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HERMOGENES IN ASIA MINOR: GIVING SPATIAL PRESENCE TO TEMPLES OF DIONYSUS AND ARTEMIS LEUKOPHRYENE IN VIRTUAL SPACE

A.Denker [1,2]
[1] Istanbul Bilgi University, Faculty of Engineering and Natural Sciences, 34060 Eyupsultan, Istanbul, Turkey
ahmet.denker@bilgi.edu.tr
[2] University of South Florida, College of Engineering, 4202 E. Fowler Avenue, ENG 030,Tampa, FL 33620, USA
adenker@usf.edu

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ABSTRACT:

Hermogenes and his works in Asia Minor is one of the central subjects of research in both classical architecture and archaeology. In this study, the questions of what role Hermogenes played in Hellenistic architecture, what he intended and built, and why Vitruvius gave him the highest praise are once again brought up. The Temple of Dionysus in Teos and the Temple of Artemis Leukophryene in Magnesia are masterpieces of the great architect Hermogenes, who left his mark on temple architecture in Asia Minor during the Hellenistic period. Both of these temples are now in ruins. The pedestals of several columns, the lower shafts of the columns and a few fallen Ionic capitals convey the buildings' former beauty, but few vestiges remain of these important sanctuaries. Yet these marble monuments still captivate the imagination, twenty-two centuries after they were built. As a result of a systematic and comprehensive application of digital 3D reconstruction methodology, 3D visualizations of these works of this famous architect of the Hellenistic period are created and presented.

1. INTRODUCTION

Since the emergence of interest in Greek architecture Hermogenes and his buildings in Asia Minor has been a central topic of architectural research and archaeology. The questions of what role Hermogenes played in Hellenistic architecture, what he aimed for and built, and why Vitruvius gave him the highest accolades have been kept raised and worked out.

The Temple of Dionysus in Teos and the Temple of Artemis Leukophryene in Magnesia (Figure 1) are the masterpieces of the great architect Hermogenes, who left his mark on the temple architecture in Asia Minor during the Hellenistic period. These temples are also of special importance in terms of establishing a bond between another great architect, Pytheos and Hermogenes. For this reason, the close interest of the archaeological world to these two temples has continued unabated since the 18th century. Hermogenes produced works that codified and perpetuated the rules of the Ionian order, which he blessed first with the Temple of Dionysus in Teos in the Ionia region of Asia Minor, and then the Temple of Artemis Leukophryene in Magnesia on the Maeander River. Both these temples, which Hermogenes created in Asia Minor, are now in ruins. They were plundered and destroyed as the various empires in the region rose and fell. In this looting and destruction, besides men, nature also played a role. Rivers flooded the temenoi and filled the archaeological remains, earthquakes knocked down the pillars and turned the cellas into heaps of rubble (Figure 2). However, tens of hundreds of years after they were built, these marble monuments still captivate the imagination. The purpose of this paper is to present a 3D visualization of these works of this famous architect of the Hellenistic era, together with a systematic and comprehensive review of the implemented digital 3D reconstruction methodology.

In the first section, Vitruvius, Pytheos and Hermogenes are discussed. Hermogenes was presented by Vitruvius (III, 3, 8) as the inventor of the pseudo-dipteros form. Hermogenes' temples were dominated by a simple harmony; they were the embodiments of proportional relationship. Vitruvius described his aesthetic system as *eustyle*. The same principles were seen before in Priene, in the Temple of Athena by Pytheos who lived 150 years before him. Pytheos' work would inspire Hermogenes to apply a similar architectural design philosophy in his own work. In the second part a study of the available information of the Temple of Dionysus in Teos, the first temple of Hermogenes in Asia Minor, is given. This edifice, which has been excavated by three different teams since the 19th century, has had different interpretations. In the third section, Hermogenes' main work, Magnesia Artemision, which he performed towards the beginning of the 2nd century BC, is discussed. In the fourth part, the digital 3D visualization methodology developed in this project is presented. Due to scarcity of solid archaeological evidence of these temples at Teos and Magnesia, attempting to give them spatial presence in 3D required a good amount of interpolation.

Figure 1. Geographical location of Hermogenes' buildings in Asia Minor (Map by the author).

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While archaeological remains provide some evidence, the missing elements necessitated the development of reconstruction hypotheses based on architectural principles of

Hermogenes which came down to us through Vitruvius. In the fifth part, temples of Dionysus in Teos and Artemis Leukophryene in Magnesia are given spatial presence in virtual space: Their 3D reconstructions are presented. In these reconstructions it is aimed to revive the temple in the first construction phase attributed to Hermogenes in 3D by reconsidering the temple in a way that covers the whole to the extent of the available information.

