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# Observations on the Orientation of Some Mughal Gardens

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## Abstract

The Mughal gardens are a typical form of landscape architecture developed by the Mughal Dynasty. These gardens had a style heavily influenced by the Persian gardens of charbagh structure, with a use of rectilinear layouts within walled enclosures. Here we propose some observations on the typical layout of these gardens and on the orientations and alignments of a few of them. Title: Observations on the Orientation of Some Mughal Gardens; Author: A.C. Sparavigna, DISAT, Politecnico di Torino, Italy; Keywords: Landscape Architecture, Solar Orientation, Solstices, Urban Planning, Satellite Images, Google Earth.

## Introduction

Respect and reverence for water and trees which, as told in a recent paper [1], were so strong in many ancient civilizations, assumed in Persia the architectural form of beautiful gardens, the Persian gardens. Their design influenced the layout of other gardens in the world, from those of Al-Andalus to the magnificent gardens of the Mughal Dynasty [2].

The oldest Persian garden that has been discovered dated to the Achaemenid Era (500-300 BC) [1]. It is that of Pasargadae, built around 500 BC, the outline of which is still visible today in satellite images. Under the influence of Zoroastrianism, the religion of Achaemenid, Parthian and Sasanian empires, the emphasis on the role of water constantly increased and the gardens were enriched with fountains and ponds [3]. During the Sasanian Era (AD 226-641), the Mandala design of the garden appeared [4]. In any case, it was from the time of the Achaemenid Dynasty that the garden was connected to the idea of an earthly paradise. This influenced other cultures, such as the Hellenistic gardens of Seleucid and Ptolemaic Dynasties in Alexandria [3]. In this manner, the Avestan word 'pairidaeza', meaning 'walled garden', passed into Ancient Greek 'paradeisos', which was rendered into the Latin 'paradisus', and the Garden of Eden became the Paradise on Earth.

After the advent of Islam in Persia, basic concepts of garden design were developed and refined; the aesthetic aspect of the garden increased in importance, overtaking utility [3]. As told in [1], 'Heaven' became an important concept that modified the garden. Several heavenly features, highlighted by the Quran, were used to make the Persian garden a successfully combination of artificiality and naturalness [1]. In this manner, many gardens assumed the form of a charbagh, which is representing the Eden with four rivers and quadrants that are the four corners of the world.

In two recent papers [5,6], we have proposed the use of satellite images to investigate the layout and orientation of charbagh gardens. We can easily see that some of them are oriented to the cardinal directions, that is, they have axes aligned to north-south and east-west directions. Since the architecture of ancient civilizations is showing, sometimes, alignments to the directions of sunrise and sunset on solstices, we can investigate if they are shown by charbagh gardens too. In fact, we had found them in the Gardens of Tal Mahal and in the Nur Jahan charbagh [5,6]. These gardens have such alignments besides the cardinal orientation. Here, we continue our observations with satellite images of Mughal gardens and show, besides the abovementioned cases, some other examples of charbagh gardens discussing their orientations.

## Babur's gardens

The charbagh gardens had their origin in Persia, and was Babur, the first Mughal emperor, that introduced them to India [7]. Babur (1483-1530), direct descendant of Timur through his father and of Genghis Khan through his mother, was coming from the Central Asia. Moving from Farghana, the present-day Uzbekistan, he succeeded in establishing the Mughal Empire. Babur was greatly influenced by the Persian culture, which affected both his own actions and those of his successors in the Indian subcontinent [8]. In particular, during his tenure in Samarkand, the city's impact upon him was so profound that the city shaped his attitude toward architecture and, even more significantly, toward landscape [7]. In fact, "Samarkand, embellished by Timur and his immediate successors, with splendid charbagh gardens, mosques and other buildings, was one of the wonders of the fifteenth century" [7].

Samarkand is most noted for its central position on the Silk Road between China and the West. In the 14th Century, it became the capital of Timur's empire. As told in [9], Timur "evidently wished to surpass all known precedents while he created his capital par excellence Samarkand". Perhaps, he desired to recreate in a suburban environment the summer life of his people, building several gardens in which it was possible to move at caprice from one to the other, staying either in tents, or in small garden pavilions, with the urban civilization close at hand [9]. In fact, Ref.9 observes that an entire 'necklace' of garden settlements encircling Samarkand existed, with gardens named after the renowned cities of the Muslim world, which Timur had conquered in the course of his expeditions.

Babur too preferred to camp in gardens than in palaces: he created several gardens which were as campsites, situated at a day's or half-day's horse ride from one another, in the manner that other rulers built serais [7]. Locations of many of these gardens are known from Babur's writings and from those of Zain Khan, but today none of these gardens exists in their original state and of others is even lost the location [7].

