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Scenic and Scientific Representation of Water in Mughal Architecture: A case study of ShahJahan's Quadrangle Lahore Fort, Pakistan

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Abstract

Nothing is useless in this world. Everything has its specific purpose and objectives with respect to its importance. The present-day hardware and materials utilized as a part of building swallow noteworthy measure of our national vitality. Ancient monumental buildings and palaces are still a place to relax without fans, coolers and air conditioners. There is a need to study the traditional buildings because they are time-tested. Mughal Architects are legendary for their creativity. Without beauty, architecture would just be the combination and amalgamation of some material. Hence, art is the soul and spirit of architecture. Mughal Architecture is the example of "Feeling of Wonder" that is the source of aesthetic experience. Mughals showed the great skills in infusing the Islamic idea with local tradition. Water has had been an important element in Asian culture and architecture. Water is an architectural element that is extensively used in our ancient buildings and in the garden of the Mughals. Water not only pleases the eye on a hot summer day, but also provides passive cooling. This paper deals with the utilization of water not only for the purpose of beautification of the site but also for studying the scientific utility of water. This study is a mixture of basic and applied methods according to architectural research methods. The study in this research will show how Mughals used water as an eminent representation of undaunted Mughal mastery in retaining and regulating the temperature along with the beautification purpose via fountains, water channels, and pools.

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Keywords

Water; Architecture; Mughal

1. Introduction

In the West, the term "MUGHAL", usually spelled Mogul, means a man of great power (Robinson, 2006). In the seventeenth and eighteenth century, the great Mughal empire seemed like a wonderland of fabulous wealth, priceless jewels, and gold treasures. The term Mughal still signifies power and wealth. It is also said that no other dynasty in the Islamic world has left behind more comprehensive documentation in the history than Mughals (Schimmel, 2004). They not only left a history of power, wars and treasure but immense art and architectural treasures were also their marks. Mughal architects are legendary for their creativity. Mughal Architecture is the example of "Feeling of Wonder" that is the source of aesthetic experience. The great skills were shown by Mughals in infusing the Islamic idea with local tradition. Water has had been an important element in Asian culture and architecture. The idea behind this research is that "Mughals utilized water for aesthetic purposes via its scientific

utility". The question designed to study is: Is the utilization of water by Mughals in Lahore Fort still an eminent representation of undaunted Mughal Architectural mastery in retaining and regulating the temperature along with the beautification purpose via fountains, water channels, and pools? The research will be qualitative as it will be subjective and will assess water in terms of its technical functions as well as its use as a beautification method. This research will follow the inductive process covering a little about Mughals, their architecture, Lahore Fort as a breathtaking symbol and then focusing on Shah Jahan's quadrangle as a case study.

Lahore

It generally lies between north scope 30 degrees – 38' and 31 degrees- 44' and east longitudes 73 degrees – 38' and 74 degrees – 58'. It includes the entire plain nation lying between the Ravi River on the north and the Sutlej on the South and has the state of a general quadrilateral titled in the general northeast and south west bearings of the river (Fig 1).

1.1. History of Lahore Fort in Mughal Period

“ The Lahore Fort is one of the noblest structures of its kind on the planet. Ascending out of the north-west of the walled city, it has been an image of its most punctual days. On the off chance that it could talk, it would tell such things that would spellbind the audience. It could recount love, sentiment and enterprise of dim looked at wonders and furious browed warriors, of rulers in streaming silks and lords in sparkling protective layer, of writers, performers, slaves and mistresses, of fighters and descendants, of transformations and court interest, of crowning ceremonies and deaths, of foul play and dark requital” (Qureshi, 1998)

a.Location:

The Lahore Fort is situated on the left bank of river Ravi and in the northwestern part of the walled city. The site is ideally located at the intersection of the ancient north-south riverine route which used to run parallel to the river Ravi and east-west hinterland route connecting Kabul with Delhi. (Ed Muhammad Naeem Mir, Mahmood Hussain, James L. Wescoat Jr, 1996) (Fig 2)

b.Significance:

The Lahore Fort is basically the key site to study Mughal Architecture as it contains buildings starting from Akbar's reign till Shah Jahan's reign. It covers the complete history of Architecture from 10th century onwards to the extinction of Sikhs and occupation of Punjab by the British.

There are five main quadrangles in Lahore Fort.

