inn from the Centric Mosque measured in units of Akbar's time, is 300 'ilahi gaz', where one 'ilahi gaz' equals one royal yard, equivalent to 30.75 inches or 78 cms. This measurement became the dimension of the

square module applied to determine the location of important structures and the main elements of the city. Petruccioli has further analyzed that "the whole city, the sweep of the walls, the opening of the main gates, and the road network, are based on a grid of 8 squares of 1,000 'illahi gaz', equalling 20 'tonab' per module. Each of these in turn, through a grid based on sub-modules of 500 and 250 'ilahi gaz' (20 and 10 ban, respectively), sets the dimensions of the different districts and the architectural structures" [8]. To put it in another way, the territory was divided into 8 super-squares, each of which was then divided into 9 smaller squares of sides measuring 300 of the above units (Figs. 18 & 20). Each of the nine modular squares was further divided into sub-modules. Therefore, a grid of 9 squares applied both horizontally and vertically, together with a network of super squares was instrumental in establishing a well articulated form of the city.

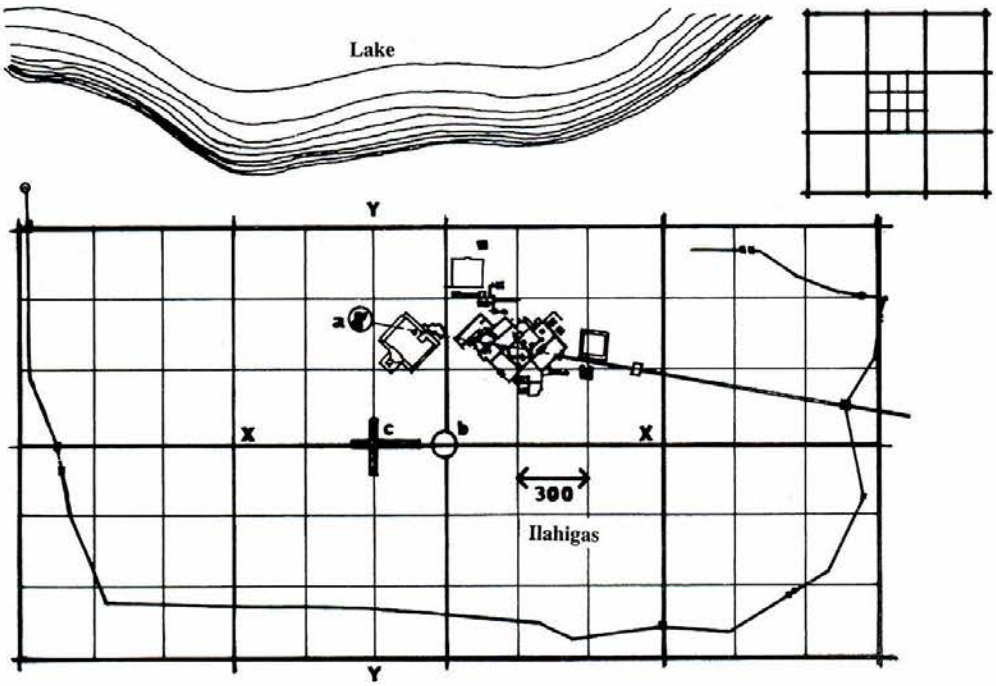

Fig. 20. Royal palace complex and the Jami Mosque in relation to the location of two mosques, a&b, and the inn marked c. Top right shows division of the modular grid into nine squares.

A number of conclusions may be drawn from these analyses. Firstly that the modular grid, developed from an axis and the square, which became a systematic design instrument at all scales, has given the city a powerful, dynamic and harmoni-

ously unified form. Secondly that the modular grid was developed with utmost sensitivity and imagination. It was flexible to adjust to changing situations. Several factors, such as the orientation of the Jami mosque in the direction of the Holy Makkah and topography of the ridge for example, were important considerations. Finally, the city form developed over a period of time from the site itself rather than having been based upon a preconceived plan imposed on the site. The planning was not governed by the whims or tastes of an individual.

