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Virtual Archaeology: Remains of a Roman Villa in the Bay of Stari Trogir, Central Dalmatia

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ABSTRACT

The paper focuses on the challenges of creating a computer visualization of a site with scarce source data, originally gathered for documentation purposes only. The particular site considered in this article is a Roman maritime villa in the bay of Stari Trogir, Central Dalmatia, Croatia. The well-preserved remains are constantly under threat of destruction, as they are exposed to local construction work. First described in the 17th century, and sporadically researched from the early 20th century, the remains were again newly documented and interpreted in 2004. They are especially interesting because of their peculiar semi-circular structure. The objective in the present work is to create virtual presentations of multiple interpretations of the site, to tell a story about the locals' home. This should encourage an emotional connection with the remains and induce respect towards the place's history, as well as the desire to preserve and protect it.

1. Introduction

In the field of conservation and interpretation of archaeological heritage, the importance of documenting and presenting heritage virtually increases every year. Virtual environments are a privileged way of distributing the knowledge of cultural and scientific themes. The interest in computer graphics has therefore been present in these fields for quite some time and has eventually led to the establishment of the fields of virtual archaeology (see Reilly 1990) and virtual cultural heritage; for example (Addison 2000; Berndt, Carlos 2000). Furthermore, with the technological development that is more and more capable of reproducing the lost heritage for the purposes of research and representation, this interest only keeps increasing. All this brings additional responsibility for scientifically evaluated visualizations, as described more thoroughly in charters like Principles of Seville (2011) and The London Charter (2009). These guidelines suggest that visualization should strive for historical rigour, authenticity, scientific transparency, and should also be made accessible.

The advantage of computer visualizations in this context

is that they enable the evaluation of models better than any other type of media and at the same time provide a comprehensive understanding of the monument. In the virtual model, for instance, the relationship between the building and the surrounding terrain is visible, and the placement of different architectural features can be tested on a virtual terrain. By positioning the virtual camera on various points of interest, viewshed analysis can be performed. It also enables a physical simulation of daylight or water tide. The mass of the building material, and consequently also the building time, can be calculated. Moreover, the volume of structures is easily measurable, such that, for example, the amount of fish that could be raised in a particular breeding pool can be calculated.

Computer visualizations can also present interactively the possible reconstructions of the monuments on site. This way, the authenticity of the monuments can be preserved – and there is no need for them to be subjected to a contemporary reconstruction (Pirkovič 2003).

In this context, a virtual presentation most significantly benefits a site that is at the moment undervalued in the eyes of the public. The public understanding of its significance in the past and its connection with the present day could

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Figure 1. Area of the site in the bay of Stari Trogir (photo: Lužnik 2011).

once again turn it into a building block of local, regional and national identity and involve locals and visitors on a personal level (Vidrih-Perko 2008; Merriman 2004; Šola 1985). With these considerations in mind, the present work aims at raising awareness for a particular site that fits the above characteristics, by drawing on computer aided visualization. The context of this work is a research project comprising three different levels: (1) computer visualization of the site; (2) implementation of the visualization, making it available to the public; and (3) later evaluation of the success.

From the data available to the Department of Archaeology (University of Ljubljana) for a case study of this kind, the

site of Roman remains in the bay of Stari Trogir near Trogir in Central Dalmatia, Croatia was chosen (Figure 1, Figure 2 and Figure 7). The overall project is still ongoing, with the current first stages being to establish a virtual model of the archaeological interpretation of the site. At this point, valuable experience has already been collected on how to visualize the information that is intended to be conveyed, and a suitable visualization workflow has been established. These issues will be the main focus of this article. In future stages of the project, a quality heritage interpretation will furthermore be conducted, which is a prerequisite for better understanding of the archaeological finds by the general



Figure 2. The position of Stari Trogir, relative to Tragurion and Salona after Zaninović (1997; geographical data after NASA Worldview).

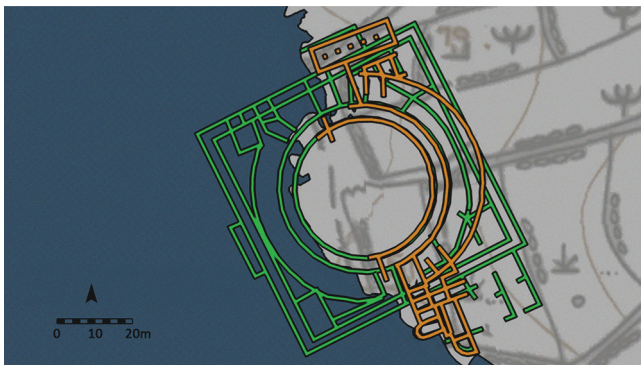


Figure 3. Site of Stari Trogir – comparison between the measured floor plan in 2004 (orange) and sketched floor plan from 1918 (green, after Jelić 1918/1997).

public (Colquhoun 2005; The ICOMOS Charter for The Interpretation and Presentation of Cultural Heritage Sites 2008; Tilden, Craig 2007). At the end of the project, users will be asked for feedback to help evaluate the resulting interpretation.

