

**Transcript of Mark Mudge Presentation for *Cultural Heritage and Computer Graphics* Panel  
SIGGRAPH 2004, Aug 10**

**Implementing Digital Technology Adoption by Cultural Heritage Professionals**

Good Afternoon.

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I'd like to begin by offering a potentially controversial vision:

First, what if all significant cultural heritage objects and sites were digitally documented in a way that captured their relevant features.

Second, what if this information was accessible to anyone anywhere on the planet.

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I'm sure that the need for this shift to digital documentation is clear to everyone here.

But let me offer one example. A Tlingit Native American living in South East Alaska who wants to explore his or her cultural legacy is essentially out of luck. Most of their patrimony has either been destroyed or dispersed around the globe. It resides in the museum of Anthropology and Ethnology in St. Petersburg Russia, in Switzerland, Germany, France, England, New York, Washington DC and a host of other locations.

To most Tlingits, this material might as well be on the dark side of the moon.

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The advantages of digital representations are also obvious to everyone here, and will be explored by others on this panel.

Let me give you one example of how the interactivity of digital representations can promote the adoption of digital techniques by the cultural heritage community.

When an Assyriologist wants to read a cuneiform tablet, they pick it up, put it under a desk lamp or take it to a window, and rotate it to disclose it's markings. The potential interactivity of virtual cuneiform tablets provides the same opportunity with tablets residing anywhere in the world.

There are over 120,000 cuneiform tablets in the British Museum. Only about 15% have been read. Clearly, more hands and eyes on the job is a good thing.

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If the transition for cultural heritage workers to digital techniques was straight forward, the process would be well under way. But it's not.

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Current computer graphic techniques must be adapted to the requirements of the cultural heritage community. Just as 'real world' cultural material requires a provenance, digital representations require an 'empirical provenance' that tracks the path of captured information to its final digital representation.

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For example, textured 3D virtual objects require an account of, among other things, the placement relationship between geometry and textures, the alignment and merging of separate scans, and the effects of data compression.

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For cultural heritage professionals to adopt digital technology, we must have answers to some very practical concerns. For example:

Do we really need to do this?

Is it practical to use in our daily activities?

Can we afford it?

We must answer these questions with compelling evidence that digital documentation is affordable, can provide more and more useful information, and can make this information accessible to a much greater audience.

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We must realize that there are many different cultural heritage jobs that require many different tools. If all we offer is a hammer, all that will happen is the pounding of nails.

At Cultural Heritage Imaging, we suggest an adoption plan for equipment acquisition and skill development that incorporates a staged approach.

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We start by building on existing photographic skills, with digital photography and image processing, including HDR imaging. Then we recommend adding panorama and object movie capability. This can be followed by more advanced photographically based techniques such as Polynomial texture mapping and 3D structured light scanning. Laser scanning can be added if desirable and the budget permits.

Let me show you a couple of quick demos that we use to entice the cultural heritage folks.

This is a Polynomial Texture Map. PTMs encode a reflection normal for each pixel in the image.

This example shows a Danish flint axe, from 3000 BCE. The PTM discloses fine knapping and use details not readily seen in a simple photograph.

Danish Axe

[http://www.c-h-i.org/examples/ptm/ptm\\_st\\_danish\\_axe.html](http://www.c-h-i.org/examples/ptm/ptm_st_danish_axe.html)

This is 3D textured geometry of a silver Athenian Tetrachama, captured with structured light, and output as an object movie. It was minted in 449 BCE by Pericles to help pay for the construction of the Parthenon. It's 22 mm in diameter and the scan contains 38 range samples per square mm.

Athenian Tetrachama

[http://www.c-h-i.org/examples/3d/3d\\_tetra\\_obj.html](http://www.c-h-i.org/examples/3d/3d_tetra_obj.html)

And finally, here is a work in progress that integrates structured light scanning and polynomial texture mapping.

This is a neo-sumerian Cuneiform tablet. It is 50mm across and is made of fired clay. Here's a clear example for the assyriologist that these techniques can enhance their ability to decipher this material.

*<3D PTMs are a work in progress, and the viewer is not yet publicly available>*

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I'd like to acknowledge our collaboration with Tom Malzbender and Dan Gelb of Hewlett Packard Labs and the assistance of Marc Proesmans of Eyetronics NV. I'd also like to thank Carla Schroer, the co-founder of CHI, for running the demos today.

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I want to close with a note about Cultural Heritage Imaging. We are a 501 C 3 non-profit corporation, that does digital documentation and consulting in the cultural heritage field.

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If you want more info, here's our website and my email address.

Thank you

Cultural Heritage Imaging  
<http://www.c-h-i.org>