

Abstract Book

Material Matters

2018



**46th Annual Meeting
May 29-June 2, 2018
Houston, Texas**

AIC

American Institute for Conservation
of Historic and Artistic Works

AMERICAN INSTITUTE FOR CONSERVATION
OF HISTORIC & ARTISTIC WORKS

2018 Abstract Book

The American Institute for Conservation of Historic & Artistic Works (AIC) is the national membership organization supporting conservation professionals in preserving cultural heritage by establishing and upholding professional standards, promoting research and publications, providing educational opportunities, and fostering the exchange of knowledge among conservators, allied professionals, and the public.

The Foundation of the American Institute for Conservation of Historic and Artistic Works (FAIC) supports conservation education, research, and outreach activities that increase understanding of our global cultural heritage. Its mission is to elevate the vital role of cultural heritage conservation by applying its expertise to urgent global preservation initiatives while empowering conservation professionals, motivating collecting institutions, and engaging the public.

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46TH ANNUAL MEETING

Material Matters 2018

May 29 – June 2, 2018 at the Marriott Marquis in Houston, Texas

How does a better understanding and appreciation of the properties of materials change their treatment, interpretation, and preservation? Papers were solicited that demonstrate the impact of material studies – or studies of materials – on the conservation profession, including the emergence of innovative treatments, new ways of “looking” and “seeing,” shifts in decision-making and desired outcomes, and changes in collection care strategies. Also welcomed were explorations of the impact of trending “materiality” studies on related disciplines including archaeology, museum and curatorial fields, and art history among others. Topics could include, but were not limited to: cutting-edge imaging and analysis techniques of materials, new materials having conservation applications, revelations about the meaning and significance of materials within an artist’s work, and improved methods of authentication.

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Use of Leather in Book Conservation

Leather has long been used as a repair material for damaged leather bindings. The working properties of historic leathers can be very different than modern ones. In recent years, conservators have begun to employ other materials, such as paper or cast acrylic, as an alternative to leather in book conservation treatments. Tanned animal skins offer less long-term stability and may be more difficult to prepare than other materials, but may also provide better strength and flexibility in a functioning book. Should conservators continue to employ leather using traditional book repair techniques on leather bindings? Should we abandon the use of tanned skins in favor of more chemically stable materials? Do alternative book repair materials really stand up to the mechanical stresses of use?

Symposium organizers are Henry Hebert and Marieka Kaye.

A Virtual Tour of the J. Hewit & Sons Tanner and the Leather Manufacturing Process

David Lanning

The author aims to give an insight into the way J. Hewit & Sons produce their bookbinding leathers, by way of a virtual tour of our factory, using slide, diagrams, and movie clips. The presentation will serve as a virtual tour of the Hewit factory and will take you through the leather whole production process including:

- The source of the raw material we use
- The various states we can purchase the skins in, such as “wet-salted,” “pickled,” or “native-tanned”
- The structure of skin (from hair-on to pre-tanning)
- De-hairing, liming, fleshing, scudding, tanning, dyeing and re-tanning, finishing

David Lanning has been at leather manufacturers and bookbinding suppliers J. Hewit & Sons Ltd. since 1987. He started work as the London Sales manager and since 1992 has filled the roll of Sales and Marketing Director.

During this time from August 2009 - August 2013 he served as President of the Society of Bookbinders, and from April 2005 - April 2006 President of the Institute of Bookbinding and Allied Trades.

He considers himself quite a competent armchair bookbinder, although he has never welded a bone folder in anger.

A Brief History of (a) Time: Reflections on 53 Years of Leather Conservation at the Boston Athenaeum

Dawn Walus

This presentation will discuss examples of past and present materials and methods employed to preserve the leather bindings at the Boston Athenaeum. Founded in 1807, the Boston Athenaeum

remains one of the oldest independent libraries and cultural institutions in the United States. From fine bindings to commercially made ledgers, leather bindings can be found not only in the rare book collection, but in the circulating collection as well. Both collections provide many examples of historic bindings in varying quality leathers in various states of deterioration. Since 1963, Athenaeum conservators have dedicated themselves to the care and repair of paper-based materials—including leather bound books—with inherent historic, artistic, or literary value. Consider early leather conservation endeavors, made before the establishment of the conservation program, in the form of rebinding, consolidation of leather bindings with Liquick Leather, and various acidic enclosures. Later there were efforts to clean and dress leather bindings. Today, leather binding/rebinding is still performed but is limited to Special Collection materials, and is carefully considered by conservation staff in consultation with the Curator of Rare Books and Manuscripts. Other preservation efforts include: working with Facilities staff to secure the building envelope and maintain a stable preservation environment; removing acidic brown paper wrappers and other acidic enclosures; removing deteriorated leather from bindings and replacing/rebinding in cloth or paper; and consolidating old leather with Klucel-G in ethanol or isopropanol. In addition, Conservation staff has performed preliminary research on the identification and removal of Liquick leather from bindings and has prepared and compared leather consolidation recipes containing Klucel-G in various solvents.

Dawn Walus is chief conservator at the Boston Athenaeum. Previously, she worked as a book conservator at the Weissman Preservation Center, Harvard Library and has held conservation internships and positions at The Preservation Society of Newport County in Newport, RI; The Brooklyn Museum of Art; The New York Academy of Medicine; Rieger Art Conservation (Works on Paper) in New York City; and The Huntington Library, Art Collections, and Botanical Gardens in San Marino, CA. She received an MA/CAS in art conservation from the Buffalo State College Art Conservation Graduate Program in 2009 and a BA in fine arts from Rutgers University in 1995. She is a member of the American Institute for the Conservation of Historic and Artistic Works (AIC), and the Guild of Book Workers.

Materials Used for the Application of Japanese Paper Repairs in the Conservation of Leather Bound Books

Emilie Demers

Books have historical importance both in the written word and the materials used for their construction. Looking at the increasing number of books in need of conservation, many conservation techniques have been developed in the last few decades. Knowing the number of books only keeps growing indicating a long future for book conservation and the need for research looking for alternative treatment solutions. In order to accommodate the ever-growing demand for conservation treatment methods, such solutions have explored how to create strong and stable repairs which do not require the use of leather, the typical material

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employed. Although the art of bookbinding and leather preparation are important and still considered in conservation, other material options include the use of Japanese paper. These options prove to be cost effective and time efficient. Japanese paper is a material commonly found in a great number of labs and has many conservation qualities. During treatment, it may be coated or come in contact with various materials. For the purpose of this research, a selection of three materials were tested on Japanese paper toned with acrylic paint: Cellugel, SC6000, and PVAC. The objective of this project was to observe how these materials affect the physical strength of Japanese paper by performing a fold endurance test. In order to observe the viability of such solutions over time, two thirds of the samples underwent accelerated aging. Additionally, a selection of samples underwent SEM-EDS analysis, in order to give insight into the interactions between the materials and the paper substrate, including the penetration level of the material used. Preliminary results will be discussed.

Emilie Demers is a recent graduate student from the Master of Art Conservation (MAC) program at Queen's University, with specialization in paper objects, photographic materials and new media. Her undergraduate degree was completed at the University of Ottawa majoring in History and Theory of Art. She also studied Archives & Records Management and studio art. She has experience in bookbinding and book conservation through her internships at the Library of Parliament in Ottawa as well as the Library of Trinity College in Dublin. At Fraser Spafford Ricci Art & Archival Conservation she was able to take part in large scale projects and treatments through another internship. Having attended various conferences and workshops, she has exchanged her experiences and learnt with other conservators. In an effort to contribute to the field locally and globally, Emilie chose to write a post for the AIC blog. She thrives on knowledge sharing and contributing to the field. Emilie is fascinated in the art of bookbinding and its long history of apprenticeship. She is also interested in time based media and the ethics involved in conservation work.

Replicating Original Leather Surfaces with Textured Repairs

Sarah Reidell

The presentation will review the basic components of the synthetic texturing technique first introduced by book conservators Grace Owen-Weiss (New York Public Library) and Sarah Reidell (University of Pennsylvania) in a short presentation at the 2010 Library Collections Conservation Discussion Group (LCCDG). Since then the technique has been shared in publications and workshops to conservators across the specialties who work not only on library and archival collection materials but also with cased photographs, modern art, textiles, and natural history collections. Treatment examples will be shared where synthetic textures made from surrogate surfaces, reusable silicone molds, and acrylic media were used as aesthetic compensation and integrated into more robust stabilization treatments. A discussion of advanced applications will support that the study of material culture and scholarly interest in binding evidence countermand

invasive conservation techniques. The presentation will conclude with the declaration that the technique supplements, but does not outright replace, repair techniques that use new leather or acrylic-toned paper. Conservators who work with leather bindings too often limit themselves to traditional bookbinding techniques that can be slow, invasive, and require continued practice and repetition to master. Treatment techniques that utilize paper can match the color of the original, but not the texture. Completed textured repairs are less invasive and thinner than leather, introduce more controllable materials, are visually more compatible than paper, and greatly expand the aesthetic possibilities of loss compensation techniques.

Sarah Reidell is the Margy E. Meyerson Head of Conservation at the University of Pennsylvania Libraries in the Kislak Center for Special Collections, Rare Books and Manuscripts with a specialization in the conservation treatment of rare books, paper, and parchment. A Fellow of AIC, she is the AIC Publications Committee Chair and has served in various elected and volunteer positions in the Book and Paper Group. She held previous appointments at The New York Public Library and Harvard University Library. She received an MLIS/CAS in Conservation and Preservation of Library and Archival Materials from the University of Texas at Austin and an AB in Anthropology from Bryn Mawr College.

SINTEVA Cuir, an Alternative to Current Materials for Leather Loss Infills

Ségolène Girard

The considerations and multiple debates that animate book conservators have been a concern of mine quite early into my year of studies, as I found myself quite unsatisfied with current methods of leather loss infills. As any student I was bold and naive enough to think that I could revolutionize this field by finding an alternative everyone could agree upon. Needless to say I soon understood mentalities could not be easily changed unless some kind of miracle was found, which, I dare say, is what happened. Not everybody will be easily convinced by the material I wish to introduce through this Symposium, and a few will be reluctant until they have witnessed and been able to try this new material, but I am eager to take the challenge.

I have been working on some results performed on BEVA 371 by the Canadian Institute of Conservation, as well as the Natural History Museum of New York in the eighties, which proved to be more satisfying than the use of contemporary leather. I based myself on BEVA 371 to develop a product patented as SINTEVA Cuir, recalling its components origins, and being in the shape of a neutral "faux-leather." SINTEVA Cuir is more neutral and less invasive than leather, and answers in many ways better to conservation standards than contemporary leathers.

I found that the only element missing to prove its superiority to other materials was double fold endurance tests: SINTEVA Cuir is 20 times stronger than standardized Japanese tissue repairs, and as strong as leather. Results have shown that it breaks itself before the original material if submitted to strain, whereas an infill

of contemporary leather will be stronger than an antique leather, and thus break the original leather. SINTEVA Cuir can be shaped into any leather surface appearance and thickness, colored with no risk of discoloration, pared with a paring knife and pasted with natural pastes. It is removable and answers in many ways more positively to conservation ethics than leather. SINTEVA Cuir is in many ways an interesting alternative to current materials used in leather conservation.

Ségolène Girard: I have been working on SINTEVA Cuir through my Master's thesis, and pursued with a grant for a 6th year of research. The National Natural History Museum taxidermy department (Paris), the Clementinum (Prague), the National Scholar Library (Strasbourg) and the Palace of Versailles' conservators (some of them being my mentors), encouraged me to publish my work. I introduced the material through a poster during this year IADA Symposium in Oslo and against all odds, it was most welcomed. I realized at that point that there was a real issue with materials available today for leather conservation. I patented the material and thanks to the Symposium publicity I was contacted by some institutions amongst the National Archives of France.

From student project, SINTEVA Cuir became a dedication, and I made a goal of making it available to other conservators when I realized what potential it had. The final steps of the product elaboration and the beginning of its large scaled application will take place in the Library of Versailles where I work as conservator. There, I will have the full playground for writing a new article on the various aspects and uses of this material on different case studies commonly met in libraries, with the appeal of this historic and long-forgotten library.

Love It or Hate It: Tanned Leather in Institutional Conservation Programs Compared to Private Practice

James Reid-Cunningham

The inherent vice of tanned leather contributes to the failure of leather bookbindings, especially those dating from the 19th and 20th centuries. For this reason the use of tanned leather in the repair of leather bookbindings declined over the last forty years in institutional conservation programs, even as tanned leather remains common in private practice. For private clients, tanned leather suggests high quality in a binding. This is often a cosmetic concern for the client. Conservators commonly advocate repairing materials with like materials, but this has not been the case recently with books bound in tanned leather. Until the 1980s, leather rebacking was the primary repair technique used on damaged leather bindings with loose boards or spine. The decline of leather rebacking occurred at the same time as book conservation training moved away from an emphasis on craft skills, resulting in fewer practitioners with the hand skills necessary to do traditional methods of repair. Rebacking is an intrusive process, and conservators conflated this inherently intrusive process with the suitability of using tanned leather in any repair. New tannages developed at the end of the 20th century greatly improved the durability and stability of bookbinding leathers, providing conservators with new options for utilizing tanned leather.

A survey of traditional leather binding repairs will elucidate situations where the use of tanned leather is acceptable or even desirable given contemporary conservation principles. An evaluation of the characteristics of bindings suitable for repair using tanned leather will be followed by a summary of the training needed to execute these repairs and an exploration of the suitability of cosmetic treatments that may alter the appearance of a historic binding.

James Reid-Cunningham is a book and paper conservator in private practice. He spent thirty years as a conservator at Harvard University and the Boston Athenaeum, and served as the President of the Guild of Book Workers from 2006 to 2010. From 2009 to 2013, he was the adjunct lecturer on book conservation in the graduate art conservation department at Buffalo State College. His website is www.reid-cunningham.com.

Discussing Leather Standards: A Group Effort to Understand the Material Properties of All Leathers, Both Old and New

Panel members: William Minter, Kristi Wright, Katie Wagner, Holly Herro, Laura McNulty

The leather discussion group is a small group of book conservators that formed in 2016 to discuss observations on leather and leather dyes traditionally used in conservation. The goal is to determine the best products available to suit conservation needs and, if necessary and feasible, to make those needs more apparent to product manufacturers.

Why does modern leather deteriorate faster than older leather? Early observations by the group, corroborated by multiple sources, suggest that leather produced prior to the industrial revolution has generally remained in better condition than leather produced after that time. One widely observed change is an increased rate of hydrolytic breakdown of leather fibers in regions with a greater concentration of sulfur dioxide in the air. Shifts from locally managed farms to large-scale operations also began to take place as the result of increased urbanization, resulting in changes to the diets and living conditions for host animals. Additionally, US-based tanners have confirmed that both the need to increase production and Environmental Protection Agency rules required changes to the tanning processes.

How have these variations in environmental conditions, animal husbandry, and changes to the tanning processes combined to lead to differences in the quality of leather produced since the advent of the industrial revolution?

The group has accumulated a collection of unused skins and discarded leather-covered boards and is in the process of working with scientists and students who are performing tests on fibers from both deteriorated and stable skins. Tests, both in process and proposed, include:

- SEM (Scanning Electron Microscope) for testing the presence/absence of sulfur
- XRD (X-Ray Diffraction) for consolidants
- FTIR (Fourier Transform Infrared Spectroscopy) for consolidants

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- ICP (inductively coupled emission spectroscopy) to quantify the amount of sulfur
- GCMS (gas chromatography/mass spectroscopy) to determine tannin and dye compounds
- Proteomic testing on skins produced before and after the industrial revolution for species and cross-linking analysis
- Further examination of the correlation between skin stability and materials used during the tanning process, including but not limited to tanning agents, leather pH, and dyes.
- Review of the efficacy of former tests to determine leather stability

During early discussions, the group decided to solicit input from tanners, bookbinders, conservators, and scientists in multiple disciplines including genetics and zooarchaeology, to build a broader understanding of observations made in the field. Questionnaires were created and tailored separately to bookbinders and tanners, then tested among a small group of individuals in preparation for dissemination to the larger leatherworking community.

The questions for bookbinders and conservators focus on desired skin qualities, workability, observations on longevity, preferred dyes, and whether any changes in skin quality have been noted during the person's career. Questions for tanners focus on tannins and dyes used, skin preparation, the tanning process, documentation of process changes, and the reasons behind them over the decades.

Thus far, responses have been informative, indicating a need to continue the discussion. During the proposed panel session, the group will provide updates on the testing progress, summarize responses to the questionnaires, and ask for input from the conservation community.

William 'Bill' Minter began his career as the editor, writer and photographer for the employee magazine of a large Chicago based printing company. Shortly thereafter he met Bill Anthony, noted fine-bookbinder and book conservator, who became his immediate supervisor. Within a short time, the young Bill began a seven-year apprenticeship with the master-binder. In 1978, Bill started his own book conservation practice in Chicago and later moved to Pennsylvania. In 2014, Bill accepted a position as senior book conservator at The Pennsylvania State University Libraries with funding from the Andrew W. Mellon Foundation. In addition to his interest in the testing of book materials, Bill is known for his inventive character with many different items to his credit -- most notable is the ultrasonic welder for polyester film encapsulation.

Kristi Wright is a contract book conservator at the National Library of Medicine (NLM) in Bethesda, Maryland and principal of Wright Conservation & Framing, located in Front Royal, Virginia. She has a master's degree in library and information science and a certificate of graduate study focusing on preservation from the University of South Carolina. While pursuing her graduate degree Kristi began her book-binding and conservation training under Holly Herro, currently the senior conservator at NLM, and she continues her training through an apprenticeship with Tom Albro, retired head of Book Conservation, Library of Congress. She is a member of the American Institute

for Conservation, the Guild of Book Workers (Potomac Chapter), and the Washington Conservation Guild.

Katie Wagner is a rare book conservator for the Smithsonian Libraries. The Libraries are a pan-institutional organization with 21 libraries located in every museum and research facility across the Smithsonian.

Katie is currently serving a 2-3 year term on the Smithsonian wide PRICE (Preparedness and Response in Collection Emergencies) Committee. Katie participated in the Smithsonian's Haiti Cultural Recovery Program working on a cleaning and re-housing project at The Bibliothèque Nationale d'Haiti. Recently activities include taking part in the ICCROM organized, and Smithsonian hosted, "First Aid to Cultural Heritage in Times of Crisis" training the participants in the salvage of library materials after floods, fires and earthquakes. She recently gave several workshops on Fire and Flood Prevention in Peru that were sponsored by U.S. Embassy and the Peruvian Ministry of Culture.

Katie holds a Masters of Library Science with a concentration in archives and records management from the University of Maryland and a B.A. in History and Art History from Mt. Holyoke College. She studied abroad at the University of Edinburgh in Scotland and in Germany at the Ludwig-Maximilians-Universität and the Universität des Saarlandes. She is a Professional Associate with the American Institute for Conservation and serves as the co-chair of the AIC Emergency Committee.

Holly Herro is the Senior Conservator at the National Library of Medicine on the National Institutes of Health campus in Maryland. For nearly thirty years, she has been a book and manuscripts conservator. Holly is apprenticed to Tom Albro, retired Head of Book Conservation at the Library of Congress and holds a graduate degree in library science. Holly is a Professional Associate with American Institute for Conservation, serves on the AIC Emergency Committee, and is the co-chair of the National Heritage Responders working group.

Laura McNulty is currently a conservation intern at the National Library of Medicine on the National Institutes of Health campus in Maryland. In addition, she has worked at the American Philosophical Society, Library of Congress, United States Holocaust Memorial Museum, Colonial Williamsburg Foundation, and Hirshhorn Museum and Sculpture Garden. Laura is thrilled to be joining the Winterthur/University of Delaware Program in Art Conservation's Class of 2021 as a Library and Archives Conservation Education (LACE) Fellow.

The FULL TOOLKIT Approach to Leather Repair at the Library of Congress

Katherine Kelly, Dan Paterson, Shelly Smith

Leather is one of the materials used by the Library of Congress (LOC) in its treatment of leather objects, including the repair and rebinding of damaged leather bindings. When planning treatments, conservators articulate a set of requirements that they want the new repair material to meet. The requirements may be aesthetic, favor certain physical properties such as rigidity or flexibility, or specify a choice between a strong or a weak material. Considerations might also include what is appropriate to the item

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from a curatorial or contextual standpoint, whether the repair must be mechanically or chemically reversible, and so forth. Conservators then choose from a large repertoire, or full toolkit, of techniques and materials to select those that will achieve the desired results. At present, the LOC Conservation Division uses leather, paper, cloth, cast acrylic, parchment, and woven polyester with a wide variety of adhesives and application techniques to repair leather objects. Evidence from previous projects involving the application of one conservation technique to a variety of leather bound books has shown that what works for one volume may not be appropriate for another. Understanding that individual conservator preference may lead to the use of one material over the other, this presentation will systematically discuss the shared LOC Conservation Division approach to designing a treatment protocol based upon the questions that are asked to determine the techniques and materials that are employed. Speakers from the LOC will give examples of historic and recent treatments where leather was chosen as the covering material for rebinding or as the primary repair material, as well as examples where cloth, cast acrylic, paper, parchment, or woven polyester were used. They will offer a rationale for maintaining a large toolkit, both of techniques and materials, to meet the varied needs of condition, anticipated use, aesthetics, and historical appropriateness.

Katherine Kelly is a Senior Book Conservator at the Library of Congress in Washington, DC. Previously, she has worked at the Smithsonian Institution Libraries, the National Archives, Iowa State University, Harvard University, and Cornell University. She received her MS in Information Studies and Certificate of Advanced Study in Conservation of Library and Archival Materials from the University of Texas at Austin in 2007.

Dan Paterson is a Senior Book Conservator at the Library of Congress, where he has worked since 2003. Prior to working at LC he held internships at several institutions, including the Newberry Library, The LBJ National Historic Park, the LBJ Presidential Library, and the Library of Congress. He graduated with a MLIS degree and a Certificate of Advanced Study in Conservation of Library and Archival Materials from the University of Texas at Austin, 2003.

Shelly Smith is the Head of the Book Conservation Section in the Conservation Division at the Library of Congress. She was previously the Head of Conservation Treatment at the New York Public Library, and was a Rare Book Conservator at the Conservation Center for Art and Historic Artifacts in Philadelphia, PA, and at the Huntington Library, Art Collections, and Botanical Gardens in San Marino, CA.

Whose Cultural Heritage? Whose Conservation Strategy?

This is AIC's first symposium on diversity, equity, inclusion, and access in cultural heritage preservation. The Symposium will be divided into two parts. Part One will focus on the changing ways that museums and conservators are engaging with the diverse communities from which their collections originate. Part Two will focus on discovering the barriers to promoting a more diverse workforce in cultural heritage conservation and discussing how they can be overcome. What success stories are out there and how can they be reproduced?

The Equity & Inclusion Working Group organized this symposium.

A New Resource for Collaborative Conservation: Part One

Landis Smith, Brian Vallo, Cynthia Chavez Lamar, Kelly McHugh

Increasingly, museums are engaging with the diverse communities from which their collections originate. From traditional arts revitalization to conservation decisions and the documentation of collections, museum staff and community members are sharing expertise and perspectives. While collaborative museum work helps to address the non-inclusive, historic imbalance of access and authority vis a vis cultural collections, a collaborative approach is also critical for a more sound and complete understanding of the museum collections with which we work. Positive relationships built on trust and mutual respect build bridges between museums and communities and allow for a two-way exchange of knowledge and perspectives. As conservation and collections work moves from a series of discreet events or consultations toward a collaborative methodology, there has been little information and no general resource to help navigate this process. In response to this expressed need, a resource for collaboration has been developed over four years of periodic, critical discourse among Native and non-Native museum professionals, cultural leaders, artists and scholars. Sponsored by the Indian Arts Research Center at the School for Advanced Research (SAR) in Santa Fe, New Mexico and with additional support from the Smithsonian Institution National Museum of the American Indian (NMAI), *Community + Museum/Museum + Community: Guidelines for Collaboration* presents principles and practical considerations for meaningful engagement between museums and communities. Although the foci of the Guidelines are Native American communities and collections, they can be broadly applied to any community working with a museum.

The Guidelines are comprised of two parts: Part 1: *Community + Museum*, is intended for communities currently working with, or considering working with, museums. Information for community members about what to expect when working with museums – before, during and after their visit – is discussed with points to consider from logistics to issues surrounding documentation and

safeguarding sensitive information. Potential outcomes of collaboration are presented as short case studies illustrated in text, photos and video.

Part 2: *Museum + Community*, is geared toward conservators and other museum professionals interested in, or currently engaging in, collaborative work with Native American or other communities. Information is offered on topics such as building trust and long-term relationships with communities, essential for truly collaborative work. Outcomes of collaboration are discussed and include incorporating cultural information into all aspects of collections stewardship and conservation practice, augmenting and/or correcting museum records including conservation reports, traditional arts revitalization in communities, and generally creating a more equitable platform in which collections are understood and presented.

The format for this session is a moderated panel discussion and a variation on PechaKucha for the presentation of case studies.

Landis Smith is Projects Conservator at the Museums of New Mexico Conservation Unit, working primarily with the Museum of Indian Arts and Culture. She is also Collaborative Conservation Programs Consultant at the Indian Arts Research Center at the School for Advanced Research in Santa Fe, and Research Associate at the National Museum of the American Indian. Landis was previously Anchorage Project Conservator at the Smithsonian Arctic Studies Center, National Museum of Natural History and Conservator in the Department of Anthropology, American Museum of Natural History, NY. Since 1988, much of Landis's career has been focused on developing conservation and documentation methodologies that are collaborative with Native artists, elders and cultural leaders. Her work includes the development of a community-based program in New Mexico for National Museum of the American Indian Conservation Fellows as well as co-facilitating, through the Indian Arts Research Center at SAR, the development of a set of guidelines for communities and museums engaging in collaborative work. Landis currently serves on several advisory boards including the Board of Trustees of the Haak'u Museum at Acoma Pueblo.

Brian Vallo is Director of the Indian Arts Research Center at the School for Advanced Research. A member of the Pueblo of Acoma tribe, Brian has over 25 years of experience working with tribal groups throughout the Southwest. A former lieutenant governor, director of historic preservation, and founding director of the Haakú Museum at Acoma, his recent work experience extends into the fields of architecture, planning, and the arts. Brian attended New Mexico State University where he studied business administration and marketing, and later studied anthropology at the University of New Mexico. His passion for historic and cultural preservation results from his involvement as a tribal leader during the early years of NAGPRA. A self-taught artist (painter and potter), Brian enjoys experimentation with natural materials he discovers on the New Mexico landscape to create mixed media works that celebrate aspects of Native American culture and history.

Cynthia Chavez Lamar (San Felipe Pueblo/Hopi/Tewa/Navajo) is currently assistant director for collections at the Smithsonian's National Museum of the American Indian (NMAI). Prior to her appointment at NMAI, she served as director of the Indian Arts Research Center

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(IARC) at The School for Advanced Research (SAR) in Santa Fe starting in 2007 until 2014. Cynthia began her career at the Smithsonian's National Museum of the American Indian (NMAI) where she served as an associate curator from 2000–2005. Her major accomplishment during her tenure was leading the development of the inaugural exhibition, *OurLives: Contemporary Life and Identities*, which currently remains on exhibit at the NMAI. In 2006, she was recruited to become the museum director at the Indian Pueblo Cultural Center (IPCC) in Albuquerque where she revitalized the educational programming and exhibits. Cynthia received her B.A. from Colorado College in studio art, and a M.A. in American Indian Studies from the University of California, Los Angeles. In 2001 she completed her Ph.D. in American Studies from the University of New Mexico with an interdisciplinary focus on Native art history, museum studies, and cultural anthropology. In 2008 she received an honorary doctorate from her alma mater Colorado College, and in 2009 she was appointed by Governor Bill Richardson to the New Mexico Arts Commission. In 2010 she was nominated and appointed by President Barack Obama to the Institute of American Indian Arts Board of Trustees. She has been active in the museum profession for fourteen years, and much of her work focuses on fostering and facilitating collaborations between Native peoples, organizations, and institutions.

Kelly McHugh is an objects conservator at the National Museum of the American Indian (NMAI). She began working for the museum in 1996 in New York, based at the museum's former storage facility in the Bronx. There she participated in a survey of the over 800,000 objects in NMAI's collection, prior to the collections move to the Cultural Resources Center (CRC) in Maryland. She currently cares for the collection and works to prepare objects for exhibits at NMAI-DC and NMAI-NY at the CRC. She specializes in evolving the Conservation Department's collaborative conservation methodology and in caring for the museum's contemporary art collection.

A New Resource for Collaborative Conservation: Part Two

Kelly McHugh, Marian Kaminitz, Susan Heald, Emily Kaplan, Megan Doxey-Whitfield, Nora Frankel, Diana Gabler

Most collections management policies and collections care programs are based on western museum practice, which gives the museum authority in determining what is important to preserve. The notion of customizing these policies or programs implies that this structure is primary and can only change if collections managers or conservators choose to do so. The mission statement of the National Museum of the American Indian (NMAI) directs employees to work in partnership or collaboration with Native constituencies. The motivation for this collaborative action is not to claim universal inclusiveness, but to fundamentally expand and broaden the authority over decisions related to collections care. Without Native knowledge regarding materials, techniques, cultural use, cultural practice, care and treatment we would be neglecting critical information required for making responsible and appropriate care and treatment decisions.

NMAI Conservation works to broaden the circle of who decides and how. We do this in various ways: internship programs;

working in partnership and collaboration with Native American scholars and subject matter experts for conservation, housing, loans, display and documentation; conducting place based education programs; and designing inclusive research that will benefit constituent communities. We briefly discuss how NMAI, a museum born out of Native American activism, inspires evolution in museum practice and we share some of these projects in this pre-session to illustrate our working practice that fulfills our mandate of partnership and collaboration.

Kelly McHugh: see above talk.

Marian Kaminitz has been Head of Conservation at the Smithsonian National Museum of the American Indian (NMAI) since 1991. She was Assistant Conservator in the Anthropology Department of the American Museum of Natural History (1985-91), Adjunct Professor at NYU Conservation Center (1989-99), and an Andrew W. Mellon Fellow at the Pacific Regional Conservation Center, Bernice Pauahi Bishop Museum, Honolulu, HI (1984-85). She specializes in conservation of ethnographic materials, facilitates collaborative conservation efforts and administers the NMAI Conservation Department. She received an MS in Art Conservation from the University of Delaware/Winterthur Museum in 1984 and was a 2013 recipient of the Sheldon and Caroline Keck Award recognizing her sustained record of excellence in the education and training of conservation professionals.

Susan Heald has been the National Museum of the American Indian's textile conservator since 1994, where she has supervised many pre-program interns and post-graduate fellows. Prior to NMAI, she served as the Minnesota Historical Society's textile conservator, and was a Smithsonian Conservation Analytical Lab postgraduate fellow. She holds an MS in Art Conservation (textile major/objects minor) from the University of Delaware/Winterthur Museum, and a BA in Chemistry and Anthropology from the George Washington University. She served as chair and vice-chair for the AIC Textile Specialty Group (1997-98), and as a board member for the North American Textile Conservation Conference (2004-09).

Emily Kaplan is an Objects Conservator with an MA (1993), Queen's University Art Conservation Program, and a BA in art history/studio art (1984), University of Massachusetts, Boston. Her areas of interest are in preventative conservation, collections storage and moving; Latin American collections; and the history and technology of plant resins and mineral and organic colorants used in the Andean region during pre-Hispanic and colonial eras.

Megan Doxey-Whitfield is currently a Mellon Fellow in Objects Conservation at the National Museum of the American Indian. She is a graduate of the Queen's University Master of Art Conservation program (MAC '15) and holds a Bachelor of Arts in Art History from the University of British Columbia. Megan has previously completed conservation contracts with the Field Museum of Chicago, and the Archaeology Lab of the Canadian Conservation Institute.

Nora Frankel is an Andrew W. Mellon Fellow in Textile Conservation at the Smithsonian Institution's National Museum of the American Indian. Past work includes positions at the Rijksmuseum, Burrell Collection, Death Valley National Park, Petrie Museum of Egyptian Archaeology, and the Southwest Museum of the American Indian.

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Textile passions are natural dyes and fibers, spinning, weaving, embroidery, and knitting. She is a graduate of the MPhil programme in Textile Conservation at the University of Glasgow Centre for Textile Conservation (2016) and holds an MA in Principles of Conservation from University College London Institute of Archaeology (2014).

Diana Gabler holds a Diploma (MA) in Conservation of Archaeological, Ethnographic and Decorated Arts Objects from the State Academy of Art and Design Stuttgart, Germany. She is currently Research Fellow in Conservation at the National Museum of the American Indian (NMAI) Washington D.C., where she completed a two-year Andrew W. Mellon Fellowship in Objects Conservation (2015 – 2017). Her research project focuses on collaborative work with Native communities and the development of a systematic approach to the documentation process of conservation consultations with Native community members, scholars, and artists. Before joining the NMAI team in 2015, she has worked at the Ethnological Museum in Berlin (2013 – 2015) as Objects Conservator of the Americas' collections. Diana is Chair of the Ethnographic Working Group of the Association of Conservator-Restorers (VDR e.V.), Germany.

Decolonization and Conservation of Aboriginal Art and Artifacts

Erin A. Murphy

Australian Aboriginal peoples produce a variety of beautiful art and artifacts the conservation of which presents a particular challenge to the conscientious cultural heritage professional. Museums Australia, a national professional body, has encouraged outreach to the Aboriginal community and the thoughtful conservation of these objects through their directives, such as Continuous Cultures, Ongoing Responsibilities.

A research project was initiated by the author to investigate some of the issues raised in the conservation of Aboriginal Australian art and artifacts and learn about the importance of ritual in giving meaning and purpose to Aboriginal artifacts. Several museums were visited along the eastern coast of Australia from Melbourne to Rockport. A survey was sent out to museum professionals and/or personal interviews were used to collect information on current practices and attempt to understand their purpose, extent and success. In Australia and the UK, the term “decolonization” is used to describe efforts to remove the distorting paradigms of the dominant culture and to understand the viewpoint of the aboriginal or ethnographic group that produced the objects. These decolonization and outreach efforts are what were surveyed, i.e. proper and respectful signage, terminology, storage and accessibility of the artifacts. Various Aboriginal outreach efforts and policies were also shared and some negative as well as positive aspects came to light.

The research, interviews, and survey responses helped in the grouping of Aboriginal objects into categories with similar conservation ramifications. Art that fits into the first category (inward facing art) is art that carries traditional aboriginal meanings and functionality, while art that fits into the final categories (outward facing art) usually carries assimilated meanings and westernized attributes. It is hoped that overall this breakdown will help the

heritage professional to determine whether consultation with the Aboriginal community is necessary, and how established institutions undertake it. This research into the current practices of Australian national, regional and local institutions revealed that although the national flagship institutions were actively working on decolonization issues, due to time and money constraints there was very little being done at smaller institutions. Also, although it is easy to say “consult with the aboriginal community,” it is not so easy to build the network of relationships necessary, nor is it obvious who represents a given Aboriginal community. This research looks at institutions successfully implementing decolonization efforts, some of the problems for smaller institutions, and general considerations of outreach into the Aboriginal community.

Erin A. Murphy is currently a Marshall Steel Fellow, Archaeological Conservation at the Colonial Williamsburg Foundation. Erin is a recent MA and MSc graduate from University College London where she studied general object conservation. During work at the Horniman Museum and Gardens in London she specialized in ethnographic and natural history specimens. She enjoys on-site work studying Buddhist wall painting restoration at the Chhairo Gompa, Nepal, Italian ceramic conservation, and Gompa conservation in Leh, Ladakh. Internships at the Hirshhorn, Milwaukee Art Museum, Arizona State Museum and the Buffalo Bill Center of the West exposed her to archaeological and ethnographic conservation challenges. As an undergraduate she double majored in Art History and Studio Art at St. Olaf College in Minnesota.

Metalwork in the Kathmandu Valley: Melding of Reverence and Preservation

Susanne Gänsicke

In Nepal, devotees of Hindu and Buddhist faith often pay visits to temples and shrines. Many of these sanctuaries are home to an abundant amount of metalwork, such as repoussé covered doors, architectural cladding with applied three-dimensional elements, lamps, bells, ritual items, as well as images of deities. Application of offerings, paint, and libations to surfaces and sculptures, as well as touching, are integral to the religious experience of the visitors. Yet, over time these practices lead to wear, alteration, and ultimately loss of the very material that attracts reverence.

This paper examines how the maintenance and preservation of metalwork in Nepal is approached by various local communities and entities of faith, craftsmen, scholars, and local as well as international conservation professionals. Over centuries, in Nepal, this type of metalwork has been created and maintained by Newari craftsmen, who also supplied their crafts throughout the Himalaya region and still do so today. By its very nature, the metalwork experiences a complex set of issues pertaining to its long-term preservation, including ritual handling and exposure to the elements. More recently, severe damage was inflicted by the 2015 earthquake that led to the collapse of many structures and sculptures.

Recent research trips to Nepal in 2014 and 2016, the latter supported by the Asian Cultural Council, NY, allowed in depth visits to UNESCO World Heritage Sites in the Kathmandu Valley. Interviews with various stakeholders explored issues such

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as: Who are the traditional caretakers? How and by whom are metal cladding and images of deities repaired, restored or replaced? How have the techniques used in the process changed? Is there an active role for conservation professionals, to what extent are current conservation standards applied, and how are they received by the community? Are mechanism being developed for future needs, such as special training?

Case studies will be used to illustrate a number of diverse past and present preservation projects, ranging from grass roots efforts to international collaborations, aided by strong local crafts traditions. Glimpses into Newari society's complex hierarchy, where different crafts professions occupy specific spaces, are important to understand how preservation within "living" World Heritage Sites is approached by local residents. Homage will be paid to the immense beauty of Nepali cultural heritage, its survival, and repeated resurrection in the face of adversity.

Susanne Gänsicke is Head of Antiquities Conservation at the J. Paul Getty Museum, Los Angeles. Prior to her appointment in 2016, she served as Conservator in Objects Conservation at the Museum of Fine Arts, Boston (MFA), where she was also responsible for the opening ancient art exhibition and conservation for the Nagoya/ Boston Museum of Fine Arts, Japan (1997-2001). She remains an adviser to the conservation project of the auloi from Meroë, Sudan.

In 1987, she was awarded a certificate in Archaeological Conservation from the Römisch Germanisches Zentralmuseum, Mainz, Germany, followed by an advanced-level internship at the MFA (1988), and an Andrew W. Mellon Fellowship in Objects Conservation at the Metropolitan Museum, New York (1990). She is a Fellow of the International Institute of Conservation, and a recipient of an individual grant by the Asian Cultural Council, NY (2016). She is a member of CAST:ING (Copper Alloy Sculpture Techniques and history: an International iNterdisciplinary Group).

Susanne worked at the New York University-Apis Expedition at Memphis, Egypt, the MFA and NCAM Jebel Barkal Mission, Karima, Sudan, and the Field School for Architectural Conservation, American Research Center in Egypt, Luxor (2007-2010). She was Chair of the Publication Committee of the American Institute for Conservation 2005-2010, and she is currently Associate Editor of JAIC. She has lectured on conservation and examination of works of art in classes at the MFA, MIT, Harvard Extension School, UCLA, and the Metals Conservation Summer Institute (Higgins Armory Museum and the Metal Processing Institute at WPI, Worcester, MA).

Her research interests include the examination of ancient Mediterranean and Nile Valley material culture, site preservation, relocation of monumental sculptures, and the study of ancient and historic metalwork. In addition to examination of metal artifacts in the museum setting, she has collaborated with craftsmen in different parts of the world.

Achieving Diversity and Equity in the Field of Museum Conservation

Martina Dawley

The purpose of this research is to examine the challenges and impacts of achieving diversity and equity in the field of museum

conservation, including associated funding needs. The study focuses on the lack of underrepresented groups, specifically Native American professionals in conservation through the perspective of a Native American scholar. For years, museums have housed a rich diversity of objects representing cultures from around the world, yet the cultural background of professionals within museums are not diverse (Bloomfield, 2013). Museum professionals and scholars have, indeed, recognized the need for diversity, but most of the emphasis has remained at the level of hopeful discussion and entry level workshops or trainings. Additionally, institutions do not promote advanced level programs to recruit and train underrepresented populations, especially in the field of conservation. Instead, these populations participate in various grant projects as consultants for curatorial, exhibition, and preservation activities (Clavir, 2002; Erickson, 2002; Lonetree, 2012; Odegaard and Sadongei, 2005). Diversity and equity in museum conservation, therefore, has evolved at a snail's pace directed toward a pseudo-collaborative process where underrepresented community members act as cultural experts, policy makers, and stakeholders.

The need to promote a more diverse workforce in cultural heritage conservation is forthright; however there are barriers to overcome. The barriers, which can be overcome, include lack of cultural competency, funding, and meaningful mentorship. It was hypothesized that there is a lack of diversity in the field of conservation. It was also hypothesized that a low percentage of underrepresented populations, specifically Native Americans, are qualified as professional conservators. Interviews and surveys were piloted to analyze diverse cultural and professional backgrounds in the field of conservation. Factors influencing the lack of diversity in the field of conservation linked directly to the relationship between identifying as a Native American, a professional conservator, and having a college degree. Underrepresented groups working in museums fell below 1% and did not have the education and skill sets needed to facilitate conservation practices as professionals. Native Americans fell below .5%. Statistically, a conservator is 9 times more likely not to be Native American than a conservator who is not Native American. The data collected from this study will impact the design of future conservation degree programs for underrepresented populations; and may serve as a resource to overcome the barriers and issues of diversity, equity, inclusion, funding, and access to cultural heritage conservation.

Dr. Martina Dawley (Hualapai/Navajo) is a faculty member and the Assistant Curator for American Indian Relations at the Arizona State Museum (ASM) at the University of Arizona. Dr. Dawley's responsibilities include managing ASM's Southwest Native Nations Advisory Board, serving on ASM's repatriation, exhibit, and faculty committees, facilitating consultation and collaboration with tribal communities, working as adviser, mentor, and collaborator with university students and faculty, and researching the intersection of American Indians and museums. Her research focuses on Native Americans as conservators in museums and the factors that determined their career path; including ongoing statistical research of underrepresented populations in the field of museum conservation.

Discussion on Active Use of Catholic Items Beyond Research and Outside Special Collections Custody

Barbara Hebard

Special collections at Boston College, including the University's Archives, are housed in the Honorable John J. Burns Library. Burns Library staff work with students and faculty to support learning and teaching at Boston College, offering access to primary sources through instruction sessions, exhibits, and programming. The Burns Library also serves the research needs of external scholars, hosting researchers from around the globe. The Burns Library is home to more than 250,000 volumes and over 700 manuscript collections, including holdings of music, photographic materials, art and artifacts, and ephemera. The Burns Library, a part of a Jesuit, Catholic institution, sometimes receives unusual requests for use of its holdings; in this talk, artifacts relating to the Catholic faith.

My talk will primarily focus on two items, a processional crucifix and a bible. The 19th century crucifix, significant because of historic as well as liturgical value, presented both usage and storage challenges for the library. I will go over the discussion held in the library regarding appropriate treatment and contextual display of the crucifix. This will cover the decisions about its exhibition during the Boston College sesquicentennial through locating suitable storage on the campus afterwards. The interdepartmental discussion included the Library Director, Archives, and Conservation personnel. The crucifix has been in regular liturgical use in Boston by the Jesuit community since before the founding of Boston College, 1863, to the present day. Because of this continued need for access, the participation of this stakeholder community was vital to the proper care and handling of the processional crucifix, particularly when transported off campus.

Additionally, I will talk more about the role of the conservator in the treatment of the crucifix and assistance to prepare the crucifix for use. The conservation and preservation issues surrounding the loan of a bible presented different challenges. The bible, historically significant as the first Catholic bible printed in the United States, is known as the Carey Bible. The printer of this bible, an Irish emigrant named Mathew Carey, worked for Benjamin Franklin in Philadelphia until he was given funds by the Marquis de Lafayette to start his own printing firm. A request for use of the bible was made by US Senator Edward Markey, BC '68, and BC Law '72. Senator Markey wished to use the Carey Bible for his ceremonial swearing-in at Boston's Faneuil Hall on the evening of August 8, 2013. I will discuss the loan challenges: condition of the book, handling, and location. That location, however, proved to be an excellent venue for a contextual display of the bible. Faneuil Hall, built in 1743, houses an assembly hall that has hosted numerous swearing-in ceremonies. The Burns Library encourages faculty, students, and researchers to use primary sources and rare books in their courses and research. The Carey Bible while in the hands of Senator Markey served as a lesson for students, demonstrating in a notable way, the usage of the book during its history prior to being donated to the library.

