On-line Virtual Museums: An Application of an On-line VR Museum for the Parthenon Marbles

Internet: A Means of Cultural Repatriation

by

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Abstract

Among the most debated archaeological problems is the repatriation of cultural objects that have been removed from the country of origin and then dispersed in Museums around the world. The need for the return of cultural objects to their homelands is not only derived from the people they belong to, but also from those they appreciate their value and have archaeological interest in them. However, there are a number of problems revolved around most cases, which prohibit the cultural repatriation to be achieved. The case of the Parthenon Marbles is one of the best-known claims for the repatriation of cultural property, as its sculptures, which constitute an integral part of it, have been removed from the temple and are stored in different Museums.

Towards the problem of cultural repatriation, Parthenon Marbles case study is used to research to what extent the Internet can be introduced as a means of providing a form of cultural repatriation through the idea of a Virtual Museum. The argument is supported by the conception, design and construction of a Virtual Museum for the Parthenon Marbles. The web site is a pilot application implementing some sides of the temple, while providing guidelines and techniques for completion of the rest. The development of the web site also provided an opportunity for evaluating tools and techniques used in virtual museums. Finally, the VR Museum concept as a means of repatriation is evaluated, discussing the areas where such an application would be beneficial and also the level of information that can provide for the specified “repatriated” object(s) according to specific user groups and needs.
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ACCOMPANYING MATERIAL

The Thesis is accompanied by a (ISO burn) CD-ROM, containing the Parthenon (Pilot) Virtual Museum Files. In the CD-ROM’s root directory there are 3 directories and one .htm file. The directories are named Parthenon, Images and British and contain the source files for the Virtual Museum, the Images used in it and the British Museum’s locally cached files respectively. The file index.htm is the home page of the site and is the one that should be opened in order to view the Pilot Parthenon Virtual Museum.
1. Introduction

A large number of cultural objects are removed from their country of origin and are scattered in different Museums all over the world. The application, which is a pilot study of an on-line Virtual Museum is intended to research to what extent the Internet can be a means of cultural repatriation. The Parthenon Marbles case study is used to provide evidence that the Internet can be an interim solution to cultural repatriation.

The sculptures (known as Marbles) of the Parthenon, the temple of the fifth century of classical period in Athens, which form an integral part of the temple, are dispersed across different European Museums. The Parthenon Marbles constitute the frieze, the metopes, which are square panels sculptured in high relief, and the pediments. Parts of the frieze and the pediments, as well as some metopes are kept in the Acropolis Museum and in the British Museum, while some other parts are in other Museums (Appendix A, Fig.1). Therefore, people who are interested in the sculptures of the Parthenon, cannot view them in their own context, which means that problems of understanding the relation of the architecture of the temple and its sculptures arise. It is even more difficult for students who are interested in classical studies to view the sculptures in their context. In effect, there is call for the repatriation of these parts of the Parthenon. The political debate about the cultural repatriation of the Parthenon Marbles has a long history. However, the case is complicated and the debate continues, as the different sides have not come down to any common grounds. As one mechanism for dealing with this problem, the Internet will be introduced as a means of providing an interim solution to cultural repatriation through the idea of a Virtual Museum. The Internet cannot be replacement for the real repatriation of the Marbles, but it can be a means for bringing them together and presenting them in a single context making them accessible to those who study them.

As far as the background research is concerned, cultural repatriation issues will be discussed, as the call for the repatriation of cultural property of a given country has been the subject of debate in many countries since the nineteenth century. This will provide an
idea about the subject in general and will indicate the problems that surround the issue of repatriation. There are a number of problems revolved around most cases and they prohibit the cultural repatriation to be achieved. Moving on to the case study of the Parthenon, the history and the architecture of the temple will provide an idea of its significance and the reason of why the repatriation of its sculptures matters. Then, focus will be placed on the politics of the repatriation of the Parthenon Marbles in order to introduce the problems of the restitution of these sculptures. This will emphasize that a number of problems surround also the case of the repatriation of the Parthenon Marbles.

