Computer-aided Animation of Antioch's Ancient City Walls and the Sights about the Process of Urbanization

Kayhan Kaplan

Abstract: In this study, Antakya city walls constructed in several period and the city gates which make it possible to access to city are examined and an attempt is made to produce opinions about the city size, population and outdoor areas. With small parts of Antakya city wall standing in our days, Antakya city walls are predicted to be more than 20 km long and to accommodate more than 300 towers in Hellenistic Period. In addition, there are gates which create the city connection on the city walls. These gates are magnificent structures and provide information about architectural characteristics of the period. Although the city walls lose its importance in the following centuries, the gates continue its existence as the most important centers where the public gathers and has a rest. In this study, Antakya city walls and gates in the Hellenistic period are animated with the computer-supported three-dimensional views. In modeling the city walls and gates, a great deal of gravures, pictures and historical photos are used as well as many archeological excavation reports made in several periods. In this study, the aim is to have chance to understand the architectural and historical connections within the entirety of the region generally and also people and buildings with the help of three-dimensional building presentations prepared on the basis of historical information.

Index Terms: 3-D reconstruction, Ancient cities, Antioch, digital archeology, virtual heritage

I. INTRODUCTION

It is paramount to learn the size of the structure and population of the ancient cities in the past in terms of keeping cultural heritage alive. Information given by the historians and authors in the past about the cities provides us with important information. However, data about periodic or regional structure is sometimes missing and creates gaps.

In this study, the aim is to animate city walls and city gates as their components which can give information about the size of Ancient cities through the use of computer-aided three dimensional images and to reveal the cultural heritage. This study is considered to be a means of imaging ancient cities, most historical reminiscent of which cannot reach up to our times, but can be deducted from the books, maps, inscriptions and pictures.

In this study, as a result of comparative examination on historical research and similar examples, models which indicate the historical status of elements or structures which have been subject to change, addition or partial destruction or become destroyed throughout the process since the beginning of their original designs are produced and tried to be visualized. This scientific and compulsory study will make it

Asst. Prof. Dr. Kayhan Kaplan, Faculty of Architecture and Fine Arts, Istanbul Gedik University, 34876 Istanbul, Turkey.

possible to explain unique design of a work, to analyze historical development and to grasp the reminiscent better through the use of computer-aided visualizations and restitution works although it is not possible to re-make the parts. This study aims at having an opportunity to understand the people, buildings and generally historical and architectural connections within the entirety of the region through the use of three-dimensional building presentations prepared on the basis of historical information

A. Ancient Antioch

Antioch, which is mentioned along with Rome, Alexandria and Constantinople among the big metropolis in the Empire of Rome, is deemed to be one of the magnificent cities dominated by Hellenistic culture and luxury life [1]. At the same time, ranking 3rd city in the world with its population reaching up to 300 – 400 thousand of population, Antioch became the capital city of Roman Syria on the crossroads of the west and the east [2]. Having the most magnificent structures of the world with its Hippodrome, Arena, Royal Palace, theaters and bath houses, the city became the center of the empire as a social structure where art and demonstrations and Olympic Games took place.

Up to great earthquake in 526, which is agreed to be the second greatest fatal disaster in the history, it preserved its characteristics of becoming center [3]. This great earthquake and subsequent secondary earthquakes, Persian attacks, invasion, fires and great plague destroyed the city. Most of the Hellenistic structures cannot reach up to our dates due to earthquakes; for this reason, information about urbanization and architectural elements of Antioch city is obtained rather from written resources. The place called as Lost City: Antioch is currently located under the land of Antakya's central district in modern Hatay Province on the south end of Turkey. [4]. The first archeological excavations for Antioch city were commenced by Princeton University in 1930s; however, only a small amount of works from Rome period can be dug out up to now.

B. Ancient Antioch

One of the most important features of any ancient city in determining its population size is the walls of the city. While it is true that in many cases, the built up area of ancient cities either did not reach the full area enclosed by city walls, or in other cases surpassed it, it does give an idea of its order of magnitude [2].

Concerning the walls of Antioch, in fact significant parts still remain, especially in the east over the crest of mount Silpius. Much of the visible remains are essentially to be dated to the Justinian walls of the sixth century – Justinian, as

mentioned in the introduction, reduced the size of the city walls to match the much smaller Antioch of his time – and several parts of what may be Hellenistic walls are visible as well.

Within the period up to the mid of 19th century, the city walls are known to have been in good condition. Based on the available reminiscent, the walls can be said to have been constructed in 6th century [5]. Besides, excavations in 1930s revealed that these structures on the skirts of Habib Neccar Mountain were older and wall patches belonging to the period of Selecuid.

