The Future of Art History in Higher Education with Immersive Technology:

Experiencing Ancient Architecture, Objects and Culture like Never Before

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Abstract

This paper delves into the possibilities of incorporating immersive technologies into art history in higher education. After a quick look at what art history class is like in the present, immersive technologies are introduced and an explanation of virtual and augmented reality and some of what they entail follows, for example: haptic feedback, head mounted displays and multisensory experiences. The reader will get an idea of some of the devices that are involved. The paper describes pertinent and interesting developments within immersive realities and explains how they might relate to art history and be of use to educators and students. Some fields like archaeology and surgical training in the military could inspire a course of action. Museums have the artifacts and artwork that students need to see. Of course, there are considerations to think about before diving into a plan for implementation. The paper discusses a few hurdles to overcome and how a partnership between museums and schools may be the answer for integrating immersive realities into art history classes while also preserving history.

Keywords: immersive realities, virtual reality, augmented reality, art history, higher education, technology in education, instructional design, art history educators, art museums

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Most college art students must take some art history courses to complete their degrees. Up against the excitement of the studio, these classes can sometimes be a little boring and feel more like a requirement than an inspiration. However, there are some teachers who know how to make the subject come to life. The art history classes that I most enjoyed had teachers who were excited about what they were teaching, and their excitement came through in their lectures, mostly accompanied by a slideshow. Now back in the day, the slideshow was an actual slide projector, and the professor clicked to advance while narrating the slides. More recently the slideshows were made with programs like PowerPoint which raised the level of interest slightly, especially when it included bullet lists or interesting effects. This upped the organization and structure of the lecture, made it easier to organize notes, and limited frequent tangents or trips down the rabbit hole as much as possible. Art history students are ready for more and technology is getting ready to bring it.

Immersive Realities

Instructional designers (IDs), educators, and students can be excited about the future of education in general with new technologies like immersive realities on the horizon. Even though these technologies are not new, the widespread use of immersive realities in school has not yet become the norm. They will not replace what the educators use today but will be an exciting addition to their toolbox. This paper will address two types of immersive realities, their potential in higher education – specifically in art history education – and examples of successful applications that are happening in related fields. I will also explore some of the pros and cons and ways that schools can implement these technologies into their programs.

Virtual Reality

Immersive realities allow the user to engage with computer generated information. One example is, virtual reality, which I will refer to as VR. VR is computer simulated, looks like an environment, and immerses users in that environment by wearing devices, like headsets, that use some of their senses (Fernandez, 2017, p. 2). Even though, this technology has been around for a while, there have been new developments in headset technology, like the Oculus Rift, that allows the user to be immersed in a virtual world from the classroom and to explore the virtual surroundings even "from multiple perspectives" (Sweeney et al., 2017; 2018;).

VR uses "computer graphics systems in combination with various display and interface devices to provide the effect of immersion in the interactive 3D computer-generated environment" (Pan et al., 2006, p. 20). One of the reasons I am so excited about this particular technology, is that these environments could be real, created by artists, or a combination of both, which could be very promising for studying art history. These virtual worlds can be historical places that can be documented, with technologies like LIDAR, and even manipulated to show what they might have looked like in the past, the way Virginia Tech has used historical items like photos, interviews and artifacts to piece together a historical simulation (Sweeney et al., 2017; 2018;). I am interested in this technology for application in art history to let the learner walk around and feel like they are in the space of the ancient architecture that we learn so much about – usually from a 2D perspective as a slide or photograph.

In many cases, art history students are trying to imagine places or architecture that have been changed by time or looting, and it would be helpful to see those places at different time periods throughout history intact – even if that included artists' renderings layered on top of the real environment. There are other fields, like archaeology, that are using technology to gain a

clearer picture of the past. Lercari et al. (2017; 2018) said, "Real-time visualization engines allow us to simulate the stratigraphy of a site, the three-dimensional surfaces of ancient buildings, as well as the ever-changing morphology of cultural landscapes" (p. 368). Technology like this is something students can look forward to in art history.

Haptic Feedback

In addition to headsets, Wu et al. (2017) says there are also gloves to enhance the haptic feedback, a sense of touch or vibration, of some of these VR experiences "to increase the realism" (p. 19). There are advantages to being able to involve multiple senses in immersive realities. It isn't only for enjoyment but increasing the "haptic feedback can help with skill training" that requires a higher level of dexterity (Wu et al., 2017, p. 19). Think about a surgeon training with VR being able to feel more accurately and how that might help when it comes to the real thing (Zahiri et al., 2018). Now imagine art history students building a famous sculpture from virtual pieces or feeling the difference between a low and high relief carving on ancient sculptures.