Figure 2. The sacred sites of the Temples of Dionysus (above) and Artemis Leukophryene today (Photos by the author).

2. VITRUVIUS, PYTHEOS AND HERMOGENES

We know very little about Hermogenes of Priene beyond what the Roman architect Vitruvius who admired him told us. Hermogenes is not only one of the a few architects who are named by Vitruvius in *De Architectura* but he is also the only one whose name comes in four places (III 2.6, III 3.6.1-2, III 3.8-9, IV 3.1-2) Vitruvius appears to respect Hermogenes highly and praises him as the greatest master builder of the Hellenistic period in Asia Minor (part of modern Turkey). Thanks to Vitruvius we can attribute to him two temples in Aegean Turkey: The peripteral Dionysus Temple in Teos, and the pseudodipteral Temple of Artemis Leukophryene in Magnesia which were located on the west coast of Ionia, at a distance of approximately 80 km from each other (Figure 1). Vitruvius also says that Hermogenes wrote treatises on the design and construction of these two temples, but these were lost before they could come down to us. With our present knowledge, we cannot ascertain whether Vitruvius' writings on Hermogenes originated from and were limited to these books, or if they were also based on sources and observations other than them. Vitruvius said that Hermogenes invented the pseudodipteros. From the symmetrical layout of the dipteros of classical temple design he omitted the inner row with 34 columns. He says (III 2. 6) :

There is no example of this at Rome, but there is at Magnesia the Temple of Diana (Artemis) built by Hermogenes.

Thus, Hermogenes created a new design for the Temple of Artemis in Magnesia which did not exist in Rome and had only been seen once before in Asia Minor, in Sardis. In this temple, Hermogenes enlarged the peristyle surrounding the cella to 2 interaxial widths by removing the inner ring of the columns. By removing the inner row of columns, he created an open space between the outer row and the walls of the cella. This plan was called pseudodipteros, because it gave the temple the appearance of a double row of columns. Not only was the space between the outer rows of columns (pteron) and the walls of the cella thus doubled, but it also achieved a striking visual effect by contrasting the bright whiteness of the outer columns with a dark background of shadows cast by the broad colonnades. In adopting this plan, Hermogenes also saved a great deal of time, money and labour by excluding a total of 34 columns that would have been required for the inner rows of columns in a dipteral temple. The total number of columns was thus 54, but if the temple had been a true dipteros type, there would have been 34 more columns. In the pseudodipteros plan, the distance between the columns of the peristasis and the walls of the cella was twice that of the dipteros, i.e., the distance between the axis of two columns. This space was so large that the difficulty of suspending the ceiling over such a span was probably a deterrent to earlier architects. Although Vitruvius did not address this issue, Hermogenes' solution to this difficult problem, showing that large ceiling openings could be passed through, was an important feat of engineering. The pioneering role of this temple in learning how to close such gaps in the wide-span roof constructions that emerged with the removal of intermediate columns gave it a special place in classical architecture. Furthermore, while saving costs and labour, the beautiful appearance of the edifice was, in no way, diminished. This is how temples were built from then on.

According to Vitruvius, a pseudodipteros is a dipteros temple with 8 by 15 columns, in which the inner row of 34 columns is omitted. Strangely, pseudodipteroi were taken only after the Magnesian temple with the stated number of columns, and surprisingly, temples with other combinations of column numbers were not given place. However, the characteristic of this design is a wide columned hall, in which theoretically another row of columns could be added. Furthermore, Vitruvius related Hermogenes to the architects Pytheos (who built the Temple of Athena in Priene and wrote a book about it as well) by saying that both dispensed with the Doric order and adopted the Ionic order, because of the conflict the Doric order inserts at the meeting of the columns at the corners. Hermogenes continued the design principles of Pytheos. In the 3rd century BC, the architect Hermogenes carved a temple plan on the wall of the temple of Athena Polias in Priene. Hermogenes' plan was characterized by simple harmony, the embodiment of a proportional relationship. For example, measured from axis to axis of the corner columns, the length of the colonnade was exactly twice the width of the colonnade. From axis to axis, the column spacing was equal on all sides. The width of each cubic column base was exactly half the column spacing. These regular proportions ensured that the axes of the walls of the cella were aligned with the axes of the columns, so that the whole structure rested on a grid reflected in the joints of the floor stones. This

