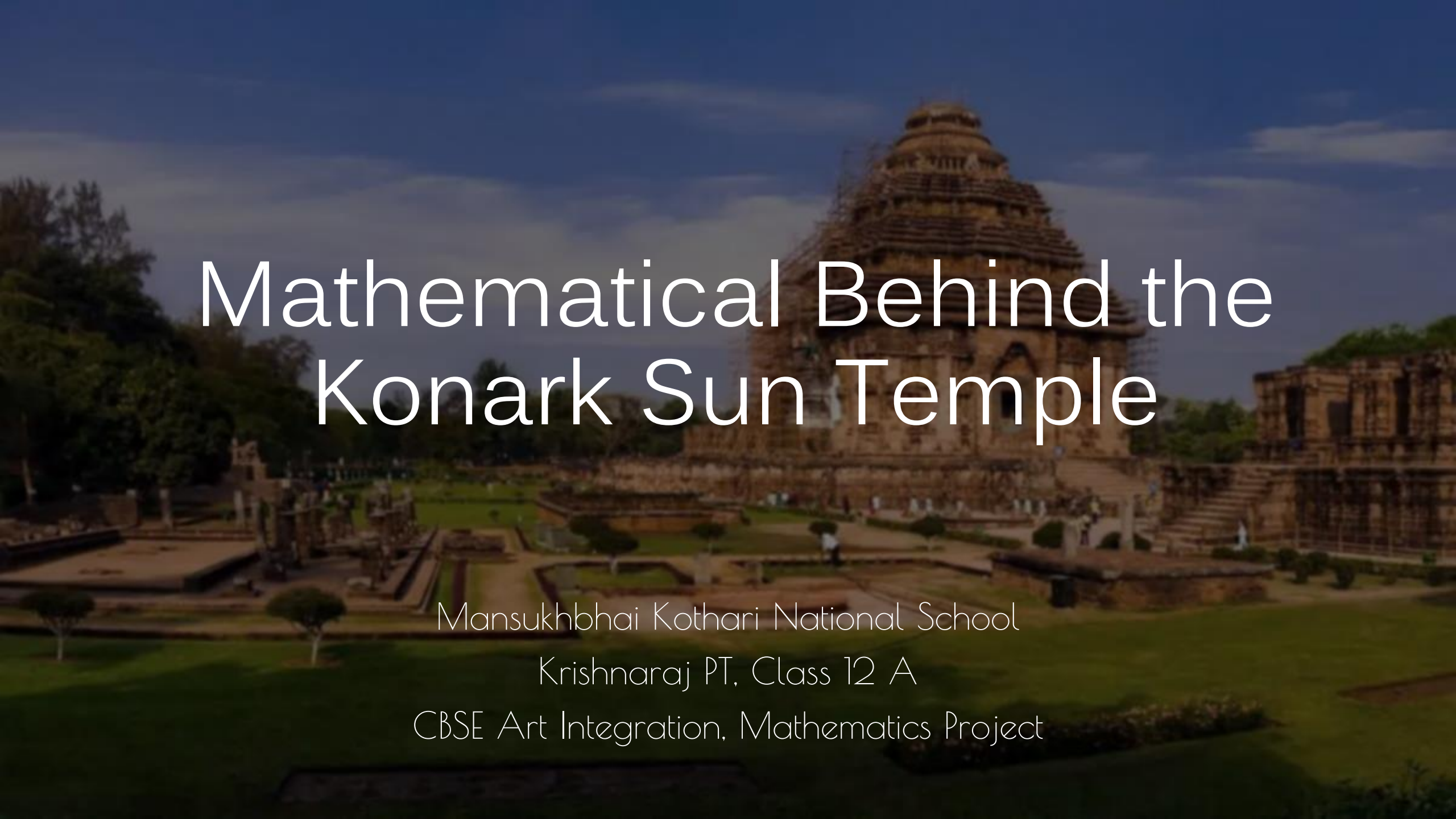
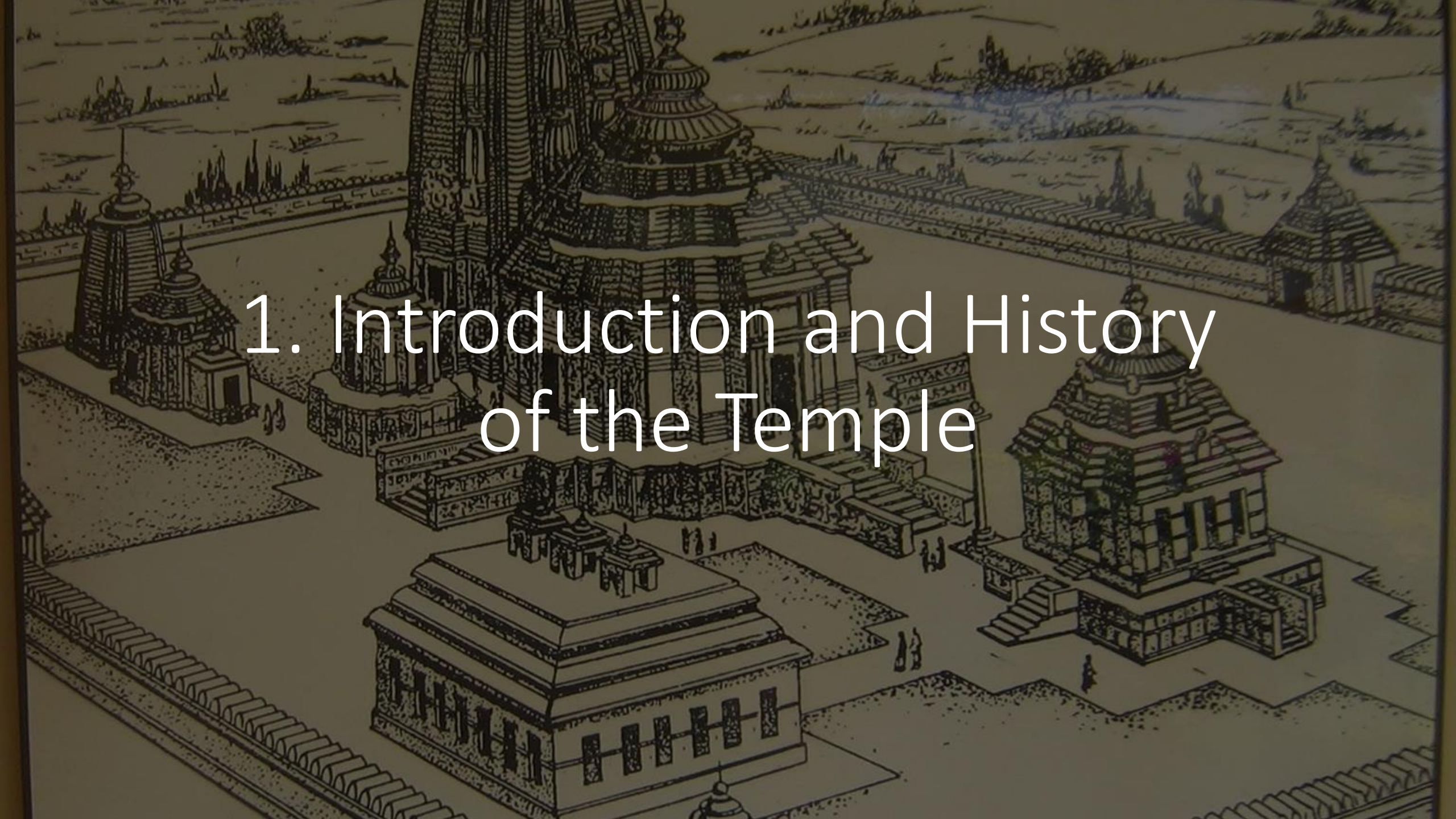


