

Art History and technology for the Museums with Ajanta as a case study

by Eshwar Kumar G. B

Supervisor: Prof. Sumant Rao



IDC, School of Design
Indian Institute of Technology Bombay

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Abstract

India is a diverse country which has a glorious history in art and culture from past centuries. We have the responsibility to cherish our artefacts or should be aware of them so that they do not fragile. There are numerous magnificent structures in India. The Ajanta caves are one among them and also a world's cultural heritage site. The paintings, sculptures in the caves are getting fragile, and the tourists who visit the caves are unable to understand the paintings due to several reasons, like some portions of paintings got dissipated which is resulting difficulty to interpret the information of art, especially the narrative paintings because they are not in a linear pattern. Therefore, several measures are taken by ASI (Archaeological Survey of India) for conserving the historic art. Some people are also trying to digitalize the paintings before they get fragile. Therefore, even a design team of IIT-Bombay, also take a step ahead to conserve the historic Ajanta art in various platforms

like digital and immersive virtual reality. The aim is not only to preserve and reconstruct the artifacts digitally but also to make the world understand the potential of art by giving the right information about the exhibits and communicating the stories of narrative paintings using animation as a medium, so that it will be useful for education and researchers to know them in a better way. The other purpose is to bring Ajanta to the people who are unable to visit the site in person. In this paper, I would like to present the insight on why Ajanta for contemporary museums, hands-on experience, advantages of virtual experiential museums, and how the technology is significant for museums.

1. Introduction

In the current world the technology is rapidly growing up every moment, People started experiencing and involving into an easy way of living with the help of intuitive smart

devices and getting in touch with anything they wanted in a fraction of seconds. As these intuitive technologies are moving up rapidly connecting with the people, some other technologies were developed, making people astonished with the immersive virtual world experience and making them feel to be existing in the real world. However, these technologies are used in various domains like information and communication in the fields of education, research and business, while engaging people interestingly and entertainingly. Coming to technologies like virtual reality and augmented reality used in many museums in all parts of the world. Some of them are used to popularise and some are to preserve the cultural heritage before they get fragile. The other purpose of the virtual museum is to get to the people who are unable to visit the cultural heritage site or the actual museums in-person so that they can experience the real world museums from wherever they can. Virtual reality is an artificially generated three-dimensional image, which through appropriate software and hardware, works on our senses (mainly sight and hearing) to imitate the reality surrounding us [1]. The virtual museums allow the user to tour into the virtual world while interacting with exhibits and getting informed with the related information about them [2]. However, there are many advantages and disadvantages of virtual immersive technologies for the people. As of now, people are just stepped into the virtual world and becoming aware of these immersive virtual reality technology and enjoying the features as part of their time. In the coming years, there is no doubt to say that these technologies are going to be more and more advance beyond our expectations. However, the amenities of these immersive virtual reality technologies are amazingly incredible integrated with the museums, as the historical artefact and the monuments which are going to be fragile, can be restored and preserved with the help of these techniques.

2. Problem Statement

Art History is the pride of every nation. These are to be persevered and looked after as they are getting fragile. As part of my case study, Ajanta - the world's heritage site is prestigious for their incredible paintings, architecture and sculptures.

- At present, some of the artefacts got fragile, and most of the paintings in the Ajanta cave got damaged, and it is complicated to understand the painting, especially the narratives.
- Most of the tourists visiting the site are not aware of the potential of each painting and the story behind them, probably most of the scenes in the paintings are not in a sequence, and few got damaged.
- Visiting and understanding Ajanta once or thrice is not easy by tourists because it is a massive structure with several magnificent artefacts within it.

3. Objective

Most of the copies of Paintings are created past in time from centuries, but the damaged and missing portions are left in the same way. Some people have also tried to photograph

Ajanta paintings with special permission from ASI (Archaeological Survey of India) and digitise them. Digital restoration of paintings is one of the ways to make people understand the potential of paintings and the story flow. However, restoration of historical paintings in a digital form is not so easy. One needs to have definite evidence or a proper insight about the style, structure and the story. Although if one finds a proper story that may or may not be right because there are a different version of every story, so it is better to have a vast insight of various stories, matching them together and also meeting the intellectuals, researchers, reading historic books and then come to a conclusion to restore them or adding extra elements.