The area of Trogir consists of a small territory between the Split and Šibenik area in Central Dalmatia, Croatia. Beside the coastline, it also encompasses a few minor islands. Its hinterland is a rocky, impoverished area, while the coastline

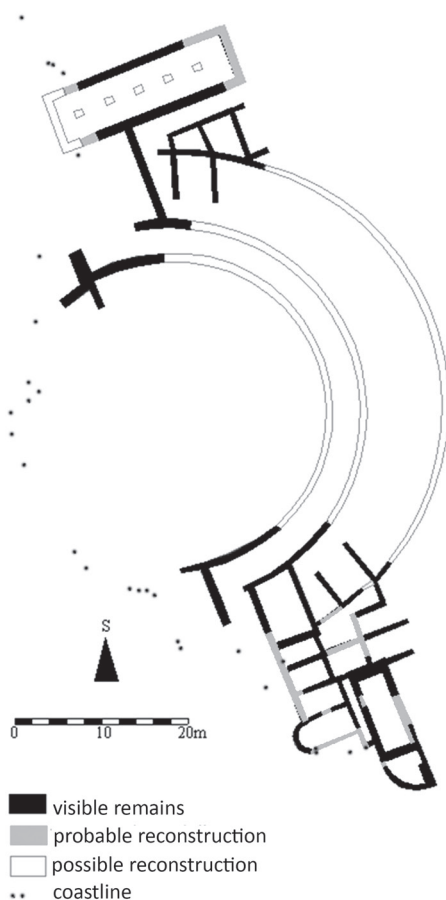


Figure 4. The measured plan of the site of Stari Trogir, after Novaković (2004).

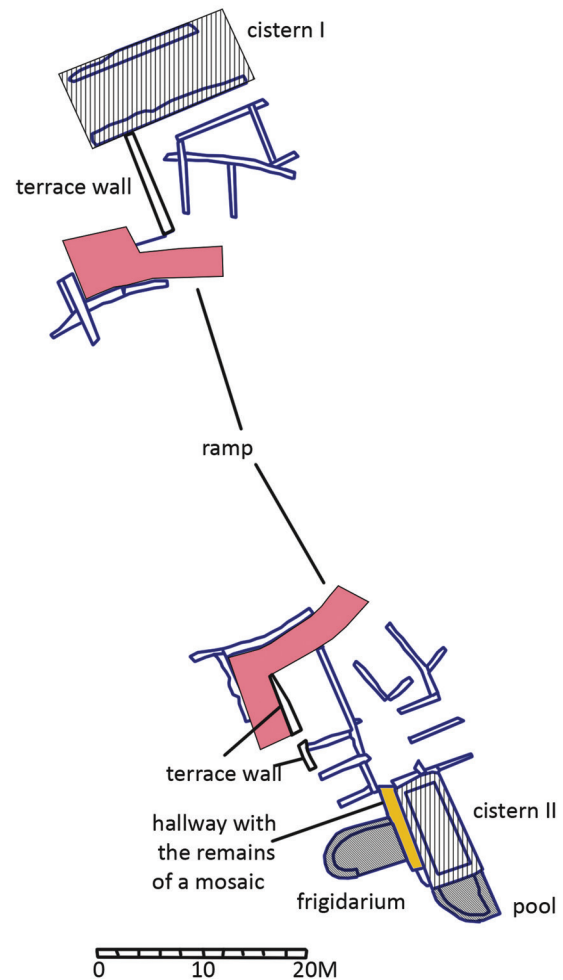


Figure 5. Interpretation of the structures in the bay of Stari Trogir, after Novaković (2004).

is a fruitful area favourable for life. Access to the bay of Stari Trogir from the mainland is hard due to the steep slope and remote location, while it is easily accessible from the sea (Kirgin, Marin 1989). Roman remains are common in the area, and maritime villas that are similar to those on the coast of Italy (D'Arms 1970; Lafon 2001; Marzano 2007; Matijašić 1998) and, for example, to those in ancient sources (such as: Pliny, The epistles of Pliny the Younger, 2.17; Horace, Shorey, Jennings Laing, Odes and epodes, 2.18; Varro, Storr-Best, Varro on farming, 3.3.10) are also not unknown to this part of the Roman Empire (Figure 7; Matijašić 1998; Begović, Schrunck 2003; Begović, Dvoržak 1994; Schrunck, Dvoržak 2004; Gnirs 1909 after Matijašić 1998; Suić 2003). The relatively well-preserved standing remains of the Roman villa in the bay of Stari Trogir itself are constantly under a process of destruction, since they are exposed to construction work by local residents trying to improve the functionality of the coast.

These remains were last extensively documented in the year 2004 (Figure 4, Figure 5). The project was issued by Konzervatorski Ured in Split, under the guidance of

M. Katić, and the works were executed by the Department of Archaeology, Faculty of Arts, University of Ljubljana (SI) under the leadership of P. Novaković in 2004. A key challenge in the process of moving to a computer 3D visualization is that the above documentation was not primarily intended for computer visualization. It was executed with an electronic tachymeter – a total station that is still the most commonly used documentation device at archaeological sites. Outlines of visible structures were measured, and a DTM (Digital Terrain Model) of the northern part of the site was created. Our endeavour therefore presents an interesting test of how well traditional ways of documenting can be used for this purpose.

Furthermore, the remains themselves are of special interest, as they include a peculiar semi-circular structure, the function of which is not especially well understood. Similar structures, according to the remains, can be found in two villas: Villa della statua and Villa della terma/del peristilio in Barcola, Italy (Lafon 2001; De Franceschini 1998). Presenting it in a virtually rebuilt environment can serve as an efficient way of assessing different theories of its former appearance or function. Combined with the conclusions of older reports of the site and analogies, this allowed for first interpretations of the remains to be made. First, for better understanding of the site and its interpretation, an overview of its history and past research is in order.