Mathematical Behind the Konark Sun Temple

Mansukhbhai Kothari National School

Krishnaraj PT, Class 12 A

CBSE Art Integration, Mathematics Project



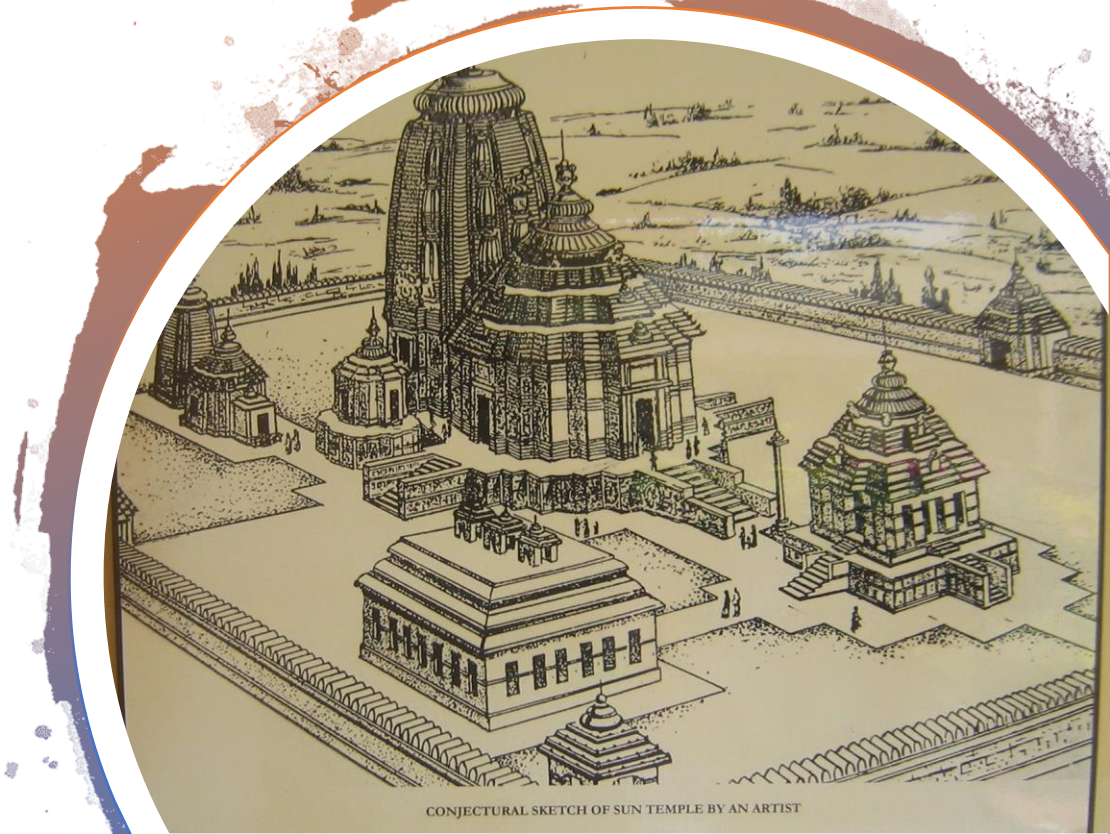
1. Introduction and History of the Temple

