Learning to Look: Real and Virtual Artifacts

Janet Rountree and William Wong
Department of Information Science
University of Otago, P.O. Box 56, Dunedin, New Zealand
Tel: +64 3 479 8142
Fax: +64 3 479 8311
janet@cs.otago.ac.nz
william.wong@stonebow.otago.ac.nz

Robert Hannah
School of Language, Literature and Performing Arts
Department of Classics, University of Otago, P.O. Box 56
Dunedin, New Zealand
Tel: +64 3 479 8711
Fax: +64 3 479 9029
robert.hannah@stonebow.otago.ac.nz

ABSTRACT
This article presents a case study that investigates the effectiveness of virtual artifacts in the teaching of classical art to first-year university students. It was expected that a virtual artifact would not be as successful a tool as a real artifact for this purpose. However, digital images provide the advantage of a mediated focus and prove to be useful, effective tools in supporting visual literacy.

Keywords
Art Virtual reality, Classical, Digital images, Image presentation, Visual literacy

Introduction
Art is an intrinsic expression of culture; it can offer an exciting and yet puzzling key to the past. It is fascinating to study classical art and architecture that has so extensively influenced Western images, yet recognise that ancient Greece and Rome are alien cultures. Studying Greek vases, for instance, offers students a window to this past world and an opportunity for a new perspective on the present.

“Learning to look” at ancient artifacts requires practice. It involves developing the skill of “visual literacy”—that is, considering how we look at objects and understand the effect of what we see. It is a process of learning to set aside personal and cultural preconceptions and being able to share the meaning of visual forms “at some level of universality” (DeLong, 1987, p. 3). Students are challenged to learn to interpret unfamiliar messages in an objective manner and to “make appropriate connections between those images and their own experiences, values and beliefs” (Beard, 1991, p. 12).

One of the charms of participating in a course in ancient art is the prospect of viewing in person real artifacts created thousands of years ago. Unfortunately, for reasons of location and preservation, it is not always possible to see the original. Traditionally, students have relied on photographs in books for images, but recently digital media have both expanded the possibilities for access and altered the way in which artifacts can be displayed.

Digital photographs and virtual reality (VR) objects are becoming valuable study tools for students at sites available over the Web. Two such important sites are the Perseus Project (http://www.perseus.tufts.edu) and the Beazley Archive (http://www.beazley.ox.ac.uk). The Perseus Project is a digital library which includes primary and secondary sources (text and images) for the study of ancient Greece and Rome. It has recently included some QuickTime virtual reality objects. The Beazley Archive is a research unit of the University of Oxford's Faculty of Classics. One of their online resources is a text and image database of Athenian figure-decorated pottery.

Background
In museum tutorials, first-year students of classical art and architecture at the University of Otago learn to provide a basic description of what they see, consider the artist’s choices and their effect, and place the artifact in context through comparison with other works.
At this level the students are primarily concerned with basic image analysis. They learn to become aware of how they perceive, understand and judge images. Avgerinou (1997) itemises four phases to this process of image decoding:

- the description of the graphic elements composing the image;
- an analysis of the way those images have been arranged;
- the interpretation of the messages being communicated; and,
- the aesthetic appreciation of the image.

Digitising an image affects colour and resolution, presenting students with a copy that alters the impact of scale, texture and detail. Fidelity of image is paramount to the study of Greek vases. So a question arises: Does the medium of delivery have an effect on visual literacy? “Since reasoning about an object starts with the way the object is perceived, an inadequate percept may upset the whole ensuing train of thought” (Arnheim, 1970, p. 27).

One other important aspect may be lost. Learning to look begins with the students engaging in some way with the item in front of them. Making a connection can be easier when the item is in their physical space and the richness of information can present the detail of a potter’s fingerprint or the groove of a fingernail. This link is part of the essential fascination and excitement of the subject.

Similar studies which are also interested in non-immersive VR are by Johnson (1998) and Nieder (2000). In Johnson’s study, web pages which included a QuickTime VR object of a Greek head were shown to visitors of the Hunterian Museum. It was hypothesised that this resource would capture the users’ attention in a way that would not be possible with a static image. The results suggested that the VR improved the web pages and that the greater “feel for the object” was more important than keeping the users’ attention for longer. The study by Nieder reasoned that QuickTime VR could provide a more realistic presentation of anatomical structures than a 2D atlas. VRs of a skull were incorporated into an instructional program for first-year medical and graduate gross anatomy students whose evaluation indicated that the images were an effective learning tool. A point of interest was that most students felt it was best to have a real skull available when using the computer program. The authors view this as encouraging because it suggests the students were using the program to interpret the real skull.