Procopious (AD 500-565) in his work says the following about city walls of Antioch and Justianus [6].

Before all, he (Justianus) made Antioch fairer and stronger place. In the past, the city walls were both longer and more folded. In some places, it surrounded empty land areas wastefully and in some places, it could climb up to the summit of the mountain. For this reason, it became harder for us to defend. Justianus re-built the walls in a way to surround only the city. Orentes (Asi) River flowing in curving way within the city was taken to new river bed and made side by side with the walls. In addition, he constructed baths, bath houses and reservoirs inside the walls and built a tank per tower to meet the need for water.

Gates embedded in the walls surrounding city had important architectural characteristics in Hellenistic city structure. In later times, though such gates could preserve their features throughout the period of the Rome Empire, they acted as aesthetic monument rather than their functional feature due to enlargement of the cities and possibility to exceed the city walls and decreased wars and it took long times to re-build such gates [7].
According to (Downey, 1961), there are 6 city gates. In this study, sufficient architectural data could be obtained only about Dog Gate, Cherubim Gate and Beroea Gate.

II. METHOD

Cultural heritage protection and planning of historic urban environments are closely related to the methodology and the tools used in various case studies. The method used and accepted in many commercial animation films and known as 3d computer animation process of (Kerlow, 2004) was developed and adopted to the study.

In this research, a way covering data collection, analysis, modeling, covering and rendering was followed. Modeling, the longest and the most important phase of the research, was made under the light of data obtained from the decisions of the experts. Modeling was started first with the formation of topography (terrain). 2D numerical data obtained from satellite images and maps via ArcGIS and AutoCAD 2009 software were exported into Vue Infinitive 9 and 3d MAX 2011 3D modeling software and dimensioned. Thus, numerical height model of Hatay region was obtained. After this phase, under the light of the data obtained, city walls and gates were modeled. Subsequently, camera movements (camera tracking) and camera aspects were determined. In this phase, routes and objectives of the camera were chosen. In addition, the speed of the camera and the dynamics of other movable objects were adjusted.

In the study, 'Pre-render' was taken from settings whose light, shading and covering was finished and determined camera and aspects. An idea about the final status of the animation in this process was obtained. According to this, any settings which disturb eyes or seem to be problematic in the covering and modeling could be changed. This render acting as a checkpoint was repeated for each camera and movable objects. Following ''final render'', the last phase of the study, animations were obtained.

III. FINDINGS

In this research about modeling ancient Antioch's city walls and gates, time-wise period was chosen to be 2nd century when the city reached to its largest borders. The structures to be modeled were first chosen in the study and resource information was gathered. To this end, Downey (1961) map describing Ancient Antioch city is taken as basis [8] (Fig. 1).
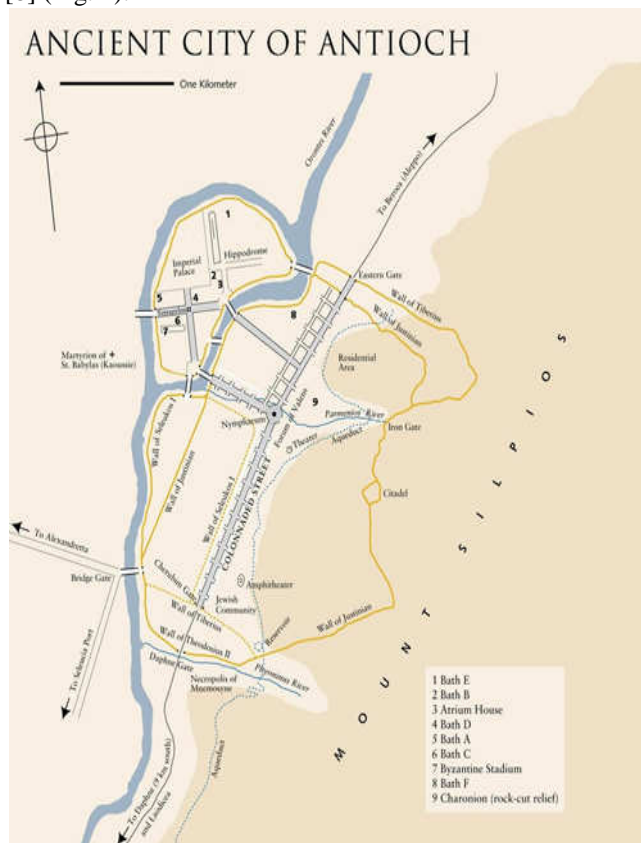

Figure 1. Ancient Antioch water.