Barbara Adams Hebard, Conservator of the John J. Burns Library at Boston College, is a graduate of the North Bennet Street School bookbinding program. Ms. Hebard is a member of the Guild of Book Workers and the Ticknor Society. She is a Professional member of The American Institute for Conservation of Historic and Artistic Works, a Fellow of The International Institute for Conservation of Historic and Artistic Works, and Board Member of New England Conservation Association. She frequently exhibits books of her own design nationally and internationally. Ms. Hebard also enjoys writing articles on book related topics.

Diversity and Inclusion at the Minnesota Historical Society: A Conservation Perspective

Thomas J. Braun

For many years, the Minnesota Historical Society has striven toward greater diversity and inclusion in our programming. We have dedicated several recent exhibits to local minority and refugee groups, specifically exhibits related to the local Hmong community and the local (continental) Indian community. Our next major exhibit will focus on our local Somali community and will open in June of this year. In the early 1990s, the sub-Saharan country of Somalia began to be regarded as a failed state, mainly due to the struggle for power among tribal groups and due to a number of famines. A civil war broke out, and military forces from the United Nations attempted to try and stabilize the situation, with moderate success. Unfortunately the fighting resulted in the deaths of more than a quarter of a million people. Around 150,000 Somalis, both refugees and non-refugees, migrated to the United States in the aftermath. As of 2013 there were an estimated 25,000 Somalis in Minnesota, and according to United Nations estimates from 2015, more Somalis live in Minnesota than any other U.S. state. Beginning in late 2015, the Minnesota Historical Society began planning an exhibit focusing on Somali history and the local community. Our exhibits staff teamed up with staff from the Somali Museum of Minnesota, located in Minneapolis. This paper will update AIC on the progress on this exhibit, with particular emphasis on what we have learned about interpreting these groups within our local community.

Thomas J. Braun is the Head of Conservation and the Senior Objects Conservator at the Minnesota Historical Society (MNHS). Tom holds a BA in Art History from the University of Minnesota, an MA in Art History from Tufts University, and an MS in Art Conservation from the Winterthur/University of Delaware Program in Art Conservation.

Format Changes and the Dignity of Asian Art and Its Heritage

Yoshi Nishio, Michael K. Lee

This paper discusses the cultural integrity of Asian art and the dignity of Asian paintings as the primary focus. Format changes in Asian scrolls and screen paintings will be discussed. Art objects are created by the artists and "born" new with their integrity intact. As the art object passes from patron to patron over its lifetime, the

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integrity and even the dignity of the object can be altered while in the possession of the owner, art dealer or even while in the hands of a cultural institution where the traditions of art appreciation and understanding of the cultural heritage differ. The conservation profession should not address only the artist's intentions but must also focus on the cultural intent and respect that heritage to the utmost degree possible and preserve the object within that context.

Changing an object's format was often done for the purposes of financial gain, ease of transport, handling and display and even sometimes for preservation purposes. Bearing this in mind, we will discuss the challenges of conserving a "five panel" 17th century Japanese folding screen, the extensive discussions of the historic and cultural context and how it influenced the conservation goals required to preserve this artifact. This paper will also address the long tradition of changing the format of art objects from fusuma sliding doors to folding screens, hanging scrolls to framed panels, and lengthy hand scrolls into multiple sections for ease of display. In each case we address the restoration of "dignity."

Yoshi Nishio is the President and Conservator of Nishio Conservation Studio. His studio specializes in Asian Painting Conservation. Mr. Nishio received his MA and Certificate in Conservation from the Cooperstown Graduate Program. He worked at the Freer Gallery, Smithsonian and the Museum of Fine Arts, Boston, and he received the Smithsonian Award in recognition of his work in 1985. He was a consecutive visiting lecturer at the Buffalo Conservation Center from 1987 through 2000. Mr. Nishio has presented numerous papers on techniques of Asian painting conservation at the AIC Annual Meetings during the past 30 years. Mr. Nishio has been using video for conservation documentation since 1990 and his hobby, making video documentary, has become his profession. This video documentary is his first commissioned work.

Michael K. Lee has worked as a professional in the field of paper conservation since 1985. His expertise includes the conservation of works of art on paper, photographic materials, archival documents, and large format objects. He has extensive experience in managing a busy conservation lab, and has performed conservation surveys and onsite evaluations for major institutions throughout the eastern U.S. Michael has lectured on a wide variety of conservation topics. He is a graduate of the Cooperstown Graduate Program in Conservation, and is a Fellow of the American Institute for Conservation (AIC).

Diversifying Conservation in the U. S.: What's Happening Now?

Ellen Pearlstein and Laleña Arenas Vellanoweth, Debra Hess Norris, Joyce Hill Stoner, Caryl McFarlane, Ian McClure, Shannon Brogdon-Grantham, Dana Moffett, Renée S. Anderson, Sheila Payaqui, Casey Mallinckrodt*

60-minute presentation and discussion

When we think about the composition of our profession, most of us think about Caucasian women privileged enough to undertake the extensive preparation needed for admission to graduate programs. This assessment was corroborated by The Andrew W. Mellon Foundation Art Museum Staff Demographic Survey published in July 2015. This study found that non-Hispanic white staff members

dominate professional positions, including conservators, in art museums across the country. A detailed look at the 494 museum conservator respondents analyzed within that survey shows that 87% are white, 4% are Asian, 4% are Hispanic, 1.4% are African American, and 2% are all other groups. How can this be possible, given the impressive history of initiatives taken to address this imbalance, including an FAIC-Bay Foundation initiative supporting underrepresented students in summer museum internships, Winterthur-University of Delaware's work with Historically Black Colleges and Universities (HBCUs), and the National Museum of the American Indian, Arizona State Museum, and the Museum of New Mexico's important work with tribal communities?

Once again, there are a number of strategic initiatives underway that are designed to address this imbalance, each with its own set of successes and challenges. The AIC has assembled an Equity and Inclusion Working Group to examine "mechanisms to assess issues of race and diversity whose implementation will result in a more inclusive organization," and, by extension, a more inclusive profession. Internship opportunities for pre-baccalaureate and undergraduate students are being developed that target students from underrepresented backgrounds, as defined by the Mellon Demographic Survey. These opportunities are being offered at the UCLA/Getty Program in the Conservation of Archaeological and Ethnographic Materials, the Virginia Museum of Fine Arts, Winterthur-University of DE, Yale University's Institute for the Preservation of Cultural Heritage, the National Museum of African Art, and pan-institutionally at a number of other Smithsonian museums. While many of the past efforts included many partners, there is a current increased emphasis on coordinated efforts to effect change.

The panel will include representatives from five of these institutions; each will present for three to five minutes, lightning round style, about current and past initiatives and respective successes and challenges. These presentations will be followed by 30 minutes of discussion between panelists and audience members, in order to summarize best practices to date with the goal of designing future initiatives to achieve the most successful outcomes.

- Ellen Pearlstein and Laleña Arenas Vellanoweth, 5 min.
- Debra Hess Norris and Joyce Hill Stoner, 5 min.
- Caryl McFarlane, 3 min.
- Ian McClure, 3 min.
- Shannon A. Brogdon-Grantham, 3 min.
- Dana Moffett and Renée S. Anderson, 5 min.
- Sheila Payaqui and Casey Mallinckrodt, 5 min.

Renée S. Anderson, PhD, is Head of Collections at the Smithsonian's National Museum of African American History and Culture (NMAAHC), coordinating programmatic activities for collections management as well as for the pan-Institutional diversity internship program funded by the Andrew W. Mellon Foundation. In addition to this project grant, Dr. Anderson serves as Principal for a Mellon grant to NMAAHC that works to identify and train members of the next generation of museum professionals committed to the conservation and curatorship of African American history and culture, helping to enhance the diversity of talent and perspectives in the museum vocation. She holds a Ph.D. in Clothing and Textiles, a M.S. in Textile Science from Virginia Polytechnic Institute and a B.F.A. in Fashion Design from Virginia Commonwealth University.

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Shannon A. Brogdon-Grantham is the Photograph and Paper Conservator at the Smithsonian Museum Conservation Institute (MCI). She is a 2015 graduate of the Winterthur/University of Delaware Program in Art Conservation where she focused on photograph conservation and had minor concentrations in paper and preventive conservation. She holds a B.A. in art from Spelman College. Prior to her current position, Shannon was a Smithsonian Institution Post-graduate Fellow in the Conservation of Museum Collections and was based at the Hirshhorn Museum and Sculpture Garden. Shannon has held internships at the Center for Creative Photography, Paul Messier, LLC – Conservation of Photographs and Works on Paper, the National Museum of the American Indian, the National Museum of African Art, Southern Art Conservation, LLC, the Robert W. Woodruff Library – Atlanta University Center, and the Emory University Michael C. Carlos Museum. Shannon has also performed collection surveys and assessments of photograph and paper-based collections for the Longwood Gardens Archive and the Spelman College Archive. Shannon is active in her professional organizations and is a member of the American Institute for Conservation and the Vice President of the Washington Conservation Guild.

Catherine (Casey) Mallinckrodt is an assistant object conservator at the Virginia Museum of Fine Arts where her primary focus is the technical analysis and conservation of the African historic arts collection through an Andrew W. Mellon funded project. The project involves public outreach and mentoring interns and students. Casey received a MA in conservation at the UCLA/Getty Program in the Conservation of Archaeological and Ethnographic Materials and previously received a MFA in sculpture from Yale University. She has been a Kress Fellow in Object Conservation at the Museum of Fine Arts Boston and worked at the Museums of New Mexico in Santa Fe, the State Antiquities Museum of the Netherlands in Leiden, and on the Coffin Conservation Project at Tel el Amarna Egypt.

Caryl McFarlane, PhD, is the current Executive Consultant for The HBCU Alliance of Museums and Galleries. McFarlane is the former Senior Program Officer of the Woodrow Wilson National Fellowship Foundation. She is an independent higher education consultant who has expertise in fundraising and strategic planning as well as in the development and facilitation of non-profit organizations. She focuses on bridging diverse students with majority institutions through creative programming and through the networking of invested and interested partners in foundations, universities and other organizations. She is currently working with the Diversity and Inclusion Office in the Princeton University Graduate School.

Ian McClure moved to the USA when he was appointed the Susan Morse Hilles Chief Conservator at Yale University Art Gallery and Conservation Advisor for the Yale Center for British Art in 2008. In 2014 he was also appointed Chair of the Steering Committee for the shared Conservation Laboratory of the Institute for the Preservation of Cultural Heritage (IPCH), a conservation and research center for all Yale's collections on Yale's West Campus. The Conservation Lab designed by Samuel Anderson Architects was completed in 2015. McClure trained as a painting conservator at Glasgow Art Gallery and Museums and was appointed Head of Paintings Conservation in 1978. In 1983 he was appointed Director of the Hamilton Kerr Institute, a department of the Fitzwilliam Museum, University of Cambridge, a center for paintings conservation and research and

the graduate education of painting conservators. He was appointed Deputy Director (Conservation) of the Fitzwilliam Museum in 2004. His research interests include the history of conservation, most recently a history of conservation at Yale with Irma Passeri and Mark Aronson in the Burlington Magazine, and the structural treatment of panel paintings. He is an UK ICON accredited conservator/restorer. He has curated three exhibitions on the issues of conservation of art objects, the most recent, co-curated with Laurence Kanter and Lisa Brody, was *Time will Tell, Ethics and Choices in Conservation*, at Yale Art Gallery in 2010. He currently teaches an undergraduate seminar, *The Technical Examination of Art* and co-organizes the Summer Teachers Institute in Technical Art History in collaboration with the New York University Institute of Fine Arts, which is funded by the Samuel H. Kress Foundation. In June 2017 with Paul Messier he organized the HBCU students and Mentors program for Yale's Institute for the Preservation of Cultural Heritage with the support of the Kress Foundation.

Dana Moffett is Senior Conservator at the Smithsonian's National Museum of African Art and serves as Principal for the museum's Andrew W. Mellon Foundation grant focused on promoting training and diversity in the field. In addition, Dana serves on the Advisory Committee for the Smithsonian's pan-institutional Mellon-funded diversity internship program. Her work experience includes more than twenty years at the NMAfA as well as caring for African collections while in private practice, including the Stanley collection at the University of Iowa Museum of Art, the Nooter collection at the Virginia Museum of Fine Art and at African works at the North Carolina Museum of Art. Along with a degree in Archaeological Conservation from University College, University of London, she holds both undergraduate and master degrees in Anthropology. Dana has mentored numerous interns and fellows, many of whom are practicing in the field today.

Debra Hess Norris is Chair of the Art Conservation Department and Professor of Photograph Conservation at the University of Delaware where she has also held many senior administrative roles. Since 1985, Norris has authored more than 45 articles and book chapters and co-edited with Jennifer Jae Gutierrez *Issues in the Conservation of Photographs*. She has taught 130+ workshops for conservators and allied professionals and lectured on the preservation of photographic collections worldwide. Norris was chair of Heritage Preservation (2003 - 2008) and president of the AIC (1993-97). Today she also serves on the boards for the Historically Black Colleges and Universities Library Alliance and the Conservation Center for Art and Historic Artifacts, the Metropolitan Museum Department of Photographs Visiting Committee, and as a UD Trustee, among other interesting appointments. She holds many cherished awards, most recently the College Art Association/ AIC Award for Distinction in Scholarship and Conservation (2016).

Sheila Payaqui is Sculpture & Decorative Arts Conservator at Virginia Museum of Fine Arts. Payaqui joined the museum's conservation team in 2008 following previous appointments at the National Park Service, Queensland Art Gallery (Brisbane), Philadelphia Museum of Art, and the National Gallery of Art, Washington, DC. She received her BA in Studio Art from the University of California at Santa Cruz, and her MS in Art Conservation from the University of Delaware, Winterthur Museum.

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Ellen Pearlstein is a professor and member of the founding faculty in the UCLA/Getty Program in the Conservation of Archaeological and Ethnographic Material, where she teaches graduate classes in the conservation of organic materials, ethics of working with indigenous communities, preventive conservation and managing collections. In 2008, Pearlstein joined UCLA's Department of Information Studies, and invited students interested in library and archive materials into her preservation and management classes. Before 2005, Pearlstein was senior objects conservator at the Brooklyn Museum in New York for 22 years.

Pearlstein is the Principal Investigator for the Andrew W. Mellon Opportunity for Diversity in Conservation project at UCLA. She has taught and advised on local and international projects related to conservation of indigenous materials, featherwork, preventive conservation, and conservation education. Her research and publications include conservation of featherwork, including editing the recently published *Conservation of featherwork from Central and South America: effects of environmental agents; pre- and post-Hispanic qeros from the Andes; developing diversity within conservation, and curriculum development within conservation education.*

Pearlstein sits on the board of Connecting Cultures Mobile Museum, is a Fellow in the American Institute for Conservation, winner of the AIC Keck award, and President of the Association of North American Graduate Programs in Conservation.

Joyce Hill Stoner, PhD, has taught for the Winterthur/University of Delaware Program in Art Conservation for 41 years and served as its director for 15 of those years. She has lectured at Howard, Morgan State, and Hampton Universities and hosted students from Spelman, Fisk, and other HBCUs for treatment projects in paintings conservation at Winterthur Museum. Both an art historian and a practicing paintings conservator, Stoner has treated paintings for many museums and private collectors and was senior conservator of the team for the five-year project of examination and treatment of Whistler's Peacock Room at the Freer Gallery of Art in Washington, DC. Stoner has authored more than 85 book chapters and articles, and over the last decade has been studying the paintings of the Wyeth family.

With Rebecca Rushfield she edited *Conservation of Easel Paintings*, Routledge, 2012, with 79 international authors. Following the advice of George Stout, Stoner founded the international oral history project for the Foundation of the American Institute for Conservation in 1975. She has conducted more than 55 of the 350+ interviews with pioneer conservators, conservation scientists, and interested art historians now available to researchers. She received the CAA/Heritage Preservation Award for Distinction in Scholarship and Conservation-2011, the award for outstanding contributions from the AIC-Paintings Specialty Group-2011, and the AIC/University Products Lifetime Achievement Award-2003.

Laleña Arenas Vellanoweth is a textile conservator in Los Angeles, CA. She received her B.S. in Biochemistry and B.A. in Art from California State University, Los Angeles and MA in Art History and Certificate in Conservation from the Institute of Fine Arts, NYU. She has interned at the Museum of Modern Art, Cathedral of St. John the Divine, Peabody's Island Resource Center, and Los Angeles County Museum of Art. She has held conservation positions at the Costume Institute at the Metropolitan Museum of Art where she worked with collections and prepared exhibitions such as Alexander McQueen: Savage Beauty, and Natural History Museum of Los Angeles County.

She now currently works as an independent conservator at the Autry Museum of the American West, the Academy Museum of Motion Pictures, La Plaza de Cultura y Artes, and Los Angeles County Museum of Art. Laleña is also the Program Manager for the Andrew W. Mellon Opportunity for Diversity in Conservation and Adjunct Professor at California State University, Fullerton, teaching Introduction to Museum Conservation.

Infusing Multiculturalism into Conservation Education: Developing Culturally Competent Practitioners

Melissa Tedone

Diversity, equity, and inclusion form the core of a critical, ongoing conversation in the conservation profession, one drawn out from the wings onto center stage by Sanchita Balachandran's courageous address two years ago at the AIC Annual Meeting in Montreal. Addressing these deficiencies in our profession will take a multiplicity of efforts among our colleagues of all backgrounds, and will require both a looking-outward and a turning-inward as we assess the political, educational, economic, and cultural forces that have created the current state of the profession. This work will take many forms: outreach, facilitated conversations, strategic partnerships, assessment, and scholarship.

One such effort has recently launched in the Winterthur/University of Delaware Program in Art Conservation (WUDPAC). Dr. Adam Foley, Associate Director in the University of Delaware Office of Equity and Inclusion, and Dr. Melissa Tedone, Affiliated Assistant Professor for Library & Archives Conservation, have initiated a three-year longitudinal research study to assess the WUDPAC curriculum content and delivery through a multicultural lens, and to gauge the awareness and understanding of current WUDPAC students about issues of diversity, equity, and inclusion as they progress through their conservation education.

The study defines "multiculturalism" as work to restructure education so that all students acquire the knowledge, attitudes, and skills needed to function in an ethnically and racially diverse nation and world. Multicultural education seeks to ensure educational equity for members of diverse racial, ethnic, cultural, and socioeconomic groups, and to facilitate their participation as critical and reflective citizens. Furthermore, multicultural education seeks to provide students with educational experiences that enable them to maintain commitments to their community cultures as well as to acquire the knowledge, skills, and cultural capital needed to function in a multiculturally-inclusive global society.

Drawing on Dr. Foley's expertise in multicultural curriculum design, this study will serve as a pilot study for WUDPAC, and potentially for other training programs and cultural heritage institutions. Meaningful partnerships between cultural heritage preservation professionals and multicultural education practitioners may offer one path to truer representation within the conservation field, in turn reflective of a richer valuing and safeguarding of cultural heritage for all. As one such partnership, the WUDPAC research study may influence dominant cultural attitudes within the field, benefit conservation recruitment

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efforts, and positively impact diversity among conservation graduate school applicants, future WUDPAC students, and the conservation profession at large.

Melissa Tedone is Book & Library Conservator at Winterthur Museum, Garden, and Library. She holds a PhD in Slavic literary history from Yale University, and an MSIS with a Certificate of Advanced Study in the Conservation of Library and Archival Materials from UT Austin. In addition to her work as a practicing conservator at Winterthur, she teaches the Library and Archives Conservation major in the Winterthur/University of Delaware Program in Art Conservation (WUDPAC). She is passionate about conservation education and advocacy, libraries, and sustainability, and she serves as Chair of the AIC Sustainability Committee (2015-2017). Her current research interests include Russian papermaking and bookbinding history, the industrialization of American book production in the nineteenth century, and the relationship between digitization and the conservation of physical textual artifacts in philosophy and practice.

Dialogue on Race and Experience in Conservation and the Museum Field

Laleña Arenas Vellanoweth, Shannon A. Brogdon-Grantham, Lylliam Posadas, Jennifer Kim

Results from the recent Andrew W. Mellon Foundation Art Museum Staff Demographic Survey show the field of conservation suffers from an even more pronounced lack of diversity than the racial homogeneity found across museum staffs broadly. A deep and systemic shift in the mentoring and training of American conservators is required if the profession wishes to mirror the country's demographic transformation and become a socially ethical endeavor. In practice, diversity is needed so that the field can have the myriad perspectives and voices needed to sensitively and appropriately work with diverse communities, especially those historically disenfranchised, to preserve their heritage. A first step for self-reflection as a profession would be to de-center the predominant voices in the field and listen to the experiences of the limited people of color who have thus far managed to create a small place in conservation.

Four colleagues will share stories of their individual journeys and obstacles, to include: choosing their field, interning/preprogram, applying for graduate school education, navigating graduate school, and emerging as museum professionals and conservators. They will discuss how these experiences have affected their work in conservation and their current commitments to work on diversity and equity in the field. Laleña Arenas Vellanoweth is a Textile Conservator in Independent Practice. Shannon A. Brogdon-Grantham is the Photograph and Paper Conservator at the Smithsonian Museum Conservation Institute. Jennifer Kim is the Objects Conservator at the Autry Museum of the American West. Lylliam Posadas is the Repatriation and Community Research Manager at the Autry Museum of the American West.

After a brief discussion of personal experiences, case studies will be presented on anonymous (real) museum and conservation workers' experiences tackling engagement and response to racial

prejudice within their respective institutions. Afterward, conversation will open to individuals' reactions to the case studies, creative solutions and practices.

Conversations on race and experience can be challenging, but can also provide opportunities for engaging, open and honest reflection and understanding. While working towards an inclusive environment, dialogues like these can foster a stronger conservation community that is not only inclusive on paper, but inclusive of personality, cultural beliefs and experience.

Laleña Arenas Vellanoweth: see previous page.

Shannon A. Brogdon-Grantham: see page 15

Lylliam Posadas is the Repatriation and Community Research Manager for the Autry Museum of the American West and was previously Assistant Curator of Archaeological Collections at the Fowler Museum at UCLA. Lylliam holds an MS in the Technology and Analysis of Archaeological Materials from University College London, and a BA in Anthropology and Psychology from UCLA. Lylliam is interested in the development of institutional policies on repatriation, research access, and collections care that value a flexibility and adaptability that allows for culturally appropriate protocols and perspectives to influence and be integrated into museum practice. Lylliam is currently developing strategies to increase indigenous community access to collections via digital means which will assist in collaborations with formal representatives to re-evaluate and better inform collections catalogues and museum collecting histories. Lylliam is also examining how institutions can come together to improve standards of care for indigenous material culture.

Jennifer Kim is an objects conservator at the Autry Museum of the American West and works seasonally at the the Archaeological Exploration of Sardis, Turkey. She has also held conservation positions at the Academy of Motion Picture Arts and Sciences and the Natural History Museum of Los Angeles County. Ms. Kim received her MA in History of Art and Archaeology and Certificate in Conservation from the Institute of Fine Arts, NYU, and received her BA in Art History from the University of California, Berkeley.

Opening General Session

Materiality and Immateriality in Conserving Contemporary Art

Glenn Wharton

Conservators of contemporary art have responded to conceptual, ephemeral, and time-based media with new theoretical models and strategies for practice. Along with the need for new approaches to manage variability and change on a conceptual level, material matters persist in the new objects of contemporary art. Collected materials include deteriorated plastics, desiccated food, and obsolete playback equipment. Following artist expressions about their work, these objects may be conserved in a traditional manner or may be allowed to deteriorate over time. They may also be replicated or be migrated to new technologies.

An examination of recent literature reveals tensions in discussions of materiality and immateriality for contemporary conservation objects. Often these tensions derive from artist statements, or directives regarding the future disposition of their work. Some authors write about the language of materials, with concern when unintended alteration communicates new meaning to the viewer. Others point to patina that develops on material manifestations of conceptual art that were meant to be ephemeral but were nonetheless collected. Interviews with artists expose complex responses to the status of these accidental testaments from past installations. Time-based media conservators face similar dilemmas, for example with commercial monitors purchased somewhat randomly by artists such as Nam June Paik. They accrue historic value over time and are seen as important evidence of the past, regardless of the artist's original intentions.

Some recent models for understanding materiality and immateriality in contemporary art are adapted from theory across the humanities and social sciences. Nelson Goodman's distinction between autographic (object-based) works and allographic (performed and re-produced) helps us understand authenticity in variable works that radically change through migration and replication. Similarly, the model of object biography was adapted from anthropology to conceptualize both physical changes and the layering of social meanings that artworks accrue over the course of their lives.

Conservators of contemporary art also draw from theory, practice, and professional ethics developed for traditional conservation objects to help them navigate new issues around materiality and authenticity. Recent attention has been given to the likes of Ruskin, le-Duc, Riegl, and Brandi to revisit earlier questions of preservation vs. use, noble and vile patina, and aesthetic reintegration in conservation. Notions of risk, sustainability, and minimal intervention also influence recent thinking about the materials of contemporary art.

This presentation will trace how material and immaterial matters are treated in contemporary art conservation literature and emerging models for practice. Through analysis of the literature, an argument will be made that the values and professional

ethics developed for traditional conservation objects serve new models for objects of contemporary art that are less bound by traditional material concerns.

Practicing What We Preach: An Argument for the Recognition and Preservation of a Material Culture of Conservation

Carrie McNeal

Though we often think of modern conservation as a "young" field, the truth is that our history becomes longer with every passing day. The importance of establishing a historical record for our field has long been recognized. Substantial progress has been made through efforts such as the establishment in 1975 of the FAIC Oral History Project and more recent scholarship that considers the history of key figures, institutions, and events. Some important aspects of our history, however, have still received little to no attention. This presentation argues that, in addition to the development of a historical record, it is important to recognize and preserve the material culture of conservation. As exemplified by the theme of this year's AIC meeting, the conservation field is partly defined by materials: those that we preserve, but also those that we use in our work. So, too, is our history.

Examples of this material culture range from those objects which are already symbolic of conservation, such as Edward Forbe's pigment collection, to historical treatment records and photography, to previously conserved objects that now serve not only as an example of the history of their own genres, but also as an indication of conservation's past and development. The preservation and future study of these objects in the context of the history of conservation will be integral to the success of ongoing scholarship in the history of conservation and of closely allied fields such as museology and art history. Study of field-specific material culture has long been an important aspect of the history of medicine, science, and archeology. This presentation will use examples of this scholarship and its effects to argue for the importance of recognizing the existence of a material culture of conservation, identifying which artifacts may fit into this category, and taking steps to preserve them now. After all, if we do not preserve our own history, who will?

Preserving Innovation: Considering the Treatment and Materiality of 3D-Printed Objects in Museum Collections

Vanessa Applebaum

As of 2018, it is now possible to 3D-print a vast array of object-types including art, jewellery, clothing, medication, bones, and human organs. 3D printing also has an emerging presence in the cultural heritage and museum sectors: there have been 3D printing exhibitions at various institutions, with an increasing number of 3D-printed objects accessioned into the permanent

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collections of museums.

Despite the increased popularity of 3D printing and its use in the museum world, it is curious that greater consideration has not yet been given to the conservation of 3D printed objects. There seems to be no academic information or journal articles that describe the correct handling or treatment of 3D manufactured objects, with most literature focused on 3D scanning and printing as methods of digital preservation and replication. Due to the dearth of information on the conservation of 3D printed objects, this presentation will attempt to begin a dialogue on the matter. The intent is to demonstrate the complexity and scope of knowledge required for the conservation of 3D printed objects, as well as how conservators should understand and subsequently approach their unique and varied materiality.

In 2013, London's Science Museum put on a temporary exhibition entitled "3D: Printing the Future." The exhibition included approximately 600 3D printed objects, which were composed of many different materials (including plaster, plastic, metal, ceramic, and animal cells) and were manufactured through a wide range of 3D printing processes. In 2015, close to 10% of the objects were accessioned into the permanent collection. Conservators at the museum must now devise a treatment plan with no information or precedent to guide them, as they confront the possibility of future degradation or damage to the objects. This presentation is based upon research and work as an objects conservator at the museum, and the contention that in order to provide optimal care and implement appropriate treatments upon an object, or group of objects, there must be a basic understanding of the object-type.

The Science Museum's exhibition "3D: Printing the Future" is an ideal lens through which to view the potential for conserving 3D printed objects as they are produced today. Expanding upon the exhibition, the paper discusses the applicability of existing conservation guidelines and practice when considering 3D printed objects. As new materials are developed, and 3D printed objects become more integrated into contemporary culture and manufacturing, they will undoubtedly become increasingly accessioned into museum collections. It will, therefore, become essential to understand how to ensure their longevity. This presentation confronts many issues, including the need for adequate documentation, the possibility of replication, the extent to which 3D printing presents new conservation challenges, and, significantly, how can and should these objects be conserved?

The Physical Nature of Digital & What it Means for Conservation

Crystal Sanchez, Lauren Sorensen

In working with digital collections, we are often asked, "What is digital? Where are the collection materials actually held? What does digital collection's storage look like?" In an increasingly wifi-bluetooth-mobile-data world, digital can seem invisible to us as end users, however the digital world is highly dependent on technology that has material form- physical hardware, network wiring, and often entire buildings of carefully monitored and controlled infrastructure.

What does this mean for art conservators? The material science of digital files held in our care is important to consider: how a file is constructed and how it tells us how it needs to be opened, played, or understood. However, equally important is the storage that those files are held on, how they are transferred from one place to another, and how they are handled at each stage of this move. What are the physical aspects that make up the storage environments of digital storage? And which of these aspects are critical for us to understand as conservators? The NDSR Levels of Digital Preservation provide a nice one-sheet listing tiered guidelines for storage, integrity, security, etc. for a digital preservation system, and the OAIIS reference model gives us a framework from which to build out our digital preservation storage. But what is digital preservation storage, anyway? Is it specific hardware that is different than other digital storage that we purchase for our personal lives?

For the past 10 years, the Library of Congress has been convening an annual "Storage Meeting" to discuss digital storage for collections material among collection holders and storage technologists. And out of the iPres2016 workshop, and now in draft form, is an initiative to create guidelines for collecting organizations on Preservation Storage Criteria. These are a good start to understanding digital preservation storage and may lead us towards a conversation on digital conservation practices. When we understand the material nature of the digital world around us and the physical components that make up our digital ecosystem, we can more effectively care for our digital collections through the lens of the conservation field, create policies and assess risks in digital care and handling, and work productively and in partnership with our IT colleagues.

Imaging Technology

High-Resolution Imaging as a New Research Tool in the Rijksmuseum

Susan Smelt, Robert Erdmann, Rik Klein Gotink, Petria Noble, Gwen Tauber, Carola van Wijk

With the conservation treatment of the two pendant portraits by the Dutch 17th-century Master Rembrandt van Rijn (*Portrait of Marten Soolmans* and *Portrait of Oopjen Coppit*, 1634, canvas, 207.5 x 132 cm, SK-A-5033, SK-C-1768), newly acquired by the Dutch and French Governments, the Rijksmuseum saw an opportunity to push their photographic imaging capabilities even further. Although the Rijksmuseum has a well-established imaging protocol, including consistent lighting and end-to-end color management, it was decided, given the importance of the paintings and their conservation treatment, to utilize high resolution (1200 ppi) and multiple imaging modalities. Additionally, in order to better understand the physical condition of the pictures, they were imaged at each stage of conservation using the same imaging techniques, facilitating high-precision stitching and registration of images of both paintings and across wavelengths. The stitched and registered images, each exceeding 6 gigapixels, were then visualized using the “curtain viewer,” an internet-based image viewing technology developed by Erdmann for the Bosch research and conservation project.

For this high resolution photography the museum faced several challenges. For the overall images of these large paintings, a total of 242 images were required. This amounts to approximately 70 Gb per painting per imaging modality. The maximum storage capacity of the Rijksmuseum’s Digital Asset Management (DAM) software is currently only 2 Gb per file. It was also an enormous undertaking to stitch such a large number of composite images and register them for use in the curtain viewers, enabling the conservators to fluidly switch from an overall image to the micro level and back using only the mouse wheel. In this way, different technical and chemical images of the paintings, including X-radiographs, ultraviolet fluorescence images, infrared photographs and reflectograms, and elemental maps acquired with macro-XRF scanning, could be selected and compared “side by side” using the curtain viewer.

Despite the challenges, the images have been indispensable for the conservation treatment, providing insight into painting technique and condition including degradation phenomena. For example, lead soap aggregates can clearly be discerned in the high resolution visible light images, and remnants of older coatings in the high resolution UV images. By comparing photographs from before, during and after treatment the conservators could precisely track the area of interest during different stages of treatment. This paper presents the impressive benefits for conservation and research of such a large multimodal data set resulting from the combination of high resolution and multiple imaging modalities. We argue that such imaging strategies could serve as a standard in the future, both for art-historical and conservation research, as well as for comprehensive documentation of the state of a painting and its treatment.

A Study of Two Picasso Blue Period Paintings in the Collection of the Art Gallery of Ontario, *La Miséreuse accroupie* (1902) and *La Soupe* (1903)

Sandra Webster Cook, Kenneth Brummel, Dr. Francesca Casadio, Dr. John Delaney, Gianluca Pastorelli, Emeline Pouyet, Dr. Marc Walton

In anticipation of a multi-disciplinary exhibition devoted to a reassessment of Picasso’s Blue Period (with the Phillips Collection, Washington, in 2020) the Art Gallery of Ontario (AGO) engaged Senior Imaging Scientist John Delaney and the special expertise of scientists at Northwestern University and the Art Institute of Chicago (NU-ACCESS) to study two important Picasso Blue Period paintings: *La Miséreuse accroupie* (1902) and *La Soupe* (1902-3).

The research has provided valuable insights into the artist’s process with a particular focus on his materials, the relationship of underpainting to the visible composition, the chronology of the pentimenti and the relationship of all forms to extant drawings and other paintings of the period. Diffuse hyperspectral infrared reflectography was used to expand on the results of traditional infrared reflectography and x-radiography of both paintings. Fibre optics reflectance spectroscopy (FORS) was also collected from numerous sites to help with pigment identification. Hyperspectral image cubes consisting of ~200 images (spectral range 967 to 1680 nm) were generated.

Significant changes in composition were revealed in both paintings. One of the major findings was that *La Miséreuse accroupie* is painted over another composition estimated to be by an artist and friend of Picasso, in Barcelona at the time. In addition, reflectance transformation imaging combined with photometric stereo provided detailed information about the brush strokes as well as the application of colour, and served to clarify complexity in the surface texture. New findings were further explored with point and 2D macro-X-Ray Fluorescence analyses. Elemental maps revealed more subtle changes in the composition of the underlying paint layers. It also helped selecting sites from which cross-sections were sampled, to potentially elucidate the chronology of the image changes. A complex stratigraphy was frequently revealed.

Micro-sampling analyses allowed further differentiation of the artist’s palette in the development of the painting and will be discussed within the context of current Blue Period Research. In depth studies of Pablo Picasso’s painting materials and techniques, though rare in the past, have seen a resurgence in the past ten years. This study is exemplary because of the high level of integration of curatorial, conservation and conservation science research. Curatorial input on visual sources for the artist, in the form of related drawings and artworks has accompanied the analytical campaign hand in hand, influencing, directing and inspiring interpretation of the scientific imaging. Furthermore, two different groups of scientific experts have been involved, thus pushing the limit of interdisciplinary research beyond the boundaries of a single discipline or institution in a fully integrated, not consultancy-based framework. This study greatly enhances our knowledge of the AGO Picasso Blue Period paintings and their relationship to other paintings and drawings of the period by drawing on a global network of experts and increasing body of knowledge.

Optimizing Imaging Modalities to Improve Understanding Materials

Fenella G. France, Meghan A. Wilson, Chris Bolser

Imaging has been through the fashion cycle with a move away from the importance of materials analysis through microscopy, back to the current realization of how different imaging modalities complement each other. Spectral imaging utilizing controlled and modified modes of illumination provides a synergistic approach to materials analysis, while also mapping the spectral response of all materials across a document or object to augment the workflow for analysis by knowing what other regions on heritage materials require additional analytical techniques for characterization.

The spectral imaging system at the Library of Congress was carefully customized to incorporate a number of imaging components that allow for multiple types of materials information within a single capture sequence. The base imaging sequence begins with reflected illumination throughout the visible and invisible range single LED illumination wavebands with a monochrome camera that assists with the full range of data in a high resolution 16-bit TIFF file. This is followed by raking (or side lighting at specified angle) illumination in both the blue and infrared (IR) regions of the spectrum to capture the topography of the object, and provides extremely useful information about production techniques, tool marks, etc. and indentations remaining if ink or pigments have been eroded. The IR often shows the base substrate material without covering by inks and colorants. Raking at 90-degree angles or more essentially provides the information often associated with RTI. All image sequences are fully registered, greatly improving the productivity and workflow for processing of the image stack, as no re-registration is required since there is no filter used for the base sequence.

Understanding materials refers not only to their characterization, but also to tracking change over time due to the impact of treatments, natural aging or specific environmental parameters. A standardized process for assessing any variation from the baseline has been invaluable for assisting the assessment of conservation treatments as well as change due to exposure to light or other factors, without the need for additional micro-fading. Additionally, z-plane imaging (focusing at multiple levels) adds a three-dimensional component and is enhanced within the workflow process by the inclusion of a laser for controlled layering. A fluorescent wheel incorporates multiple broadband filters to capture and enhance the fluorescent response for greater ease of characterization between similar colorants to assist pigment identification. Extending our understanding of materials is assisted with the addition of transmitted illumination, through a selected spectral range. The incorporation of transmitted imaging into the base sequence allows a combination of reflected and transmitted captures to be used in spectral processing and provides invaluable information about the impact of treatments on materials, disturbances with the base substrate, and imaging through treatments such as lamination. Overall, a structured standardized approach to integrated spectral imaging provides a thoughtful and nuanced approach to a better understanding of materials, while allowing for the potential of additional information to be captured from a diverse modality imaging methodology.

A New Workflow for Color and Tone Calibrated Multispectral Imaging

Marina Ruiz Molina, Anna Serotta, Scott Geffert, Ashira Loike

Multispectral imaging has become a critical analytical tool in the examination and documentation of cultural heritage. But despite the popularity of this technique there are numerous impediments to standardization and repeatability. Within a single institution, the Metropolitan Museum of Art, we found that approaches to capture, processing, archiving methods, and even terminology varied significantly between the various conservation labs. This talk will introduce the ways in which the Met has begun to address these issues, and will focus specifically on our efforts to standardize a reliably repeatable in-house image capture workflow that can be adopted both internally, and across institutions.

Our work is indebted to the CHARISMA project (Cultural Heritage Advanced Research Infrastructures: Synergy for a Multi-disciplinary Approach to Conservation/Restoration) spearheaded by the British Museum. CHARISMA made great strides in presenting a capture methodology and an open source solution for standardization of post processing; however, our efforts at unifying our results through CHARISMA met with limited success. Rather than relying on post-processing to standardize results, our methodology uses scene referred capture, which uses targets to correct for color, tone, and white balance during the capture process to achieve a successful image regardless of the camera, lens, and light source used for capture. We started by creating a protocol to capture visible light images, the backbone of which leverages the new ISO19264 artwork reproduction standards. Images are captured using an X-rite Color Checker Digital SG Card and a Munsell Linear Grayscale, and we chose to use Adobe Lightroom to evaluate captured images, as it is one of the few applications that gives a read-out for L* values. Through the evaluation of the targets, we are able to obtain a color profile that falls within the acceptable range of color fluctuation as defined by ISO and tone curve for any camera and lighting set-up that can be applied to all subsequent images. The same color profile and tone curve obtained through this process can then be applied to the multispectral imaging suite, including Ultraviolet-induced Visible Luminescence imaging, Visible-induced Infrared Luminescence imaging, Ultraviolet-reflected imaging and Infrared-reflected imaging. Through using this workflow, we have found that one is able to achieve repeatable, high quality images and produce similar results across multiples set ups.

This paper will share the step-by-step details of this workflow and case studies for which this workflow has been applied in Objects Conservation, Paper Conservation and other labs at the Met. Additionally, ongoing research on light sources and other aspects of multispectral imaging practice will be presented.

Integrating Multispectral Imaging, Reflectance Transformation Imaging (RTI), and Photogrammetry for Archaeological Objects

Emily Frank, Chantal Stein, Dr. Sebastian Heath

This project utilizes a 3D-model built with photogrammetry as scaffolding for the combined display and analysis of other types of imaging data, such as Reflectance Transformation Imaging (RTI), and broadband Multispectral Imaging (MSI). Photogrammetry, RTI, and broadband MSI are well-established imaging techniques widely used by cultural heritage professionals. These techniques have seen rapid adoption by archaeologists and conservators working together in the field. While recognizing that no technique produces a perfect or undistorted representation, the data that this project integrates complement each other very effectively and result in high-resolution and visually expressive renderings that emphasize physical shape, surface variability, and spectral properties. Combining techniques facilitates very detailed study and visualization of an artifact that both highlights otherwise invisible features. Furthermore, it can effectively communicate these aspects without requiring direct inspection or handling of the object.

Three-dimensional models were built of a stone object from Sardis, Turkey and an Egyptian painted wood fragment using Agisoft Photoscan Pro. RTIs were created of the worked surfaces of each using the RTIBuilder 2.0.2 available from Cultural Heritage Imaging (CHI). MSI images were processed with the add-in for nip2, the graphical interface of the free processing system VIPS, developed as part of the CHARISMA project, available from the British Museum. So-called “connection images” were used to integrate and align the data sets. These evenly lit images, taken with the same camera position and parameters as the auxiliary data sets, are included in the set of images used to build the 3D model with photogrammetry. The data sets were combined and visualized using Blender, an open-source 3D graphics and animation software. We stress that this project uses software, equipment, and methods that are readily accessible to conservators and archaeologists in museum photo studios and in the field.

We have also established a workflow for combining potentially any source of imagery. This technique shows promise for many applications where advanced visualization can contribute to analysis and conservation treatment, particularly in situations where ongoing contact with the object is limited or ill advised. In summary, the successful combination of RTI, MSI, and photogrammetry data sets results in 3D models that support compelling interactive visualization and analysis of archaeological materials.

Using Photogrammetry to Understand the Mechanical Behavior of Bound Volumes

Alice Carver Kubik, Jean-Louis Bigourdan, Douglas Nishimura, James Reilly

Image Permanence Institute (IPI) has been studying the chemical and mechanical stability of collection materials for thirty years. One area of focus has been on the rate of moisture equilibration

of library and archive materials. That research has led us to understand that it may take weeks or even months for an entire bound volume to equilibrate to a change in ambient relative humidity. However, experiential evidence demonstrates that the outer layer, or “skin,” of a book can react quickly to certain environmental changes leading to potential mechanical deformation. Studying the mechanical behavior of books is particularly challenging as they are three-dimensional, complex, composite objects made of diverse materials and constructed in a variety of ways.

IPI is currently using a photogrammetry technique called Digital Image Correlation (DIC) to further our understanding of the mechanical behavior of common library and archive materials as well as the “skin” of bound volumes. Individual materials such as paper, book cloth, leather, and parchment were tested as well as bound volumes that range in date from early 18th century to late 20th century. Book samples are bound with a variety of materials and have varying structures, including tight back, hollow back, and perfect bindings in full, half, and quarter leather, cloth, and paper as well as full vellum bindings. DIC is a relatively new imaging technology that allows for the study of dimensional changes in two-dimensional and three-dimensional objects. A random dot pattern is applied to the test material and imaged in stereo. Software analyzes the images and measures dimensional displacement within the material producing 2-D and 3-D strain models. Of particular interest is the correlation between moisture transfer and strain, and the amount of strain experienced in bound volumes with changes in environment. This data will help determine the upper and lower limits of temperature and relative humidity necessary to avoid permanent deformation and will better inform our models for sustainable preservation environmental parameters.

Material Questions

The Colors of Desire: Examination of Colorants in the Beauties of the Yoshiwara

Michele Derrick, Michiko Adachi, Joan Wright, Richard Newman

Woodblock prints, first produced in Japan during the sixth to eighth century, progressed from early black line prints, sometimes with hand-applied color, to vibrant full color printed images by late 18th century. Publishing proliferated in response to the literate population’s desire for books and affordable imagery. Prints and printed books, with or without illustrations, became an integral part of daily life. Known broadly as *ukiyo-e*, literally meaning pictures of the floating world, these prints depicted Kabuki actors, beautiful women, scenes from history or legend, views of Edo, landscapes, and erotica.

