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The Arts 3D VLE Metaverse as a Network of Imagination

by Ulrich Rauch, Marvin Cohodas, and Tim Wang

While academic discussions and investigations of the virtue of three-dimensional virtual learning environments (3D VLEs) have provided ample evidence of student enjoyment (Dillenbourg, Schneider, and Synteta 2002; Strangman and Hall 2003; Nonis 2005), they have proven inconclusive in evaluating the net effect of such environments on student learning. Anecdotal evidence suggests that students are more engaged or immersed in subject matter when it is offered in a 3D VLE (Yair, Mintz, and Litvak 2001), although these reports sometimes bear the sign of enthusiastic bias. Nevertheless, more recent publications focusing on the research and development of games and simulations in online learning tend to support the effectiveness of student engagement in immersive media (Gibson, Aldrich, and Prensky 2007; Van Weigel 2002).

Our own experience suggests that using a networked 3D VLE can create a particularly dynamic learning environment. The [Arts Metaverse](#), a [Croquet](#)-based 3D VLE under development at the University of British Columbia (UBC) in the [Faculty of Arts](#) (Wang 2007), was designed as an aid for teaching and learning in the departments of [Art History, Visual Art & Theory](#); [First Nations Studies](#); [Anthropology](#); [Classical, Near Eastern and Religious Studies](#); and [Landscape Architecture](#). By presenting students with an alternative way of experiencing a remote physical or ancient world and allowing them to participate actively in that world's reconstruction or interpretation, the project engages students in the construction of the virtual environment and the visualization of academic concepts. This engagement facilitates the negotiation between instructors and students that produces a collaborative and participative learning experience (Brown 2007; Lombardi 2006, 2007). Further, the project seeks to provide digital fora for peer-to-peer and teacher-to-student discourse and to promote the development of multiple learning channels for humanities students.

As the Arts Metaverse project evolves to enable students and academics to become joint researchers creating and sharing knowledge beyond the walls of the university, we hope to create a simple interface for sharing, qualifying, and evaluating interactive three-dimensional content.

Precedents of the Arts Metaverse: Viewing Artifacts

The Arts Metaverse developed from the synthesis of two strands of development in virtual learning environments initiated in 2003 by students, faculty, and the instructional technology team ([Arts ISIT](#)) in the Faculty of Arts ([Exhibit 1](#)). The first of these strands involved two projects that allowed students and instructors to view important artifacts in immersive three-dimensional environments.

The Maya Vase Viewer

One of these early projects was the Maya Vase Viewer, which was developed for use in an upper-level undergraduate art history class. Using [Macromedia Shockwave](#), we developed the viewer as a virtual turntable to allow students to examine Maya cylindrical beakers that are painted in framed narrative scenes, published previously as both still views and [rollouts](#). The virtual turntable recreated digitally the experience of viewing the vase as if holding and turning it, a process that allows only about one-third of a cylinder to be seen at a time. Using the virtual turntable in the classroom, students could reconstruct how the image would be "read" by turning the vessel clockwise, allowing the viewer's eyes to move in the same left-to-right direction as Maya hieroglyphs are read ([Exhibit 2](#)). The project was subsequently adapted for use in the

virtual environment of [Second Life](#) with considerable enhancements to the efficiency and visual quality of the experience ([Exhibit 3](#)). The Second Life version is now being redesigned for the Croquet platform ([Exhibit 4](#)).

The most important advance using the 3D Viewer technology came when a vase painted in a type of framed narrative scene that was common in the eighth century was placed on the virtual turntable in the classroom. Previous scholarly discussions and classroom lectures concerning this type of scene had identified the spatial configuration as incoherent, as it seemed to be developed from multiple viewpoints. The classroom discussion of one example, carried out by students with almost no direction from the instructor, generated a much more sophisticated interpretation. Students realized that the rollout photographs through which these images are usually studied create an artificially static single view, characteristic of European-style narrative painting but inappropriate to the vase format. They showed that rotating the vessel allowed for a more naturally shifting viewpoint through which the spatial configuration was experienced as entirely coherent ([Exhibit 5](#)). In this way, what had been considered a crude insufficiency of design emerged instead as a sophisticated integration of format, content, and viewing practice. As one student in the class observed, the Vase Viewer "facilitate[d] dialogue between students and assisted in the development of new interpretations, and therefore, new understandings of the material being examined" (e-mail to authors, July 21, 2008).