Therefore, the project aims to develop this pilot application, in order to bring the Marbles together in the context of a Virtual Museum. A large number of Virtual Museums is available on the web, plus, there are different categories as they serve different purposes. Among them, a Virtual Museum can be one that can present cultural artefacts that are dispersed throughout different museums all over the world and in effect, it can enable their digital repatriation (Anon. 1999). Thus, as part of the background research, some examples of some of the most representative Virtual Museums will be provided. What technologies have been used and what the purpose of these Museums is will be also examined. This will indicate what has already been done in the area of Virtual Museums and to what purpose. Some 3D models of the Parthenon that have been implemented will be also examined, as the pilot application will include 2D rendering of a simple 3D Model of the Parthenon for navigational use. This will emphasize what makes the pilot application different to what has already been done in terms of the 3D modeling of the temple and VR Museums.

The pilot application for the On-line Virtual Museum for the Marbles of the Parthenon will present some of the parts of the metopes, frieze and the pediments that are known and stored in different museums (Acropolis Museum, British Museum, Louvre), as well as those that are known by Carrey’s drawings (Bowie & Thimme, 1973). It is not intended to present the sculptures of all sides of the temple, due to the fact that it is a pilot
study. It will present the south metopes, as these are the only metopes drawn by Carrey\(^1\), and there are drawings for the missing metopes. These are the only dispersed in different museums, while the fragments of metopes from the other sides are either in the Acropolis Museum or in situ on the monument. It will also present the east frieze and the east pediment, as the east side of the temple is considered to have been the most important side, as there was the entrance. Furthermore, as the application is intended for the repatriation of the Parthenon Marbles, it will include web pages, which will come from the web sites of the British Museum and the Louvre and they will present those parts of the Marbles that have been removed from the Parthenon and are now stored in different Museums. This will emphasize the fact that the Marbles of the Parthenon are scattered in different Museums and that the pilot application of the VR Museum is intended to be a means of repatriation for the Marbles. In the context of the Virtual Museum parts of the sculptures (frieze, metopes, pediments) of the temple will be joined together, as their images will be presented in a continuous way and in relation to the architecture of the temple. The relation of the sculptures with the temple will be indicated through the use of a 2D rendering of a 3D Model that will be also used as a navigational tool and it will indicate the exact position of each part of the sculptures. Further access to more details about the specific parts of the Marbles will be possible. The images and the information available will be grouped and presented in terms of the frieze, the metopes and the pediments.

To conclude, this kind of digital repatriation will consider the needs of those who study the temple, as they will be able to access the Marbles and view them in the same context. Through the Virtual Museum better understanding of the sculptures and their relation to the architecture of the temple will be achieved. In effect, the application will provide the appropriate conditions for studying them and it will emphasize that there is a sequence in what the Marbles represent and that they form a unity, what would have been easy to conceive if they were in their context.

\(^1\) J. Carrey saw and drew the sculpture in 1674, before the explosion of the temple in 1687, when the sculpture were still in place on the building. His drawings are of great significance. Carrey drew the pediments, the frieze and the south metopes (Hatziaslani 2000, 144).
2. Background

2.1 Cultural Repatriation/Internet, a solution

The repatriation of cultural objects that have been removed from the country of origin and then dispersed in museums around the world constitutes an issue that has been debated since the nineteenth century. Repatriation is the claim to cultural property as a country’s patrimony, a people’s or community’s heritage, something integral to it - literally, a culture’s property (Sharipo 1999, 96). Therefore, repatriating cultural objects is required as cultural property constitutes who people are and without which they could loose some aspect of their identity.

