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HYPOTHESIS OF RECONSTRUCTION OF THE ROMAN THEATER OF URBS SALVIA

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Abstract

The modern city of Urbisaglia, Roman Urbs Salvia, features many traces of its ancient origins. One of the most noteworthy is the theater, dated at around 23 d.C. The article presents a new, hypothetical virtual reconstruction of the structure, which was carried out based on the recent research of the geometric framework used by Roman architects in design. The principal intention of the article is to demonstrate the methodology of the study, in the case of a monument characterized by poor state of preservation.

Keywords

Analysis, geometry, survey, drawing.

1. *Introduction*

The article presents the methodology and outcome of the virtual reconstruction of the ancient Roman theater in Urbs Salvia, present-day Italian city of Urbisaglia located in the province of Macerata. The easily-recognizable semi-circular remnants of the structure are situated only a short distance to north-east from the gate on the north end of the city. The theater is placed against the slope at the bottom of which lied the road connecting the most important buildings of the ancient town. The precise dating of the theater to 23 AD was possible thanks to the monumental inscription found on the site.

The virtual reconstruction of the original form of the theater was based on the thorough analysis of the extant fragments of the structure, in order to establish the system of metrology and geometric relationships used in the design. The virtual reconstruction hypothesis is based primarily on the analysis and interpretation of the sources, both archaeological and documentary. However, the poor state of preservation of the theater made it necessary to include in the research a comparative study of multiple analogous structures to restore the missing parts. An in-depth survey of the archetype of the Roman theater was therefore fundamental for the project and used as a starting point to collect data on the principles of the design, proportional systems and metrology (Sear, 2006).

In the extant Roman theaters in which it is possible to identify dimensions unequivocally, it is possible to find a variety of proportions between

Fig. 1: Existing condition of the Urbs Salvia theater (photo I. Bassoli)

Fig. 2: Survey of the existing condition of the theater in *Urbs Salvia*

the measurements of the principal design elements, such as the ratio between the width of the orchestra and that of the stage. At *Urbs Salvia* it is approximately 1: 2. Recent studies of the geometric framework of the Roman theaters (Fuchs, 2020) demonstrated that Roman designers worked with flexible schemes adapted to different situations, rather than following a single design scheme advocated by Vitruvius. The initial part of the study was therefore aimed at testing the hypothesis that also the theater of *Urbs Salvia* was designed not by applying the fixed Vitruvian rules, but by other geometric schemes and principles.

The survey presented a very large number of questions about the original form of the theater. Potential individual answers had to be confronted with each other, in order to create a comprehensive general vision of the design.
The article will elaborate only on the main aspects of the investigation, such as the design of the theater according to grid framework, and the new interpretation of several reconstruction proposals made in the past concerning the *velarium*, the wooden roof of the *scaenae* building, the façade of the *postscaenium* and finally a new proposal for the design of the upper entrance to the cavea.

The main resource of the analysis was the current status, i.e., the material evidence of the archaeological remains (Fig. 1). A new survey was performed using the Lidar technology, which allowed the three-dimensional restitution of the extant form of the theater site, based on which the fundamental drawings were made (Fig. 2)[1]. Twenty stations were placed to cover the entire area of the theater, of which thirteen were in the *vomitoria*, in order to understand the design of the system of arches and corridors connecting the *ambulacrum* to the cavea. The most important scans, however, were those placed in the *ambulacrum*, in particular at its highest accessible point, in order to determine the slope of the ramp

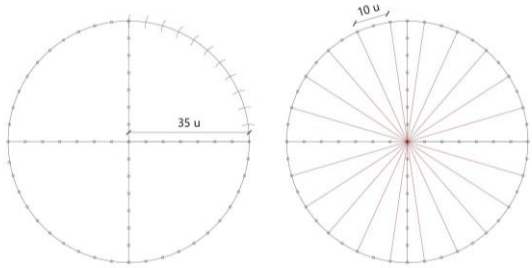

Fig. 3: Approximate subdivision of a 22-sided polygon

around the cavea and the design of the arches and the corridors leading to the *vomitoria*.
In the next step, the drawings of the theater were analyzed for the conformity of the layout with the instructions provided by Vitruvius in his book.[2] The author proposes a scheme that starts from the construction of a circle of the orchestra, relative to which the location and the dimensions of all other parts of the building are determined: the layout of the cavea, the dimensions of the *pulpitum* and the *proscenium* as well as the heights of the *pulpitum* and columns of the *scaenae frons*. However, since no original drawings of Vitruvius were preserved, the formulas presented by Vitruvius lend themselves to interpretations. Vitruvius himself also declares that some relationships must be adapted to the particular placement and size of the theater. The statement suggests that he was aware that the geometric relationships and dimensions he described were only guidelines and not universal principles, and that not all theaters would follow his prescriptions. It is also necessary to remember that *De Architectura* contains the point of view of only a single architect from the period, and that other architects could have designed the theaters differently. Indeed, recent studies have shown that the proportions presented by Vitruvius are almost never found in extant theaters, except for a few individual cases. The present study demonstrates that also the

[1] Two methods of digital representation were adopted to construct the virtual 3D model of the theatre: mathematical and polygonal. The entire process of the 3D virtual reconstruction can be divided conceptually into four phases. The first phase was the survey of the archeological remains. The second phase comprised the processing of the point cloud. In the third phase, the mathematical model of the theater was constructed, which was converted into the polygonal model and the illustrations were produced in the fourth phase.
A Laica C10 scanner was used for the survey of the site. Cyclone Leica and Autodesk Recap were used for the processing of the point cloud; while Autodesk AutoCAD was used for the two-dimensional drawings. The mathematical model was constructed using Rhinoceros 7.0 software and converted into the polygonal mesh model to produce the final renderings of the presentation with the Autodesk 3DS MAX software and Corona render.

[2] The fifth book of *De Architectura* is entirely dedicated to the construction of the theater.

architect of the theater of *Urbs Salvia* didn't follow the Vitruvian scheme.

2. The principal considerations for the reconstruction of the layout of the theater and the scaene.

The geometric analysis of the extant Roman theaters showed that they don't follow the principles described by Vitruvius: their plans are not based on the single geometric model described by Vitruvius, but are instead characterized by great amount of experimentation.
The configuration of the *cunei* in the cavea was not based only on the twelve-sided regular polygon (as described by Vitruvius), but was designed based on the central angles of a variety of polygons (which is equivalent to the division of the circle into different numbers of equal parts), including those geometrically not constructible with an unmarked straightedge and a compass (Fuchs, 2019; Mele & Maniglio, 2015). The layout of the theater in *Urbs Salvia* is one of the most unique this way. The extant foundations of the cavea of the theater in *Urbs Salvia* demonstrate that it was subdivided into *cunei* based on a geometry of a 22-sided regular polygon. There are only three other Roman theaters that follow the same pattern. The first is in Teramo (*Interamnia Praetuttianorum*), built between the end of the first century B.C. and the middle of the first century A.D. The other two are located in Palmyra and Thugga and are dated to the second half of the second century A.D.