The Museum of Fine Arts, Boston (MFA) collection of Japanese woodblock prints numbers over 50,000, representing the full-range Japanese woodblock printing development. From 1998, when the first conservator dedicated to this collection was hired, work has been ongoing to document, treat, and re-house this vast collection and thus enable its use in exhibitions, scholarship, and

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research. While numerous literature studies have been conducted on the history of the printing techniques and materials, the MFA's study is the first to use a combination of visual and non-invasive spectroscopic techniques to systematically identify the thin layer(s) of inorganic and organic colorants on Japanese woodblock prints. The combination of the large study set and the ideal analysis techniques have provided the MFA with the unique opportunity to fully characterize the palette and techniques on these prints.

To illustrate the range of results obtained from this large-scale study, this presentation will examine a sampling of the techniques and palette used for the 1770 printing Harunobu's five volumes of Beauties of the Yoshiwara. Every illustration was surveyed using a stereo binocular microscope to determine which colors were overprinted to create new tones. The illustrations were also viewed under ultraviolet radiation to reveal the characteristic fluorescence or absorption properties of the individual colors. Following these visual inspections, colors were examined by three spectroscopic analysis methods that did not require sampling. X-Ray Fluorescence (XRF) provided information on the chemical elements found in inorganic pigments. The red and yellow organic colorants, such as madder, safflower, sappanwood, turmeric, flavonoids, and gamboge, were indicated by Excitation Emission Matrix (EEM) fluorescence. Fiber-optic Reflectance spectroscopy (FORS) was used to readily distinguish between dayflower and indigo blue, even in mixtures that appear green or purple. The parameters of the analysis methods were thoroughly vetted using printed references of traditional Japanese colors that were prepared in-house. This combination of techniques, both visual and spectroscopic, was critical towards gaining a better understanding of the materials and techniques used for the prints.

Explosive Beauty: Material Studies of Cai Guo-Qiang

Rachel Rivenc, Michael Doutré, Vincent Dion, Vincent Beltran

Cai Guo-Qiang is one of the most prominent contemporary Chinese artists active today. Based in New York, he works and exhibits internationally. Cai uses a wide variety of media, including paintings, installations, videos, but has become especially known for his systematic use of gunpowder to create gunpowder drawings and paintings, some of them on a very large scale. For almost three decades, he worked mostly with black gunpowder but has recently (2015) started using colored gunpowders to produce more sensuous and lavish compositions. He also uses gunpowders and fireworks to create ephemeral explosion events and community projects. Cai's works encapsulates many of the issues inherent to contemporary art, such as the adoption of a non-artistic process as a signature medium, as well as working across a wide variety of genres and media including some traditional ones all the way to ephemeral practices, community participation and the incorporation of new technologies.

The GCI has embarked on a collaboration with the studio to systematically document the materials and processes used by Cai Guo-Qiang for his work across media. The goal is to understand how the adoption of gunpowder has influenced Cai's artistic

practice; how his use of materials has evolved throughout his career; and the artist's attitude towards materials, making, and conservation. The interdisciplinary approach combines numerous interviews with the artist, technical examination of a large corpus of gunpowder drawings, paintings and installations (including early transitional works mixing painting with gunpowder), scientific analyses, as well as the use of microfadeometry and artificial weathering to predict the aging of some of his work such as the colored gunpowder paintings. This paper will detail the findings of the project to date and explore the role that material studies can play in the understanding, interpretation, display, presentation and preservation of Cai's work.

Martin Ramirez's Creative Compulsions: The Composition, Construction and Conservation of His Monumental Collaged Drawings

Harriet K. Stratis, Ken Sutherland, Mary Broadway

Like many "outsider" artists who were not championed by the art establishment until late in their careers or well after their deaths, Martin Ramirez was until recently a somewhat mysterious figure. The details of his biography were scant and the 42 years that passed between his death and their coalescence in a 2015 biography by Victor Espinoza bred apocryphal tales of his artistic process. Ramirez immigrated to the United States from Mexico, worked for a time, and then found himself homeless on the streets of Los Angeles only to be incarcerated into the state's mental hospitals for the last decades of his life. His isolation and diagnosis as a catatonic schizophrenic fueled rumors that without access to art supplies, he was compelled to squeeze grapefruit to make ink from their juice and to macerate bread, mashed potatoes, and cereal to make adhesives.

While it is true that Ramirez's circumstances necessitated ingenuity, such descriptions of his desperation detract from the technical skill, sophisticated visual lexicon, and thoughtful revisions that he employed in the production of some 400 extant drawings (as well as many more destroyed by hospital staff) over a period of three decades. Fashioned from papers that Ramirez removed from waste paper baskets and magazines, from the cafeteria's paper placements and napkins, and from paper bags of all sorts, the artist's collaged supports are works of art in their own right that possess a tactile three-dimensional quality. His imagery includes trains running into tunnels, men on horseback, towering madonnas, and Spanish colonial-style architecture.

In anticipation of the inaugural exhibition of the new Institute of Contemporary Art in Los Angeles (ICA LA), a large number of Ramirez's works housed in Chicago collections were examined and conserved. Among them, a monumental 18-foot-long drawing that Ramirez constructed from hundreds of scraps of paper would become central to the exhibition after a major conservation intervention. To better understand Ramirez's materials, technical study and scientific analysis were undertaken to characterize the adhesives and various components of the drawing media and colorants. Research into arts education in public schools and institutions like

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the ones in which Ramirez lived was also undertaken to determine what products were available to students and patients alike in the 1940s, 50s, and 60s. Combined with observations made during the conservation treatment of the large drawing noted above, as well as 14 others, a better and more precise understanding of Ramirez's materials, his methods of constructing his supports, and the types of damage to which they are susceptible over time, will be presented.

Connecting the Dots: Visitor Interaction in Contemporary Art Collections

Anouk Verbeek, Gwynne Ryan

Contemporary artworks are often comprised of unconventional materials, concepts, and formats. Together with the fact that the requisite display often precludes the use of platforms or vitrines, the ability to differentiate between the boundaries of what comprises the artwork and the degree of interactivity can become challenging to the museum's visitors.

In 2017, the Hirshhorn Museum and Sculpture Garden hosted the exhibition "Yoyoi Kusama: Infinity Mirrors," putting on display an oeuvre characterized by a mix of brightly colored wall paintings, soft sculptures on platforms, inflatable artworks suspended from the ceiling or sitting directly on the floor, and immersive mirror rooms for visitors to enter. This exhibition exemplified the inconsistencies of allowable interaction, and also posed a unique opportunity of studying the artworks in a range of settings across the venues. This show, therefore, became the focal point of an expansive and ongoing exploration into visitor interaction in contemporary art collections. The methodology of this research has been highly collaborative in nature.

Over the course of the exhibition, human behavior in the galleries was observed and discussed on many levels throughout the institution and included a wide range of departments. Collection Management, Conservation, Visitor Services, Security, Communications, and Exhibits all came to the table with a range of perspectives and experiences that guided the overall approach and development of systems during the exhibition. Much was learned through these discussions with the added benefits of closer interdepartmental relationships and a broader view across the Museum of the issues regarding visitor interaction and the intersection of staff roles. The strategies that were adopted during these discussions have also been applied to future exhibitions that pose similar challenges.

Taking advantage of the full run of the exhibition, HMSG fellow Anouk Verbeek is following the exhibition "Yoyoi Kusama: Infinity Mirrors" as it travels to five other venues in North America. This continuation of her initial research includes monitoring the considerations of gallery layout, visitor flow, signage, staff involvement, and free versus paid admission. Observing the same artworks in a different setting and environment and with different demographics of visitorship will give insight into both overlapping and differing issues regarding visitor interaction. By communicating with colleagues at all venues, as well as other museums worldwide, and learning from each other's mistakes and

successes, we will hopefully get closer to creating a clear image of the issues—and possible solutions—posed by visitor interaction in contemporary art collections.

An Enlightened Perspective: Balancing Artist Intent with Conservation Concerns

Sarah Scaturro, Christopher Mazza

Rei Kawakubo, the avant-garde fashion designer and founder of the fashion label Comme des Garçons, is known for her provocative ability to push past boundaries. Unsurprisingly, the monographic exhibition organized by the Metropolitan Museum of Art's Costume Institute in cooperation with Kawakubo, "Rei Kawakubo/Comme des Garçons: Art of the In-Between," was in many ways the antithesis of a typical museum exhibition. Standard exhibition practices, such as displaying objects on platforms and maintaining safe touch distances, were abandoned in allegiance to Kawakubo's larger creative vision that espoused democracy and public access. The most challenging conservation aspect was the lighting design: a diagonal grid of over 300 72"-long T12 Fluorescent lamps that had the potential to illuminate fashion objects to a projected 123 foot candles.

As with all exhibitions involving living artists, the Costume Institute conservators engaged in constructive dialogue with the designer in order to reach a solution that balanced Kawakubo's wishes with conservation concerns about high light levels. Paramount to the conservators' approach was using conservation ethics as the guiding framework structuring decision-making and compromise efforts. Significantly, the exhibition was the first and only authoritative exhibition sanctioned by the designer herself and the majority of the objects were from the designer's archive, two factors that led the conservators to accept the lighting design in theory, although with modification to ensure conservation requirements for museum objects. The use of UV-filters and an iron-clad damage waiver provided additional conservation and legal protections.

In recognition that the ultimate lighting design still fell far short of normal conservation standards, the CI conservation team seized the opportunity to collect valuable data that could inform future exhibition design. To achieve this objective, the CI conservation team took a wide-ranging approach that included the following measures: testing CI objects selected for exhibition using a microfader to identify each object's potential for light damage; testing actual light levels against projected light levels to assess the precision of the light modeling software Autodesk Revit; tracking lamp lumen depreciation (light intensity) over the course of the exhibition to more closely calculate cumulative light exposure; and placing blue wool standard cards throughout the exhibition as a means to evaluate possible cumulative light damage through pre- and post-exhibition colorimetry measurements. Through this aggregation of data the CI conservation team endeavored to gain the broadest understanding of the many variables that converge when lighting an object over the course of an exhibition, especially when artistic intent must take precedence over standard conservation requirements.

Between Subtle and Silent: The Conservation of Max Neuhaus' *Sound Figure* at the Menil Collection

Bradford Epley, Sarah Thompson

In 2006 the Menil Collection commissioned Max Neuhaus to create a sculpture for the museum's main building using the artist-specified medium of sound. The resulting work, *Sound Figure*, was inaugurated at the museum's entrance two years later. Neuhaus died the following year and despite combined efforts of the artist, his consulting audio engineer and the Menil to plan for the preservation of the work, it has operated only intermittently since 2011.

Sound Figure will be used as an introduction to Neuhaus' permanent installations in the United States and Europe while examining specific components of his works that present conservation challenges, including programming created to automate the works and corresponding websites designed for maintenance and monitoring. An additional complicating issue revolves around the technical means by which *Sound Figure* actively adjusts output to maintain a consistent relationship to ambient noise levels—a distinguishing feature that points to new directions the artist's work was taking prior to his death.

Using excerpts from Neuhaus' 2008 Artists Documentation Program interview and the treatment history of *Sound Figure* as a case study, the opportunities and challenges presented by the work in recent years will be explored: the discrepancy between the preservation plan provided by the artist at inception and the actual needs demonstrated over time; the accelerated rate of hardware and software incompatibility leading to the ultimate failure of the artwork; the unanticipated need to quantify the audio output prior to replacing components; the role of consultants, the artist's estate and other stakeholders in resolving functionality issues; and the experience and training opportunities this multi-faceted project has presented to emerging conservation professionals.

Material Transfers & Translations

Tauba Auerbach's *Altar/Engine*: A Case Study in Reconceptualizing Materiality

Megan Randall, Peter Oleksik

On December 12, 2016, the Museum of Modern Art acquired Tauba Auerbach's 2015 work *Altar/Engine*. The work consists of 76 Rhino files 3D-printed into individual plastic components of various types, resins, and finishes that are subsequently installed in a specific pattern on a nine-foot square highly finished painted aluminum platform and stainless steel base. It quickly became apparent to the artist and MoMA staff that in the short time since its creation, many of the material aspects had changed in significant and unacceptable ways.

This paper will examine the steps the artist and MoMA took to ensure the work met the desired standards of the artist which resulted in a collective redefinition of its materiality. This

redefinition, or reconceptualization, impacts its treatment, display, and long-term care. Fifteen of the 76 3D-printed components significantly changed since their 2015 creation and were subsequently reprinted by the artist after acquisition. Changes were primarily indicated by breaks in the 3D-printed structures or in deformation of coiled forms. The components are printed in four distinct visual types: white, black, frosted clear, and gold. The components in need of reprinting were the white, frosted clear, and painted gold types. This process revealed necessary changes in aspects of the printing process from the resin to the printing company that resulted in alterations to the texture and appearance of the components.

Although accepted and approved by the artist, these changes led to a dialogue with the artist to develop MoMA's understanding of the artist's parameters of visual and material acceptance as well as a protocol for caring for the work moving forward. The goal of these initial reprinting efforts was to increase the stability of the components for long term storage and display. However, their complexity and fragile nature will likely necessitate future printing by the artist and/or MoMA. This brings up larger questions of the relationship of the Rhino files with their 3D physical counterparts and where the work's fundamental materiality is located. Changes in files, software obsolescence, upgrades in printing and polymer technology can all drastically impact a work depending on the definition of its materiality. As contemporary artists are gravitating to new materials and methods, this case study will illustrate MoMA's examination of the relatively nascent method of 3D printing. Combining expertise from various disciplines of conservation, namely sculpture, media, and science, MoMA is developing its approach to the long term care of 3D printed material. This strategy considers its evolving status both in the artist's practice as well as mutable objects in the collection, touching on issues of maintenance, storage, and travel. This paper will also explore the possibility of refabricating components in the future, while addressing the likelihood of changing technologies with regards to the media files, the printing process, and polymer technology.

Whitney Replication Committee: Transparency in the Age of Reproduction

Margo Delidow, Clara Rojas Sebesta, Farris Wabbeh

Since its 2008 inception, The Whitney Museum of American Art's Replication Committee has explored ethical and practical considerations related to the reproducibility of works of art in the collections for purposes associated with the Museum's mission. Museum objects have been replicated, reformatted, and altered in various ways for a variety of reasons. While transformation has always been a part of the history of museum objects, these types of interventions have become even more pervasive in the last decade, especially as a conservation treatment option. Often, these activities have a profound impact on the object itself, either physically, conceptually, or both.

At the outset of Committee discussions, it became clear that it was necessary to frame the context for replication by defining a set of vocabularies and language through which the range of such

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practices is understood. Initially, it was believed that the development of such protocols would subsequently apply to other artworks under review. However, the thinking of the group began to evolve as the Committee attempted to contextualize replicated works.

Using replication case studies, the presenters will outline the dynamics of the Committee's decision making process. They will explain the rationale used to define the Museum's institutional criteria for works that are fabricated, refabricated, or replicated, and the challenges in establishing systems which capture transformations that are more complex in nature. This process includes producing transparent information and documentation, clearly alerting our audiences to these changes, and allowing for a more complete understanding of the work as a materialized object at a moment in time.

Flaming Pearls and Flying Phoenixes: Materiality, Research, and Stewardship of Liao Dynasty Metalwork

Evelyn Mayberger

Metalwork from the Liao Dynasty (907-1125 CE) displays material and technical mastery that draws on the metalware and gilding traditions from the Tang and Song dynasties in China. When the nomadic Khitan people created the Liao polity, their military dominance, worldview, and cultural tastes culminated in a rich physical heritage. The Museum of Fine Arts (MFA) Boston has three opulent Khitan funerary objects in its collection: a Mongolian-style gilded bronze saddle (with original wooden substrate), a pair of gilded silver boots, and a gilded silver crown. The choice of precious materials, employment of specialized knowledge, and incorporation of kingship iconography highlights the importance and power of these objects within the culture of the Liao Dynasty. The discovery of these highly decorative and luxurious objects in noble tombs suggests they served a ritual function within the burial customs of elites. The manufacture of utilitarian forms (e.g. saddle and boots) in prized materials unsuitable for functioning objects highlights the importance of the nomadic identity even in death. Decorative programs incorporating flaming-pearls, phoenixes, dragons, ruyi clouds, scrolls, and vegetal motifs employ a Buddhist visual vocabulary common in the Liao Dynasty. Through their funerary objects, the individual identities can be contextualized and encapsulated through the manipulation of physical materials. This materials-based interpretation is grounded in scientific analysis (e.g. energy-dispersive x-ray fluorescence, electron microprobe, Fourier-transformation infrared spectroscopy, and wood identification) and imaging (e.g. x-ray radiography and reflectance transformation imaging) in conjunction with research of other Liao Dynasty comparanda.

Transcendancy of materials in the pursuit of form can embed meaning and cultural significance in ways not readily apparent. The sheet metal used to make the gilded silver boots were cut to form in a manner similar to the textile footwear counterpart while the unusual choice of metal substrate (i.e. pure copper) for the saddle complicates the traditional interpretation of this equine apparatus.

Increased awareness of the Liao Dynasty metalwork tradition and new archaeological finds are slowly changing the narrative of the Khitan people from "barbaric" nomadic outsiders to cultural-empowered elites. The MFA initially acquired and understood the gilded silver crown as a Korean flat plaque; however, this interpretation was soon abandoned with subsequent archaeological excavations and the discovery of similar forms in the shape of a crown. In the early 1960s, museum restorers decided to reshape the plaque, using the annealing process, to its current crown form. This significant intervention and other smaller treatments (i.e. reducing tarnish, passivating active corrosion, and stabilizing structural breaks) illustrates the degree museum restorers and later conservators re-contextualized and cared for these Khitan funerary objects. Treatment decisions are scrutinized against their historical frameworks as new technologies (i.e. three-dimensional imaging and printing) offer exciting avenues of research and options for display and accessibility. As the museum strives to understand these enigmatic objects, the Liao Dynasty funerary metalware continues to offer a glimpse into the material mastery of the Khitan people and the world in which they lived.

Collecting Collections: Negotiating the Complexities of Material Value at the National Park Service

Joannie Bottkol, Margaret Breuker, Angela Campbell

In the 101 years since its inception, The National Park Service (NPS) has been overseen by 18 United States Presidents and 27 Secretaries of the Interior, while amassing a collection of over 50 million accessioned objects. Thirty-six million of those objects reside in the NPS's Northeast Region. Examples include a Buddhist altar table owned by Henry Wadsworth Longfellow, a 19th-century Japanese screen collected by Laurance Rockefeller, a glass and plastic inkwell used by Maggie Walker, and numerous outdoor monuments.

The care and upkeep of these pieces is in part the responsibility of just seven regional objects and paper conservators. With such thinly stretched resources (when evenly divided, each conservator is responsible for a stunning 5.1 million objects), it is important to have a clear understanding of the cultural value of the materials we care for, and to whom (or to what) we, as conservators, are ultimately held accountable, as we collaborate with one another, with Park stakeholders, and with contracted conservators. In many ways, the decision-making process used to determine a treatment is no different for an NPS Conservator than it is for a museum or private-practice conservator: we, too, are responsible to colleagues as well as administrative supervision (with the caveat that our administration changes entirely every four to eight years) and our decisions, in keeping with section II of the AIC Code of Ethics, are governed by "an informed respect for cultural property, its unique character and significance, and the people or person who created it."

That said, one of the most challenging complexities of the National Park Service is that, unlike most museums or private individuals who collect discrete objects, the NPS collects

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collections — currently over 2,500 of them. In essence, these collections are the objects. In telling the story of the creators of these “objects,” we become primarily responsible to Henry Wadsworth Longfellow, rather than to the worshipper or monks who commissioned the elegant altar table, which was altered by the Longfellows to serve as a sideboard in their dining room, and to Laurance Rockefeller, rather than to the 19th-century Japanese artist who surely intended his spectacular flying cranes screen to be shown with all six of its panels, rather than used with only five, and to Maggie Walker, whose civil rights activism is memorialized in her home as it was at the time of her death in 1934.

It is imperative, of course, to study and understand the materials of individual objects before proposing or beginning treatment. And treating the object with care and respect is always essential. The unusual circumstances of the National Park Service, however, necessitate a third step: contextualizing and assigning value to the narrative of the collector or collection so that we may support that vision and share it with future generations. This paper will discuss the complexities of this decision-making process and how we, as conservators, are responsible for not only the objects themselves, but also for their historic (versus historical) interpretation.

Natural History Collections

Moose on the Move: Relocation and Conservation of the Bell Museum’s Diorama Murals

Kristy Jeffcoat, Luke Boehnke, Megan Emery, Don Luce, Tom Amble

Established by the state legislature in 1872, the University of Minnesota’s Bell Museum of Natural History has a long history of preserving, researching, and displaying the diverse plant and wildlife of Minnesota. In the late 1930s, then-president of General Mills and conservationist James Ford Bell helped provide funds to construct a dedicated museum building on the Minneapolis campus, which opened in 1940. The driving force behind Bell’s contribution was his desire to educate the public about Minnesota’s diverse wildlife and habitats, and encourage public support for their protection, especially declining species such as the gray wolf.

The Bell museum was designed specifically to showcase 16 large-scale dioramas, as well as several small and medium size dioramas. The first diorama constructed in the new space was the Gray wolf diorama sited on the shores of Lake Superior, with a background painted by well known American wildlife artist and Minnesota native Francis Lee Jaques (1887-1969). Over two decades, Jaques painted a total of nine large scale and many small diorama backgrounds for the Bell Museum, creating an internationally recognized collection with a focus on Minnesota’s wildlife and diverse ecosystems. Over time the dioramas didn’t appear to change, however, the building around them posed serious challenges and limitations. Poor climate control, reoccurring water infiltration, lack of handicap accessibility, and poor public access created the need to discuss options.

After ten years of debate and planning, the decision was made to build a new Bell Museum on the St. Paul campus, opening summer of 2018, which would include the move of Jaques’ nine large scale dioramas and a tenth painted by Charles Abel Corwin in 1919. The planning phase also led to the creation of a project team, including Bell museum staff, a construction crew, conservators, riggers, and museum specialists. Examination of the painted murals by conservators indicated that removing the canvas from the wall was not viable as it would severely damage the painted image and create a health hazard. Due to the size of the murals and constraints of the existing building the best option was to move the mural walls in three parts. Therefore, a plan was developed in which the murals would be stabilized, cut, secured with armature, and rigged out of the building. The team carried out a test move in January 2016. After the test was completed successfully, the project was fully approved and in January 2017 the diorama move began. While moving the foreground material was part of the overall scope of the project, this presentation will focus on the relocation and conservation of the murals. Preparation, structural fortification and rigging, reassembly and conservation of the components in the new building will be covered. Completion of the project yielded murals intact and structurally stable with no visible sign of the adventure they had been on.

Preserving Penn’s Woods: The Restoration of the Mammal Hall Dioramas at the State Museum of Pennsylvania

Eugenie Milroy, Rachael Perkins Arenstein, George Dante, Stephen C. Quinn

The Hall of Mammals was one of the first permanent exhibitions planned for the State Museum of Pennsylvania (SMOP) in Harrisburg. It opened to the public in 1968 after almost a decade of research, preparation and construction by a team of artists and scientists. In the years since, it has remained beloved by visitors. The space features thirteen site specific habitat dioramas. These large-scale exhibitions incorporate taxidermy, dried plant specimens and fabricated plant materials, all arranged within a sculpted foreground that ties in with a curved illusionistic background painting. The dioramas were individually designed to depict groups of animals at a known location, season and time of day. This sense of place was reinforced by attention to detail in lighting, pose and positioning of specimens.

Many similar exhibits were installed in institutions across the country, not only in Natural History museums, but also in more general and university collections whose staff often designed versions to elucidate the indigenous regional flora and fauna with an educational goal and subtext encouraging land and wildlife conservation. Several of the species depicted in the Mammal Hall were already long extinct in Pennsylvania at the time of construction. Featured creatures range in size from the relatively diminutive striped skunk to the imposing bison. In addition to plants, the illusionistic materials they created include, trees, rock formations, snow, ice, running and still water, eggs, mud and many others.

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The media and methods employed in the creation of habitat dioramas are not codified, but rather the practice was local and idiosyncratic. Earlier in the century, dioramas were made from a more predictable pallet of materials. However, the SMOP dioramas comprise a wide range of traditional artist's materials as well as commercially available products such as modern artist's materials and commercially fabricated plants, often combined in unusual ways.

Beginning in the Summer of 2016 our team of taxidermists, conservators and artists began a restoration of this historic Mammal Hall. The open design of the light boxes above the diorama shells had long allowed infiltration of particulates and debris into the exhibit spaces. Many of the diorama elements had become discolored from dust and/or fading and some of the plants were no longer configured in a naturalistic manner. The animals had experienced significant fading. The water surfaces were dusty and irregular in their surface sheen and the snow was piled in heavy drifts against the glass at the front of the winter dioramas as the snowfall had often been "topped off" from above. Previous treatment, including a refurbishment in the 1990s by some of the original artists, had introduced incompatible new materials, overpaint and coatings posing significant treatment challenges. This talk will focus on the documentation and treatment of the dioramas with an examination of the condition of various materials used in the foregrounds and how subsequent treatments affected their longevity and behavior during the current campaign.

Ongoing Investigations into the Use of Metal-Complex Solvent Dyes for Recoloring Faded Hair and Fur

Julia Sybalsky, Fran Ritchie, Paul Whitmore, Lisa Elkin, Judith Levinson

In an ongoing multi-year research project, the American Museum of Natural History, in partnership with Yale University's Institute for the Preservation of Cultural Heritage (IPCH) and the Peabody Museum of Natural History, is investigating metal-complex solvent dyes as a reversible means for recoloring faded taxidermy. The project has unfolded in three phases. In the first (published in the Pre-Prints of the 2017 ICOM-CC Triennial Conference), accelerated light aging was used to establish the lightfastness of 25 BASF Orasol dyes, as well as selected commercially available equivalent colorants. This testing assessed the performance of dye deposits applied to quartz plate with a solvent carrier but no binding media, an application that is more germane to our recoloring protocol than the manufacturer's testing of Orasol dyes in polymer resins.

This talk will present results of two further complementary phases of the research project, which are intended to evaluate these materials in applications that better simulate object treatment. A key question is whether the lightfastness of the Orasol dyes is impacted by their application to fur substrates, which differ from quartz in their photochemical activity and optical properties. The results of our previous work (described above) enabled us

to reduce the number of dyes tested by excluding unacceptably fugitive materials. For this evaluation we applied the selected dyes to fur, exposed the dyed fur samples to accelerated light aging, monitored color change in the samples, and assigned Blue Wool rankings. A second key question is whether the presence of Orasol dye on a fur substrate can be expected to alter the rate of light-induced chemical degradation that fur will undergo in future display. Again, working with a reduced palette of relatively stable colors, fur samples were dyed and subjected to accelerated light aging. Using Fourier transform infrared (FTIR) spectroscopy to probe chemical changes in the fibers, we compared the chemical degradation of the fur in the dyed samples with undyed fur aged in the same conditions. This discussion will benefit conservators charged with the care of taxidermy on exhibit, as well as colleagues in allied fields, in contributing to a more complete understanding of the long-term impact and longevity of treatments using Orasol dyes applied to hair and fur.

Touring Nature's Treasures: The Conservation Challenges of Touring and Displaying Natural History Specimens

Nicola Harrison, Lorraine Cornish, Gillian Comerford

Since the Natural History Museum in London opened to the public in 1881, it has established itself at the forefront of natural history research and public engagement. This has involved a long history of in-house exhibition as well as international loan and touring exhibitions. The ambition and scale of these touring exhibitions has recently been raised substantially with the emphasis on display of original material. This presentation will focus on the first, and most complex, of these "specimen rich" touring exhibitions and the associated conservation challenges.

"Treasures of the Natural World" is a collaborative exhibition containing specimens selected from the 80 million collection items housed within several scientific departments at the museum. This included herbaria sheets, taxidermy, palaeontology, insects, gems and meteorites plus works of art on paper. Over three-hundred collection items required conservation evaluation and in some cases remedial treatment. The size of some specimens ranging from a complete Giant Ground Sloth skeleton to a small selection of iridescent orchid bees, raised logistical challenges and risks for their transport and display. In addition, the touring of Natural History specimens creates interesting challenges for care and conservation with the need to balance the differing display requirements of different materials. An understanding of material properties and deterioration was essential for the safe treatment, transportation and display of these specimens. The environmental and lighting requirements for all specimens had to be assessed and managed while enabling the grouping of specimens within their individual stories. In addition, careful conservation of specimens needed to be undertaken to ensure their stability for transportation between multiple venues over up to a five year period. Alongside these challenges, touring natural history specimens also raise unique concerns in relation to the transportation of fluid preserved

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specimens, specimens controlled by CITES regulations, and inherently hazardous materials. An understanding of the health and safety issues surrounding natural history specimens was also integral to the safety of team members. This presentation will discuss the Conservation team's response to these challenges and how our understanding of the varied nature of the materials impacted on these responses and outcomes.

Smudges, Snakeskins, and Pins, Oh My!

Nora S. Lockshin, William Bennett

The Smithsonian National Museum of Natural History, the Smithsonian Institution Archives (SIA), and Smithsonian Institution Libraries have collaborated since 2010 on the Field Book Project, involving cataloging, preservation survey and assessment, conservation treatment, digitization, and creation of an innovative crowd-sourced Transcription Center in order to make widely available our vulnerable, unique, scientific manuscripts and other archival documentation held in a variety of contexts within our collections and research departments.

The physical nature of field books at the Smithsonian varies widely in their size, media, format, and orientation over almost two centuries of scientific record keeping, making for a fascinating overview of structures (commercial and ad-hoc), styles, and secret surprises found in these sometimes intimate journals. Catalogers, collection managers, and volunteers from all over the world have reacted to and realized that these records, besides supporting original location evidence of a natural specimen collected, often hold much more unique contextual content. These include visual observations of color and behavior, hand-drawn maps, and notes on environmental conditions that may fill out missing data in the environmental record. Beyond their original purpose, the authors' entries also reflect humanity via the occasional tasty recipe, remarks upon life in the field, and also bear witness to societal and political changes, the stresses of which sometimes become remarkably poignant through observable changes in handwriting and care taken in writing personal correspondence.

This presentation will review guidelines and best practices that SIA has preferred for stabilizing, preparing, and conserving our original field books prior to and after digitization. Key to the core concept of connecting collections, special care is taken to identify and preserve in-situ inclusions (such as the eponymous moulted snakeskin) and other physical evidence that can be further linked to accessioned specimens. While low-tech minimal preservation actions can allow the collections manager to preserve these with a minimum of fuss, at times, the materiality of a field book can interfere with access, or cause great risk to the content, such that disbinding may be considered. Reversing vigorous prior interventions has been an especial challenge, where we advocate for the productive application of the sewn-boards binding as a useful tool in the archive and library conservator's kit as an excellent option for conservation rebinding (see also Poster Session - Application of the Sewn Boards Binding for Field Books and Pocket Journals).

Eggstraordinary: The Conservation and Mounting of Historically Significant Great Auk Eggs

Arianna Lea Bernucci, Douglas Russell, Duncan Jackson, Amin Garbout, Amy Scott-Murray

The Natural History Museum, Tring, UK is one of only a handful of institutions around the world that holds several Great Auk (*Pinguinus impennis*) eggs within its collection. Great Auks were hunted to extinction in the mid-19th century and there are less than 100 eggs known to be left in existence around the world. The eggs are not only important due to their rarity, but also their provenance. Each one has a significant history and previous owners include these important collectors: William Bullock, Lionel Walter Rothschild and Henry Baker Tristram.

The project initiated through a PhD thesis to investigate the surface and porosity structure differences among egg shells within the Auk family. The curator requested that specialist mounts be fabricated to hold and protect the eggs while carrying out the micro CT scanning in addition to remedial conservation treatments. All materials used had to be conservation grade as it was requested that the eggs be kept in these scanning mounts during the project. Two of the eggs exhibited severe cracking and were vulnerable to further damage and potential loss. All of the eggs were housed in acidic packaging (increasing the risk of Byne's disease) and inappropriately sized boxes. Repair and consolidation tests were carried out on experimental egg shells to formulate an appropriate treatment. The cracks were consolidated and repaired using Lascaux Medium for Consolidation and Lascaux 498HV (aqueous acrylic dispersions) with Japanese tissue paper. Failed adhesives from previous repairs were removed using laser ablation.

In addition to this, a 3D print of Bullock's Great Auk Egg was created from a 3D digital surface scan in order to fabricate a new mount and storage solution for the egg. This conservation project has comprised a multidisciplinary team from across the museum including a conservator, curator, engineer, 3D visualization specialist, micro CT scanning specialist and a PhD student. It has highlighted the conservation needs of our egg collections within the museum and demonstrated how the use of technology can contribute to mount fabrication. It is hoped that the materials and treatments applied in this case can be further applied to other fragile egg collections in institutions.

Problematic Materials

Modern Materials: Not Our Fault, But Our Problem. Reflections on the Development of Conservation Treatments in Private Practice

Delia Müller-Wüsten, Giuliana Moretto

The conservation of contemporary art, in private practice in New York City, operates within a vibrant and fast-paced art market. Contemporary Conservation Ltd. is daily challenged to strike a balance between the artist's intent, the unavoidable physical changes that materials undergo, and the satisfaction of our clients.

CONCURRENT GENERAL SESSIONS - DAY 2

Artworks entering the studio cannot be treated as if they exist in a vacuum. The decision-making process is guided by all parties involved, which can include: artists, galleries, auction houses, private collectors, insurance agencies, and appraisers. Treatment solutions need to be developed quickly with everyone's consent, while adhering to a framework of practices of conservation ethics. Works made of modern materials—especially plastics with industrially finished surfaces—are deceptively considered robust and unbreakable. An artwork made of unstable material can be subject to rapid unintentional deterioration, while lack of material knowledge may damage the work during handling and transportation. Restoring industrially finished surfaces is often challenging and requires extensive testing and research.

However, conservators in private practice lack the resources available to museums, dedicated time and an allocated budget for research. Therefore, a more treatment-based approach is needed and solutions are often achieved by trial and error. These two case studies on the conservation of artworks made of plastics illustrate this decision-making process, arising material challenges and the limits of physical treatment within private practice. Since the 1970s the prolific John McCracken (1934-2011) created highly polished polyester columns and planks. The pristine surfaces of these sculptures scratch easily, resulting in an overall dull appearance, which diminishes the experience of the artwork and compromises its authenticity. Over six years, 20 works have come into the studio demanding a systematic approach—the refinement of a polishing technique that allowed treating large surfaces in an adequate time frame.

During the course of several months, research was carried out and an exhaustive list of materials and techniques were tested until a well-balanced result was achieved. Between 2004 and 2012, Seth Price (b. 1973), a multi-disciplinary artist, created wall reliefs made of thermoformed high-impact polystyrene (HIPS) sheets. Due to the inherent brittleness of polystyrene and the tension induced during the production process, a number of these panels have developed cracks, which are not only visually disturbing but also structurally weaken the artwork. An immediate stabilization method for the cracks was necessary to prevent further exacerbation before it reaches a condition beyond recovery. Further research and testing is currently being carried out in order to assess and optimize the method. Meanwhile the degradation of the polystyrene will unavoidably progress and the shelf life of these artworks will always remain in question. Much can be gained by comparing the approach these two specific sets of problems present. With the current high turnover rate in the contemporary art market, it is becoming increasingly important to take the time to reflect on the quality of our treatments, their longevity, reversibility and how these actions preserve the artists' or artworks' legacy.

Managing Expectations in Scrapbook Conservation Approaches

Jennifer Hain Teper

Historic scrapbooks are one of the most problematic formats found in many library, archive, and museum collections due to their

complicated and deterioration-prone structures. Unfortunately, they are also one of the formats of greatest interest to historians and genealogists, among others. These often bedraggled books offer a wonderful and unique glimpse into history through the eyes of the individual or group who created them. Although some scrapbooks contain only duplicate printed information, such as newspaper clippings of current events on particular topics or collectable printed cards or illustrations, others contain a wide variety of materials such as photographs, postcards, letters, documents, and realia. In either case, however, scrapbooks can serve as a valuable resource for researchers. Unfortunately, due to the nature of their construction, their previous use, and the deterioration of their contents, many historic scrapbooks are in very poor condition and present a myriad of preservation challenges. These challenges range from binding deterioration and dangerously brittle paper to the often dramatic deterioration of their contents.

At the University of Illinois Library we hold a large number of such historic scrapbooks (nearly 1,000) broadly held in the collections of our University Archives, Student Life and Culture Archives, or Sousa Archives and Center for American Music. Condition, curatorial value, and use of these materials vary greatly, as do expectations from our archivists and curators on what "conservation treatment" may mean when items are brought to the conservation lab. Over the last ten years, treatments have ranged from over 100 hours per item for various full treatment approaches (including maintaining and preserving the original format, or completely removing items from their scrapbook format) to simple boxing, and everything in between. This variability in approaches has been particularly heightened recently by the planning for an upcoming exhibition and digitization project focusing on a single historical scrapbook from our Rare Book and Manuscript Library as well as several incoming requests to remove items from scrapbooks to be permanently housed separately from their original scrapbook. In an attempt to better manage curatorial expectations on what scrapbook treatment may involve and better articulate the benefits and drawbacks of more invasive conservation and/or disbinding, our conservation staff have been developing a more strategized and, perhaps, standardized approach to the conservation treatment of historic scrapbooks. This presentation will give an overview of some of our previous scrapbook treatment approaches, analyze the successes and failures of those treatments, and how we propose to better streamline our treatments as well as to better communicate with curators to arrive at agreed upon treatment approaches that meet their collections and users needs.

The Painting's Life, Silk or Paper: Materials and Methods for Lining a 15th-century Chinese Handscroll at the Cleveland Museum of Art

Yi-Hsia Hsiao

Asian scroll paintings are executed on delicate and fragile materials such as silk. Many of the aging scrolls already show different degrees of natural deterioration. For treating these scrolls, remounting and replacing the first lining is a crucial step to stabilizing the damages.

The first lining is also called Life paper, indicating that it is crucial to the life of a painting. Paintings on silk with the extensive loss to the silk support have been found lined overall with a sheet of silk to compensate/back-fill the losses. This is considered a “lazy” way to disguise losses as opposed to the method of infilling the losses individually with silk trimmed to the same shapes as the losses. Silk bonds much better to paper than it does to another layer of silk; therefore, lining a painting on silk with a whole sheet of silk requires thicker and stronger paste to bind two sheets of silk well. If two sheets of silk are not well adhered they will delaminate more readily with rolling and unrolling; these delaminations can eventually lead to losses to the painting silk. Is it true that lining with silk is a “lazy” way? Are there other reasons why an overall silk lining may be preferable in terms of the scroll’s context or the condition? Some Japanese Buddhist paintings are lined with a whole sheet of silk simply because silk is expensive and considered more luxurious and thus, is the best material to show proper reverence to the deity or deities represented in the painting.

At the CMA, a silk painting in a handscroll format had been treated in the past with an overall silk lining. This handscroll was recently remounted due to the delamination between the primary and lining silks. When the lining silk of this handscroll was taken off, extensive tiny losses and spider web-like creases were revealed with transmitted light. Here lies the crux of this discussion: if the losses are compensated using an overall silk lining, it might cause the same problem of delamination. If lined with sheets of paper, the losses then have to be infilled with trimmed silk, and with extensive losses, this is extremely time-consuming. Most of the losses are the size of pencil dots, so infilling with the same size of trimmed silk is impractical: there is not enough material (surface area) to paste down and the infills would just fall off due to poor adhesion. Furthermore, trimming the infill silk to the exact shapes of the losses and then reinforcing the inlaid perimeter would result in too many overlapping reinforcement strips. Finally, a painting will shrink or expand differently than the fills while drying, resulting in gaps around losses; with numerous tiny infills, all of the resulting gaps present a concern. In this presentation, the advantages and disadvantage of lining with silk or with paper for Asian silk paintings are compared and discussed. The filling and lining materials and methods for a 15th-century handscroll at the CMA are introduced.

Investigation of Cellulose Nitrate Motion Picture Film Chemical Decomposition & Associated Fire Risk

Dr. Mahesh Mahanthappa, Dr. Heather Heckman, Kathleen Mullen

Is deteriorated cellulose nitrate film relatively inert, “comparable to the flammability of paper,” as ISO standards state, or is it shock sensitive, presumably more like an explosive, as the Kodak MSDS for cellulose nitrate film tells us? Disparities about cellulose nitrate film abound in the literature which then pose challenges for the conservator and collections care professional in making choices for these materials. Strict government regulations about storage,

handling and transportation—based on conflicting information in the literature—compound the problem.

The purpose of the Wisconsin Nitrate Film Project was to understand the chemical processes by which cellulose nitrate decomposes and to ascertain whether deteriorated nitrate film stock is more dangerous than nitrate stock in good condition. The project sought to establish the validity of the five-stage classification model for cellulose nitrate degradation, to understand the friction sensitivity of cellulose nitrate “brown powder,” to closely investigate the role that relative humidity plays in degradation pathways and to engage with the regulatory community which establishes handling and storage requirements for cellulose nitrate. This presentation describes the results of three avenues of research undertaken during this NEH funded project: Chemical and physical testing on samples of heritage nitrate film (still and motion picture); evidence gathered through oral histories, a survey of archives, and the creation of an extensive annotated bibliography of cellulose nitrate related literature; and it describes our interactions with the National Fire Protection Association. Future research and advocacy needs are defined.

The Element of Surprise: Contending with Historic Lead Fills on an Outdoor Bronze Mercury

Sarah Giffin, Christina Varvi, Humberto del Rio

Lead has been used for centuries as a filling agent for a wide variety of materials ranging from metals, to ceramics, and even teeth. Its flexibility, low melting point, and ability to form alloys with a variety of common metals made it an ideal conservation material before the health hazards of lead were well known. As a result, lead fills can be found in a large number of museum artifacts. Despite the prevalence of historic lead fills in collections, there is little published information on how to contend with historic lead fills in modern object conservation treatments. Of particular interest for the authors is the interaction of more current conservation fill materials with lead repairs.

This presentation will focus on the challenges encountered in working with in-situ lead fills, as demonstrated through the case study of an outdoor, cast bronze sculpture of Mercury currently on display at the Huntington Library, Art Collections and Botanical Gardens in San Marino, CA. With this object, the authors not only had to contend with damage to the bronze caused by leaching lead corrosion, but also the unforeseen complications involved in attempting to apply new, modern fill materials on top of the preserved historic fills. Health and safety concerns were also a consideration when developing the treatment plan, as the complete removal of the lead was not an option due to lack of disposal facilities and suitable protective equipment. In the end, a treatment methodology was developed through trial and error that, while using somewhat unorthodox materials for museum object conservation, resulted in a treatment that preserved the original fills, stabilized the sculpture for outdoor display, and vastly improved the aesthetic appearance of the bronze.

The Day Day-Glo Loses its Glo(w): An Interdisciplinary Approach in Conserving Artworks Containing Daylight Fluorescent Paints

Stefanie De Winter

Since the 1960s, American artists like Frank Stella (1936^o), Richard Bowman (1918-2001), Herbert Aach (1923-1985), James Rosenquist (1933-2017) and Andy Warhol (1928-1987), started to incorporate Day-Glo (daylight fluorescent) paints in their artworks. These luminescent, synthetic, modern paints, became popular because they revealed a new dimension in color that resulted in unseen visual experiences, like illusory color depth, optical vibration, and new contrast effects. Unfortunately, there is a downside to the use of fluorescent paints, in that they age much faster than conventional colors and digitalising their luminescent effect wasn't possible until now.

Most colors in artworks appear through absorption and reflection of inorganic pigments. Fluorescent pigments, on the contrary, consist in a grounded substance based on an organic dye-resin-mixture. This kind of pigment absorbs energy of the short-wavelength range of the light spectrum and reemits this energy over a narrow range of longer-wavelength light. The resin matrix of fluorescent pigments is very fragile and already after a few years, due to exposure to (ultraviolet)light, the fluorescent color gradually starts to lose its intensity and saturation.

For this presentation, I'll start by briefly discussing my art historical research, in which I'll compare three different uses of fluorescent colors in paintings of Frank Stella, Richard Bowman and Herbert Aach. After interviewing Stella, I found out that he not only used them for their intensity and self-referential quality, but also for their transparency. These material-qualities perfectly fitted his "paintings as object"-concept. Bowman was among the very first artists who used them (since 1950) and saw the fact that these paints emit real light from the canvas as an extension of the painted light effects in works of the (post-)impressionists. Aach was an artist and color engineer who made his own fluorescent paints. Beside the fact that his paintings reveal unseen fluorescent colors, he also developed a detailed study of their visual effects in his writings. While discussing this selection of artworks, both the (unique) visual effects and their irreversible loss of intensity due to aging, will be addressed. In the second part, I'll draw attention to the fact that it is impossible to digitalise or photograph the visual effects of a fluorescent artwork. A photo will only capture a high-key colored version without the fluorescent-effects. As the degradation is inevitable and the problem of reproduction remains, it is necessary to create an additional fine-grained taxonomy of each artwork, which enables and preserves a correct reading of the fluorescent works. To conclude this presentation, I will give an example of such a taxonomy, based on recent interdisciplinary research on four of Stella's Irregular Polygons paintings, consisting in art historical methods, perceptual psychology and data gained from material-technical research. As a solution, readings resulting from such a taxonomy will serve as "visual memory" for artworks that eventually become milky-coloured "ruins," devoid of their original meaning.