was probably the plan of the temple of Athena itself. The architect of the Temple of Athena was not Hermogenes, but Pytheos, who lived 150 years before him. Pytheos' work would inspire Hermogenes to apply the same principles to his own work. Hermogenes continued Pytheos' design principles. First with the Temple of Dionysus at Teos in Ionia, Asia Minor, and then with his masterpiece, the Temple of Artemis Leukophryene at Magnesia on the Maeander River, he codified and perpetuated the rules of the Ionian order that he had consecrated. The Temple of Dionysus in Teos and the Temple of Artemis Leukophryene in Magnesia are of particular importance as they form a link between two great architects, Pytheos and Hermogenes, who left their mark on temple architecture in Asia Minor during the Hellenistic period. For this reason, the archaeological world has been paying close attention to these two temples since the 18th century.

Hermogenes received great praise from Vitruvius due to his eustyle which he arrived at the six-columned Dionysus Temple in Teos (III 3.8):

Of this we have no instance at Rome; but in Asia there is the hexastyle temple of Father Bacchus in Teos. These proportions Hermogenes determined, and he also was the first to use the exostyle or pseudodipteral arrangement. For from the plan of the dipteral temple he removed the interior rows of the thirty-four columns, and in that manner abridged the expense and the work. He made an opening for the ambulatory round the cella in a striking fashion, and in no respect detracted from the appearance. Thus, without letting us miss the superfluous parts, he preserved the impressiveness of the whole work by his arrangement.

The temple that resulted was viewed as Hermogenes' *opus magnum*. We also learn from Vitruvius that the design principles and architectural details of his buildings were narrated in a prose book written by Hermogenes himself. It is very likely that this book which did not survive must have been seen by the Roman writer and made great influence on him.

3. TEMPLE OF DIONYSUS AT TEOS

The antique city of Teos was founded on the narrowest part of an isthmus of a peninsula approximately 60 km from Smyrna (Modern İzmir, Figure 1). It was one of the twelve Ionian cities mentioned by historian Herodotus and geographer Strabo. The probable reason why the city was built in this area is that it had two natural harbours located both to the north and to the south which provided shelter against all winds. The ridge which forms the peninsula slopes gently down towards the east and makes a terrace in the north-south direction. The temenos area of the Temple of Dionysus of Teos is located roughly there, in the middle of the isthmus, located within the Hellenistic period walls. The romantic ruins of the Temple of Dionysus lie in the open space between oak and ancient olive trees (Figure 2). The pedestals of several columns, the lower shafts of the columns and a few fallen Ionic capitals convey the building's former beauty, but few vestiges remain of this important temple.

This temple, which is the largest temple dedicated to Dionysus in Anatolia, was the early work of Hermogenes of Priene (circa 220-190 BC) Hermogenes based his design on the temple of Athena Polias in Priene, designed by Pytheos (4th century BC). Vitruvius says he applied his own aesthetic system, which is described by him as eustyle. According to the Eustyle, to which Vitruvius gives the highest praise, ideally the spacing between columns should be two and a half times the lower diameters, and the column should be nine and a half times its diameter.

In 1861, the Society of Dilettanti commissioned R. P. Pullan to excavate the temple, and the temenos plan published in 1862 showed that the temenos area had an unusual trapezoidal shape (*Antiquities of Ionia* IV, 1881). In 1924, French archaeologists Y. Béquignon and A. Laumonier confirmed the trapezoidal shape of the temenos and defined its boundaries. (Laumonier and Béquignon, 1924) In their excavations, the French archaeologists also found on the eastern side of the temple an altar foundation and a floor between this altar and the temple. In 1962-65, excavations were resumed and another important part of the Temenos area was uncovered. Afterwards, in the studies carried out by Mustafa Uz between 1980 and 1992 it was found that due to the slope of the temenos area towards the east, part of the ground was shaved, and the foundation of the temple was placed on top of it. As a matter of fact, since the ground was higher on the west, there were five steps to the temple podium in the west and twelve steps in the east. Uz conducted systematic excavations in Teos. He stated that some of the various architectural remains scattered around the temple are of Hellenistic origin, while the surviving temple belongs to the Roman period. It is understood that the temple was built in the Hellenistic period but underwent extensive repairs during the reign of Hadrian. After an intermission of approximately 40 years the excavations in Teos were resumed under the Direction of Musa Kadıoğlu (Kadıoğlu, 2021). The temple of Dionysus is an Ionic hexastyle peripteros. The peristasis had six columns on the short sides and eleven on the long sides with a total of 34 columns. In this early work of his, Hermogenes faithfully followed the design of Pytheos. The building is very similar to Pytheos' temple of Athena in Priene in that its design also was based on a square gridal system. Like the Priene building it has a deep pronaos with two columns and a narrow opisthodomos with two columns. The main difference in plan is that the cella in the temple at Priene was exactly twice the size of the pronaos, while the cella in the temple at Teos was only slightly larger than the pronaos (Figure 3).

