

Case Study

# 3D Photogrammetric model of Eflatunpinar monument at the age of Hittite empire in Anatolia

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## Abstract

Eflatunpinar monument is located about 25 km at the North of Beyşehir (Konya–Turkey). The monument which belongs to Hittite Empire Age was known since XIX century and there are several papers written on this monument in the literature. The monument which is 7.02 m wide and 3.6 m high was built of large trachite block stones. Latest excavation carried out by Konya's Archeology Museum in 1996 showed that the monument was built with some other parts and surrounded by a water channel. These results have pushed the scientist into a discussion – as it has usually been done intensively several times in the past – on environmental arrangements surrounding the monument. Hittite scripts brought to light implicate that monument surrounded by trees and prohibited someone to cut these trees off by law. Archaeological studies done on Eflatunpinar monument were carried out by classical techniques. Therefore, those studies were limited by capabilities of classical techniques and were not able to present more than plan and some cross-sections. By this study, it is made a modern approach which is alternative to classical technique and using a digital and virtual environment provided by computer technology. As a result of this study, all measurements can easily be collected by the help of this 3D virtual model of the monument with no need to be on the site at any time they are required. Complete 3D model will also provide a numerical evaluation, interpretation and several analyses on monument together with its environment and surroundings. This 3D virtual model approach will bring a novelty into Hittite archeology.

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## 1. Introduction

Historical objects, monuments and monumental groups, are assets that reflect the great value coming from the historical background of a country because they often represent the history and memory of the communities where they are placed. Heritage must normally be protected by local, national or international authorities, in order to prevent its deterioration and destruction [1]. Such protection is not always as efficient as might be expected. Sometimes, it can never take place. If the case is this, there should be something to be done beforehand such as implementation of a comprehensive documentation work by

the help of any conservation technique even if it is specially focused to the historical asset in interest. It can be found in several documentation and conservation techniques available in the practice [2]. These methods are capable of providing the building within a co-ordinates system [3]. The methods and equipment mainly preferred for the documentation and surveying of buildings are [4]: traditional manual methods, topographic methods, photogrammetric methods and scanning methods. Such techniques are taken in the documentation process as tools for the conservation of heritage monuments. The documentation has to be carried out prior to the building's destruction, transformation or any intervention.

Related to this study, when digital photogrammetry technique is chosen as a conservation technique, it should be created 3D models and scaled orthophotos, plans, etc. The course of time, if the progressive deterioration of materials, the exhaustion of some structures and the damages caused by successive reforms, end up leading to the destruction and loss of the monuments. The

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3D models, orthophotos and plans can then be used to rebuild the monument as similar as how it was before the destruction, even if in the cases of that intervention is undertaken subsequently to partial collapse of the monument. In such occasions, some materials are replaced and the restoration works are run by the engineer with respect to those plans, whose most significant criterion is accuracy.

Today, measurement procedures carried out in excavated archaeological sites and for objects found at these excavation sites represent a very interesting contest where the potentialities of new digital technologies of photogrammetry can be productively expressed. But, some difficulties related to the 3D modelling from digital images can be encountered when modelling surfaces and complex archaeological structures. Several problems can also come out at any time with respect to modelling of terrain or of manmade objects. We can even meet with some problems related to the data acquisition and integration and to the automatic or semi-automatic data handling, or to new methods for data representation and exploration in general. In spite of these problems and difficulties, digital photogrammetry technique has been used successfully and proved its potentiality on providing 3D models and documentation of historical monuments and archaeological sites with successive studies in the practice.

Anatolia is one of the very few special and unique places in the world that have played a cradle role for many civilizations during the every stage of human history. In Anatolia, there are plenty of historical assets, monuments, constructions, items and so on trying to stay stand on the ground or just underneath the ground and buried by soil. They all have been remained from the time of these civilizations. All those historical assets reflect life style and carry traces of their owners, user or contractors to our time from the time when those owners lived in this great land, Anatolia. One of the great civilization left traces of their civilization in this land is Hittite community. Several historical remains from Hittites have been found especially in the region of Konya which is a great city located at the heart of Anatolia.

## 2. The monument of Eflatunpinar

We are not going to give historical and artistical details widely since this study is especially going to focus on creation of 3D model for the monument.

The main aim of this study can be stated as building of 3D model of a very important archaeological site called as Eflatunpinar close to Sadıkhacı village and at the 25 km North of Beyşehir County within Konya province in the hearth of Turkey [5–15]. It is a historical site remained from the Hittites' era. This study is also expressed as one of the historical documentation missions executed and directed by Çorumluoğlu who works for the geodesy and photogrammetry department of Selçuk University.

*Tarhuntašša* was the Hittites' capital city located at the South of Central Anatolia [16]. II. Muwattali carried the capital of Boğazköy to *Tarhuntašša* from today's Boğazköy due to *Kaška's* attacks when he went to state of Kadesh battle and to take logistic support during the Kadesh battle against to Egypt. This land

known as Lower Land (*KUR ŠAPLITI*), *Tarhuntašša* or *Hulaia* River Land was governed by Kurunta who called himself as a "Great King". Governor of the Lower Land before Kurunta was Hannutti. Later on, competition between IV. Tuthaliia and Kurunta was seen in this Land.

So, it is assumed that Eflatunpinar monument (or open air temple) was built at that time of this competition (for date of monument) [7–9,10,12,15,17–20]. Ruins of the open air temple, which consisted of a pool area surround by a low level site walls in front of it (in terms of our opinion it is a worshipping Garth surrounded by a low level wall), were brought to the light after an archaeological excavation by Archaeologic Museum of Konya.

Some figures were seen as they were carved on the façade of temple monument which was built up as enormous stone blocks. Any manuscripts cannot be found on the monument and suggested that those are only figures [14].

These figures were interpreted as hybrid creatures which were lion-bull men carved on the stones surrounding a one god and goddess couple's figure with tapering conical cap on their head [7,15]. In our opinion, they are probability men whirling around themselves, similar to ceremonies seen in Mevlana rituals.

Due to the uncompleted two stone blocks just at 2 m back of the monument, there are several opinions on how should be the original status of the monument [9–12]. One of these opinions assumes that arslantash and Fasillar monuments were located on Eflatunpinar monument [9]. It was also argued that these two monuments were not representing features that follows the features on Eflatunpinar monument [15].

In our opinion, these two monuments do not complete each other [16]. Eflatunpinar monument is also an especially important historical asset since it was located at the intersection of the routes from the gates of Hittites opening to the West (Arzawa). Contrary to that, Fasillar was located at the the intersection of the routes from the gates of Hittites opening to the South (Lukka). Therefore, such monuments are assumed as open sacred places located on these routes [16].

It is suggested that around this monument and similar's should be surrounded by decoration trees and also it should be prohibited to violate such sacred places [21,22].

## 3. 3D modelling by digital photogrammetry

Digital close-range photogrammetry has a few decade history and it has such a proven fact that it is a useful tool for 3D measurement and modelling in support of heritage recording. Over the past decade or so, we have witnessed a very significant growth in activity in this area and indeed in close-range photogrammetric measurement in general. A number of trends account for the broadening use of this technology. The first trend is seen in the increasing availability and suitability consumer grade digital cameras for photogrammetric applications. These cameras are ubiquitous, they have ever higher resolutions and are quite suitable for accurate measurement required in architectural and archaeological recording, forensic measurement, engineering documentation and in numerous other application domains. A second trend is the enhanced capabilities available in 3D

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