Long-Form Concurrent Session

Materiality: A Series of Questions

Lance Mayer, Gay Myers

Our recent retirement from actively treating paintings has given us the time to reflect on several aspects of this year's topic of materials and materiality. These thoughts coalesced into a list of questions about subtopics within the general category of materiality, and some tentative answers to those questions. Both questions and answers address the many changes that we have seen during our more than 35 years as conservators, and—more importantly—how we might work to shape future developments in our field.

Questions include:

- Do we know as much as we think we do about artists' materials? Our experience as researchers on painting materials tells us: probably not. Many examples bolster this point, from obvious gaps in specific knowledge about the materials used by many artists at many different periods, to the imprecise names of artists' materials, to how the aging of specific materials sometimes contradicts longstanding perceived wisdom.

- Can we balance our concern for original materials with other concerns—above all, the aesthetic impact of a work of art? Great progress has been made in the last 35 years, but much remains to be discussed in terms of the relative importance of the backs and fronts of paintings, preserving or removing "original" varnishes, and "what would the artist think?" as a valid ingredient in our discussions.

- Are we communicating with curators and academic art historians about art materials as well as we could? There are many signs of improvement, including summer seminars in technical art history, increasing numbers of art history students who have been taught to care about materials, and literature that takes as its starting point a specific material or color. Curators have always been happy when conservators can provide material evidence that proves authorship or demonstrates a connection between two work of art, but we also see curators beginning to welcome discussions about how a painting's materials can influence its appearance in more subjective ways, such as understanding a painting's yellowish color when an artist used too much medium or when a painting cannot be cleaned. Here, too, there is clearly much room for further improvement. Examples include a major misunderstanding on the part of a curator about whether a conservator can tell the difference between a 150-year-old and a 500-year-old painting by studying the painting's materials. Other occasions of miscommunication concerned problems that a curator believed to be physical faults, but which were actually caused by reflections due to imperfect lighting. Conservators' concerns with materiality make us particularly sensitive to how uneven lighting, reflections, and shadows of frames can have a more profound effect on a viewer's experience than many curators or lighting designers appreciate.

Our final question is an awkward one:

- Do conservators sometimes dodge tough questions about the ageing of materials? Unfortunately, in some recent cases we think that the answer to this is "yes."

Arts Recovery After Hurricane Harvey

John Abodeely, Marci Regan

Harvey Arts Recovery Fund (HARF) is a first-of-its-kind initiative dedicated to supporting the creative community in the aftermath of a natural disaster. HARF was created as a volunteer collaboration among multiple organizations to meet the substantial needs of the Houston arts and cultural sector during Hurricane Harvey. As such, HARF is emerging as a national model for community-based disaster recovery in the arts.

A collaborative effort of Houston's art and culture services sector, HARF is focused on supporting small and mid-sized arts, culture, and history non-profit organizations as well as individual artists, musicians, performers, writers, heritage preservationists, and other cultural producers whose ability to support themselves was derailed following Hurricane Harvey. In these communities, relief can be as simple as a new theater wardrobe and as critical as replacing revenue lost from cancelled performances. HARF funds provide recovery support across the 10-county Greater Houston region including Harris, Fort Bend, Montgomery, Brazoria, Galveston, Liberty, Waller, Chambers, Austin, and San Jacinto counties.

HARF is an example of cooperative and collective leadership, which was provided by Galveston Historical Foundation, Fresh Arts, Dance Source Houston, CultureWorks Greater Houston, The Center for Arts and Social Engagement at the University of Houston, Houston Arts Alliance and the Mayor's Office of Cultural Affairs for the City of Houston, with funding support from Houston Endowment.

Lessons from Irma and Harvey: Preparation and Response in the 2017 Hurricane Season

Moderator: Rosa Lowinger; Panelists: Steve Pine, Rustin Levenson, Lauren Hall

The Fall of 2017 was one of the most active and dangerous seasons in U.S. hurricane history. As of this writing, two of the nation's largest cities and most populous states have been affected by storms of record-breaking size and wind strength. This panel brings together conservators from Houston, Texas, and Miami, Florida, to discuss some of the solutions adopted by institutions, collections, and private conservation studios to prepare for hurricanes Harvey and Irma. We will discuss what worked and what did not, what lessons were learned, and how conservators can respond to incorrect advice that is provided by non-conservators and disseminated widely in media reports. The panel will consist of: Rosa Lowinger (Moderator) Principal and Chief Conservator, RLA Conservation, Inc. Miami and Los Angeles; Steve Pine (Presenter) Senior Conservator for Decorative Arts, The Museum of Fine Arts, Houston; Rustin Levenson (Presenter) President and Chief Conservator, ArtCare, Inc. Miami, New York, Los Angeles; and Lauren Hall (Presenter) Conservator, Vizcaya Museum and Gardens.

Joint Architecture & Archaeological Conservation Session - May 31

Digging Deep: The Importance of Collaborations between Architectural Conservators and Archeologists

Mary A. C. Jablonski

Excavating at an archeological site or probing a building can provide opportunities for architectural conservators and archeologists to work together. We do not collaborate as often as we should. This paper examines several projects where either there was collaboration or it was lacking and demonstrates how these two types of conservators examining materials together extracts a better understanding of what has been found. Building archeology is the study of a building. Despite the word archeology, it is not uncommon for Architectural Conservators to forget the archeologist. Removing floorboards for repairs in the Lower East Side Tenement Museum in New York City uncovered layers of objects including buttons, bones and tickets hidden in rats' nests as well as material that had fallen between the floorboards over the course of a hundred and thirty years. Archeologists were a key part of the team retrieving and documenting this material for interpretation. Another type of project that would benefit from more collaboration is cemetery conservation. Often cemetery conservation is limited to repairing, aligning, and resetting markers, ensuring the cemetery looks tidy. But not all cemeteries had neatly placed gravestones surrounded by careful plantings. African American burials were often marked by grave goods or "offerings" placed upon graves. These items could be pottery and shells, as well as everyday objects such as cups, spoons, dolls heads, and clothing. Sandy Ground, a cemetery on the southern tip of Staten Island, was originally the resting place for an early free African American fishing community. It was vandalized in the 1990s. In an effort to restore the cemetery, it was cleaned up and many grave goods that were thought to be trash were lost. Archeologists can also forget that architectural conservators have extensive knowledge of historic building materials. During work on New York City Hall, a brick foundation was uncovered that was thought to be an early eighteenth century foundation. An examination by the architectural conservators found the walls were constructed of pressed brick and the mortar was natural cement, which dated the foundations well into the nineteenth century. On projects where archeologists and architectural conservators have worked together, a greater understanding of the building or site can emerge. An examination of the foundations of Federal Hall in New York City by a team consisting of an architectural conservator and an archeologist quickly dispelled the notion that the foundations were from a seventeenth century structure. An examination of walls discovered in Battery Park during work on the New York City subway system also benefited from a team of archeologists and architectural conservators working together. The excavated walls could not be saved, but the team was able to thoroughly document the techniques and materials used to construct them.

Loves Me like a Rock: Care and Preservation of Ancient Graffiti in a Rock-Cut Kushite Temple

Suzanne Davis, Janelle Batkin Hall, Carrie Roberts

This talk describes the preservation of ancient graffiti in a rock-cut temple at the site of El Kurru in Sudan. El Kurru is the location of a royal burial ground of ancient Kush (a region located in modern-day northern Sudan), and the site encompasses multiple pyramid burials as well as two rock-cut funerary temples. The sandstone temple that is the focus of this project was built during the late Napatan period (ca. 350 BC), and its walls and columns are heavily inscribed with devotional graffiti from the Meroitic period (ca. 100 BC – AD 100). It is an impressive and unique structure, a source of pride for local residents, and an interesting and accessible feature for visitors. The ancient graffiti it contains provide a unique glimpse into the lives of individuals in antiquity, providing information about their thoughts, values, and daily lives. El Kurru's sandstone monuments suffer from granular disintegration and other serious condition problems. Although the conservation of archaeological heritage is often complicated, it is especially challenging in Sudan due to a fragile national economy and comprehensive international sanctions against the country (except these were just lifted in October 2017 so it might get better!). For these reasons, a holistic approach has been used to preserve the graffiti.

Work began with a criterion-anchored rating (CAR) condition survey designed to identify, prioritize, and monitor condition issues. Chemical analysis of the stone was conducted, and treatment options including alkoxysilane consolidation and grout injection were explored. Preventive conservation strategies for the temple, including a protective shelter and increased community education, have also been developed. Finally, reflectance transformation imaging (RTI) was used to document the graffiti's condition and create a virtual, visual catalog. This talk emphasizes key principles for guiding conservation at archaeological sites: practicality, flexibility, sustainability, and placing a high value on the contributions and wishes of stakeholders.

A Collaborative Model for Rock Art Conservation in the Algerian Desert

Hakim Bouakkache, Julia M. Brennan

Algeria, the biggest country in North Africa with an area over 2 million square kilometers, has seven stunning UNESCO World Heritage sites. Among them are the earliest prehistorical sites in North Africa: the Oldwayen site of Ain el-Hanech, 1.8 million years BC. The area is enormous and it is difficult to administer effective long-term site management, preservation, and preventative measures. Not only are these cultural heritage sites threatened by extreme weather and climate, but human intervention, looting, vandalism, and terrorism. In order to protect these vast heritage sites, in the mid 2000s the Algerian authorities created the "Algerian Cultural Parks Projects" in partnership with the United Nations Development Program (UNDP) and executed by the Algerian Ministry of Culture. This launched a preventative conservation project applying a new model of local partnerships

with Tuoreg and other tribal elders and stakeholders.

Contained in this centralized Cultural Parks System are five major sites. Park of l'Ahaggar – over 633,000 km²; Tassili N'Ajjer Park – over 138,000 km²; Tindouf – over 168,000 km²; Atlas Saharian Park – over 63,000 km²; and Touat Gourarar Tidikelt Park – over 38,000 km². The most important cultural heritage in this desert designation is the rock art. There are literally thousands of paintings and engravings out in the open, as well as sheltered in caves. They include masterpieces from the earliest period of art in the Sahara, the Large Wild Fauna Period. These life-size engravings of elephant, rhino, hippo, giraffe, and buffalo show a time when the Sahara was green and fertile.

Conservation management in the Park of Ahaggar focused on the sites closest to roads and human communities, and then radiated out to the remote regions, often several days' camel or jeep ride away. Preservation work commenced with detailed inventories including images, GPS, and narrative descriptions. For all the conservation surveys and routine checks, the Park recruited guides among the local population, namely the Touaregs. This detailed inventory work in remote regions was only possible with the collaboration and expertise of these partners, who are very familiar with the sites, locations, and routes. Most importantly, the communities and nomadic groups trust the guides; they often speak the same dialects, thereby facilitating a level of trust, access, and reliable information. The exchange of knowledge was two-way; the local Tuoreg elders and guides' knowledge of the terrain, history, and symbolism of the sites was a rich resource that was documented as well. As archeological conservators, we were able to provide monitoring guidelines, compile massive data inventories, prioritize conservation site needs, and introduce an acceptable level of outside management to these sites. The relationships continue, as the guides serve on the "frontline" identifying areas of need and alerting archeological managers. This partnership has allowed for a much higher success in the protection of remote sites and movable cultural heritage, by developing a model based on trust, which has enabled government and university experts to work closely with local stewards.

Evaluation of Organosilicon Materials for Conservation of Ancient Grey Bricks

Yue Yuan, Jie Mi, Xiaozhen Wang, Zhengrong Fu, Chenglei Meng, Hui Zhang

Grey bricks were produced manually and used as the major traditional building materials in ancient China. However, the characteristics of grey bricks make them vulnerable to water, salt and other environmental factors. Organosilicon materials, such as ethyl silicate, organosiloxanes and silicone resin have been tested as the effective protective materials for silicate based stones.

In this study, we evaluated the effectiveness of different organosilicon materials on grey bricks by total and half immersions. The penetration depths, appearance alterations, water adsorptions, hydrophobic properties and compressive strengths were measured after the treatments. The samples also experienced the salt solution immersion, freeze-thaw, and UV aging tests to evaluate the durability of different conservation treatments. It is

found that different characteristics of the organosilicon materials lead to different conservation performances, such as water repellency, consolidation effect, and durability. But it remains difficult to determine an appropriate material for the conservation of ancient architectures built with grey bricks.

Preventive Conservation Training in the Moche Valley, Peru

Jessica Walthew, Alicia Boswell

The MOCHE, Inc. Conservation Field School in summer 2017 (Huanchaco, Peru) provided training in preventive conservation and collections care on archaeological sites to binational undergraduate, graduate, and pre-program students. This paper reports on the program, which, co-directed by an archaeologist and conservator, aimed to bridge the gaps between training for work in the field and for work in museum collections. The program provided the opportunity for students to gain an encompassing perspective of the life-history of material culture from excavation through processing and analysis, to storage and display. We believe this holistic perspective is essential for all cultural heritage professionals, yet training programs of this type are not always available.

Participants came to the program with varying levels of skills and experience in archaeology and conservation. American students and Peruvian students from the Universidad Nacional de Trujillo worked together on excavated materials from the regional survey led by UNT's archaeology lab. The students participated in archaeological excavation, finds processing, and recording, working hands-on with finds from the current and previous field seasons. As part of program curriculum they also learned about and engaged in basic conservation and collections management principles and practices. This work complemented the field school's instruction in the materials that make up the archaeological record and the prehistory of the north coast of Peru. Students used close observation of the project collections to understand how the objects were made and used, and identified modifications in the objects from initial use-life and those occurring during deposition and post-excavation. Students visited archaeological storage facilities in Peru and learned about principles of safe storage and packing for archaeological finds. At the close of the program, students carried out some of the proposed improvements for safe objects packing using appropriate materials and methods. The students also visited archaeological sites and museums throughout the region to understand the benefits and risks that tourism development brings to local communities.

This program is part of MOCHE, Inc.'s broader heritage preservation efforts. MOCHE (Mobilizing Opportunities for Community Heritage Empowerment, <http://savethemoche.org/>) is an organization founded by archaeologists dedicated to improving the standard of living in impoverished communities, preserving archaeological sites, and promoting research and education on the rich cultural heritage of Peru. MOCHE's work over the past 20 years in Peru has demonstrated that close community ties and community-oriented projects go hand in hand with preserving archaeological sites. This project demonstrates

that preventive conservation need not be narrowly construed as concerning only tasks such as managing museum and storage environments (of course very important topics on their own) but can also encompass a variety of other community engagement and education activities crucial to the goal of heritage preservation.

Keeping it Vertical: Use of GIS to Create a Streamlined Survey and Work Order System for a Historic Landscape

Joseph Charap, Neela Kusum Wickremesinghe

Brooklyn's Green-Wood Cemetery is home to over 200,000 historic monuments and over 7,000 trees throughout its 478 acres. As Green-Wood's landscape ages and evolves, the need for more technologically advanced collections management software became apparent, a need which resulted in the creation of a unique ArcGIS-based collection management system. In Collector for ArcGIS, management and field crews input survey information such as date, material, dimensions, and conditions of a historic monument or caliper, condition, and taxonomic information of a tree. Managers also create work orders in Collector, which thanks to a first-of-its-kind script that links the two, automates the creation of a work-order in WorkForce for ArcGIS. Work orders are assigned by the Manager, and analytics related to executed work orders and efficiency metrics are reviewed in an Operations Dashboard. The link between Collector and WorkForce allows staff members to geotag work orders to specific trees and monuments while tracking their progress and saving survey information along the way. By utilizing the power of GIS, our software analyzes our landscape's varied assets simultaneously and streamlines the implementation of the work necessary to maintain those assets, thus offering an enhanced, multi-faceted portrait of Green-Wood.

Software such as this could be used across other large historic cemeteries, large archeological sites, city and state park land, throughout museum environments, and scores of other cultural landscapes. This presentation will guide viewers through the inception of the software and its application in the field. Founded in 1838 and now a National Historic Landmark, Green-Wood was one of the first rural cemeteries in America. By the early 1860s, it had earned an international reputation for its magnificent beauty and became the prestigious place to be buried, attracting 500,000 visitors a year, second only to Niagara Falls as the nation's greatest tourist attraction. Crowds flocked there to enjoy family outings, carriage rides, and sculpture viewing in the finest of first generation American landscapes. Green-Wood's popularity helped inspire the creation of public parks, including New York City's Central and Prospect Parks. Green-Wood is 478 spectacular acres of hills, valleys, glacial ponds and paths, throughout which exists one of the largest outdoor collections of 19th- and 20th-century statuary and mausoleums. Four seasons of beauty from century-and-a-half-old trees offer a peaceful oasis to visitors, as well as its 570,000 permanent residents, including Leonard Bernstein, Boss Tweed, Charles Ebbets, Jean-Michel Basquiat, Louis Comfort Tiffany, Horace Greeley, Civil War generals, baseball legends, politicians, artists, entertainers and inventors.

Architecture Session - June 1

The Development of Modern Organic Materials, 1845-1930

Norman Weiss

Up to the middle of the nineteenth century, the "liquid-to-solid" organic materials that serve as architectural paints, coatings, and adhesives represented the chemistry of natural products. The sources of raw materials were varied, including drying oils, tree resins, and animal and fish glues, but commercial users wanted products with greater ease of use, and better (and more consistent) performance. The earliest of these improved materials involved relatively simple modification of natural products, with industrial-scale experimentation giving us vulcanized rubber and cellulose nitrate. Improvements in the production of coal and oil distillates, and in the structural study of organic molecules, led to the first generation of phenolic resins and butadiene rubber in the early twentieth century. By 1930, many familiar materials—such as alkyd resins, PVC, and Nylon 66—were starting to enter the marketplace. They set the stage for a broader revolution in polymer science that dramatically changed the work of architects, engineers, and builders in the decades that followed.

Life after Lead Paint for Historic Houses

Christine Leback Sitwell

For centuries, lead based paints have been the primary paints used on external woodwork on historic houses. However, recent changes in legislation related to VOCs (volatile organic components) and the restriction of the use of lead paint due to toxicity has meant that paint formulations have changed to meet the changing legislation requirements. In addition, there has been a growing interest in the use of "environmentally friendly" paints. For historic houses, the cyclical maintenance requirements of repainting external woodwork is a major financial consideration and as result, the need to assess the performance of the wide variety of paints available encouraged the National Trust to undertake a series of paint trials to assess sustainability as well as consideration of the visual appearance of the paint (a factor which is important in maintaining the historic appearance of our properties).

In 2006, the National Trust began a series of external paint trials on 13 garage doors on one of our properties to assess the performance of the selected paints. The trials provided information about the sustainability of the paints based on visual evidence of cracking, flaking, color change and moisture penetration. Whilst informative, it was realized that the results could not provide a recognized methodology for comparing the paints' performance. As a result, a group of heritage organizations led by the National Trust decided in 2011 to conduct a series of trials at the Paint Research Association in order to provide an industry recognized standard testing procedure to assess 34 paints which were selected on the basis of those used by the members of the group as well

those which were commercially available to ensure that they would still be available after the conclusion of the trials. In addition, a number of “environmentally friendly” paints were included to assess their performance. The trials began in 2012 and after four years of testing, the results enabled the group to evaluate the performance of the paints and select 10 paints which performed above average as well as a linseed based paint, a lead based paint and a ICP (internal comparison product used as a standard) to be used to coat a number of the original panels to assess their performance. It was felt that this test would reflect more accurately the method of repainting used on historic properties where the underlying paint layer is simply sanded to remove defects and then coated with a new paint layer. It would also provide information about the sustainability of applying a different paint system over an existing paint layer. This paper explains the procedures involved and the results to date which should provide guidance for historic properties to ensure that the most sustainable paint systems are applied to external wood work.

Can't Touch This! The Treatment of Original Distemper Painted Plaster Walls

Stephanie Marie Hulman, Tia Polidori

In May of 2016, members of the Department of Conservation and Technical Research at the Walters Art Museum began to investigate the original plaster walls in the library of 1 West Mount Vernon Place, which is now a part of the museum complex. This impressive family home was designed by architects Niernsee and Neilson and was completed by 1851. After a series of other owners and uses, the building was given to the museum by the City of Baltimore in 1984. It subsequently underwent significant renovations and opened to the public in 1991 as a gallery of Asian Art. In 2016, after 25 years of use, upgrades to the HVAC system and the installation of a fire suppression system led to the temporary closure of the building and allowed for gallery refurbishments.

When the conservation department was asked to remove fabric paneling from the library so that it could be replaced, they were surprised to find that the original painted ornamental plaster that had not been viewed since 1991 was largely intact. This raised and decoratively painted ornamental plaster was first covered with fabric in the 1890s when the house underwent significant alterations. At that time, many of the high points of the plaster had been chiseled off to allow the fabric panels to span the walls without distortion. In addition, later upgrades, including the installation of gas and electric lines for wall sconces and an air duct were made without regard to the plaster walls. Despite these interventions, the original color scheme and decorative painting were intact, especially in the protected upper areas of the walls. One interesting feature of the design was the use of faux wood graining on the raised plaster elements. The faux wood graining integrated the painted plaster with the surrounding woodwork. Early hand-colored photographs of the room also show that there was an elaborate ornamental plaster ceiling that was later covered with a wooden beam ceiling. Despite numerous alterations to the room, the conservation staff advocated for the preservation and

display of this rare survival of an original architectural painted finish. Given the size of the project, the conservation department contracted additional help to complete the conservation and restoration of the library walls. Once the project started, the extreme sensitivity of the distemper painted finish to water and polar solvents posed significant challenges in the selection of treatment materials and methods. The application of any sort of mold making material to the friable and readily stained painted surface was impossible, meaning that a “touch-less” method was needed to re-create large missing raised plaster elements. A partnership with the 3-D scanning and printing program at Harford Community College provided some creative solutions for this project. Silicone solvents aided in removing some large spackle repairs from the walls by providing a safe way to remove a water-soluble material from a water-soluble surface. The material challenges of this project led to creative solutions that can hopefully be adapted for future use in architecture and other specialties.

Moving a Monument: The Relocation of Extending Arms of Christ at Houston Methodist Hospital

Kelly Ciociola, Rosa Lowinger, Christina Varvi

Extending Arms of Christ is a 96' L x 16' H site-specific mosaic mural created in 1963 by Bruce Hayes for the front façade of Houston Methodist Hospital. Originally consisting of three large scale panels of Italian glass tesserae on a concrete bedding, the mosaic was designed to be the most prominent decorative feature above the entry doors to a major teaching hospital associated with Houston's Baylor University medical school. Distinctly modern in character, the mosaic features the Christ figure with extended arms at the center of a geometric abstract background that is punctuated with stylized imagery of modern medical equipment, doctors, and historical figures, like Florence Nightingale.

In 2014, RLA was contacted by Hunt Construction Group, a firm overseeing expansion of the hospital, to determine if the mosaic could be relocated into a 50' atrium within the lobby of a new tower addition. Over the years, the mosaic had become obscured from the street by trees lining the sidewalk. A porte cochere, added in 1987, had covered up the bottom 4' of the mosaic. Relocating the mosaic would allow it to be showcased once again for hospital patrons, as well as preserved and protected in a controlled interior setting.

Moving an artwork of this size is challenging under any condition. This one was further complicated by its location over the hospital's main entrance and next to the emergency room driveway, which barred the use of a crane or blocking of the street. A test probe revealed that the mosaic was separate from the wall of the building and therefore theoretically detachable. However, preclusion of the crane meant that the original panels, which measured 38' 6" W x 16' H and weighed approximately 10,850 lbs., would need to be cut to allow them to be lowered by a gantry that could accommodate a maximum of 400 to 500 pounds. Our first task was to figure out how to do this without impacting the design elements, and determining in advance that the mosaic

could later be re-assembled seamlessly. Because design of the new addition was completed by the time the mosaic relocation was considered, our next challenge was how to reinstall the artwork onto a metal stud wall. The engineer's design solution involved the use of plywood, which raised concern because of possible warpage in the event of a catastrophic weather event. Said event occurred on August 25, 2017, when Hurricane Harvey devastated the Houston Metropolitan area. Installation of the 93 cut mosaic panels was completed at that point. Only the repair of the join lines remained to be done. As of this writing, we have not been able to return to Houston after Harvey. However, Hunt construction informs us that the mosaic is intact. As part of this presentation we will reveal what, if any, impact the hurricane had on the mosaic. The goal was to complete the conservation by December 2017.

Transportation, Installation, and Conservation of the 20th c. Fresco *Haitian Massacre, 1937*: Challenges, Solutions, and Contributions

Viviana Dominguez, Hilda Abreu Utermohlen

The transportation and installation of the fresco mural *Haitian Massacre, 1937*, followed by its conservation, was not only challenging for the conservators but also for the engineers contracted for the project. The mural, created in 1974 by Dominican artists José Ramírez Conde and Roberto Flores, presented extensive damage from being hastily cut away from its original location and enduring three years of harsh environmental conditions after being left outdoors just covered by a tarp. Funded by the Ambassadors' Fund for Cultural Preservation program, the project was led by Dominican paintings conservator Hilda Abreu Utermohlen and U.S.-Argentinian Viviana Dominguez, mural conservator. The conservators took on the task of not only conserving the extensively damaged fresco, but also of advising on its preventive care, especially during its transportation from this exposed location to the Memorial Museum of the Dominican Resistance in Santo Domingo, Dominican Republic, and subsequent installation in the museum, where it could be appreciated by the public.

Throughout the project, the authors faced technical and logistical challenges, due to the large size and heavy weight of the fresco wall, its poor condition, the long travel route from its location to the museum, the narrow entrance to the museum, its maneuvering for affixing it to the installation base, limitations in the availability of trained professionals in mural conservation and supplies, as well as budget constraints. These challenges were ingeniously sorted out thanks to the efforts and teamwork of the conservators and engineers, resulting in the successful completion of the project. Utermohlen and Dominguez presented the examination, planning and preparation phases of the project during AIC 44th Annual Meeting in Montreal in 2015, as a work in progress. On this presentation the authors will describe the completion of the project, consisting of its transportation, installation, and conservation treatment, followed by the repair of building features and exhibit completion by the museum. Highlights include: the frame used for securing the large wall during the 14 km ride through the city and into the narrow streets of the Colonial City, and the methods used for bringing in the

severely damaged wall and securing it in place. Also, they will detail the conservation treatment activities performed, including consolidation and loss compensation with local materials and techniques similar to those used by the artists. In the conclusion, they discuss and reflect on the results and benefits derived from this project, not only for the specific preservation of this artwork, but also as a tool to convey its multiple values. Moreover, the international nature of the assembled team provided not only an opportunity to collaborate hand in hand in the exchange of knowledge, but also to build bridges of understanding among the participants.

Analyzing Spanish Colonial Pigment Utilizing Sophisticated Technology: The Excitement and the Obstacle in the Discoveries

Pamela Rosser

Traditional conservation techniques first uncovered the existence of Spanish colonial era frescoes on the interior walls of the Sacristy, in the Alamo Church, eighteen years ago. The stencil designs discovered encompass the entire room; at wainscot level, frieze band above entry doors, and along the arches of walls. The universal conservation lab techniques and analysis provided some of the answers; however, there is still much to learn about the wall art in the Sacristy.

Recently, conservation work in the Sacristy began and more evident questions arose; one inquiry: Is there another way of analyzing the pigment without removal? The answer is to this question is yes, by utilizing traditional analysis and state of the art technology. Through the use of a portable X-ray fluorescence spectroscopy (pXRF), the pigments that remained on the walls in the Sacristy were sampled and characteristic elements were identified. The 2000 paint analysis report identified four Spanish colonial tinted limewashes. The recent utilization of the pXRF analysis report, identified three unknown Spanish colonial tinted limewashes and metal leaf with high levels of copper. In addition to the pXRF, a scanning electron microscope (SEM) with EDS capabilities was also used on selected sampled fragments. Elemental maps confirm the identification of vermilion (HgS). This advanced technology helps guide conservation efforts and leaves the microscopic historic elements intact.

A second inquiry transpired: How do we visually see the invisible design elements? By employing multi-spectral imaging with ultraviolet fluorescence technical photography, 3-D photographic techniques: Reflectance Transformational Imaging (RTI) and DSLR photogrammetry were also a part of this project. The multi-spectral imaging documented invisible design elements, important application techniques: "pouncing," "outlining," and "block filling." The multi-spectral imaging created high-resolution images along with 3-D models and photo mosaics.

A third inquiry loomed: Why the sophisticated equipment used did not determine the shapes of areas where high levels of Lead (Pb) exist at the "tips" of an invisible floral design? The floral designs are located symmetrically on the original walls. The invisible floral designs contain an urn painted with ochre, reds and copper green. The shape of the urn is unknown. The project

utilizing multi-spectral imaging and portable X-ray fluorescence spectroscopy results were exciting, but some of the unknown Spanish colonial designs remain a mystery. Is there a technology that can solve the mysteries in the Sacristy at the Alamo?

Architecture Session - June 2

Ground-truthing Adobe Ruins: Assessing Vulnerability of Earthen Architecture in a Changing Climate

Frank G. Matero

One hundred miles northeast of Santa Fe is Fort Union National Monument, the largest adobe ruin in North America and once the largest U.S. military reservation in the Southwest. Established as a National Monument in 1954, Fort Union challenged every succeeding generation of cultural resource specialists—archaeologists, architects, historians, engineers, scientists, conservators, and masons—to find a sustainable solution to the preservation of its earthen walls. The ruins of Fort Union now face unprecedented challenges as increased cycles of extreme weather undermine and topple walls. This research establishes a framework for the integrated study of the deterioration for earthen and masonry structures in the arid West. Risk and threat are examined as “vulnerabilities” related to factors such as materials, construction, use, environment, weather, orientation, exposure, past treatment, and maintenance. The first phase of the project focused on preparing a database inventory and assessment of past records including historical photographs, construction documents, geotechnical and engineering analyses, administrative reports, and weather data (back to 1861) as well as past and current conservation and management strategies. The second phase examined individual vulnerabilities through a survey of one unit of the Fort—the Mechanics Corral in real and projected time. The field survey studied past and current conditions of the adobe walls to calculate wall loss, attrition, and profile changes over time. Real-time recording of the weather on site was conducted over one year, including monitoring of adobe walls using embedded temperature and moisture probes and time-lapse photography to test monitoring apparatus and record actual weather phenomena and wall responses to those phenomena. Finally, parametric software was employed to dynamically model current and future weather and potential climate-based threats to the site to design smarter responses to threats in the form of preventive conservation measures.

Laser Ablation for the Removal of Biofilm at the Thomas Jefferson Memorial: A Test Case and Critical Evaluation

Justine P. Bello

The Thomas Jefferson Memorial is an iconic monument that is widely identifiable both throughout the United States and the

world. Located within National Mall and Memorial Parks, a unit of the National Park Service in Washington, DC, the design of this white marble monument combines classical iconography with modern construction to enshrine the ideals associated with one of this country’s founding fathers. Over the last decade, Memorial has become rapidly soiled by biofilm. The blackening effect of biofilm, a colony of microscopic organisms that adheres to stone surfaces, was first noticeable in discrete areas of the memorial’s white marble in 2006, and has become more pronounced in recent years. While it manifests itself in various ways, the biofilm is most pervasive—and most visible—on the Memorial’s dome.

A multi-disciplinary team of conservators, architects and other professionals has been studying the growth on the Jefferson Memorial since 2014 to determine the best treatment options. After careful review, it was decided that the initial cleaning test would be performed using laser ablation. Laser ablation offers maximum protection to this significant cultural resource as well as the surrounding natural resources: by fine-tuning the laser settings to the specific stone and soiling types, laser operators can remove the biofilm without damaging historically sensitive marble. The use of laser is also an environmentally sound procedure and eliminates the need to use more aggressive chemicals or abrasive cleaning methods. Rigorous safety controls are maintained for the duration of the cleaning process to protect the public and the operators. The project will achieve the cleaning of a test area of 1,000 square feet on the northeast side of the Memorial.

This presentation will evaluate the efficacy of laser cleaning to remove biofilm through the lens of this trial cleaning effort. This will include a discussion of: the decision process by which this cleaning method was arrived upon; the characterization and understanding of this biofilm phenomenon to date; the intricacies of implementing and scaling a cleaning project at this site; and what might be done to prevent or deter soiling recurrence in the future. A brief comparison of this phenomenon to the incidence of biofilm at other major sites in Washington, DC, will also be included.

Biofilms and White Marble Monuments: Recent Work

Judith M. Jacob

Biofilms are microbial communities, held together and to a substrate by a gel-like material. Biofilms cover all marble monuments. The biofilms that are considered visually unattractive are black; the black color is melanin, a pigment produced in response to UV radiation. Conservators are often tasked with “cleaning,” or “removing” a melanin-producing biofilm. To better understand these biofilms and concerns for their removal, the National Park Service’s Historic Architecture, Conservation, and Engineering Center executed a series of cleaning tests for long-term monitoring (15 years ago and 3 years ago); collaborated with the Center for Biofilm Engineering, Montana State University, and the Mathematics Department, Temple University on a National Science Foundation grant; and collaborated with students in the Biotechnology Lab, Thomas Jefferson High School

for Science and Technology, Arlington, VA.

Results from research and tests thus far conclude:

1. Biofilms are far more complex than one can imagine.
2. The bio-receptive surface of eroded marble is the perfect substrate for biofilms.
3. Stressing biofilms (many cleaning treatments) will produce immunities and a biofilm more resistant to that stress when it returns.
4. All brands of products containing quaternary ammonium compounds (quats) used for cleaning tests behaved the same.
5. Quats can be used as a diagnostic tool to determine the presence of biofilms, whether they contain melanin or not.
6. There is a relationship between biofilms, moisture, and salt deliquescence on a marble surface. Biofilms might be keeping surface salts in solution.
7. Microorganisms categorized as “extremeophiles” are found on white marble monuments in Washington, DC.
8. DNA sequencing of biofilm samples taken from a marble surface before and after cleaning tests is a way to understand success—or not—of cleaning.

Collaborations continue, tests continue, observations continue, and research continues. Assumptions of biofilm activity and relationships to marble need to be constantly questioned. There is no solution to keeping eroded white marble monuments white, but with the efforts of many institutions, individuals, and industry, working together, we will learn more about biofilms and may even find a solution to keeping melanin-producing biofilms at bay.

Classification of Early Building Campaigns Using Petrographic Examination of the Historic Masonry Found at the Josiah Benner Farm, Gettysburg, PA

Amy Elizabeth Uebel

This study focused on using petrographic analysis of brick located at the Josiah Benner Farm in Gettysburg, Pennsylvania, to develop a more complete understanding of the architectural development of the Josiah Benner Farm and its involvement in the Battle of Gettysburg. Completed in 1862, the Benner Farm is significant for its involvement in the 1863 Battle of Gettysburg. The Benner Farmhouse provided cover for Union Soldiers and served as a field hospital while also being shot, shelled by artillery, and set afire. The Benner Family rebuilt the farmhouse soon after the battle and the farm remained in private ownership for the next 149 years before being acquired by Gettysburg National Military Park. Despite the farm’s proximity to one of the best documented battle sites in the United States, there is little archival information surrounding the farm. Traditional building practices in Southeastern Pennsylvania reused building materials where possible, further obscuring potential evidence related to the house’s involvement in the Battle of Gettysburg. As a result, traditional physical investigation was unable to shed light on the early years of the farm’s history. Petrographic analysis, primarily using microscopic evaluation and thin-section

petrography, was performed on raw samples and polished thin-sections of historic masonry that were removed from both the farmhouse and the springhouse on the property. Emphasis focused on classifying manufacturing techniques, clay matrix, and source aggregate of each sample. This would presumably allow investigators to group similarly aged brick into unique clusters. Samples were taken across the structure and from interior locations whenever possible to avoid confusion from weathering forces. Additionally, several other samples from other regional structures were taken for comparison. Ultimately, six different groups of historic brick were identified, suggesting that the Benner Farm underwent significant rebuilding during its early history.

Contour Scaling in Bluestone: An Investigation of Potential Causes Through Microscopy

Edward G. FitzGerald

Bluestone, the common name given to a form of blue-colored feldspathic sandstone or greywacke quarried in Pennsylvania, New York, and Newfoundland, is now and was historically a popular building stone in the northeastern United States and eastern Canada. While generally durable, its laminar structure makes it susceptible to delamination, or the separation of layers of stone along their natural bedding planes. Examples of delaminating bluestone are easily found among historic buildings and monuments where the material was used. The nature of this form of deterioration has been well studied. However, a much less ubiquitous and less understood form of surface loss may also occur. In certain conditions, the stone may develop a hardened outer surface crust, as thick as 1 to 2 cm, which runs both parallel and perpendicular to bedding planes. This outer crust invariably detaches from the body of stone in a phenomenon known as case hardening or contour scaling. Contour scaling has been attributed to a variety of processes, such as precipitation of secondary minerals, hygroscopic swelling of constituent clays, thermal cycling, etc. This paper will discuss the use of microscopy in exploring the chemical and mineralogical alterations contributing to contour scaling in bluestone. This information may also be applied to understand scaling in other clay-bearing or laminated stone types. Applications for the presented research include diagnosis of stone deterioration in the field and development of effective conservation treatments. Examples will be drawn from New York City’s Highbridge Park and presented with photomicrographs of affected stones in thin-section.

Electro-migrating Process with Silicone Quaternary Ammonium Salt for Protecting Historic Reinforced Concrete Buildings

Shen Ling, Wendong Chen, Kaihao Chen, Hui Zhang

Today, historic concrete structures from the late 19th and early 20th century are facing severe degradation problems due to chloride ions, carbonation, and other aggressive environmental factors. Although

repair and reinforcement become urgent, effective methods are still under development. Electrochemical techniques (for example, realkalisation and electrochemical chloride extraction) and corrosion inhibitors have been used in protecting reinforced concrete buildings from corrosion. Recently, bidirectional electro-migrating (BIEM) is considered as a new technique, transferring corrosion inhibitors to the surface of steel rebar to prevent its corrosion. The materials acting as electro-migrating corrosion inhibitors are required to form cationic species in alkalinity concrete pore solution and with high mobility in concrete mortar. The available electro-migrating corrosion inhibitors now normally contain an amine, amino alcohol group or quaternary ammonium salt. But none of them can improve the durability of cement and concrete matrix directly.

This study investigated the protective effectiveness of a new electro-migrating corrosion inhibitor—silicone quaternary ammonium salt (Octadecyldimethyl[3-(trimethoxysilyl)propyl] ammonium). Due to its molecular structure, it can create cations in solution and the silane group forms silicic acid by hydrolysis reaction generating silicon-oxygen bonds, which brings consolidating effect; besides the alkyl groups provide hydrophobicity. Experiments were performed in specimens that imitate reinforced concrete. The effectiveness of preventing corrosion was characterized by electrochemical measurements including potential dynamic polarization curve (PD) and electrochemical impedance spectroscopy (EIS) before and after BIEM treatment. The contents of nitrogen in different depth was measured to evaluate the efficiency of migration. Hydrophobicity was evaluated by contact angle after immersion of silicone quaternary ammonium salt. The results showed that the corrosion current (the corrosion kinetic parameters derived from the Tafel plots value) for steel in concrete before and after BIEM treatment was found to be reduced respectively. Improvement of the polarization resistance and charge-transfer resistance were determined by fitting parameters for specimens of EIS, suggesting that the resistance of concrete matrix and steel rebar were both increased after BIEM. The contents of nitrogen becoming higher as the depth increasing, means that silicone quaternary ammonium salt accumulated around the steel rebar. The contact angle was around 90 degree after immersion of silicone quaternary ammonium salt solution. The results obtained in the laboratory experiments indicate that BIEM treatment with silicone quaternary ammonium salt enhance the resistance ability to corrosion of steel rebar. In addition, this material has good migrating mobility in cement paste though BIEM and can maintain hydrophobicity. The investigated results reveal that BIEM technique with silicone quaternary ammonium salt could be a potential multifunctional treatment applied in conservation of historic reinforced concrete buildings.

Alkoxysilane Sol-Gel Consolidants for Calcareous Stones

Alison Robly, Mary Striegel, Dean Webster

Ancient stone artifacts and architecture deteriorate over time due to environmental factors, air pollution, salt efflorescence, and biodeterioration. As a result, effective stone consolidants are

necessary for the conservation and protection of stone materials. Alkoxysilanes are effective stone consolidants, undergoing hydrolysis and condensation to produce a sol-gel coating capable of penetrating the stones porous structure. However, demands for improvements in commercial formulations have led to research efforts focused on increasing flexibility, “breathability,” and durability without compromising water repellency and strength. In order to allow water vapor evaporation out of the pores after consolidation application, a “breathable” consolidant is required to permit the transport of water molecules. Polyhedral Oligomeric Silsesquioxane (POSS) structurally contains nano-meter sized pores, allowing for permeability of water molecules out of the stone in addition to added mechanical durability. Polydimethylsiloxane (PDMS) was utilized for increasing flexibility and water repellency. Current research is focused on formulating POSS, PDMS, and other additives into alkoxysilane stone consolidants for limestone and marble substrates.

From Wreckage to Relics: Conserving and Exhibiting Fragments from Frank Lloyd Wright’s Midway Gardens

Jessica Betz Abel, Ellen Moody, Joy Bloser, Chris McGlinchey, George Wheeler

A financial failure from the beginning, Frank Lloyd Wright’s Midway Gardens was bulldozed and dumped into Lake Michigan just 15 years after its construction. Nearly a century later, three salvaged fragments from this entertainment center were uncrated at the Museum of Modern Art in New York, where they now form part of the Frank Lloyd Wright Archive, acquired jointly with Columbia University’s Avery Library. Built in 1914, Midway Gardens was a precursor to Wright’s textile block houses: employing cast stone blocks with complex geometric relief, it embodied a new use for concrete that united ornament and structure. However, by 1916, Midway Gardens had filed for bankruptcy, and many of the innovative design elements employed by Wright were altered by subsequent owners, including Edelweiss Brewing Company and E. C. Dietrich Midway Automobile Tire and Supply Company, to meet the needs of the various industrial aesthetics. These fragments – relocated first to Wisconsin, and now to New York – arrived with structural damages and without prior documentation.

In preparation for MoMA’s major 2017 Wright retrospective, the museum’s Conservation Department partnered with Columbia University’s Historic Preservation Program to research and treat the works. Through examination, mock-ups, petrographic and chemical analysis, and research in the newly accessible Archive, the team shed new light on these works’ technology and history. The transfer of these fragments from the built environment – where they formed part of an evolving structure – to the museum collection – where they have become ossified relics – has shifted the way in which they are approached, both in interpretation and in preservation strategies. Their new home in acclimatized museum spaces expanded treatment options to include more reversible repair and loss-compensation materials than those typically

used in historic preservation. This paper will cover the results of this year-long project that culminated in the treatment of these fragments, including the development of a technique to create large, vertical fills in cast stone with toned, Paraloid acrylic resin films and sand.

similar texts and vignettes in royal and private tombs, the original position of the blocks could be to a great extent reconstructed, which will allow for a proper and comprehensive museological display of the blocks in their original context, going as far as the complete reconstruction of parts of the tomb-chapels.

From Blocks to Tomb-chapels: Documentation and Reconstruction of 246 Stone Blocks for Display in the Grand Egyptian Museum

Nassef Elsayed Abd Elwahed, Nagm El Deen Morshed Hamza

The Grand Egyptian Museum-Conservation Center (GEM-CC) will host the conservation and reconstruction of the Nilometer's blocks. The research follows a values-based methodology where the archaeological, historic, artistic values and significance of the blocks guide the conservation and the reconstruction decisions. An impressive number of blocks—about 246—might belong to several tomb-chapels from the Late-Period. Other blocks have been excluded from the present study, since they date to other periods, and their provenance are likely different than the majority of the blocks. Since their discovery in the 1930s, the current location and most of the contents of the blocks reused in the substructure of the Nilometer at Roda Island have become obscured for the Egyptologists. After thorough research, it is quite certain that they came from the Nilometer at Roda Island. They had been reused in the substructure of the Nilometer and discovered during the restoration work, which took place from December 1934 till July 1939 by the Ministry of Public Works under the supervision of Kamel Osman Ghaleb Bey.