The return of cultural treasures to their homelands is an issue, which has been debated since the nineteenth century, as there have been a number of cases in which cultural objects have been removed from their context and stored in museums in other countries. A large number of these cases originated in the seventeenth and eighteenth centuries due to the extension of colonial empires, the activities of travellers and traders and the growth of a class of wealthy private collectors along with a tendency to intense competition and rivalry (Greenfield 1995, 91). As a result, for example, of the expeditions and the international race for antiquities, the treasures of Central Asia are today scattered throughout the world in over thirty museums and institutions. Another example is the treasures brought together that are now held at the Egyptian Museum in Berlin. Among these is the coloured limestone bust of Queen Nefertiti, which was removed to Germany causing a worldwide Egyptological scandal. There have also been other claims for the return of artefacts removed from Turkey to Berlin’s Museums, such as a statue from Aphrodisias, a sphinx from the Hittite, and a thirteenth-century prayer niche taken from Beykehim Mosque in central Turkey (Vitelli 1996, 85). Although the return of cultural property is often considered to be difficult, there are numerous cases where intergovernmental or inter-institutional negotiations and domestic legal suits have successfully affected returns. Thus, there are a number of examples worldwide. In 1950, for example, there was an agreement between France and Laos about the restitution of Laotian objects of art and in 1977, Belgium returned several thousand cultural items to
Zaire (Greenfield 1995, 262). However, there are numerous other cases where the opposite parties have not come to any common grounds and the restitution of the cultural objects has not been accomplished due to the difficulties that are encountered.

Although the return of cultural treasures to their homelands has become the subject of public debate, there are many obstacles that prevent it. As there are historical, legal and political issues surrounding many cases, all these factors should be taken into account in the case of the claim for return. Therefore, the historical and political circumstances under which the removal of the cultural property from its country of origin took place are often presented as the arguments against the return. Sometimes the removal of cultural objects from their context has been the result of war, colonialism, missionary activity, and sometimes objects have been peacefully collected and bought. Thus, the issue of return should be determined by the circumstances of acquisition, which makes it more difficult to achieve, as so many factors are involved.

Moreover, many difficulties arise, when the case of repatriation of cultural treasures is to be dealt with according to property law or other legal approaches. This is due to the fact that legal approaches ignore the symbolic and unique nature of the cultural property, which is very important to the nation it belongs. When it comes to repatriation of cultural objects, it is more important to answer the question of to whom the cultural treasures belong as a matter of identity rather than as a matter of property rights and ownership (Sharipo 1999, 100). In effect, when the case of repatriation of cultural treasures is to be dealt with according to property law, no conclusions are made, as the symbolic nature of the cultural objects is not taken into consideration and the debate remains years later.

In addition, as far as cultural repatriation issues are concerned, in some cases there are reservations against return. A well-founded reservation is the potential physical danger to objects returned which may be destroyed or dispersed (Greenfield 1995, 295). Some of the countries that claim for the return of their cultural objects kept in Museums
in other countries may lack the resources for caring for them. In these cases, the repatriation of these cultural objects is prevented.

As it has already been mentioned, repatriation is part of a wider movement of cultural treasures and need not only mean restitution in the sense of repatriation for wrongful taking. It may also refer to other kinds of restoration, reinstatement, and even rejuvenation and reunification (Greenfield 1995, 257). In effect, repatriation may refer to reunification without having the cultural objects sent back to their place of origin. Thus, a digital repatriation through the Internet can be a means of providing a kind of restitution of cultural objects.

The Internet, through different technologies can contribute to the issue of repatriation, as a form of reunification can be achieved. The cultural objects that have been removed from their context and are dispersed in different museums all over the world can be reunified in the context of an on-line Virtual Museum, which constitutes a web site. Tsichritzis and Gibbs (1991) have introduced the concept of Virtual Museums. Among the different kinds of Virtual Museums, an on-line Virtual Museum can be one that can present cultural artefacts that are dispersed throughout different museums all over the world and in effect, it can enable their digital repatriation. Current IT and communication technologies (digitisation, internet, hypermedia and virtual reality) allow for the use of a wide selection of media for reproducing and exhibiting objects through the Internet. In effect, cultural objects that cannot be returned to their country of origin can temporarily be presented using the Internet. In the case of claims for repatriation of groups of objects, these can be presented as a unity in the context of a Virtual Museum, where the appropriate details about them will also be available. The Internet has also the potential of presenting the cultural objects directly from the web sites of the Museums, where they are stored, if the Museums have any web sites. This kind of cultural repatriation cannot be replacement for real repatriation. However, it can be considered as cultural repatriation of the objects concerned and it is still valuable for those who need to study the artefacts and acquire some knowledge about them.
2.2 Parthenon Case Study

2.2.1 History

The case of the Parthenon Marbles is the best-known claim for the repatriation of cultural property. The British Government on behalf of the British Museum bought the collection of marble sculptures from the Parthenon in Athens from Lord Elgin in 1816. The Parthenon Marbles are considered to be a unique case in that they form part of a unique historical monument which for humanity and international public opinion symbolizes civilization and democracy, while for the Greek people much more than that, as they symbolize the history and the continuity of the Greek nation (Stewart, 1997).

