ZUSAMMENFASSUNG / SUMMARIES

Thomas Mannack, Greg Parker
The Digital CVA – Status 2010

The development of *Corpus Vasorum Antiquorum* (*CVA*) for over 90 years necessitated new approaches. Indexes to a printed work of such size and complexity are difficult to keep up-to-date. Using the digital archive of Athenian figure-decorated vases created in 1978, *CVA* has been made accessible on the internet, free of charge, since 1998 (www.beazley.ox.ac.uk). Presently, this site has approximately 20,000 registered users and contains data on all vases published to date in *CVA*; it also contains data on other Attic vessels, both those included in *ABV*, *ARV*, and *Paralipomena*, and those not attributed by Beazley. CVA-Online is powered by XDB (eXtensible DataBase), a flexible database for text and images that was developed in the Beazley Archive. It enables users to perform searches using a combination of user-defined search fields; registered users also have access to a photo-album function. The database capacity is currently 4 Terabytes (TB), but it is estimated that a capacity of 8 TB will be required by 2020. File protection is of utmost importance; maintaining backups is a priority as is developing protective measures against attempts to make illegal copies, for example by applying watermarks to available images. Development continues steadily. Curators, with password protected access, can upload their portfolio and a print-on-demand function is being developed.

Hubert Mara, Julia Portl
Aufnahme und Dokumentation von Gefäßen mittels hochauflösender 3D-Scanner

3D-Scanner werden zunehmend in vielen Bereichen zur Dokumentation von archäologischen Funden eingesetzt. Optische 3D-Scanner bieten sich dafür besonders an, da sie transportabel und vom Bedienkonzept ähnlich zu Photoapparaten sind. Darüber hinaus arbeiten sie berührungsfrei, strahlungslos und erfassen die Farbe von Oberflächen. Für den Einsatz in den österreichischen CVA-Projekten wurden industrielle 3D-Scanner eingesetzt, da die damit gewonnenen hochauflösenden 3D-Modelle zusätzlich Methoden zur Dokumentation und Auswertung ermöglichen.

In diesem Kapitel werden zu Beginn die praxisrelevanten Eigenschaften von optischen 3D-Scannern vorgestellt. Die weitgehend automatisierbaren Arbeitsschritte, die zur Erfassung von rotationssymmetrischen Gefäßen nötig sind, werden vorgestellt. Da manuell gefertigte Objekte in den seltensten Fällen eine perfekte Symmetrie haben, werden die Möglichkeiten zur Berechnung von Profilschnitten und Silhouetten aus 3D-Modellen gezeigt. Im Gegensatz zu den Rastergraphiken von digitalisierten Handzeichnungen, werden die berechneten Profile als Vektorgraphik exportiert und ermöglichen damit eine einfache Finalisierung zur Publikation.

Zusätzlich können orthographische, maßstabsgetreue Ansichten erstellt werden. Mit Hilfe von geometrischen Hilfskörpern, wie der Kugel und dem Konus können die 3D-Modelle transformiert werden. Die Ergebnisse dieser Transformationen entsprechen Abrollungen der Gefäßoberflächen. Abschließend werden exemplarische Ergebnisse zur Volumenschätzung von 3D-Modellen geschlossener Gefäße gezeigt. Bei Vorhandensein von Einsatzbehältern werden aus Röntgenbildern und den Rotationsachsen der 3D-Modelle die Volumina dieser Behälter errechnet.

Bettina Vak
In Search of the Original. The Scientific Diagnosis of Figured Painted Attic Pottery in the Antiquities Collection of the Kunsthistorisches Museum, Vienna, using Applications and Illustrations

This paper will address on two particular issues based on the work of vessels from the collection of the Kunsthistorisches Museum, Vienna, for CVA Wien 5 and 7: the visualization of barely visible or concealed parts of the image; and the differentiation between original substance and modern amendments including their technical classification.