One of the Babur's gardens/serais is the Aam Khas Bagh. The structure was extended and almost rebuilt by Mughal Emperor Shah Jahan. It is along the Mughal military road between Delhi and Lahore. The complex was famous for a perfect air-conditioning system called Sarad Khana [10]. We can see it in the Figure 1. Let us note that the garden has a rectangular shape with a north-south axis.



Figure 1: One of the Babur's gardens/serais is Aam Khas Bagh. The structure was extended, and almost rebuilt, by Mughal Emperor Shah Jahan. Note that the garden has a rectangular shape, and has a north-south axis (noon). In the image, it is also shown the angle between the directions of sunrise on solstices

(yellow lines) and the angle between those of sunset (orange). Note that these lines are passing rather close the corners of the garden. The image was obtained using SunCalc (suncalc.net).

As remarked in Ref.7, "the manipulation of natural untamed landscape into a rational, ordered creation was for Babur a metaphor for his ability to govern". Babur contributed also to the urban processes in the Indian subcontinent by the development and extension of the 'garden city' concept, having as a model the cities of his homeland, particularly Kabul, Herat, Ferghana, Samarqand and Bukhara [9].

### Humayun's Garden Tomb

The second Mughal emperor was Humayun. His tomb is located just south of the Din-Panah citadel. A contemporary Mughal source indicates that the tomb was finished in 1571 after eight or nine years of work [7]. Its Timurid appearance must be credited to its Iranian architect, known from contemporary texts as both Mirak Sayyid Ghiyas and Mirak Mirza Ghiyas [7]. This architect was from Herat and worked extensively in Bukhara, where he excelled at buildings and landscape architecture [7]. Around 1562, he returned to India to work to the design of Humayun's tomb. The tomb complex is centrally situated in a charbagh (Figure 2). Each of the four garden plots is further subdivided by narrower waterways. Ref.7 explains that this garden was "based on the charbagh types established in Iran and more fully developed in Babur's own concept of the ideal garden".

Humayun seems to have been rather obsessed with the idea of perceiving the cities as 'zones of peace', adopting the mentality of his father Babur, of establishing places of 'rest and order' within disorder [7,9]. He makes also the first attempt of using a monument as the organizational center of the city and of delineating a grid for the development of the urban structure [9]. In [9], it is supposed that the form and position of the Humayun's mausoleum within the urban structure was already conceived to some extent by the emperor himself before his death.



Figure 2: Humayun's Tomb inside the charbagh garden. Note that the axis of the garden is not perfectly aligned to north-south direction.

In [11] it is told that, towards the south-east corner, within the charbagh garden, lies a tomb known as Nai-ka-Gumbad, that is, the Barber's Tomb, datable to 1590-91 CE. Its proximity to the main tomb and the fact that it is the only other structure within the complex suggests a certain importance; however, there are no inscriptions telling the names of the persons interred therein or giving other information. We can ask ourselves if this building had a specific position or alignment in the garden.

In the previous papers [5,6] we used sollumis.com software to investigate alignments to the rising sun; here, we apply SunCalc, a software used in Ref.12. In the Figure 3, we can see that, on the summer solstice, the south gate of the garden and the Barber's Tomb are along the direction of sunrise. In the image, the yellow line is showing sunrise and the orange the sunset. Of course, this could be an unintentional result of the garden layout.