The temple of the Parthenon, which stands on the highest point of the Acropolis, or citadel of Athens was built after the Greek army’s final triumph over the Persians at Plataea in 479 B.C. Work on the Parthenon began in 447 and it was completed in 438 BC. It was dedicated to Athena, the daughter of Zeus and it was conceived by the Athenian statesman Pericles. It was designed by the architects Ictinus and Callicrates to house a statue of the goddess Athena and the Athenian treasury. Phedias, the greatest sculptor of Athens, was put in charge of the total building with direct responsibility for the sculptural ornamentation. The Parthenon remained as a temple for 900 years. It is believed that four temples were erected successively on the Parthenon site. After the Roman conquest of Greece (87-86BC) the Parthenon remained a place of worship. In the third and fourth centuries the Vandals and then the Goths attacked Athens but it is believed that the cult statue of Athena was still in place in the fifth century AD, which sometime thereafter was taken to an unknown fate in Constantinople (Boardman & Finn, 1985). The first major change to the building was in the sixth century when the temple was converted into a Christian church under the Byzantine Emperor Justinian (AD 527-565) and was dedicated to Saint Sophia. The northwest and east metopes were defaced because of their pagan images. In 1204 the Latin conquerors took over the Parthenon for a Catholic church and they dedicated it to the Virgin Mary. In 1456, the Ottoman Turks captured Athens and the Parthenon was turned into a mosque some years later. These were almost the only changes in 2000 years (Greenfield 1995, 43). It is remarkable that
Jacques Carrey saw and drew the sculptures of the Parthenon in 1674, before the explosion of the temple in 1687 (Bowie, T and Thimme 1973).

In 1687 the Venetians under their general Francesco Morozini besieged the Acropolis, where the Turks kept their gunpowder in the Parthenon. The Venetian bombardment ignited the powder, which exploded, blowing up the Parthenon; eight columns fell on the north side and six on the south. Following this the building was ravaged by collectors. Morozini tried to remove the sculptures from the west pediment but succeeded only in smashing them. Venetians and mercenaries in their service took a few heads and other pieces of sculpture from the debris caused by the explosion. These are now in various European museums (Browning 1984, 39).

By the end of the eighteenth century, Count Choiseul-Gouffier, the French ambassador to Constantinople, had already obtained a metope and a block from the east frieze, which today are exhibited in the Louvre. At the beginning of the nineteenth century Athens was still under Turkish occupation when the British diplomat, the seventh Earl of Elgin, obtained permission from the Turkish authorities to remove some of the marble sculptures from the Parthenon. Lord Elgin removed some of the sculptures in 1810-3 and ceded them to the British Museum. The sculptures that were removed from the temple were parts of the frieze along with metopes and sculptures from the pediments of the Parthenon. With the independence of Greece and the evacuation of the Acropolis by its last Turkish garrison, restoration work began almost immediately (Lawrence 1996, 112).

