Piquette, Kathryn E.

*Reflectance transformation imaging (RTI) and ancient egyptian material culture*

**Damqatum: The CEHAO newsletter – El boletín de noticias del CEHAO Nº 7, 2011**

Este documento está disponible en la Biblioteca Digital de la Universidad Católica Argentina, repositorio institucional desarrollado por la Biblioteca Central “San Benito Abad”. Su objetivo es difundir y preservar la producción intelectual de la institución.
La Biblioteca posee la autorización del autor para su divulgación en línea.

Cómo citar el documento:


(Se recomienda indicar fecha de consulta al final de la cita. Ej: [Fecha de consulta: 19 de agosto de 2010]).
Reflectance Transformation Imaging (RTI) and Ancient Egyptian Material Culture

Kathryn E. Piquette | University of Oxford
kathryn.piquette@classics.ox.ac.uk / kathrynpiquette@gmail.com

Introduction

Whether an archaeologist or text specialist examines artefact surface details first-hand or via a photograph, lighting is important for accurate viewing. With the former method, lighting proximity, intensity and direction can be adjusted to improve visibility. For the latter, whether during the making or use of photographs, light location and angle is fixed. This presents particular difficulties for fully visualising convex, concave or undulating surfaces; some surface features may be over-lit while others are lost in shadow. For photography in the field, in addition to overcoming lighting issues, there is also the need for portable and affordable equipment and a relatively quick capture procedure. Reflectance Transformation Imaging (RTI) is an emerging advanced digital imaging technology with the capability of overcoming these challenges.

Reflectance Transformation Imaging

RTI entails taking multiple high-resolution detailed digital photographs of a surface with light applied from a different position for each exposure. The multiple captures are amalgamated together using mathematical algorithms such as Polynomial Texture Mapping (PTM), developed by Tom Malzbender et al. (2001). The two main RTI techniques are distinguished primarily by the way illumination is applied during photography:

1. RTI using a lighting dome, generally referred to as “RTI”.
2. RTI using a hand-held flash, referred to as “Highlight RTI” or “H-RTI”.

Design of a more portable, affordable and faster RTI dome
measuring 17cm² or less, especially in quantity, larger objects or those presenting logistical challenges can be imaged using H-RTI (Figure 2). This method requires a camera on a tripod, a hand-held light source, and reflective spheres. H-RTI is adaptable to a wider range of surface sizes and locations, e.g. rock art, tomb relief, stelae, etc. (see Mudge et al. 2006), but is more time consuming.

Figure 2. H-RTI equipment set up for the capture of a limestone ostraca in the Ägyptisches Museum und Papyrussammlung, Staatliche Museen zu Berlin. The author measures the distance between the flash gun and target surface prior to taking one of a series of digital photographs. Photograph courtesy Hembo Pagi.

Figure 3. Screenshot of the RTIViewer displaying detail of impressed jar sealing (EA 35520, British Museum) with light from upper right, in the default mode, at 48% magnification.

system constituted the primary aim of a collaborative 1-year project, Reflectance Transformation Imaging System for Ancient Documentary Artefacts (RTISAD), recently undertaken at the University of Oxford and University of Southampton. RTISAD was funded by the UK Arts and Humanities Research Council via the Digital Equipment and Database Enhancement for Impact (DEDEFI) scheme.

A lighting dome system was designed and built by the University of Southampton. The dome consisted of a plastic hemisphere measuring 1 m in diameter (Figure 1), which disassembles into four parts for portability. 76 LED light sources are affixed to the dome’s underside. A digital camera is attached overhead to a frame and positioned so that the lens projects through the opening at the top of the dome. Objects are placed under the dome and 76 high-resolution digital photographs of the artefact surface are made, each with a different LED turned on. The captures are then combined together with a fitting software into a PTM file. The RTI file can be viewed using software such as the open access RTIViewer (Figure 3). The user is presented with a high resolution image of the artefact surface and importantly, can virtually re-light the surface in real-time. Enhancement settings (rendering modes) make surface features more visible.

While the dome is the most efficient way of imaging objects...
Figure 4a. Decorated side of the Hunters Palette (EA 20792, British Museum). Author’s photograph, courtesy Trustees of the British Museum.

Figure 4b. Detail showing evidence for re-carving. The body of the human figure appears to have been shifted to the left and the rope may have originally passed over rather than under the figure’s body. Author’s photograph, courtesy Trustees of the British Museum.
As part of the RTISAD dome system development and testing, my particular task was to photograph ancient documents made from a variety of material types (e.g. clay, bone, ivory, metal, stone, wood), inscribed using different techniques (e.g. incisions, relief carving, painting, stylus and seal impressions). In addition to cuneiform tablets and Latin-inscribed tablets, I imaged ancient Egyptian artefacts in the Ashmolean Museum, British Museum, and World Museum in Liverpool. As the results compellingly attest, RTI holds tremendous potential for the study of Egyptian material culture. Marks on the Late Predynastic (c. 3100 BCE) Hunters Palette clarify the detailed process of carving (Figure 4). Through light control RTI supports the rigorous comparative analysis necessary for identifying patterning in technical practice in order to answer questions of broader cultural consequence, such as the extent to which the palettes are the products of shared practices or work in relative isolation.

An Early Dynastic stone vessel inscription is not only more easily readable with RTI, but the difficulty of cutting hard stone is also apparent (Figure 5). Light from certain positions reveals multiple tool marks, some of which veer off from the main incisions forming the hieroglyphic signs. In addition to revealing unambiguously the challenges posed by inscription in certain material types, RTI also enables the detailed study of ductus, and methods of tool use. Evidence for direction, pressure and force may reveal the skill and habit of an artisan, perhaps even aiding the identification of ‘hands’ or ‘workshops’.

Beyond its applications for ancient Egyptian inscriptional evidence, RTI also presents tremendous potential for documenting other material culture, from skeletal or botanical evidence to lithics and ceramics. Although the 1-year RTISAD project has recently drawn to a close, the team is keen to develop follow-on research projects and identify potential collaborators.

The RTISAD Team

The RTISAD team, led by Dr. Graeme Earl (Archaeological Computing Research Group [ACRG], University of Southampton) brings together expertise from computer science and archaeology including textual studies in the areas of Egyptology, Assyriology and Classics. The University of Southampton team also include Dr. Kirk Martinez (Electronics and Computing [ECS]), with Mr. Hembo Pagi (ACRG), Mr. Sascha Bischoff (ECS), Mr. Michael Hodgson (ECS). The University of Oxford team includes Prof. Alan Bowman, Dr. Charles Crowther (both Centre for the Study of Ancient Documents [CSAD]) and Dr. Jacob Dahl (Oriental Institute [OI]), with Dr. Kathryn E. Piquette (OI, CSAD) and Mr. Leif Isaksen (CSAD) ■
References


RTI on the World Wide Web

- RTISAD project summary: http://www.soton.ac.uk/archaeology/acrg/AHRC_RTI.html


- Various RTI resources prepared by our project partner, Cultural Heritage Imaging (CHI): http://www.c-h-i.org/technology/ptm/ptm.html

- CHI video of papyrus RTI: http://www.youtube.com/watch?v=EDQPsP70DyM

- RTIViewer: http://www.c-h-i.org/learn/learn_RTIviewer_download.html

CEHAO IN THE WEB

FOLLOW US:

WEBSITE
http://www.uca.edu.ar/cehao

FACEBOOK
http://www.facebook.com/groups/208703295538/

ACADEMIA.EDU
http://uca-ar.academia.edu/Departments/Centro_de_Estudios_de_Historia_del_Antiguo_Oriente