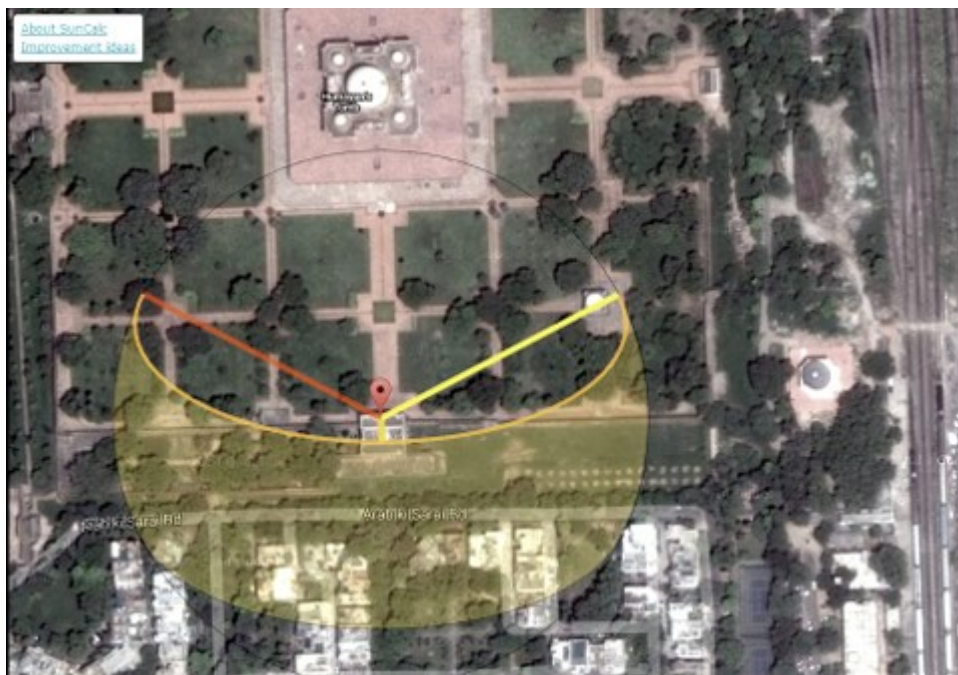


Figure 3: On the summer solstice, the south gate of the garden and the Barber's Tomb are aligned to the direction of sunrise. The image is obtained using SunCalc, where a yellow line is used for sunrise, orange line for sunset.

### **The Gardens of Taj Mahal**

The best known and famous example of Mughal architecture is the Taj Mahal, the Crown of Palaces, a splendid white mausoleum in Agra, Uttar Pradesh, India. Mughal emperor Shah Jahan built it in memory of his third wife, Mumtaz Mahal [13,14]. The mausoleum is one of the components of a quite large complex of structures, composed by buildings and gardens, including subsidiary tombs, waterworks infrastructure, the small town of Taj Ganji and a Moonlight Garden, north of the River Yamuna (Figure 4). The construction began in 1632 AD and was completed around 1653 AD. A board of architects under imperial supervision worked to the Taj Mahal, among them there were Abd ul-Kari, Ma'mur Khan, Makramat Khan, and Ustad Ahmad Lahauri [15]. Lahauri is generally considered the principal designer of the complex.

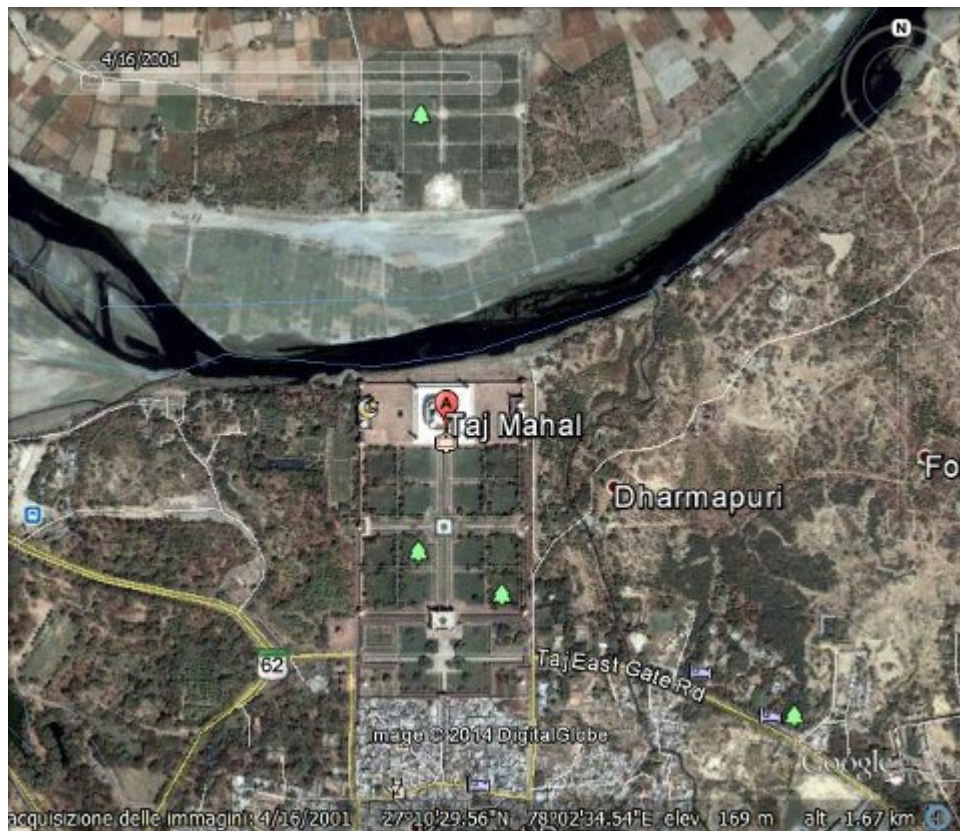


Figure 4: The complex of the Taj Mahal as shown in the Google Earth images. Besides the white huge mausoleum and the garden, we can see the small town of Taj Ganji and the Moonlight Garden, north of the River Yamuna.