The importance of the research is the primary study that confirms the blocks are from six tomb-chapels that date back to the Twenty Six Dynasty. The blocks still have the remains of pigments; blocks have a depiction of texts and vignettes from parts of the book of the dead. This depiction is considered one of the rare depictions from ancient Egypt, not present in other tombs, particularly late period tombs. It will be considered a research guide for those studying this time of ancient Egypt civilization. Complete documentation of the blocks starting from photographic documentation to digital drawings were made, recording all details and information to make a new register. Digital drawings made to complete the missing parts of the stone depend on completing the depictions.

The second part focus on investigation and analysis of the blocks which will make to identify the composition of the stone and the pigments to identify the source of the stone and type of color used at this time. The analysis will depend on the X-Ray diffraction (XRD) and portable X-ray fluorescence (pXRF) to trace elements to determine the elemental composition of the stone. Also Scanning Electron Microscope (SEM) is able to distinguish the texture of the stones. The reconstruction of the depictions depend on studies to reconstruct the scenes and texts, using the book of the dead as a reference, which includes the complete scenes. Through this, using facsimiles and translation of the texts of the complete scenes in comparison with the location of

Book & Paper Session - May 31

Washi: Understanding Japanese Paper as a Material of Culture and Conservation

Brook Prestowitz, Yuki Katayama

Washi, or Japanese paper, is both a material of cultural heritage and a material used ubiquitously in conservation. Long before it became an amazing conservation material, washi had specific purposes tied to Japanese culture. Japanese papermaking is a historical craft that has experienced significant changes in the past few decades. Sadly, not all changes are for the better—the number of papermakers is dwindling and certain types of washi have become extinct due to closure of papermaking mills responding to various pressures. The accelerated changes in the world of washi compounded by potential language barriers for conservators who are not fluent in Japanese make it difficult for conservators to be certain of how these changes might be affecting washi used for treatment. Seminal research has been conducted in the past about Japanese papermaking materials and techniques as well as technical analysis of handmade and machine made washi to determine its most appropriate use in conservation. However, these references may not be current enough for conservators to assess papers made in modern times.

By maintaining a current understanding of the history and process of Japanese papers we are respecting washi as both an object of cultural importance and as a conservation material that we use so commonly. This presentation seeks to review the history and technical process of Japanese papermaking. It will look at the methods and techniques of the papermakers represented by Hiromi Paper Inc., as well as some of the toolmakers, and raw materials involved in the papermaking process. Related conservation research published to date will be covered, and methods of extracting information through visual examination of washi for practical applications in conservation will be discussed.

Optical Clearing of Repair Tissues for the Treatment of Translucent Papers

Roger S. Williams

There are many types of translucent papers, each with its own set of conservation issues stemming from various manufacturing processes. The characteristic that makes them stand apart from other papers—transparency—can itself be at risk when there is a need for applying mending or lining tissues. This project explores the physical aspects of paper transparency, and investigates the concept of optical clearing (transparentizing) of repair tissues, with the goal of achieving appropriate repairs on translucent papers without dramatically increasing the opacity of treated areas. The term “optical clearing” is borrowed from the fields of biology and medical research; it refers to the process of rendering biological tissues transparent through the application of clearing

agents, which minimize the scattering of light and allow greater visibility for microscopy and imaging. This is similar to some historical processes of transparentizing paper, in which oils, waxes and rosins were added to fill light-scattering interstices, allowing more light to travel unimpeded through the paper web. This concept is applied to conservation repair tissues, with the goal of determining a coating to serve dual functions: optical clearing agent and reactivatable adhesive.

A wide range of adhesives and coatings familiar to paper conservation was tested for their transparentizing effects on a variety of repair tissues, including more traditional Japanese papers and the recently developed nanocellulose papers. Opacity measurements were taken using a spectrophotometer and the contrast-ratio method. Acrylic polymer dispersions proved to be the most consistently successful clearing agents. The most substantial transparentizing effects occurred in gampi-fiber Japanese tissues, with some cleared by over 90% of their original opacity. This can be attributed to the superior film-formation qualities of the acrylic dispersions and their amorphous polymeric structure. The heat-reactivation capability of acrylic adhesives also proves advantageous for the treatment of translucent tissues, which tend to react dramatically to moisture.

A range of repair methods was applied to modern translucent tissue samples. These were measured for opacity before and after treatment to compare to repairs made with cleared tissues. SEM cross-sectional imaging was used to visualize adhesive penetration. Attempts at removing each repair were also made to characterize ease-of-reversibility. The long-term stability of optically cleared repair tissues is considered alongside an aging test that measures the yellowing and turbidity of acrylic transparentizing coatings under different light exposures.

The application of the optically cleared tissues is discussed via the treatment of two large objects possessing damaged transparent overlays: Atlas Photographique de la Lune (Observatoire de Paris, 1896–1910) and Frank Lloyd Wright’s “Wasmuth Portfolio” (1910). The suitability of different clearing agents in varying contexts is also considered, such as in the treatment of coated transparent papers.

Cocktails and Mixers: Ethanol-modified Treatments for Iron-gall Ink

Julie Biggs, Lynn Brostoff, Cindy Connelly Ryan, Claire Dekle, Cynthia Karnes, Yasmeen Khan, Susan Peckham, Andrew Davis

The admixture of ethanol to aqueous treatment solutions is commonly used by conservators to mitigate the solubility of water-sensitive media. Prior research and direct observations by Library of Congress conservators have likewise indicated promising applications for the addition of ethanol to treat manuscripts with water-sensitive iron-gall ink. Building on the pioneering research initiated by the Netherlands Cultural Heritage Agency, which demonstrated the efficacy of calcium phytate and calcium bicarbonate to significantly slow the deteriorative mechanisms of iron-gall ink, a team of conservators and scientists at the Library

of Congress sought to identify effective “cocktails,” or ratios of ethanol and other components in the preparation of phytate and bicarbonate solutions.

This talk will present the results of a multi-year study comparing treatments on artificially-aged iron-gall ink, including washing in ethanol-water mixtures; varying proportions of ethanol in phytate and bicarbonate solutions; comparing ethanol-modified magnesium phytate with ethanol-modified calcium phytate; and ethanol-modified magnesium phytate at different pH values and solution concentrations. The presentation will also discuss the impact of the research on future treatment choices and procedures for iron-gall ink on paper.

Chancery Master Exhibits - Piecing it Back Together

Sonja Schwoell, Lora Angelova, Rose Mitchell

The focus of this paper is the conservation of a 17th c. map damaged by water and iron gall ink. Triggered by a document request for the Victoria County History project, archivist Amanda Bevan discovered the bad condition of a 17th c. map, which is of great historical interest. The map is part of a group of objects (C 110 64-67) dating from the mid-15th c. to the 18th c., which all had been evidence material in a court case: In his will, Samuel Travers dedicated the proceeds from the sale of his land to the establishment of a foundation for poor naval lieutenants. Travers' will became the subject of much dispute and litigation and the trust relating to the Naval Knights was not validated until 26 July 1793, almost seventy years after his death. The map appears to have been worked with to the extent of its material failing, which led to the production of an 18th c. copy. The transfer process of the ink drawings involved pricking through the paper onto the new support. The map also shows staining from water damage, which would have contributed to the breakdown and removal of the adhesive holding the lining to the paper and exacerbated the iron gall ink damage. The three factors together, the iron gall ink degradation, the pricking and the water damage, led to the paper delaminating in fragments like a jigsaw. New treatment approaches for iron gall ink damage included the use of gels and a heat mat.

This conservation project is a reflection of recent developments in paper and book conservation at TNA's Collection Care Department. It included the identification of materials and the development of tailored conservation treatments with the help of the conservation scientists. It required historical research provided by the archivists and non-TNA historians. As a result, the map is being used as a case study for in-house training and for various outreach events. In the newly created position of the Senior Conservation Manager for Single Object Treatments I have been focussing on high profile documents and conservation challenges and directing the development and adaptation of new treatment methods. The present conservation project lent itself to contribute to TNA's conservation skill development programme and to improve the organisation's conservation methodology for single objects.

Peregrinations of an 18th-century Armenian Prayer Scroll

Xiaoping Cai, Emily Williams, Sylvia Albro, Claire Dekle, Lynn Brostroff, Levon Avdoyan

Armenian prayer scrolls are Christian talismans used to protect bearers from harm, to promote healing of illness, and to ensure good fortune. Hmayil, the Armenian name for these scrolls, means “enchantment” in Old Armenian. Early examples were manuscripts, but printed scrolls became common with the advent of movable type. There are three printed Armenian prayer scrolls in the collections of the Library of Congress. All were printed at about the same date, in the same city. All are illustrated, but the individual palettes used for coloring the woodcuts are very different. This presentation will focus on the recent conservation treatment of a severely damaged hmayil, and will highlight the complicated and precise procedures of the treatment and housing as well as the scientific analysis of the scroll.

The hmayil was printed in Constantinople in 1729; the text was printed on European paper with movable type and the illustrations added as woodcuts. It is about 3.5 inches wide, but 15 feet long. When the Library received the scroll, it was broken into fourteen fragments of varying lengths despite evidence of several efforts to restore and repair it. Stains and surface dirt disfigured the paper and obscured the hand-colored illustrations. Given the size of the object and the labor intensive treatment needed, the conservators considered treatment materials and methods to determine a treatment process that would be both efficient and sustainable. In addition, they carefully organized the project to maintain consistency in procedures while retaining flexibility to respond to new challenges that might arise. The treatment employed materials relatively new to conservation and blended Western and Eastern conservation techniques. For example, fragments were washed on layers of non-woven polyester-cellulose cloth (Tekwipe®), chosen for its strong vertical capillary action and reusability.

To stabilize fragments and reconstruct the original sequence of the scroll, primary and secondary linings of two different Asian papers were applied using a combination of traditional Asian and Western lining techniques. To dry the linings, conservators used both Japanese materials and methods for tensioned drying, as well as Western papermakers' felts. Since the strength and flexibility of the paper did not permit returning the scroll into its original format, a Western method of storage and presentation - window mats - was used, but their structure was tailored to meet the special needs of the curator and researchers. The conservators investigated the colorants used in the scroll by non-destructive analytical techniques: multi-spectral imaging and X-ray fluorescence spectrometer. The findings will be discussed in the presentation. The characterization also establishes a future direction for research by a multidisciplinary team to compare different color palettes from the Library's hmayils and the reference collection of Armenian pigments available to the Library, with the goal of contributing to the knowledge of historical Armenian artist's materials.

Looking Back and Taking Stock – A Journey through Past Projects

Elmer Eusman

Since this year's AIC's Annual Meeting theme has been expanded for the Book and Paper Group session to include re-evaluation of materials used in historical conservation treatments, the speaker would like to reflect back on more than 30 years of training and working in the conservation field and publicly review some cases that provided great anxiety at the time or give pause upon reflection today. He will in fact review his own – by now – historic conservation treatments. The cases range from unintended immediate physical and chemical modifications, to unexpected long-term changes that have an impact on the use of collection items. The speaker will review a number of conservation treatments and evaluate how they have stood the test of time. He will also recount his experience as a conservation student, damaging a 16th century Albrecht Dürer print during a conservation approach that he has since then no longer used. He will discuss his experience with light bleaching a 19th century drawing by Joseph Keppler, an action that created unanticipated chemical changes in the paper. And he will delve into mechanical paper splitting and the unexpected long-term effects of this technique on 19th century US newspapers. The speaker ends with an observation made using Russell-effect photography and wonders whether the wide-spread use of the mat window as storage container should receive closer scrutiny in case in certain circumstances this type of housing unintentionally creates an environment that will give rise to a higher oxidation rate within the confines of the window.

Book & Paper Session - June 1

Small But Bulky: A Study on the Rebinding of a Portable 15th century Book of Hours

Kimberly Kwan

Book conservation treatment rarely calls for the full rebinding of a book. Where possible, conservators preserve the material nature of a book by keeping its original components and performing minimal intervention. At times, more interventive treatments are necessary to prepare the book for safe handling. HRC 10, a 15th-century Flemish book of hours from the Ransom Center's Medieval and Early Modern Manuscripts Collection, presents a case-study where rebinding became essential, allowing an in-depth examination into combinations of different binding components suitable for small, bulky manuscript formats. Prior to treatment at the Ransom Center, HRC 10 was in a 19th-century stiff board, laced-in binding sewn on recessed cords. While the manuscript is small enough to fit into the palm of a user's hands, its 226-folio text block makes the volume very thick. The opening of the volume's parchment leaves was restricted by the binding and the text block's heavily lined spine. To access the book's contents, users had to exert pressure to open the text block, often with their fingers touching the fragile illuminations and writing that is

close to the edges of the pages. As the manuscript is often studied for its illuminations, curators and conservators determined that treatment was necessary to increase the openability of the text block. Multiple conservators worked on HRC 10 over the course of its treatment, and the treatment plan changed greatly from its initial development to completion. When a decision to re sew and rebind a text block is made, conservators usually attempt to create a new binding structure that is sympathetic to the period of the text block. For HRC 10, this would have meant resewing on raised supports. While this is a strong sewing structure, it is not optimal for small, bulky text blocks, where the sewing supports tend to restrict the movement of the spine. Resewing HRC 10 in such a structure were therefore not successful in increasing the openability of the volume. Several models with various sewing structures were made to determine the best structure for HRC 10, using different combinations of components such as sewing style, sewing support materials, lining materials and methods of attachment, and endbands. An unsupported link stitch, similar to the sewing used for earlier Byzantine and Coptic bindings, was finally selected. It greatly improved the openability. The binding was then covered in an alum-tawed skin, a conservationally-sound material. The treatment project of HRC 10 presented an opportunity to trace the thought-process of different conservators throughout the treatment of one manuscript, culminating in an in-depth examination of the structural complications of working with small, bulky text blocks to provide a satisfactory treatment solution.

Branded by Fire: Treatment of Los Primeros Libros

Jeanne Goodman

The Texas A&M University Libraries collections contain twenty examples of volumes designated as "primeros libros" and form the basis of international collaboration of nearly thirty institutions to build a digital humanities collections of these volumes available for research (<http://www.primeroslibros.org>). These Texas A&M University volumes are previously untreated and several are in need of intense conservation treatment to bring them back as functional research tools. This presentation will review the unique characteristics of volumes of primeros libros selected for conservation, such as the marcas de fuegos (burned in brand) that is on several foreedges of the books, and how those characteristics informed the treatment decisions while preserving the significance as unique artifacts.

For treatment strategies, different approaches were considered and selected based on the diverse needs of the volumes selected for treatment such as parchment repair, new sympathetic binding, and a reversible "medium solution" binding for an incomplete manuscript will be reviewed and presented. Primeros libros from other collections in the state of Texas previously treated will be reviewed to see how previous treatments function in high use research collections and how those repair materials have aged.

Item Background: "Primeros libros" are books first printed in the Americas from approximately 1539 to 1605 in colonial

Mexico and Peru. They are part of the Colonial Mexican Collection, which contains thousands of works either produced in Mexico or European imprints concerning Mexico during the Age of Exploration, Colonial, and early National periods and is a significant collecting area for the library as well as resource for the scholarly community in this area. The collection offers a significant number of examples of Mexican colonial bindings, woodcuts, illustrations, illuminated and decorated manuscripts, types, publishers, marginalia, and other information.

The Unintended Effects of Some Book Treatments on Original or Early Binding Structures and Materials

Olivia Primanis

The treatment of bound materials in special collections has become more conservative over the past half century. Today, book conservators choose treatments that safeguard physical information intrinsic to early bindings. The treatments focus on mending and stabilizing book structures, which lessen the need for invasive treatments such as rebinding or rebacking covers. However, in repairing rather than replacing older structures and materials, the book conservator is often challenged by the binding's deteriorated condition, which can range from slight to considerable. At the Ransom Center, we have found that the repair of one binding structure can stress and, in some cases, break adjacent deteriorated binding components. This presentation will discuss problems that typical repairs can cause such as a new break in the sewing structure or stiffness in the spine, which changes how a book opens and how the pages turn. Techniques used by Ransom Center conservators to minimize stress to older components in order to preserve early structures and materials will be described using case studies.

Transparent Liquid Colors: 'Not Just For Ornament'

Joan Irving

Today, transparent graphic effects can be made with the click of a mouse. However, in the 18th century, a specific type of colorant was commercially manufactured to render clear, brilliant, transparent effects. These colorants were called transparent liquid colors. They are little mentioned in the conservation literature and in the history of watercolor. These liquids are very different from water-based media used for other types of objects, such as miniatures and even other types of popular prints. The transparent liquids were commonly used for coloring maps, plans, prints, and even painting on velvet. This paper will examine the history and development of the transparent liquids and will include observations from recreations based on recipes found in historic manuals. The identification of transparent liquids, visually and analytically, may help to answer one of the vexing questions regarding hand coloring – that is “who put the color on the map or print?”

The use of the transparent colors may suggest a professional or technical hand, versus amateur, particularly after the invention of watercolor in cake form.

John Singer Sargent: New Insights into his Watercolor Materials and Techniques

Mary Broadway, Veronica Biolcati, Ken Sutherland, Francesca Casadio, Emeline Pouyet, Agnese Babini, Gianluca Pastorelli, Danielle Duggins, Marc Walton

As imaging technology continues to be developed in the service of material identification and mapping, long-standing assumptions about artists' media and processes can finally be tested. Analytical methods such as GC-MS, SERS, XRF mapping, and hyperspectral imaging represent opportunities to breath exciting new life into exhibitions of works by artists who have become perennial favorites. John Singer Sargent is one such artist on whom numerous tomes have been written and about whom it may seem there is nothing more to say. This talk will contradict that notion by presenting new insights into Sargent's materials based on the coordination of close visual observation, scholarship, and material analysis using established scientific techniques as well as techniques that have only recently become available such as hyperspectral imaging and macro-XRF mapping. The present exhibition *John Singer Sargent and Chicago's Gilded Age* afforded the opportunity to conduct a technical study of eleven of Sargent's watercolors at the Art Institute of Chicago. Though the sample set is small for such a prolific artist, the works span nearly forty years of the artist's watercolor production. He sustained passion for the medium throughout his life and, as analysis revealed, he sometimes experimented by altering his media. These discoveries were made possible through collaboration between curators, conservators, and scientists who are innovators in fields ranging from computer science to spectroscopy. They stress the importance of establishing a scientific basis for claims made about artists' processes, even if they originate from primary and secondary sources. This information adds to the extensive body of technical work that has already been published on the largest American collections of Sargent's watercolors, namely those at the Museum of Fine Arts, Boston, the Brooklyn Museum of Art, and the Worcester Museum.

Multi Spectral Imaging and the Digitization of the Dead Sea Scrolls

Orit Rosengarten, Pnina Shor

The discovery of the Dead Sea Scrolls (DSS) in the Judean hills seventy years ago is considered one of the greatest archaeological discoveries in modern times. The scrolls were either written or copied in the Land of Israel between 250 BCE and 68 CE. They represent the oldest written record of the Old Testament, and contain the earliest copies of every book of the Bible, except one. This “Ancient Library” allows us to peer into a period, 2000 years ago, pivotal to both Judaism and Christianity. Thanks to

these remarkable texts, our knowledge concerning the origins of Judaism and early Christianity has been greatly enriched. Issues of publication, conservation, preservation, and documentation of the DSS have concerned both scholars and conservators ever since the scrolls' discovery. The Israel Antiquities Authority (IAA) first embarked on this ambitious project of multi-spectral imaging as yet another conservation effort, but it very soon it evolved into an overall project that is gradually changing DSS research environment and methodology. I will begin with a general overview presenting a short historical assessment of the state of preservation and documentation of the scrolls and their availability to the public and to the scholarly community before this project began. The presentation will discuss in depth the technology and sciences involved in the imaging, the development of a noninvasive monitoring system based on the multi spectral images for following the state of preservation of the scrolls; the creation of highest-quality color images and advanced near infra-red images for public and scholarly use; the online digital library, open access, computer generated tools, algorithms, virtual work-spaces, and new studies resulting from these best possible images. Finally, I shall briefly survey future objectives and challenges we still face. The Dead Sea Scrolls are a universal cultural heritage. As such, it is our duty to safeguard and preserve them for future generations while sharing them with the public and scholarly community worldwide.

2018 BPG Wiki Discussion Session

Katherine Kelly, Denise Stockman

The BPG Wiki is a collaborative knowledge base of conservation techniques that belongs to all of us. Please come to the 2018 BPG Wiki Discussion Session to keep updated about its progress. We will acknowledge the people who have made contributions, demonstrate new and improved Wiki pages, and facilitate an open dialogue. Attendees will be invited to comment on the developments and discuss what to focus on in 2018-2019.

The 2017 BPG Wiki Discussion Session in Chicago provided energy, inclusion, and focus to the continuing effort to make the Wiki as relevant as possible. We discussed reformatting and updating chapters; how to deal with outdated (historical) treatments, materials, and terminology; and the importance of including images and videos. With the help of a group of volunteers, we have been following through on your input with great success.

This has been the best year yet for the BPG Wiki. Let's keep the momentum going. The feedback that we receive during these sessions is invaluable in planning for the future of the BPG Wiki and maintaining an engaged and active membership.

Book & Paper Session - June 2

Stone Paper: Examination of Géricault's *Lion Devouring a Horse* Lithographic Printing Matrix

Christina Taylor, Georgina Rayner, Katherine Eremin, Christopher Wallace

As lithography gained popularity during the beginning of the 19th century, Alois Senefelder, the inventor of lithography, marketed stone paper as a cheaper, more accessible alternative to the cumbersome limestones most commonly used for printing. Between 1820 and 1821, Théodore Géricault, one of the early proponents of lithography, experimented with the use of stone paper. The *Lion Devouring a Horse* stone paper matrix is in the collection of the Harvard Art Museums and is the focus of this study. Stone paper is a lithographic printing matrix made of a heavy weight paper prepared with a special coating. Like other lithographic processes, the image is drawn on the prepared surface with a greasy material and the surface is then processed and printed from. The stone paper matrix for *Lion Devouring a Horse* sustained numerous losses to the coating, and during printing the losses in the image area transferred to the prints as voids. Through examination and comparison between the stone paper matrix and various impressions of the print, it is evident that some prints exhibit more voids than others. This variation is an indication that the coating deteriorated as the impressions were being printed and these voids helped build a chronology of this coating deterioration. Earlier impressions of prints are typically considered to have stronger impression quality but based on the developed chronology, earlier impressions of *Lion Devouring a Horse* do not necessarily relate to stronger impressions.

Senefelder described stone paper coatings as compositions of clay, chalk and metallic oxides. X-ray fluorescence (XRF) analysis of the stone paper coating revealed only the presence of lead. Small samples were taken for analysis by Fourier transform infrared spectroscopy (FTIR), gas chromatography mass spectrometry (GCMS), scanning electron microscopy with energy dispersive analysis (SEM-EDX) and matrix assisted laser desorption/ionization (MALDI). Analysis confirmed that the material was dominated by lead white (basic lead carbonate) combined with a drying oil binder, casein and gum. Lead soaps are thought to be present within the medium.

The results of these careful comparisons, the instrumental analysis, and tests carried out on modern examples of stone paper will illustrate the practical challenges Géricault faced when printing from stone papers and the reason for their limited commercial success.

Édouard Manet's Pastels on Canvas Supports

Rachel Freeman, Christine Conniff-O'Shea, Don H. Johnson

Édouard Manet (1832 – 1883) is celebrated as an accomplished painter and draughtsman, equally conversant with canvas, oil paint and brush as he was pen and ink. From the perspective of materiality, his pastels, particularly those executed on primed canvases, stand at the intersection of these two disciplines. Relying on analysis carried out for an ambitious online scholarly catalogue, this talk compares and contrasts two of these works, *Man with a Dog* and *Portrait of Alphonse Maureau*, and discusses the adoption of paintings conservation techniques to stabilize the artworks for storage and display. Both works are portraits in the collection of the Prints and Drawings Department at the Art Institute of Chicago. Although dissimilar as portraits, the works are strikingly similar in terms of materials and techniques. Examination of the works indicates that Manet borrowed heavily from his knowledge of painting practice. Notable technical analysis included thread count and weave match analysis, which demonstrate that the supports were cut from the same bolt of cloth, likely a commercially prepared canvas. Unfortunately, the canvases are significantly undulated and the ground does not provide adequate purchase for the layers of unfixed pastel, and thus there is media loss throughout both artworks. The second part of this lecture details how paper conservation staff have used padded inserts, similar to those used for oil paintings, to fill the recesses created by the stretcher from the verso to provide an even support and cushioning to the slack canvases, and to reduce or eliminate vibration. The Édouard Manet online scholarly catalogue is available through the Art Institute of Chicago's Conservation web page or through the following address: <https://publications.artic.edu/manet/reader/manetart/section/140020>.

Think Outside of the Box: Displaying Paper Objects Without Using Classic Method

Hsuan-Yu Chen, Chi-Chun Lin, Jen Jung Ku

Toilet paper is one of our daily necessities. However, when it is becomes a museum object that needs to carefully be treated and stored, it takes a lot of efforts for its light, thin and soft property. This essay targets on making preventive conservation of toilet tissue object by utilizing friction and static electricity. Unlike other paper objects, the toilet paper has same special properties; for example, it is thinner to be torn apart, lighter to be blown away, and more sensitive to moisture. For those reasons, we need to preserve and display this kind of object in different ways instead of expected paper conservation ideas.

We focus on how to preserve and display this kind of object by choosing suitable materials and trying different methods of fixing museum objects. Due to its vulnerable structure and hygroscopic feature, we avoid using any adhesive on the object directly. Instead, we try to use friction and static electricity testing the stability of storage method. First of all, we made use of the storage method of textiles and fiber objects to fix the paper and the textile via friction.

Through friction tests, we found the object could be sit steadily on textile. Then, we made a deep window with inner tray for each toilet paper. Last, we fixed the object with imperceptible strips to preserve sliding and falling. Therefore, we found the static electricity is another function to hold the toilet tissue object, not only the friction but the static electricity became ideal way to house and display object at the same time.

The object is a manuscript written by Lu Hsiu-lien on toilet paper with a ballpoint pen when she was imprisoned for a political event known as "Kaohsiung Incident" back in 1979. This manuscript focus on New Feminism and the political issue she has long been concerned with, which is quite important in the development of both society and politics in Taiwan. The manuscript used to be displayed on a poster by sticking it on copying paper with double-side tape, which resulted in deterioration. As a result, it required treatment when it was housed in National Museum of Taiwan Literature. The discussion aims at the conservation of an object made of toilet paper. Besides coming up with a measure to conserve an object made of toilet paper and consider preventive conservation for a toilet paper object with minimal intervention and reversibility, it is also important for us to plan how to display this kind of object.

Screenprint on Plastic (Some assembly required): A Case Study of Joe Tilson's *The Software Chart* 1968

Joan Weir, Eric Henderson, Vincent Dion

By the beginning of the sixties, contemporary printmaking in the Americas and in Europe was already in the midst of a renaissance. Artists and printers actively began to collaborate to produce artworks which challenged traditional concepts of printmaking. The boundaries of size, materials, content and production were virtually obliterated and resulted in some of the most unique, affordable, and accessible art produced at the time. *The Software Chart*, 1968, by British artist Joe Tilson is a screenprint on plastic printed by the Kelpra Studio, leaders of the era in the production of artist's screen printing in London, England. The five-colour screen-printed image, appropriated from print media and referencing a major international event, is printed on plastic (noted as Astrafoil) and backed with a reflective surfaced plastic (noted as Lumaline). Print and backing were adhered to each other with double sided masking tape, mounted to card and framed in a shallow metal frame. Printed and produced in an edition of 150, most known versions of this print assembly exhibit severe pressure related distortions and offgassing (vinegar odour). The print was not considered to be in exhibitable condition and came to the conservation department for review. This presentation will describe in detail the print history and concept, components, condition issues, material analysis, treatment stages, degree of treatment success, and the many issues relating to possible reconstruction, final presentation and long term prognosis.

Caring for Electrophotographic Art: A Case Study of the Pati Hill Archives at Arcadia University

Gillian Marcus

This paper details a preservation strategy for the long-term care of electrophotographic art in museum and archival collections, using the Pati Hill Archives at Arcadia University as a case study. In 2016, Arcadia University was gifted copy artist Pati Hill's archives and original prints — and along with them an interesting preservation challenge. Hill was one of the most prolific electrophotographic artists of the late 20th century, and her prints were almost exclusively produced using the black and white photocopiers manufactured for office use from the 1970s through the 1990s. Her working process pushed the mechanical capabilities of the copier; she overfed the machine with black powdered toner to produce what she called “stars,” areas where a very dense black toner layer was broken up by spots in which the toner particles did not fully adhere. Hill's manipulation of the amount of toner applied to her prints is a trait which separates her from many other copy artists, and is also key to identifying the order in which multiple prints of the same object were produced. This makes it especially crucial that the toner layers of her prints are prevented from deteriorating over time. Electrophotographic prints (also known as photocopies, Xeroxes, and xerographs) are extremely common in archival document collections, where they are often considered secondary resources or copies of primary source material. However, there is a dearth of preservation literature providing a protocol for their care and preventive conservation as art objects. This paper will discuss the history and technology of the electrophotographic process, as well as risks and potential agents of deterioration to both the paper support and toner layer(s). Hill's materials, working methods, presentation choices, and curatorial decisions are analyzed in the context of potential preservation challenges, including issues impacting future conservation treatment. The paper concludes with recommendations for practical steps toward the preservation of electrophotographic prints, including guidelines for housing and storage, environment, light exposure, conservation treatment, and exhibition.

Improved Methods of Authentication and the Resulting Shifts in Decision-Making in Parchment Conservation

Patricia Engel, Matthew Collins

Shifts in decision-making in the conservation of cultural heritage can be understood by browsing the old instructions in conservation and comparing them with our current perception of the results of older conservation treatment and the current ideas of what a conservation measure should be like. Through understanding old methods and material we can estimate the objectives set by conservators in the past and get a better insight into the complex environment of conservation. Technical changes, including better analytical methods and changes in society accompanying

them, lead to a different perspective of cultural heritage and to continuous emergence of innovative treatments being adopted to our new objectives and vice versa.

One very recent example of technical development relevant to conservation of cultural heritage items is the decoding of proteomes and genomes that helps understand the sources of the skins and use manuscripts as a stock of information. To demonstrate the above we started out with the analysis of Otto Wächter's *Restaurierung und Erhaltung von Büchern, Archivalien und Graphiken*, 1982. We narrowed the topic further down to parchment conservation, as new molecular research applies to this area. The question was: which old conservation treatments altered parchment in such a way that information stored in the material was damaged, changed or overlaid and consequently made uninterpretable? If so, could we, with improvements to current methods, deconvolute the data to read the original signal through the conservation overprinting? The choice of the book was determined by two considerations: first, it was very influential in its time; second, it is difficult to interpret if you were not a pupil of Wächter, and one of the authors was his pupil. Since Wächter's time, our knowledge of the features of material improved greatly and so did our procedure of decision-making in conservation. Our view of old methods changed in a way that allows us to understand that some of them had a significant impact on the information carried by the material, which is considered an added value in research today.

The project results made scholars:

- understand how old methods and materials in conservation changed the historical material;
- appreciate different types of biological data that can be recovered, from livestock management, through craft production to the use history of the object,
- understand how we might gather and interpret this palimpsest of biological and craft information, such as kind, sex or breed of the animal, the breeding history of the flock or herd, etc.
- explore the changes imposed by subsequent conservation and understand how to avoid conservation methods that either overprint with new biological signals or destroy the original ones and identify a conceptual framework for alternative methods;
- examine which types of modification induce changes which can be detected and isolated, thereby recovering the original signal;
- explore how new methods might fulfill the conservation task without changing the original information carried by the material, show how the new demands on the material side alter the demands in aesthetics in conservation.

JOINT SESSIONS
BOOK & PAPER + ELECTRONIC MEDIA [ACDG]

*Archives Conservation Discussion
Group (ACDG)*

**Preserving the Protest: Collection and Care of
Social Movement Archives**

*Moderators: Patricia Falcao, Stephanie I. Gowler, Flavia Perugini,
Crystal Sanchez*

The Archives Conservation Discussion Group (ACDG) and the Electronic Media Group (EMG) will host a panel presentation and discussion session addressing the preservation of physical and digital objects used in political demonstrations and social movements.

Materials produced and used during protest marches, vigils, and political actions tend to be ephemeral — made and used on-the-fly with available, inexpensive materials — and are often exposed to a range of environmental hazards prior to entering collections. Digital media, from live video streaming to social media posts to smartphone photos, have become integral to contemporary protest movements and require innovative approaches to preservation and access.

Presentations and Panelists:

**Preserving Artifacts of Free Speech: Simple Solutions for
Buttons, T-shirts, and Bumper Stickers**

*Whitney Baker, Head, Conservation Services, University of Kansas
Libraries*

**The History, Evolution, and Growth of Digital Printing
Technologies and Materials Correlated with Major Political
and Social Movements and Events over the Last Three
Decades**

Daniel Burge, Senior Research Scientist, Image Permanence Institute

**Moldy Oldies: Saving Historic Audiotapes with Digitiza-
tion & Organic Particle Masks**

*Kim R. Du Boise, President & Senior Photograph Conservator of
PhotoArts Imaging Professionals, LLC., and Roy Cazinero, VP
and Electronic and Time-based Media Conservator for PhotoArts
Imaging Professionals, LLC*

**Making Social Movements Accessible at Media Burn
Archive**

Dan Erdman, Video Archivist, Media Burn Archive

**Caught Up in the Current: Documenting, Preserving, and
Digitizing Political Protest Ephemera**

*Cher Schneider, Juanita J. and Robert E. Simpson Senior
Conservator, University of Illinois at Urbana-Champaign*

Discussion topics will include:

- Documenting and collecting in “real time” as events unfold
- Preserving and making accessible materials which are being used as part of direct political action
- Correlations between social movements and the use of contemporary materials
- Storage and treatment of ephemeral materials
- Creative housing solutions for oversized and 3-dimensional objects
- Navigating issues of provenance, copyright and metadata
- Collaborating with activists and community organizations
- Addressing condition issues resulting from environmental exposure

Library Collections Conservation Discussion Group (LCCDG)

Matters at Hand: The Evolution of Staffing and Prioritization in Library Conservation Labs

Moderators: Sofia Barron, Angela Andres, Jessamy Gloor

Conversations with BPG colleagues at the 2017 meeting in Chicago and in the following months revealed a common interest in how library conservation practice is changing in the 21st century. Through in-person, phone and email exchanges, fellow conservators and preservation administrators have shared their observations and concerns about adapting to shifting institutional priorities. These include prioritizing treatment of certain types of materials over others, responding to and meeting broader institutional goals, and the challenges such changes present to traditional models of staffing and divisions of labor in library conservation labs. A panel of speakers (listed below) from a variety of libraries and archives will offer short presentations that explore both the day-to-day issues and the big picture implications surrounding these concerns. An interactive discussion with the audience will follow to allow for questions, comments, and sharing of experiences.

Prevention and Promotion Round-up

Ellen Cunningham-Kruppa, Harry Ransom Center, University of Texas at Austin

Ellen will discuss new approaches to managing the Preservation and Conservation Division at the Humanities Research Center, concentrating operations and providing ladders of professional advancement for conservators and technicians.

From DIY to Collaboration and Innovation: Observations on the Evolution of Collections Conservation

Werner Haun, Yale University Library

In its beginnings, collections conservation work included identifying early signs of damage (such as loose hinges and pages), creating in-house archival housings (such as pamphlet binders and phase boxes), and increasing widget counts. Through automation and collaboration with commercial binders and vendors, many innovations and improvements advanced the quality and variety of products and services, allowing libraries and archives to outsource much of the routine work. Now, conservators and technicians can perform more complex treatments for all collections, while still applying production-based approaches.

Preservation Librarian to Preventive Conservator: Shifting Priorities in Collection Care at NYU Libraries

Laura McCann and Jessica Pace, New York University Libraries

Over the past ten years, NYU Libraries' Barbara Goldsmith Preservation & Conservation department changed the focus of its

collections care program from the general collections to the special collections in order to meet new and growing needs. Since the 1990's, NYU's archival collections grew exponentially in both size and complexity. In response, the position of Preservation Librarian evolved into that of Preventive Conservator, a newly emerging specialization. We will discuss the evolution of the position as well as its benefits and challenges. Topic addressed will include the impact of high-density off-site storage, changing collecting patterns, and specific needs for artists' archives.

Teaming Up on Treatments

Ashleigh Schieszer, The Preservation Lab (Public Library of Cincinnati and Hamilton County/ University of Cincinnati Library)

This presentation will highlight the role of the conservator as project manager, reconsidering the conventional division of work between conservators, technicians, interns, and student workers; with a focus on each member's role in increasing visibility of special and medium rare collections. The conservation workflow of a unique WWII era scrapbook illustrates a team-oriented work style between conservator, technicians and students. Parceling the large treatment into smaller segments utilized skills to reduce costs and timelines that directly lead to heightened usability and accessibility of the materials.

Shifting Conservation Strategies in Harvard Library Preservation Services

Lauren Telepak, Harvard University Library

Harvard Library Preservation Services is positioning its conservation practices to better respond to library initiatives and priorities which include an increased commitment to digital formats, acquiring unique materials and building collaborative collections. This talk will explore how a recent shift to a unified management of the general and special collections conservation labs has allowed the department to develop cross training opportunities for conservators and conservation technicians to develop skill-sets that can be strategically deployed to address future needs.

Doing More with What You've Got, and Doing it Differently!

Sonya Barron, Iowa State University

Preservation priorities of the university library have shifted to lean heavily towards investing in rare and unique materials and away from general collections, as is the case with many academic libraries. Preservation staff members, who have been doing the same kind of work for decades, now find themselves in a position of needing training to perform their new duties. In this talk I will discuss the challenge of responding to change creatively as a manager, while operating under the constriction of state funding cuts and within union limitations.

Collection Care Session - May 31

STASH FLASH V – Storage Tips Session

Moderators: Lisa Goldberg and Rachael Arenstein

The STASHc (Storage Techniques for Art, Science and History collections) website www.stashc.com, hosted by FAIC is now five years old and continues to expand as a resource for sharing well-designed storage solutions. To complement AIC's 46th Annual Meeting conference theme, the 2018 STASH Flash session will focus on the interplay between the material composition of artifacts and the materials chosen for the construction of storage and support solutions. The session will utilize a lightening round or "tips" format and the full presentations will be posted on the STASHc website following the conference. After the presentations there will be an update on the Collection Care Network's new Materials Working Group and we will engage participants in discussion about their hopes and needs for an online resource that will aid in making suitable materials choices for storage, exhibit and transport.

Scrapbook Rehousing

Alison Reppert Gerber, Smithsonian Institution Archives

The Archives recently received several scrapbooks created by Elizabeth C. Reed during her husband's tenure as Director of the National Zoological Park (NZP). These scrapbooks contain information about noteworthy events and consist mainly of newspaper clippings and pamphlets from around the country. The primary goals of this housing was to provide added support for the textblock to prevent damage during handling and the mitigate future deterioration of the groundwood paper pages. It was also important to maintain them in bound form to prevent any dissociation or disarrangement of pages. First, the scrapbook was taken apart and the plastic posts and nylon cord of the spine were removed. Interleaving paper (80 lb. weight, acid-free, buffered) was cut to size and used between each scrapbook page. To replicate the support of the removed plastic posts, a "spine wrap" was created using archival E-flute corrugated board. The textblock was placed inside the wrap and the original cover pages were reattached using an 8-ply hemp cord, mimicking the original structure of the scrapbook.

Mounting Caps: from Imaging to Storage

Sarah Gordon and Isaac Facio, The Art Institute of Chicago

This project involved rehousing a series of 17th-century English caps when they were presented for imaging. The caps feature fragile metal-wrapped thread embroidery and paillettes, which were vulnerable to loss due to abrasion and lack of sufficient support in their previous storage configuration. The scope of the project was therefore two-fold: create an efficient mounting system for imaging, as the project was time-sensitive, and reconceive the storage design to prevent losses to the material. The solution was to use 0.31 mil polyethylene sheeting ("painter's plastic") as

a quick, economical, and safe material to form easily adjustable mounts. Isaac Facio covered the existing thin, somewhat abrasive padded muslin inserts with plastic to shape a fuller mount, leaving a gap in the middle to receive an Ethafoam insert on which to rest. While the plastic was used to adjust mount size, the insert provided stability and could be removed and reused for different caps. To limit handling long-term, Sarah Gordon then constructed individual FomeCor trays, each with a universal Ethafoam insert adhered to receive a padded hat; the trays were secured with bumpers in a new blue board box. Modification of this simple imaging mount has provided an efficient approach to housing hats while limiting direct handling in the future.

In-Situ Storage of Wrought Iron Gates

Dorothy Cheng, Smithsonian American Art Museum

The historic Art Deco-era building housing the Seattle Asian Art Museum is currently undergoing major renovations. To prepare for these comprehensive updates, the entire collection was packed and transported to storage in either the downtown museum location or an off-site facility. However, the iconic wrought-iron Samuel Yellin gates, commissioned specifically for the newly established museum in the 1930s, are integral parts of the architecture and could not be removed from the premises. It was determined that the gates would be packed in-situ with materials that would buffer against inevitable environmental fluctuations and provide protection from renovation dust and debris. Associate Objects Conservator Geneva Griswold and I used a combination of the stiffer and more affordable Tyvek HomeWrap and the more commonly used needle-punched Tyvek SoftWrap, along with polyester quilt batting, Volara, cable ties, and twill tape to create secure and affordable "blankets" for the gates.

Bug Tubs: Streamlining Blunder Trap Collection for Storage and Transport

Morgan Nau, Peabody Museum of Archaeology and Ethnology at Harvard University

Blunder traps are used throughout most museums as a critical component in Integrated Pest Management. However, given the nature of blunder traps, collecting, storing, and transporting them can become a frustrating and sticky task. Detaching traps that are stuck together not only takes time (and accidental contact with creepy crawlies!), but it can also cause loss of data through damage, as well as contamination of data if pests accidentally transfer from one trap to another.

This presentation will discuss a storage and transport system for traps that was devised at the Peabody Museum. The system utilizes easy to source and relatively inexpensive materials including sealable plastic tubs and coroplast trays, requires little skill to assemble, but will result in a secure, efficient storage solution that can be used for movement within your institution or when shipping traps off site to your pest specialist.

COLLECTION CARE

Boa Storage: Development and Execution

Mary Kuhn, Courtney Bolin, Namrata Dalela, Miriam G. Murphy, John Weingardt, Allison Gentry, Jake Shonborn, and Mary Ballard

A group of boas were found amidst the Black Fashion Museum collection. Several appear to be associated with the Precola DeVore's School of Charm, a charm school and modeling agency in Washington, D.C. It appears to have opened its doors in 1955

A literature survey of feather storage in other museums did not provide an adequate storage solution for these costume accessories to be stored at an off-site facility. One ethnographic conservator said that proper storage would be vertical storage with the feather hung from their central yarn cord. Such a system would not answer the needs of the National Museum of African American History and Culture (NMAAHC): safely transportable, protected from insects, easily accessible, and ready for transfer to a gallery space and exhibition. A special storage method was needed that would be easy to use and to re-use, that suggested to the viewer, even in storage, how stunning and alluring such a garment accessory could be.

Rehousing a Collection of Pre-Columbian Ceramics and Stone

James Thurn, Library of Congress

During the past five years, the Collections Stabilization Section of the Conservation Division re-housed a large collection of pre-Columbian objects made of stone and fired clay. The collection is under the care of John Hessler, Curator of the Jay I. Kislak Collection of the Archeology and History of the Early Americas at the Library of Congress. The pre-Columbian collection was donated by collector Jay Kislak, who acquired his first pre-Columbian piece in 1980. The collection includes pieces dating to the Olmec period around 1,000 BCE to the entire Maya period from 300 to 1,500 CE. At the time of donation, the collection was housed in packing crates constructed of plywood and particle board with interior padding. In addition to the non-archival nature of the original housing materials, the travel packing held each object in close-fitting cavities or complex collars that would complicate handling or observation of the objects. The packing crates also occupied an excessive amount of space. Smaller, archival housings that can be handled safely by the curator allow storage of the objects in newly-acquired, museum-quality cabinets for long-term storage. A total of 341 objects have been re-housed in custom-made, corrugated-board housings. The housings are outfitted with foam, polyester batting, and polyester sheeting (i.e., Tyvek) to protect the objects housed within. Three general box designs were used for the project: the standard box, the pillow box, and the drop-front box. Each object is housed in the box design deemed most protective for the specific object. Protective foam is configured to the specific size and shape of the object and adhered to the interior of the box with hot-melt glue. Challenges faced during the re-housing project include the large size and heavy weight of some objects, and the fragility of the objects, many of which were repaired prior to arriving at the Library of Congress. The bases of housings for larger, heavier objects are reinforced with rigid board containing a honeycomb interior structure to provide strength and rigidity. Removable trays constructed of the same rigid, honeycomb board

material allow viewing of heavy objects, while limiting the need to handle the objects directly. A label containing an identification number, handling information, and a photograph is affixed to the top and front of each housing.