4. About Ajanta

- Ajanta caves are located in Aurangabad district of Maharashtra.
- It is a Monolithic Buddhist caves, in which artefacts depict the life of Buddha.
- There are 29 rock cut caves with Chaityas (Prayer halls) including Stupas(with Buddha sculptures and without Buddha sculptures), Viharas (dormitories)
- Construction took place in 2 and 1 st century – satavahana period (early phase), 480 to 650 AD – Vakataka period (late phase), but as per the researcher Walter M. Spink, the late phase constructing took place in 462 to 480 AD [10].

5. Why Ajanta for Museum?

Ajanta caves show how a robust massive rock can change into a beautiful masterpiece. It is a holy site for all the people who wanted peace, and it is one of the most excellent sacred sites of the Buddhist religion. This is a magnificent place which holds the historic Indian cave paintings with the stunning beauty of art and culture. They are extraordinary for all the people following Buddhist philosophies, which depict the stories of Buddha's past life with high morals. Such a prestigious divine structure should be preserved safely, but they are getting fragile subsequently. The identity and significance of Ajanta caves were known to the entire world after the discovery by John Smith in 1819. Later the caves were glorified and became a famous heritage site, which is usually visited by the tourists, but the paintings in the same caves are still in the dark, because they got fragile and most of the portions are not existing. So, the information and the morals of the paintings are unknown to the ordinary public, and they see them as fragile great historical paintings but unable to understand the potential significance of narration stories, morals, the insight of art and culture of the magnificent Ajanta caves. Therefore, museums are the only one through which we can connect people all around the world to know the potential historical information of Ajanta.

6. Information and communication

6.1 Kiosk

This is an interactive VR app on Ajanta caves, which can be placed at museum sites or any other places and also a compact version can be installed in any smart devices. Kiosk gives the complete information about the caves of Ajanta, with additional options convenient to the users by making them know in deep, by exploration each cave separately or the simple, auto-play which give a basic introduction of the zone. This app includes cave elements like paintings, architecture and sculptures. The interface of this app is made in a very simplified version so that it can be accessible for any user regardless of age. While keeping in mind, the user flow, UI elements and the mood boards should be exact so

that the user doesn't get bewildered. The app allows the user to get into any of the Ajanta cave directly with the popping up indication of chaityas and viharas. This app also shows the user a clear view of the cave and high-resolution paintings with additional options to explore, along with the line drawings which helps the user to understand the entire painting with related information by comparing and checking the line art with the original paintings. They have another additional option to narrate the non-linear stories in a sequence with related images.

6.2 3D Ajanta (AR and VR - Technology)

The 3D Ajanta aims to make the users enjoy the reality of staying in the actual site with AR (Augmented Reality) and VR (Virtual Reality) technologies. Augmented reality allows the user to mark which cave he wants to visit out of his own choice from the extensive digital panoramic view of the Ajanta cave, which displayed at the museum site with the help of a digital tablet. Virtual reality allows the user to get entirely into the immersive virtual world of Ajanta with the natural sounds and ambience. These technologies made the user navigate anywhere around the Ajanta site either interior or exterior by looking at the extraordinary masterpieces while getting engrossed with Ajanta's splendid beauty and connection

themselves with the history of art and culture.

6.3 Hologram

Holography is a science to create holograms. Basically, to generate an immersive virtual object which can be seen in any direction with our naked eyes. There are two ways to create a complete three-dimensional object, one is through Terrestrial laser scanning, and the other is Digital Photogrammetry. When the object is photographed in its entirety, with a sufficient coverage between the photos, it is possible to recreate the orientation of images in relation to each other and then create point cloud describing 3D geometry of the object with dense image matching techniques [1]. The creation of point cloud and then generating the mesh onto it can be done in various software's like Agisoft: photo scan, reality capture

etc., later the maps are generated and then the mesh is adjusted in 3D software and exported to game engine software for programming to the final execution. Terrestrial

laser scanning is much easier to generate a point cloud than photogrammetry, but it was not allowed to scan in the Ajanta site because they might damage the artefacts. So the team had to go with Photogrammetry technique, and they have captured nearly 3000 to 4000 images of a single Ajanta cave.

Why Hologram?