Application of the axis and the square: other examples

The application of the nine modular squares in architecture and planning of cities has been an old tradition in India. For instance, in the planning of the 18th century city of Jaipur, the layout was divided into nine super square blocks, which were determined on the basis of main roads and other factors (Fig. 21). The city center is located in the central square with residential and related functions distributed in the remaining eight squares.

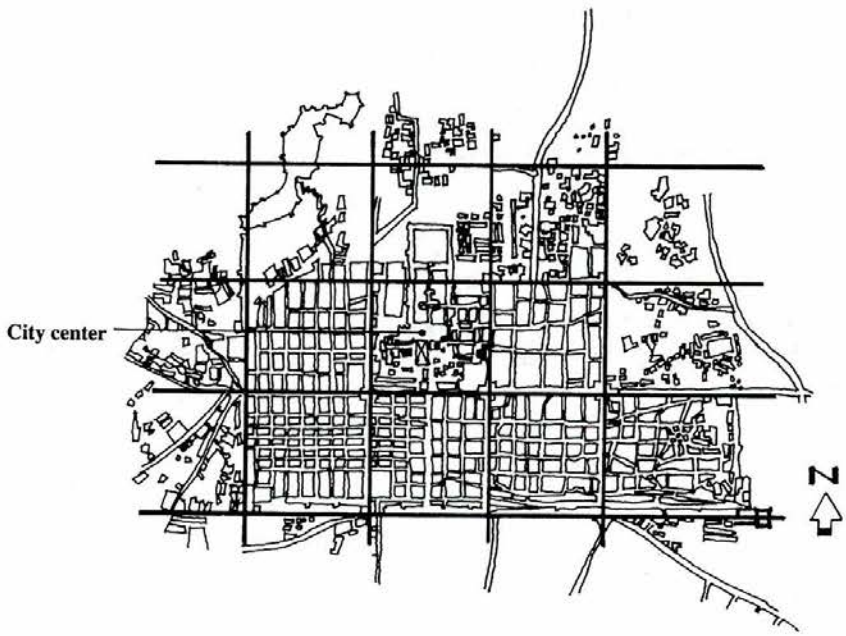

Fig. 21. Plan of Jaipur based on nine modular square

The planning of Shahajahanabad (old Delhi), built by Akbar's grandson, Shahjahan, about 70 years after the founding of Fatehpur Sikri, is also based on eight super squares, each comprising nine modular squares (Fig. 22). The location of a number of city gates, as in case of Fatehpur Sikri, is also determined by the super grid [9].