Multisensory Experience

A complete multisensory experience can be created for museum or gallery visitors, which Vi et al. (2017) explains is the case of

> the Jorvik Viking Centre (Jorvik, 2017), where multisensory stimuli were used to enrich the experience of a tour concerning the Viking past of the city of York. This experience allowed visitors to touch historical objects (Viking Age artefacts), taste the unsalted, dried cod of the Viking diet, smell the aroma of the corresponding displayed objects, see the animals and inhabitants of the Viking city, and listen to the Viking sagas. (p. 2).

How exciting this must have been for visitors there! Art history students would love this type of experience when they are learning about different cultures. It seems like this type of multisensory learning would make more brain connections and stick with students longer.

The creation of a virtual reality experience has a tremendous amount of work that goes into it, takes a lot of resources, and can involve processes like "terrestrial laser scanning" and "drone surveying" for mapping out the environments (Lercari et al., 2017; 2018, p. 370). VR "has made rapid advances in recent years" and can even be used to let users try on ancient Tibetan costumes (Chen et al., 2018, p. 52). This is exciting for fashion design students who are taking art history! Chen et al. (2018) makes a great point about why the effort is so important

> Old and worn fabrics are difficult to preserve because they easily oxidize and break down. Digitization and the use of virtual reality can overcome problems of handling and accessibility by design students, with access via 3D models of historic clothing (p. 57).

Clothing is another important part of learning about a culture in art history. It would add another dimension and inspire students beyond the classroom.

Augmented Reality

Augmented reality, AR, is similar, but instead of a created world, the viewer interacts with AR in their real environment in real time. AR uses Global Position System, GPS, to incorporate these simulations into the user's environment (KOÇAK et al., 2019). Augmented Reality (AR), or "Mixed Reality (MR) refers to the incorporation of virtual computer graphics objects into a real three-dimensional scene, or alternatively the inclusion of real-world elements into a virtual environment" (Pan et al., 2006, p. 20). AR is not only for entertainment, like with the Pokémon GO phenomenon, but has potential for educational use as well. Huang et al. (2019) describes

AR is a technology that blends digital information with the information from

physical-world environments, enabling users to interact with virtual objects and view the

physical environment (usually through a digital camera in a mobile phone or tablet)

simultaneously (p. 105).

There are also devices, called the Merge Cube, sold on Amazon that children can hold in their

hands and explore museum artifacts that are surprisingly affordable and used with a cell phone or

tablet (3D, 2019).

Head Mounted Devices

Exciting technologies, like Tombseer, which is a head mounted device, or HMD, already

have the right idea for making learning more fun with augmented reality that aims to "enhance

museum exhibits, cultural heritage sites, and galleries" (Pedersen et al., 2017, p. 11). Their

technology uses AR to provide an interactive experience for the visitor with an immersive

headset that they have spent years testing and refining (Pedersen et al., 2017). This can be

incorporated into the classroom, by enabling the professor to let students see a work of art or

artifact in the round by wearing special glasses, using their smartphone or mobile device and

studying the object up close in a whole new way. This can be a reality in the near future with the

help of museums and technologies like Tombseer.

Museums, Archaeology, and Art History

Museums play an integral part in the success of these immersive technologies becoming

widespread in instructional design for art history. They must find a way to document all their

items to be viewed with VR or AR. In 2004, there was an article that described a database

system for this very thing, except it was for the purpose of making museum exhibitions

(Wojciechowski et al.). I would like for students to be able to access those databases for

educational purposes. Instead of talking about ancient Greek vessels, students would be able to hold and rotate them in their hands with AR in their classroom.

I am hoping that museums and universities can develop some type of partnership to allow students to see more art and historical objects in their classroom, whether that be at the university or accessed online with their at-home devices. The vast number of resources that it takes to make these types of technologies a reality may be possible by technology companies partnering with museums and archeological sites to thoroughly document their inventory and create databases that could be available to a university's students by annual membership to that database. This extensive documentation is how one company does it at a "World Heritage site of Çatalhöyük" which is part of an amazing effort by archaeologists to fully document every bit of information about their findings (Lercari et al., 2017; 2018;). It is a wonderful example of how it should be done in the art world.