According to Ref.15, since most Mughal charbagh gardens are rectangular with a tomb or pavilion in the center, the Taj Mahal garden is unusual because its main element, the white Mausoleum, is located at the end of the garden. This fact created a debate amongst scholars regarding the reasons why the traditional charbagh form had not been used. In [16], it is suggested that a variant of the charbagh was employed.

The Taj Mahal complex has a north-south axis. As we have discussed in [17], when an architectonic structure is aligned in this manner, it is aligned to the projection on the horizontal plane of the 'axis mundi', the axis about which the world is rotating. However, in their planning, architects could also use some elements aligned in the directions of sunrise or sunset [17,18]. In fact, architects have six main directions: two are joining cardinal points (north-south, east-west) and four are those given by sunrise and sunset on summer and winter solstices.

Alignments to solstices are present in the garden of Taj Mahal, as we can see in the Figures 5 and 6. In the Figure 5, the yellow and orange lines of solstices are bisecting the sides of the garden. In the Figure 6, these lines are passing through the pavilions at the corners of the garden. About this image, we can repeat what we have observed when we discussed a court of the Forbidden City in Beijing [17]. The enclosure of the garden is a symbolic horizon, where its axis is representing the 'axis mundi'. On the solstices, from the centre of the rectangular enclosure, we can see the sun rising and setting at its four corners.

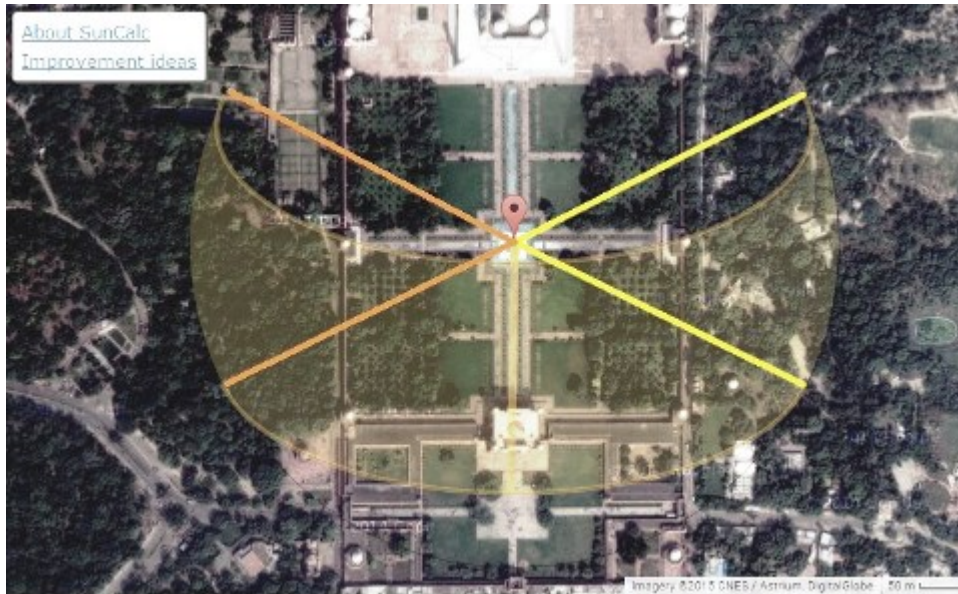


Figure 5: Here we can see, using SunCalc, the gardens of Taj Mahal and the directions of sunrise (yellow) and sunset (orange) on the winter and summer solstices.