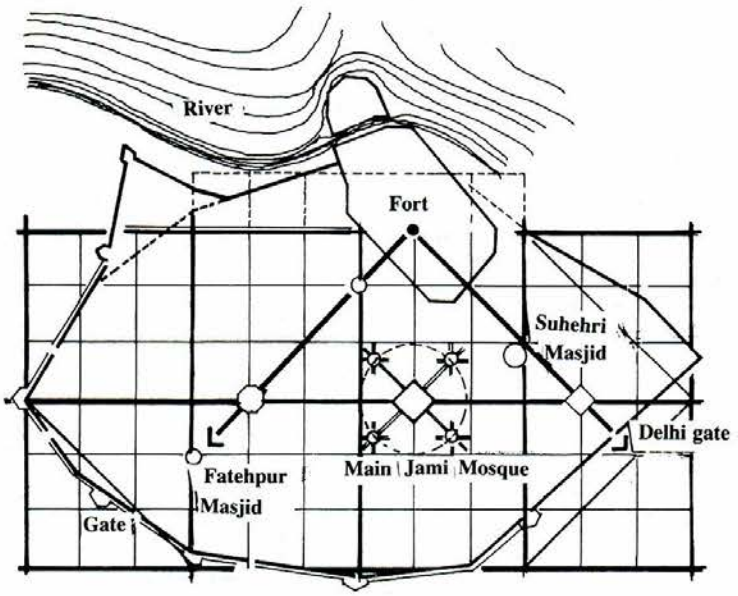

Fig. 22. Plan of Shahjahanbad (Old Delhi) based on eight super squares

Another characteristic example of Mughal architecture and planning may be cited of the Humayun Tomb, in Delhi, in which harmony is established in the layout of gardens with the application of the nine square modular (Fig. 23). The Tomb is located on a raised ground in the central square of the nine square grid, flanked by a formal layout of gardens in the remaining eight squares. The geometry rationalizes with the environment.

Earlier, the Arabian mathematicians with originality and spirit of independence had most admirably developed and applied the nine square grid in architecture and planning. They discovered that by the application of numerals 1 to 9, "numerical relationships reveal artistic relationships and characteristics, and visual forms and patterns" [9, p.30]. They had calculated harmonic proportions and developed design theories to guide the thought process of generations to come. The result of their

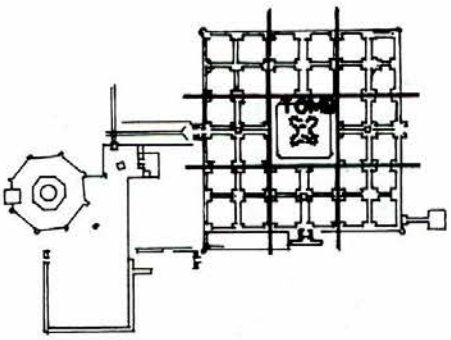

Fig. 23. Plan of Humayun Tomb, Delhi, based on nine square module.

pioneering work has become the hallmark of Islamic architecture itself, and have led to birth of some of the best designed buildings in the world.

Geometry of multiple axes

In a geometry of interlocking axes (Fig. 24), the two major axis, A3 and B6, meet in the middle of the main court (Mahal-i-Khas), and sets an order of inter-relationship. The individual elements have their own axis and having been connected with the two major axis, play a subordinate but supportive role in an overall spatial organization. Diwan-i-Khas, perhaps the most important structure in the main court, is located at the meeting point of the axis A1, and B6. Axis A2 passes through the emperor pavilion located on the west of Diwan-i-Am to meet the main axis B6, where the game court (pachisti court) is located. The square platform in the middle of the pool from where Tansen, the famous singer in the royal court used to sing, is located at the crossing of axis A3 with B7. Axis A3 is further extended towards west to meet axis B5 to determine the location of a square court. Maryam house, an important structure in the palace complex, is located in the middle of this court.

Axis also defines privacy values by locating private functions such as royal residences, pavilions, halls and meeting areas in the central core, and public activities on the periphery of the palace complex.

Axes, however, have not led to symmetry or to an identical visual perspective on either side. Although several of the buildings are symmetrical in design, their spatial setting is non-axial. In fact "they might be defined more as balancing axes than as symmetrical ones" [8, p. 59]. Uniformity in design is considered fatal to the freshness of imagination.