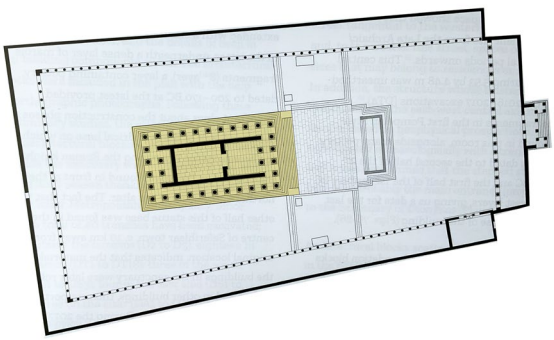

Figure 3. The placement of the temple building in a trapezoidal temenos drawing of the temple of Dionysus (After Uz, Kadıoğlu and Spawforth).

This resulted in a slightly shorter cella in the Teos temple. From the beginning to the end of the crepidoma the temple measured 42.25 m on the long side and 22.75 m on the short side. The poor preservation state of columns' fragments does not allow us to determine the column height from archaeological data.

However, the column height can be calculated if we follow Vitruvius' prescription which says the full height of the column (including the base, column shaft, and capital) should be 9.5 times the lower diameter of the columns (between 0.96 and 1.03 m), then the column heights could be estimated between 9.12 and 9.93 m (Kadioglu 2021, pg. 207). These results are compatible with the measurements that the English and French researchers had taken of the temple. Uz had confirmed the accuracy of the earlier measurements. Consequently, all of the reconstruction drawings of Pullan including the elevation drawing of the façade and the flank are still accepted without dispute and give us a solid foundation for the 3D reconstruction of the building (Figures 4 and 5).

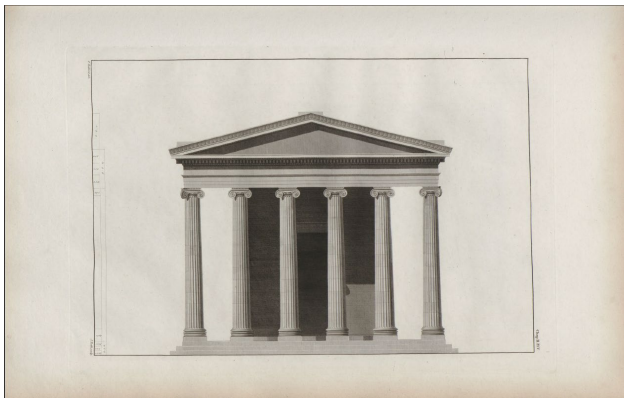

Figure 4. Elevation drawing of the east façade by Pullan (*Antiquities of Ionia* IV, 1881, pl XXIII).

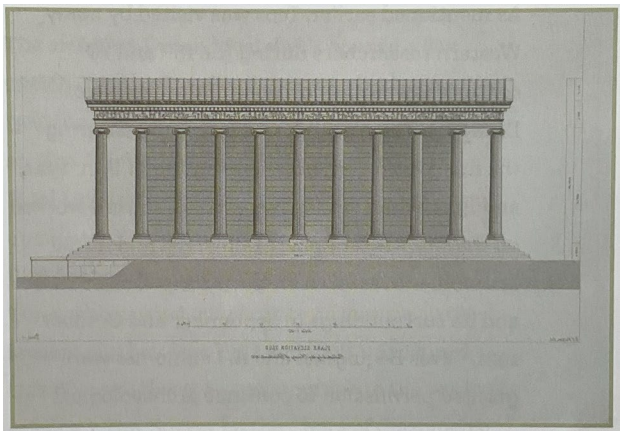

Figure 5. Elevation drawing of the flank by Pullan (*Antiquities of Ionia* IV, 1881, pl XXIV).

Excavation results in Teos showed that the Temple of Dionysus does not fit to the hexastyle eustyle temple which was described by Vitruvius. We know that Vitruvius never saw the temple in person, and he probably only got his information about the building from the book written by Hermogenes. Perhaps Hermogenes had originally designed the temple according to the principles transmitted to us by Vitruvius, but in the different phases of the temple's construction the execution might have changed. From this point of view, it is possible that Vitruvius' principles might have been ignored when the peristasis was added to the temple during Hadrian's reign. Another possibility, as Hoepfner (Hoepfner, 1990) points out, is that Vitruvius might have incorrectly identified the Temple of Dionysus at Teos as Eustyle.