2.2.2 Architecture

The Parthenon has eight columns along the east and west facades and seventeen columns to the north and south (Appendix A, Fig.2). Within the outer structure was an inner structure called cella, consisting of two unconnected chambers: the naos housing the statue of the goddess Athena made of gold and ivory, which was the icon of Athens, and the opisthodomos. The opisthodomos, which was to the west, seems to have been used only as a treasury, but its original name ‘The Parthenon’, means ‘room of the
maidens’ and suggests that it had been intended to house those who served the goddess (Cook 1997, 17). Around the outside of this central building ran a peristyle, or colonnade, of forty-six columns. The whole temple stands on a base with three steps, and there are three more steps up into the porches. The specialty of the Parthenon is found in its subtle architectural refinements (corner contraction, entasis, horizontal curvature). Therefore, the building shows an extraordinary understanding of the principles of visual perception and how to compensate for its errors. The outer columns support a marble beam on which rests a Doric frieze consisting of the metopes, alternating with triglyphs, which are vertically, grooved blocks. Triglyphs and metopes are found in the Doric architectural style of the Ancient Greek temples. In these temples, the columns support a horizontal entablature consisting of the metope-triglyph frieze. Into the Parthenon, which is a Doric temple, the architects introduced a number of features from the Ionic order. In the inner building, the most prominent was the replacement of the Doric frieze of triglyphs and metopes over the inner porches by an Ionic frieze sculptured in low relief without interrupting triglyphs (Appendix A, Fig.3). This frieze was extended along the sides of the building, so that it formed a continuous sculptured band around the central structure below the ceiling of the colonnade (Lawrence 1996, 114).

Moreover, it was this sculptural adornment of the building that was of major importance, as it was symbolic of Greece’s cultural and political history. The sculptures were set up to commemorate the local myths and traditions of the city and to proclaim the power of its culture (Skeates, 2000). They are an integral part of the building, not decorations attached after the temple was completed (Browning 1984, 40). The sculptures of the Parthenon consisted firstly of groups in the pediments and contained about fifty figures. The pediments depict the birth of Athena and her contest with Poseidon for the land of Attica. They are over 90 feet long and about 3 feet deep, measured from the back wall and their height rises to over 11 feet in the center (Greenfield 1996, 53). There were also square panels sculptured in high relief, the metopes, on the external order. The ninety-two metopes, carved in high relief, portrayed the victories of Greek gods and heroes over their enemies and thus the victory of civilization over barbarism. The frieze, with the scene of the Panathenaic procession, surrounded the central chamber. The
Panathenaic procession was part of the Panathenea, the festival in honour of Athena, which was the main religious event of the year in Athens. The frieze through the Panathenaic procession portrayed citizens as close to the gods, which to an Athenian of the time signified the glorification of all Greece’s people. In effect, the ultimate purpose of the Parthenon and its sculptures was to glorify Athena and her city, Athens, proud ruler of an empire that spread through the Aegean and beyond, making her one of the two great powers in the Greek world (Cook 1997, 19). All these mean that the sculptures were an integral part of the Parthenon, which in turn is part of the landscape, natural and manmade, in which it is set (Browning 1984, 40). However, of the ninety-seven surviving metopes, thirty-nine are either in situ or in the Acropolis Museum and fifteen are in the British Museum. Some parts of the metopes are also stored in the Louvre (one panel and a head), in the Vatican (one head), in Wurzburg (part of a head), and in Copenhagen (two heads). Of the ninety-seven surviving panels of the frieze, fifty-six are in the British Museum, forty are in-situ or in the Acropolis Museum and one in the Louvre. The British Museum has also seventeen pedimental figures (Greenfield 1996, 53).

2.2.3 Politics for Repatriation and the Parthenon Marbles

As far as the marble sculptures from the Parthenon that are in the British Museum are concerned, the British Government on behalf of the British Museum bought them from Lord Elgin in 1816. The Parthenon Marbles case is the one that has incurred the greatest publicity among the repatriation case of cultural objects around the world.

Lord Elgin was appointed British Ambassador to the Ottoman Empire in Constantinople in 1799, when Greece was one of its colonies. There were a number of circumstances that helped him acquire the marbles and remove them from the Parthenon. The conquest of the Greek people by the Ottoman Turkish Empire in 1453, which lasted about 400 years, was a main factor that enabled Elgin to remove the sculptures and take them away to Britain. Due to the Ottoman rule the Greeks were helpless to prevent the removal of the marbles. He was given permission to sketch and excavate sites, including the Parthenon, where his men began removing as many sculptures as they could. It was
Elgin’s claim that he had official sanction to do this, but only an Italian translation exists of that alleged agreement. However, it has been said that the document was ambiguous because it was probably a misinterpretation of the meaning of the words to say that permission to dig and take away meant that Lord Elgin could take sculptures from the building (Greenfield 1995, 56).