The method of dividing the circle into 22 equal segments used in the case of the theater in *Urbs Salvia* is difficult to interpret, due to the geometric complexity of this type of structures. However, recent studies showed that there were many other Roman circular buildings designed in similar manner. The same layout can be identified in the Temple of Vesta in Rome (Fuchs, 2022). The study of the site and several specific architectural elements demonstrated that it was designed with 22 columns instead of 20, as was believed previously. Other examples of the circular plan divided into 22 equal parts are the early Christian church of San Stefano Rotondo in Rome, and the structure known as Carceri Vecchie in Capua. The research showed that since the Augustan period the circular structures based on that the division of a circle into 22 equal segments were common in Roman design. The ancient architects used for this purpose the approximation of π=22/7, and the length of the radius of the principal circle of the layout that could be divided into 7, for example 28 RF, 35 RF etc. The resulting length of the circumference could be this way divided easily into 22 equal parts, with the length expressed by whole numbers of units (Fuchs, 2022).

The theater of *Urbs Salvia* lends itself well to the application of this approximate geometric construction. The construction of the regular polygon with 22 sides in this case must have begun by drawing a circle with a radius equal to 35 RF (remembering that the radius of the orchestra is greater by one foot, 36 RF). The circumference of such circle is therefore C=2*35*22/7=10*22 RF. Thus, the length of each side of the 22-sided polygon is 10 RF. It was therefore sufficient to measure the arcs of 10 RF around the circumference of the circle to mark the beginning of the lines dividing the semicircle of the cavea into the *cunei* (Fig. 3). Similar calculation had to be performed at the top of the cavea. Considering the thickness of the perimeter wall of the cavea, the radius of 140 RF was probably used. The circumference of the full circle was therefore C=2*140*22/7=40*22 RF, and the lengths of the individual arc segments were 40 RF. The endpoints of the arcs at the level of the orchestra and at the top of the cavea were used to mark the beginning and the end of the staircases. The error amount of the calculation was minimal, no greater than 0.02 RF on each arc segment.

In *Urbs Salvia*, the division of the cavea into *cunei* can be recognized only at the level of the *media*- and in particular the *summa cavea*, but there are no visible traces of the staircases in the *ima cavea*. According to Vitruvius the *media cavea* had to be divided into cunei by staircases positioned alternately in respect to those of the *ima cavea*. However, there are only a few theaters in which this type of subdivision was used, for example the theaters of Ostia and Benevento. In some cases, the shifting of the staircases can be found in the *summa cavea*, as in the theater of Catania. In most theaters, the staircases of the *ima cavea* continue into the *media cavea*, and there are additional stairs inserted half way between them.

This way there are twice as many *cunei* in the *media cavea* than in the *ima cavea* (as in the theaters in *Volaterrae* or *Arausio*). Because of the prevalence of the design, the same configuration of the *cunei* was also assumed for the reconstruction of the layout of the theater in *Urbs Salvia*.

The cavea was separated from the *pulpitum* by the *aditus maximi*, the lateral entrances to the

orchestra, and the *tribunalia* that were located above them.
Their design in the virtual reconstruction is based on the limited archeological data, that by itself could be interpreted in different ways, and a comparative study of the same feature in other Roman theaters, amongst which several different approaches to the problem can be identified.
In Leptis Magna the cavea is divided according to the geometry of a 12-sided regular polygon. The diameter line of the cavea is aligned with the front of the *pulpitum*, and the *aditus maximi* are on its