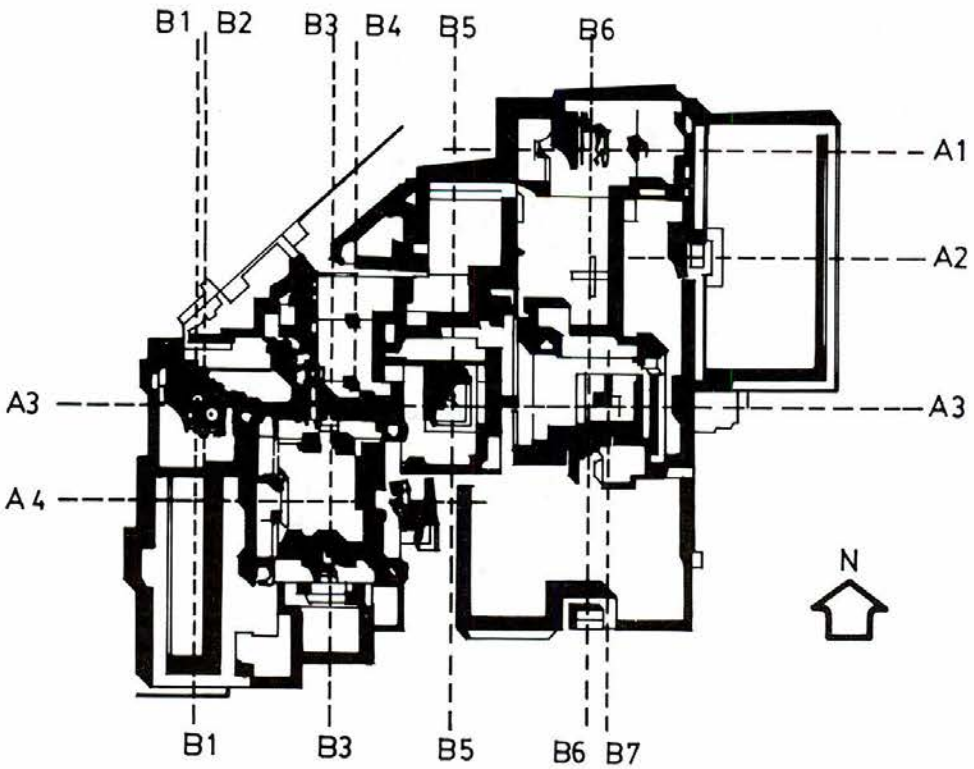

Fig. 24. Geometry of multiple axes: the two major axes A3 and B6 set on order of interrelationships; other axes play a supportive role in the spatial organization.

In conclusion, therefore, axes connect the buildings visually giving a sense of unity and balanced co-existence within one ensemble.

Geometry of ratios

Turning the pages of history, thoughts expressed and theories advanced by the ancient Greçk and the Renaissance scholars and architects on the harmonic proportions of design in architecture are among the most influential today.

Greeks were always concerned with perfection and aesthetics. They applied principles of optics and mathematics in pursuit of the perfection of form. The Parthenon in Athens is perhaps the best example of the Greeks' perfection and perception. In the 'Metapyia', Aristotle has written that the forms of the major elements of

beauty and harmonious relationship between parts are 'Taxis', 'Symmetria', and 'Horismenon'. These find clear expression in the mathematical system in architecture followed by the Greeks. Taxis means order; symmetria implies measured together to indicate the total division of the whole into parts on the basis of module or fixed dimension or volume; and, finally, Horismenon implies restriction or limit due to varied factors (topography, for example).

Later, Renaissance scholars and mathematicians also advanced theories on the harmonic proportions in architecture and planning. "Proportions for architectural works, cities, squares, and nearly everything in art could be reduced to geometric form – the basis for which was, in theory, human form" [6, p. 74]. In contemporary architecture too, Le Corbusier, for example, based the modular system, which was the guiding force of his work, on harmonic proportions derived from the human form.

These observations point to the fact that certain numerical relationships manifest harmonic structure in architecture. This is established by an analytical study of Diwan-i-Am, one of the main courts in the palace complex, in which numerical relationships occur in a geometric series (Fig. 25).