**Questions and Expectations**

General remarks from students of classical art suggested that it was not uncommon for them to turn to digital images as source material for essays and general study. In fact, there was an impression that there was some preference to this approach over sitting in the library with a book. However during informal tutorial discussions, the students remarked that they wanted the opportunity to study the real object whenever possible.

What we wanted to know was how useful digital images were in supporting the process of learning vase analysis. There are two types of display for photo-realistic images that were of interest: still digital images and non-immersive VR. This type of VR uses a series of still photos taken at regular intervals around an object. The software then treats them rather like a flip-book animation creating the illusion of a 3D object in which the user controls the navigation through a mouse or keyboard.

This case study investigated two questions. First, does the type of artifact the students view (still, VR or real) affect the grades they achieve on visual literacy assignments? Second, are there any qualitative effects that are important?

It was reasonable to expect that digital reproductions would not be as successful a study tool as the real artifact during museum tutorials. After all, there is nothing like the real thing; it is the richest source of information and a physically tangible link with history.

VR is compelling because it offers the possibility of moving toward the “ultimate visual display medium” (Gunkel, 2000, p. 45). VR is part of the tradition of illusion, of creating an image in which the viewer perceives a third dimension, or sees the perfect life-like copy. VR appears to be a useful instructional medium for visual-spatial tasks, combining both small-scale (single vantage point) and large-scale space (extends beyond immediate vantage point), and helping eliminate the mental demand on the student to “translate the representation from 2-D to 3-D” (Regian et al., 1992, p. 137).

In practical terms, VR imaging of a classical vase should support understanding about vase shape, continuity of image, and the placement of decoration and figures in relation to each other. Therefore, VR was expected to be
more successful than still digital photographs for image analysis. As still images contain the least information and provide “disjointed” views it was expected that they would prove to be the least successful learning tool.

Methodology

The first step was to create high quality virtual artifacts for use in museum tutorials. There is always a trade-off between quality and quantity. The priority was to create quality digital images that retained as much information as possible whilst remaining a manageable file size for the computer’s processor. First, vases were photographed with a high resolution, still digital camera. Images were taken at ten degree intervals to provide a smooth transition between views for the VR. Three vases were chosen for the experiment: a Proto-Corinthian *oinochoe* (wine jug), an Athenian red-figure *kalyx krater* (for mixing wine and water), and a Campanian red-figure *skyphos* (drinking cup). These images were processed into a high quality jpeg format for display through a web browser. The VR artifacts were created with a Java applet that could provide double buffering to assist with the smoothness of image rotation. Using a tailored program provided more control over “behind-the-scenes” processes than was possible with commercial software. This VR could be rotated only on the horizontal plane (i.e., it was a single level VR).

Three optional museum tutorials were held on alternate weeks. Students were randomly assigned to a condition in the first tutorial and were rotated about the three conditions of presentation during the following weeks. These conditions were: viewing the real artifact in its display case, a VR artifact on a laptop, or still digital images on a laptop. During each tutorial students experienced only one type of presentation. The *oinochoe, krater* and *skyphos* were studied in subsequent weeks. For each vase the students were asked a different question requiring a short written answer. These questions were concerned with a basic description, a choice the artist had made and its effect, or the relationship between decoration and the vase’s purpose. Ten students came to all classes in this study. Since there were 3 sessions (over which students were expected to improve in their analytical ability) and 3 different types of presentation, we can view this as a “within subject” 3x3 factorial design with students as the subjects, and with session and presentation-type being the blocking factors.

The students viewed the digital images on full colour, high-resolution laptops. They were presented with a web page with either four still images showing the front, back and sides of the vase, or a single VR artifact. Both types of presentation included a button to turn on and off a thin red outline box on the image marking “hotspots” which they could click on to bring up respective details. At the start of the first tutorial the students were shown how to work the VR and image hotspots. Each digital display also included any textual information that was available on the museum label beside the real vase. This was standard information one would expect to see, listing the technical name for the vase, the height, diameter and approximate date of the artifact.