The reconstruction drawing of the propylon which formed part of the grandeur of the edifice was also given by Pullan (Figure 6)

Figure 6. Elevation drawing of the propylon by Pullan.

4. TEMPLE OF ARTEMIS LEUKOPHRYENE AT MAGNESIA

Magnesia on Meander is located about 80 km to the south-east of Teos, and some twenty to the south-east of Ephesus. These three cities which occupied the corners of a not very large triangle were famous for the beauty of their Ionic temples. It is now determined that Hermogenes was engaged on the temple of Artemis Leukophryene at Magnesia a few years after he built the temple of Dionysus at Teos. His early work brought Hermogenes the fame that led him to design this. When the Magnesians decided in the Hellenistic period to rebuild the temple to hold their deity Artemis Leukophryene, they did so pompously by gathering the resources and inviting the reputed architect Hermogenes. The resulting project was to showcase the wealth of the Magnesians who were proud to be the residents of one of the largest cities in Asia Minor. Vitruvius was not the only author touting this work of Hermogenes; Strabo also praised its size as the third largest temple in Asia Minor, after Ephesian Artemision and Didymaion and its elegance (Strabo 14.1.40).

In the present city is the temple of Artemis Leukophryene, which in the size of its shrine and in the number of its votive offerings is inferior to the temple at Ephesus, but in the harmony and skill shown in the structure of the sacred enclosure is far superior to it. And in size it surpasses all the sacred enclosures in Asia except two, that at Ephesus and that at Didyma.

Because both Vitruvius and Strabo spoke so highly of the Temple of Artemis at Magnesia, starting as early as 18th century many explorers travelled to the region in search of the temple. Magnesia was identified at the outskirts of Mount Thorax, and the ruins of the temple were discovered, in 1803, by W. R. Hamilton. In 1824, W.M. Leake drew the first plan of it. Between 1842-1843 French archaeology Charles Texier's attempt to excavate the temple was thwarted by the marshy ground and the rising level of water. His excavation endeavour resulted in the removal and transportation of approximately 40 meters of the temple's friezes to the Louvre Museum. In 1887 another 20 meters-long portion of the friezes was carried off by Osman Hamdi Bey to the Istanbul Archaeological Museum. Between 1891-1893 Carl Humann, on behalf of the Berlin Museum, carried out the most extensive digging comprising the

temple and Magnesia. Humann's work resulted in the most comprehensive account of the temple and the city (Humann, 1904) The finds from his excavations were taken to the museums in Istanbul and Berlin (Figure 7).

Figure 7. A pair of Ionic columns of the Magnesian temple at Berlin Pergamum Museum (Photo by the author).

The Temple of Artemis Leukophryene at Magnesia on the Meander exposes a cosmopolitan sanctuary. On one hand, it is a model example of a Hellenistic Greek temple; on the other, it features the native aspects of Anatolian culture. In its design, the architect Hermogenes employed all the architectural elements reflecting this, including the Ionic order, the pseudo-dipteral design, and the continuous frieze in the entablature. The cult statue was lost but we know from the coins of the Roman period that the form of the cult statue of the goddess was conspicuously Anatolian (Herring 2016, Schultz 1975). These appearances of Artemis on Magnesian coinage show the cult statue of the goddess was not the virgin huntress Artemis portrayed in mainland Greece, but rather a fertility figure (Figure 8). The depictions of Artemis Leukophryene on these coins which were minted during the reign of the Roman rulers of the city show a surprising similarity between the cult statue in Magnesia and the better-known Artemis Ephesia. When we put both goddess figures side by side, we conclude that Artemis Leukophryene is a goddess closely identified with Artemis Ephesia, with breast-like protrusions on her chest, a tight-fitting robe adorned with animal figures that wrap around the body to give a column-like appearance, and tall headdresses (polos) with almost the same appearance. Both goddesses were worshipped under the name of a Greek goddess. Due to the proximity between the cities of Ephesus and Magnesia, as hybrid products of Greek and Anatolian religious beliefs, most likely they developed from the same origin. In addition to the similarity between the cult statues, the temples of Artemis in Magnesia and Ephesus shared another distinctive feature. As appears in some numismatic representations of the temples at Ephesus and Magnesia (Figure 9), and as evident from the

Figure 8. Magnesian coins showing draped cult statue of Artemis A. AD 218-222 B. AD 14-29 C. After 190 BC D. AD 54-68.