What is the Konark Sun Temple?

- The word 'Konark' is a combination of two Sanskrit words kona (corner or angle) and arka (the sun).
- It thus implies that the main deity was the sun god, and the temple was built in an angular format.
- The Sun Temple, as the name suggest, is dedicated to the Sun God, Surya, and is styled in the form of his magnificent chariot.
- It is located about 35 km northeast of the city of Puri on the coastline in the state of Odisha (earlier Orissa).
- The Temple in its present state was declared by UNESCO a World Heritage Site in 1984 CE. Many portions of the Temple are now in ruins

Why was it Constructed?

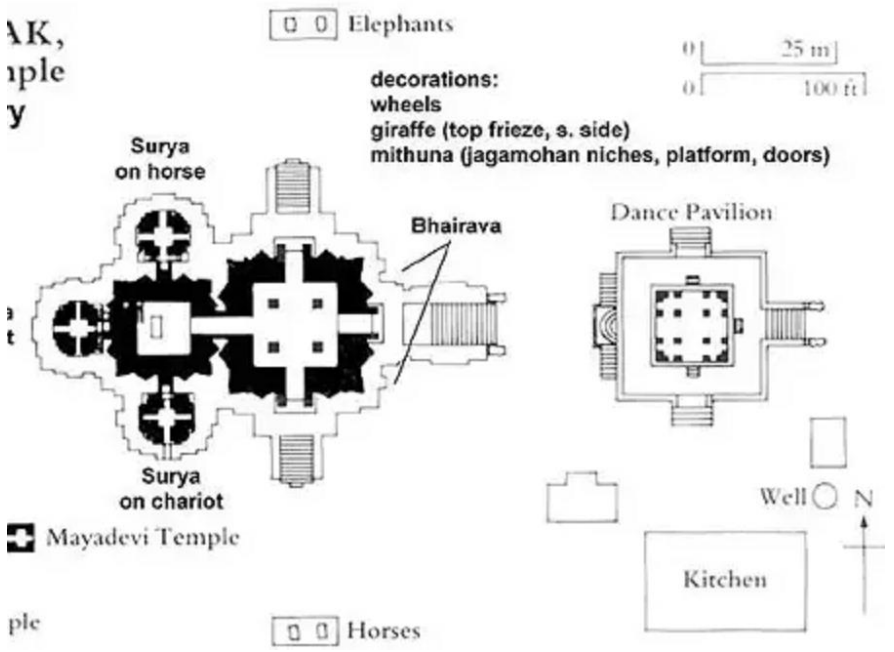
- Built in the 1238 CE by King Narsimha Deva I of the Eastern Ganga Dynasty, It is not entirely clear why he ordered the construction of the temple, but there are a lot of legends revolving around it.
- The inscriptions in the temple mention that Narsimha Deva I built the temple to fulfil a vow by his father to expand the famed Jagannath Temple of Puri, which was built by their ancestor, Chodaganga.
- King Narsimha Deva I ‘s father Anangabhima Deva III worshipped the Sun Deity at Konark which resulted in Narsimha Deva’s birth. Narsimha may have built the great Sun Temple to express his parents’ gratitude for the gift of a son.
- The temple may also have been built as a mark of expansion of Narsimha Deva’s territory. He ordered the temple’s construction in 1244 and it is said that it took 12-14 years for it to be completed