The work of stripping the Parthenon began in 1801. Elgin’s men worked for about a period of ten years in order to take down the sculptures from the temple where they had been standing for some 2,250 years. The sculptures that were removed include marble figures from the pediments, metopes (sculptures in high relief) and parts of the frieze. Most of the parts of the sculptures were mutilated so that they could be more easily shipped. When the Marbles from the Parthenon arrived in England in 1810, they were subjected to commercial bargaining between Lord Elgin and the British government. The British Parliament condemned Elgin for robbing antiquities and destroying monuments after debating his rightful claims to ownership and his actions. The Parliament decided to purchase the Marbles from him for 35,000 pounds and gave them to the British Museum. From the beginning, voices were raised in England both to condemn Elgin’s action and to urge that the Marbles should be returned to Greece (Browning 1984, 40). In the nineteenth century poets and writers wrote in favour of returning the Marbles to Greece.

As far as the dispute between the Greece and Great Britain over the case of the return of the Elgin Marbles, each side has its arguments. Beginning at least as early 1898, the Greek claims for repatriation have continued to this day with increasing support from international organizations like UNESCO and ICOM (Neils 2001, 240). However, there had been few demands for the return of the Marbles before 1981, when Melina Mercouri became Minister of Culture in Greece. It was her initiative in calling for the return of the Parthenon sculptures to Greece at an international conference of the Ministers of Culture in 1982. The importance of the case of the Parthenon Marbles lies in the fact that they constitute an integral part of the temple. They were set up to commemorate the local myths and traditions of the city and to proclaim the power of its culture. Removed from their original setting, they therefore lose meaning and value or at best they take on a
new meaning and value, which is quite different from that if the various elements were re-integrated (Skeates, 2000). The Marbles also, occupy a central position in the cultural heritage of Greece and are symbolic of the Greek people’s link with its own past.

As today international organizations are actively concerned with the restitution or return of cultural property, a British Committee for the Restitution of the Parthenon Marbles has been working since 1983 to spread information and stimulate discussion of the arguments for the return (Anon. 2002). The Committee’s objective is to bring together all the separated parts of the fabric of the Parthenon, so restoring the integrity of the monument. However, there are many problems that prohibit the restitution of the Marbles. For many years the Greek government has also been trying to bring the Marbles back to Greece through diplomacy, but to no effect.

Although a new museum in Athens is under construction, which could house all the Parthenon Marbles, the British government is opposed to the idea of the return providing some arguments for keeping the Marbles in the British Museum. First of all, the removal of the Marbles was proper under the applicable international law that existed at the time of Lord Elgin’s actions. The fact that the Marbles have been in England for more than a century and in that time have become a part of the British cultural heritage is also presented as an argument against the return. In addition, a frequently expressed concern is that the return of the Marbles would result in the impoverishment of a great institution, the British Museum, and lead to the future depletion of museum collections, so feared by curators, keepers and directors (Neils 2001, 244). This is one of the main arguments for keeping the Elgin Marbles housed in the British Museum, as it is argued that the return of the Marbles to Greece would constitute a precedent for the universal removal of major acquisitions of the world’s museums. This would allow countries to demand restitution of works of art they believe had been acquired in questionable circumstances. In addition, the British Museum regards itself as a ‘universal museum’, which holds cultural material in trust for the whole mankind. It is designed to present as complete and integrated a picture as possible of the development of different but related cultures through the ages (Wilson, 1989). Therefore, for decades, all the attempts to get
the Elgin marbles returned to Greece have failed. All the above arguments constitute the proof for the difficulties that occur over the case of the repatriation of the sculptures of the Parthenon, which would have been the reunification of the scattered parts of the Marbles.

2.3 Internet

2.3.1 Virtual Museums on the Internet

The term ‘Virtual Museum’ has recently, become indistinct and means different things, like digital collection, cyber museum, on-line museum, virtual space, interactive installation, but also information gateway or simply portal (Jaggi & Kraemer, 2002). A large number of Virtual Museums is available on the web, while there are different categories as they serve different purposes.