Enhanced Understanding

Another way that technology is used for historical artifacts in museums that would be beneficial for art history teachers and students is described in a paper by McClary (2018) where the importance of contextual understanding of objects is enhanced with technology (p. 263). McClary (2018) describes how they have used technology

> to build structural displays that give important context to Islamic tiles by showing them in their intended environment and bringing light to their meaning for visitors within the museum. In some instances, they are trying to preserve as much history as they can and rescuing these tiles from looting and perilous areas where shrines could and have been destroyed. Some of the tiles have been scattered to the wind and they have lost hope of getting them back with restitution into one location because new owners do not wish to

return them. They feel there is more that can be done rather than the way these precious

objects are currently being displayed in distant museums. They are using technology to

help visitors envision the original purpose, place and complete the display of missing tiles

(pp.263-265)

If the art world is open to using technology, then students should be working with it at their

universities so they can be better prepared to use it in their career.

Online Learning

During my research, I investigated the online use of immersive realities as well and found

a study that has to do with this subject. Recently, Makransky et al. (2019) published their study

on science students who participated in

a virtual lab simulation compared to those that performed the same thing in the

classroom. They wanted to see if the at-home students were able to achieve the same

level of success as the in-class students. They also wanted to know if they were as

motivated as the classroom students. They found that both groups were able to achieve

successful outcomes in both learning and motivation (p. 1)

This is a positive result for online art history classes. In this research experiment "the simulation

is an immersive and interactive digital environment designed to facilitate learning of key

concepts and techniques in microbiology at a university or college level" (Makransky et al.,

2019, p. 5). Surely, if it works for microbiology, it will work for many subjects, including art

history.

Another successful use of these technologies in distance learning is in the military. In the

field of surgical training there is a very interesting VR training system as presented by Zahiri et

al. (2018) in which the military can train surgeons remotely (p. 86). This training is intricate and

uses the haptic feedback that I mentioned earlier to teach delicate surgical skills in the field to treat injured soldiers. The possibility of this training is particularly fascinating.

> PortCAS allows trainees to practice surgical tasks and eye– hand coordination exercises. These exercises run in a web browser, which is hosted on a web server that collects the information required to show the performance of each trainee's task. Instructors can see the progression as trainees increase their mastery of surgical skills through these standardized tasks. Entire exercises can be replayed to allow instructors the ability to explain to a trainee the particular areas that require improvement. All trainees and instructors have unique usernames and passwords, and instructors can view the results of their trainees (Zahiri et al., 2018, p. 87)

Possibilities in Art History Education

With technology and programs like this, art history teachers could assign students lessons to help rebuild an ancient building. Art history majors and grad students could participate in projects for museums to help build elaborate displays that show items in their original context, like the McClary (2018) article discusses. These types of things surely take many people to accomplish. This partnership between universities and museums would add to student's portfolios and give the students contacts and experience for their future.

Mirror World

Schools, like Virginia Polytechnic Institute and State University, widely known as, Virginia Tech, are at the forefront by integrating these new technologies into their education program with an "immersive, mixed reality learning environment" (Gautum et al., 2018, p. 119). Gautum et al. (2018) explained that they have created

The Mirror Worlds project, which mixes VR and AR. This project was developed to involve students and try to figure out the possibilities of mixed reality (MR) technology within the educational realm. Students get to interact in this MR, and they don't limit it to students on campus – online students can participate as an avatar! They are learning about the importance of students feeling connected socially as well as with their instructors. They also are getting to test HMDs and newer technologies that "recognize hand and body positioning" for enhanced interaction that feels more authentic. As the technology gets better so will this MR environment. They are really paying attention to make sure that online students also have a good and equitable experience (pp. 119-124)

Now that is research that I would love to see in action! I wonder if they have virtual tours.

Considerations

All of this sounds wonderful to me, but I know there are two sides to every coin. I also investigated the downsides of immersive realities and some of the negative consequences were illuminating but not deterring. With most things, moderation is a good thing, and that also applies here.

Sensitivity to Immersive Realities

Jensen & Konradsen (2017; 2018) have a section in their paper about HMDs dedicated to cyber-sickness, which is real and affects some HMD users (p.1523). I can imagine that, depending on the size and weight of the HMD, your neck might get sore, or you might get a headache. My daughter came home from a friend's house one time where they had used a VR HMD, and she said she had a little dizziness that subsided shortly after removing the device. I once got on an immersive ride at an amusement park, and the graphics combined with the motion made the experience so life-like that I felt sick and had to get off the ride. This is a kind of

cyber-sickness. According to Jensen & Konradsen (2017; 2018), some users fair better than others when it comes to this technology.

> They reported that different factors cause this problem. One factor they address is age. Older people had more sensitivity to the technology. Another discovery was that people who were avid 3D game players had less sensitivity to it. Sometimes it wasn't about the person, but more about the experience that had something that affected a majority within that test group. The negative thing about that is that some participants have to "drop out of the experiments," while others are turned off of the whole thing because of a bad reaction. (p.1523)

In my excitement, I hadn't considered some of these technologies being a no-go for some students, but it might be the reality. Instructional designers and teachers would have to plan for that scenario too. Which leads me to my next concern.