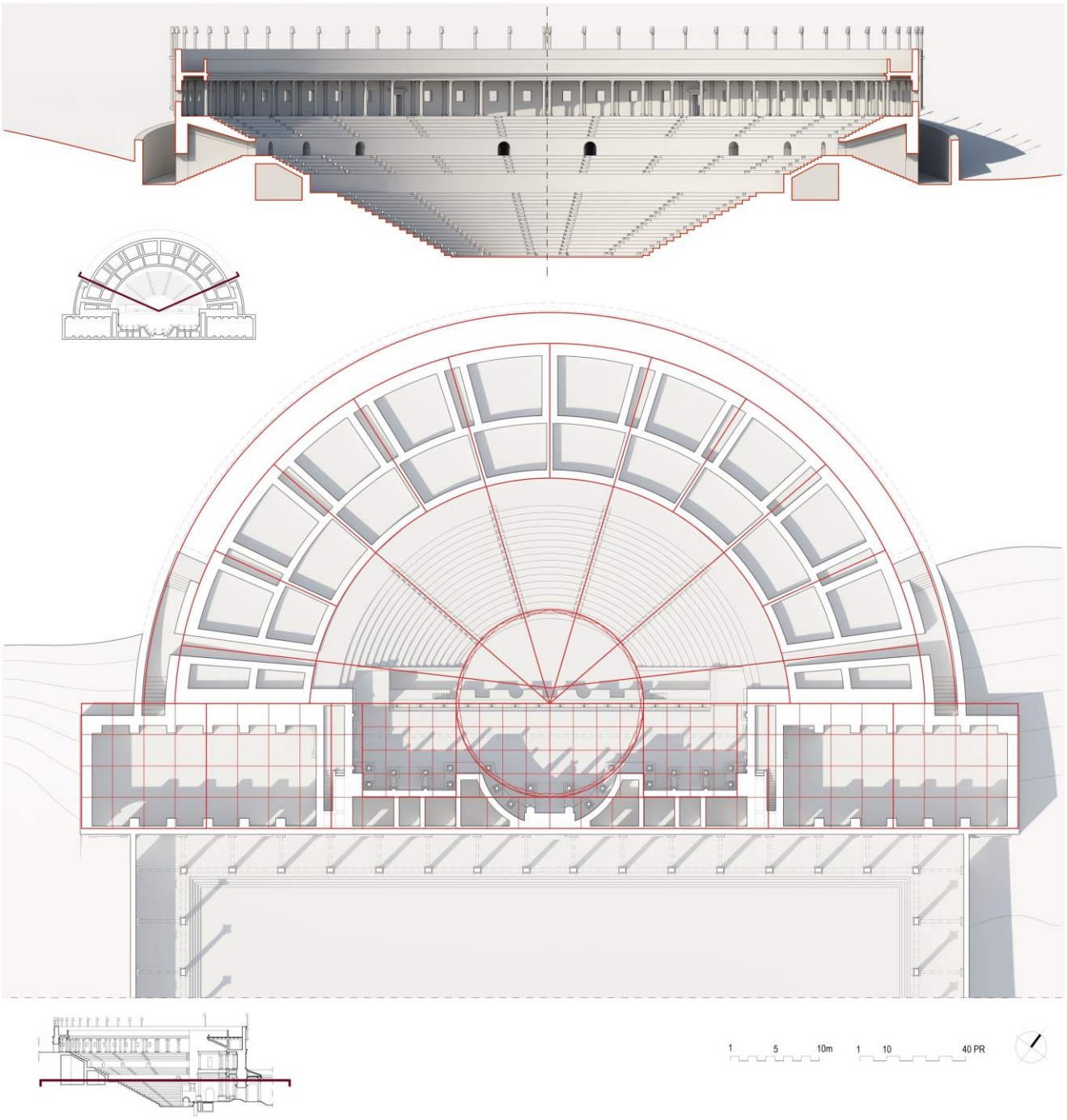

Fig. 4: Virtual reconstruction: the section and the plan of the theatre with the geometric framework lines in red

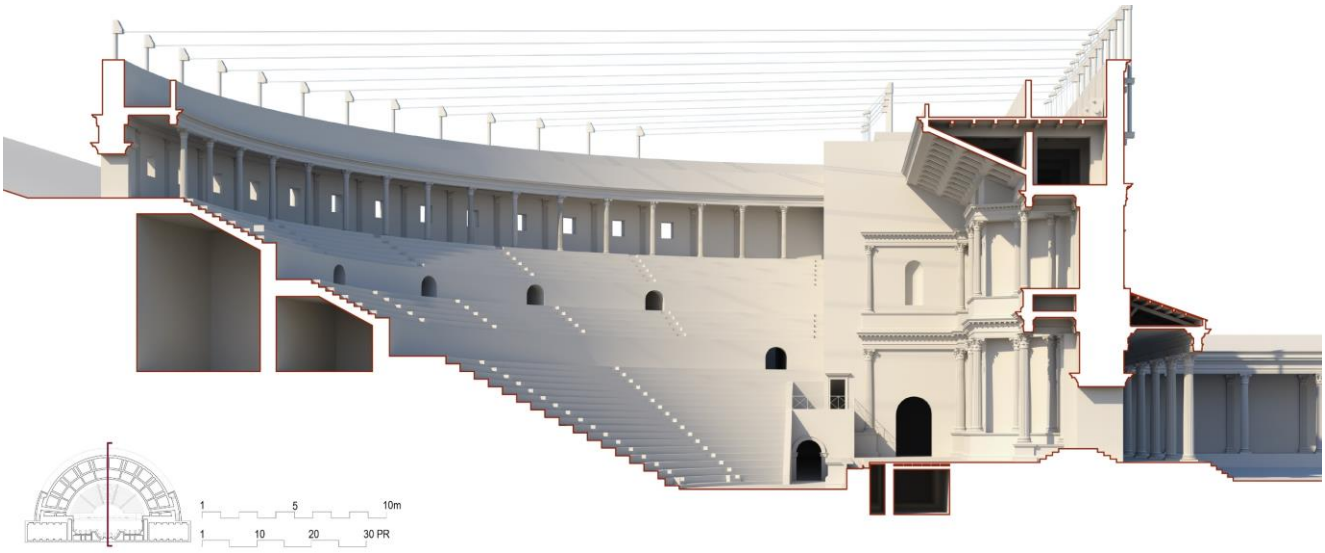

Fig. 5: Virtual reconstruction: perspective section

opposite side, thus occupying a portion of the two lateral *cunei*, which this way became much narrower than the others.

In the case of *Augusta Emerita*, the cavea was divided according to a tetradecagon (a 14-sided regular polygon) created by overlapping of two heptagons (7-sided regular polygons). The diameter line of the cavea passes through the ateral axis of symmetry of thus created figure, and the *aditus maximi* were placed symmetrically on its both sides, using as spatial references the points of intersection between the two 7-sided polygons.

The virtual reconstruction of the theater of *Urbs Salvia* proposes a different design that provides a compromise between the two described above, but is well attuned to the geometric characteristics of the layout based on the division of the circle into 22 equal segments. The *aditus maximi*, and the *tribunalia*, have been placed opposite the furthest, narrow *cunei* of the cavea, between its lateral diameter of the latter and the first set of stairs.

The design of the *scanae* buildings in the Roman theaters is best characterized by the layout of the three principal doors to the stage (*porta regia* in the center and the two *hospitalia*) and the design of the colonnade of the *scaenae frons*.The location of the *portae hospitalia* had the most significant effect on the composition of the entire *scaenae frons*. It was explained by Vitruvius relative to the angles of the 12-sided polygon, which was also the basis of the layout of the cavea. Yet, there are no known Roman theaters in which the layout would adhere to the description. For this reason, several suggestions have been offered by scholars in the past to explain the principles that could have been used by the Roman architects. They typically used the Vitruvian scheme as the principal reference, thus declaring the observable discrepancies from the 12-sided polygon scheme as modifications of the presumed Vitruvian universal design method, and deriving the location of the *hospitalia* doors from the same central scheme.

However, linking the location of the *hospitalia* doors to the angles of the staircases of the cavea was prone to error and none of these solutions has proven to be universally applicable. A recent geometric study made it clear that the scene could be designed by Roman architects with a uniform proportional system: a bidirectional square grid used to locate all the elements of the composition, and determine their main dimensions based on simple ratios (Fuchs, 2019).

According to this hypothesis, a grid framework was based on the radius of the orchestra and the length of the *pulpitum*. It was generally consistent with the Vitruvian principle according to which "the length of the scene should be twice the diameter of the orchestra", with some modifications based on the choice the architects made for the actual architectural features aligned with the grid lines. Based on these studies, a grid configuration for the scenic building of the *Urbs Salvia* theater was proposed in the virtual reconstruction (Fig. 4). The radius of the orchestra has been reconstructed at 36 RF. The analysis of the measurements of the extant elements of the *scaneae* allowed to restore the module of the grid as 9 RF, or ¼ of the former value. The nominal,

overall width of the *pulpitum* was therefore 4*36=144 RF.
The analysis of the existing structures demonstrates clearly that the overall layout of the Roman theaters combined two different types of geometry: radial for the cavea and rectangular for the scene (Fuchs, 2019). They were integrated with each other through the line shared between the *pulpitum* and the diameter of the cavea, and the radius of the orchestra which was the source of the module used for the design of the *scaenae frons*.