2. Ancient sources

The site has an interesting history. In the Roman state, the area originally belonged to the province of Illyricum, which was established as a military zone after the Third Illyrian War. According to recent theories, it was administratively organized by Octavian. Due to its size, the province was divided into the Upper and Lower Illyricum under Augustus, which were renamed into Pannonia and Dalmatia under Vespasian (Šašel, Kos 2010). The area of the bay of Stari Trogir belonged to the latter (Figure 2; Wilkes 1969; Zaninović 1977).

In ancient literary sources, the Trogir area is described in the “Periegesis”, work by Greek geographer Pseudo-Skymnos (404–412, GGM I, 213) from the 2nd century BC. In this part, he describes the coast of the Mediterranean, as well as the eastern coast of the Adriatic Sea. After the description of northern Dalmatia, he continues with a description of the Island of Hyllos, where he thinks of the landscape between Šibenik and Trogir. He estimates it about the same size as the Peloponnesus. The area was supposed to be settled with the people of Hyllos in fifteen cities, who were Hellenes by origin and took Heracles’ son Hyllos as their leader. At the same time, they also became wild and barbaric, which supposedly could be seen from their practices, which closely resembled those of their neighbours. For this description, Pseudo-Skymnos refers to Timaeus and Eratosthenes, who were Greek historiographers and geographers from the 4th and 3rd century BC. The Trogir area is similarly described by

Pseudo-Skylax (Periplus, 22, GGM I, 28), a writer from the mid-4th century BC.

At the beginning of the 1st century AD, in the work “Natural History”, Roman encyclopaedist Pliny the Elder (Naturalis historia, 3, 58) mentions the Trogir area with reference to: the cape Diomedes (nowadays cape Planka) on the Hyllos Peninsula; Tragurium (Trogir), a town famous for its marble; and the city Sicula (Bijaći), which is where the divine Claudius was sending military veterans.

In the “Geography of Strabo” (The geography of Strabo, 7.5.5), from the beginning of the 1st century AD, we find the interesting fact that Trogir is an island, as it is listed as such among the settlements of the Issa people and their most famous islands like Issa (Vis) and Faros (Hvar).

3. Archaeological interpretation

In modern times, the site itself was first mentioned in the 17th century by historiographer Ivan Lučić (1986, first published 1666) in the work “De Regno Dalmatiae e Croatiae”, who recognized it as a public square with porticoes and water cisterns. In 1918, Jelić (1918/1997) characterized it as Praetorium Caesaris and recognized a forum, cisterns, rooms with barrel vaults and a room with an apse (Figure 3).

Later, Karaman (1954/57) recognized in the remains a *villa rustica*. However, Katić (1994/95) interpreted it as a road station Loranum, more precisely as a part of its harbour. He recognized water cisterns and the vaulted rooms and the apse as a *balneum*.

In 2004, Begović (2004) interpreted it as a maritime villa with cisterns, a *balneum* and a central fishpond – a *piscinam vivarium*.

Maritime villas are in principle a kind of *villa rustica*. That is, a building or a group of buildings within its own land, that is positioned outside of towns. It includes a residential area, as well as a production area. The goods produced were meant to satisfy the needs of the villa, but were also used for trading. Sometimes the production area is located only in satellite villas on the land owned by the villa. Maritime villas are mainly positioned on a peninsula or circling a bay, or running along the coast. They follow a specific architectonic form that dominates over the seashore and has a panoramic view (Begović, Schunk 2003; Marzano 2007; Matijašić 1998).

Cisterns were used in karst regions for rainwater collection. Due to the lack of accessibility of drinking water from springs or streams, these reservoirs were an important water supply (Matijašić 1998). In general; they are located near remote small agricultural buildings or dug in the yards of countryside villas. The subterranean nature of the cistern provided the water a constant temperature, better quality and taste (Vitasović 2008).

Cisterns in Stari Trogir are built in a similar way as other examples in Dalmatia and in the south and east of Istria. Usually, the walls are made of two layers: the outer layer is made in an *opus incertum* technique that has on the external

side multiple cut blocks and a centre made entirely of cement; and the inner layer that is made in an *opus cementicium* technique – the so-called hydraulic mortar that was used to line the walls of water cisterns and was obtained by mixing coarse and fine sand, slaked lime and pounded bricks, and applied to the wall in several layers (usually three), of which the last, external, layer was finished (*ligadina*) and had a finer composition (Matijašić 1998; Kilić-Matić 2004). The cisterns were covered: either in a barrel or a cross vault. This was the only technical solution to keep the water cold throughout the year. On the other hand, the largest possible span using a barrel vault was 3–4 m. That is the reason for cisterns being long and narrow. If they had to be wider, pilasters were used that divided the cisterns into multiple aisles (Matijašić 1998).

The Roman baths within residential villas were called *balneum*. The basic rooms were the same as in public baths. There was a sequence comprising the dressing room (*apoditerium*), the warm room (*tepidarium*) and the hot bath (*caldarium*). The *caldarium*, and sometimes also the *tepidarium*, had hypocaust heating. Finally, there was the *frigidarium*, a room with a pool of cold water that was used to cool down. Important parts of the *balneum* were also the dry sweat room (*laconicum*) and a hot steam bath (*sudatorium*). In the Mediterranean, the windows of a *balneum* were turned towards the afternoon sun, so that the rooms were additionally heated. The individual rooms had vaulted ceilings and apsidal ends (Brödner 1997; Johnston 2004).

