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Art Conservation with Computed Radiography: Buffalo State College

The value of radiographic imaging in non-destructive (NDT) testing practices is indisputable. For almost half a century, advanced radiography techniques have lent a hand in providing critical safety inspections to a vast array of industry applications. While advanced NDT methods are most commonly utilized in mission-critical operations such as aerospace, infrastructure, automotive, manufacturing, and energy; radiographic testing methods have also long been applied in the fields of art and archaeology. The Art Conservation Department at Buffalo State College, in Buffalo N.Y., provides its students with cutting-edge Carestream technology to assist them in the conservation of important historical art pieces in order to prepare them for the ongoing paradigm shift to digital technologies in the art conservation profession.

Art Conservation and Radiography

The methodologies of art conservation encompass the examination, preservation, and restoration of works of art and cultural material. Because of the inherent degradations caused by time, environmental conditions, and other catalysts of deterioration, art conservation is essential to insure the preservation of the art and artifacts that make up our cultural heritage.

In addition, the information revealed by conservators in their technical examination of works of art can provide scholars and the public with exciting information about past civilizations, cultures, and people

While radiography has been an integral part of the technical examination of artifacts for many decades, digital computed radiography is rapidly becoming a preferred modality for this essential tool in the advanced examination of works of art. Before any restoration efforts are undertaken, practitioners must scrutinize subjects at intensely detailed levels in order to make key observations that will uncover not only the history of the piece, but also structural and qualitative information that is essential for its preservation and restoration. Radiographic imaging is applied to the examination of virtually all media including paintings, sculptures, woodworks, engravings, pottery, paperwork, bronze, and iron, among others.

Radiography in the Collegiate Environment



The Buffalo State Art Conservation Department provides students with education and training in preparation for careers in the conservation of paintings, paper, and objects along with the vast material subsets of each medium. “Radiography helps us discover the intricacies of subjects under evaluation. Through detailed imagery, we can decode the many layers of a painting, the structural properties of a piece of pottery, or even the age of a paper artifact” says Dan Kushel, *State University of New York Distinguished Teaching Professor, Technical Examination and Documentation*. Kushel spearheads departmental efforts in the non-destructive testing and inspection of pieces both in the classroom and for private collectors and institutions that trust the department with preservation and restoration of their collections. “It’s quite amazing what our students discover on pieces that look simply one-dimensional to the naked eye.”



Conservation student Ariel O'Connor feeding 14" x 60" imaging plate into the ACR2000 scanner.

In the past, film-based radiography was the de-facto standard in art conservation. Kushel and his team of distinguished educators, however, recently acquired a Kodak Industrex ACR2000 digital radiography system. “We decided the time was ripe for a transition to a digital inspection technology. Improved flexibility, shorter exposure times, broad dynamic range, and powerful post-acquisition inspection software are all benefits of the digital system that our students can take advantage of to prepare themselves for careers in a profession that is transitioning quickly to digital technologies.”

The Future of Art Conservation

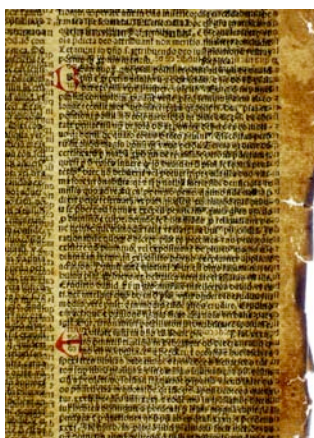
A primary factor in the decision-making process to purchase a Kodak Industrex computed radiography system was the conservation profession’s progression towards digital technologies

for documentation and technical examination. The department's three-year program is designed to prepare students for careers as professional conservators in museums, libraries, and other institutions as well as in the private sector. "In order to provide the best education for our students, it is crucial to maintain a technological edge in the conservation techniques we teach,



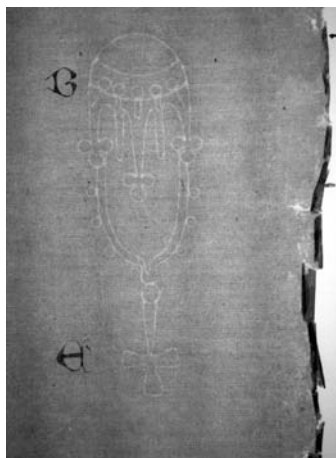
and we believe film-based technologies are becoming obsolete for many applications", emphasized Kushel.

There are many key reasons as to why digital radiography is gaining a strong foothold over film in the profession. When examining fragile subjects, it is crucial to minimize handling of the artifact so as not to risk damage to the piece. A single capture with a digital imaging plate can provide much more information on a subject due to the flexibility of plate sizes with the Kodak Industrex system. With the support for large plates up to 14" x 60", a complete study of a painting or large artifact can be



achieved with just a few radiographs. "With film, we sometimes needed a dozen over-lapped captures for a single large painting. The Kodak Industrex digital system allows us to capture the same information in as little as three shots" says Kushel when referring to the advantages of the large sized plates available for the Kodak Industrex system.

Another benefit of digital radiography over film is the increased dynamic range of the images. At a full resolution similar to that of most films, a single digital capture provides a wider dynamic range allowing more information to be deciphered in less time and with fewer exposures. When practicing art conservation, it is important to capture not only as much information as possible, but also to view the most detailed imagery. A wider dynamic range allows students to decipher important variations in a painting or artifact to make conclusions on paint layers, structural defects, and even artist signatures buried beneath previous re-touches.



Top: A 16th century printed bible page prepared for Grenz radiography using Kodak Industrex HR 2174 imaging plate. Center: Bible page

viewed with transmitted light showing nearly total obscuring of watermark by printed text.