Two points deserve emphasis here. First, these sophisticated and vastly improved understandings of Maya visual strategies would not have been possible without a viewing method that simulated the real-world viewing experience through a virtual three-dimensional environment. The students' analysis provided insights of which the course instructor, who had been lecturing with the rollout photographs for two decades, was not aware. Second, students seemed particularly engaged by the innovativeness of the mode of analysis. Perhaps because this mode of analysis was also new to the instructor, the virtual learning environment promoted an atmosphere of shared intellectual discovery. Students perceived their role as that of participants both in uncovering information about the pre-Hispanic past and also in evaluating the technological changes that continuously affect education.

While it is clear that actually holding and turning this type of painted vase could generate the same interpretations, this method of analysis is simply not possible for most students. The virtual environment provided the class with an opportunity to view objects that are scattered around the developed world in private collections and in museum collections. Further, the environment allowed more than a few persons to view the same object simultaneously.

Bonampak

In a second and related project, we asked professional programmers to create a virtual three-dimensional reconstruction of the mural paintings in structure one at [Bonampak](#), covering all interior surfaces of three adjoining rooms. The comparatively well-preserved Bonampak murals have been known outside of Mexico since 1946, and watercolor copies were published in a reduced foldout format in 1955 (Ruppert, Thompson, and Proskouriasoff 1955). While these two-dimensional reproductions have been very useful in understanding the layout of the rooms and the basic narrative content of the murals, they have been insufficient for scholars seeking a satisfactory interpretation of the stories told in the murals.

The Bonampak project demonstrates the importance of a virtual three-dimensional space for analyzing an actual three-dimensional space. The painted structure itself is located in the rainforest of southern Mexico. The chambers are so small (much of the floor space occupied by a U-shaped bench) that only three visitors are allowed in at once, and there usually is a long line of other visitors waiting impatiently to enter. In March 2007, an instructor took a class on a fieldtrip that included Bonampak, but these viewing conditions made it impossible to show students the murals. The same restrictions apply to the full-scale copy at Mexico's [National Museum of Anthropology](#). Only a virtual, three-dimensional, immersive space allows for a community of students, instructors, and scholars to view the space simultaneously and to share ideas concerning such monuments ([Exhibit 7](#)).

When the UBC library acquired a volume published by the National Autonomous University of Mexico ([UNAM](#)) containing high-quality photographs of each wall (de la Fuente 1998), it became possible to create a virtual three-dimensional environment where students could view and analyze these murals. Since the Second Life platform became available as this project was being designed, we decided to use the Bonampak project as a trial for determining the pedagogical value of the environment and platform.

While preparing a demonstration of the immersive Bonampak environment for faculty members in the Faculty of Arts at UBC, we recognized for the first time the order and direction in which the murals, in our opinion, are most suitably read ([Exhibit 6](#)). This reading order is not evident from the flat paper rollouts. Viewing the murals in a three-dimensional environment clarified and reinforced the narrative sequence of the images, making it possible to demonstrate that the upper scene was designed to be read counterclockwise from the bench scene on the right wall, culminating in the dressing scene on the doorway wall. This order also provided a link to the lower scene that begins on the doorway wall and then diverges along both sides to culminate in the dance scene on the back wall.

