

Using Computer Graphics in Archaeology: A Struggle for Educative Science or to Educate Science?

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1 INTRODUCTION

Computers have long been used by archaeologists for tasks such as recording excavation plans, illustrating artefacts and presenting the results of scientific analyses. However, recent developments in computer graphics and interactive techniques are providing powerful tools for modeling new multi-dimensional aspects of the data gathered. Computer graphics can now be used to reconstruct and visualize features of a site, or artifact which may otherwise be difficult to appreciate. This new perspective may enhance our understanding of the environments in which our ancestors lived and worked, but there is also a very real danger that we may be misrepresenting the past.

2 EXAMPLE

One example of the potential for computer graphics as a real research tool with which archaeologists may explore the past, is the accurate modeling of firelight. Before the advent of modern lighting, illumination within ancient environments was dependent on flame. The fuel used for the fire directly affects the visual appearance of the scene. Furthermore, flames are not static and their flicker may create patterns and moving shadows that further affect how objects lit by these flames might look. Any realistic reconstruction of an archaeological site must take into account not only the accurate spectral profile of the fuel being burnt, but also the manner in which the flame may move over time. Computer graphics can do this.

The Franco-Cantabrian cave art site at Cap Blanc, Les Eyzies, France is a remarkable record of one of the earliest representational artistic expression, dating to the Upper Paleolithic era. As figure 1 shows, with an accurate model of the spectral properties of candle flame (here made from animal tallow) archaeologists can investigate how this ancient environments may have been perceived and even explore, in the case of Cap Blanc, whether 15,000 years ago our ancestors were in fact making “movies” with careful use of the dynamic nature of the flame and the 3D structure of their carvings.

3 CURRENT SITUATION

The film industry has long used computer graphics to represent the past in order to entertain. Many of these images have in fact been gross distortions of the real evidence resulting in perhaps thousands of people believing Hollywood's inaccurate version of history. Archaeologists in turn have been rather slow to adopt the new technology, fearing that as they don't know all the facts, any use of graphics imagery will be misleading.

To date the creation of high fidelity 3D models has been a costly undertaking with archaeologists typically unable to afford such luxuries when budgets are needed for excavators, conservation of finds etc. Thus, many of the major 3D reconstruction projects so far have been decided by richer institutions who have used the archaeological project to try out their latest technology, rather than by archaeologists to further their research. A major issue was whether there was a way to routinely make this technology accessible, or if graphics would be relegated to a few demonstration projects.

The advent of modern high performance graphics cards and

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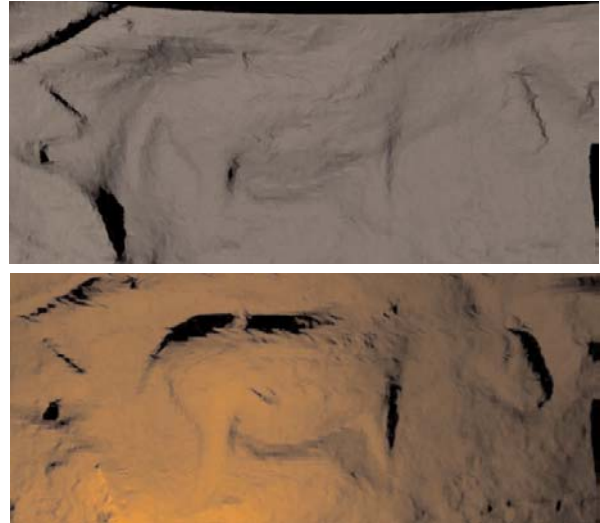


Figure 1: Cap Blanc, horse carving lit by (top) modern lighting and (bottom) animal tallow candle light.

low cost 3D capture techniques, such as photogrammetry, have put the graphics technology within the financial means of the archaeologists, the question is now whether they are prepared to use it or not.

4 THE FUTURE

“Despite the gulf of time and technology which separates them, the earliest rock art and the most sophisticated of modern computer images share a common heritage; they are artefacts of the very human effort to record the world and explore our place within it.” [Kate Robson Brown, archaeologist]

There is no doubt that archaeology and paleontology captures the public's imagination like few other subjects. There is an enormous appetite for television documentaries and books on the subjects. Computer graphics is increasingly being used to augment these programs and books, and unlike the film industry, a few archaeologists and paleontologists are routinely appointed as “specialist advisers”, and at least some attempt being made to accurately represent the past.

But this is not enough. Film, television and the internet has the potential to bring virtual archaeology to a vast audience. Computer graphics does not require the discipline of archaeology to construct a new theory of the visual image, however archaeologists have long been aware of the many uses and abuses of images, that they document only the intent of the image maker, that they abstract, and sometimes that they mislead. If archaeologists are to educate a large audience then they must embrace computer graphics technology, work closely with the graphics practitioners, and assume the responsibility that the audience is informed as what is the real evidence underpinning the reconstructions and what is educated conjecture. Furthermore, this information needs to be recorded as meta data with any reconstruction so that in the future the models can be improved upon as more evidence comes to hand. Archaeologists need to be bold. Computer graphics will be increasingly used in archaeology. It is up to the archaeologists to ensure it is used responsibly.