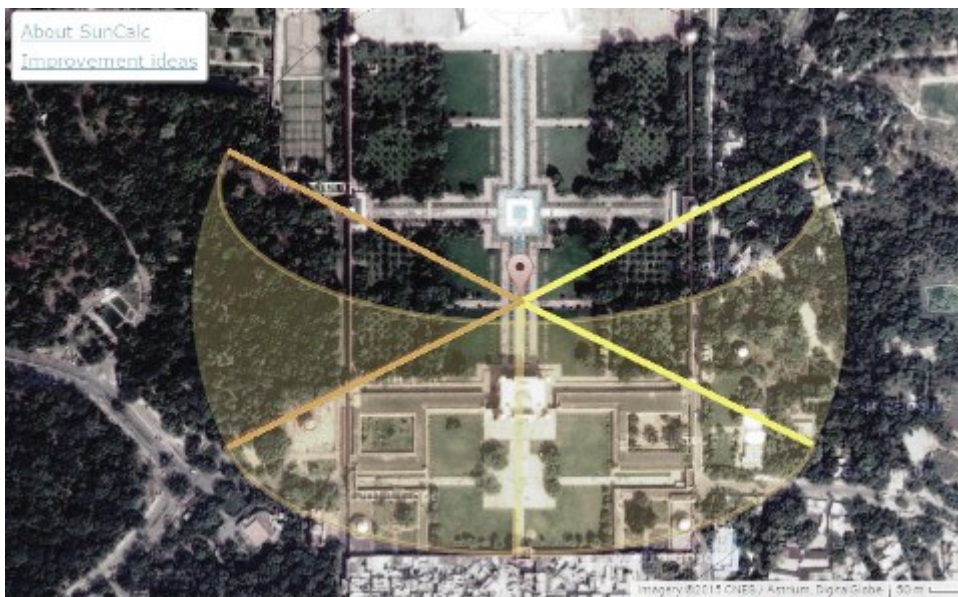


Figure 6: If we use the reference point at the center of the southern part of the garden, we see that the directions of sunrise (yellow) and sunset (orange) on winter and summer solstices are passing through the pavilions at the four corners of the garden.

### The Dilkusha Charbagh

Among the monuments of the golden age of Mughal architecture, we find the mausoleum of Shah Jahan's father. He was Jahangir, the Conqueror of the World. Jahangir (1569-1627), was the fourth Mughal

emperor who ruled from 1605 until his death in 1627. His reign was characterized by political stability, a strong economy and impressive cultural achievements [19].

The mausoleum is located near the town of Shahdara Bagh in Lahore, Pakistan. Placed at the centre of a walled garden, the Dilkusha Charbagh, the mausoleum was built ten years after the death of Jahangir. The garden was laid out previously by the empress Nur Jahan (1577-1645), the Light of the World, with the typical structure of a Mughal garden. Like that of the gardens of Taj Mahal, the Dilkusha Charbagh shows alignments on solstices.

It seems that a local tradition is claiming "the design and construction of Jahangir's tomb were in Nur Jahan's hands" [20]. But in Muhammad Salih's Shah Jahan Nama (The History of Shah Jahan, completed in 1659-1660), the tomb is primarily attributed to Shah Jahan. The name of the architect is not known; it seems that Chandar Bhan, a historian and writer, served as a supervisor of the site for some time [21]. The walled tomb-garden is entered from the Akbari serai on the west side (Figure 7). At the centre of the garden lies the tomb which rests on a high podium, surmounted with tall minarets on all four corners. The square garden was divided into four parts in the charbagh pattern, with water canals. There were fountains and water flowing. The water for the garden was lifted from eight wells located immediately outside the enclosure wall to an aqueduct running on top of the wall. Some terra cotta pipes were feeding fountains and tanks [21]. Every intersection in the garden was marked by octagonal and square tanks [22].



Figure 7: Jahangir's Tomb is located near Shahdara Bagh in Lahore, Pakistan. The mausoleum is at the centre of a walled garden, the Dilkusha Charbagh.

The Jahangir's mausoleum seems having an east-west axis. However, the Dilkusha Charbagh, built before the tomb, can be considered aligned in north-south direction. Has this garden, like that of Taj Mahal, some references to solar azimuths? The answer is positive, as we can see in the Figure 8.