Diwan-e-Aam quadrangle, Moti Masjid Quadrangle, Jahangir's Quadrangle, Shah Jahan's Quadrangle, Paien Bagh quadrangle. The focus of the research will be Shah Jahan's Quadrangle (Fig 3)

Shah Jahan's Quadrangle

2. Shah Jahan's Quadrangle

Immediately west of the Jahangir's quadrangle is located an open court enclosed with buildings of the period of Shah Jahan on all the four sides. It is thus known as Shah Jahan's Quadrangle that has some of the most beautiful places manifesting the pinnacle of the Mughal art of architecture inside it. Shah Jahan is known as the royal builder and he can really crown the architectural domain of Mughal history by virtue of his contribution to palaces, forts, tombs etc. Under his reign, the Mughal architecture took on a new aesthetic and entered its classical phase (Chaudhary, 1991) (Fig 4).

The building in this quadrangle includes the *Diwan e Khas* on the north and Shah Jahan's sleeping chambers on the south. The open courtyard in these buildings has been designed based on the formal *Charbagh* style by dividing it into four by means of walkways, with a square-shaped platform serving as *Mahtabi* in the center. The charbagh has been converted into grassy lawns now (Khan). The raised platform has a shallow cistern in the center while a fountain occupies a central place in it (Nadiem, 1996).

2.1. Diwan e Khas (Hall of Special Audience)

It is situated in the northern part of Shah Jahan's quadrangle. This hall was built in 1645 A.D. This graceful pavilion is 53'x 51' and 20 feet and 4 inches in height depicting a perfect example of refined Mughal architecture. It was placed on a raised platform having the qualities of lightness and freshness because of the grills facing the riverside with openings all around (Fig 5).

2.2. Khawab gah e Shah Jahani (Sleeping Chambers of Shah Jahan)

It is situated south of the Shah Jahan's quadrangle. It is known as the sleeping chambers of Shah Jahan. The Khawab gah has five spacious rooms laid along an east-west direction opposite to *Diwaan e Khaas*, the front of which had grand multi-cusped arched openings. The projecting portico on the northern side has been cut off now leaving only the foundations of the walls through the fountain in the cistern still remains at the central place (Kombo, 1994) (Fig 6).

2.3. Lal Burj (Red Pavilion)

It is situated on the north-west corner of Shah Jahan's quadrangle. This summer pavilion is octagonal. It was built between 1617 and 1631.

2.4. Hammam e Shahi

Hammam e Shahi or the royal bath is situated at the west of sleeping chambers of Shah Jahan. It is a single storey structure symmetrically designed on a longitudinal axis.

2.5. Khilwat Khana (Room of solitude)

A general tradition was that the Mughal emperor did not generally reside in the harem, but in a separate court adjacent to it. It was constructed by Shah Jahan in 1633 A.D. The court of Khilwat Khana was divided into two parts:

I) Paien Bagh (South)

The chief characteristic of this garden was the provision of a number of paved paths and walks. A spacious platform in the middle of the garden was the provision of a number of paved paths and walks. A spacious platform in the middle of the garden, in cut and dressed brickwork with a water basin in the center enhances the beauty of paien bagh (Fig 7)

II) Emperors Private residence (North)

A small door opening from the garden areas leads to the adjoining second court which has a small but elegant curvilinear pavilion on the north. A deep tank with a fountain is set in the center (Fig 7)

3. Scenic and Scientific Representation of Water

The architecture of any time depends on two main concepts:

- a. The needs of the people
- b. The idea of beauty prevalent during that period

Kant suggested beauty as a distinct and autonomous employment of the human mind comparable to moral and scientific understanding (Scruton, 1979). Among many other assets, the architecture of Mughals is admired worldwide because it was the product of experiences based in the field of geometry, hydraulics and other building scenes. New eras in refinement were at their peak in the Akbar's era but Shah Jahan's style and traditions in architecture

created wonders. Today, the eye-catching and splendid cultural and historical buildings, along with the services, also gratify the eye (Abdul Rehman, Munazzaha Akhtar, 2012).

Landscaping is an integral part of Mughal monuments. Trees, green areas and water bodies in and around the building improve the physical comfort along with pleasure (Mittal, 2010). Great skills were shown by Mughals in infusing Islamic ideas with local traditions. They used hydraulic features to promote landscape design. According to the researchers, landscape designers and microclimate control experts, the water bodies like fountains and water channels were added in the buildings which pass through the internal buildings to modify the internal environment (Mittal, 2010).