Maritime villas were especially well-suited for fish keeping. Many fishponds of various sizes and shapes were located adjacent to villas, in seaside coves and inlets, or in lagoons, where they could be fed by both salt and fresh water and were a clear display of wealth (Higginbotham 1997; Lafon 2001). These *piscinae vivariae* were, according

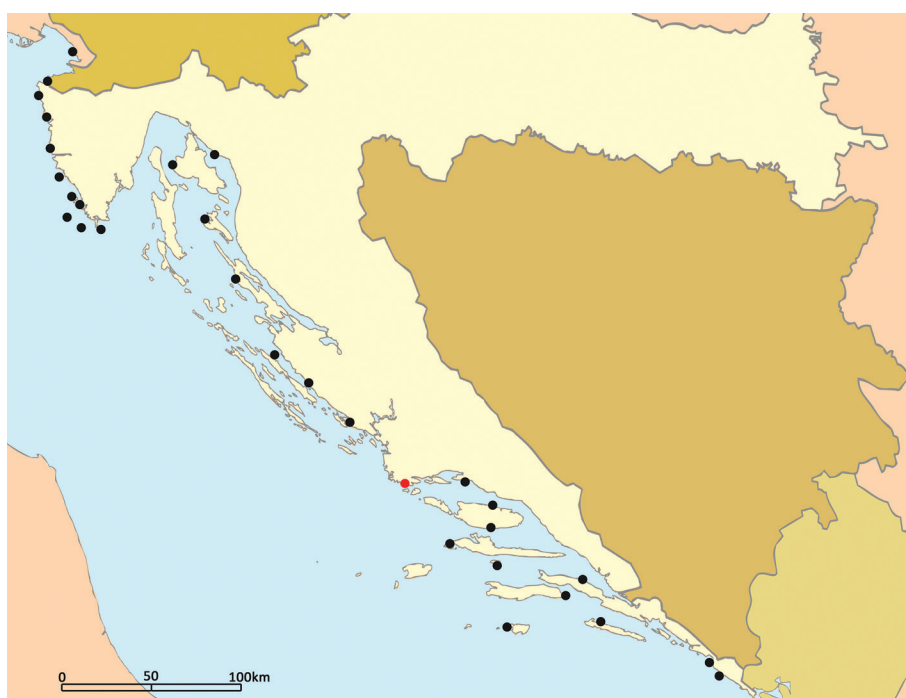


Figure 6. Site of Stari Trogir – comparison between the measured floor plan in 2004 (orange) and sketched floor plan from 2009 (green, after Živkov 2009).

to Varro, more pleasing to the eye than to the purse, and were rather exhausting on the resources instead of increasing them, as they were built, stocked and kept up at great cost (Varro, *Storr-Best*; Varro on farming, 3.17.2).

In the same year as Begović, Novaković (2004) also interpreted the remains as a maritime villa, though he recognized in the central semi-circular part an *exedra* (Figure 4, Figure 5). This part of the architecture is poorly preserved. According to Lučić, there used to be porticoes in this area (Lučić 1986). An *exedra*, in Roman buildings, is a semi-circular structure, possibly with porticoes, that connected different parts of the complex. There are several examples of villas with similar structures: some of them are two villas in Barcola, Italy – Villa della statua (De Franceshini 1998) and Villa della terma (De Franceshini 1998; Lafon 2001); a villa in Anguillaria Sabazia (Mielsch 1987; Zarmakoupi 2005); and villa Giulia at Punta Eolo Ventotene (Lafon 2001).

Figure 7. Maritime villas in the northeastern Adriatic; the red dot marks the villa in the bay of Stari Trogir (after Begović, Schunk 2012; geographical data after NASA Worldview).



Novaković identified the following features on the site: terraces, presumably ramps, two cisterns, as well as a *balneum* and a central half-circular part that was interpreted as an *exedra*. Some of the main features of the villa remain to this day. First among them are the two cisterns, one on the northern and one on the southern part of the ruins. The most important criteria for defining the features were the presence of hydraulic plaster on the floor and the wall, as well as the indication of a vaulted ceiling. He defined the rooms around the southern cistern as a *balneum*, due to the walls covered in very characteristically-red plaster, and due to research reports prior to the last documentation in 2004, from when the remains were still better preserved. Apart from the group of structures that are undoubtedly connected with the luxurious architecture – *frigidarium*, cistern, the pool, the mosaic hallway between the *frigidarium* and the upper part of the architectural complex – there are also six other rooms recognizable that most probably are part of the *balneum* as well.

According to his analysis of the features of the plan and the terrain, Živkov (2009) saw in the remains a monumental villa, which consisted of several tracts disposed along the coast of the bay and was connected with a promenade (Figure 6). In his opinion, there are also indications that the complex is probably located over a series of terraces, while the cisterns, the thermal complex and possibly the curing facilities are all adjacent to the main wing with the semi-circular *exedra*.

Among others, he compared it to the plan of the villa in the bay Verige on Brijuni islands, where various segments of the complex were located along the coast of the bay and connected with a promenade (Figure 11).