Glass Enclosures for Papyrus

Marieka Kaye, Harry A. and Margaret D. Towsley Foundation

While there is a general consensus that papyrus be handled, exhibited, and stored between sheets of a transparent rigid material such as glass, debates remain as to the very best material for glazing. Historically soda-lime glass has been used, but acrylic has been more recently favored in some institutions. The use of damaging materials such as cellulose nitrate and polyester films are also found in collections. There is much advancement in the field of glass manufacture in recent years, influenced by the need for a lightweight, scratch-resistant, and unbreakable glass to be used in the manufacture of electronics. With a particular focus on Corning Gorilla Glass, this paper will explore how new types of glass may be successfully employed in the housing of papyri, including economic feasibility and an investigation of the way the glass ages and how it handles under stress in a variety of environments.

Preservation Housing System for Cased Daguerreotypes

Ralph Wiegandt, University of Rochester

Due to their reactive silver and silver-gold-mercury nano-structured surface, daguerreotypes are highly sensitive to atmospheric deterioration and excessive relative humidity. Destructive deterioration occurs readily within the enclosed American-style cases, exacerbated by relative humidity >50% and off-gassing case materials containing acidic and sulfur-bearing leather, dyed wool, and silk. This submission describes a low-profile inner daguerreotype plate isolation package assembled with 0.5mm ultra-thin surface-enhanced cover glasses and placed inside the case, without modification of original materials and presentation. The "enhanced" daguerreotype case is then placed in an aluminized flexible barrier foil enclosure with a lock-zippered closure and a 40% RH equilibrated silica-gel sheet. An indicator strip is visible through a clear barrier window to monitor for sustained <50 % RH. Specific daguerreotype deterioration will be described along with the merit and imperative to address this pervasive risk to daguerreotypes with a low-cost and efficiently achievable solution.

Making the Most of What You Have: Digital Documentation Solutions Utilizing Existing Software

Raina Chao, L. H.(Hugh) Shockey, Mike Peters

Documentation is an important aspect of a conservator's work and is essential for communication between conservators in the present and the future. While vital, documentation using traditional methods can also be very time consuming, when time is an ever more limited commodity. In an effort to streamline the documentation process, conservators at the Saint Louis Art Museum

(SLAM) have implemented a process for digital condition reporting using Microsoft OneNote and tablet computers. While a number of options for digital condition reporting have presented themselves in recent years, these tend to rely on specialized software or apps and are often restricted to a single type of operating system. By using Microsoft OneNote, already a part of the museum's IT infrastructure, and tablet PCs the conservation department has been able to improve the efficiency of documentation processes without purchasing additional software or placing undue burden on SLAM's IT department. This paper will focus on the genesis and implementation of digital condition reporting at SLAM using Microsoft OneNote, including an analysis of the strengths and weaknesses of the process. The potential for further applications of Microsoft OneNote for collections documentation will also be discussed.

How to Label Everything – A Review of Current Best Practices in Natural History Labelling

Carolyn Leckie, Luci Ciperá, Erika Range

Natural history collections are used primarily for research by scientists and academics. These collections are continually growing to track information about species and populations in the natural world. These collections are often quite large and labels are fundamental to help distinguish one specimen from its similar looking neighbours. Labels in natural history collections often contain original information which is not recorded elsewhere in museum records and specimens without labels are generally regarded as having no research value. Labels should last as long as their associated specimens. Finding materials to ensure the archival properties for each element of the label, including paper, plastic, inks and adhesives, can be a daunting affair.

At the Canadian Museum of Nature, we undertook a comprehensive review of our labelling protocols. The results have been disseminated on the Society for the Preservation of Natural History Collections wiki page on Best Practices for Labelling Natural History Collections. It addresses a tremendous range of labelling issues that can be easily adapted to other collections from inorganic to organic, microscopic to massive, and wet to dry to ultra-cold. The project's aim was to improve the decision making about the selection and purchasing of labelling materials. We presented our results to maximize end user benefits. We identified three generalized natural history labelling scenarios: dry labels, wet labels and ultra-cold labels. For each scenario, we made a decision tree to clarify and highlight the logic behind the selection of certain materials. To facilitate purchasing of the best materials, we summarized key archival concepts, terms, and symbols used by commercial suppliers that curatorial staff are likely to encounter on supplier websites. We also summarized relevant industry and government standards relating to archival materials, which could be used to objectively evaluate materials. Finally, we summarized previously-developed simple testing protocols that could be used to evaluate purchased materials once acquired. Focusing on the end users, through decision trees to present key information to facilitate purchasing, has been well received and has great potential

to be adapted to other categories of archival materials for which conservators make recommendations. This project also highlighted the challenges in making effective recommendations when new archival materials continue to be developed and adopted. As a profession, we therefore need to continue to have higher level discussions among all stakeholders including, but not limited to, manufacturers, purchasers, conservators, conservation scientists, and standards and testing organizations. A more comprehensive understanding of material science, industry standards and simple tests for archival quality will help collections care staff make informed decisions when selecting labeling materials.

Vibration Testing and Wandering of Objects in a Natural History Collection

W. (Bill) Wei, Esther Dondorp

Studies on the effects of vibrations on the condition of objects of cultural heritage often focus on paintings or unique objects with particular historical value. However, vibrations are also of concern for large collections of objects which serve as (inter) national reference collections. One such collection is the Naturalis Biodiversity Center, Leiden, The Netherlands, home to the fifth largest natural history collection in the world with over 37 million objects. The storage facilities are physically attached to the museum, offices and laboratories, which are undergoing major renovations. This collection cannot be moved elsewhere, so there are obvious concerns about the effect of vibrations due to heavy construction on the wide variety of objects in the collection. There is virtually no data in the literature on the effect of vibrations on natural history objects. Naturalis and RCE therefore conducted a limited set of vibration tests to obtain an initial impression of what could happen to representative objects under vibration loading. Of particular interest were object resonance, movement on the shelves ("wandering"), and the appearance of damage. The storage situation was simulated by placing objects on typical free-standing metal shelves used in the storage facilities, which were placed unfastened on a commercial vibration testing table. Objects included mounted fauna, small specimen boxes, wood and mineral samples, mounted insects, and bottled biological samples. In order to study the effect of vibrations on the objects alone, they were also tested directly on the vibration table. Testing was conducted at different vibration frequencies and levels. Members of the Naturalis collection care staff visually determined the resonant frequencies and wandering behavior of the objects.

The results showed that object vibration behavior depends on a number of factors including their weight, geometry, and mounting, the vibration behavior of the shelves, and characteristics of the object/shelf contact surface. If objects were placed directly on the vibration table, they began to resonate visibly at their resonant frequencies above levels of around 5 mm/s, and began to wander at levels above 20 mm/s. No damage was found for the objects tested for short durations, except for a small loss of particles from a large historical tree branch, and from minerals which lay unpadding on the table. However, vibrations were amplified through the loose standing shelves, reaching levels up to 20 times that of the vibration

table itself. This resulted in significant wandering of objects on the shelves, including small specimen boxes falling off of stacks of such boxes. These results indicate that the 2 mm/s low-risk limit suggested by Wei et al. (2014) for collections for one construction project would be applicable as a low-risk limit for natural history objects. However, measures would be needed to prevent objects from wandering (see also Smyth et al. 2016). Non-reactive padding would help, and would also prevent damage to objects in direct contact with hard shelving materials. Furthermore, monitoring would need to be performed directly on the shelves, as opposed to just on the floor near the shelves.

Collection Care Session - June 1

Materials Selection for Storage, Exhibit, & Transport: A Moderated Panel Discussion

Moderators: Pamela Hatchfield, Catharine Hawks; Presenters: Eric Breitung, John Dunphy, Andrew Robb, Michael Skalka

It is an acknowledged truth in the field of preventive conservation that materials selected for storage, exhibit, and transport of collections play a critical role in the long-term preservation of these same collections. The wrong materials—those selected without careful consideration or those selected based on flawed assumptions (e.g. one batch of material varies in composition from another)—can impact the overall stability of collections, promote damage to collection items, or result in material failure. Selecting an appropriate material can be fraught with challenges: What are the specific properties necessary for the task? How can these properties be evaluated to relate to material performance and overall task compatibility? How can communication with industry result in a supply of consistent material? Nevertheless, collection care professionals must regularly select materials for purpose amid these challenges, which can leave the professional feeling like their best efforts still rely on guesswork, qualitative evaluation, and inconsistent results.

To begin unraveling this complex issue and begin developing solutions, a working group (Materials for Collection Care Working Group) consisting of the various stakeholders engaged in material development, testing, and selection is underway. This group is currently engaged in identifying the current challenges with materials selection and evaluation and more clearly defining the stakeholders and their roles. From there, the group will develop a resource for advancing the community's ability to take a more educated role in material development, selection, evaluation, and use.

A moderated panel focused on improving awareness of materials, their components, and the testing required for their use in collection care will consist of:

1. A Standards professional representing an organization that develops community-tested standards, such as ASTM. This person will address how standards are developed, resources needed for their development, and community expectations: Michael Skalka, National Gallery of Art and ASTM Chairman of DOI.⁵⁷ Artist Materials

2. A Conservation Scientist to present the complexities of material testing: Eric Breitung, The Metropolitan Museum of Art

3. A Conservator experienced in developing specifications for products: Andrew Robb, Library of Congress

4. A Supplier discussing the challenges of working with manufacturers and consistency of materials: John Dunphy, University Products

5. An Exhibit Designer discussing the challenges of working with collection care professionals and materials suppliers and manufacturers to develop in-budget exhibitions with a collection care priority: Tomomi Itakura, Fine Art Museums of San Francisco

Through presentations and moderated discussions, continuing steps for the working group will be identified and prioritized. Each panelist will be given 10 minutes to speak, followed by 30 minutes for guided discussion and questions.

Towards Understanding the Basis of Oddy Test Failures via Quantitative Volatile Organics and Other Analytical Analyses

Eric Monroe, Fenella France, Amanda Jones, Cindy Connelly Ryan, Kelli Stoneburner

We have been examining and testing a range of building, construction, and housing materials for their suitability and level of risk to a range of collection materials. Upon initial testing of proposed materials for use in two large construction/renovation projects, a substantial number of the materials were found to fail the standard Oddy metal coupon test, often in a rather unusual and/or spectacular manner. It should be noted that the original Oddy test focused on the impact on metal only, rather than considering the impact on other material compounds as the dose recipient (such as paper, parchment, polymers, etc.). We have been examining the compounds emitted by these construction and housing materials and how they interact/react with the metal coupons. Through the use of thermal desorption gas chromatography mass spectrometry, we are able to identify and quantify the compounds emitted from each material. In addition, other analytical tools are being utilized to examine what compounds are depositing or have reacted at the surface of the Oddy test coupons during exposure to elevated temperatures and humidity. Coordinating and comparing the chemical analyses with the results from the Oddy test are improving our ability to understand the mechanism(s) behind the failure of the Oddy test and, in turn, guide and speed material product selection. Testing of proposed materials aims to minimize risk to the collection but this risk often cannot be entirely removed by product choice alone. As a means of mitigating the residual risk from volatiles, we have also examined and characterized commercially available sorbent materials for their selectivity, capacity, functionality and adsorption/desorption characteristics. This presentation will detail our on-going research using quantitative volatile organic compound analyses of building, construction, housing, and sorbent materials to further understand and minimize the risk to the range of materials in our collections during storage and exhibition.

Evaluating the Potential of A-D Strips for Assessing the Safety of Materials for Museum Objects

Kelly McCauley Krish, Jean-Louis Bigourdan

This presentation will deliver the results of experiments designed to evaluate how A-D Strips, originally developed to quantify the condition of cellulose acetate film, can be applied to detecting other forms of acidic off-gassing as well. Organic carbonyls are found in a variety of materials including adhesives, wood and laminates, flooring, paints, and textiles used in the storage, display, and transport of objects. Acetic and formic acids are believed to be the primary risks to cultural heritage materials from organic carbonyl pollutants, whether directly emitted from a source or oxidized from the aldehyde forms acetaldehyde and formaldehyde. These pollutants are particularly damaging to metals such as lead and copper and calcareous materials (in the form of Byne's Disease), but can also affect a range of other acid-sensitive materials.

Monitoring for the presence of organic carbonyls is currently limited because the methods for doing so (primarily diffusion tubes) can be expensive to employ. A-D Strips though provide a relatively quick, easy, and inexpensive way and because of this, they have been used in a wide variety of applications: for monitoring of collections, to check the effectiveness of mitigation measures, to evaluate housing seals, and to confirm whether or not products are off-gassing in a version of an Oddy-like test.

In order to use the strips informatively where other acids aside from acetic are present, experiments will be conducted to develop a scale describing the response of the strip to the presence of formic acid. While A-D Strips will continue to react in the presence of any acid so that it will not be possible to identify whether the color changes are due to acetic, formic, or another acid, experiments into their reaction to formic acid will help to add to our scientific understanding of how the strips should be applied in contexts where another organic carbonyl is the concern. With additional testing, this tool can be appropriately used to perform preliminary screening of materials to be used in collection spaces as a complementary procedure to Oddy testing, as well as potentially inform their utilization in a broader range of applications for collections degradation and pollutant monitoring.

Collaborative Project Between Museums: The Case Study of The National Museum of Taiwan Literature and Zhong Lihe Memorial Institute

Jen Jung Ku, Chi-Chun Lin

In 2017, The National Museum of Taiwan Literature (NMTL) began a new project that focuses on preserving the collections of local museums by providing both collections management and preventative conservation education. The local museum staff will have the ability to preserve their collection independently through this project. The project has produced trilateral benefits on national museums, local museums and the public. The NMTL is the first national literary museum in Taiwan that works

toward displaying the history of Taiwan literature and teaching civilians about their own historical literature. As the first official literary museum, the NMTL has the responsibility to assist and guide other local literary museums in developing and preserving Taiwan literature. The Zhong Lihe Memorial Institute (ZLMI) is the first unofficial local literary museum established by a private legal institute, which occupies an important position in the field of Taiwan literature. The ZLMI houses not only the collections of significant Taiwanese authors, but specifically the collections of its namesake, Zhong Lihe. The collections provide evidence of Taiwan literary history and its developments. However, shortage of funds and lack of professional knowledge has left a gap in collections care. Their collections suffered because of an unsuitable storage environment and resource shortages. Due to this situation and the historic significance of the collection, the NMTL decided to use its greater funds and large professional staff to assist them in preserving their collections.

During this project, we helped ZLMI to improve staff abilities in collection management by contributing our resources, such as professional knowledge, experiences and resources of preservation. We planned a series of programs helping them to develop collection management skills including improving their own collection system, teaching preservation and conservation knowledge, and improving the museum environment. Furthermore, the new collection system will now allow the staff to know the condition and the total amount of their objects. Secondly, we held education seminars to give local museum staff basic ideas about preservative conservation. Last but not least, we built a database of the ZLMI collection by digitally recording whole script collections. As a result the collections can be promoted and applied for research and education across Taiwan. The results show unparalleled success. Now the ZLMI has a comprehensive collection system. In addition, the staff have improved professional skills and management abilities to preserve collections. As for the NMTL, we now have access to the research resource of the ZLMI digital database collection. The case of collaboration with ZLMI is the first stage for a large-scale collaborative project, and the success of the ZLMI collaboration will be used to enact similar methods to assist other local literary museums in the future. As a result, NMTL can not only establish long-term collaborative partnership between NMTL and local museums, but also aid in the preservation of Taiwan's literary history.

Electronic Media Session - May 31

Rewind, Pause, Playback: Addressing a Media Conservation Backlog at the Denver Art Museum

Eddy Colloton, Kate Moomaw

While the field of electronic media conservation continues to grow in sophistication, museum acquisitions of electronic media artworks have historically outpaced the development of the field and museum professionals' understanding of the fragility of analog audiovisual materials, software-based artworks, media installation, and other forms of electronic media art. As awareness of electronic media preservation has spread, a need to address the backlog of works already in museum collections has also come into focus. Over the course of the past seven years, the Denver Art Museum (DAM) has worked to establish institutional practice and policy directed at preserving the electronic media in the museum's collection and to deepen institutional knowledge of the complexities associated with this "new" form. However, the DAM began collecting and exhibiting electronic media artwork far before this institutional priority was in place. While developing museum-wide processes for the exhibition and preservation of new acquisitions, the museum has also taken steps to safeguard the electronic media already in the collection. The effort aimed at addressing the backlog of pressing preservation actions necessary to ensure the sustainability of these electronic media works has resulted in two survey-based projects.

In 2015, a pilot project to survey 70 electronic media objects from the AIGA Design Collection of the AD&G Department resulted in an initial framework for preserving born-digital content. Building on the success of this survey, a broader electronic media conservation project, funded by the IMLS, began in December of 2016, and will continue through September of 2018. The goals of the DAM's ongoing grant-funded conservation project affect every media artwork in the collection. Any material from the museum's collection which had previously been stored on videotapes, optical discs, and external hard drives will be migrated to the museum's digital repository, and cataloged in the museum's collection management system. In the process of performing these tasks, video playback equipment, digital storage, and physical storage needs for the institution have been assessed and improved. Much of electronic media conservation literature emphasizes the significance of a particular work's history, promoting an approach of compiling "significant properties" through research, in order to determine the work's "identity" and basing any treatments on this knowledge. This current project addresses the highest risk factors of the DAM's backlog of materials in an efficient and timely manner. Therefore, the "survey style" of this project does not include complete scrutiny of each object before taking certain actions. This presentation will examine the benefits of the DAM's approach, while also acknowledging the constraints of this pragmatic methodology.

Archiving Computer-based Artworks

Jonathan Farbowitz

Art museums throughout the world have been acquiring computer-based artworks with increasing confidence. As artist-created hardware and software enters museum collections, it presents unique challenges for long-term preservation. Conservation staff at these institutions face urgent questions about appropriate materials to collect related to these works and how to define their technical, functional, and conceptual constituents.

The Guggenheim acquired its first computer-based artwork in 1989, Jenny Holzer's *Untitled*, a colossal LED sign installed in the museum's rotunda. Since that time, the collection has expanded to include examples of artist-created websites, custom-made microcontroller units, artist-modified computers, and installations involving video games. As a part of the museum's initiative to "Conserve Computer-based Art" (CCBA) in its collection, this paper takes a critical look at the physical and digital elements that museums retain or generate in order to archive and preserve their computer-based artworks.

Drawing from the Guggenheim's own CCBA collection survey and back-up project, which encompasses artworks from a range of ages and employing a variety of technologies, the paper provides an overview of collected digital assets and documentation, investigates crucial archival elements that are missing in hindsight, and proposes elements that museums should consider obtaining or creating now in order to sustain the collection life of their software- and computer-based artworks.

The paper will devote particular attention to: disk imaging of artist-provided computers, web servers, and removable media (such as floppy disks and CDs); measures that can be taken to enable future access to these disk images; capturing metadata about the hardware and software that an artwork depends upon to function; exploring instances where obtaining source code alone proves insufficient to sustain the life of an artwork; and the importance of technical and descriptive metadata for future migration or emulation of a work. Where relevant, the research draws from the knowledge and experience of the allied fields of computer science, library science, archival studies, and digital preservation. The paper highlights how understanding the practices of these fields as well as engaging in interdisciplinary collaboration becomes essential for conservators to fulfill their mandate as stewards of computer-based art.

Conservation Surveys for Time-based Media Art Collections

Mona Jimenez

Collection surveys provide data to enable conservators to mitigate risks to art collections and to set priorities for item-level conservation going forward. Collection surveys are an essential tool to identify works with urgent needs, but assessing an entire collection of time-based media artworks can be daunting. These collections can exhibit great variations: obsolescent analog and digital videos;

a multiplicity of film types, file-based works on optical media or hard drives; multi-channel projections/installations; software-based works; and works relying upon networks or databases, to name a few. Collection surveys typically focus primarily on environmental factors and item condition. However, with time-based media an depth-in examination of each individual artwork may not be feasible within the parameters of a survey. Common risks to time-based media art are material characteristics (such as inherent tape deterioration or the fragility of emulsion or substrates), and internal/external dependencies (such as obsolescence of critical equipment, software or communication protocols). While works in a collection may seem very disparate, a majority of works will fall into general categories that share at least some of the same risks. For example, multi-channel video works of a certain era likely use the same synchronizing devices.

This session will propose categories that support the identification of works with shared risks and needs, drawing on an understanding of material characteristics, processes within a work, and artists' working methods. Also, another historical emphasis of surveys – on environmental conditions and traditional storage practices – is not sufficient to identify risks. Time-based media artworks are increasingly created digitally, and digital holdings grow as older analog media are migrated to files for preservation. These artworks have not meshed easily with collection management and art handling practices, and in many cases are not given the same care as other art objects. New and reshaped museum systems are needed, and an examination of existing systems can be equally as important as the examination of the artworks themselves. Thus a survey should include information-gathering in areas such as descriptive systems and metadata management, the management of hardware and software, and the adequacy of digital storage systems. Taken together, the individual and systemic risks can then be weighed to develop a plan of action for the collection as a whole.

Sounds Challenging: Documenting the Identity and Iterations of Ragnar Kjartansson's *The Visitors*

Amy Brost

This talk demonstrates the application of a documentation framework for the aural elements in media installation art that the speaker presented at the 2017 Annual Meeting. The focus of this case study is *The Visitors* by Ragnar Kjartansson, a work jointly owned by the San Francisco Museum of Modern Art (SFMOMA) and the Museum of Modern Art (MoMA) in New York. It was recently installed for the "Soundtracks" exhibition at SFMOMA. This large-scale, nine-channel video performance piece has been exhibited worldwide to great acclaim. The setting of the work is a stately, aged mansion in rural upstate New York. The artist gathered fellow musicians there in 2012 to perform an original composition with lyrics inspired by the writings of the poet and performance artist Ásdís Sif Gunnarsdóttir, his ex-wife. One of the themes in the work is the break-up of their marriage, giving the piece tremendous emotional range which has a corresponding broad dynamic range in terms of sound. The piece involves vocals

and numerous musical instruments including two pianos, drums, electric and acoustic guitars, bass, banjo, accordion, and cello, as well as the sounds of the natural landscape, punctuated by two cannon blasts. Life-sized video projections of the individual musicians encircle the audience, whose experience ranges from contemplation of the solo performers to immersion in the music of the entire ensemble. This case study highlights the importance of collaboration between conservators and sound engineers, both within the institution and, where applicable, in the artist's studio. Central to the conservation documentation of the aural aspects of "The Visitors" was an in-depth interview with the artist's director of sound, Christopher W. McDonald. This talk will cover the identity of the work, including both its aural and visual aspects, characterization and assessment of the digital files, significant properties of audiovisual equipment and the acoustic environment, and documentation of the iteration at SFMOMA. Various methods, challenges, and limitations of documenting sound will be discussed, along with future directions for this research, including the further development of the framework and terminology for sound art documentation.

VR Tools as Spatial Documentation

Jack McConchie

As a Time-based media conservator at Tate, recent experience installing complex multi-channel sound pieces led me to think more deeply about how we install and document these types of artworks.

Our aim as conservators is to understand the display parameters of a work, defining whether visual and technical properties of equipment or space are conceptual or incidental. This influences our options for the preservation of an artwork. Acoustic aspects of a work have mostly related to specific equipment, or appropriate spaces for installation, but we do not currently capture information regarding the acoustic properties of a space, leading us to consider the questions we want to ask regarding the environment in which an artwork is installed.

In looking at the relationship between the aesthetics and the acoustics of space holistically, we can easily see how the design of a space becomes an intervention into a work: lessening the acoustic reflection of a space becomes a treatment. In comparison to video and visual works, where, as a community we have a rich and nuanced vocabulary to describe the work within a space and the treatments we might apply, the corresponding vocabulary and shared understanding of audio treatment feels frozen in a more primitive state. This is reflected by our documentation, which historically has been limited to text and pictorial representation. What if our documentation closer resembled the artwork medium?

In this presentation I would like to share our experimentation in practically applying current recording technologies to documentation, our exploration of its uses, limitations and dissemination. Starting with the technique of binaural recording, we are able to accurately capture the spatiality of sound within a space, and provide greater context by a point of view video recording, for viewing on a monitor or a VR headset for a more immersive

experience. This can expand into spherical photos and videos, in which the wearer of a headset is able to freely look around a space.

Once virtual reality is introduced as a tool, it raises many questions about where accurate documentation ends and synthetic reconstruction begins, and for what purposes should the resulting documentation be used for? Given how easy it is to embed 360 files in a web browser to be viewed on a phone, should we be rethinking the idea of the viewing copy, or the thumbnail image?

In sharing this, I hope to raise questions around a potential new documentation framework, and also highlight a new and exciting area of ethics.

Time-based Media Art Conservation Education Program at NYU: Concept and Perspectives

Christine Frohmert, Hannelore Roemich

In recognition of the emerging field of contemporary art, New York University's Institute of Fine Arts Conservation Center will expand its course offerings by establishing a specialization explicitly for the conservation of TBM artworks—the first of its kind in this country. This innovative course of studies will require students to cross the disciplinary boundaries of computer science, material science, media technology, engineering, art history, and conservation. The Conservation Center prepares students for careers in technical study and conservation through a four-year graduate program leading to a dual degree—an MA in the History of Art and Archaeology and an MS in the Conservation of Historic and Artistic Works. The program is committed to maintaining its traditional strengths in paper, books, paintings, and objects conservation, while adding TBM as a new specialization.

During the curriculum planning phase from 2016-2017, the core competencies and skill sets for future TBM conservators were identified based on meetings with experts from European programs and potential employers and practitioners in the U.S. The learning objectives have been organized to fit into the most suitable teaching formats and built around the best possible time line for acquiring specific skills. As with other specialties within conservation, the core competencies of future TBM conservators are grounded in conservation ethics, conservation methodologies, and conservation science. The conceptual framework of modern and contemporary art conservation alongside modern and contemporary art history and media theory will provide the basis early in the student's education.

Building on that foundation, specifically designed courses will cover topics such as electrics / electronics, computer science / programming, audio / video technology, digital preservation, and photo-chemical processes to develop a solid knowledge of each TBM media category, such as film, slide, video, audio, software, performance, light, kinetic, or internet art. Furthermore, the equipment associated with each media, the signal processing and characteristics of different display and playback devices, needs to be understood in context to assess the visual and aural integrity of a TBM artwork. In addition to the technical competencies, communication skills and the ability to create a network of experts are equally important. To gain physical and intellectual

ownership of an artwork, future TBM conservation students will learn and practice how to identify the work-defining properties of an artwork and to understand and document all components in context, which requires close communication with all stakeholders involved. Students will learn how to draw a preservation plan for a TBM collection, which will translate into the general skills needed to promote advocacy for TBM works in an institution, to build and grow a lab, and to establish workflows. This presentation will outline the major steps planned for the education of future TBM art conservators and how this program will augment the body of knowledge in response to the needs of a rapidly growing art conservation discipline. The inaugural class will be launched in the fall of 2018. The development of the TBM art conservation curriculum has been generously supported by the Andrew W. Mellon Foundation.

Electronic Media Session - June 1

Collaboration in the Aesthetic Zone: Trisha Brown and Robert Rauschenberg

Bill Brand, Shu-Wen Lin, Cori Olinghouse, Francine Snyder

Set and Reset is a masterpiece of American postmodern dance, establishing Trisha Brown's role as a seminal choreographer working within abstraction. The performance, a collaborative project between Trisha Brown (choreography), Laurie Anderson (music), and Robert Rauschenberg (set and costumes), made its U.S. debut in 1983 at the Brooklyn Academy of Music, New York. To assure the longevity of *Set and Reset*, preserving the set's film elements has become a collaborative effort between two of the artists' estates, demonstrating a new preservation strategy for the exchange of information, histories, funding, storage, and clarification of rights.

Since its inception, the Trisha Brown Dance Company has frequently toured *Set and Reset* domestically and internationally, including a major performance this past spring 2017 as part of the Rauschenberg exhibition at Tate Modern, London. Prior to London, the performance continually used Rauschenberg's original set, which Rauschenberg entitled *Elastic Carrier (Shiner)* despite the entire performance being named *Set and Reset*. The set consisted of a freestanding multi-pyramid structure on which montaged archival footage from 6 reels of films is projected, and the film elements were deteriorating from years of continued use. Recognizing this, TBDC applied without success for several grants to preserve the films. The project was "set and reset" a few times until fall 2016 when TBDC joined with the Rauschenberg Foundation and work proceeded with BB Optics and independent media conservator, Shu-Wen Lin. The result of this project debuted at the performance in London.

Throughout the preservation project, we endeavored to track and document the reasoning behind the unavoidable changes between the 1983 and 2017 presentations. Given the collaborative nature, we carefully address the following issues — who is responsible to preserve a moving image work that is part of a

performance? Is *Elastic Carrier (Shiner)* an independent work, or may it only exist as an element of the dance? What are the implications of migrating a moving image work in performance from film to digital projection? This panel aims to share the continuing conversation among estates and foundations, and to shed light on issues and principles surrounding the preservation of moving images in performative artworks.

Emulating Horizons (2008) by Geert Mul: The Challenges of Intensive Graphics Rendering

Claudia Roeck

Similar to a conservator going into the details of a certain paint or plastic used in an artwork, I will concentrate on the graphics pipeline of *Horizons (2008)*, a software-based artwork by Dutch media artist Geert Mul. The graphics pipeline is a chain of software and hardware tools a computer needs to render graphics. It can be very specific for video games or software-based artworks that make use of intensive, real-time graphics rendering and it has an impact on the preservation strategy. This research is based on the publications Falcao et al. 2014¹ and Rechert et al. 2016².

Computer rendered graphics are quite common in software-based art. Artists may use video game software to produce video games for their simulations or interactive animations, as for instance for *Sow Farm (2009)* by John Gerrard or *Olympia (2016)* by David Claerbout. Other artists and their collaborators produce the software themselves, as for instance Geert Mul and his programmer Carlo Prelz did for *Horizons (2008)*. *Horizons (2008)* has a classical setup for a computer-based artwork: it receives user input from a sensor, the computer generates a video by combining image sources and the sensor input and outputs the video on video projectors. Thus, it should be possible to generalize the findings of this research for artworks with a corresponding setup.

While preparing for his retrospective, Geert Mul realised that many of his artworks did not function anymore and needed updating or transfer to newer hardware. Consequently, he initiated a project with LIMA, a platform for research and archiving of media artworks in Amsterdam, in order to make his artworks “future proof”³. *Horizons (2008)* did not have an immediate problem. However, when evaluating its long-term preservation options, it turned out that its graphics rendering was video card dependent. The model of the video card was hard-coded into the software, which means that changing the video card makes the work dysfunctional. As emulators of personal computers usually do not emulate specific video cards, I also feared that *Horizons* could not be emulated. The hard-coding of the video card could be remedied by adapting the reference from the old to the new video card. However, it would still not make the work suitable for emulation. Furthermore, it appeared that certain intermediary software libraries are necessary in order to make the work independent from the hardware and therefore enable software rendering or virtualization. By analysing the graphics pipeline, it is thus possible to assess with a high probability whether the work can be emulated or virtualized. Other factors that might impede an emulation such as peripheral equipment are not discussed here.

Yet I will show what has to be considered when “building” such an emulation or virtualization for graphics intensive artworks.

1 Falcao, Patricia; Ashe, Alistair; Jones, Brian (2014): Virtualisation as a Tool for the Conservation of Software-Based Artworks. Tate. London.

2 Rechert, Klaus; Ensom, Tom; Falcao, Patricia (2016): Introduction to an emulation-based preservation strategy for software-based artworks. Pericles / Tate.

3 <http://www.li-ma.nl/site/news/future-proof-transformation-digital-art-2017>

Preserving Stephan von Huene’s Electronic Artworks by Means of Bit-Stream Documentation

Sophie Bunz

The ZKM | Center for Art and Media Karlsruhe, Germany is well-known for its media art collection. Recently the ZKM inherited two artworks by German-Californian artist Stephan von Huene, which have been undergoing a comprehensive acquisition process by means of audio, video and bit-stream documentation during a one and a half year fellowship. Von Huene’s computer-based sound installation *What’s wrong with Art? (1997)* shall be core theme and case study of the given talk. Stephan von Huene is a particular case, when it comes to systematic documentation of his electronic artworks by the artist himself. The artist’s estate, a meticulous archive of photographic and technical documents, is demonstrating this systematic way of working, and thus is an outstanding source for researchers. *What’s wrong with Art? (1997)* consists of three computer-controlled organ towers in the colors red, yellow, and blue, a complex electronic circuit, custom-made computer hardware as well as executable and compiled files written by the artist. Assessing the risks, future access, and preservation it became apparent that the computer, with its individual plug-in cards and compiled code once failing could not be reactivated, reproduced or emulated and would therefore be lost. To cope with this issue, the electronics technicians, information scientists and conservators of ZKM worked closely together to tackle the risk of loss by designing an individual “Logic Analyzer,” recording and documenting the output and bit-stream of the computer and conducting comprehensive documentation of the logic system.

Introducing ‘Code Resituation’: Applying the Concept of Minimal Intervention to the Conservation Treatment of Software-based Art

Deena Engel, Joanna Phillips

This joint paper proposes a new treatment method for the conservation of software-based art that was developed as part of the ongoing research collaboration between the Guggenheim Conservation Department and the Department of Computer Science at New York University. The new treatment technique, termed “code resituation” by the authors, is tailored to serve artworks where code intervention is necessary to restore the artwork’s functionality. Traditional code migration, as practiced

by computer programmers, includes the deletion and replacement of non-functional, original code. Intended behaviors and discernable output of an artwork would be recreated by means of contemporary programming languages, aiming for the most elegant and efficient programming solutions currently available. This traditional migration approach, the authors argue, has the potential to strip an artwork of some or all traces of the artist's hand. His or her choice of programming language, artistic expression as seen through nuances in the source code and algorithmic detail, code annotations and unrealized drafts can all be lost in code migration. Code resituation, instead, aims to preserve the original artist's code while adding conservation code to reanimate the original to full functionality. With the development of this new treatment approach, the authors apply the conservation principle of minimal intervention to the conservation of software-based art. The new method of code resituation was successfully tested on three artworks from the Guggenheim collection, which were treated in the course of the Guggenheim's initiative "Conserving Computer-based Art."

Revealing Hidden Processes: Instrumentation and Reverse Engineering in the Conservation of Software-based Art

Tom Ensom

Software-based artworks possess a curious material status. While rooted in bits stored on a physical medium, they can also be considered performative and ephemeral in that the tangible elements of such works are created on-the-fly when the software is executed. When realised, the artwork is experienced primarily in relation to the experiential elements of the performance (i.e. its inputs and outputs). However, the conservator must also understand the underlying mechanism of code being processed in a technical environment: a challenge which has required the development of new analytical approaches. Source code analysis provides one means of addressing this layer, and has been demonstrated to be a powerful approach to understanding software programs through the close study of the code they were written in. However, this approach might not be suitable in all scenarios. While source code relates closely to the compiled software, the process of transformation involved means that equivalence between the two is not always direct or clear. Where source code presents high levels of complexity, it may not be possible (or even necessary) to find the resources to carry out in-depth source code analysis. In a worst case scenario, source code is simply missing or inaccessible. Furthermore, elements of performance linked to the software's interaction with its technical environment can often not be completely understood or measured through source code alone.

In this paper, I explore methods that intercept the software performance and directly address the compiled software in order to derive useful conservation information. In these cases analytical and interrogative approaches from software engineering may be repurposed to reveal hidden computational processes, profile performance, log events and decompile code. Careful analysis of

information gathered can yield important insights for conservation, including elucidating complex dependencies, revealing unclear program behaviours and ensuring that significant characteristics of the software performance can be maintained. This paper will report on the application of these approaches to software-based artworks from the Tate collection. In doing so I reach some overarching conclusions regarding the potential and limitations of these novel methods in relation to existing approaches, and argue for their place in the toolbox of the time-based media conservator.

Establishing Preservation Practices for Net Art and App-Based Works

Coral Salomón

Over the years, efforts by libraries, archives, and museums to incorporate digital media artworks into their collections has grown increasingly complex. The vast amount of born-digital art output is changing traditional approaches to archiving, collection building, and preservation. The National Digital Stewardship Residency for Art Information (NDSR Art) is an IMLS-funded initiative created to address the challenges of digital preservation while fostering career development for new professionals. Coral Salomón is the NDSR Art resident at the University of Pennsylvania's Fisher Fine Arts Library where she is focusing on the preservation of arts-related apps and websites, as well as providing repository recommendations for born-digital artworks. During this presentation, Coral will highlight some of the outcomes of her residency, focusing specifically on app and website preservation. She will discuss tools, strategies, and resources needed to capture web- and app-based art. The presentation will include challenges encountered, lessons learned, and "real world" applications of the recommended processes. It will also cover strategies for communicating the importance of preserving and providing access to this content to potential collaborators such as curators, gallery owners, and artists. This session is intended for individuals beginning to establish a web archiving program at their institutions, who are currently preserving this type of dynamic and ephemeral content, or that are interested in a walk-through to this subject matter.

Electronic Media Session - June 2

Starting at the Beginning - Morning Panel

Looking Forwards and Backwards: Practical Approaches to the Stewardship of Time-Based Media Art

Erin Barsan, Elise Tanner

While time-based media art (TBMA) is defined by how it unfolds to the viewer over time, this increasingly popular artistic medium is uniquely complex in its physical, technical, and conceptual structures. In many cases, artists are explicit about the media they

choose, the way in which their work is installed, and the technology used to display it. Museums need to adapt their installation and preservation practices in equally complex ways as a result, pushing the boundaries of traditional museum practice. Nevertheless, many institutions have been acquiring ever-increasing numbers of TBMA without proper documentation or systems in place to ensure that the integrity of these works is preserved over time. Leaders in the field have laid much of the groundwork for the stewardship of TBMA. However, these large institutions number their collections of TBMA in the hundreds to thousands, and what might be a good solution for them might not be appropriate for museums with more modest collections and resources.

This presentation introduces two projects currently underway from the National Digital Stewardship Residency for Art Information (NDSR Art) at the Philadelphia Museum of Art and the Minneapolis Institute of Art which are building on the existing work related to the care and preservation of TBMA. The NDSR Art residents at these institutions will detail their efforts towards creating frameworks for the acquisition, documentation, installation, display, and preservation of TBMA. They will highlight how they are tackling the challenge of simultaneously developing best practices for future loans and acquisitions while retroactively applying these standards to their existing TBMA collections. By juxtaposing these two projects and opening the conversation in a panel discussion, the residents aim for these cases to serve as a practical model for art institutions of varying sizes, backgrounds, and needs on how to begin taking steps to ensure the viability of these complex media artworks now and into the future.

A Steep Learning Curve: Developments in the Field of Time-Based Art Conservation in Australia

Asti Sherring

In recognition of the significant historical, cultural and financial value of Australian time-based art collections, conservation, registration and curatorial departments have been working independently to develop policies, procedures and programs for time-based art. These efforts are not moving quickly enough, however, to meaningfully reduce the risk of losing important twentieth and twenty-first century time-based artworks. The past efforts of individuals working in an ad-hoc fashion, while adequate to resolve minor issues at hand, does not adequately address the ongoing challenges of time-based art conservation as a discipline. Consequently, many Australian institutions have fallen behind in the development and specialisation of time-based art conservation; this lack of participation can be attributed to geographical isolation, a lack of financial investment and resourcing within Australian institutions, very little expertise, a lack of training programs for specialists in the field, and an absence of upper level advocacy within the sector.

Australian institutions are approaching the precipice of a breakthrough regarding the way we embrace and manage our time-based art collections. To achieve a broader vision for the

future of Australian time-based art collections, national institutions need to focus on the following goals:

- The implementation of comprehensive new policies and procedures for time-based collections in Australian institutions
- Education and advocacy for the management of time-based art collections in Australia
- A shift in institutional culture and the traditional demarcation of roles when seizing opportunities to create new streams of museum practice and collaboration
- Contribution to the greater dialogue surrounding the end of life strategies applied to time-based artworks
- The development of training programs in the field of time-based art conservation

While the efforts of institutions such as The Art Gallery of NSW (AGNSW) have begun to facilitate a shift in thinking, combined with tangible momentum from conservation professionals working towards addressing the needs of Australian time-based art collections, much remains to be done to ensure this progress can be both consolidated and built upon to bring about lasting, comprehensive change at a national level.

The Preservation and Conservation of Digital Technology Heritage: A Case Study of New Media Art Collection of National Taiwan Museum of Fine Arts

Yu-Hsien Chen, Shin Chieh Tzeng

The rapid evolution of modern digital technologies has made tremendous impact on human culture, and has fundamentally changed our ways of life and perceiving the world. Advanced sciences and technologies have been more than ever innovated so that preserving the cultural heritage of digital technology has become a trend for museums worldwide. In Taiwan, new media art works started to gain popularity in 2006. Now, all domestic representative museums preserve new media art works. Among them, the National Taiwan Museum of Fine Art (NTMoFA) maintains the largest amount of collections. The work of acquiring, cataloging, preserving, conserving and restoring the collections is the key function for a museum to maintain the originality and authenticity of its collections. However, new media art works constantly challenge the past concept of minimal intervention when maintaining and restoring art works to their original forms with more emphasis on physical maintenance and restoration. The challenge is due to its re-producibility property, form of multiple presentations, cooperative exchange, and fast evolving technology of modern society, as a result of numerical representation of new media arts.

This research's main objective is to understand the actual impact made and associated reasons when Taiwan public art museums are preserving, conserving and restoring new media artworks. By reviewing the related literature, we first investigate the characteristics of new media art, how it has been developed in our country, principles of preserving and restoring art collections, and necessary professional museum expertise and ethnics. Next,

we will further study the discussion in related domestic literature on the subjects of new media art works' preservation and re-exhibition. Furthermore, we summarize the obtained experience from both inside and outside our country, and the associated challenge and opportunity in preserving new media art works. Finally, we specifically investigate the new media art collections of NTMoFA as a case study.

This research adopts the method of semi-structured in-depth interviewing. The professionals to be interviewed include those who are practitioners in preserving and repairing art works. We particularly take three NTMoFA's new media art collections as the main subjects for the interview, and reconstruct on-site real scene of preservation and restoration. Lastly, from both aspects of new media's cultural and computer layer, we analyze the transformation of meaning in the museum's reservation and conservation principles, followed by summarizing the research and proposing conclusion. We suggest that based on current administrative system, it is necessary to build up new methodology and strategy for conserving new media art works in full scale. Hopefully, this research can provide a useful reference and different vision to related practitioners of art museums and other interdisciplinary people who are interested in conservation of new media art works.

Unsustainable Digital Collections

Jo Ana Morfin

This paper analyzes how in the context of Mexican museums, the lack of policies, frameworks and strategic planning has led to the creation of unsustainable cultural digital collections. It focuses on the challenges in rescuing the digital collection "Bial Internacional de Poesía Visual y Experimental" [Biennale of Visual and Experimental Poetry], held at the Mediateque of the Museo Universitario del Chopo. The Mexican artists Araceli Zúñiga y César Espinosa organized the International Biennales of Visual and Experimental Poetry between 1985 and 2009. These events brought together practitioners from all over the world whose work is placed at the intersections of the fields of contemporary visual writing, copy art, concrete music, mail art and performance.

Throughout the years, Zúñiga and Espinosa became interested in creating a "memory" of these events. Therefore, they started to gather videos, mail art works, photography, artistic electrography, from each event. The collection was stored at their house and classified and organized by the artists themselves. Through the years, the collection became a key source for researching and tracing the development of alternative and experimental art practices in Mexico. Given the significance of this collection and with the aim of preserving and providing greater access to its contents, Zúñiga and Espinosa agreed with the Museo Universitario del Chopo in digitizing the materials and donating a digital version to be included in the collection of the museum. Over 2,000 artworks were digitized.

In 2015 the museum received a grant to put these contents online. However, during the development of the project we realized that most of the digital objects were unstable. Given this situation, the project focused on rescuing this digital collection

from the oblivion. The project brought to light several concerns, such as the lack of a digital preservation planning, the deficient use of metadata standards, the shortage of expertise, and more importantly, the lack of institutional policies to create sustainable digital collections. The museum's team did not follow clear guidelines, standards and best practices for the creation of digital objects and their subsequence management. Thus affecting the ability to read, access and understand the digital materials. Furthermore, we became aware that several cultural institutions in Mexico shared this scenario. The project's findings show, that numerous museums undertake digitalization-driven projects without following a strategic plan thus resulting in unsustainable digital cultural collections. Fortunately, in 2016 three major initiatives aimed at overseeing the creation and management of cultural digital collections emerged. Working in close collaboration with these platforms, "Metadata for the Mexican Cultural Heritage," "Cultural National Agenda for Digital Projects" and "Digital Preservation Group," we developed a plan for rescue and long-term access to the collection of Bial Internacional de Poesía Visual Experimental.