The *scaenae frons* in the Roman theaters evolved from the simple, rectangular layout with a linear colonnade to an elaborate system with three curvilinear niches around the principal doors to the stage (Sear, 2006). The extant fragments of the foundations in *Urbs Salvia*, found and restored in the excavations of the twentieth century, demonstrate that in this case the royal door was surrounded by a semicircular exedra, while the *portae hospitalia* were placed in rectangular ones. This type of layout was in fact very common among the Roman theaters, and it can be seen in the structures in *Iguvium, Verona, Ferentum, Hercolaneum, Faesulae, Arelate* and *Augusta Emerita*.
Regarding the specifics of the design of the *scaenae frons*, there are only a few extant elements that provide information about the ornamentation during the Tiberian-Claudian age: the architectural vestments are for the most part dispersed and the few fragments still preserved are difficult to place. It was possible, however, to identify the presence of columns with Corinthian capitals in the *scaenae frons*, which can be seen in the virtual reconstruction model.

2. *The design specifications.*

We must assume that Roman architects designed the theaters according to the initial specifications provided by the client, who was also the benefactor of the project. They must have concerned the choice and the characteristics of the site, the position and the orientation of the building and the capacity of the theater.

3.1 *The site of the theater and its orientation.*

Vitruvius stated in his book that the theater must be oriented so that the audience is turned away from the sun. He wrote that the objective was to ensure that the theater "does not have exposures around noon". However, the majority of Roman theaters don't follow explicitly this rule. Instead, it is possible to observe that the needs of the land and the overall urban planning objectives were the principal consideration. Similarly, the orientation of the theater of *Urbs Salvia* is almost East-West: the axis of the theater is inclined with respect to the West of 21° to the North and it's aligned with the decumanus of the Roman city.

The cavea of the Roman theater could be constructed on a substructure or supported by the natural slope, the latter option being obviously much less expensive. Therefore, the topography was an important aspect of the of the selection of the site for the project. Different approaches can be observed. For example, in the theaters in *Volaterrae* and *Fiesole*, the cavea is built completely against the hillside, and in *Iguvium*, the *ima cavea* was placed on an artificial hill, and the upper part of the cavea was supported on the series concentric walls and arches, with open spaces between them, which might have been used as shops or storage.

In the theater of *Urbs Salvia* the *scaenae* and the orchestra were located at the bottom of a small natural hill, with the ground leveled after the excavation of the site, while the *media* and *summa cavea* were supported by substructures (Fig. 5). In some theaters the spaces delineated by the substructure were used for the circulation in - and out of the theater, or other functions. In the case of *Urbs Salvia*, the chambers between the walls were evidently filled by the compacted earth, and only the corridors of the *vomitoria* remained open.

3.2 *Capacity of the theatre*

Capacity was also a fundamental parameter for the design of Roman theaters. Several scholars

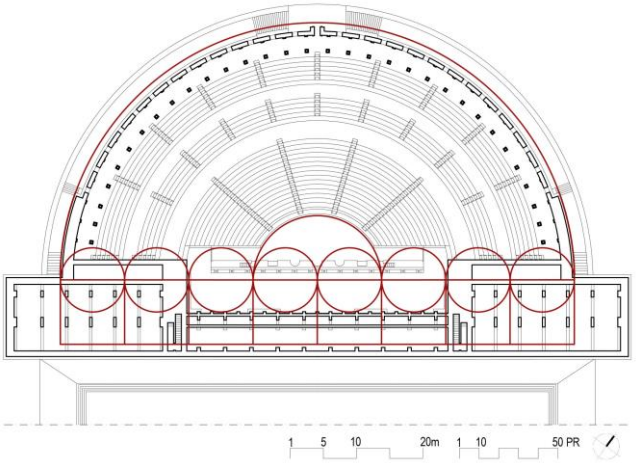

Fig. 6: Diagram of the capacity calculation

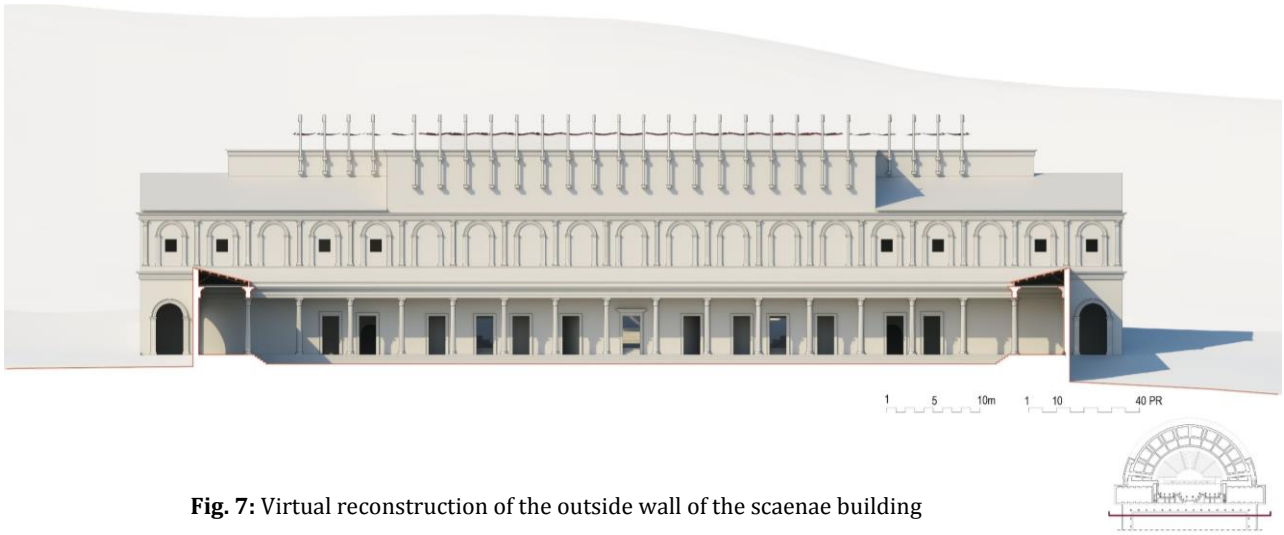

Fig. 7: Virtual reconstruction of the outside wall of the scaenae building

have proposed methods to determine it for the extant structures (Bianchini & Fantini, 2015).