City walls in ancient Antioch were made to pass through different routes in different times. In the modeling, each city walls constructed by each emperor was modeled separately. Best efforts were made to adopt the ground to the surface in defining the routes. A great deal of engravings and pictures were examined for modeling city walls. (fig. 2).
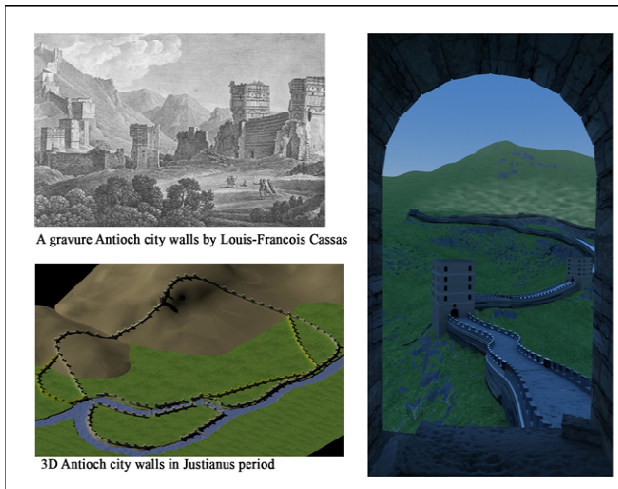
Fig. 2. An 18th-century gravure by Louis-Francois Cassas depicting Ancient Antioch's city walls and the model produced from this gravure equation.

An animation describing the sizes and dimensions of the city walls was prepared after modeling. A frame taken from this animation is provided in Fig. 3.

Dog Gate (Porta Ganis) was actually a bridge-gate complex. According to what Libanius told, this gate was located on the bridge connecting the Island to Columnar Street and this road was going on until Tetrapylon [9].
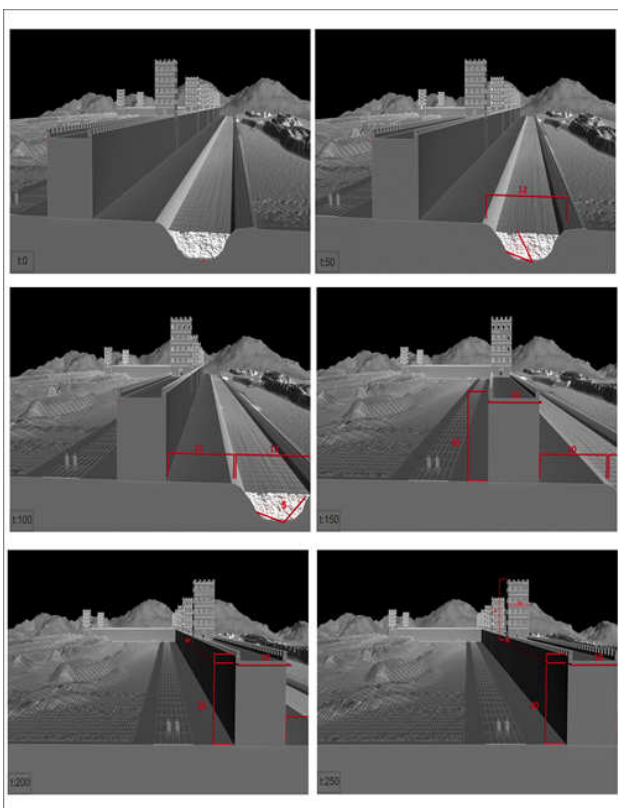

Fig. 3. Wireframe Animation Indicating Dimensions of City Walls

Excavation reports about the first period in 1934 maintained by archeology team of Princeton University mention this gate. In the excavations made on the island, the head of bridge – gate complex was dug out from these excavations. It is referred as Dog Door or Bab el-Kelb or Bab el-Jenêneh in the records. The island disappeared due to alluvial filling brought by Orontes (Asi) River in the 19th

century and thus bridge-gate lost its functionality. [10] According to the report issued, the gate was put into pieces in this period and brought to famous barrack of İbrahim Pasha.

According to data obtained, this gate-bridge complex was tried to be modeled. Such information obtained indicated the place of the structure gut gave no information about the visual nature of the gate. For this reason, other Roman cities located in close areas in the same period (Pseudo-Antioch, Ephesus and Palmyra) were evaluated and gate samples were examined. Models made in relation to this gate are provided in Fig. 4.