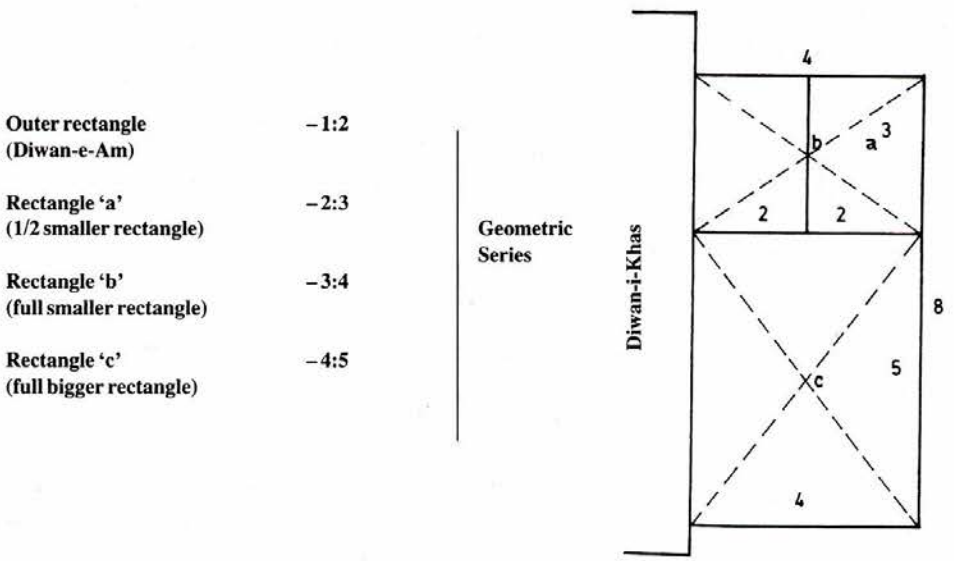

Fig. 25. Geometric series in Diwan-i-Am.

Aesthetic vision

The intellectual mathematical system is complemented by the aesthetic qualities of a sequence of ordered, but diversified, spaces of extraordinary quality.

On approaching the city in silence, and on entering the core of the city on foot through the gates [r and s in Fig. 5] of the two courts, Diwan-i-Am, and Diwan-i-Khas, you are impelled forward with an irresistable urge. Moments later, you are strolling in a world of spaces with promise of free unconfining continuity. With a surprise approach, there is often an explosion of space. With sharp transitions, there are soft and subtle changes. With vertical space seemingly infinite, horizontal space is shuttered by screens veiling covered walls.

It appears as if a big house is cut into visually digestible and coherent spaces. Scaled to people on foot, every place and every space offers an overall sense of 'being'. You are then part and not apart of this powerful and beautifully constructed drama of buildings and spaces.

Feelings of anticipation, suspense and surprise are engendered. Everywhere through the great courts, through doorways and openings of various sizes and set at different levels, the eye catches a memory of what has been passed and a hint of what is yet to come [10]. One can rarely see the entirety of the core of the city as one enters its gates or at a particular point within it. With every step and bodily movement, the invisible becomes visible. With a series of partial revelation combined with the absence of symmetry, the viewer's attention is directed not so much on the form of the building or the space as to the experience itself. The viewer mentally completes the incomplete in relation to himself but according to his own pace and at his own will. Such an emphasis on movement and partial revelation makes the city a dynamic event rather than a static object.

The essence of design therefore is the "excperience itself which one enjoys not at a particular stationery point (thus from a static view point) but as seen and experienced by a moving eye without being filtered by a limited subjective perspective. In fact there is no concept of the single view point; the eye is not pinned at a single point" like a pin pinned to a drawing board "or to view in a single direction. The concept is neither towards development of a linear perspective nor of the single vanishing point" [1, p. 127]. Our eye does not really work this way. It is moving, sometimes slowly, sometimes in a swoop. The vision is changing and broadening as the eye is moving.

This is a useful reminder to architects and urban designers that architecture can only be appreciated by movement around and through it. If we stop at one point, we no longer have architecture but merely scenic design. Undoubtedly, this is an overwhelming message of Fatehpur Sikri.

The aesthetic vision is further enriched by the inner details and build up of visual forces in the architectural detailing. A general overall unity is achieved in the structural system by surface decoration and, at places, with stylized Arabic calligraphy. An order and rhythm in the individual facade of buildings further result from repetition of identical architectural features such as ornately carved stone brackets, projections and balconies besides extensive use of red sandstone not only in buildings, but also as floor paving in the open spaces. In addition is repetitively used intricately carved stonework using geometric and floral patterns, besides stone-inlay work which is typical of Islamic architecture.