What Happened When? Creating Retroactive Iteration Reports for Time-based Media Artworks

Alexandra Nichols

Since 1999, the Metropolitan Museum of Art (The Met) has been building their collection of time-based media art. In recent years The Met has increasingly acquired time-based media, and the Museum currently holds 250 artworks in its collection. The Met established a Time-Based Media Working Group in 2001, which now comprises conservators, collection managers, curators, archivists, registrars, technology experts, and other allied museum professionals. In the past few years the Museum has spearheaded initiatives, collaborations, programs and activities surrounding the unique preservation needs of the collection, including engaging the Museum's first Fellow in the conservation of time-based media art.

A current best practice in the documentation of time-based media artworks is to create iteration reports, which document the way that a variable artwork is displayed in a specific exhibition. Although this is best conducted at the time of exhibition, the author, the incoming Fellow, was challenged to create retroactive iteration reports for past exhibitions of works in the collection. This project provides the Museum with an opportunity to create a complete history of exhibiting time-based media art at the Museum and in some cases also prior.

In this paper the author presents the research involved in creating iteration reports for past exhibitions. Cross-departmental collaboration is key, as conservation relies on conversations and interviews with a wide range of staff members involved in the installation of the works. In addition, this project requires creative methods for external research to provide photographic and video documentation of the artworks in the Museum's collection. Creating these reports proved challenging, as the author was not present for the installation, and was relying on secondary sources and prior documentation.

Unique information was gained through research into other fields. The author investigated scientific research related to the formation and recall of human memories, in an effort to overcome challenges posed by eyewitness accounts. This included researching publications related to the improvement of a subject's recall of past events. The results of this research will be demonstrated in case studies from artworks in The Met's collection, as well as a discussion of lessons learned and practical advice gained throughout the project. This paper will be of particular interest to museums and professionals who are starting to address the conservation needs of time-based media artworks in their collections.

See Joint Session: Book & Paper + Electronic Media, page 50, for the abstract on 'Preserving the Protest: Collection and Care of Social Movement Archives [Archives Conservation Discussion Group]'

Getting It On Record: Stabilization, Enhanced Imaging, and Documentation of Archival Instantaneous Audio Discs

Dave Walker

This case study presents some of the new ways conservation documentation images can serve multiple functions outside of direct treatment. For example, the enhanced images can provide data for archival description and cataloging, create an augmented research experience when paired with digitized content, and serve as a visual lexicon for material deficiencies and condition issues prevalent among instantaneous discs. In 1987, the Center for Folklife and Cultural Heritage at the Smithsonian Institution acquired over 4,000 unique audio discs as part of its acquisition of the New York-based label Folkways Records & Service Corporation. These archival recordings represent a sizable cross section of the early- to mid-20th-century recordable discs distributed and used throughout the United States.

Nearly 70 years after their creation, many of the recordings display a range of condition issues not uncommon to the medium including physical damage, delamination, plasticizer leakage, warping, crazing, and evidence of biological growth. In 2017, media conservators and technicians conducted conservation documentation and rehousing to assess, stabilize, and identify treatment priorities for each disc. Their documentation provided archivists with a framework for establishing holistic treatment plans and preservation digitization priorities. As part of this project, high-resolution digital images were created using efficient workflows to provide enhanced views of each disc to highlight their condition and document unique surface features such as etched-in song titles, performer names, matrix numbers, and intentional groove destruction. In addition, it will explore practical housing and storage strategies, including custom solutions for severely deteriorated and broken instantaneous discs. This presentation will be of particular interest to time-based media conservators, preservation specialists, archivists, and other cultural heritage professionals working with legacy recorded sound media.

Objects Session - May 31

Manipulating Materials: Preparing and Using Paraloid B-72 Adhesive Mixtures

Stephen Koob

Recent AIC presentations (2017 Annual Meeting) indicate that there are numerous misunderstandings about the use of solvent adhesives, particularly Paraloid B-72. The increasingly popular use of Paraloid B-72 is based primarily on its notable and favorable conservation attributes. Paraloid B-72 is the most stable, reversible and dependable resin now used in conservation. It was introduced as an adhesive by the author just over 30 years ago and also has very commendable working properties, including excellent adhesion and fast setting time, but these can easily be compromised by improper preparation and improper application.

This paper discusses the many ways that Paraloid B-72, or other solvent-based adhesives should be prepared, modified or manipulated to obtain easy and efficient application as well as consistent and excellent results. Preparation is critical to having a dependable solvent-based adhesive. B-72 can be very easily made up with only a few minutes of preparation, and then allowing about 8 hours for the resin to dissolve in solvent. The choice of solvent is very important, and acetone has proven to be the best solvent, on its own, or in some cases with a small amount (5-10%) of ethanol. The ratio or percentage of resin:solvent can be modified to control the application and setting time for different uses. This then allows the conservator to control the application of a thin or thicker adhesive. One additive is recommended in the initial preparation, and that is the addition of a small amount of hydrophobic fumed colloidal silica, which aids in uniform application, stabilization of the mixture, film formation and solvent evaporation. Fumed silica is an inert material, classified as a rheological agent (to control flow characteristics). It is not necessary to evaporate off any solvent after the B-72 resin has dissolved in the acetone, as the initial amount of solvent can easily be calculated for producing an adhesive of specific viscosity (or thickness). For glass, a thinner solution of approximately 60% weight/volume is recommended because glass is non-porous and non-permeable, while a thicker solution of 72% works better on more porous substrates, such as low-fired ceramics, porous stone, wood, bone and ivory. For best results, including application and maintaining a consistent fluid mixture, the prepared adhesive should be poured into adhesive tubes, specifically designed for solvent adhesives. This also improves the ease-of-use and accuracy of assembly.

Visible Effects of Adhesive and Pressure on Color in Kingfisher Feathers

Michaela Paulson, Ellen Pearlstein

Structurally colored feathers render color through physical scattering of light rather than pigments. There is an expected, but

heretofore unexplored, effect of adhesive choice and pressure on the color of these materials. Further, such feathers are generally considered to be more light-stable than pigmented examples. In the current study, structurally colored blue kingfisher feathers are used to examine these effects in order to guide conservation treatments and preventive care.

The Chinese tradition of *tian-tsui*, literally “dotting with kingfishers,” describes a technique of cloisonné style jewelry that utilizes blue, blue-green, and purple feathers instead of fused glass powder. The feathers are adhered to a backing, usually metallic, though occasionally composed of thick layers of paper. This technique appears in Chinese culture from as early as the first century BCE, though surviving examples date most prevalently to the Qing dynasty (19th century) (Chambers et al. 1981, 32). The early featherwork items were not restricted to jewelry, but also appeared in the form of feather mosaics on clothing, bed coverings, and palanquins (Chambers et al. 1981, 32; Garrett 1994, 86). Such items are now ubiquitous in museum collections. Through a technical study of kingfisher feather jewelry from the Ruth Chandler Williamson Gallery at Scripps College in Claremont, California, as well as accelerated light aging studies and pressure tests completed on mocked up samples of recently plucked kingfisher feathers at both the UCLA/Getty and the Getty Conservation Institute labs, I evaluate the effects of original and conservation/restoration adhesives and coatings, and effects of mechanical interactions, on the structural colors of the feathers.

For the experimental part of the study, feather specimens from skins of *Halcyon smyrnensis*, the White-breasted Kingfisher, donated by the United States Fish and Wildlife Department, were plucked, trimmed, and adhered onto inert quartz glass plates and subjected to three methods of light aging, with color measurements occurring after aging with an integrating sphere. The accelerated light aging methods included museum conditions (free of ultraviolet radiation), window conditions (ultraviolet radiation present), and high intensity UVA conditions, with an additional control group kept in the dark. Adhesive systems tested were those documented as having been used originally or in the conservation of kingfisher featherwork, including: protein glues (gelatin and isinglass), funori, methylcellulose, and Paraloid B-72. Characterizing the adhesives used on the Scripps collection items provided supporting technical evidence.

Taken together, the results of this study provide insights into kingfisher feather *tian-tsui* technology, and the effect of adhesive systems and mechanical actions on the preservation of color within these structurally colored feathers. Findings will be presented about the color stability, both separately and upon interaction with different adhesives, leading to recommendations for adhesive choices for the conservation of such featherwork. Further, results of mechanical disruption of kingfisher feather coloration will be illustrated. Experimental work and technical analysis provide an enhanced understanding of a complex material, effectively aiding its conservation and preservation.

Manganese Stain Reduction on an Ancient Greek Terracotta Vase

Susan Costello, Katherine Eremin, Georgina Rayner

A 5th century BCE Greek red-figure terracotta pelike (jar) at the Harvard Art Museums exhibited areas of black manganese dioxide staining from burial. In addition to ceramics, these black stains are found on bone, glass and stone. They are not considered harmful to the object and are often left as part of its archaeological history. The disfiguring staining on this particular ceramic made interpretation of the painted design difficult necessitating treatment. Studies have been published on reducing manganese staining from glass, but very little was found for ceramics. Thus, a research project was undertaken to develop a safe method to reduce the manganese staining.

A variety of treatment techniques were investigated including Nd:YAG and Er:YAG laser cleaning, and application of a range of chemicals by swabs and poultices. The latter was deemed the most promising option and a variety of poulticing materials, chelators and reducing agents were investigated. To avoid testing on the pelike itself, treatment options were evaluated first on terracotta mock-ups with artificial manganese staining and then on an ancient terracotta plate fragment with archaeological manganese staining. Based on the results, treatment was carried out on the pelike using a poultice of bentonite clay with 80:20 deionized water:ethanol. Bentonite is mostly sodium or calcium montmorillonite but also contains minor amounts of other minerals. It was chosen because it has a high ion exchange capacity (80-150 meq/100g) and thus was able to break the stain's bond to the ceramic. After the poultice was applied, allowed to slowly dry and removed, a cotton swab dampened in water reduced the manganese staining. Because ethanol is a less effective solvent than water for soluble salts, it replaced a portion of water to minimize the amount of salts brought to the surface during treatment.

The 80:20 ratio proved to be the most efficient at preventing the majority of salts while maintaining bentonite's ability to reduce the staining. The thickness and the water content (Water content (Wc) = weight water/weight dry poultice) of the poultices were critical factors. Poultices used for effective treatment were about 3 mm thick with a Wc of approximately 5. If the poultice was too thin or the liquid content too low, the poultice dried quickly and was ineffective. The manganese staining was characterized by x-ray fluorescence spectroscopy (XRF), scanning electron microscopy with energy dispersive microanalysis (SEM-EDS) and x-ray photoelectric spectroscopy (XPS). SEM-EDS, XPS and Fourier-transform infrared spectroscopy (FTIR) were used to analyze the bentonite poultice and the manganese stained terracotta before and after treatment. Results showed that the terracotta surface was unchanged and no bentonite was left behind. XPS analysis enabled identification of the manganese species present on the terracotta before treatment. The treatment of the pelike significantly reduced the manganese staining and achieved the desired outcome of a clearer interpretation of the painted design. The results of this research project can inform future treatments of manganese stained ceramics.

Loss Compensation on Ceramics using Photogrammetry, Digital Modeling and 3D Printing

Kathleen M. Garland, Stephanie Spence, R. Bruce North

This paper will describe some tools for producing detailed, 3D printed restorations for ceramics that may also be applicable to other areas of conservation. Photogrammetry is a 3D imaging process that is relatively easy to do with standard photography equipment in the conservation lab, provided one has a computer with a sufficient processing capability. Agisoft PhotoScan was used to create three dimensional mesh models of several different ceramics that were in need of restoration. The project involved experimentation with available 3D modeling and sculpting programs. Autodesk Meshmixer, a free software system, was selected to digitally "sculpt" and process the meshes for a 3D print in resin. The finished resin parts were then easily attached to the body of the ceramic and painted using conventional methods.

The ceramics in this study include a small Meissen porcelain with a missing right hand and eyeglass lens, a 12th century Persian ceramic with a missing handle, and an 18th century English delftware posset pot lacking sculptural elements on the lid. The use of 3D printed parts resolved a variety of problems commonly found in ceramic restoration, such as complex and simple modeling, shiny glazed surfaces, achieving fine detail on very small elements, mirroring of meshes to create a right hand from a digital model of the left, and the need for precise joins on complex break edges.

While the learning curve for using these programs is steep, familiarity makes the operator more efficient, and there are a number of advantages to printing these restorations instead of using conventional techniques. First of all, handling of the artifact is dramatically reduced, an important safety factor. Conventional modeling and casting of very small detailed parts, such as a missing porcelain hand, is challenging for many, and may require some creative interpretation by the conservator. However, with digital models, it is possible to provide a more "authentic" restoration. For example, a missing left hand can be created and articulated from a digital mesh model of the right hand. Thus, the restored right hand, as a mirror image of the original left hand, could be considered a closer iteration of the artist's intent. It is also very easy to create a digital mesh of the "stump" or break edges of the ceramic and use this to make a nearly perfect match in the printed restoration.

One practical and timesaving advantage is that much of the imaging and printing work can be subcontracted to volunteers, students or contractors who have specialized digital skills. Sharing the highly accurate digital models based on laser scanning or photogrammetry will also make similar examples by the same artist or workshop easier to share, either for the purpose of loss compensation or study. The digital files are also available for future research. Finally, the use of 3D digital models allows for experimentation that is helpful in discussing positioning and articulation of restorations with curators. The techniques discussed here are likely to have applications beyond ceramic restoration.

The Use of 3D Printing for Casting Proportional Replicas Used in the Treatment of Articulated Skeletons

Christine Haynes, Julia Sybalsky

The anatomical accuracy of natural science specimens is important for their use in education and display. This case study explores the recreation of missing elements of an articulated brant goose skeleton (*Branta bernicla*) from a study collection in the Ornithology Department at the American Museum of Natural History (AMNH). The articulated skeleton was treated during a course at the Conservation Center of the Institute of Fine Arts, New York University (NYU). In current AMNH practice, molds taken from other specimens of the same species are often used to cast replacement elements missing from an articulated skeleton. However, the goose skeleton in this case study is larger than other brant specimens at the AMNH, so casts made in the usual way would not have been proportionally correct. To create replicas of the required size, the analogous bones from a smaller specimen were laser scanned at NYU's LaGuardia Studio, a facility providing advanced digital media services to faculty, students, and visiting artists. The scans were enlarged using modeling software and then used to 3D-print a model of each bone. In order to ensure low cost with long-term stability, the printed models were then used to create silicone molds from which casts were made in a stable epoxy.

This presentation will detail the options available for 3D scanning, file manipulation, and printing, with emphasis on cost, practicability, and long-term stability. Both the printing process and printing materials will be discussed. For this case study, the final cost was under \$60 for the scanning and printing of five small bones. Including creating the second molds, the treatment required about 20 hours, spread over a few weeks. The lag time was mostly due to scheduling with the LaGuardia Studio rather than the necessity of the process. Combining digital technology with traditional mold-making techniques allowed for the more accurate calculation of shape and proportion of the bone replicas and the creation of highly detailed molds quickly and economically.

Conditioning Basketry Elements with Water and Ethanol: An Investigation into the Effects of Standard Conservation Methods

Hayley Monroe, Ellen Pearlstein

Humidification or conditioning of baskets to effect realignment or re-shaping is a standard conservation treatment performed wherever these collections are held. We know that baskets are particularly prone to damage caused by the alternate swelling and shrinking of fibers due to fluctuations in relative humidity. At the same time, this sensitivity has long been used in the conservator's favor. The chemical composition of cellulose, specifically its ability to form hydrogen bonds, allows for both water and polar solvents to plasticize dried plant tissue. While humidification (or conditioning when using solvents) has become a standard conservation procedure, its effects on material properties have remained only

theoretically evaluated rather than through a material study. In fact, untested concerns have been raised over microbial growth, and also the potential for irreversible swelling of the basketry elements. As a result, polar solvents – for example ethanol – have been added to or become a preferred conditioning media instead water.

The research for this thesis project, conducted at the UCLA/Getty Conservation Program, revolved around designing an experiment to track the extent of swelling and subsequent recovery of basketry samples treated with water and ethanol vapor. These samples represent two plant species, willow (*Salix* spp.) and spruce root (*Picea* spp.), one deciduous and the other coniferous, which occur with some frequency in the basketry traditions of the western United States and Canada. The extent of swelling before and after the conditioning process between all the samples was compared, using measurements taken with a Keyence digital microscope. Pure water, pure ethanol, and three mixtures of the two at different proportions, were each evaluated for consequent dimensional changes occurring before, during, and after conditioning to the same relative humidity as is typically used in conservation treatments. The results of this study not only corroborate information from fields as diverse as conservation, forestry science and material science, but also point towards clear trends which can inform the conservator's decision-making in planning humidification/conditioning treatments of basketry. By performing a material study, we are able to provide clearer guidelines about the effects of different conditioning solutions.

Objects + Archaeological Conservation Joint Session - June 1

Facial Reconstruction of Ancient Egyptian Mummies: Experiences from the Johns Hopkins Archaeological Museum

Sanchita Balachandran, Juan Garcia, Mark Roughley, Kathryn Smith, Meg Swaney, Caroline Wilkinson

Poised at the intersection of science and art, the field of facial reconstruction offers an unprecedented way to approach the ancient dead as human beings who “look like us.” This paper discusses issues precipitated by the digital reconstruction of the faces of two ancient Egyptians stewarded by the Johns Hopkins Archaeological Museum, and considers how new scientific technologies as well as ethical concerns complicate attempts to render human remains more recognizably human. The interdisciplinary nature of this project required developing a new framework for respectful practices for the preservation and presentation of human remains, particularly as there were many perspectives involved; in the case of this research, this included the combined expertise and insights of forensic artists and anthropologists, a facial prosthetist, radiologists, biomedical engineers, digital imaging specialists, Egyptologists, graduate and undergraduate students, as well as an art conservator. Focusing on two ancient Egyptian individuals who have been closely associated with the history of Baltimore, and Johns Hopkins University, its hospital and its Archaeological

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Museum since the early twentieth century, this paper highlights the many unexpected types of documentation that were required to more fully understand the “object biographies” of these two individuals. From their acquisitions to early autopsies, to past conservation treatments, recent computed tomography scanning and digital reconstruction as well as multi-band imaging of associated objects, the kinds of data, and expertise required to decode these new kinds of data, has raised questions about how we affect a more holistic stewardship of human remains. The paper will also consider how the final digital depictions were contextualized and interpreted for a broader audience through student documentation and student-designed public programming in order to invite the museum visitor and the public to have a role in ensuring a respectful stewardship of the people of the past.

Gold Working at Ur: A Collaborative Project to Better Understand Ancient Gold Smithing

Tessa de Alarcon, Moritz Jansen, Richard Zettler

This paper presents recent research on gold artifacts from the Royal Cemetery of Ur, ca. 2450-2100 BCE and proposes some possible methods for their manufacture. Sir Leonard Woolley excavated these artifacts at the site of Tell al-Muqayyar (ancient Ur) in southern Iraq in the 1920s-1930s as part of a project sponsored by the Penn Museum and the British Museum. Iraq's 1924 Antiquities Law provided for a division of finds, and half the material went to the Iraq Museum, with a quarter going to the Penn Museum and a quarter going to the British Museum. The initial data were collected as part of the Ur Digitization Project, a joint initiative between the Penn Museum and the British Museum to digitize objects and records at both institutions. The collaborative nature of the Ur digitization project fostered interdisciplinary research at the Penn Museum. These relationships have continued beyond the Ur Digitization Project and so too has the examination of the gold from Ur.

Initial analysis of the gold from Ur focused on objects from Private Grave (PG) 1422. It has since expanded to include a diverse selection of gold items from the Royal Cemeteries as new research has been conducted in preparation for the re-installation of the Middle East galleries at the Museum. This paper will focus on three distinct object types, gold vessels, gold jewelry, and gold fillets. All the data presented here were captured non-invasively using digital X-radiography and digital photomicrographs. While X-radiography and microscopy are not new techniques for the examination of archaeological objects, new developments in digital processing allows for better data collection that can highlight features previously difficult to capture. The present study combines the knowledge of conservators, archaeometallurgists, and archaeologists to better understand how the gold vessels and adornments from the royal cemeteries may have been manufactured. This interdisciplinary study places the objects within their archaeological context as well as highlights which aspects of their manufacture are significant.

The Tell-Tale Conservation of Two 2,000 Year Old Leather Water-Skins

Irit Lev Beyth, Hadas Seri, Liatte Dotan, Jessica Lewinsky

In the early sixties, archaeologist Yigael Yadin excavated the “Cave of Letters,” located near the Dead Sea in the Judean Desert, Israel. The cave probably served as a hideout during the second Jewish revolt against the Romans in 132 CE. Among many rare finds were several vegetable tanned leather water-skins, two of them in nearly complete form. While water-skins were originally created to contain liquids, the content of one of these excavated water-skins was different. It included: unspun wool skeins, jewelry, clothing, small glass vessels, wooden cosmetics utensils, and spindle whorls, indicating a secondary use of the water-skin as a satchel. The most historically significant items in the water-skin were a packet of letters written by Shimon Bar Kokhba himself, the leader of the rebellion, to his subordinates in hiding – hence the name “Cave of Letters.”

The dry, stable conditions in the cave resulted in the leather's fine state of preservation. Details such as historical repairs, in the form of sewn patches, could clearly be recognized in several places on the water-skin, and its opening end was still tied with an original rope. The water-skins, which are under the jurisdiction of the Israel Antiquities Authority (IAA), are part of the archaeological collection of the Israel Museum (IMJ) in Jerusalem and are on display. Prior to their arrival at the IMJ, the water-skins were treated, probably in the mid 1960s. Although no treatment records exist, black and white photographs from the excavation revealed that this initial treatment included cleaning, reshaping and inserting an inner support of a thick, cream colored fabric stuffed with hay. Nylon filament was used to hold down leather pieces which were folded over. In 1998, the IMJ's Metal and Organic Materials Conservation Department was asked to assess the condition of the two treated water-skins. The evaluation concluded that while the leather was in exceptional state for its age, the 1960s materials used in the treatment were not of conservation grade, and the aesthetics of the objects were not pleasing. It was therefore decided that one of the water-skins would be retreated. In 2017, fifty years after its initial treatment, and twenty years after the retreatment of its “twin,” the second water-skin was retreated.

Over the span of 55 years, three different teams of well-meaning professionals tended to these invaluable treasures. Each team, with their knowledge and available materials, used these to their best abilities. This presentation aims to reveal, compare, and evaluate the advantages and disadvantages of each treatment within the perspective of time.

Evaluating Factors Affecting Corrosion and Conservation of Archaeological Wrought Iron

Eric Nordgren, David Watkinson

Archaeological wrought iron artifacts are subject to damaging corrosion both in the burial environment and when subjected to environmental changes after excavation. The roles of water,

oxygen, and chloride corrosion accelerators are central to iron corrosion processes. Factors intrinsic to the material, such as the amount and distribution of slag in wrought iron may also play a role in corrosion and in the outcome of active iron conservation treatments. Previous research has established that deterioration of archaeological iron can be minimized through application of preventive measures such as low relative humidity or low oxygen environments. Such conditions can however be difficult to maintain consistently in long-term storage, with the result that active treatments such as desalination may also be of benefit. While desalination treatments have been undertaken for over a century, their effectiveness in reducing corrosion rates of archaeological iron has only recently begun to be studied quantitatively.

Recent doctoral research at Cardiff University examined a range of factors that may impact active conservation treatments to mitigate post-excavation corrosion of archaeological iron by removing chlorides. Archaeological nails from Colonial Williamsburg and the 2nd C AD Roman site of Caerleon in Wales, UK were evaluated. Examination of the effect of slag on corrosion rate and chloride content formed the core of this project, which also considered morphology of corrosion product layers. Corrosion rates were quantified before and after conservation treatment using measurements of oxygen consumption while slag content and corrosion layers were studied in cross-section using optical and scanning electron microscopy and the resulting data analysed statistically. The alkaline sulphite washing treatment applied to the iron nails produced results that aligned with those reported in other studies and confirmed its relative efficiency for removing chloride and reducing iron corrosion rates. Slag content of the wrought iron objects examined did not directly correlate with either their corrosion rate or their chloride content although clustering of chloride around slag inclusions was identified, which may offer challenges for chloride removal and hence provide opportunity for post-treatment corrosion. Morphology of corrosion product layers and patterns of micro-cracking present also appeared to be significant factors in corrosion rates of archaeological wrought iron. Research focused on how the dynamics of practical conservation treatment can aid conservators in the conservation decision-making process. This study helps inform understanding of active conservation treatments for archaeological iron and factors that may influence their results and effectiveness in mitigating deterioration.

Hot Tub Time Machine: A Heated Water System for Artifact Disassembly and Treatment

William Hoffman, Ralph Spohn

The conservation of complex composite artifacts can pose a real challenge for conservators. Different material types often require dissimilar treatment methods, which can be incompatible between materials, resulting in the potential to damage one while attempting to conserve another. Therefore, when determined necessary, the decision can be made to disassemble an object, treat component parts separately, and then reassemble after treatment. This approach can be especially difficult for objects recovered from archaeological sites. The effects of the burial environment can lead

to the hardening and embrittlement of organic materials and corrosion and de-alloying of metals. In both scenarios, this can result in an inability to easily and safely take part archaeological objects requiring the development of new treatment techniques and procedures.

Between 1998 and 2002, over 210 tons of artifacts from the wreck site of the Civil War ironclad USS Monitor were recovered off Cape Hatteras, North Carolina by archaeologists from the National Oceanic and Atmospheric Administration (NOAA) and US Navy divers. Many of the retrieved artifacts came from the vessel's engine room which included five steam engines and an assortment of plumbing assemblies. Having spent nearly 140 years on the seafloor, the cast iron elements of these artifacts had de-alloyed through graphitic corrosion and now possessed the structural integrity of chalk. If that was not challenging enough, a majority of the "graphitized" objects had attached component parts which had become adhered together by rubber gaskets that had hardened having lost their elasticity over time.

Early in the treatment of these artifacts, it was clear that some level of disassembly would be required so that organic, copper alloy, and iron alloy elements could receive independent treatment. However, any attempt to separate the objects into their component parts led to the cracking or breaking of the fragile "graphitized" material due to the rigidity of the gaskets. Fortunately for the conservation staff, during the application of a routine hot treatment technique used to remove concretion from copper alloy artifacts, it was discovered that a temperature of approximately 160 degrees Fahrenheit caused a previously hardened rubber gasket to soften and become pliable. This revelation led to the hypothesis that one potential solution to the disassembly conundrum could be to submerge the artifacts in a hot water bath and allow the transmission of heat to soften the gasket material; thus, limiting damage to the de-alloyed cast iron during disassembly. Additional experimentation to identify the effects of an elevated temperature on "graphitized" cast iron samples followed. Positive results from sample testing led to the design and construction of a heated water system and the development of a treatment procedure for artifact disassembly. This paper will provide an overview of the project and the operation of the hot water tank apparatus. In addition, other potential treatment uses for the machine will be highlighted.

'All That Is Gold Does Not Glitter': Developing Guidelines for the Recovery of Tin-plate on Mineralized Archaeological Iron through Material Analysis

Michelle Crepeau, Nicola Emmerson, David Watkinson

X-radiographs are important guides for the air abrasive cleaning of archaeological iron. What happens then when an important feature, such as a finishing surface, recorded by an x-radiograph fails to materialize? Is this merely human error on the part of the conservator? Can the x-radiographic signatures of these surfaces be caused by other factors? Or have residual finishing surfaces simply degraded past the point of un-assisted visual detection? This

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presentation will discuss how the combination of spectral imaging and elemental analysis can contribute to x-radiographic interpretations of non-ferrous finishing surfaces on archaeological iron and inform decisions as to the practical recovery of such surfaces.

Tinned surfaces are fairly ubiquitous in the archaeological record and are frequently documented in x-radiographs. Actual recovery of these surfaces, however, is under-reported in academic literature. Due to the nature of tin corrosion and its products, tin-plate is often assumed to be a visually discrete, recoverable surface. This is an assumption seemingly supported by the presence of distinct areas of differential density known as 'tinning lines' on x-radiographs. However, the extent to which these lines reflect the actual condition of the underlying tinned surface and can predict the success of practical recovery is not well documented. This is especially true in the context of highly mineralized artifacts in which metallic tin may no longer exist. The aim of this project is to positively identify and characterize presumptive tinning surfaces on a highly-mineralized iron artifact using SEM-BEI imaging and SEM-EDX elemental analysis to corroborate x-radiographic and optical microscopy evidence of tinning. This project uses an archaeological wrought iron key dating from the late medieval period of the deserted English village of West Whelphington as its subject. Previous conservation indicates that the artifact was likely tinned. The validity of this identification is tested through a) producing an array of x-radiographs that explore variables, such as penetrative power, exposure time and geometry to confirm the presence of tinning lines, b) performing investigative cleaning via air abrasion to test recoverability of the layer based on x-radiographs, and c) sectioning the key and using spectral analysis techniques to better chemically and physically describe and corroborate the presumptive finishing surface. The presentation will also use SEM micrographs and SEM-EDX mapping to illustrate the distribution of highly mineralized tin layers in the corrosion matrix and discuss the extent to which these morphological changes can be detected in x-radiographs and used as signifiers of surface condition. Ultimately, this will prompt commentary as to what constitutes a recoverable surface and what factors a conservator will need to take into account, such as, stakeholders, work constraints, and artifact 'value', etc. when making decisions about whether or not to attempt recovery of a finishing surface that is analytically distinct but not necessarily visually or physically identifiable. Much like "all that is gold does not glitter" this paper will demonstrate that not all things of value are strictly material.

Measuring the Burial Microenvironment on an Archaeological Site as an Aid to the Conservation Management of Artifacts in the Museum

Ian D. MacLeod, Alice Boccia Paterakis

Preliminary results will be presented from an in-situ assessment of the chemical microenvironment of an Early Bronze Age site in Central Anatolia. The work involved assessing the pH, the redox potential and chloride ion activity and was carried out in August 2017 on the soil of the Kaman-Kalehöyük excavation site in Turkey

of the Japanese Institute of Anatolian Archaeology to ascertain the changes that occur in the burial and post excavation environment. A chloride ion electrode, pH meter, and corrosion meters with appropriate reference electrodes and calibrating materials were used. Surface chloride and pH mapping was carried out on excavated copper alloy objects and correlated with the archaeological profiles and records. Initial measurements indicate that it will be possible to prepare a degradation and conservation index as part of a mechanism to determine on a systematic basis corrosion behavior and which objects are in greatest need of conservation intervention. Treatment priority score cards will be prepared based on the significance and conservation needs assessments.

Objects Session - June 2

Keeping them Ruby: The Preservation of Dorothy's Ruby Slippers

Dawn MP Wallace, Richard Barden, Janet Douglas, Dr. Gwénaëlle Kavich, Dr. Alba Martín Alvarez, Dr. Regina Baglia, Mary Ballard

The National Museum of American History's Ruby Slippers, the beloved shoes worn by Judy Garland in the 1939 classic film *The Wizard of Oz*, have been on display at the Smithsonian Institution since 1981. In 2016 their conservation, preservation, and long term display became the focus of the Smithsonian's second Kickstarter campaign. This successful campaign funded research into their history, use, and construction, an in-depth assessment of their materials and condition, and identifying off-gassing degradation products. This analysis guided the Slipper's treatment, and the design and construction of a display case with optimal environmental (temperature, humidity, light, oxygen) conditions. The shoes are comprised of at least 12 materials which have undergone various types of deterioration, some of which occurred during filming and others by natural degradation processes. The Slippers were created from commercially available pumps that were dyed, painted, and then adorned with sequins, bows and beads. Of particular interest are the sequins, consisting of a gelatin core with a red cellulose nitrate coating, which give the slippers their iconic ruby appearance. Some of the sequins appear transparent ruby red, while others are faded, opaque, have fractured surfaces, and coating losses. They are susceptible to changes in humidity, temperature, light, and chemical degradation.

Micro-X-ray fluorescence spectroscopy (μ -XRF), micro-Fourier transform infrared spectroscopy (μ -FTIR), polarized light microscopy (PLM), and scanning electron microscopy - energy dispersive X-ray spectroscopy (SEM/EDS) were used to identify the various materials used in the construction of the Slippers. A protocol to identify and monitor for volatile organic compounds included the analysis by solid phase micro-extraction gas chromatography/mass spectrometry (SPME-GC/MS) in parallel with Ormantine diffusion tube analysis. Rhodamine B was identified as the major colorant on the sequin coating using high performance liquid chromatography - diode array detector - mass spectrometer (HPLC-DAD-MS). This informed the creation of a VIS

spectrophotometric library used to determine the most aesthetic LED light combination providing a spectral range that complements the light reflected by the slippers, as well as the optimum spectra to slow the deterioration of the materials.

Eva Hesse *Addendum*: Exploring Materiality and Emerging Technologies

Tamar Maor, Dr. Angelica Bartoletti, Dr. Bronwyn Ormsby

The third case study for the NANORESTART research project at Tate focuses on Eva Hesse, *Addendum* (1967), a sculpture made of rope and papier mâché. The project aims to address cleaning challenges by exploring the use of newly developed gels synthesized using nanotechnology. The first phase focused on material characterisation and analysis in combination with historical research to help understand the context of the materials Hesse used for this sculpture. Analysis using FTIR, EDX, microscopy, pyrolysis GCMS, and UV fluorescence confirmed the presence of a pEA/MMA acrylic paint throughout, with a transparent PVAc coating. The painted cotton ropes have an additional transparent pnBA/MMA coating which has degraded and yellowed. The surface of the entire sculpture has embedded surface dirt with particular soiling of the rope ends in contact with the gallery floor during display.

Research into Hesse's use of materials with a focus on her exploration of new synthetic materials at the time she was making *Addendum*, will help to determine if the secondary coating on the ropes was artist applied or applied subsequent to acquisition. In 1967 Hesse attended lectures such as Polymers and Acrylic Materials as part of a wider series on Experiments in Art and Technologies. These lectures significantly influenced her practice both in terms of her material choice but also her subject matter. Although pnBA/MMA was introduced commercially in 1967, given Hesse's exploration of materiality it is possible she may have chosen to use this new latex-type material. The next phase was to undertake extensive cleaning tests on papier mâché and rope mock-up samples that were created using contemporary equivalents of the same materials used in *Addendum*. The mock-ups were also artificially soiled and aged. The surface cleaning options evaluated explored a range of commonly-used cleaning solutions, micro-emulsions, and various gel systems.

These included the polyvinyl alcohol-based gels developed through the NANORESTART project and new gels tailored by CSGI specifically for this case study. Once the most appropriate strategy was fully evaluated, the sculpture underwent an extensively documented conservation treatment, where key decisions were made in conjunction with Tate's curatorial team and relevant stakeholders. This practice-based research included a collaboration of conservators, conservation and academic scientists and art historians/curators, where the balance of information gathered aimed not only to result in the successful treatment of this significant sculpture, but to contribute to our knowledge of Hesse's work and the refinement of new technologies which can aid in the conservation treatment of complex modern and contemporary works of art.

The Nanorestart project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646063

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Conserving Alchemy: Bonded Bronze and the Art of Michael Richards

Anne King, Ainslie Harrison, Eugenie Milroy

In 2001 the 38-year-old Jamaican-American artist Michael Richards was flourishing. His body of work was compelling and suggested immense promise. He had already won a number of competitive artist residencies including one from the Lower Manhattan Cultural Council (LMCC). His work had been exhibited at the Studio Museum in Harlem, the Miami Art Museum and the Aldrich Museum, amongst others. Often addressing themes of race and social injustice, his work from the 1990s has particular current relevance. Imagery of aviation and flight recurs in Richards' art expressing the potential of both uplift and downfall. Richards's best known work is *Tar Baby vs. Saint Sebastian*, a full size cast of himself dressed as a Tuskegee Airman pierced by airplanes. This piece became prophetic when the artist perished in the September 11 attacks after working overnight in his studio on the 92nd Floor of the World Trade Center's Tower One.

In the spring of 2016 in conjunction with the 15th anniversary of his death, the LMCC organized an exhibition entitled Michael Richards: Winged on Governor's Island in New York. A.M. Art Conservation was asked to examine and treat 11 pieces for the show. The majority of these, which came from Richards's estate, had not been exhibited since his death. Treating the sculptures within the LMCC's tight timetable and budget was a challenge. These pieces are among the most significant surviving works by the artist yet none had been stored in conditions optimal for preservation.

Richards employed unique applications of a wide range of non-traditional materials, including human and synthetic hair, latex rubber, feathers, tar, barbed wire, fiberglass and mechanical moving parts/motors. These carefully chosen materials were often linked to themes in his work. The title work *Winged* (1999) was "cold cast" in "bonded" bronze, a material made from metal powder and resin. Bonded bronze became popular in the 1990s and was increasingly used by artists. The material gave the appearance of bronze without the costs associated with a foundry and the raw materials themselves, while affording direct control over the final product. Richards referred to himself as an "alchemist" for this use of "resin instead of bronze." For him, the use of bonded bronze was also a play on the significance and permanence of bronze monuments.

Richards experimented with finishes, ratios of materials, hollow versus solid sculpture construction and variable use of armatures. Examination of the works revealed a progression in his

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use of these materials. Surprising corrosion patterns were observed in the bonded bronze. Differential thickness of resin, surface flaws and vacancies and incomplete coverage of complex molds and forms contributed to some of the condition issues. Happily, in 2017, *Winged* was purchased by the Virginia Museum of Fine Arts, ensuring that the object could be properly cared for and studied further. This paper will explore Richards' use of bonded bronze and some of the challenges it presents for conservators during treatment.

Preparing the Apollo 11 Columbia for its National Tour

Lisa Young, Malcolm Collum

The Smithsonian's National Air and Space Museum is home to the world's largest collection of objects related to the history of space-flight. Spacesuits, personal items, scientific instrumentation, satellites and entire spacecraft make up this inspiring collection. The Apollo 11 Command Module Columbia stands out as the most significant artifact, representing one of mankind's most remarkable achievements of landing a man on the moon and returning him safely to Earth. The last time Columbia traveled throughout the United States was in 1970, where it embarked on a 50-State Tour following the moon landing in 1969. Almost 50 years later, this historic spacecraft that carried astronauts Armstrong, Aldrin and Collins to the Moon and back, is headed out on the road for a second nationwide tour. Columbia was built for a single mission and while it was designed to withstand the rigors of launch and re-entry, 50 years later many of its materials are showing signs of deterioration.

For the first time since the Smithsonian acquired the spacecraft in 1972, conservators had the opportunity to examine the materials, take an-depth look at the engineering and technology and to re-examine the history of the object. This analysis served to enhance the curatorial and historical record, guided the conservation treatment and informed the exhibition design. This paper will present a technical study of the Command Module, illustrating its design, engineering and use of materials while presenting its conservation challenges. Astronaut graffiti and a study of the many features of this spacecraft will help humanize the artifact that traveled nearly a million miles in 8 days. Today, shipping an iconic artifact of this scale across the country should be a comparatively simple task but it still proved to be a logistical challenge and required collaboration with a team of experts to design a climate-controlled container, fabricate handling fixtures and provide security and suitable exhibition venues. .

Ghost Lives On: The Treatment of Rachel Whiteread's Monumental Plaster Sculpture

Judy L. Ozone, Shelley G. Sturman, Andrew Watt

The conservation treatment of Rachel Whiteread's monumental plaster sculpture, *Ghost*, was shaped by many challenging factors:

physical size of the object, unstable material properties and construction, available technology, costs, institutional constraints, tempered expectations, ethical boundaries, and artist's considerations. *Ghost* is an assembled, four-sided structure comprised of 86 plaster panels attached to a steel armature. The iconic sculpture is a negative cast of an entire room in a Victorian townhouse in London, and is Whiteread's best-known work. To prepare for a retrospective exhibition in fall 2018, a trial installation and examination was scheduled for early 2016. In the course of unpacking, one of the keystone plaster panels was found to have cracks such that it could not be installed without jeopardizing the entire structure. Because the damaged panel was on the bottom course that supports all of the panels above, the panel needed to be strengthened and all other elements needed to be re-examined to assess their integrity. Almost half of the 86 panels were found to have cracks.

The primary purpose of the treatment was to ensure that the sculpture be made stable so that the work could be safely exhibited. This was accomplished by improving several distinct but interdependent conditions: the physical stability of each plaster panel, the attachment strength between the fastener and the back of each plaster panel, the security of the panels to the armature, and the overall stability of the supporting armature. The treatment sparked many logistical and aesthetic obstacles due to its structural complexity and monumental scale (approximately 9' wide, 12' high, and 10' deep), and prompted conservators to reach out not only to other departments within the museum but to industrial sources for materials and processes not usually associated with fine art conservation treatment.

'Once in a Whale': The Conservation Treatment of Historic Cetacea at the Oxford University Museum of Natural History

Bethany Palumbo

In January 2013, the Oxford University Museum of Natural History (OUMNH) closed its doors for 14 months, allowing for the restoration of the original Victorian glass roof. The scaffolding required for this work enabled for the first time easy access to several whale skeletons suspended from the museum roof. This provided the opportunity for a thorough condition assessment and conservation treatment exercise which is the focus of this paper. The project, titled "Once in a Whale," encompassed several large articulated skeletons as well as a Humpback Whale skull and the huge mandible of a Sperm Whale. The specimens had been on continuous display since the museum opened in 1860 and were in poor condition overall. One hundred fifty years on display had left these specimens with varied types of deterioration: decades of dust and ingrained dirt, acidic sebaceous secretions, and delamination and bleaching caused by continuous exposure to UV and the constant instability of the museum environment.

With only 6 months to complete treatment and with limited funding, the aims were to preserve and stabilize the specimens for display and to improve their scientific accuracy. Treatment

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was guided by our own research, experimentation, and consultation with other conservators working on similar materials. The specimens were thoroughly cleaned, and consolidated to provide additional strength. Corroded wires were replaced and inappropriate anatomy was corrected where possible. Once completed, the skeletons were transferred to new positions and installed higher than previous to take advantage of the vast roof space and to make them a more prominent feature of the museum displays. The project blog onceinawhale.com was created to capture and convey the conservation process. This outlined the material science and treatment rationale for working on these unique materials, drawing interest from the public and conservation professionals alike.

The whales attracted considerable positive attention, with artistic professionals and enthusiasts inspired to join us in the “whale tank” to illustrate, film and photograph the work being carried out. The skeletons featured in the BBC4 series “Secrets of Bones” (2014) and the project was eventually awarded “Highly Commended” in the Conservation and Restoration category at the 2014 UK Museum and Heritage Awards. Overall the “Once in a Whale” project delivered many beneficial outcomes. Firstly, by highlighting environmental issues and the resulting impact on these specimens, there have been positive institutional changes to collections care. Secondly, our research contributed and strengthened a limited knowledge base regarding the treatment of these types of materials and highlighted areas requiring further research. Finally, the project also served as an exemplar demonstration of how bringing conservation out of a laboratory setting and to new audiences can inspire and create innovative and exciting outreach opportunities.

New Ways of Looking at Historic Ship Models: A Comparative Technical Study of a Pair of Napier & Sons Ship Models in the Rijksmuseum Collection

Riley Cruttenden, Davina Kuh Jakobi

Ship models of the *Buffel*, an ironclad ram ship, and the *Tijger*, an ironclad monitor, were built by R. Napier & Sons in Glasgow, Scotland, between 1867-1868 for the Dutch Department of the Navy. Both models were presented to the commander of the *Buffel* and subsequently transferred to the Rijksmuseum in 1883 alongside other models in the naval collection. In 2017, the Rijksmuseum undertook a comparative technical study of the two models. Techniques employed by the craftsmen associated with historic ship models are generally not well understood and object-based examination had not previously been performed to characterize the materials found on these models.

This presentation will review the results of this comparative technical analysis, which have provided new insight into the models and the practice of historical model making and suggest routes for future research. Additionally, it will describe the implications of utilizing a technical art history approach in the study of ship models. Historically, ship models have typically been used to

represent their larger counterpart, to demonstrate developments in shipbuilding, or to embody aspects and historical maritime events. As a result, the materials and techniques found on ship models have often been obscured or even completely removed by intrusive restoration campaigns, which usually focus on preserving the aesthetic and illustrative values of the ship model. However, historic ship models carry traces of social histories that have not been widely explored and their various media demonstrate a range of craft techniques. Comparative technical analysis offers a novel approach to the study of ship model making; in-depth technical studies comparing ship modelling materials and techniques have neither been published nor presented previously. Importantly, this method of study, when combined with art historical research, offers significant potential in exploring these understudied areas, identifying historical model making practices, and building a more holistic understanding of historic ship models.