Figure 4. Dog Gate Model

According to Downey'(1961)s map, famous cherubim door was located in a close place to outer wall of Columnar Street. It was in the same direction with Daphne Gate located on the outer (theodosian) wall. The city walls needed enlarging due to rapid increased population and distribution of settlement places. Until the construction of Daphne Gate, Cherubim Gate, which was older and more interior, had been used as the main gate on the south wall.

Downey wrote a comprehensive article about Cherubim Gate in Quarterly. Cherubim Gate and the traffic of the gate were published by L. Duliere in newspaper called Zeitschrift Religions und Geistesgeschichte. Both the authors took two historical resources as basis. One of these resources is Malas (and the similar version using the same resource with this resource is chonicon paschale); the other was biography writer of Saint Symeon Stylites. The first diary contained hagiographic version sights and the efforts of another saint to get through Cherubim Gate while narrating the historical background of the gate.

The gate is located in an area close to the place where the Jewish people live and is said to have been erected by Titus upon the invasion of Cherubim due to its name from the Temple in Brail. It consists of two angel-like figures located on a duct with tablets brought from the mountain where Moses is protected. Exodus book 25:18 ** 20 narrates their creation as the following ''And you shall make two cherubim of gold; of hammered work you shall make them at the two ends of the mercy seat. Make one cherub at one end, and the other cherub at the other end; you shall make the cherubim at the two ends of it of one piece with the mercy seat.'' Then, cherubim stretch out their wings high, covering the mercy seat with their wings, and they shall face one another. The faces of the cherubim shall be toward the mercy seat (Figure 4.61). Original arc is lost and no new arc is constructed for 3rd Herodrad Temple. Some researchers have tried to create connection between these figures and the big-winged figures

used in designing Assyrian palace, Nineveh and other places. As it is known, the Jewish war was ended in AD 70 upon the arrival of winter in Israel; the public is distributes, the city is plundered and 3rd temple constructed by Herod is destructed. Roman conquerors grasped the booty. Menorah and Shewbread tables (both of them were made of golden) and temple's trumpets were among these goods. It is imaged in the form of relief on Titus ark in Roman forum.

While modeling Cheribum Gate, this gate is considered to have big scale like other main entrance gates of the city and designed in a way to satisfy the human traffic of the period (fig. 5).

Figure 5. Cheribum Gate Model

Beroea Gate and The Sprıng of Olympias have different names. Known also as Halep (Aleppo) Gate, this entrance was located on the east part of the city. The pool fed from the springs and Daphe via the arcs were located in the interior walls of the gate. Traveler Martinus Lycklama mentioned this gate and springs in his notes in 1866 and envisaged with an engraving [11].

The height of the people in the engraving is taken as basis for dimensioning the gate and its surrounding. According to this, the gate had width of 8 meters and height of 18 meters approximately. Scaling animation and frame gaps of this gate are provided in Fig. 6.
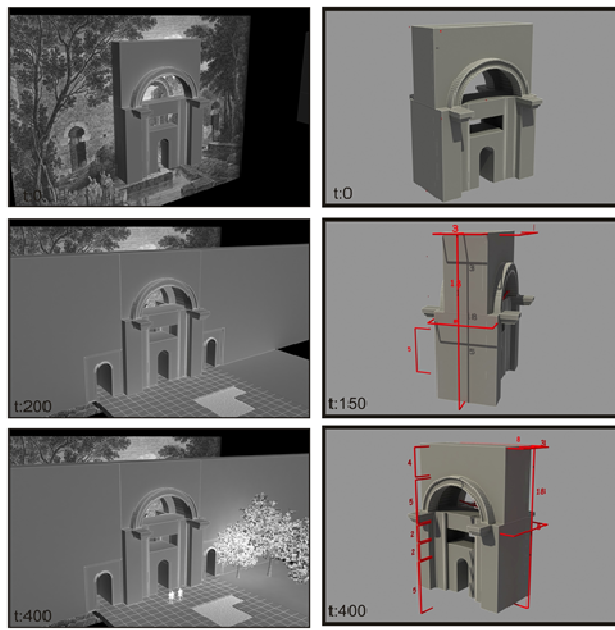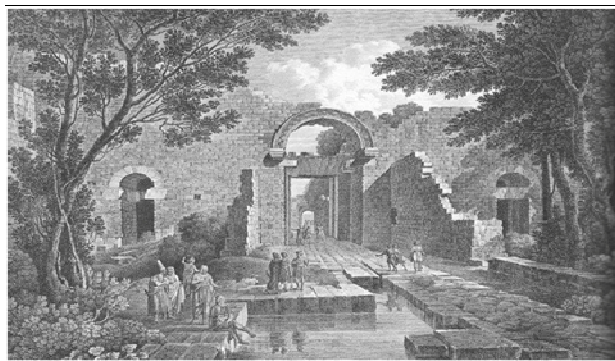