The course lecturer provided a detailed marking sheet for each question, graded 40% of the answers and went over the process with the tutor who blind-marked the remaining question sheets. Near the end of the course six talkative and competent students were asked if they would be willing to be interviewed on their thoughts about viewing the real, still, and VR images. Four of these students had attended all three sessions; the other two had each come to two of the sessions.

Quantitative Observations

An analysis of variance (ANOVA) was performed on the marks obtained from the student’s museum tutorial sheets. Ten students attended all three sessions, giving us thirty answer sheets. The blocking factors were:

- Student effect: due to range of academic ability across the class;
- Session effect: due to the time spent learning vase analysis skills; students were expected to perform better during sessions held later in the course; and,
- Presentation effect: what we are primarily interested in: whether the form of presentation (still, VR, or real) affects mark achieved.

<table>
<thead>
<tr>
<th>VR Artifact</th>
<th>Still Images</th>
<th>Real Artifact</th>
<th>Session Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>5.00</td>
<td>5.25 *</td>
<td>5.67</td>
</tr>
<tr>
<td>Session 2</td>
<td>5.67</td>
<td>4.67</td>
<td>5.25 *</td>
</tr>
<tr>
<td>Session 3</td>
<td>7.25 *</td>
<td>5.50</td>
<td>6.50</td>
</tr>
<tr>
<td>Presentation Mean</td>
<td>6.10</td>
<td>5.15</td>
<td>5.75</td>
</tr>
</tbody>
</table>

*Table 1. Summary of assessed marks. Starred groups had 4 subjects; the rest 3*
Table 1 provides a summary of average marks (graded out of 10) obtained in each session and the average marks for each form of presentation. Table 2 presents the mean squares for the three separate effects. From Table 2, F-values show:

- Significant evidence of variation due to student ability (p = 0.01);
- Significant evidence of variation due to progression through the course (p = 0.05); and,
- No evidence of difference due to form of presentation.

Two assumptions have been made:

- The ten students were normally distributed, with no selection bias. The focus of this study is dedicated students (those who attended all sessions).
- The answer sheets were evenly marked.

**Qualitative Observations**

Several interesting qualitative observations emerged from the student interviews. All students expressed a preference for viewing the real object. Reasons included the fact that they could choose what they wanted to look at; there was a better sense of depth and detail; that shifting their perspective altered the lighting and highlighted different features of interest; and, that it was easier to imagine actually holding and using the item because “you get some sense of its relation to you.” It was commented that the real object was also easier to remember “I think you remember the real thing a lot better…because you can put them in a place and time.”

The next preference was for the VR since it was “quite handy” and “pretty much like viewing the real thing.” The advantage was being able to see all the different views joined together so the relationships between the composition of the scene and shape of the vase was stronger. One student said that is was easier to be “able to move it around…and stop it when you wanted to stop…so you could actually look at the decoration.”

The still images were the least popular and it was suggested that the students were inclined to look at them as separate images rather than as a coherent vase. However, it was also commented that the still images helped you look “piece by piece,” that it felt more analytical, “it directs what you look at” and that because the image is there “they must want me to look at the detail”. Another student said that the still images were “actually pretty good…the more I looked, the more information I could find.”

The interviews emphasised several inherent problems with the digital images (both still and VR). These were:

- Not comprehending the scale of the artifact: most students were surprised by the real object, having imagined it to be bigger or smaller while viewing the digital images.
- Colour: even slight differences in colour between the digital images and the real artifact were disconcerting to the students.
- The lack of surface details, since this fineness of detail could not be retained in the digital images. This meant that much visual information on the state of the item’s preservation or perhaps on the clarity of the artist’s preparatory sketching was lost.

**Limitations of the Study**

In this case study we were interested in the effect of presentation for the dedicated student. Many other students attended one or more of these tutorials. However, due to outside pressures (such as examinations) only ten attended all three sessions. These are small sample numbers so the results can only provide an indication of outcomes. It is worth noting though, that even with ten students there is a clear student and session effect so that we should expect also to see a presentation effect if there were one.
Any possible novelty effect of the technology is mitigated by the sheer “gee-whiz” factor of viewing a 2000+ year old artifact up close — it is one of the draw cards of taking the course. Indeed, it is particularly exciting for students of the relatively young cultures of New Zealand. It was a necessary part of the experimental design to rotate the students around the different presentations so that they all had the opportunity to study the real item. If this had not been done the numbers assigned to the digital images would have dropped because when the students come to the museum they wish to have access to the actual object.