The Bonampak model in Second Life has since been used as a teaching tool in two undergraduate courses. In addition to clarifying the reading order of room one, the program has also made it possible to demonstrate to students another subtlety of the paintings, found in room three, that cannot be conveyed with paper foldouts or presentation slides. This is the mounting energy and visual enclosure of the dance scene, which is created by the expansion of registers as one moves from front to back walls. One might approximate this format by arranging the published foldout in a rectangular shape, but as these foldout images are only a few centimeters high, they cannot provide the viewer with any approximation of the experience of being immersed in an environment, the format of which is itself designed to enhance the quality of immersion. Furthermore, there is no way to convey the viewing experience of reading a lintel carving over the door other than by visiting the site, either physically or virtually.

Precedents of the Arts Metaverse: Recreating Ancient Spaces

The Maya Vase Viewer and Bonampak projects have created immersive environments where students, instructors, and scholars can examine artifacts collaboratively to produce new insights; the second strand of learning that has contributed to the Arts Metaverse allows students to recreate virtual spaces and artifacts. In its initial development, the [Ancient Spaces](#) project used the sophisticated three-dimensional modeling and viewing capabilities of computer gaming engines to model the ancient architecture of Greece and the Near East. The [Parthenon Project](#), phase one of Ancient Spaces, is a representative example of how students in a first-year course began to construct three-dimensional models of these ancient sites. In an initial offering of the Ancient Spaces software and environment carried out in 2004, 18 students in a first-year Classical Studies course volunteered to research various buildings in the Athenian Agora and reconstruct these buildings in the 3D environment; software training was provided by senior students, including a graduate student in Classical and Near Eastern Archaeology. Students were required to research the architectural and sculptural forms to build an accurate virtual representation of, for instance, the Parthenon or a similar edifice. While teaching themselves about the construction and viewing practices of classic-era Athens, they were also acquiring computer-modeling skills.

For a second and overlapping project, a different pedagogical model was invoked in the virtual construction of a [Nisga'a](#) settlement. The goal of this initiative was to develop content and technology to enable students in UBC's [First Nations Studies](#) program and members of the Nisga'a community to log into a common network and transform a virtual three-dimensional space in dialogue with each other. The project team rejected Second Life as the supporting platform because of the limitations of its primitive-based modeling routines ([Exhibit 8](#)) and chose instead to use [Blender 3D](#). With the support of Wilp Wilxo'oskwhl Nisga'a First Nations (indigenous) People of coastal British Columbia and under expert guidance by a Nisga'a community member, students modeled type examples of several building forms (long house, smoke house, and others) in Blender 3D. While researching and conversing with Nisga'a elders and peers on the modeling, students also learned

about the social and cultural significance of these structures. The materials used in the virtual constructions were then separately modeled and "stockpiled" so that students and subsequent cohorts could use these virtual elements to construct their own examples based on research. Part of this project's underlying philosophy, and a key source of its sustainability, is the large role given to student modelers, who gain experience in interpolating their designs from the available data and defending their decisions when they choose one possible solution (or perspective) over another ([Exhibit 9](#)). Students employing the Ancient Spaces 3D model editor are thus able to learn by doing or, more precisely, learn by reconstructing key architectural and artistic environments. In comparison to traditional teaching methods, this program makes it easier for students to demonstrate their knowledge of varying theories by producing four or five different replicas of the same site, reflecting interpretive conflicts in the field. At the same time, students learn a great deal about Nisga'a social structure and practices of social interaction.

Anecdotally, the Ancient Spaces project seems to have generated enthusiasm among students. One graduate student in architecture who had just taken the course on North West Coast Architecture observed, "For people who are used to playing games, moving through virtual worlds is probably a better thing than reading or even watching a video" (Link [2007](#), 5). Another student with no prior experience with 3D modeling before taking a course using the Parthenon Project found the academic and teaching possibilities of virtual three-dimensional objects and environments exciting:

traditionally students would learn about archaeological artifacts like the relief from photos and write-ups in texts. But the context of the relief, its placement in the palace, and what it looks like from various angles would be lost, and its original cultural meaning obscured or distorted. Rendering the relief as a 3-D model in its original context in the palace can restore its meaning. (Link [2007](#), 5)

Ancient Spaces to Open Croquet: The Machu Picchu Project

Running simultaneously with the Nisga'a project and funded by the same grant, the Machu Picchu Project ([Exhibit 10](#)) has allowed co-op student programmers, a majority of whom came from the applied sciences, to create an immersive three-dimensional model of a portion of the Inca site of [Machu Picchu](#) by experimenting with various modeling and texturing techniques ([Exhibit 11](#)).