surviving remains of the pediment of Magnesian temple (Figure 10) they each had a large central doorway flanked by two smaller doors in their pediments

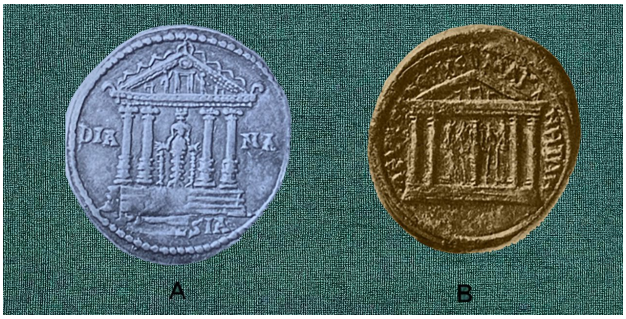

Figure 9. A. Ephesus, Hadrian Era. B. Magnesia, Trajan Era.

Figure 10. Surviving pediment of the Artemis temple (Photo by the author).

In Ephesus, these gates were flanked by statues of Amazons (Bammer, 1972), while the pediment of Magnesia was plain. Based on the evidence of an inscription found at Magnesia,

Humann hypothesized that these gates were used to stage the annual symbolic re-enactment of an event known as the "Epiphany", when Artemis revealed herself to the people. An alternative hypothesis puts forward that they were used to allow moonlight into the *cella,* at certain times of the year for illuminating the cult statue.

The superstructure was rising on a high podium (crepidoma) measuring 31m x 58m. It could be reached with 7 steps on one side and 6 steps on the other from a foundation of 41.0 m x 67.5 m. Another feature was that each of the building's portions, including the pronaos, naos and opisthodomos, was designed using a constant set of proportions. All the columns and walls were arranged in a regular pattern along orthogonal axes, as if planned on a checkerboard divided into 28 squares (4x7). According to this system, the columns of the peristasis were arranged so that one square contained three columns. Similarly, the cella was divided into three sections that followed this pattern of squares. The pronaos and naos consisted of four squares and the opisthodomos consisted of two squares, in other words pronaos and naos were equal in size, while the opisthodomos was exactly half the size of them (Bingöl, 2007), (Figure 11).

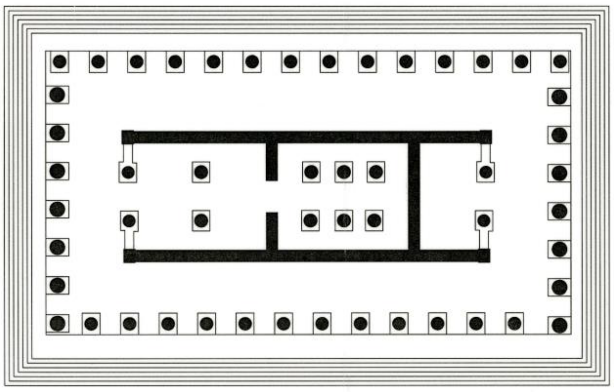

Figure 11. Ground plan of the temple of Artemis Leukophryene at Magnesia (After Humann (1904) and Bingöl (1990)).

Although the exact height of the columns is not known, it is estimated that they were about 12 -14. 85m tall as calculated prom the prescription of Vitruvius and measured also from the reconstruction in the Pergamum Museum (Figure 7). They were topped with Ionic capitals which carried also a novelty. For the first time here the Ionic capitals and the fluted neck of the column were made of a monolithic block of marble. Another innovation was that the buttress between the Ionic volutes on either side of the capitals had a different decorative design on each column. Some have an upper torus decorated with laurel leaves, while others have a curved band. The column bases of the temple are of the Attic-Ionic type. They represent the first use of this type of pedestal in Asia Minor, replacing the traditional Anatolian-Ephesian type.

Hermogenes' magnum opus, the Magnesia temple of Artemis at Magnesia, reveals his personality as an artist, both in his skill and mastery in the creation of a monumental space, with magnificent staging of a temple and altar centrally placed in a great temenos, and in his intense attention to detail, right down to the small decorative feature of each Ionic capital, varying on each column. Frontal elevation and ground plan of this plan are reconstructed in Figure 12, after Humann.