However, it must be considered that the architects had to have an ability to estimate it during the earliest phases of the design process rather than calculate it after the project has been completed.

A recent study showed it could have been done based on the proportional relationship between the radius of the orchestra and the radius of the *cavea*. (Fuchs, 2019) In a significant number of Roman theaters, located mostly in northern Italy and southern France, the radius of the cavea is equal approximately the radius of the orchestra multiplied by π (Sear observed that it is a little more than three times the former distance (Sear 2006)). In those cases, the capacity seems to be approximate to the area of the orchestra, calculated in Roman feet (*pes quadratus*) C = πr^2. It was therefore a very simple rule that allowed Roman architects to make a preliminary project based on the capacity required by the clients. The second group of extant structures is characterized by the radius of the cavea being four times the radius of the orchestra. In this case the capacity was one and a half times the area of the orchestra C = 1 ½ πr^2. The theater in *Urbs Salvia* belongs to the latter category (Fig. 6). It is therefore possible to estimate that the structure was intended for the maximum capacity of about 6000 spectators. Depending on the actual value of the approximation of π used, it could be between 6075 and 6110, with the most accurate value:

C=1 ½ *π*36^2 ≈ 6107.

However, it is necessary to adjust this number for the presence of the porticus at the top of the cavea, which would reduce the original number significantly, to between 5000 and 5250. In the past, several scholars made attempts to calculate the capacity of the theater, proposing very different values without explaining the procedure that led them to it. According to Amucano, the maximum number of spectators could be estimated at 12,000 (Amucano 1992), while for Salvucci it could hold 5150 people (Salvucci, 2003). Sear proposes a slightly smaller number: 5050. The latter two values corroborate the validity of the method and the calculation adopted in the virtual reconstruction and presented above.

3.3 *The outside wall of the scaenae building*

The design of the outside wall of the *scaenae* building was of great significance in the Roman theaters, especially in those structures that were built against the slope of the hill. In the case of the theater of *Urbs Salvia*, it can be said that it was in fact the actual front façade of the building, facing towards the rest of the Roman city, and the first that the visitor saw when approaching the structure from below. Since nothing remained of its original form, the reconstruction of the façade was based on the case studies of other theaters.
There are only two examples in which the wall has been preserved to its full height and extents. The reconstruction of the theater in *Urbs Salvia* is therefore based on the structures in *Arausio* and *Aspendos*, in which the outside walls of the scaenae building are very well preserved.

In the former structure, the façade was divided by the intermediate cornices into five levels. Its overall height was dictated by the grand scale of the *scaenae frons*, which was designed with three orders of columns. The first level of the back wall

was decorated with a series of arches, some of which were open to the corridor connecting the spaces behind the *scaenae frons*. The rest of the wall, including the arches of the third level, was blind. In the topmost part of the wall there are two rows of corbels that supported the masts of the velarium.

The virtual reconstruction of the outside wall of the scaenae theater in *Urbs Salvia* uses the same general design pattern, with the vertical dimension reduced to three levels of the intermediate cornices, according to the height of the colonnade of the *scaenae frons* (Fig. 7).

4. *The entrances to the theater*

The inside corner spaces between the scaenae building and the end walls of the cavea (*analemmata*) were often enclosed, and took form of basilicas. They served as a form of foyer, a transition from the outside to the lower-level entrances to the theater. The archaeological remains of the theater of *Urbs Salvia* clearly indicate their presence. Each of them had two doors, one that accessed the *ambulacrum*, and the second gave access to the orchestra floor. The latter were the so-called *aditus maximi*, above which there were the *tribunalia*, reserved for public tribunes. The *aditus maximi* were the entrances through which the senators and all the distinguished guests passed to take their seats in the orchestra. The access to them from the *basilicas* was through the arches in the *analemmata* walls, behind which the spectators had to turn at a right angle towards the center of the theater.

The spectators of the lower classes accessed the upper-level seats in the *media* and *summa cavea* through the *ambulacrum* around the cavea and the *vomitori*. The theater had a total of ten *vomitoria*: two were located at the slightly lower level than the *praecinctio* that separated the *ima cavea* from the *summa cavea*. It connected to the *cavea* via a slightly sloping ramp, while the other eight *vomitoria* were distributed along the *ambulacrum* at gradually higher levels, with access to the *summa cavea* via stairs.

The older documentations of the archeological site of the theater of *Urbs Salvia* shows traces of a structure at the apex of the cavea, that was in the past interpreted as the *podium* of a small *sacellum*. Although it is no longer visible today because it is covered by vegetation, but it was evidently structurally integrated with the outer wall of the cavea and thus it must be considered part of the theater complex. The dimensions of the alleged building reported in the literature are inconsistent between sources[3]; but it was definitely very narrow for a temple, even of the tetrastyle design.

In addition, considering the location of the platform and its geometry, the access to the alleged temple would have to be by stairs perpendicular to the axis of the *podium*, which would be a very unusual design. It must be also emphasized that the temple at the apex of the *summa cavea* was not always present in Roman theaters, and the known examples in Italy of such design are generally limited to the structures located in Rome or further south.[4] There are no theaters in the vicinity of *Urbs Salvia* demonstrating this feature. Consequently, the virtual reconstruction proposes a different interpretation of its function than originally believed, that of the entrance to the theater from the back.

A solution similar to the one proposed in the virtual reconstruction is found in the theater of the Roman city of *Vasio Vocontiorum*[5], which has a monumental access door in the curved façade.

The entrance in the case of *Urbs Salvia* would connect to a wide walkway at the top of the cavea, which was probably part of a colonnade, called *porticus* by Vitruvius and *porticus supra caveam* by Pliny. According to Vitruvius, its roof was to be at the same level as the top of the *scaenae frons*, as shown in the reconstruction.

5. *The velarium – the fabric roof of the theater*

The Roman theaters were also equipped with *velarium*, which offered the audience protection from the sun. It has been documented by various authors, including *Lucretius* (Lucretius, 1708). It

[3] Amucano, from what remained on site and from the Annibaldi plan, assumes the measurements of 5 x 5.50 m; Perna reports the measurements of 7.4 m for the long sides, 5.5 and 6.5 for the short sides respectively (Perna 2006); Cingolani indicates 5 m for the long sides, 4 and 4.50 m for the short sides (Cingolani 2019).

[4] For example, the theater of Leptis Magna.

[5] The current Vaison La Romaine.