Most recently, Begović and Schrunck (2012) described that the remains of a stone quay and a circular structure are visible in the sea. They suggested that this circular structure of 8m in diameter may be part of a *piscina*, a fishpond with a central circle framed by lateral rectangular compartments. On the beach, they saw remains of the baths and a large cistern, divided into two compartments, and other walls. They observed that the villa was built in two terraces. On the aerial photos, they managed to discern further in the sea some harbour structures and a big mole (pier or breakwater) that protected the bay from the south wind.

Interpretation of the architectural remains as a maritime villa seems legitimate, as it is based on: the historical background (Šašel, Kos 2010; Wilkes 1969; Zaninović 1977); the development of such villas, their definition and functions (D'Arms 1970; Lafon 2001; Marzano 2007; Matijašić 1998); and, for example, ancient sources (Pliny, The epistles of Pliny the Younger, 2.17; Horace, Shorey, Jennings Laing, Odes and epodes, 2.18; Varro, Storr-Best, Varro on farming, 3.3.10); similar examples in Istria and Dalmatia (Figure 7; Matijašić 1998; Begović, Schrunck 2003; Begović Dvoržak, Schrunck Dvoržak 2004; Gnirs 1909 after Matijašić 1998; Suić 2003); as well as the fact that the coast of Dalmatia is similarly formed as the coast of the original area in Italy where this type of villa first appeared (D'Arms

1970; Lafon 2001). As there are three different interpretations of its appearance and functionality, the visualization of the villa will compare and evaluate multiple predicted structures of the floor plan in 3D space.

4. Vizualization

The virtually presented archaeological interpretations are mainly based on the functional interpretation of the architectural remains from older sources, when the remains were still in a better preserved state, as well as the research of the Department of Archaeology, Faculty of Arts, at University of Ljubljana under the guidance of Novaković in 2004. Additionally, by projecting the measured plan from 2004 over the scientific sketches from 1918 and 2009, it was determined that the overall features match to a high degree. Therefore, the combined plans could be used as a base for reconstructed interpretations. Partially, the presentations are also based on logical conclusions and analogies of other similar villas along the Adriatic coast.

As already mentioned, no excavations were executed for the villa in the bay of Stari Trogir. There was only surface research conducted, with documentation of the remains with a total station in the year 2004. Furthermore, there are neither contemporary descriptions of the villa, nor any other sources that would allow a construction of a scientifically evaluated model. Therefore, the visualization must be counted as a speculative one. In this light, it is important to present multiple reconstruction possibilities in order to convey a comprehensive understanding.

The remains of the villa, although relatively very well preserved, are very limited in comparison to research on other bay-enclosing Roman villas, as there are only a few rooms left. The majority of the villa has been evidently lost through time, demolished or engulfed by the sea. To reconstruct a detailed visualization of the whole villa therefore does not make sense, as too much of the data is missing. But even for the remaining architectural elements there are too many gaps in the knowledge to fill in the details for a precise reconstruction. Consequently, the form of non-photorealistic visualization seems the most appropriate to implement for such scarce data.

This technique focuses on a wide range of expressive styles based on painting and drawing. Its advantage is that the viewer is immediately confronted with an abstraction, which emphasizes the hypothetical aspect of the reconstruction (Roussou, Drettakis 2003). It can also direct the viewer's attention towards the most important information, while omitting secondary features (Klein *et al.* 2000). In addition, non-photorealistic computer graphics offer control over expressivity, clarity, and aesthetics; hence the resulting pictures can be more effective at conveying information and can express a specific mood (Buchholz *et al.* 2005).

In the case of the present work, simple volume-like structures were made upon the measured walls in order to represent the function of the preserved architectural

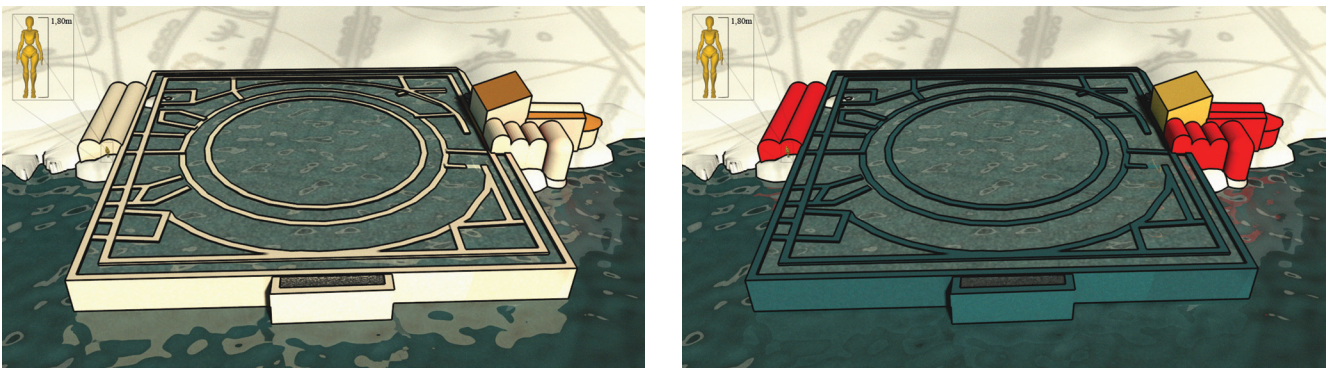


Figure 8. Visualization of the villa with the central semi-circular structure represented as a piscina vivaria (plan of the piscina after Jelić 1918/1997). Illustration in monochrome with levels of certainty superimposed in different colours (red representing very certain, yellow distinguishing likely, and blue marking out uncertain structures).

elements. Complementary to this representation, textures are kept simple and monochrome. In this style, the wider terrestrial area is obtained from the Primošten geographical map, which is at the same time its texture. All is rendered in an ink style that emphasizes the speculative nature of the models. To show levels of certainty, a colour-coded scale was also applied, where, in this particular case: red symbolizes the most certain features, whilst blue represents uncertain features; the certainty of yellow-coloured objects is understood to lie somewhere in between (Figures 8–10).