2. Architecture and Construction of the Temple

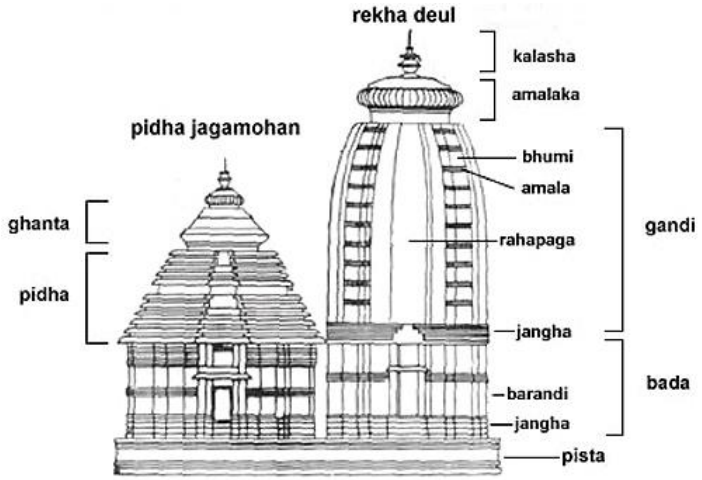
Architecture of the Temple

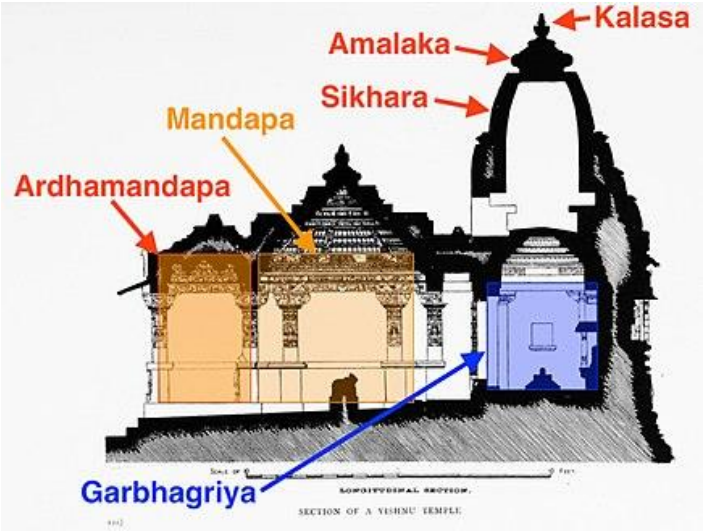
- The temple follows the Kalinga or Orissa style of architecture, which is a subset of the nagara style of Hindu temple architecture.
- The Sun Temple is a wonderful culmination of all the defining elements of Kalinga architecture and include:
  - ❖ a jagmohana (audience hall),
  - ❖ shikhara (crown),
  - ❖ vimana (tower)
  - ❖ natmandir (dance hall).



Hindu Temple Architecture

- Classification of Indian Temples
- Indian temples can be classified into two broad orders as
- Nagara (in North India)
- Dravida (in South India)
- At times, the Vesara style of temples as an independent style created through the mixing of Nagara and Dravida orders.





Architectural Style of the Temple

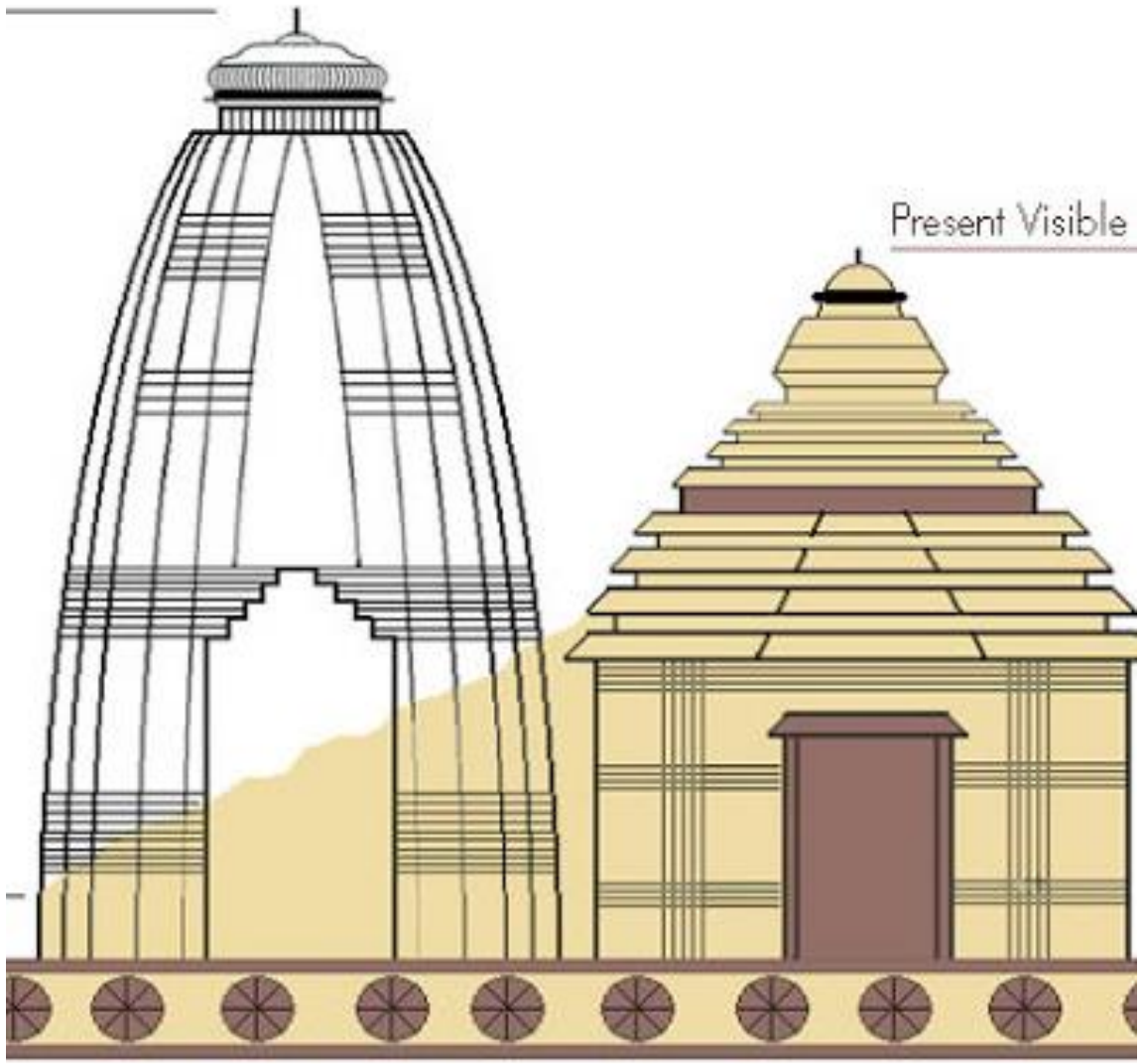
- The main characteristics of the Orissa style are primarily two: the deul or the sanctum housing the deity covered by a shikhara, and the jaganamohana or the assembly hall.
- The latter has a pyramidal roof built up by a secession of receding platforms known as pidhas. Both structures are squares internally and use a common platform. The exterior is variegated into projections known in this style as rathas or pagas which create effects of light and shade.
- Many temples built in this style show their own peculiar variations, and Konark is no exception.