The evaporation of water is useful in hot and dry climates because it raises the level of humidity. Water has a moderating as well as regulating effect on the air temperature of microclimate. It retains very high thermal storage capacity, much higher than the building material like brick, concrete, and stone. It also has a cooling effect on environs. The heat is taken up from the air through evaporation and causes significant cooling. Wind direction is an important factor in technique and science as well. The wind direction of Lahore varies with the weather. In winter it is from North East to South West. In summer it is reversed i.e. from South West to North East.

Water is an architectural element which is extensively used in our ancient buildings and in the gardens of Mughals. Water not only pleases the eye in a hot summer day but also provides passive cooling. Water improves physical comfort by the evaporative cooling of the surrounding air. The rate of heat loss from the moving air depends on the area of water in contact with the air and the careful zoning of the sheltered spaces so that strips of the water could be strategically placed around the structure (Mittal, 2010).

A water pool in the middle of the courtyard with maximum dimensions stores the solar energy and decreases the heat of the summer. This pool (Fig 10) along with gardens, trees, and the boundless sky provide limited but fresh nature. Evaporation from the surface of the building or from objects within the interior can produce a cooling effect on the buildings, which reduces heat (Samadi, 2014). Evaporative cooling is also the part of the internal environment in Mughal architecture. It had not been an element of external spaces. The process is simple; air passing over water causes evaporation, and as the result of this process heat is absorbed and the air is cooled, increasing air humidity. So, the aim is to channel breezes over the water pools before they enter the building (J. Fernandes, J. Correia da Silva, 2007).

To enhance the process, the pool or fountain is placed in the center of the courtyard or the building. The fountains are placed in the center of the quadrangle. When the air passes over the water in the fountains, it takes up the heat and channelizes the breeze before it enters in the Khilwat Khana. The flow of cool breeze inside the Khilwat Khana gives a cooling effect even in hot summers (Fig 7). The water pool in the middle of the courtyard with maximum dimensions store energy and decreases the heat of summer (Fig 10).

Moreover, water on the surface of a building has a tendency to evaporate. For every gram of water that evaporates, roughly 2500 Joule of heat energy is consumed. Wetting a building, therefore, helps to remove heat, a process that is analogous to human sweating (Ali, 2013). When the fountain in front of khawab gah e Shah Jahani (Fig 6) evaporates water, it makes the building wet and removes the heat produced by the sun. The water pressure was maintained by salsabil. It forces the water to come out of the fountainhead. For beyond the psychological effect, the sound of the water has a soothing and relaxing effect, more significant in human comfort related with the capacity to balance and reduce environmental temperature (J. Fernandes, J. Correia da Silva, 2007).

There are many symbols of heaven on earth. "Water" is one of them. The water in the pool, because of its stagnancy, reflects the sky. It is the place on Earth where we can see the depth and exquisiteness of the infinite sky. The tranquil and quiescent water omits the boundary between the sky and ground. Water not only affects the psychology or the aesthetic sense of the human but it also has a remarkable effect on auditory and visual sense. "The sonic and aquatic properties of water are other positive and effective aspects of pools. A fluid like water has the ability to reduce a remarkable amount of sonic energy in its fluctuations, and in fact the existence of water in the pool acts as a hidden barrier against the sound passing inside and outside the house. The magic power of water mostly presents itself through its view and sound." This is why often there are some fountains in the rectangular pools from which water falls naturally due to the water level difference and presents a desired view and sound that

brings happiness and joy. The illustration of cooling of Shah Jahan's quadrangle is shown in Fig 8. The fountains in front of Khwab gah and Diwaan e Khas not only controls the temperature and allows the cool breeze to blow but helps in maintaining a peaceful visual and psychological environment. These are situated in between coming and going passages of the wind and provide the residents with a calm and pleasant environment. The natural resources like water, plants sun, and wind – all provide a symphonic and pleasant set of environmental efficiencies (M. Shokouhian , F. Soflaee, F. Nikkah, 2007).

4. Conclusions

Water is a key element in human life. It as a lifeblood that is important in different philosophies and cultures. Architects have always tried to make the best possible use of the environmental resources and in architecture, water finds a special place from a scientific as well as an artistic point of view. According to the

findings of research water bodies like fountains and water channels were added in the building to keep the temperature moderate inside the building. When air passes above the water bodies, water absorbs the thermal radiation (as water has high latent heat of vaporization). Hence the cool air is introduced into the building. Moreover, water along with its beauty, has its magical power to present itself through view and sound. It omits the boundary between the sky and ground. It not only affects the psychology or the aesthetic sense but has a positive effect on sonic and visual properties of humans. Hence, Mughal used water not only to enhance the beauty of the place but scientifically as well to cope with the climate of that area. So, utilization of water by Mughals in Lahore Fort is still an eminent representation of undaunted Mughal Architectural mastery in retaining and regulating the temperature along with the beautification purpose via fountains, water channels, and pools.