Practical Conclusions

The design of Fatehpur Sikri is a combination of mathematics and aesthetics. The emperor worked with the imagination of a true artist and with a mathematician's mind to produce a city of great promise and accomplishment. A lasting symphony of architectural and space forms, the city sits like a mathematical theorem in the middle of a beautiful sepia landscape of a rocky ridge.

A clear perception and application of the science of proportion, clarity and harmony are at the heart of a beautiful and functional architecture, so convincingly established in Fatehpur Sikri. In contemporary architecture (including planning and urban design), this implies a keen sense of order as integral. An order apprehended by reason and executed by science in which the integrity of the parts – function, aesthetics, materials, form, nature – are in themselves interrelated. Besides, we must demonstrate in our present day conception of architecture, concern for unity and harmony, qualities of proportion, rhythm and respect for nature and its elements, precision of details, interplay of solid and void, enclosure and privacy, transparency and repose.

These indeed are the great necessities of contemporary architecture. But, perhaps, not many architects have approached architecture with this ideal. Many of the buildings designed by them are pretty rare and unworthy to stand along with architecural accomplishments of the past. Contemporary architects might therefore be inclined to rethink about architecture. The question before us is: what kind of architecture? And how many kinds?

We might then begin with a new investigation and re-examination of what modern architecture is lacking. It is true that contemporary architecture is not to be imposed either with traditions or with traditional forms. Nevertheless, contemporary architecture should draw its character and consistency from its local context. The real test of our ability is therefore in creating an architectural atmosphere which would reflect our cultural and traditional values and, at the same time, form a happy combination with high technology and other necessities of contemporary living. Hopefully, the architecture so produced would be far more functional and beautiful and appropriate to its traditions and relevant to its future. The relevance of the design of Fatehpur Sikri, particularly in a large scale urban development, is also quite significant. The development on a human scale with a framework of meaningful composition of spaces that can effectively generate and accommodate a multiple of activities and, at the same time, bring in vitality is what we should strive for.

To this end, with an attitude of optimism, the magnetic attractions of the design of Fatehpur Sikri would continue to inspire us in works of ours. Today Fatehpur Sikri is still our teacher. The lessons we get, we may pass them on to succeeding generation of architects.

Credits and Acknowledgements

Photos

[Figs. 6, 10, 11, 12, 13, & 14] – Brown, P., 'Indian Architecture (Islamic Period)', Bombay, Taraporevala Sons & Co., Pvt., Ltd., 1975, (plate nos. Lxxi to Lxxiii);

Drawings

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النسبة الجمالية والرياضية في العمارة الإسلامية بمدينة «فتح بور سيكري» بالهند

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ملخص البحث. العمارة الإسلامية أسست منهجًا متميزًا مبنيًا على الانضباط والنظام المستمد من العلوم الرياضية والنسب الجمالية المكملة لبعضها البعض.

ويمكن استخلاص ذلك من الدراسة التحليلية واقتفاء الأثر لبعض الحقائق المجهولة عن تصميم مدينة «فتح بورسيكري» المدينة الامبراطورية التي شيدت حوالي ١٥٧٠ ميلادية بالقرب من مدينة آجرا في الهند. هذا الإنتاج الكبير والمبدع كان دون شك أعظم الأعمال المعمارية طموحًا لامبراطور المغول الثالث (أكبر) بعد تاج محل أكثر المباني والإنجازات عظمة في امبراطورية المغول. وبهذا الفن الإسلامي الرائع والرقيق أصبحت المدينة أسطورة فنية. فهي باختصار قصة ذكية وحية تثير في عقولنا سحر التاريخ الماضي وفتنة الأسطورة التي تشحذ الخيال.

فالعمارة وتخطيط الفراغات المدهش لمدينة «فتح بور سيكري» يحمل رسالة للمصممين المرهفين والمعاصرين. والبحث عن هذه الرسالة هو نقطة انطلاقنا نحو إنجازاتنا المستقبلية، وهو موضوع هذه المقالة.