It was possible to get only four suitable laptops for the study. This meant that, depending on numbers attending, there may have been one to three students per machine. This was not an ideal situation but could not be helped. Though they were asked not to discuss the item with others while they were writing their answer, they may have helped each other to “see” the artifact.

**Discussion of Results**

Earlier we suggested that it was reasonable to expect that the real item would prove to be the most successful study tool, that VR would be the next best and still images the least helpful. However, the resulting student grades indicate no difference between these forms of presentation. The testing instrument (short answer questions) was sensitive enough to detect variation in student ability and student improvement over time. It is possible that it did not afford enough granularity to indicate more subtle differences that may have been present between media presentation types. However, we believe the most likely reason for the results is that presentation is all about mediation; as soon as a decision is made about angle of view, lighting and surroundings it can influence the viewer’s perspective.

The real artifact afforded the students the most freedom of choice in perspective—or the least mediation. However, students are often not certain where to begin with such a wealth of information and a common difficulty is to jump too quickly to conclusions and not take enough time to slow down their observations. It requires more skill to know what is important to focus on.

The VR allowed the students to move the vase around 360 degrees but from one vantage point with the lighting set to focus on areas that would be important.

Plain digital photographs provide students with the reassurance that this choice of view is important, providing focus to work from. Students tended to assume that if the information has been put in front of them then it must be important. The photographs, as the most mediated form of presentation, had the result of directing the students’ study.

We can summarise the advantages and disadvantages of using VR artifacts as follows:

**Advantages:**
- The artifact is carefully mediated for the novice student, directing attention to important features. This is also true of still images.
- The student still feels “in control” of where they want to look around the vase. In contrast with still images, a more subtle sense of limitation is imposed than with still images.
- Physical access to real artifacts is often limited. This may be because they are in storage, on the other side of the world, or are partly obscured by other artifacts in a display case. VR artifacts afford an uninterrupted view around the entire object, at any computer. Students commented on how much they would like to have VR study materials of the famous works that are part of their courses.

**Disadvantages:**
- VR artifacts affect students’ sense of an object’s physical scale. This is important in classical art because scale tells one something about the original function of the object; for example, whether the object was for everyday use or served a monumental purpose.
- Digital images are never quite the same colour as the real artifact. Colour is important because it give clues as to geographic region of origin.
- Fine details (such as hairline fractures) are often lost in digital images. These are clues to the history of the object; for example, a good state of preservation suggests that the item may have been a tomb offering.
- A sense of physical relationship with the object is lost in all digital images. Students make connections with the form and substance of the 3D object in front of them. To be direct, the sense of the item being real is lost.
It takes more time and effort to create VR objects.

The results that we see in this study suggest that choice of object presentation is a trade off between independent observation and mediated viewpoint. VR artifacts provide a better balance of these issues, thus eliciting a stronger sense of satisfaction from the students.

**Future Work and Conclusion**

A further study has been undertaken using sculptures rather than vases as the study artifacts. For sculpture we explore the usefulness of VR objects that allow you to rotate through not just the horizontal but also the vertical plane.

To summarise this article: real artifacts, VR artifacts and still digital photographs have been used in an empirical study to examine student acquisition of visual literacy in a first-year classical art and archaeology class. The results of this study provide some indication that there is no statistical evidence of difference due to the form of the artifacts’ presentation. On the surface this seems to be a surprising result as surely there is nothing like seeing the real thing. Digital images provide less visual integrity. However, the digitised artifacts make up for the loss of excitement and authenticity by providing the advantage of mediated focus. Digitised artifacts thus turn out to be useful, effective study tools in teaching students to view classical art.

In this study we see no quantitative effect on student grades, but there are qualitative effects which may be of concern for student progress in this topic. Given this result, it is possible that such is also true in the wider application of instructional technology. Further studies into media used in visual observation and analysis should try to identify any critical insight a student may either obtain or have diminished as a consequence of the media presented to them.

**Acknowledgements**

Thanks go to the Otago Museum for permission to photograph their artifacts. Thanks to Dr. Patricia Hannah of the Classics Department at the University of Otago for help and support with this project. Thanks are also due to Mr. Nathan Rountree of the Computer Science Department at the University of Otago for creating the Java applet.

**References**