In the visualization of the Stari Trogir maritime villa, three possibilities of its former appearance are presented. The first interpretation shows its central semi-circular part as a *piscina vivaria* (Figure 8), where circular *piscinae vivariae* from other maritime villas north and south of Rome, illustrated by Lafon (2001); most of them date from the Augustan period (Lafon 2001; Begović, Schrunck 2012). The plan for the *piscina* is taken after the plan of Jelić (1918/1997). Though similarly shaped *piscinae* are known from the literature, the visualization reveals that a *piscina* of this size would have disrupted the smooth path along the bay in this particular location.

In the second interpretation, the central part is coarsely presented as an *exedra*, an open semi-circular space (Figure 9, Novaković 2004). The third visualization is built

after the interpretation of Živkov (2009), which is based on the floor plan of Jelić (1918/1997) and also interprets the semi-circular feature as an *exedra* (Figure 10). These two interpretations are very similar, with the third one mainly extending the second. Indeed, it seems reasonable that an *exedra* like this would be surrounded by other structures. However, even the extended interpretation could be refined, since it seems that the inner rooms above the *balneum* area would not have had access to light.

In summary, all three interpretations are possible; among them, the third interpretation seems the most probable at this point despite the abovementioned concern.

5. Implementation

The virtual archaeological model of the villa in the bay of Stari Trogir is not precise enough to serve as a detailed model for archaeological research, due to the source data that was primarily collected for the purpose of simple documentation of the remains. For precise research, the model is too crude and cannot supplement the inspection of the remains *in situ*. Nonetheless, it does provide a valuable gateway to discussion of the appearance and function of the architecture.

Non-photorealistic visualization leaves room for individual interpretation and is therefore appropriate for

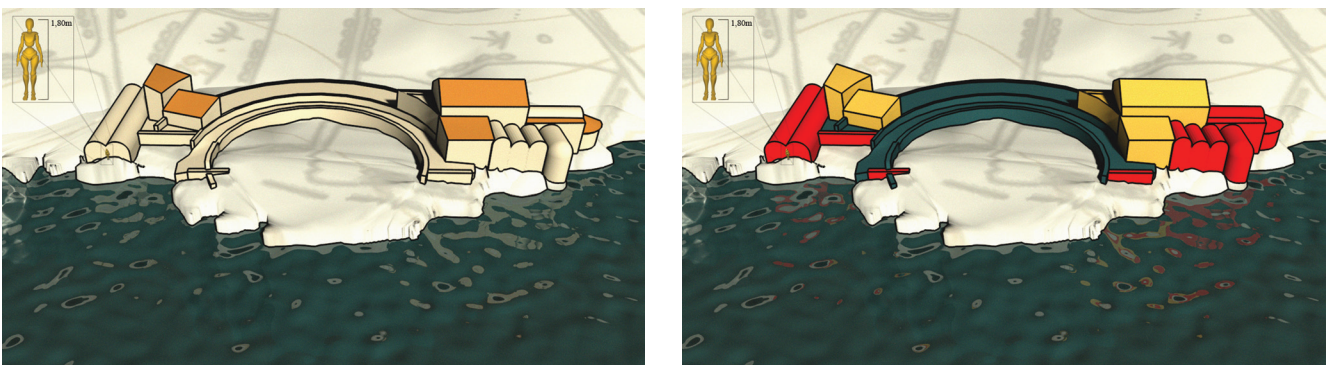


Figure 9. Visualization of the villa with the central semi-circular structure represented as an exedra, after Novaković (2004). Illustration in monochrome with levels of certainty superimposed in different colours (red representing very certain, yellow distinguishing likely, and blue marking out uncertain structures).

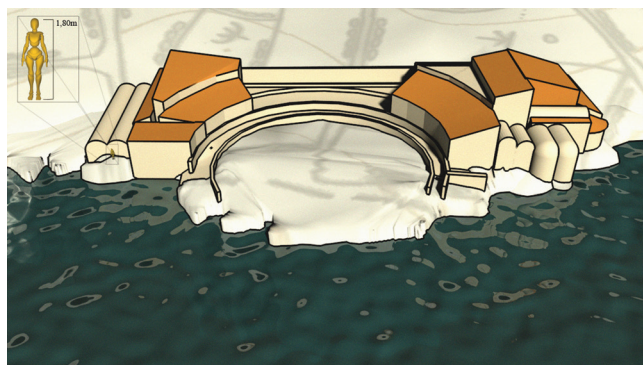
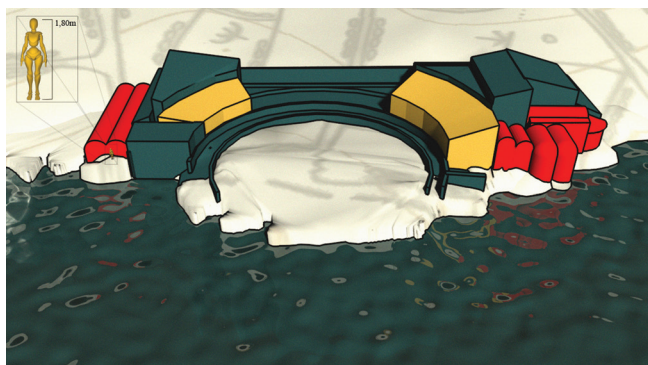