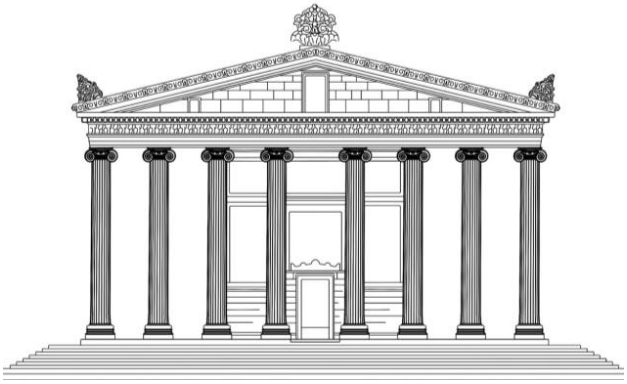

Figure 12. Front elevation of the Temple of Artemis Leukophryene at Magnesia (Adaption after Humann).

5. VIRTUAL RECONSTRUCTION METHODOLOGY OF THE TEMPLES OF HERMOGENES IN ASIA MINOR

The two temples of Hermogenes in Asia Minor have been reduced to quarries due to the ravages of time and human intervention. Thus, it is inevitable that virtual reconstructions of these temples contain some uncertainties and hypothetical elements. In the absence of field data and architectural elements, other sources were sought to fill in the missing information. The temples of Dionysus and Artemis Leukophryene have been studied with evidence provided by various circles (historians, archaeologists, architectural historians, epigraphists, numismatists). Since the evidence provided by these separate groups is very fragmentary, the successful reconstruction of the temple required the synthesis of these fragmentary pieces of information. We began with literary evidence and historical research and progressed by examining archaeological, epigraphic and numismatic evidence. As the first source of information, Vitruvius in his *De Architectura* suggested, though not very consistently, that harmony and beauty of these temples result from the proportions of small integers. He suggested that there should be a correspondence between the members of a whole building and a particular part of the whole (module) chosen as a standard. He then suggested that the proportions governing the dimensions of a building should be derived from this basic module. Although this kind of regularity does not always emerge in the field, Vitruvius' modular, systematic approach fits with the computational mindset of the digital age. We have utilized in calculating column heights his prescription which says the full height of the column should be 9.5 times the lower diameter of the columns.

The process of virtual 3D reconstruction requires structured data. In the problem of reconstructing the Ionian Temples of Hermogenes, there is a large amount of scattered and unstructured data that should be used to detect connections and patterns between these temples in order to gain insight into their common features. Holistic modelling of the temples of Hermogenes is based on the assumption that there are significant benefits to be gained from connecting each modelling element in accordance with its context within the Hermogenes principles as a whole, provided that resources for the model can be effectively managed and documented. This helps to test informed hypotheses worth making to fill the knowledge gap. This holistic approach is based on the following basic procedures:

1. Trailing their chronology: In order to garner information about these buildings, their construction, reconstruction and destruction were traced.
2. Assembling a Corpus of Hermogenes: The superstructures of these temples, created by an exceptional master of Hellenistic architecture, were analysed through the accounts of ancient and more recent authors, fragments in museums, and surviving remains.
3.Collecting Empirical Data: They can only be properly studied by going to the places where they were found and visiting the Museums that hold large parts of them in their collections. By traveling from one temple site to another and moving from one museum room to another, the author has tried to understand the unique identity of their architecture and discover the links that once connected them.
4. Ordering and Prioritizing Content: Measurements and values used for the reconstructions of the temples are given in Table 1. Workflow of the reconstruction process is illustrated in Figure 13, which shows what is taken into account.

Temple Name	Temple of Dionysus at Teos	Temple of Artemis Leukophryene
Date	3rd century BC	3rd century BC
Peristyle Type	Peripheral	Pseudo-dipteral
Portico Style	Hexastyle	Octastyle
Crepidoma Length	42.5 m	58 m
Crepidoma Width	22.75 m	31 m
Stairs Type	All sides	All sides
Number of Steps	5 west, 12 east	5-6
Column Height	9.12-9.93 m	12-14.10 m
Array of Columns	6x11	8x15
Column Diameter	0.96-1.03 m	1.263-1.485m

Table 1. Measurements and values used for the reconstructions of the temples

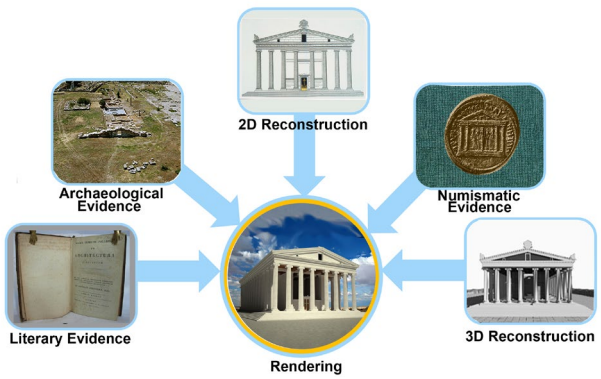

Figure 13. Workflow of the reconstruction process of the temple.