The most representative kind of Virtual Museums is one that represents a virtual architectural environment of a Museum that does not exist in reality. In such a Museum, one can visit virtual exhibits presenting, for example, artefacts or pieces of art. As an example should be mentioned the Muva (Anon.2002b). It has been conceived as a dynamic, interactive Museum bringing together the most renowned works of contemporary Uruguayan art. The environment of the exhibits of the works is a virtual architectural building designed by architects. This Virtual Museum is designed in JavaScript. JavaScript is a limited programming language, which allows creating interactive web pages without a whole lot of programming effort. The web presentation is based on a series of linked 2D images generated from a 3D model. Muva has been designed as an alternative to a real Museum that would have housed works of contemporary Uruguayan art. However, the construction of a real Museum was impossible, as it would have cost over 100 million dollars, a prohibitive sum for the Uruguayan reality. Thus, the Virtual Museum is intended for worldwide web users who would be able to visit it, walk through it, and investigate the works that are presented.

Another category of Virtual Museums is an on-line user interface that provides virtual exhibits of collections that are stored in a number of real Museums. The Virtual
Museums Project (Charitos et al.) has been intended to create a VR Museum that has the above characteristics and presents the artefacts in a virtual architectural environment. The virtual environment constitutes the user interface, where visitors of the participating Museums will be able to view the exhibits either through Internet or locally. A number of real Museums participated in the project and provided 2D or 3D content to be digitised and included in the Virtual Museum. This VR Museum uses up-to-date technologies and its exhibits are presented through the use of music, text, narration, video, 3D graphics and animation. The development of the Virtual Museum mainly involved the digitisation process for the 2D and 3D objects which are exhibited, the creation of 3D models for the environmental design of the museum complex, the positioning of the content in certain positions within the exhibition space and the design and development of the manner in which participants will interact and navigate within the virtual museum. The Virtual Museum is intended for use for researchers or students, or in general for people that are interested in the exhibits of the participating Museums.

As Virtual Museums are considered some web sites that are gateways to other Museums’ sites on the Internet. The Virtual Museum of Canada is an example of this kind. Actually, it is a web site that provides access to other web sites of Museums of Canada (Anon. 2001) The above Virtual Museum uses apart from HTML for creating the web pages, JavaScript for the home page that gives interactivity to it, as JavaScript allows creating interactive web pages. This Virtual Museum is intended to provide information about the above Museums to the general public.

Moreover, the Ancient Civilizations Virtual Museum belongs to the category of VR Museums that constitute web sites, which provide access to pages with a specific kind of information by using 3D images as navigation tools in the home page (Anon. 2002a). It also constitutes a web site created by JavaScript. It is aimed to provide information about ancient civilizations to the general public. Although a Virtual Museum usually presents real objects and uses different media for reproducing and exhibiting the objects, this category only provides information.
Apart from just providing information about a specific subject, a Virtual Museum can also be used for other purposes. A Virtual Museum can be one that can present cultural artefacts that are dispersed throughout different Museums all over the world and in effect, it can enable their digital repatriation. It is the same idea as that of a VR Museum that presents artefacts or works that either do not exist in a real Museum or they come from a real Museum. The Four Directions Virtual Museum Project could be mentioned as the only example of creating a VR Museum that presents artefacts that are dispersed throughout different Museums, as they are brought together in the context of the Virtual Museum (Anon. 1999).

The project explores the uses of cutting-edge technology to help American Indian schools produce Virtual Museums of their cultures that combine the resources of the local community and Museums such as the NMAI (National Museum of the American Indian), which have substantial Native American collections. The project uses QuickTime Virtual Reality (QTVR), a photography-based VR that enables a user to explore panoramic spaces and examine objects by rotating them to any viewpoint using a computer mouse. This immersive imaging software, which is easy to use, along with high quality digital still and video cameras contribute to the creation of realistic virtual spaces and objects and provide new forms for the communication of visual information. In the context of this kind of a VR Museum, apart from viewing the artefacts altogether that are stored in different Museums, one can also manipulate them by rotating and investigating them from different angles.

2.3.2 Parthenon 3D Models

Some of the technologies that have been used for the Virtual Museums mentioned so far have also been used for Parthenon virtual models that have been constructed.