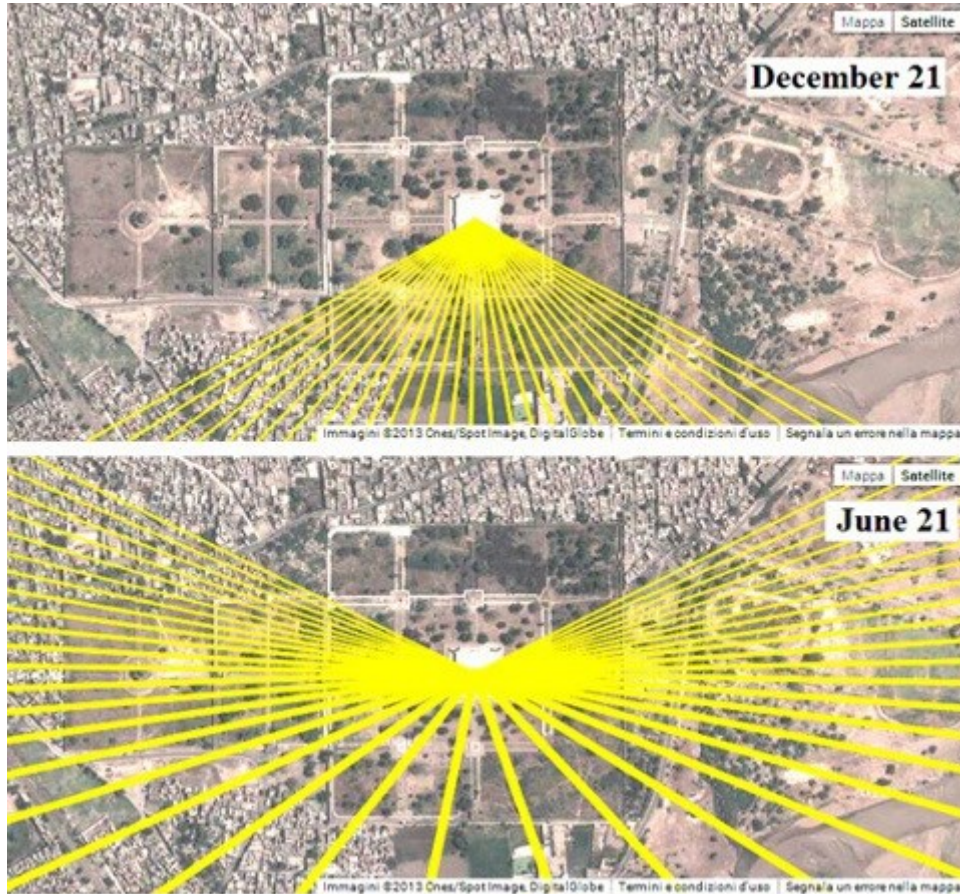


Figure 8: The Dilkusha Charbagh in shown the two images where we can see the direction of the sun during the winter and summer solstices, given by Sollumis.com (<http://www.sollumis.com/>). This site provides a polar diagram, overlaying a satellite map, showing the directions of the sun for any day of the year. The lines on the drawing show the direction and height (altitude) of the sun. Thicker lines mean the sun is higher in the sky. Longer and thinner lines mean the sun is closer to the horizon.

Even the tomb of Nur Jahan, which is located not far from the tomb of Jahangir is showing interesting alignments, as shown in the Figure 9. The whole mausoleum was surrounded by the garden. Today, only the western part exists.



Figure 9: The Tomb of Nur Jahan and the directions of sunsets on solstices, given by Sollumis.com.

## The Charbagh of Akbar

Akbar the Great (1542-1605), was Mughal Emperor from 1556 until his death. Akbar succeeded his father, Humayun. Akbar gradually enlarged the Mughal Empire to include nearly all of the Indian Subcontinent north of the Godavari river [23]. His tomb is an important Mughal architectural masterpiece, built 1605–1613, in Sikandra, a suburb of Agra, Uttar Pradesh, India. As we can clearly see in the Figure 10, Again, we find the layout and the solar alignments already observed for the gardens of Taj-Mahal and the Dilkusha.