Bottom: Grenz radiograph of same area of page showing papermaker's watermark. (5kV, 2200mAS, FFD 14", imaged reversed using Kodak Industrex Image Viewing Software.)

The Kodak Industrex system also provides the department with advanced radiographic imaging software. Students use the software as a post-capture tool to inspect imagery in a variety of ways. Without the hassle and maintenance of high-intensity light boxes, image captures can be analyzed immediately and efficiently with advanced options not available in physical film inspection techniques. Tools such as contrast manipulation, image rotation, sizing, and support for a wide dynamic range provide super-detailed images that can be examined right on the department's high-resolution computer monitors. "The Kodak software lets students examine pieces in much higher detail and with much more flexibility than standard film light-box methods. Add to that the ability to easily share images over the network and our department has become addicted to the digital technology" declares Kushel when discussing the digital analytical software.

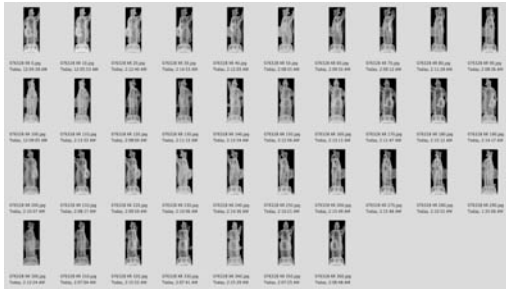
Exciting Benefits to a Variety of Artistic Media

The department's students and faculty work to assess the condition of collections and provide expertise in preservation management. The scientific analysis of objects and the careful examination of their condition allow the conservator to design and implement an appropriate treatment. Buffalo State has benefitted greatly from the utilization of digital computed radiography when inspecting such unique artifacts as ancient Chinese ceramic figures, historical texts, and old bronze artifacts.



Qing Dynasty Chinese ceramic sun god roof figure and radiograph of statue taken in single exposure. (Collection Buffalo Museum of Science)

In one exciting analysis, an ancient ceramic Chinese figure was inspected using the Kodak Industrex system. The large artifact was over two and a half feet tall with a relatively large diameter. A unique challenge was presented to students when trying to capture a complete three hundred and sixty degree image of the piece. It was estimated that over one-hundred film shots would be required due to the size and shape of the figure. "When we realized the scope of the film process when analyzing the Chinese ceramic figure it was quite clear that only a digital capture with the Kodak Industrex system would be an efficient use of time" states Kushel when discussing the project. To solve the capture problem, Dan and his students rigged a turntable-like device to rotate the piece while digital images were



captured with the large flexible plates allowed by the Kodak system. A complete image capture of the figure was completed with just thirty-six shots – a third of the work that would have been required by a film capture. Students then combined the images into a single QuickTime video file to allow a seamless motion view

of the complete artifact. “In just one and a half days, our students were able to capture a surround-view of the Chinese ceramic piece and create an exciting 360-degree QuickTime video file to share with their associates and the college” says Kushel of the project.

Radiography is an important tool for the inspection of historical texts on paper, because it can reveal hidden elements such as watermarks when they are obscured by printed text or images. Access to the watermarks permits Kushel’s students to accurately date these artifacts.

“Watermarks can be directly related to a specific location, time, and trade guild, allowing historians to gain insight into the language and culture of a specific time period.” In the examination of historic documents, using both grenz (low energy) and beta source sheet techniques provides significant advantages over its film counterpart. Because film must be bare for these techniques, the radiography must be carried out under a dim safelight, making handling of the artifact difficult and resulting in increased risk of inadvertent damage. “CR plates allow for the work to be done under higher light levels. This substantially diminishes handling risks and greatly facilitates setup. The enhanced sensitivity of CR plates to low energy radiation also results in exposure times of only a few minutes instead of the quarter to half hour exposures required with film”, states Kushel.

Ancient bronze sculptures are highly valued for their craftsmanship and casting technology. When evaluating these artistic achievements, students must be careful in identifying the authenticity of the artifact. Utilizing the flexibility of the Kodak Industrex analytical software, students and faculty can identify structural characteristics of the sculpture that aid in authenticating the source and history of the object and assessing its condition. Cracks, casting flaws and other disfigurements all can be clearly revealed helping to substantiate the analysis of the artifact. “From bronze sculpture to archaeological items such as coins and vessels, students are provided with an exciting opportunity to gain insight into these artifacts through the greater understanding of techniques and methods used in their construction that computed radiography provides” emphasizes Kushel.

Well Equipped Students and University Faculty

Buffalo State College's Art Conservation department chose the Kodak Industrex ACR2000 because of the many advantages it provides its team of students and faculty over film-based radiographic techniques. Kushel's department uses the system daily to prepare students for the inevitable transition to digital technologies in their future professional environment. "We see many large museums now moving to or planning to move to digital radiographic systems and it is clear that this is the direction the profession is going" states Kushel when asked about the college's decision to purchase a computed radiography system. "On top of its ability to handle larger plate sizes than the other solutions we looked at, the support that the Carestream team provided us before we even purchased the system was the final deciding factor in our decision."

Through the successful implementation of the Kodak Industrex ACR2000 digital computed radiography system, Kushel hopes to provide his conservation students with the best preparation, education, and training for long-term success in the private and public sectors.

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With revenues of more than \$2.5 billion, Carestream Health, Inc. is a leading provider of dental and medical imaging systems and healthcare IT solutions; molecular imaging systems for the life science research and drug discovery/development market segments; and x-ray film and digital x-ray products for the non-destructive testing market. The company emerged in 2007 when Onex Corporation of Toronto, Canada purchased Eastman Kodak Company's Health Group. For more information about Carestream Health, contact your Carestream Health representative or visit www.carestreamhealth.com.

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