Structure of the Temple

- It is designed as a massive chariot mounted on 12 pairs of intricately carved giant stone wheels that are drawn by a set of seven mighty stone horses.
- Thus, the depiction of a chariot invariably became part of any artistic creation related to the sun god in India. The 12 pairs of wheels represent the 12 months of the year.
- The temple is built with such a fine slant towards the east that the first rays of the rising sun illuminate the main entrance.
- This main entrance is ornamented with two huge stone lions standing on both sides. Both these lions are shown as trampling an elephant and a man beneath – This represents the Problems faced by Humans, the Lion signifying pride, and the Elephant signifying wealth.

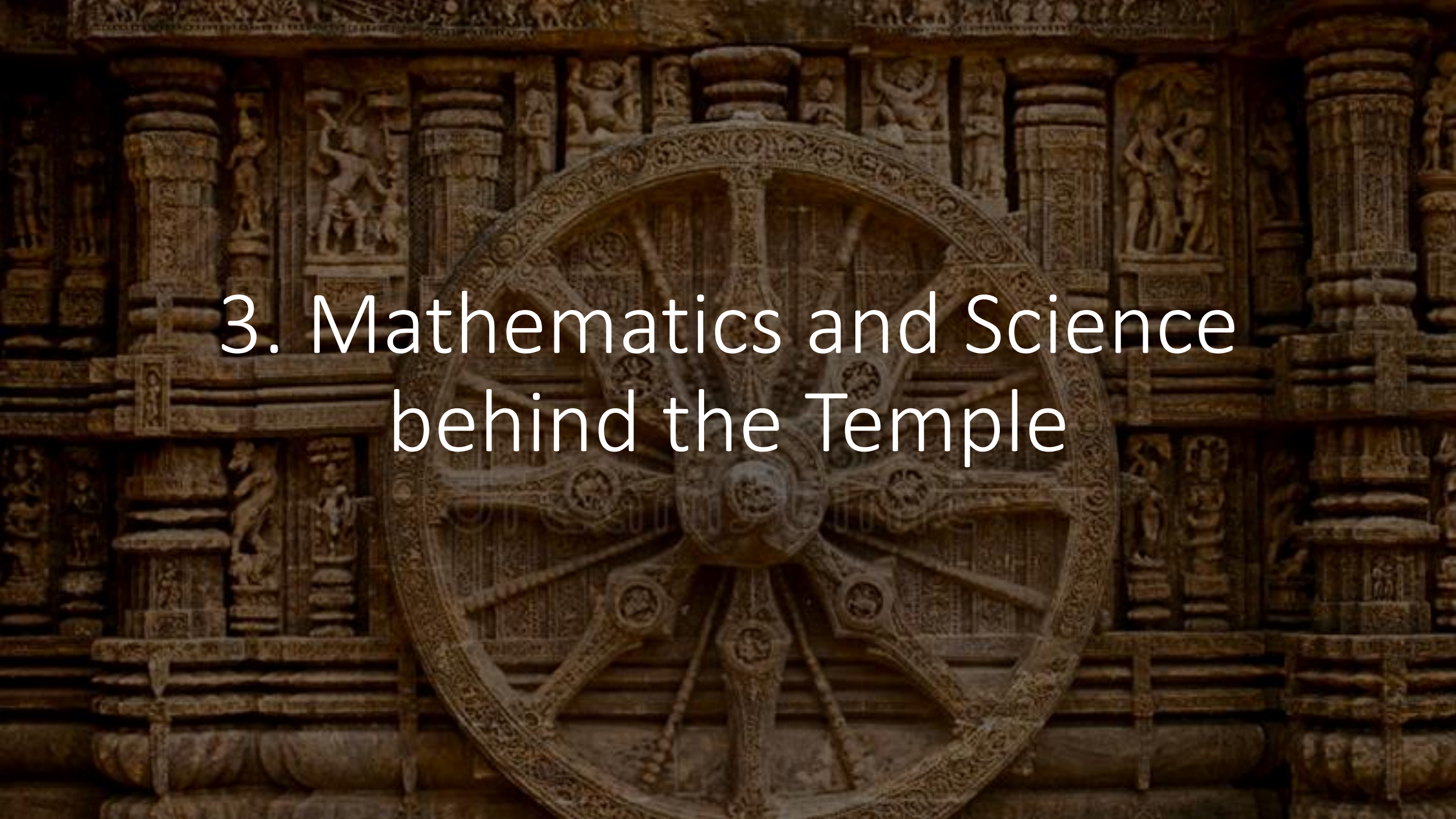
What remains

The deul including the magnificent shikhara has been lost with time. Today, only the jaganamohana and the pillared bhoga mandapa (refectory hall), also known as the nata mandapa (dancing hall) owing to the numerous sculptures of dancers and musicians on its walls and pillars, in front, remain.