Figure 10. Visualization of the villa with the central semi-circular structure represented as an exedra with additional structures, after Živkov (2009). Illustration in monochrome with levels of certainty superimposed in different colours (red representing very certain, yellow distinguishing likely, and blue marking out uncertain structures).

representation of reconstructed objects and monuments. Even though the public may be more accustomed to photorealistic visualizations produced by the game and film industries, non-photorealistic presentations are still suitable for public interpretation of the site. In our specific case, the visualization can be complemented by visualizations of better-preserved sites to give a better impression of the former grandeur of the villa. The most luxurious villa in the vicinity is the one on Brioni islands, which was ideally reconstructed in the form of a drawing (Begović 1990; Begović Dvoržak 1994; Begović Dvoržak, Schrunck Dvoržak 2004; Figure 11).

There are not many other examples of 3D virtual visualizations of maritime villas in the vicinity that could be an adequate comparison, but an insightful example of a photorealistic visualization is the Roman villa of Minori, Campania, Italy. It was reconstructed during the project *Colori nella Storia* and especially focuses on the various colours that were used on architectural structures. The reconstruction resulted in a short video called *La villa romana di Minori ieri e oggi* (Campanelli, Pacetti, 2012; GiuntiScuola 2015).

Nonetheless, the current visualization of Stari Trogir is effective for a presentation of the remains to the broader public, as it combines the remaining walls in a uniform model of this part of the villa. In this way, the visualization also makes sense to untrained observers, who often face difficulties combining them into one unit and envisioning the complex on the site. In this sense, it is intended that further heritage interpretation will be implemented into the presentation of the site. Such interpretation has no precise definition, but all explanations of the term agree that it should seek to describe the broader context of the presented objects and to find their own specific story: if the information provides facts, a good interpretation provides a story and connects the facts with the wider context (Colquhoun 2005). The main function of heritage interpretation should be to create personal connections between the people and the places of heritage, in order to preserve them. Though the goal to conserve must not come only from the field of interpretation – due to the continuous degradation of the natural and cultural heritage all related sciences have to establish a procedure for the preservation of heritage, where the interpretation is only part of the complete system (Kohl, Eubanks 2008).

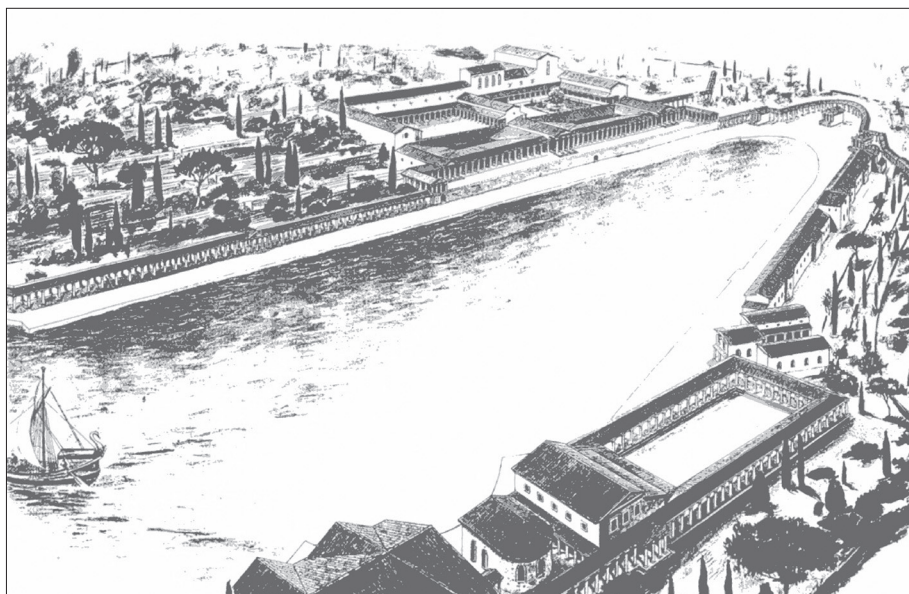


Figure 11. Image of an ideal reconstruction of the villa in the bay Verige, Brijuni islands, Croatia (reconstruction by V. Begović Dvoržak in Begović Dvoržak, Schrunck Dvoržak 2004, Figure 3).

At the archaeological site, the first interpretation of archaeological finds is definitely a subjective interpretation based on the experience, knowledge and expectations of the archaeologist who implements it in time and space and attributes it its importance. Similarly, Copeland (2004) states that there is a difference between the primary interpretation, which is given at the moment of confrontation with the ruins and only seeks to give a reasonable explanation, and the secondary, which can be equated with a presentation that is meant to transfer these explanations – or at least the parts of general interest – to the target audience. In this subsequent demonstration phase, which is greatly influenced by its purpose and the expected audience, the interpretation and its presentation are carefully planned. For the transparency of interpretation itself, multi-interpretation plays an important role, as it shows that there are several equivalent interpretive truths. Indeed, the notion that a collection of artefacts or other heritage should be subjected to only one story has been strongly refuted by Howard (2003).