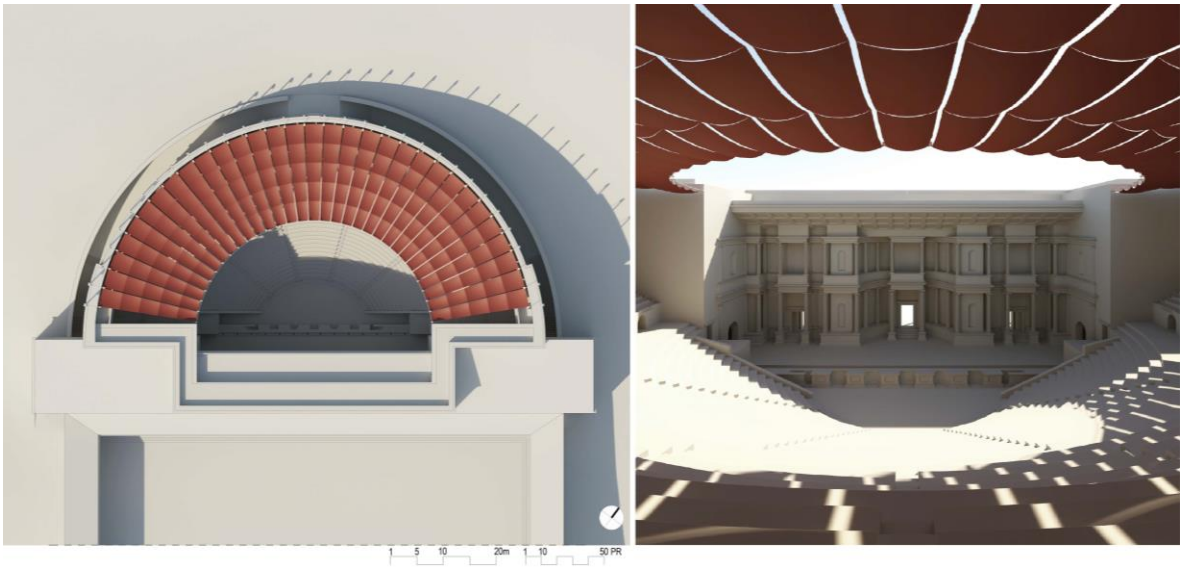

Fig. 8a: Virtual reconstruction of the velarium according to the previous hypotheses

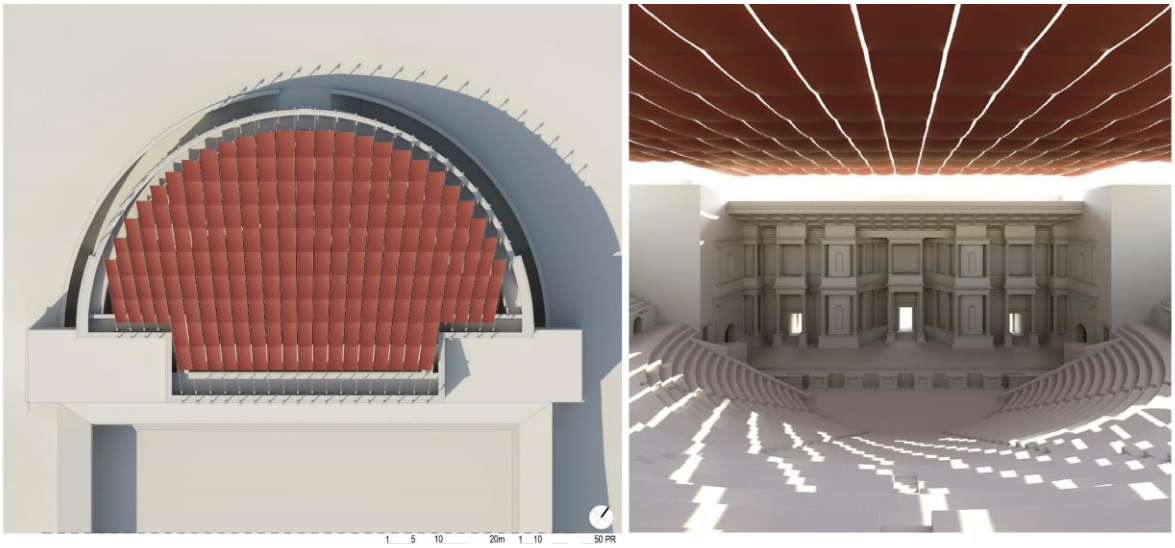

Fig. 8b: Virtual reconstruction of the velarium: new hypothesis

was a system of the bands of fabric that was held up by ropes extending from wooden masts. In some theaters and amphitheaters some elements of the *velarium* are still visible. In the Colosseum and the theater in *Arausio* it is possible to see stone blocks protruding from the walls that supported the poles. In Volterra, there is a series of regularly spaced u-shaped stones around the perimeter wall of the cavea, in which the masts of the *velarium* must have been anchored.

A variety of hypotheses about the operation of them featured radial pattern with the roof inclined outwards, forming a large central void (Fig. 8a).

Such design presents multiple problems, the most important of which is that such roof would leave a major part of the lower cavea without cover, and that there would be no room to store the long strips of fabric when the roof was folded. While considering the first point it is necessary to remember also that the seats in the orchestra and the *ima cavea* were reserved for the most distinguished spectators, and it is unlikely that they were left exposed to the sun. It is therefore evident that the *velarium* had to cover the entire interior of the theater.

Architect Francesco Alvino, in his proposal to cover the amphitheater of Capua (Alvino, 1933), envisioned rectangular strips of canvas that were suspended between stretched ropes. Furthermore, engineer Pierluigi Molari, in his study on the *velarium* of the Colosseum (D'Anna & Molari, 2020), hypothesized that the Romans used two different types of the roof structure: radial for the curved part of the oval and rectangular over the

arena, supported by a central chain. Additionally, the presence of the support bases of the wooden poles in the front façade of the *scaenae* building in the theaters of *Arausio* and *Aspendos* also suggest that there was a rectangular section of the *velarium* over the *pulpitum* and the orchestra. The studies inspired the design adopted in the virtual reconstruction of the theater of *Urbs Salvia*, consisting of semi-parallel bands of fabric stretched between the back wall of the *scaenae* and the semicircular perimeter wall of the cavea (Fig. 8b and Fig. 9).