Access

Access to these technologies and the devices used to see them would have to be available to all students. Each student must have the equal opportunity to use this technology (KOÇAK et al., 2019, p. 32). As I have seen in my children's high school, laptops are distributed to every freshman with a small fee for insurance. In middle school, they have carts or storage shelves of tablets or laptops available to the teachers for students when needed. In several classes, while I was at the College of Visual Arts and Design at the University of North Texas, when a laptop was required for the whole class, our teacher would reserve a cart for the class period. Access to HMDs could be run in a similar way. Of course, the pandemic has created new fears for our society in the germ department and this heightened awareness would make sharing headsets a little more scary than normal, but with proper sanitization methods, I am sure this can be

handled. Smart devices could also be checked out to students who need them through the computer lab.

Overuse

Another concern is overuse. This is like with anything, relying on one type of learning method could be too much and create a negative feeling from the students. It is better to use these technologies sparingly in most cases to keep it exciting, and that would also help with the cyber-sickness factor. Fernandez warned against looking at these technologies "as the end rather than a means to the end" (2017, p. 6). They should be another "tool" in the educator's toolbox to keep classes interesting. There is a consensus that students must not feel that the use of these technologies takes away from social interactions in the classroom (Fernandez, 2017; Jensen & Konradsen, 2017; 2018).

Implementation

The implementation of utilizing these immersive realities in higher education will be challenging but can be accomplished with thoughtful planning. There are several hurdles that need to be addressed when developing an implementation plan. I mentioned earlier about how making these technologies come to life is not an easy task. There must be enough art history content for instructional designers to feel confident about including it into their plans, the devices to see it have to be available to teachers and students, and the programs have to be easy to understand and utilize. As I mentioned earlier, I envision a plan that would involve a symbiotic partnership between museums and schools that would allow schools to benefit from the virtual access to millions of artworks and artifacts and would provide museums with resources to build context providing displays or help create databases for immersive realities. Art history students would be involved in preserving art history while gaining experience and connections.

Content and Programs

Not only is there the challenge of finding content for immersive realities but finding it for art history specifically. Instructional designers and educators would have to spend time researching appropriate content and programs that they could obtain and utilize for their students and in some cases may have to make it themselves (Fernandez, 2017; Jensen & Konradsen, 2017;2018). There is a big opportunity here for instructional designers and art history educators to develop content and programs. This would be a really good workshop course for instructional designers to develop for educators to learn how to do this. IDs could find experts in this field to instruct the instructors. I would have to research more to find the level of interest among educators. The museum partnership seems like the easiest way to provide an endless supply of content.

Teachers, Training and Devices

There will be a learning curve to integrating these new technologies into the classroom and that starts with making teachers comfortable with the technology. Teachers have to be able to learn the new technologies and teach their students how to use the technology (Fernandez, 2017). It may be a slight inconvenience up front, but worth it in the long run. Instructional designers may plan for more time to instruct educators on new technologies and teachers should expect to occasionally have training on new programs to add to their skill set.

It may take more time than usual on the day educators plan to use the technology with their class. For example, if they need to reserve a cart with the devices and pick up that cart prior to their class, those things take time. They may also expect to spend a portion of their class training their students how to use the devices. At UNT's CVAD, students and professors are accustomed to these types of training for the woodshop, Fab Lab and even learning new

programs in the computer lab. A new technology would be easily integrated into a state-of-the-art school like CVAD.

Once an educator or student has been trained on a new device or program, they would be able to check that device out for projects outside of class. In CVAD, there are rooms that can be used to study along some of the hallways, and they would make a great place to utilize this technology privately or in small groups. It would be hard for online or out of state students to check out devices and utilize them in this way. Maybe the classes that utilize this technology could state that during registration and there could be a supply fee or equipment requirement stated in the class description. Smartphones and gaming devices are a cheaper alternative to the powerful computers used in some immersive realities, and this may provide a more affordable option for the participation of all interested students (Fernandez, 2017, p.7).

Conclusion

There are many possibilities for immersive technology in art history education. This paper has focused on the most well-known, or common, types of immersive technologies, VR and AR. It also took a look at some of the exciting ways they are being utilized that could enhance art history classes in higher education, and the challenges that IDs, educators, schools and students may face to integrate them. There are opportunities within this field to develop relationships that would benefit both parties and create work for IDs.