The images, which more often than not, are rendered in low-temperature colours on white-ground *lekythoi*, are often difficult to recognize because of (less than perfect) storage conditions. In order to visualize these images, we selected the following approach: the surface is photographed in single exposures with the aid of a stereomicroscope and is reconstructed with the aid of an image-processing software program. Because of this, single portions (including non-antique parts of the image, for example) can be embodied separately. The stereomicroscope and image-processing software programs are well-proven for their ability to capture the finest of line-weights, even for the visualization of sketches. The precise documentation of painted vases described in the preceding steps will contribute a great deal to the future study of painters and the relationships between workshops.

Even the use of non-visible light (in the infrared and ultraviolet range) can reveal the often near-perfect restorations from previous centuries, but only the application of scientific methods will allow for a qualitative determination. For example, X-ray fluorescence analysis enables selective substance analysis and is particularly suitable for heavier inorganic pigments.

Based on the case studies discussed, it appears that, most of the time, only a combination of different investigative and analytical processes will lead to a satisfactory outcome.

Stephan Karl, Daniel Jungblut, Jördis Rosc
with a contribution from Rudolf Erlach
Non-contact and Non-invasive Investigation of Ancient Ceramics Using Industrial X-ray *Computer Tomography*

In cooperation with the Austrian Foundry Research Institute (ÖGI) in Leoben and the Goethe Center for Scientific Computing (G-CSC) at the University of Frankfurt, a study was conducted to address the documentation of ceramic vessels using high-resolution computer tomography (CT); their aim was to evaluate the possibilities and limitations of this technique in the context of the archaeological study of ceramics. The objects being examined were vessels and vessel fragments from the collections of the Universalmuseum Joanneum in Graz and the Institute of Archaeology at the University of Graz.

The low density and heterogeneous nature of ceramic substances proves to be ideal for CT examinations. The radiation exposure, as demonstrated by optimal performance, can be classified as low. TL-dating for the purposes of verifying authenticity is guaranteed even after a CT examination, taking the threshold values into consideration. More than any other method, the industrial CT achieves, without contact and in a non-invasive manner, a fully three-dimensional image of an object including all external and internal structures. The information created by the CT volumetric reconstruction-matrix, which provides a virtual three-dimensional visualization of the object based on the respective densities of a data-element (*voxel*), can be measured and evaluated using commercial software programs in a contact-free manner. In order to prepare the CT generated model for more efficient post-processing, a Surface Reconstruction Method (SRM) was developed. This method generates a surface model which provides a simple method for calculating the vessel's capacity and ceramic volume. Foreign material (such as inclusions in the clay, modern ingredients, etc.) and even air holes within the ceramic body can be made visible by setting corresponding threshold parameters. This will provide information regarding the pottery fabric, production techniques and restoration measures of the vessel. The high accuracy of this method, which is in the micrometer-range, allows for archaeometric comparisons of thin sections without the need for a material sample to be taken.

Robert Fürhacker, Stephan Karl
The Documentation of Historic Restorations of Ancient Pottery, A Case Study of Two Vessels from the Universalmuseum Joanneum, Graz, with Special Emphasis on Industrial Computer Tomography

The branch of restoration history is relatively recent in the study of ancient ceramics. The Universalmuseum Joanneum, with its more than 200-year history, is home to many ceramic vessels, some of which were substantially reworked in the 19th century. After outlining the history of the Joanneum Museum's ceramic collection, two of its vessels in particular will be studied from an archaeological and conservational point of view; the vessels have been examined in detail with conventional methods as well as with the help of industrial computer tomography (CT).

The first case study comes from Etruria: a vessel of *Bucchero* '*pesante*'-ware decorated with relief heads. As a result of the CT scan, the vessel revealed itself as a pasticio of fragments that did not originally belong together. This means that in principle the vessel is no longer a restoration in which the goal is being able to 'read' or discern the fragmented vessel, rather, it must be viewed as a new creation. With the CT-image it is possible to distinguish, in a non-destructive manner, between the ancient and modern matter. Modern interventions are also clearly evident in the second case study: a *column-krater* rendered in the Volterra style and whose status is also now far from being considered antique as a result of its being almost completely over-painted.