Illustrations

Following are the figures referred in the article. These plans are provided by the Architecture department in Lahore Fort but are graphically designed and labeled by the author. All the photographs are taken by the author.



Figure 1. Lahore during Mughal era

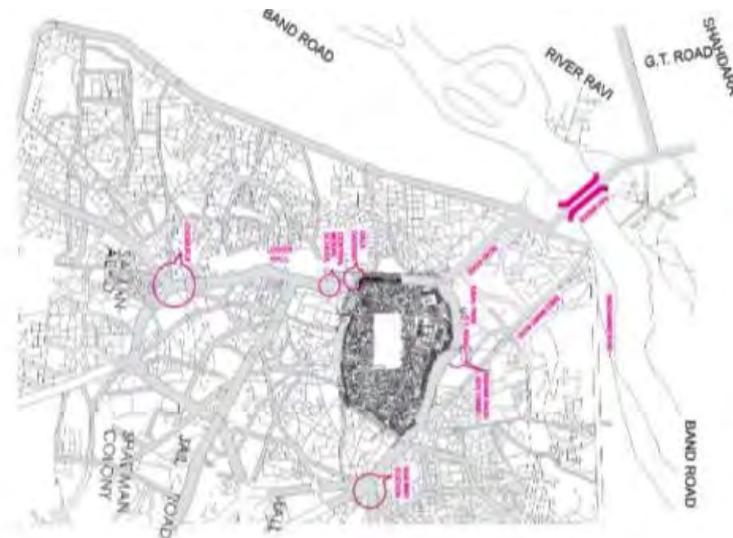


Figure 2. Master Plan Lahore Fort



Figure 3. Quadrangles of Lahore Fort

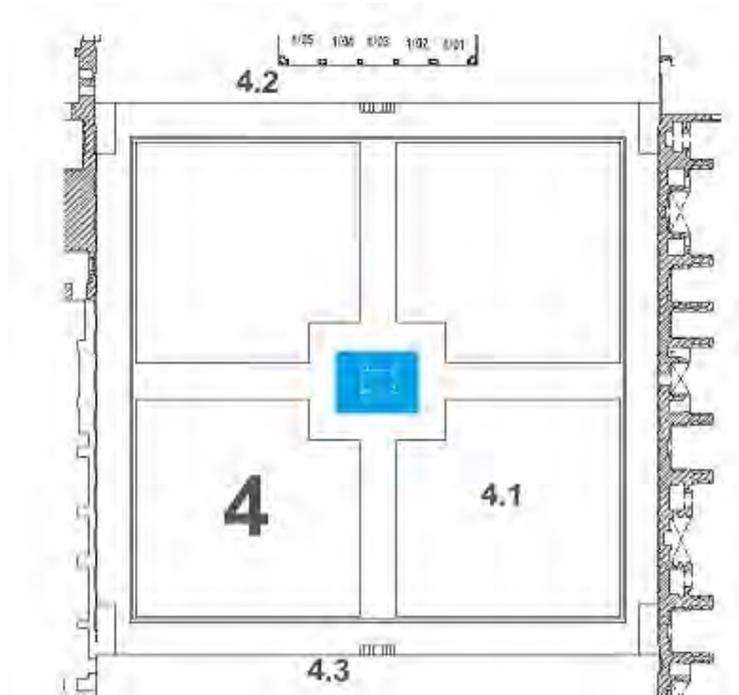


Figure 4. Plan of Shah Jahan's Quadrangle

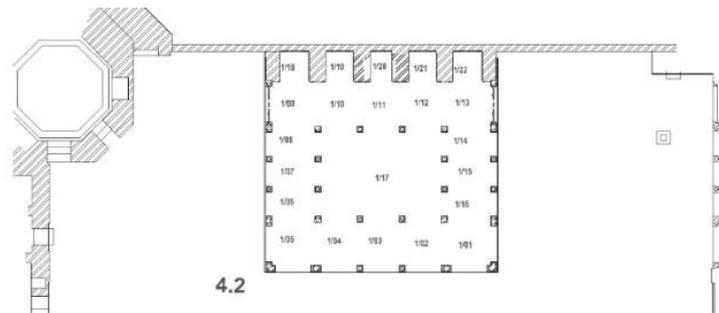


Figure 5. Plan of Diwaan e Khaas