References

Chen, G., Ma, F., Jiang, Y., & Liu, R. (2018). Virtual reality interactive teaching for Chinese

traditional Tibetan clothing. *Art, Design & Communication in Higher Education, 17*(1),

51-59. doi:10.1386/adch.17.1.51_1

Fernandez, M. (2017). Augmented-virtual reality: How to improve education systems. *Higher

Learning Research Communications, 7*(1), 1. doi:10.18870/hlrc.v7i1.373

Gautam, A., Gautam, A., Williams, D., Williams, D., Terry, K., Terry, K., . . . Newbill, P. (2018).

Mirror worlds: Examining the affordances of a next generation immersive learning

environment. *Techtrends, 62*(1), 119-125. doi:10.1007/s11528-017-0233-x

Huang, K., Ball, C., Francis, J., Ratan, R., Boumis, J., & Fordham, J. (2019). Augmented versus

virtual reality in education: An exploratory study examining science knowledge retention

when using augmented Reality/Virtual reality mobile applications. *Cyberpsychology,

Behavior and Social Networking, 22*(2), 105-110. doi:10.1089/cyber.2018.0150

Jensen, L., & Konradsen, F. (2017;2018;). A review of the use of virtual reality head-mounted

displays in education and training. *Education and Information Technologies, 23*(4),

1515-1529. doi:10.1007/s10639-017-9676-0

KOÇAK, Ö., YILMAZ, R. M., KÜÇÜK, S., & GÖKTAŞ, Y. (2019). The educational potential

of augmented reality technology: Experiences of instructional designers and

practitioners. *Journal of Education and Future,* (15), 17-36. doi:10.30786/jef.396286

Lercari, N., Shiferaw, E., Forte, M., & Kopper, R. (2017;2018;). Immersive visualization and

curation of archaeological heritage data: Çatalhöyük and the Dig@IT app. *Journal of

Archaeological Method and Theory, 25*(2), 368-392. doi:10.1007/s10816-017-9340-4

Makransky, G., Mayer, R. E., Veitch, N., Hood, M., Christensen, K. B., & Gadegaard, H. (2019). Equivalence of using a desktop virtual reality science simulation at home and in class. *PloS One, 14*(4), e0214944-e0214944. doi:10.1371/journal.pone.0214944

McClary, R. P. (2018). Re-contextualizing the object: Using new technologies to reconstruct the lost interiors of medieval Islamic buildings. *International Journal of Islamic Architecture, 7*(2), 263-283. doi:10.1386/ijia.7.2.263_1

Pan, Z., Cheok, A. D., Yang, H., Zhu, J., & Shi, J. (2006). Virtual reality and mixed reality for virtual learning environments. *Computers & Graphics, 30*(1), 20-28. doi:10.1016/j.cag.2005.10.004

Pedersen, I., Gale, N., Mirza-Babaei, P., & Reid, S. (2017). More than meets the eye: The benefits of augmented reality and holographic displays for digital cultural heritage. *Journal on Computing and Cultural Heritage (JOCCH), 10*(2), 1-15. doi:10.1145/3051480

Sweeney, S. K., Newbill, P., Ogle, T., & Terry, K. (2017;2018). Using augmented reality and virtual environments in historic places to scaffold historical empathy. *Techtrends, 62*(1), 114-118. doi:10.1007/s11528-017-0234-9

Vi, C. T., Ablart, D., Gatti, E., Velasco, C., & Obrist, M. (2017). Not just seeing, but also feeling art: Mid-air haptic experiences integrated in a multisensory art exhibition. *International Journal of Human-Computer Studies, 108*, 1-14. doi:10.1016/j.ijhcs.2017.06.004

Wojciechowski, R., Walczak, K., White, M., & Cellary, W. (2004). Building Virtual and Augmented Reality Museum Exhibitions. *Proceedings of the Ninth International Conference on 3D Web Technology - Web3D '04*. https://doi.org/10.1145/985040.985060

Wu, C., Wu, C., Hsu, C., Hsu, C., Lee, T., Lee, T., . . . Smith, S. (2017). A virtual reality

keyboard with realistic haptic feedback in a fully immersive virtual environment. *Virtual*

Reality : The Journal of the Virtual Reality Society, 21(1), 19-29.

doi:10.1007/s10055-016-0296-6

Zahiri, M., Booton, R., Nelson, C. A., Oleynikov, D., & Siu, K. (2018). Virtual reality training

system for Anytime/Anywhere acquisition of surgical skills: A pilot study. *Military*

Medicine, 183(suppl_1), 86-91. doi:10.1093/milmed/usx138

3D Museum Viewer App Review - For Merge Cube. (2019).

https://www.youtube.com/watch?v=nxQoQCkKeoE.