Starting with a larger material base will allow comparable detailed studies of restoration measures, different restoration concepts and perhaps even of individual persons and workshops (as in the case of ancient vase painting) to be recognized. The application of modern methods of investigation allows us to place an object not only in its archaeological context, but also to reconstruct the more recent transformative processes that are also a part of the object's history.

Maria Christidis
A Guttus from the Original Collection of the Institute of Archaeology at the University of Graz. Applications of Scientific Research

The focus of this paper is a black-glazed guttus which ports a relief medallion and which is kept at the Institute of Archaeology, University of Graz. When handling the vessel it appeared to be unbroken, however, it was found to contain typological as well as surface-material inconsistencies which made a detailed inspection necessary. Two imaging methods, X-ray and computer tomography (CT) were used after a microscopic examination had been made. As a result it was discovered that certain parts of the vessel contained an over-painted, non-ceramic leveling layer. The CT scan images also reveal the interior contour of the vessel, which would otherwise not have been visible. It becomes clear that the wall thickness of the individual fragments varies. The typological ambiguities are the result of earlier restoration measures whereby the spout was patched twice.

Moreover, the CT scan images reveal the density of the material, which differs from one vessel fragment to the other. Therefore, the imaging techniques provide insight into the original manufacturing technology of so-called unbroken, original, closed-form containers. In this case it revealed the separated production of base, handle and spout, and proved the mounting of the medallion as the last step.

Leonid Dimitrov, Milos Šrámek, Emanuel Wenger, Claudia Lang-Auinger, Elisabeth Trinkl
Pilot Study for the Visualization and Analysis of Ancient Vases

This paper briefly summarizes a pilot study conducted in 2006 that gauged the potential of industrial computer tomography (CT) for the investigation of ancient ceramics. Developed for human medicine, computer tomography provides a non-invasive insight into the human body; this technology can also be applied to inanimate objects, providing a substantial gain of information.

Computer tomographs have been developed with a higher x-ray intensity and a longer exposure time for the testing of inanimate matter in particular. Such industrial computer tomographs would be harmful to the human body, yet inorganic objects such as vases can be thoroughly scrutinized with great accuracy in a non-

destructive, contact-free manner. The individual CT scans are connected to a three-dimensional image of the object that includes the surface as well as the material itself. As a result, any desired dimensions (such as height and volumetric capacity) can be extracted, as can section drawings.

A squat, rounded-bellied lekythos of Gnathia-ware was our test-object. An unprofessional restoration of its neck could only be detected after a CT scan had been performed.

Paul Kammerer, Franz Mairinger, Elisabeth Trinkl, Ernestine Zolda
Colour Spectrum Analysis – a Preliminary Study

Within the scope of processing vessels for the CVA Wien, KHM 5, 17 objects were examined using reflection spectroscopy, particularly in the presence of coloured pigments. Under favorable conditions, this non-invasive and non-destructive method of measurement allows for the identification of a substance and/or pigments by comparing it with standard spectra.

There are two main reasons for the preoccupation with pigments: on the one hand, the appearance of a colour today can vary greatly from its original, ancient appearance due to external influences; on the other hand, it should be determined whether spectroscopy can distinguish between the antique (original) and modern (extant patch) pigments. In our test arrangement the signal strength is generally low due to scattering caused by the curved surface; in addition, the relatively large size of the area to be examined complicates the analysis. Nevertheless, it is clear that areas appearing similar to the naked eye sometimes display different results and/or spectrum ranges, so that one must assume a difference in materials.

For the exact identification of individual pigments however, further measurements and more detailed investigations must be conducted.

Englische Übersetzungen: Catherine Leisser