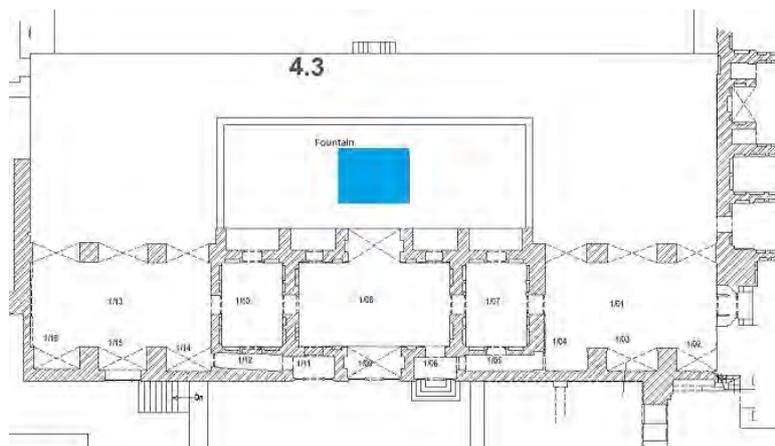


Figure 6. Plan of Khawab gah e Shah Jahani

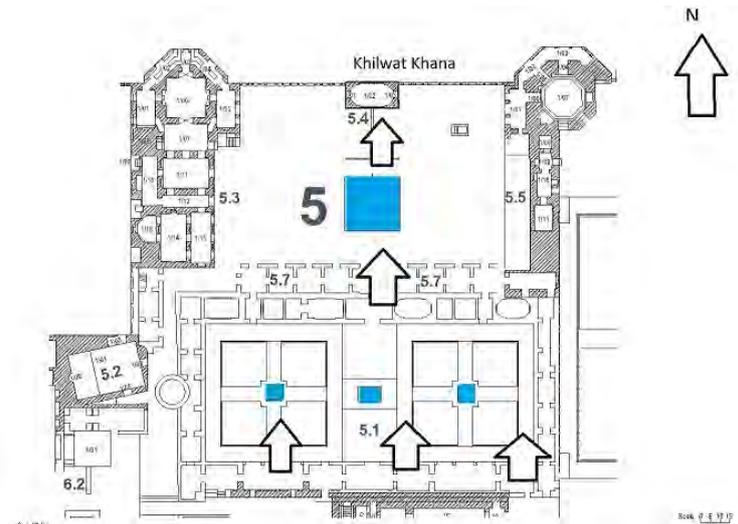


Figure 7. An illustration of paien bagh quadrangle

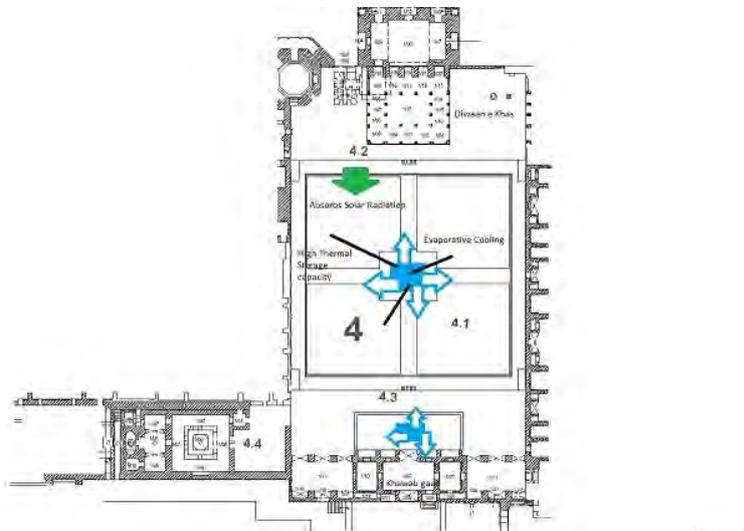


Figure 8. An illustration of Shah Jahan's quadrangle



Figure 9. Fountain in courtyard in front of Khilwat Khana



Figure 10. A view of fountain in Paien bagh quadrangle



Figure 11. Fountain inside Diwan e Khas



Figure 12. Fountain inside Khwab gah e Shah Jahani

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