As we know, the construction of the Ajanta cave was in different phases in time. Therefore, the evolution of art and architecture can be easily distinguished. Taking an example of cave 9 and 10 chaityas (early constructions) and comparing with the cave 26 chaitya (late

constructions) shows how dynamically the art evolved in time. The art in the Ajanta caves can also define the thoughts of humanity in different periods. To make my sentence more clear, simplistic prayer halls of Buddhist religion (without the form of Buddha), transformed into an extraordinary masterpieces with decorative styles including (the depiction of Buddha), which shows the simplicity and sophistication of art in time, this type of Buddhist evolution

of art can be seen in a single site. Which does not exist anywhere in the world, while also showing why and when people wanted the form of Buddha in the prayer halls, which shows

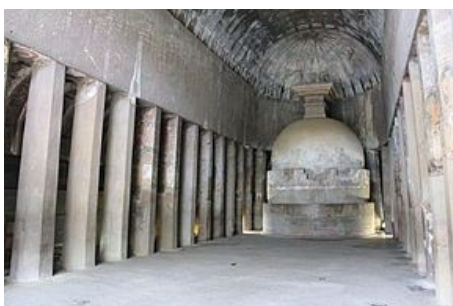
the speciality of Ajanta, in comparison with other historic sites.

This is what triggered to use hologram technology as a medium, which shows the evolution of art in Ajanta caves while taking pillars as an example.

Why pillars???

- Pillars are the best examples to show the evolution of architecture in Ajanta caves.
- They add more dynamism and beauty to any structure.
- They are a symbolic form of power in architecture.

Pillars are used to show how an ordinary rock changes into art from the initial stage to end. Therefore, the current hologram helps people to understand the stages of creating a pillar, like the stone is cut into a box initially and then equally divided into many faces to create a round surface.



Cave 10 – early construction
source of images [5]



Cave 26 – late construction

7. Interactive paintings

The user can look at the interactive paintings with the help of smart devices by augmented reality. Anyone can scan the hardcopy of the painting, which is displayed at the museum site to experience the normal art coming to life and interacting with us.

There are

various artefacts displayed at the place like the dancing girl, cave 7 - sanctum and medallion. These are some of the unique attractions in the site which makes the 2-dimensional art to an

immersive virtual object. The dancing girl is another beautiful art which has various amenities like the dance of the girl with slight elegant movements and music played by the people in the painting, while the user can explore additional options like just listening to particular music made by the instruments in the art.

8. Hands - on experience

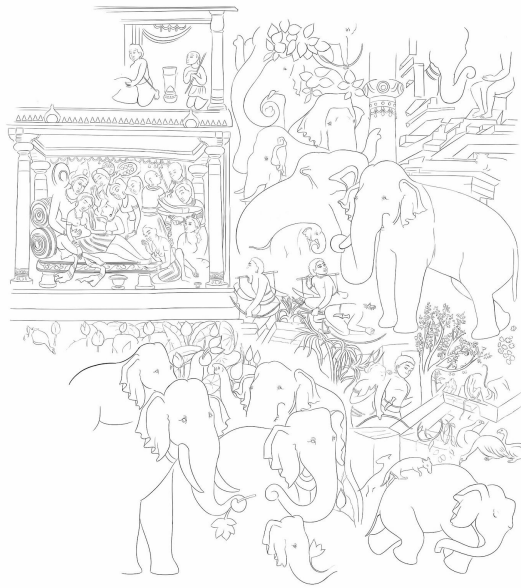
A. Revisiting and restoration

Revisiting the fragile paintings and restoring them is a huge task. Before starting, the design team has been to Ajanta cave with high-resolution cameras to capture the paintings with special permission from ASI. Although there were some parameters to capture the paintings like no camera flash. Inside the cave, there is a limited soft light illuminated from the LED because the harsh light may damage the painting layer.

The captured images were revised and understood by doing research in various ways, like studying the different versions of the stories. Relating them with the scenes which are present in the paintings and comparatively with the other sources available at the famous Buddhist sites like Amaravati, Sanchi, Bharhut mural arts and narratives. Reading books written by scholars and revising the written text of Mulasarvastivada, while also looking at the other interpretations of paintings in the book of Dieter Schlingloff [6] and amalgamating them in a right way to get the right story. All these research works are done very engrossingly because some of the paintings misinterpreted in the past. The final interpretation is done by discussing the paintings. When every scene is confirmed with proper evidence. The existing painting is first traced, and then the reconstruction of the fragile areas with the help of evidence is done later. There are two types of paintings existing in Ajanta caves, which are non - narratives and the narratives in a non - linear pattern. However, before starting the Animation film the entire painting is traced and reconstructed to know the story as a first phase of pre-production. As part of the team, I have attempted the Line art and reconstruction of the Narrative painting "Chaddanta"- an elephant with six tusks.