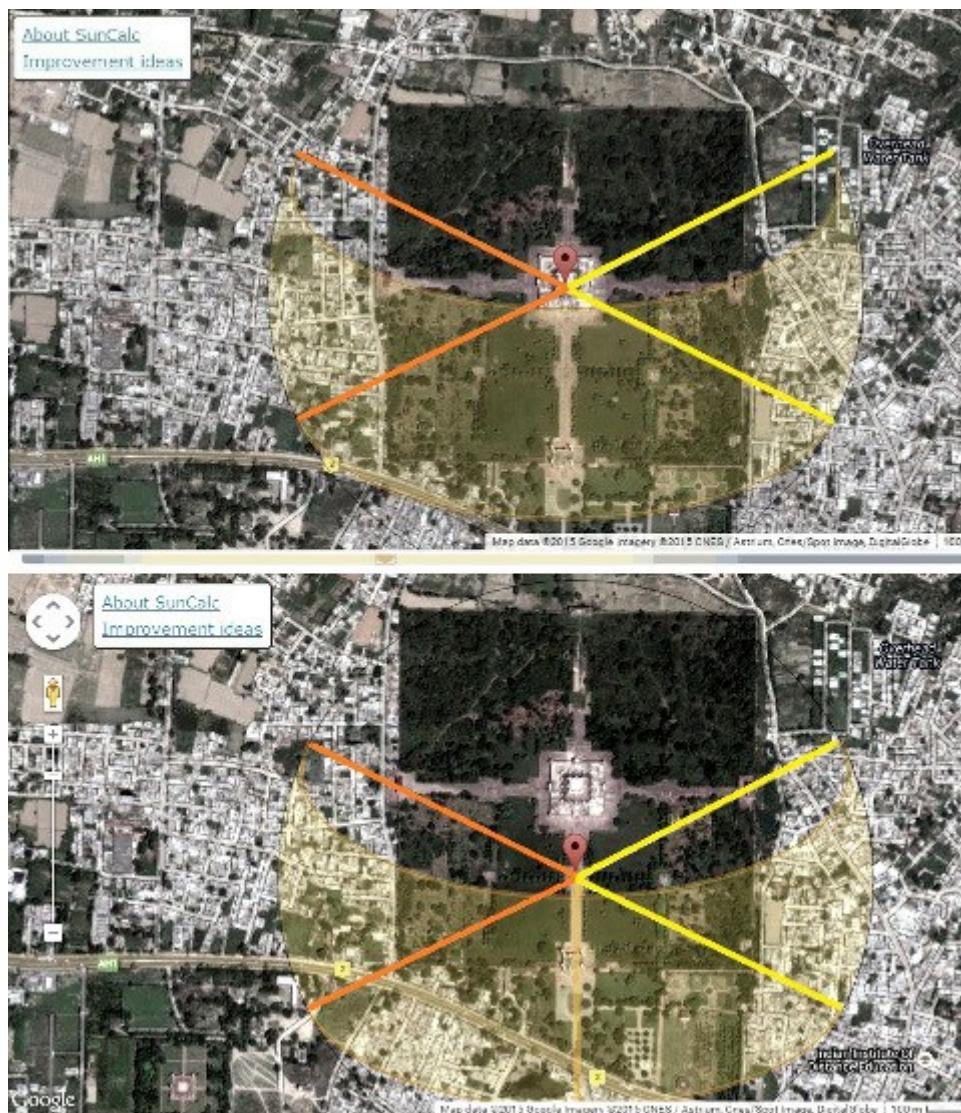


Figure 10: The Garden of Akbar Tomb and the sun on summer and solstices as given by SunCalc (yellow lines are the sunrise, orange the sunset). Again, we find the layout and the solar alignments already observed for the gardens of Taj-Mahal and the Dilkusha.

## Toward Persia

Let us note that the Mughal gardens can have a different orientation too; examples are the tomb of Itimad-ud-Daulah and the Rambagh in Agra and the Pinjore Garden. Let us discuss them and their relevant alignments.

The tomb of Itimad-ud-Daulah is also known with the name of 'Baby Taj', being regarded as a draft of the Taj Mahal. As discussed in [24], the tomb, built between 1622 and 1628 represents a transition between the first phase of monumental Mughal architecture, which was built from red sandstone with marble decorations, as in Humayun's and Akbar's Tombs, to its second phase, based on white marble and pietra dura inlay, such as in the Taj Mahal.

The mausoleum was commissioned by Nur Jahan, for her father Mirza Ghiyas Beg, who was originally a Persian Amir in exile. He had been given the title of Itimad-ud-Daulah, Pillar of the State. In the Figure 11 we can see the mausoleum at the center of the charbagh garden. Looking at the satellite images with SunCalc, we can guess that the charbagh was oriented toward Persia, in a symbolic return of Mirza Ghiyas Beg to his homeland. We can also find an alignment to sunrise on the summer solstice too.

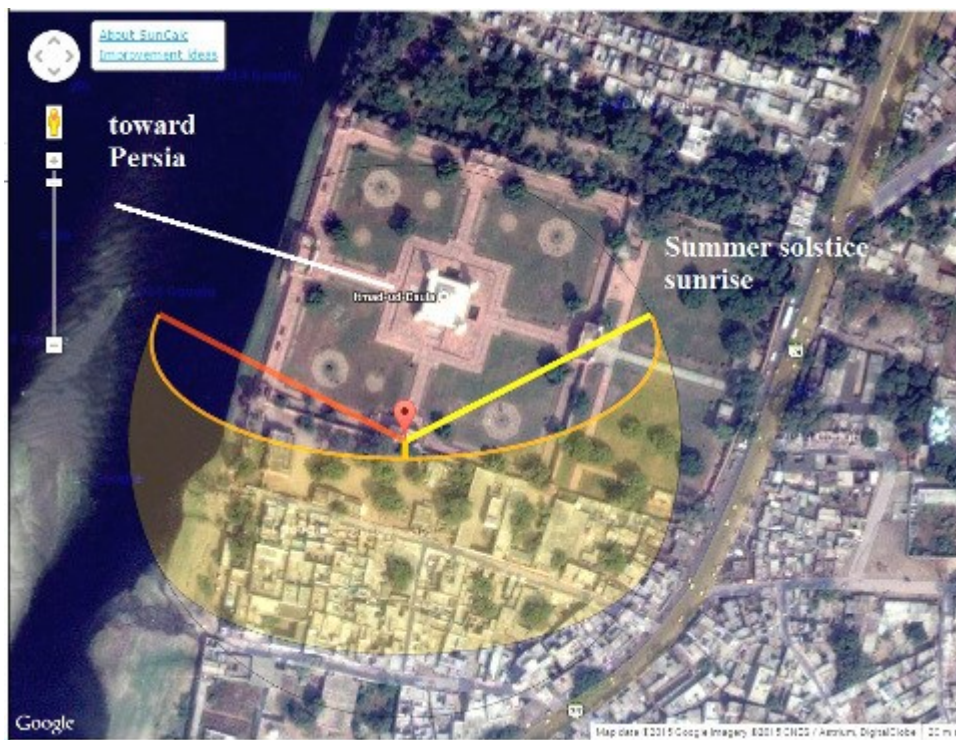


Figure 11: The mausoleum of Itimad-ud-Daulah, Pillar of the State. He was originally a Persian Amir in exile. Looking at the satellite image with SunCalc, we can guess that the charbagh was oriented toward Persia, in a symbolic return of Mirza Ghiyas Beg to his homeland. In this garden, however, we can also find a solar orientation because two gates are aligned to the direction of sunrise on the summer solstice.