In effect, QTVR technology has been used for animations of the Parthenon Virtual models, as panoramas videos are commonly used for animations of 3D models.
As an example should be mentioned the fly-through of the Parthenon implemented by the University of Minnesota\(^1\) (Appendix C, Fig.1). This is a 990 K file of 120x 90 pixels.

The most common reason for creating the models is the reconstruction of the temple, as today the temple has not survived on the whole. 3D models of the Parthenon have been created either by organizations, scholars, individuals, or as part of projects by universities. As an example of an organization that has constructed a 3D model of this temple is the Great Buildings\(^2\). This organization reconstructs famous buildings from all over the world and the models are created in Design Workshop.

A more detailed model of the Parthenon has been conducted by the University of Patras\(^3\) (Appendix C, Fig.2). The 3-D model can be navigated through PC-workstations on the same LAN as the model database server, using real-time 3-D technology. The implementation of the 3D model and the walk through environment of the Parthenon has been based on valuable scientific information available from the Hellenic Ministry of Culture.

Another detailed 3D model of the Parthenon, which has been conducted by an individual, was part of a project for drawing the whole hill of the Acropolis\(^4\) (Appendix C, Fig.3). It was done on 3D Studio 4 for DOS. The model is very detailed and it is based principally on information and drawings that come from the book "L'Acropoli e il suo Museo" ("The Acropolis and its Museum") by Giorgio Dontas (Appendix C, Fig.4). It is important that this 3D model of the temple has been constructed in relation to the other buildings of the Acropolis hill, where the temple is located.

Another re-creation of the Parthenon along with the most important monuments on the Acropolis has been done by the Learning Sites\(^5\) (Appendix C, Fig.5). Learning Sites is a commercial company developing on-line resources for archaeology and

\(^1\) http://www.geocities.com/Athens/Acropolis/5579/stonehenge.html
\(^2\) http://www.greatbuildings.com/buildings/The_Parthenon.html
\(^3\) http://www.hpclab.ceid.upatras.gr/projects/project18.html
\(^4\) http://www.3dlinks.com/panebianco/e_partenon.html
\(^5\) http://www.learningsites.com/Frame_layout01.htm
education. As part of this project by Learning Sites, the Parthenon was studied in relation to the other monuments on the Acropolis hill. The simple massing model of the major 5th century buildings of the Acropolis was conducted for a re-analysis of the history and the organization of the monuments on the Acropolis. The resulting virtual reality recreation allowed the researcher to simulate a walk around the monuments and test accurately in a 3D context hypothesis about ancient sight lines and space utilization.

However, none of the above 3D models or any other existent includes any reconstruction of the architectural sculptures of the temple (pediments, frieze etc). Only the organization of Immersive Heritage has constructed a detailed 3D model of the Parthenon, which also includes a reconstruction of the metopes and the pediments\(^6\). The 3D model of the temple has been created by 3D Studio Max (Appendix C, Fig.6). However, the reconstruction of the metopes is not detailed. It only provides an idea of how these sculptures could have been constructed on the Parthenon. The 3D model does not include any reconstruction of the frieze, which was in the inner part of the temple. As far as the accuracy of the architecture of the model is concerned, it is detailed as Immersive Heritage works with Oxford Archaeological Unit to ensure the accuracy of its models. The above reconstruction has been the only attempt to reconstruct some of the Parthenon Marbles and to bring them together on the 3D model. However, it does not provide a complete idea of how the metopes had been, as the reconstruction is not detailed.

Another attempt to bring all the parts of the Parthenon frieze together is a virtual reality film of the Parthenon frieze available on the CD-ROM that accompanies the “Parthenon Frieze” written by Jenifer Neils (Neils, 2001). This is a virtual reality Macromedia Director film of the complete frieze, based on the plaster casts in the Sculpturhalle in Basel, in Switzerland, which enables the viewer to see them in a continuous way, as they would have been on the temple (Appendix C, Fig.7). One can choose one of the four sides of the Parthenon and view this side of the frieze in a continuous way by using the right or left arrows that are available (Neils, 2001).

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