The importance of interpretation is, after Tilden (Tilden, Craig 2007), that it allows the kind of understanding that elicits sympathy and desire to protect heritage, and consequently he wishes to include it wherever possible. *“Through interpretation, understanding; through understanding, appreciation; through appreciation, protection.”* (Tilden, Craig 2007). It is important to realize that for an understanding, it is not necessary that the interpretation includes plenty of data or deep thoughts. Most often it is better if the insights that are conveyed to the visitors are quite simple, but touch them and strengthen or inspire a new understanding of how to appreciate the heritage (Carter 2001). Research has shown that the more we communicate with the intention to provoke thinking, the more personal the meanings created in the particular subject. And the more important the presentation is to us personally, the greater is the likelihood that we will develop further thoughts on the topic. An important message provokes thinking, which leads to the accomplishment of personal understanding. It is important to recognize that understanding and behaviour do not always go hand in hand. The better we can relate to a message on a personal level, and the fewer facts we have to memorize, the easier it will be for us to think about what the message actually meant to convey, rather than the facts it contained. Our understanding of something is simply what we think of it; the sum of our beliefs and opinions. When interpretation provokes a person to think, it leads to a development process that creates or otherwise affects the understanding; that is, it creates, strengthens or changes existing convictions (Ham 2009). In this way, the proper interpretation has a significant influence on the emotional perception of cultural archaeological heritage and its importance in today's fast paced consumer society; and it can encourage the desire for its protection and preservation.

On the north-eastern Adriatic coast, there are already sites that try to engage the local public with similar historical villas. There are several different approaches. On some sites, there are archaeological parks, either planned or already

present. For example, at Simonov zaliv, Istria, Slovenia, an archaeological park includes permanent exhibition space with an interactive digital map of the area, as well as guided tours of the site and different workshops being carried out (Lazar 2016). Similarly in Umag Katoro – Sepomaja, Istria, Croatia, a permanent exhibition is located in the local museum, and guided tours and workshops are organized to present the villa. They also plan to open an archaeological park (Muzej grada Umaga, n.d.). An archaeological park is also planned in Vižula, Croatia (Općina Medulin 2017). On other sites of Roman maritime villas, there are Roman-themed festivals each year to promote Roman cultural heritage, for example in Umag Katoro – Sepomaja, Istria, Croatia (Muzej grada Umaga, n.d.) and Valbandon, Istria, Croatia (Načinović 2013). A different way of connecting to local communities are Roman-themed dramatic plays that have been carried out on the site of the ruins at Colentum, Murter island, Dalmatia, Croatia during the summer of 2017 (Udruga za zaštitu prirode i okoliša te promicanje održivog razvoja Argonauta 2017) and are performed annually at the maritime villa of Vižula, Istria, Croatia (Girardi-Jurkić 2011). In the example of the villa in the bay of Stari Trogir, a logical conclusion might be to show the villa as a place of retreat for the wealthy Romans from the hustle and bustle of their everyday life in the city, taking advantage of the health benefits of the seaside and enjoying a short period of relaxation; much like people today also take a vacation and relax on the seashore in the same bay of Stari Trogir.

With the intention of sharing the knowledge about the site, the visualization of the villa can be implemented in various multimedia presentations on- or off-site. For example, these could vary from a linear representation like an animation movie, to incorporation of the built model into augmented or virtual-reality applications. In these applications, interactive features could be included, e.g. interchanging of different interpretations of the central semi-circular structure. The application could be implemented on different platforms such as Android, Windows or the World Wide Web. At the moment, the three presented models from this article are implemented on a web platform, where the whole geographical situation can be inspected from all sides and on different platforms; the viewer supports inspection of the models in virtual reality (Lužnik Jancsary 2017). Furthermore, it could also be printed or plotted, and as such be the final product – or serve as the foundation of an augmented reality application.

6. Conclusion

In this research, the main goal is to show that the distribution of archaeological information through virtual environments and multimedia is of huge significance in the process of democratization of knowledge. It provides important assistance in the process of transferring archaeological information to the wider public, and consequently helps recognize the value of archaeological heritage. The role of archaeologists is not only to document, collect and organize

the obtained data, but also to interpret and create cognitive models of the past. Our research demonstrates that not only extensive and very well-preserved sites, but also fairly fragmented sites, can be presented in a satisfactory manner. The established workflow can be effectively transferred to other existing sites with minor adaptations specific to each unique site.

Despite their limitations, this and similar examples of visualizations also enable insightful impressions of the appearance of a site from afar, over the internet. Information is provided both for the scientific and general public, allowing everybody to harvest knowledge based on their capabilities and interests, gaining a more thorough experience of the site along the way.

In this particular case, the local people are interested in the historical remains in their vicinity. The plan is to properly present the interpretations made, preferably more than one, in the near future – in order to tell a story about their place of living. I hope this will encourage an emotional connection between the residents and the remains and induce respect and love towards the history of this place, as well as the desire to preserve and protect our cultural heritage.

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