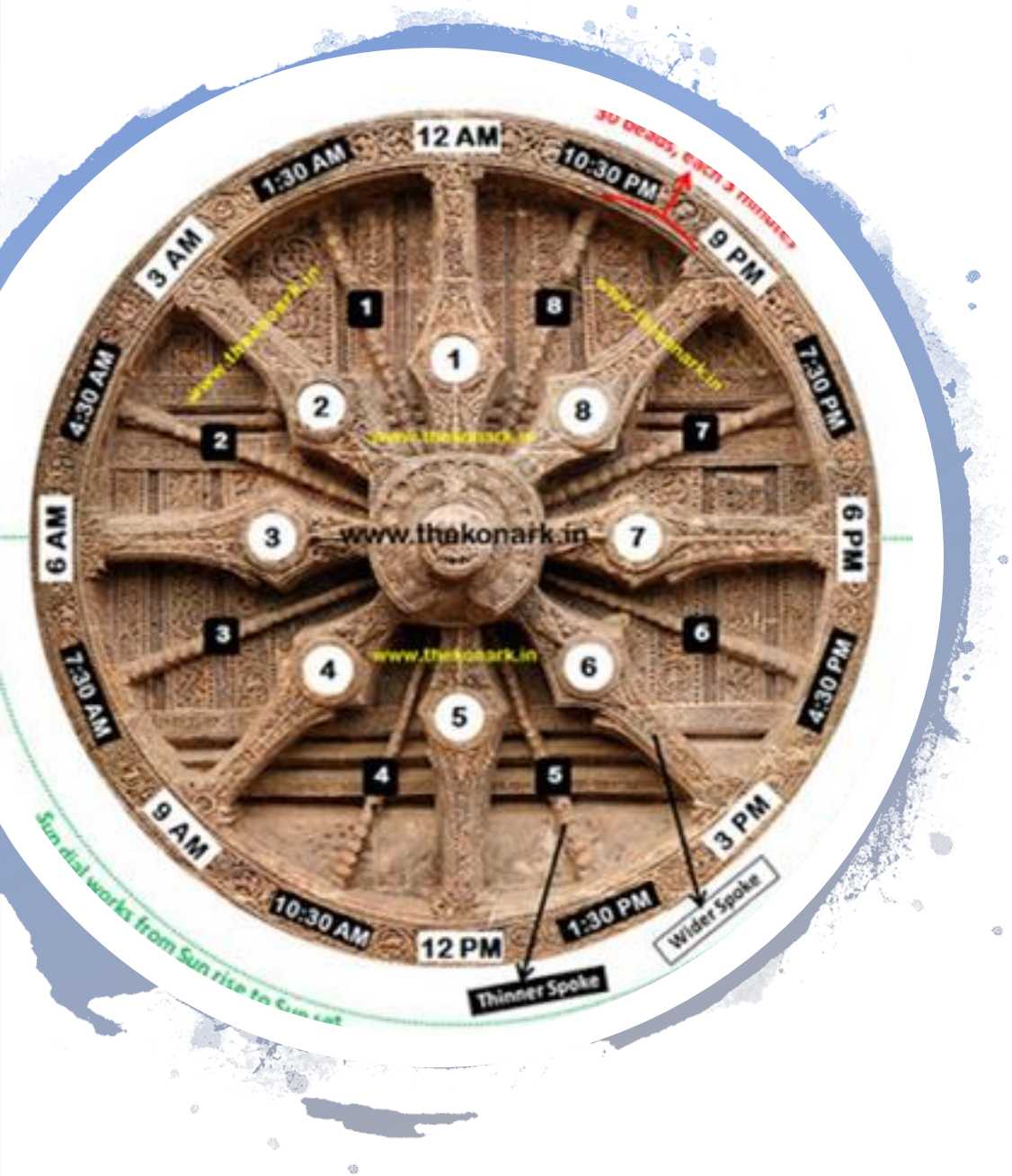


Construction of the Temple

- Three kinds of stone were used in the temple's construction - chlorite, laterite and khondalite. Khondalite (though of poor quality) was used throughout the monument while chlorite was restricted to doorframes and to a few sculptures, while laterite was used in the foundation, the (invisible) core of the platform and in the staircases.
- None of these stones was available near the site and so material was brought long distances. The stone blocks were lifted possibly by the means of pulleys, wooden wheels or rollers and then set into place.
- The fitting and finishing were done so smoothly that the joints could not be seen.