Original image



Line art

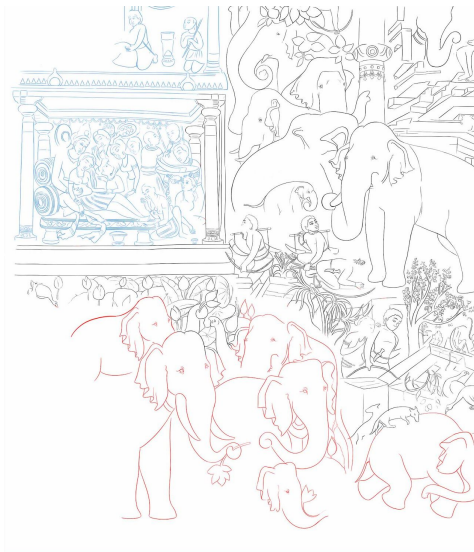


Image trace

Missing portion

Missing details

The Black lines are traced digitally on the painting in the initial stage which are clear to understand, whereas the red lines are the portions where the paintings got damaged, so I have reconstructed it with the reference stories from various Buddhist sites and also from the book - Ajanta_Handbook. The Blue strokes are the portions where the paintings is existing, but the details are missing. Therefore I took help from the book of Dieter Schlingloff to understand the details which are missing in the original painting.

B. Animation

The animation is a straightforward medium which can make any person engaged with the subject, regardless of age. However, it is a potent medium to deal with, which makes the content simplistic, astonishing and remarkable. Integrating animation principles with the historic Ajanta narrative paintings makes the art come to life, blowing the minds of the audience. Probably, one could have or have not imagined the diminishing paintings which have been in the dark for hundreds of years are now coming to life, thereby creating a miraculous effect in the whole world. The Design team of IIT-Bombay, finally selected the “Sinhala Avadana”, a narrative painting

from the cave 17, which covers almost the right wall. It is basically a Jataka story which deals with the temptation or craving and learning to overcome those feelings, which is one of the basic principles of the Buddha. This story has a lot of similarities with the mythical stories of Greece and Sri Lanka [9].

9. Advantages of Virtual experiential museum

As we know, museums are natural storytellers who also give us pleasant feel throughout the halls. Students and researchers are the general visitors who want to acquire knowledge regarding specific or in general information about artefacts. Museums in the past and

Present have a block of information regarding the period and history of the exhibit. The people who visit museums may or may not read the entire data. Some of them see the period they belong to and move away. Some people may be so illiterate that they see the visual things and move on, though they want to know more about them. Therefore, the potential of the historical artefact is not connecting much with the people. As technology evolved, it became easier to communicate with the people about cultural artefacts and making them more engaging towards art history in an entertaining way. The virtual experiential museums are inspiring people a lot, by making them exist in the immersive virtual world and providing them with reasonable information by audio and textual format. The natural sounds with the immersive world make them believe that they exist in the real world and finally when they are back to the actual world they are so amazed, thinking how glorious our civilisation and culture was in the history. Virtual reality adds an extra amenity to the same historical artefact to make it more precious, it is also because they give the clear cut information in a very simplified manner that any person can understand it and know the value of the cultural heritage. The Isabella Stewart Gardner Museum, Boston for example, is using AR (Augmented reality) technology in the museum to replace the empty art frame with the digital copies, which were holding the masterpieces in the past and left blank for 28 years when the originals were stolen. Now

people have a very special interest to see the empty frames placed with digital art by AR, rather than seeing them empty [8]. There are some more museums which are making the two-dimensional master paintings and photographs to a 3-dimensional immersive art which are engaging the public in a significant way [8] [4]. There are many more advantages to using virtual museums, which can preserve the original artefacts and the digital content which are created can be replicated several times and use them in multiple museums at the same time [9].

10. Conclusion

Thanks for the technology for saving the invaluable treasure of the historic culture and art. Virtual experiential museums hold the prominence to give information for the people more accurately by engaging them to learn and educate. These technologies should be deployed in the right way, so that we may not confront any difficulties in future. Although virtual reality is very intuitive, it may still be inconvenient to some of the users in the initial stage or forever. These museums are mostly informational based, to communicate the hidden aesthetic information and the stories of historic art and culture. Therefore, the actual site should be given more importance by the people rather than just moving on with these technologies, while conserving them. Technology should be treated as a medium which provides information about the subject in an interesting way, making our life easier by enjoying the beauty of the natural world.