Although Machu Picchu is one of the best-known archaeological sites in the world, the nature and function of the community that lived there have never been satisfactorily explained. Some scholars argue that there must have been a residence usable by the emperor on official visits to the city, but they cannot agree about which of the residences that might be. Some buildings are assumed to be temples rather than residences but often merely because they are constructed of finer stone masonry. Indeed, the wide variety of masonry qualities and styles at Machu Picchu ([Exhibit 12](#)), which was only inhabited for a short time, should provide considerable information on the nature and relations of the social groups for which it was constructed, but there has been no detailed comparative study relating variables such as masonry style, building plan, group arrangement, location, and size.

There is yet no complete photographic record available that would allow researchers to begin such a study. Even if such photographic documentation were available, it would still represent an unwieldy amount of data unless unified in the form of a virtual three-dimensional model. When made available on a multiuser Web-based platform such as Open Croquet, this format would also permit simultaneous collaboration by a community of scholars that could include students. Another potential advantage of the Machu Picchu Project has to do with the widely acknowledged necessity of limiting visitors to the physical site at some point in the future because of the wear and tear on the architecture and substrate caused by the thousands of visitors who amble through each day. Should access to the site become limited, an accurate model will become even more valuable.

Conclusion

The collaborative evolution of the Arts Metaverse has been refined through various projects, academic advisors, programmers, and digital platforms. Yet all our technical and pedagogical approaches share certain features that constitute the foundation on which future projects will be constructed. Whether students are asked to manipulate the environment in a trial-and-error process or to investigate a fixed environment guided by well-defined research questions, each of these projects is designed to be knowledge-producing rather than knowledge-illustrating. Each builds on an educational philosophy of collaborative, experiential, problem-based learning. Although each intends to push the technology a step further, as any research would do, pedagogical goals remain paramount. Student course evaluations indicate that students were surprised and highly satisfied with their own engagement although they remained somewhat critical of the amount of time and effort needed to master the technical aspects of the project as well as to understand and exploit the full potential of 3D VLEs.

Engaging in this type of teaching and research requires the collaboration and development of a community of researchers with access to the same materials, wherever those materials and researchers happen to be. Given the variety of proprietary standards the technical environments support, we are not at the point where collaboration across platforms and institutional boundaries is easy. Continued skepticism about the value of 3D VLEs as truly engaging learning environments only fortifies the technical barriers. It took a tremendous effort to get five departments across faculties to cross-list and support the pilot courses we described. At this point, it appears to be most effective to engage cohort after cohort of students in building 3D models and resources in a variety of courses with the results shared freely with the academic community. We are determined to continue to invite instructors who are eager to explore new modes of engaging with their students to join the Arts Metaverse and have them connect with an emerging scholarly network of virtual learning environments.

Above all, however, we have to think seriously about the knowledge and skills that students may take from these 3D VLE experiences to apply to other research problems, particularly the qualities of collaboration and respect for indigenous authority that we encourage students to develop. The nature of the study of society and culture in the humanities and arts changes when students can be placed inside their subjects in the 3D VLE and given the opportunity to develop new insights in a shared, socially responsible, and highly interactive mode of knowledge production. As Castricano (2007) observes, the adoption of digital technology in the arts, humanities, and social sciences encourages interactive participation in immersive experiences and thereby enables questions of representation, perception, and cognition in relation to the production of meaning.

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