3. Mathematics and Science behind the Temple

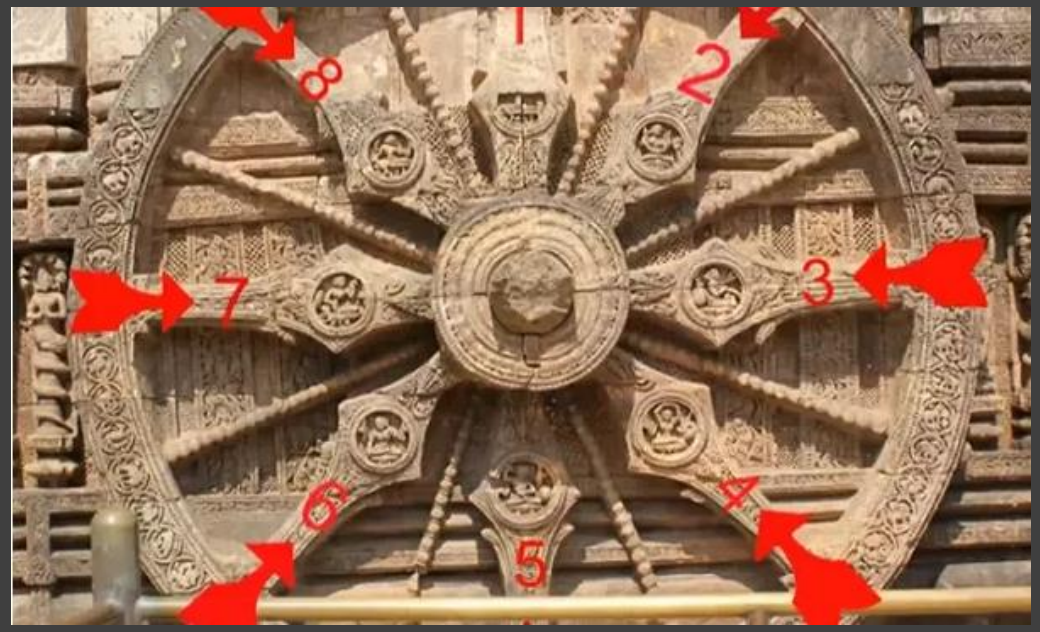


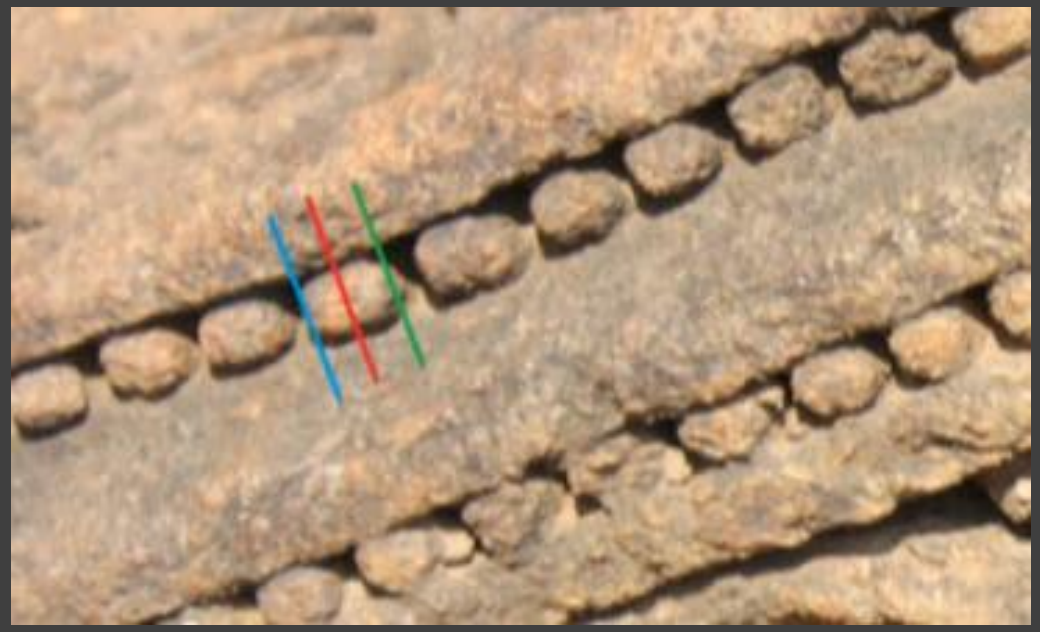
The Sundial

- 12 pairs of richly adorned wheels located at the base of the temple never fail to grab the attention of the visitors. They tell us the time of the day.
- The spokes of the wheels make the sundial and each one of them having 8 wider spokes and 8 thinner spokes. Out of these 24 wheels, 6 are on either side of the main temple, 4 wheels are on each side of the Mukhasthala and 2 wheels on each side of steps at the eastern front.
- One can calculate the precise time of the day just by looking at the shadow cast by the spokes.

Working and Time Calculation

- There are 8 minor spokes as well. Each minor spoke runs exactly in the middle of 2 major spokes. This means that the minor spoke divides the 3 hours in half, so the time between a major spoke and a minor spoke is an hour and half or 90 minutes
- The edge of the wheel has a lot of beads. There are 30 beads between a minor and a major spoke. So, the 90 minutes are further divided by 30 beads. This means that each bead carries a value of 3 minutes
- The beads are large enough, so you can also see if the shadow falls in the center of the bead or on one of the ends of the bead. This way we can further calculate time accurately to the minute.





Time Calculation during Night and Evening

What happens when the sun moves from east to west?

- Since the wheel is carved on a wall, the sun would not shine on this wheel at all. How can we tell time in the afternoons?
- Now, the Konark sun temple has another wheel or sundial, located on the west side of the temple as well. You can just use the other sundial that will work perfectly from afternoon, until sunset.

How do you tell time after sunset?

- There would be no sun, and hence no shadows from sunset till the next morning's sunrise. After all, we have 2 sundials in the temple which work only when the sun shines. The temple has a total of 24 wheels, all accurately carved just like the sundials. moondials can work just like sundials during nighttime.

The Floating Murthi

- The peak of the temple was said to be a giant 52 tone magnet
- Iron plates are sandwiched between every two stones of the temple to facilitate construction of higher floors over them.
- This ingenious arrangements of the main magnet along with the other magnets caused the main idol of the temple to float in the air.
- The magnet at the temple was, it is said, was removed by the British who were unable to conduct geodetic survey, etc. Further, it affected the functioning of the compasses used by the ocean-going ships.