Fig. 6. Beroea Gate's Engraving and Model Animation

IV. CONCLUSION AND DISCUSSION

No matter which way it is approached, of the many names it was given, Antioch certainly deserved 'the Great'. During the Roman period, it was one of the largest cities of the Empire, surpassing many others in size, wealth, magnificence and history. As the capital of Roman Syria, it was not only an administrative center, but also served as the springboard for Rome's wars with the Parthian east. Even so, while still immense, it seems likely that the city itself was less populous than sometimes held by ancient and modern authors alike.

The study is important in terms of animating lost or destroyed cities, buildings and their surroundings. Open areas such as roads, pavements, agoras and avenues by the city walls are modeled in the study. Thus, urban open areas of the ancient period can be perceived on three-dimensional and depth basis and make it convenient for the experts to produce sights and information. In addition, it is a new study in terms of following the historical development of ancient cities. The study is important in terms of covering different scientific branches such as archeology, landscaping planning, city planning and computer-aided animation. This is a unique work especially in terms of making use of different scientific methods and integrating software used in different fields such as remote sensing, solid modeling and animation.

The study is of a base for similar kinds of studies particularly about the subject matter. The area within the city

walls surrounding the city can be calculated numerically thanks to computer as a result of modeling the Antioch city. (380 and 490 hectares) Thus, researches about the archeological city information system such as population projection, density estimation or status for use of area for Ancient city can be carried out.

Images obtained as a result of the study can be used for the purposes of making researches. These images will be important data source for providing three-dimensional information about the setting in archeological researches and excavations works and make contributions to determine the direction of excavations. Models obtained from the work are important in terms of providing new data particularly for the excavations in process and excavation team still around Antakya.

Another aspect of the study is to make use of it for educational purposes. It can be assessed as a resource for undergraduate and post-graduate students studying in scientific branches such as history, art history and archeology.

REFERENCES

1. C. Kondoleon, Ed., Antioch: The Lost Ancient City. USA: Princeton University Press, 2000.
2. S. P. Kloeg, "Antioch the Great Population and economy of second-century Antioch," Leiden University, 2013.
3. M. R. Sbeinati, R. Darawcheh, and M. Mouty, "The historical earthquakes of Syria: An analysis of large and moderate earthquakes from 1365 B.C. to 1900 A.D," Ann. Geophys., vol. 48, no. 3, pp. 347–435, 2005.
4. Sandwell and J. Huskinson, Culture and Society in late Roman Antioch. Oxford: Oxbow Books, 2003.
5. G. Brands, "Orientis apex pulcher – Die Krone des Orients. Antiochia und seine Mauern in Kaiserzeit und Spätantike," Antike Welt. 35, Darmstadt / Deutschland, pp. 10–16., 2004.
6. S. Williams, Diocletian and the Roman Recovery. New Fetter ane London: Routledge, 2000.
7. H. Dey, "Art, Ceremony, and City Walls: The Aesthetics of Imperial Resurgence in the Late Roman West," J. Late Antiq., vol. 3, no. 1, pp. 3–37, 2010.
8. G. Downey, A History Of Antioch In Syria: From Seleucus To The Arab Conquest, Reprint of. New Jersey: Princeton University Press, 1961.
9. F. Norman, Libanius. Autobiography and Selected Letters. London: Cambridge, 1993.
10. R. Morey, "The Excavation of Antioch on the Orontes," Am. Philos. Soc., vol. 76, no. 5, pp. 637–651, 1936.
11. Ecclestone, "Antiochepedia = Musings Upon Ancient Antioch," 2014. [Online]. Available: http://libaniusredux.blogspot.com.tr/html. [Accessed: 15-Oct-2015]

Asst. Prof. Dr. Kayhan Kaplan Kayhan Kaplan is an Assistant Professor, Department of Visual Communication Design at Istanbul Gedik University. He received the MS and PhD degrees on Landscape modeling from Ataturk University, Turkey in 1996 and 2003, respectively. He held post-doctoral research position at Kyoto University Japan. then He received second Master's degree about 3D Animation from New York Film Academy, in 2011. His research interests include computer graphics, animation, and virtual reality.