## Rambagh Garden and the Qibla

The Rambagh Garden has the distinction of being the very first garden of the Mughals that was built in India [25,26]. Some scholars are of the opinion that the original name of Rambagh was Aram Bagh. It was built in AD 1528 by Babur. It is also said that the tomb of Babur was constructed there, but after a few years was shifted to Kabul [26]. The Rambagh Garden is in Agra, 3 km away from the Itimad-ud-Daulah's tomb. It lies on the banks of Yamuna River.

In the Figure 12, we see the garden. The straight white line determined by the two pavilions of the garden has the direction of the Qibla, the 'direction' toward Mecca, as given by <http://www.qibla.com.br>.



Figure 12: The Rambagh garden. The white line is coincident to the Qibla given by site <http://www.qibla.com.br>.

### **Pinjore Garden**

The Pinjore Garden, (Figure 13), is located in Pinjore, Panchkula district in the Indian state of Haryana. It was built under the Patiala Dynasty Rulers, and created in the 17th century by architect Nawab Fidai Khan, during the early reign of his foster brother Aurangzeb, from 1658 to 1707. It has been renamed as 'Yadavindra Garden' in the memory of Maharaja Yadavindra Singh. The garden has been laid in seven terraces with the main gate of the garden opening into the highest first terrace which has a palace built in Rajasthani-Mughal style [27]. This garden is interesting because its axis is parallel to the direction of the sunrise on summer solstice.



Figure 13: The Garden of Pinjore and the sun on summer solstice as given by SunCalc (yellow line is the sunrise, orange the sunset).

### And many other charbagh gardens

Of course, there are many other charbagh gardens to examine, several are beautiful and well preserved, others look like faint images of their past. Let us show just one of them as it appears in satellite image of Google Earth (Figure 14). It is near the Bhangarh Fort, a 17th-century fort built by order of King Prabhash Rajguru in Rajasthan, India. It seems that ghosts are haunting the old city, as a local lore is telling [28].

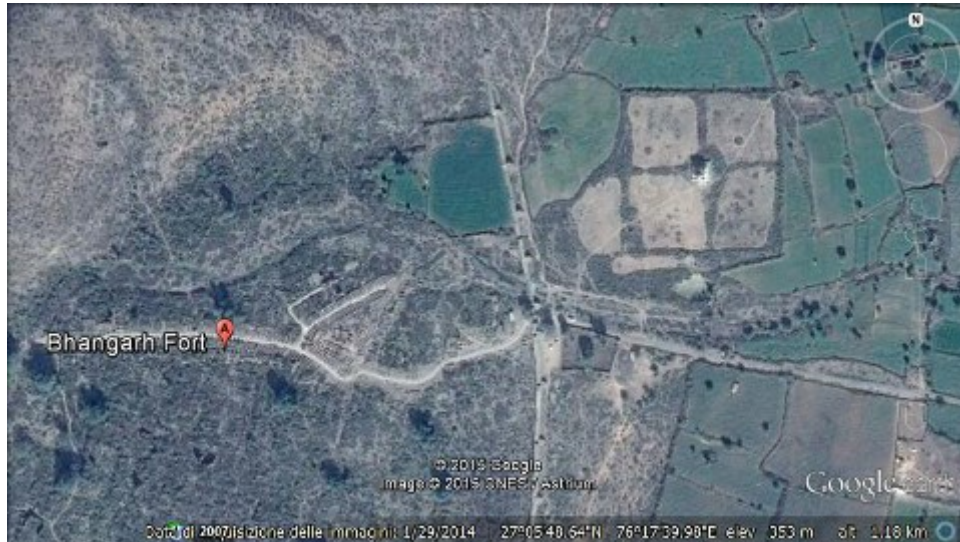


Figure 14: A charbagh garden near the Bhangarh Fort.

## Conclusion

It is well known that the Mughal gardens were created with the symbolic meaning of Gardens of Eden, with the four main canals flowing from a central spring to the four corners of the world. Here, we have shown that some of these gardens could have elements of their layouts, oriented to the directions of sunrise and sunset on solstices. However, other orientations are possible, as shown by the examples given in this discussion.

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