The virtual reconstruction features also a wooden roof over the *pulpitum*. The hypothesis of its presence in *Urbs Salvia* is based on the archaeological evidence from the theaters of *Arausio, Aspendos* and *Bostra*, in which vertical slots in the walls behind the *pulpitum* are still visible. They were clearly holding wooden beams of significant size. Although Vitruvius does not mention the presence of the roof, and there is no certainty that it was in fact present in the theater of *Urbs Salvia*, but it can be hypothesized that it was indeed a common feature of the *scaenae* that improved the acoustics of the theater. Vitruvius states that the actors, to make their voices resonate inside the theater, turned to the wooden doors. The roof over the *pulpitum* would work in a similar fashion, but much better.

Some reconstruction drawings of the Roman theaters demonstrate roofs that would have been extremely unlikely, due to the excessive overhang of its beams. The form proposed for the theater in *Urbs Salvia* was considered from the perspective of the structural performance, with the maximum cantilever of the beams of five meters. Such roof would have been also a convenient platform from which to operate the *velarium*. It was probably accessible through the stairs located in the *paraskenia*, the traces of which can be seen in the theaters of *Arausio* and *Aspendos*.

5. *Conclusions*

The process of the hypothetical reconstruction of the theater of *Urbs Salvia* was influenced by various factors that came into play in different ways, each with its own 'weight' with respect to the impact they had on the final result. It is important to identify clearly this level of ambiguity integral to the different parts of the reconstruction. A seven-tier classification was adopted that represents a different degree of reliability of the various parts of the reconstruction, depending on the type of evidence upon which it has been based. Each class is identified in Fig. 10 by a different color. On this scale, gray represents 100% certainty of the reconstruction. The remaining six classes use the range of colors from blue (most certain) to red (least certain), with gradually diminishing degree of certainty between them.

Specifically, for this virtual reconstruction the following subdivision of the elements was used, adapted to the needs of the subject matter from the classification used by Apollonio (Apollonio 2016; Apollonio et al. 2019).

• Reconstruction hypotheses derived from the extant physical evidence in *Urbs Salvia* – Color grey.

The elements of the reconstruction based on the archaeological data still available today, such as the *vomitori*, the elevations of the *praecinctiones*, the footprint on the ground of the *scaenae* and the *basilicas*.

• Reliable conjectures based on direct/primary sources in the situation when the actual object or parts of it have not been preserved – Color blue.

To this second degree of certainty have been attributed the steps of the cavea, the stairs of the *ambulacrum* (based on an archaeological data no longer visible today), the elevation of the curved façade of the theater and the columns of the *porticus post scaenam*.

• Elements reconstructed based on comparison with theaters designed in the same period and in the same geographical area, or logical deduction based on the architectural typology of the element – Color light blue.

This category includes all of the elements of the *scaenae frons* (for which the theater of *Augusta Emerita* has been used as the primary reference), the *pulpitum*, the *tribunalia*, the seats in the cavea and the roof of the *quadriporticus*.

• Elements reconstructed based on comparison with theaters designed in the same period and in a different geographical area, or with theaters designed in a different period and in the same geographical area – Color green.

This group includes the *porticus supra caveam*, for which there is evidence in the theater of *Bostra* (in present day Syria) and the façade of the front wall of the *scaenae*, the reconstruction of which was based on the theater of *Arausio*.

• Elements reconstructed based on comparison with theaters designed in a different

period and in a different geographical area, or conjectures based on stylistic/structural references for which only indirect sources are available – Color yellow.

To this color belongs the reconstruction of the *velarium*, based on the evidence found in the theater of Aspendos (present day Turkey) in the second century A.D. (period significantly later than *Urbs Salvia*). The hypothesis, as already mentioned above, is also based on recent studies on the *velarium* of the Colosseum. The size and spacing of the beams of the wooden roof are in this category thanks to the archaeological evidence that is found in the walls of the theaters of *Arausio* and *Aspendos*.

• Conjecture based on stylistic / structural references when sources are not available - Color orange.

In this category, only the upper fragments of the walls of the *basilicas* have been included, since there is no evidence of their height. There are only few examples of the walls of the *basilicas* preserved in other theaters; most noteworthy are those of the theater of Orange, Taormina and Bosra. However, they cannot be used as reliable evidence because they have been restored in modern times.

• Personal hypotheses in place of the complete lack of material evidence – Color red.

The new hypothesis concerning the form and dimensions of the wooden roof of the scene belongs to this category, since there is no written or archaeological evidence for it. The hypothesis presented in the study is the result of the speculative design logic, based on the presence of the stairs in the *paraskenia* of some theaters, i.e., Fiesole, Benevento and Orange, which suggest access not only to the upper floors of the scene, but also to the roof, from the *velarium* could be operated.

There are over 400 Roman theaters that have been preserved to modern times, probably one of the largest number of structures of the same archetype of a monumental Roman building. Although their general architectural form is well recognized, but there are still many questions whether regarding the general principles or the design of individual elements, as in *Urbs Salvia*.

The least amount of data is available for the form and the functionality of the *velarium*, and all upper parts of the theater buildings, including the front wall of the *scaenae*. The specifics of the design of the latter are almost always neglected in the virtual reconstructions of Roman theaters, due to the fact that there are only two extant examples, in *Arausio* and *Aspendos*, which are very distant in space and time from each other.

The reconstruction proposed in the article is based on three premises. The first one is the presence, in the two theaters mentioned already before, *Arausio* and *Aspendos*, of the corbels which presumably supported the masts of the *velarium* along the back wall of the *scaenae*. They would be not necessary if the layout of the *velarium* was radial only, thus they indicate the rectangular or quasi-rectangular design.