How did it work?

- Each and every pillar of the walls of the temple are surrounded by iron plates, where each iron plate separates one pillar from other.
- At key nodes of the temple, magnets were placed with variable flux and magnetic intensities. At the center and at a bottom of few feet, a large magnet was placed.
- When an idol of the Sun God was placed at the center of all these elements, it floated. For few decades, this floatation of the pillar-like statue of the God stood a great mystery.

The Sun Rays that always reach the Idol

- Every day, the sun's rays would reach the Nata Mandir from the coast and reflects from the diamond placed at the center of the idol.
- During the colonial time; these magnets had been removed by the Britishers to get the magnetic stone. Even though we get to see this view, we lost that magnetic ability of the temple.
- The pillars have been aligned to ensure the sun rays pass through without an obstruction during the Uttarayana and the Dakshinayana. This is another angle of alignment. The geometric perfection is amazing
- The placement of the main temple and the Sun God had been aligned in such a way that the first ray of the Sun from the coast would cross the Nata Mandir (Dancing Hall) and would fall & reflect from the diamond placed at the crown of the Sun God

4. Conclusion

Conclusion

- The Konark Sun Temple in Odisha, is a marvel, lesser known to us than it should be. It is an incredible feat of Engineering, Architecture, as well as co-ordination and Hard work.
- This Temple was built by King Narsimh Deva in 1238 AD, in order to pay his respects to the Sun God, SuryaDev, and mark his expansion of Territory
- The Temple is adorned with impeccable art and mind-blowing Sculptures that depict images and Scientific Truths; whose true meanings are yet to be discovered.
- There are Several interesting Mathematical and Scientific wonders in the carving of the Temple, like the Legendary Magnet placement for the levitation of the Murthy, The Accuracy of the angles in passing of Sun's rays from the reflection of a diamond, the Sundials and the Moondials, and many more
- This Project helped me to learn about the unimaginable feats of engineering and architecture involved in Ancient India, as well as the stunning beauty of Odisha and its art and mathematical intellect.
- Various Sculptures, paintings and well-known Odisha Art forms have been utilized and appreciated throughout the making of this Project.
- The Sun Temple of Konark, is therefore, undoubtedly a Wonder of this World, that needs to be protected and preserved at all costs.

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