6. RESULTS

The stylistic and structural features of the Temple of Dionysus Leukophryene, which are difficult to detect from 2D drawings and other sources, and the temple's spatial relationship with the stoa can be presented much better in 3D models (Figure 14).

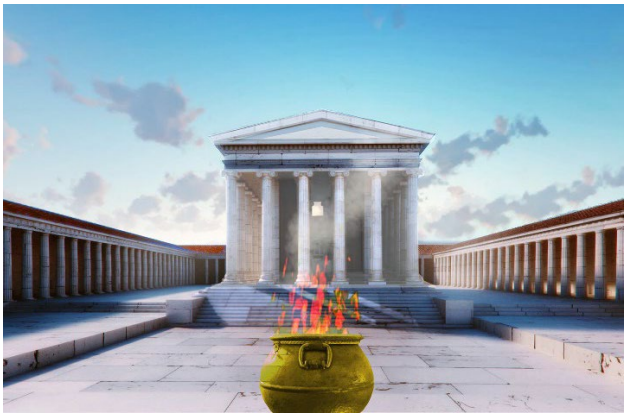

Figure 14. Near the middle of a trapezoidal temenos is seen the temple building which extends in an east-west direction.

The most distinctive feature that distinguishes the Ionic temples in the east of the Aegean from the Doric temples on the west coast was the elongated and fluted columns. This feature, which is established with the Temple of Artemis at Ephesus is the dominant element of the facade view. Hermogenes perfected this with acumen and greater artistry in the temples at Teos (Figure 15) and Magnesia (Figure 16)

Figure 15. First view of the temple through the eyes of a visitor entering the temenos from the propylon.

The visualizations of the temple of Dionysus and Artemis Leukophryene provide a clear picture of Ionian architecture on the eastern coast of the Aegean during the Hellenistic period. Designed by the pioneering and leading architect Hermogenes, whose name we know thanks to Vitruvius, these temples, with their gleaming white marble structures and bright paint contrasting with the whiteness of the marble, were the most beautiful Ionic-style buildings in the region, offering 'magnificent' visual feasts to their visitors for years. This beauty and splendor was not the work of a single architect's genius, but rather the result of an architecture that had developed in this geographical region over a long history, imbued from the cultural and aesthetic values that had already manifested themselves in Ephesus and Priene.

Figure 16. One of the most distinctive architectural features of the Temple of Artemis is the long slender Ionic columns at the facade.

Figure 17. Silhoutte of the Mount Thorax at the back and propylon in front add to the grandeur of the edifice.

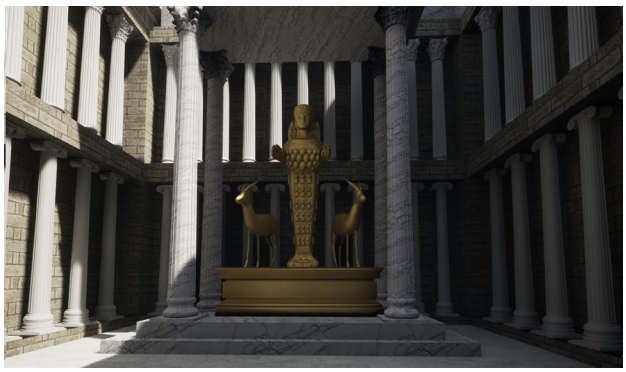

Figure 18. Recostruction of naos and the cult statue of Artemis Leukophryene.

7. CONCLUSIONS

The creation of digital replicas of the lost temples of the god Dionysus of Teos and the goddess Artemis Leukophryene of Magnesia provides virtual access to these temples that are no longer physically accessible. These 3D reconstructions offer the opportunity to create these unique monuments of our cultural heritage in our minds, to keep them alive in our memories, and to enable their accessibility and awareness. Creating, displaying, manipulating, archiving and sharing digital representations of the shape and appearance of these masterpieces of Hermogenes required solving the most challenging problems of virtual reality applications. The 3D reconstruction models obtained by solving these problems provide a wealth of information that can be analyzed, tested and improved, as they can be edited both in terms of shape and appearance and functional properties. In addition to the immersive visualizations offered by digital technologies, virtual 3D visits to the sanctuaries of these temples in Teos and Magnesia offer a very attractive opportunity to experience them.

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