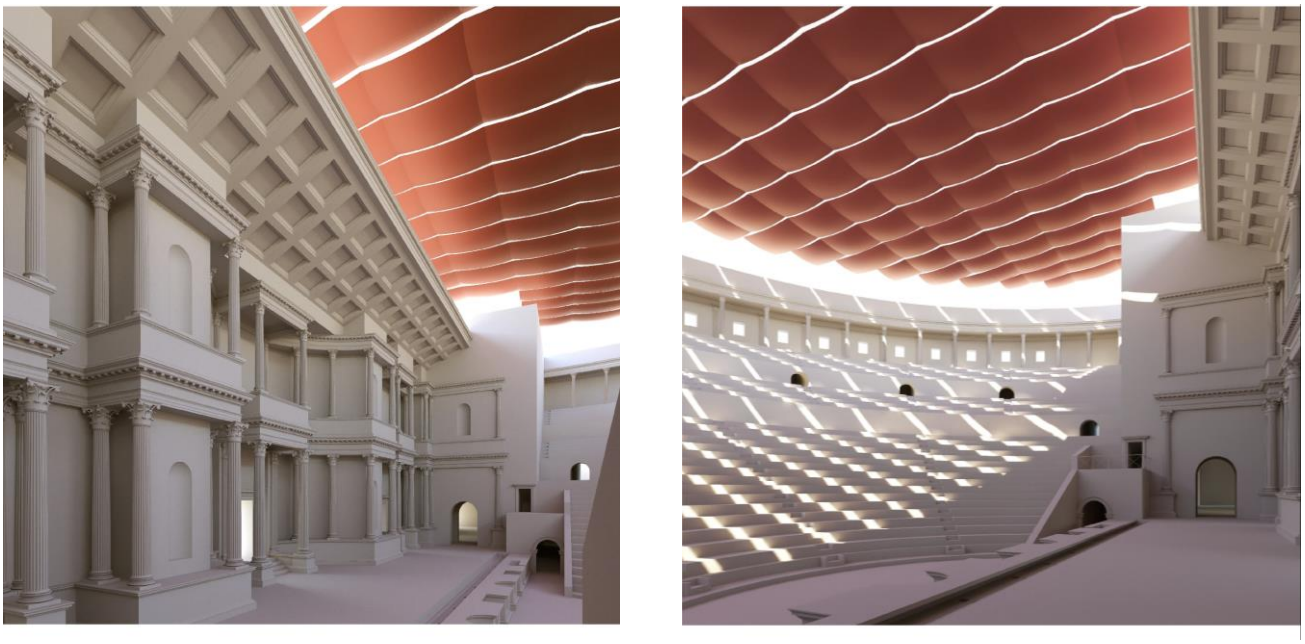

Fig. 9: Virtual reconstruction: perspective views of the inside of the theater

Consequently, the *velarium* could cover the entire cavea, including the orchestra where the most noble guests were sitting, rather than only the upper portions of the cavea.

The second premise is that the wooden roof over the *scaenae frons* was most likely much shorter than had been proposed in several earlier publications. The amount of overhang they show has no precedent in any other Roman structures.

It is most likely that the performances in the Roman theaters didn't take place during the rain or bad weather. It is therefore possible to hypothesize that the wooden roof over the scaenae frons had never been intended as the protection from the elements. The velarium, on the other hand, as reconstructed in the study, shaded the entire cavea, orchestra and the *pulpitum*. Thus, the former could have been smaller than previously imagined, and the latter had to be larger; cover the entire *cavea* and the orchestra, as shown in the reconstruction drawings.

The virtual reconstruction, by default, should include the complete structure, despite the low level of certainty by which a large number of architectural elements is qualified. This way it is possible to create a foundation upon which the scholarly discourse and research of the building can be furthered. This was the principal purpose of the study of the Roman theater of *Urbs Salvia* presented in the article.

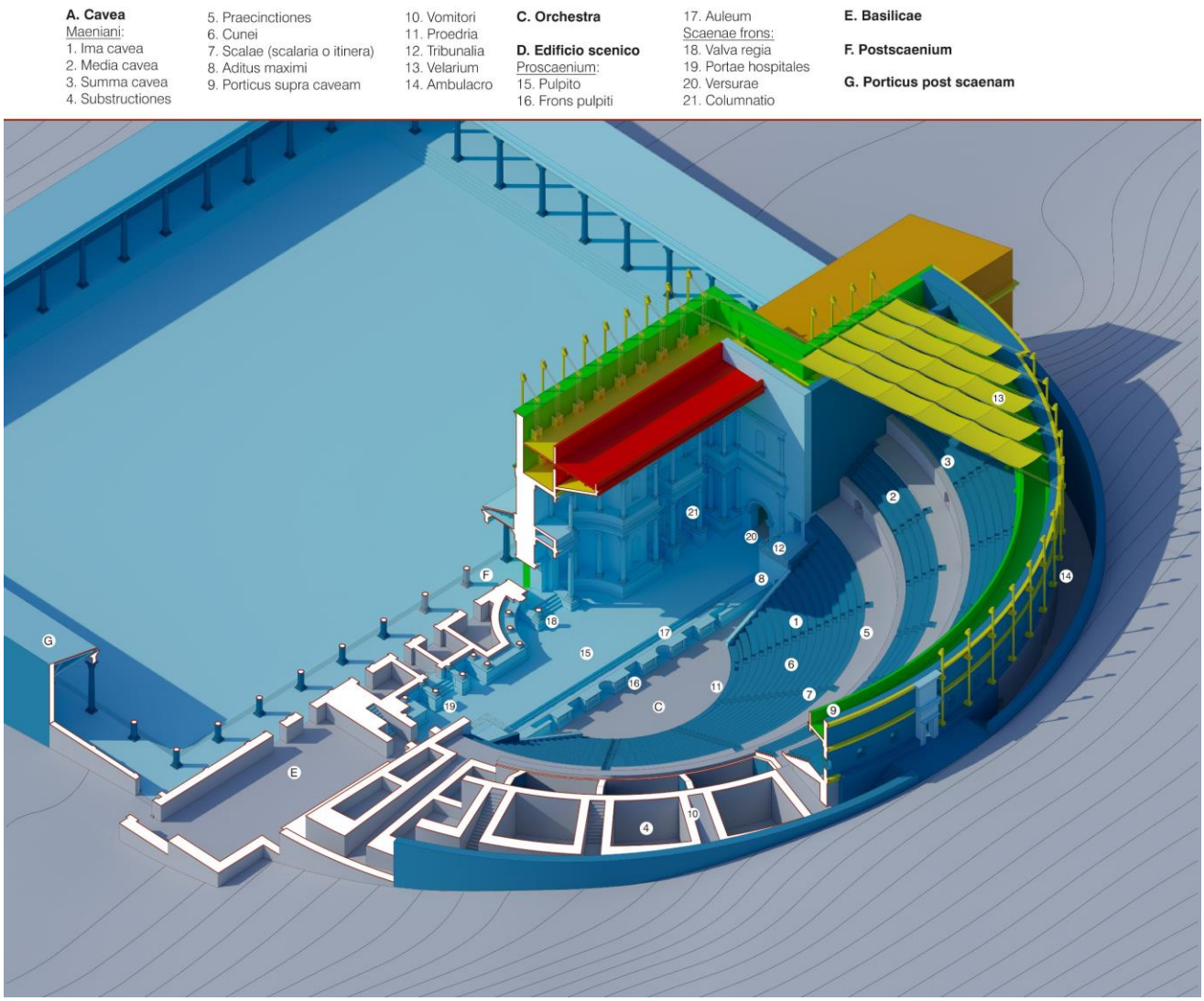

Fig. 10: The degree of certainty of the various elements of the virtual reconstruction

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