This comparative study combined scientific and technical examinations with historical and primary source research to better understand how these models were made, what they are made from, and the historical context of their production. Together, the models of the *Buffel* and the *Tijger* were investigated using visual observation, ultraviolet illumination, digital microscopy, X-radiography, XRF, and paint sampling paired with SEM/EDX. The technical examinations revealed nuances in the construction of the models such as gilding applied with an oil mordant containing chrome yellow pigment, a decorative finish over the hulls composed of granulated tin applied with a mordant, and miniature rope purpose-made from silvered copper threads. Material analysis and historical sources suggests that the Napier & Sons model makers’ methods were closely linked to contemporary techniques employed by specialized craftspeople.

Ivory, Bone and Hide: Material Identification of a 19th c. Greenland Inuit Dog Sledge Collected by Admiral Peary

Judy Jungels, T Rose Holdcraft, Dan Kirby

The Peabody Museum recently opened a new exhibition “All the World is Here: Harvard’s Peabody Museum and the Invention of American Anthropology” to celebrate its founding 150 years ago. Featured in this exhibit is a selection of materials collected by Admiral Peary for presentation at the Chicago World’s Fair (1893), including an Inuit (Inughuit) dog sledge from Northern Greenland. Inughuit sledge designs played an essential role during Peary’s explorations of Greenland and his quest to reach the North Pole. Historic accounts note that Peary’s sledges, being much heavier and rounded at the front, were often damaged while traveling across the ice hummocks. In contrast, the flexible design of Inughuit sledges and the experience of Inughuit drivers allowed them to travel gracefully through the rough landscape.

Discussions with museum curators and an independent scientist led to the desire to identify materials used in the construction of this Inuit sledge. Micro-samples were taken from hide, bone and ivory sledge components to identify the mammalian species

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from which they were derived utilizing a technique called “Peptide Mass Fingerprinting” (PMF). PMF is an analytical technique for protein identification. The method was first developed in 1992, and uses a process of enzyme digestion to break proteins down into smaller peptides. This peptide mixture can then be analyzed with a mass spectrometer to reveal characteristic marker ions. This is known as a “peptide mass fingerprint.” Each protein has its own fingerprint and can be compared to known reference samples to identify its mammalian origin. Recently, PMF techniques have been adapted to identify materials used in the creation of cultural objects. This technique requires only a micro sample and can be used to determine the mammalian origin of collagen-based materials such as ivory, skin, intestine, and bone.

This new information allows researchers to better understand the availability of specific materials at a particular time or place and can serve as a tool for Indigenous communities and other stakeholders in understanding their material technologies. Materials used in cultural objects change over time due to a variety of factors – for example, resource availability and increased external contact and trade. The construction of an object reflects its social, political, and economic context. In the early 1800s, when explorers first had contact with the Inughuit, sledges were made almost entirely of animal-based materials. By the time Peary arrived, sledges were constructed from recycled wood in combination with bone, antler, ivory, and hide. By 1895, there were known examples of sledges made almost entirely of wood, with only the runners remaining ivory. Analysis of the Peabody’s Inuit dog sledge revealed that it is constructed of materials from at least five different species. This talk will discuss the history, material identification and construction of this unique 19th century sledge from Northern Greenland.

Understanding the Form, Materials, and Meaning of Two Ritual Figures: Conservation and Curatorial Collaboration for the Analysis and Treatment of the Historic Arts of Africa

Casey Mallinckrodt, Ashley Duhrkoop, Dr. Ndubuisi (Endy) Ezeluomba

This presentation will focus on the results of research and technical analysis, and describe the conservation treatment of two objects as examples of a large suite of technical analyses underway through a three year project funded by The Andrew W. Mellon Foundation: a 19th-20th century figure from the Idoma speaking communities in the Benue state of Nigeria and a twentieth century Adja Bocio figure collected in Togo.

The project goals are to generate in-depth material, cultural, and scholarly knowledge of the objects in the African collection at the Virginia Museum of Fine Arts and contribute to scholarship on the historic arts of Africa at large. The project is jointly administered and carried out by a conservation and curatorial team with collaborative exchange a hallmark of our process. The project also supports partnerships with specialist consultants, students, and source community members.

The Idoma figure is a religious object used for the veneration

of the water spirit Anjenu and is comprised of multiple materials and mixtures that include wood, paints, dyes, coatings, plant fibers, and mineral rich pastes, as well as imbedded and hidden materials. The Bocio is a religious Vodun object empowered by an accumulation of materials. Multiple analytic methods were used to develop holistic understandings of the figures including x-radiography and UV imaging, pXRF, XRD, FTIR and Raman spectroscopy, microscopy, and SEM-EDS. Collaboration with scientists at the Virginia Commonwealth University provided access to more refined analytic methods and professional expertise in interpreting results. Identification of plant materials was aided by consultation with botanists and ethnobotanists at the Royal Museum for Central Africa in Belgium.

The knowledge and observations of curatorial partners informed the material investigations of the figures, while conservation discoveries about the materials and methods of manufacture informed scholarly investigations including curatorial interviews with members of the various Idoma speaking communities in central Nigeria including the Ortukpo, Otukpa, Igumale, and Igede, and with the collectors who acquired the Bocio in the field.

Changes in the perception and exhibition of historic arts of Africa may require reconstructing the histories and meanings of these objects that have been separated from their original context of manufacture and use. This is a complex process as objects may embody complex and secret cultural practices or they may have been altered to accommodate cultural shifts or market demands. This presentation addresses the central importance of identifying the materials and methods of manufacture of historic arts of Africa through the investigation and treatment of ritual figurative sculptures and presents the discoveries about the structure, embellishments, and surface treatments that have resulted from collaborative investigation.

Paintings Session - May 31

Surprise Encounters with Mummy Portraits at the Art Institute of Chicago

Rachel C. Sabino, Emeline Pouyet, Federica Pozzi, Ken Sutherland, Marc Walton

The Art Institute of Chicago houses two second-century Roman-era Egyptian mummy portraits in its collection. In recent years mummy portraits have been the focus of considerable study, and the Art Institute's examples have been examined using multiple analytical techniques in an effort to elucidate the methods and materials used in their creation. During the course of these investigations, intriguing differences between the two portraits were noted. With regard to the binding medium, one of the portraits bears the hallmark robust impasto of wax applied using the encaustic technique, and the other displays the flatter, matte appearance accompanied by the striking *tratteggio* and cross-hatching that is often associated with tempera painting. Indeed, prior to technical examination the two paintings were perceived as such. Analysis of the binding medium of the first portrait using Fourier transform infrared microspectroscopy (FTIR) and gas chromatography mass spectrometry (GCMS) demonstrated, unsurprisingly, that it is composed of wax, supporting a description of the technique as encaustic. However, analysis of the second portrait unexpectedly also revealed the presence of wax. A limited number of published studies of media analyses of other portraits which yielded the same dichotomous results—assumed to be egg or glue based on visual appearance but found to be wax upon technical investigation—has confirmed the existence of similar objects in other collections. The Chicago painting is, consequently, one of a growing corpus of portraits that thrusts a tint of grey into an art historical construct that has been presented as quite black and white. Additionally, both portraits were examined with a combination of non-invasive in-situ scanning X-ray fluorescence (XRF) and near infrared luminescence imaging (visible induced luminescence spectroscopy, VILS). The presence of cuprorivaite, or 'Egyptian blue', was detected on both portraits, but its character and distribution varied startlingly between them. This discovery raises numerous questions as to the artists' working methods, material choices, and the transmission of techniques between the Fayum region and the wider Graeco-Roman world. The analyses of the Chicago portraits, alongside collaborative work with other institutions housing similar portraits, adds to the body of information that will hopefully, ultimately address such questions. But it also serves as useful reminder that works of art often resist clear categorization since they are, after all, human creations and thus subject to the individualities and idiosyncrasies of their makers.

A Convenient Method: Canvas Painting in 16th Century Florence

Jean Dommermuth

In 16th century Italy, the use of canvas as a support for paintings was more closely associated with Venice than with Florence, yet Florentine painters utilized canvas for certain projects. It has been noted that this usually indicates that these paintings were created for specific purposes such as banners. However, these functions are not always so obvious, and this major clue to the origin of a work can go ignored. This study explores the reasons for using canvas by looking at the works themselves as well as contemporary writings including Vasari on Technique. Vasari, proudly grounded in the Tuscan tradition of panel painting, had a definite respect for the utility of canvas; he writes that it is a "convenient" support, a word which for him had ethical as well as practical connotations. Such research can help re-contextualize works especially those that were not originally conceived as independent paintings. By looking at materials and techniques, as well as evidence of damage and alteration, a painting has recently been identified as part of a temporary decoration (*apparato*) created for the Medici wedding of 1565; that case study is the core of this paper. At the time, such decorations were extremely important, created by the leading artists of the day, including Pontormo, Bronzino and Alessandro Allori. Designed as ephemera, few have survived, and they are almost forgotten as an art form. Canvas was "convenient" for these decorations not only because – as is often mentioned – it was cheaper, lighter and could be made quite large – but also because it could easily and thriftily be made to an exact, predetermined size so as to fit in an architectural framework that was itself the ancestor of the modern theater set. Using very simple examination techniques - measuring canvas widths, looking at seaming and scalloping as well as ground types and thicknesses and the range of pigments used – a great deal can be understood about this early modern installation art as well as other uses of canvas by artists for whom it was a specific choice. The advantages they found would then inform the more common use of canvas in later centuries.

Material Insights and Challenges in the Treatment of Maarten de Vos' *Portrait of a Woman*

Kari Rayner, John Delaney, Kathryn Dooley, E. Melanie Gifford, Michael Palmer

Material analysis was crucial in treating *Portrait of an Old Woman* by Maarten de Vos (National Gallery of Art, Washington). During varnish removal the extent of overpaint became apparent; non-invasive and invasive analytical methods were used to determine its composition and distribution. Micro-sample analysis of the background and sitter's hat revealed non-original materials: a discolored drying-oil layer (characterized by FTIR and GCMS); at least two layers of oil-based overpaint covering the hat; and at least three layers of oil-based overpaint covering the background. Stratigraphy revealed in cross sections guided decisions regarding

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treatment in these areas. The non-original oil layer was key to successful overpaint removal, providing a barrier between original and overpaint. More challenging was determining the extent of overpaint on the sitter's black garment. Microscopic visual examination of the paint surface showed clear evidence of overpaint: a coarse-textured dark paint layer traversing cracks and damage in the underlying paint. A cross-section taken from the garment revealed two dark paint layers without intervening varnish or oil layer. The upper layer (the coarse dark overpaint noted above) was rich in smalt as determined by PLM and SEM-EDX (Si, Co, As, Ni identified). This layer also contains earth pigments (Fe) and small amounts of lead white (Pb). The lower layer did not contain smalt and had larger amounts of lead white and earths with traces of umber (Pb, Fe, Mn). To determine the extent of the dark, smalt-rich overpaint compared to the original paint, X-ray fluorescence imaging spectroscopy was performed. The co-localization of cobalt, arsenic, and nickel in the XRF maps indicated the presence of smalt across the garment. Smalt original to the painting was also present on the right side of the background. However, interestingly, the ratio of nickel to cobalt showed the smalt used in the background had a higher Ni content compared to that found in the garment, suggesting two different sources of smalt were used. XRF maps of Co, As and Ni have distributions that relate to the surface design of the garment; however, XRF maps of Pb, Fe, and Mn show a different design that may relate more to the lower, original paint layer identified in the cross-section. The inclusion of smalt in the overpaint, rare after the seventeenth century, suggests it was an early intervention. Subsequently, tests were undertaken to remove the overpaint from the garment. It was challenging, however, to see a clear separation between the overpaint and the original layer, and it was ultimately decided that full removal imparted too much risk. The dark overpaint was reduced slightly in some areas, and any discontinuities between overpaint and exposed original paint were compensated during retouching. The treatment of *Portrait of a Woman* offers an example of the important role analytical and imaging techniques play before and during treatment in identifying original versus non-original materials and making informed treatment decisions. By the same token, this project highlights the humbling physical limitations of treatment options that conservators often encounter despite having a thorough understanding of materials.

Unusual Activities Between Image and Panel: A 16th Century Painting of St. Catherine in the Yale University Art Gallery

Annika Finne, Irma Passeri

In his 1916 catalogue of the James Jackson Jarves collection, the art historian Osvald Sirén considered a small painting of St. Catherine of Siena and remarked that the picture "...has lost a good deal of its pictorial bouquet." His sympathetic but dismissive words are one of the only published statements on this painting, which dates to sixteenth-century Siena and after a series of attributions is now being reconsidered as a late work of Sodoma. Overlooked by the mid-twentieth century cleaning campaign that affected the

majority of the Italian paintings at Yale, the painting remained understudied until the fall of 2016, when it was pulled from storage for conservation treatment and analysis. The resulting project uncovered an unusual relationship between the image formed by the paint film and the support beneath it, which in turn became a determining factor in the treatment the painting received. Questions concerning how the image layer relates to the support immediately arose when examination of the painting began. X-radiography, followed by computerized tomography (CT) scanning, confirmed that worm tunnels had been filled with a radio-opaque material from the front of the panel, not the reverse. This observation establishes that the painting was either transferred to its present support, painted on an old, previously worm-eaten piece of wood, or painted on paper then mounted to old wood. The possibility of a transfer seemed, initially, most likely: no trace of paper has yet been found, the ground varies markedly in thickness as it extends across the panel, and certain areas of paint appear to rest directly on a thick, glue-like layer. However, the CT scan also confirmed that all but two of the largest disruptions to the surface of the painting correspond directly to knots in the present panel. Such connections between panel and paint film indicates that the support has long induced damage to the image it holds—an observation in tension with the aforementioned indications that the two materials were not always attached to one another. The working provisional explanation for the fraught relationship between image and panel is as follows: at a date prior to the painting's purchase by Jarves in roughly 1850, the image layer was temporarily separated from the panel. The exposed face of the panel was coated with the observed radio-opaque material, and the image layer was re-glued to its original support, in what could be named an "auto-transfer." The paper will explore this possibility alongside others. Precedents within the transfer literature will be described, including a little-discussed 1751 reference to an auto-transfer technique. Since the potential St. Catherine auto-transfer has a terminus post quem of 1850, this example could complicate the prevalent notion that nineteenth-century restorers considered the essence of the work of art to reside only in the image layer.

Research and Conservation of Peter Paul Rubens, *The Raising of the Cross*, Oil on Paper, 1638

Sandra Webster-Cook, Dr. Alexandra Suda, Kate Helwig

The Raising of the Cross, an oil painting on paper, was painted by Rubens for the production of an engraving by Jan Witdoeck and the image is based on the triptych of the same title, now in the Cathedral of our Lady in Antwerp and painted by Rubens in 1610-11. The sketch was acquired in 1928, as an "oil on canvas" by the Art Gallery of Toronto as it was called, from the Holford Collection through Christie's London. The painting was "cleaned" by Thos. Agnew and Sons, London prior to the sale. Extensive restoration followed: first in 1937 in New York City and, after two thefts in 1954 and 1959, at the Art Gallery of Ontario. It is not known at what point the paper was lined to canvas but it is currently glue lined to cotton canvas. Restoration methods followed the traditions of painting conservation and the paper

support at some point became obscured by extensive overpainting.

Documentation and understanding of the work was essential to complex decisions of removal and the reconstruction of areas that suffered loss of form and detail. Interruptions in the surface tonality by discoloured retouchings and the discontinuity and flattening of form due to severe abrasion and loss of surface paint interfered with one's appreciation of the work. Scientists at the Canadian Conservation Institute provided support in the initial investigations and at intervals in the treatment process by undertaking non-invasive x-ray fluorescence and analysis of samples as required. Samples were analyzed by Fourier transform infrared spectroscopy, polarized light microscopy, Raman spectroscopy, scanning electron microscopy/energy dispersive spectrometry and, in one case, by pyrolysis-gas chromatography-mass spectrometry. Infrared Reflectography (OSIRIS) was carried out by Rachel Billinge, National Gallery, London. Removal of restoration additions was challenging and time consuming and areas of ambiguity remain untouched. Recent work exposes at least some of the original intentions of the artist. Much of the paper support however modified in colour and texture, now contributes to the final image. The leached and damaged paint layers were minimally saturated with MS2A and retouching carried out with watercolour. The relationship of the sketch to the engraving and to the earlier painting will be discussed. Both informed the finish of the AGO painting. Several pentimenti remain visible and reveal the working method of the artist. The painting was reframed in a new frame to conceal the eight centimeter extension at the top border which is not by Rubens.

Evolon: Its Use from a Scientific and Practical Conservation Perspective

Susan Smelt, Petria Noble, Gwen Tauber, Robert Erdmann, Henk van Keulen, Katrien Keune, Kathrin Kirsch, Andreas Siejek, Saskia Smulders

In recent years, Evolon® CR, made of a highly absorbent polyester/polyamide microfilament fabric, has started to be used by many conservators for the removal of varnish layers on paintings. Its potential for controlled solvent application and dramatic reduction of mechanical action is particularly appealing. Moreover, it is especially suited for large-scale paintings. Several case-studies about the use of Evolon® have been published, but up until now no scientific study into the behavior of Evolon® with solvents has been carried out. In this paper preliminary results of testing of Evolon® will be presented. Moreover, a novel procedure for varnish removal using Evolon will be shared and illustrated with case studies.

Evolon® is being characterized with the help of Py-GC/MS. The analysis of the components is necessary in order to understand how it holds up in solvents. It was found that specific solvents remove loose, extractable nano-/micro-fibers from the textile (polyamide (nylon-6) and polyester), but no monomers. From preliminary results it can be seen that a fully saturated 'tissue' first releases solvent into the painting after which it pulls it back up, together with the extractable components (free fatty acids). The rate and depth of diffusion is dependent on the solvent. This result

was shown to be identical to varnish removal using cotton swabs, but involves no mechanical action as swabs do. Analytical results using less solvent (than saturation levels) will also be discussed.

Optimal saturation of the Evolon® with solvent is namely a very important aspect. After extensive testing, private conservators at the Restauratieatelier Amsterdam, developed a simple, but highly effective system of loading the Evolon® with specific amounts of solvent. This ensures that only the amount of solvent needed to swell and remove the varnishes is administered to the painting and that every part of the painting receives exactly the same amount of solvent. After timed trials with small strips of Evolon® using varying solvents and amounts thereof on various colour parts of a painting in order to determine the most effective solvent at the least concentration for the least amount of time, the varnish removal can proceed with larger sheets.

During treatment, the location of the sheets on a painting can be documented. After evaporation of the solvent, the sheets of Evolon® can be scanned at high resolution and stitched to form a mosaic of Evolon® corresponding to the painting. Remarkably, areas of thicker varnish, retouching and fine details, such as the crack pattern of the paint can be observed in the used sheets. In order to get a better understanding of these patterns on the Evolon®, used sheets were scanned with a macro-XRF scanner (Brüker M6 Jetstream). An insight was gained into the constituents of the retouchings, but more importantly, an image of the areas with varnish could also be made visible in the elemental maps. Further study of these results with other analytical techniques will be presented.

It can be concluded, that though further research is certainly necessary, this manner of using Evolon® makes varnish removal more efficient, safer and more controlled in comparison with varnish removal with swabs. Moreover, the used sheets of Evolon® provide an invaluable record of the removed varnish and retouching for further research.

Paintings Session - June 1

The Blues of Jan de Bray: The Study of Two Blue Pigments and its Impact on Treatment

Jon Gerrit W. Albertson, Dr. Yoshinari Abe, Dr. Art Proaño Gaibor, Anna Krekeler, Dr. Annelies van Loon

This paper will present the examination, analysis, and treatment of a seventeenth-century oil on panel painting in the collection of the Rijksmuseum in Amsterdam. The painting depicts Judith and Holofernes and was painted in 1659 by Jan de Bray, a Haarlem-based history and portrait painter. The painting was brought to the conservation department for examination and treatment in the summer of 2016. Although initial stages of the treatment were straightforward, the removal of many layers of discoloured natural resin varnish revealed an unusual and confusing pattern of damage in the blue area of the bedspread. Extensive abrasions, some round and ring-shaped, were visible with the naked eye, and the presence of microscopic islands of whitish material suggested that either

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pigment discoloration or undesirable pigment-binder interactions had occurred. To more fully understand the damage and alterations, the blue area was subjected to intensive study. Non-invasive analytical and imaging techniques, in addition to micro-sample analysis, were employed, including infrared reflectography (IRR), Hirox digital microphotography, micro Reflectance Transformation Imaging (micro-RTI), cross-sectional analysis, macro X-Ray Fluorescence spectroscopy (MA-XRF), Scanning Electron Microscopy (SEM-BSE/EDS), Ultra High-Performance Liquid Chromatography-Photo Diode Array (UHPLC-PDA), and portable micro-Raman spectroscopy (pRaman) and X-Ray Diffractometry (pXRD). Two different blue pigments were identified: indigo was used in the first blue layer of the bedspread with lapis lazuli glazed on top. The whitish islands were characterized as lapis lazuli that were apparently degraded in the past. The authors propose a possible mechanism for the degradation of the lapis lazuli based on SEM-EDS data showing reduced levels of sulfur in the degraded areas. These data are then correlated with observations of the painting's condition as well as with another recent publication of a painting by Hieronymus Bosch (Genbrugge 2016). Another significant finding includes the presence of alum in the indigo, which may explain the light blue fluorescence of the dark blue indigo paint under UV illumination. Consultation of contemporary source material provides additional context for the use of ultramarine and indigo pigments in seventeenth-century Dutch paintings. Ultimately, a more complete understanding of the materials present in the blue area and the ways in which later alterations to these pigments have affected the overall appearance of the painting informed the inpainting stage of treatment. This treatment step is discussed in light of these findings.

Gabriel Revel's *Portrait of a Sculptor*: A Painting and Treatment in Transition

Nina Olsson, Samantha Springer

The examination and treatment of Old Master works inevitably involves the interpretation and conceptual deconstruction of a complex overlay of visual evidence of the artist's studio practice, natural aging of materials, past structural treatments, cleanings, restorations, and even associated damage. In the case of a portrait by the French baroque academic painter Gabriel Revel, these tasks were complicated by the dramatic revelation of compositional features in part obscured by the painter himself in pentimento. In particular, the rendering of a small statuette that had been covered by past restoration raised questions about the correct reading of the piece. As part of the creative evolution of the portrait, Revel modified the left forearm and hand position to make room for the inclusion of a classical statuary fragment of a head. Yet the positioning of the fingers is ambiguous and the painter's intentions are unclear as to whether the portrait was meant to contain both of the sculptural fragments or just one. Digital X-radiography imaging of the substrate paint layers conducted at Oregon Health and Sciences University was hampered by an aluminum sheet concealed within the wax resin lining dating to the 1960s. Mammography, with a higher resolution for assessing subtle differences between densities

in materials, also provided limited results regarding the original composition. Imaging was helpful, but failed to present a clear answer to questions that remained regarding the reconciliation of the various compositional features of the subject's left hand and his possessions. Reversal of the lining and removal of the aluminum sheet were considered to improve imaging clarity, but eliminated as options due to the sustained structural stability of the lining materials. Ultimately, a bold curatorial decision was made to temporarily reveal all compositional elements of the painting. Although the composition has greater clarity and visual strength without the statuette, suggesting a reason why it was previously masked, the restoration choice was acknowledged as potentially a transitional state. It is hoped that bringing attention to the work will inspire research of Gabriel Revel, an artist with scarce dedicated scholarship, and therefore provide greater clarity regarding the artist's intentions. The paper will discuss conservation of the portrait as a sum of multiple historic identities, and the decision making process that guided the treatment choices in the formal interpretation, perhaps ephemeral, of *Portrait of a Sculptor*.

Old World, New World: Painting Practices in the Reformed 1686 Painter's Guild of Mexico City

José Luis Lazarte Luna, Dorothy Mahon, Silvia Centeno, Federico Carò, Louisa Smieska

In 1911, Emily Johnston de Forest, daughter of the founding president of The Metropolitan Museum of Art, John Taylor Johnston, donated her vast collection of tin-glazed earthenware to encourage the creation of a permanent display showcasing the artistic grandeur of colonial Mexican art. Despite her efforts, de Forest's vision was not realized until 2013, when the Museum appointed a curator of Colonial Latin American Art. Since then, the Museum has organized exhibitions and acquired artworks from New Spain. For more than three hundred years this Spanish kingdom encompassed modern-day Central America up to the western half of the United States, as well as the Philippines. The Museum's newly focused interest in the artistic output of this territory prompted the technical examination of two paintings, one by Cristóbal de Villalpando (ca. 1649-1714) and the other by José Sánchez (active 1686-95). From 1686 to 1688, these artists worked closely in the Painter's Guild of Mexico City, scrutinizing the works of many young aspiring artists. In this capacity, they were responsible for shaping Mexican artistic practices well into the 18th century.

Cristóbal de Villalpando, the most productive painter of the New Spanish Baroque, developed an individual aesthetic that distinguished him from his contemporaries. The technical study of his *Adoration of the Magi* (1683) was carried out for a monographic exhibition on the artist that took place at the Metropolitan from July 25 to October 15, 2017. Unpublished and unknown to scholars, *The Adoration* has been in the collection of Fordham University since the mid-19th century, and has only recently been included into the artist's oeuvre. *The Marriage of the Virgin* (ca. 1690) by José Sánchez was acquired by the Metropolitan Museum in 2016. It is one scene from a series depicting the life

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of the Virgin Mary, a subject frequently explored by painters in Spanish America. The paintings were created within a span of ten years, during which these artists served two years together as Guild examiners.

The results of our findings will be discussed in both regional and international contexts and will reveal the close connections and differences between preparation practices in Spain and its transatlantic territories. Of particular interest is the identification of ash in the ground layers of both paintings. This type of preparation is described by Francisco Pacheco in his 1649 treatise and has been identified in paintings of artists practicing in Madrid. This study presents material evidence that Mexican artists were following Madrilenian traditions, which had most likely been passed down through the Spanish painters that arrived in New Spain from the motherland.

This study comes at a propitious time. Art historical attention to New Spain has increased in the last decades but technical studies that contextualize the unique qualities of these important paintings are limited. Focusing attention on the individual contributions of New Spanish artists is essential to increase awareness of their artistic production, and create a body of knowledge about their material practices.

Material Matters Research for Rare Wall Murals Revealed at the Historic Sinclair Inn Museum

Ann Shaftel, John Ward, Emma Hartman

In 2014 and 2016, Conservator Ann Shaftel enacted conservation treatment of recently discovered historic walls murals behind wallpaper at the 18th c. Sinclair Inn Museum, located in a former second floor function room. At least two layers of murals were found, the first comprising Masonic Lodge fluted columns painted in the four corners of the room, which may date to the late 18th or early 19th c. Subsequent layers of painting, done over the Masonic columns, comprise panoramic views on all four walls which appear to portray the Annapolis Basin in various scenes, together with a portrait of a man in Scottish military dress, believed to be painted in the 1830s or 1840s. Later painted details of Masonic iconography have also been identified. This room has written documentation as one of the oldest known Masonic meeting places in North America. In the Conservation Treatment of the fragile and unique wall murals, the Canadian Conservation Institute (CCI) was requested by the Annapolis Historical Association, the local community not-for-profit owner of the museum, to research and advise on the both the wall paintings and the historic structure that contain the paintings, prior to and during the work. Based on this research and conservation related advice, an understanding and appreciation of the properties of the materials of the building and its walls was developed which informed and guided the hands-on revealing and conservation treatment of the murals. Dating back to 1710, the building itself is the second oldest extant wood frame building in Nova Scotia and Canada, which is an open-concept museum today in which layers of history are revealed, with didactic labels, audio/visual interaction and local guides. The museum building itself is informed by materials and historic

research. The conservation of the wall paintings was then prefaced by site visits, sampling and materials research carried out in the laboratory by Canadian Conservation Institute painting conservators and scientists, research that continued through the two years of the Conservator's involvement in the hands-on process. Historic preservation specialists from CCI were twice invited to the site to research and advise on preservation measures for the building itself as well as for the murals once they were revealed. The range of materials research provided by CCI was augmented by simple on-site materials research undertaken by the conservator herself before and during the conservation treatment. Augmented chemical analysis on the wallpaper and pigments was provided by Saint Mary's University Chemistry Department, for example the existence of arsenic in a wallpaper colour we were working with. This presentation demonstrates the vital importance of materials research for conservation treatment of multi-layered fragile wall paintings contained within an historic structure. Acknowledgements: Paul Marcon, Tom Strong, James Bourdeau, Jennifer Poulin, Elizabeth Moffatt, Dominique Duguay Report CCI 2015 Sinclair Inn Report 127794 Report CCI Final Technical Report Sinclair Inn 100351 Sinclair Inn Painted Room Report CCI 11-2011, Prof. Christa Brosseau, Department of Chemistry, Saint Mary's University.

An Obscured Beauty: Analysis and Treatment of *Dancing Girl* by Muhammad Baqir

Melissa Gardner, Dr. Corina E. Rogge

In 2015 The Museum of Fine Arts, Houston acquired Muhammad Baqir's *Dancing Girl* dated 1192 AH (1778 AD), their first Islamic easel painting. While Baqir is primarily known for his miniature painting, this oil on canvas work is roughly 59 inches tall, 31 inches wide, with an arched top, and features a 3/4 size portrait of a female dancer. The subject is dressed in a patterned skirt with jeweled bodice holding castanets in both hands, with one arm raised above her head. She stands before an open window with a typical landscape behind and a bowl of pears to the side. Baqir was one of the first Persian painters to incorporate European motifs and techniques into his works, and his use of perspective in particular shows the intersection between West and East. Large canvas paintings are rare for this late Zand period and few of them have been studied in depth. As the techniques and materials of miniature painting do not always translate to larger works, analysis of Baqir's materials and methods in this painting compared to his smaller compositions contributes to a greater understanding of Persian oil painting in general.

Immediately after acquisition research on the painting began to aid in the overall treatment. The painting has been examined with UVF and IRR imaging along with X-radiographs. Analysis was performed using XRF and FTIR, dispersed and cross sectional samples including fiber identification of the canvas, as well as SEM-EDX. The work has been lined and treated at least twice in the past, although no conservation records are extant. Analysis shows several layers of shellac applied throughout the years and it is speculated the painting had never before been thoroughly cleaned.

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Overall the surface exhibited a thick plastic appearance detracting from its dynamic qualities. Additionally the severe yellowing of the coating distorted the color relationships of the composition and obscured any subtleties of shading. Cleaning the painting was undertaken with caution as several areas contain vermilion, which proved to be sensitive to any solvents strong enough to solubilize the shellac. The jeweled decorations in the dancer's costume are composed of metal flakes with painted details on top. These areas are likewise extremely delicate and could not be cleaned with solvents. The cleaning therefore consisted of two phases. First using appropriate organic solvents in any non-sensitive areas, then the remainder of the painting was slowly cleaned mechanically. The painstaking cleaning revealed beautiful delicacies in the technique and restored much of the original aesthetic. Older campaigns of retouching and over-painting were also removed and new compensation was completed in a more discreet manner. The investigation and treatment of *Dancing Girl* provided important insights into the painting materials and techniques of the late Zand/early Qajar period as well as several practical methodologies for their continued preservation. The knowledge gained from this project regarding larger Persian oil paintings on canvas is an invaluable addition to Western conservation circles.

Symbol, Record, Object: Treating the Many Facets of Two Qajar Iran Imperial Portraits

Nancy Pollak

This paper discusses the treatment of two life-size portrait paintings in the collection of The Smithsonian Institution, Sackler Gallery of Art: the 1859 three-quarter length portrait of Prince Jalal al-Din, son of Fath Ali Shah by Abu'l Hasan Ghaffari, and the 1915 full-length painting of Ahmad Shah and his Cabinet by Ustad Assadallah al-Husayni Naqqash-bashi. Both paintings are powerful examples of how Iranian artists responded to the influences of Western portraiture while maintaining a unique sense of stylized line and pattern. Each painting required structural and cosmetic treatment, with treatment goals including reversing extensive previous treatment and preparing the painting for exhibition. As symbols of the importance of these men, the portrait of Prince Jalal al-Din is unique in the artist's exceptional rendering and adherence to a very traditional 19th century portrait presentation, while the group portrait of Ahmad Shah, standing in front of his brother and ten members of his cabinet, was clearly influenced by contemporary photographs. Historical record was further presented in Ahmad Shah's painting by the later addition of inscriptions identifying the men, and the replacement of the original dated artist's signature at the bottom of the image. Examination and treatment of Ahmad Shah's painting sought to place these inscriptions in context with other restorations, and to inpaint damages to balance visual unity of the image with the evidence of the painting as historical document. The materials and construction of each painting also greatly influenced the recent conservation treatments. The earlier portrait of Prince Jalal al-Din had a very traditional, Western painting construction of stretched, pre-primed linen canvas. Later restorations followed with lining and

large areas of fill and restoration. Although the present treatment reversed most of the earlier treatment, it still followed a traditional path of re-lining, filling and inpainting. The later painting of Ahmad Shah had a simpler, less conventional construction, and was painted on seamed sections of thin, cotton fabric with no preparatory ground. Later repairs included small local patches and isolated restorations more in keeping with a hanging textile than a traditional stretched painting. The present treatment included a modified padded panel/stretcher support which would allow an easel painting presentation while retaining the irregularities of the seamed support fabric. Both treatments were informed by the accumulated histories of the paintings and the desire to respectfully preserve their very different constructions while enabling the vitality of the subjects to be present to the viewer.

Paintings Session - June 2

Deciphering Intention from Ageing: The Use of Archival Material in the Study and Treatment of *Winifred Dysart* by George Fuller

Roxane Sperber

The treatment of *Winifred Dysart* by George Fuller, from the collection of the Worcester Art Museum (WAM), exemplifies the importance of material study to conservation. The painting was selected for conservation in preparation for a rehang of WAM's American collection. The painting presented several questions, relating to condition and intended appearance, which were addressed before the treatment began. Fuller was an important Massachusetts artist in the late nineteenth century and is well represented in New England collections. However, little technical research about his technique is published. Existing technical research focuses on the altered appearance of his paintings due to the deterioration of glazes. While true in many cases, this information may have had the unintended consequence of discouraging conservators and curators from treating and exhibiting his work. Fortunately, technical analysis, close examination, and primary source research illuminated the artist's intended appearance of *Winifred Dysart* and allowed for a successful treatment to be undertaken. As a Tonalist, Fuller evoked an eerie atmosphere in his paintings creating what a contemporary critic described as a "soft golden hue" (Van Rensselaer, 1883) or in other cases a "sulfuric yellow tone" (Enneking, 1886). The yellow appearance of *Winifred Dysart* was thought to possibly be intentional and initially the decision was taken not to remove the varnish. However, nineteenth-century descriptions of the figure's "pale lilac" dress suggest the artist did not apply a toned varnish. This, in addition to examination of Fuller's works in other collections, prompted treatment to be reconsidered and varnish removal to ultimately be carried out. This talk will offer comparisons between *Winifred Dysart* and Fuller's works where sulfuric yellow tones were clearly intentional, with the aim of providing guidance for future conservation efforts. Another complicated aspect of Fuller's technique is the layering and scraping of paint to create texture.

Receipts from Boston colorman A.A. Walker document the purchase of large quantities of coarsely woven “Heavy German canvas”. *Winifred Dysart* is painted coarse canvas which made distinguishing scraping from previous cleaning abrasion challenging. References such as early photographs, drawings, and the study of Fuller’s innovative technique proved essential to understanding and restoring the painting to its intended appearance. John Enneking recalled a scene in which Fuller, while critiquing his painting with fellow artists, changed the figure’s arms using crayons to adjust his composition. The original composition is visible in the x-radiograph, corroborating Enneking’s story. Fuller’s hasty reworking is distinguishable from the original paint layer, but thanks to Enneking we can be certain this reworking was done by the artist. Unfortunately, a previous restoration interpreted the artist’s reworking as unoriginal and attempted to remove it. The recent treatment addressed this damage, referencing Enneking’s description and an historical photograph, to reintegrate the damaged area. Understanding Fuller’s rich and complex approach to painting has proven essential to the successful treatment of *Winifred Dysart*. By sharing the observations and approaches taken during this treatment it is hoped that more works by this talented artist will be conserved and exhibited.

Back to Blakelock: Casting New Light on Historic Technical Studies of Paintings by Ralph Albert Blakelock

Anna Krez, Anikó Bezur, Mark D. Mitchell, Meng Ren, Katherine A. Schilling

Ralph Albert Blakelock was an American landscape artist (1847-1919) famous for his paintings of moonlit Western landscapes painted in the late 1880s and early 1890s. Prices for his paintings soared and forgeries quickly multiplied after he was institutionalized with mental illness in 1899. In the present day, his works are seldom exhibited due to condition issues and concerns about authenticity. Beginning in 1969, Norman Geske, former director of the Sheldon Memorial Art Gallery at the University of Nebraska, and his team worked toward resolving the latter problem. They supplemented provenance research and documentation with systematic examination of the paintings, including neutron-activation autoradiography of several dozen works, a technique that was first applied to the study of paintings just a few years earlier. The Yale University Art Gallery’s acquisition of *Moonlight* (c. 1888), a Blakelock painting studied by Geske’s team and considered to have excellent provenance, represented a unique opportunity to revisit the examination and analysis of this painting and Blakelock’s mature oeuvre.

Based on detailed examination of painting technique and materials of *Moonlight* and two moonlit landscape paintings from the Brooklyn Museum and the Metropolitan Museum for Art as well as close observation of other paintings from these and other collections, we propose new criteria for attributing paintings to Blakelock and begin connecting condition issues to material choice and use. To convey depth and subtle tones, the artist alternated

numerous medium-rich transparent and pigmented translucent or opaque paint layers. The aging of the natural resin component in the paint layers contributed to the darkening of *Moonlight*, though the degree to which the artist may have anticipated and desired this is difficult to gauge. In addition to contributing to darkening, the resin content of the paint films has impacted the films’ mechanical properties – resulting in brittleness. The presence of resin-rich top layers also has important implications for solvent-based varnish removal or thinning treatments.

This work utilizes a suite of imaging and instrumental analysis techniques (multispectral imaging, x-ray radiography, x-ray fluorescence spectroscopy spot measurements and large area mapping, Raman and infrared spectroscopies, pyrolysis-gas chromatography-mass spectrometry, and scanning electron microscopy – energy-dispersive x-ray spectroscopy) to study *Moonlight* comprehensively, in the spirit of Geske and his team. Large area elemental mapping using micro-x-ray fluorescence spectroscopy, motivated by the desire to visualize a newly-identified female portrait under the landscape, also helped clarify the paint application sequence in the landscape, especially at the boundary of the sky and tree foliage. The many thin layers used by Blakelock for his compositions, however, complicate the inference of specific pigments from non-destructive elemental analyses; as a result, cross-sections have proven highly valuable for visualizing layer stratigraphy as well as for enabling pigment identification. These results, in combination with large-area elemental maps, can now serve to revisit neutron-activation autoradiography results from the 1970s and reinvigorates scholarship and presentation of Blakelock’s moonlit landscapes.

An American in Amsterdam – The Relevance of the Louis Pomerantz Papers for the Conservation History of the Paintings Collection at the Rijksmuseum in Amsterdam

Esther van Duijn

During her three-year research project into the conservation history of the paintings collection of the Rijksmuseum Amsterdam, the author discovered that the American conservator Louis Pomerantz (1919-1988) began his career in 1950, in the paintings conservation studio of the Rijksmuseum. Here Pomerantz learned the profession from chief conservator Henricus Hubertus Mertens (1905-1981). During this period, Pomerantz kept three notebooks, which are now kept at the Smithsonian Archives of American Art in Washington. The significance of these notebooks can hardly be overestimated, since Mertens did not keep any conservation documentation apart from occasional handwritten notes underneath or on the reverse of treatment photographs during his 40-year career at the Rijksmuseum. And such treatment photographs were only taken for very important paintings, or for paintings from outside the collection. The Pomerantz notebooks contain typed information as well as many drawings and photographs. They show the choice of materials and methods used to treat paintings although without explanation as to why one type of treatment is preferred

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over another. Indirectly, they demonstrate how the studio was run. Pomerantz also visited other departments, writing down various recipes, for example different glues used in furniture, paper, ceramic or glass conservation.

Mertens had started working in the Museum in 1930. He was a young artist from the South of the Netherlands, with – as far as we know now – little knowledge about conservation. He seems to have learned the profession in the Museum as he went along. Shortly after the second World War, he treated Rembrandt's iconic painting *The Night Watch* (1642), gaining an international reputation as the specialist in the treatment of Rembrandt paintings. After the war, the conservation department grew in size – before the war it had just been Mertens and a liner called Jenner – with Mertens as chief conservator. Between October 1950 to August 1951, Pomerantz did his one-year training there. This paper explores the relevance of this Amsterdam-America connection, both for the paintings conservation department of the Rijksmuseum, but also for the conservation practice in the United States. With the 2018 theme Material Matters in mind, it is a sad truth that in studying the material side of paintings, or any art object for that matter, conservation history is often forgotten, or discarded as insignificant. However, the materials and methods used in the former conservation treatments often play a very important role in the current appearance of paintings, as well in degradation processes of the original materials. When we say “materials matter,” we must realize that this includes conservation materials from the past. As an example of material that matters, the method of the wax-resin lining technique will be described. Pomerantz in his notebooks pays extra attention to this technique, which is also called the “Dutch” method.

The Use of Modern Paints by the Concrete Artist Ivan Serpa in Artworks of the Early 1950s

João H. R. Barbosa, Luiz A. C. Souza, Giulia V. Giovani, Alessandra Rosado, Yacy A. Froner

This work debates the use of modern paints by the Brazilian concrete artist Ivan Ferreira Serpa (1923-1973) during the early 1950s as an alternative to explore the constructivism principles in paintings. Two works will be discussed: *Forma em evolução* (1952) and *Quadrados em ritmos resultantes* (1953). Ivan Serpa was born in Rio de Janeiro and explored different painting techniques and materials during his short career. With Mário Pedrosa (1900-1981), the artist was responsible for introducing abstract art in Rio in 1949. He founded an art school for kids and adults in the Museu de Arte Moderna (MAM-RJ), created the vanguard movement “Grupo Frente” (1954-1957) and won in the I Bienal of São Paulo the “Young Painter Prize.” With “Grupo Frente” he taught precision in geometrical forms but was a prominent defender of the use of colors, in opposition to rigid principles created by the “Grupo Ruptura” (1952-1959) in São Paulo. Serpa's experience as a teacher, a graphic designer and a student in the advertisement course performed at “Fundação Getúlio Vargas” (1946-1948), probably enable him the precision and skills to build his constructive forms.

In *Forma em evolução* (1952) Serpa is possibly interested in bright, pure and translucent colors, as well as precise and flat surfaces, without brushstroke signs. This earlier composition is made of three basic layers: blue (ground layer), black and red. On the blue and red areas, it is visible how the artist applied several layers and possibly used masks to build precise lines and shapes. According to Pedrosa, during this period Serpa experimented industrial paints and brands like Ripolin. Serpa confirmed the use of this material because it was stable, self-leveling, and free from stains. On *Quadrados em ritmos resultantes* (1953), instead, the artwork is made by the contrast of vivid and dark colors, glossy and opaque surfaces. The geometrical areas are possibly painted with masking tape. The chemical analysis realized on *Forma em evolução* (1952) and *Quadrados em ritmos resultantes* (1953) revealed the presence of alkyd resin.

This result is consistent with household paints composition in the 1950s in Brazil. Alkyd paint also had desirable properties for modern artists like Serpa: fast drying, glossy and self-leveling surfaces. Historical research on paint materials and chemical industry in Brazil showed that the importation of Ripolin paints occurred since the beginning of the XX century. Alkyd resins, instead, were imported in the mid-1940 and started to be manufactured in the early 1950s. However, the availability of alkyd paint is noticed only in the Brazilian market in the mid-1950, suggesting that when the artist produced this group of paintings alkyds weren't available in Brazil. Serpa probably had to mix the resin, pigments, and solvents by himself; the effect of this process could be observed on the bubbles and pores formed on the surface of both paintings. This study aims to contribute to a better understanding of Ivan Serpa's production as well as his artistic intention.

American Abstract Expressionist painter Sam Francis (1923-1994): Techniques and Materials Inform Conservation Treatment in the 21st century

Aneta Zebala, Debra Burchett-Lere

Debra Burchett-Lere, director of the Sam Francis Foundation, and Aneta Zebala, conservator in private practice, have investigated Sam Francis's materials through ongoing conservation interventions of Francis works and in preparation for the 2011 release of *Sam Francis: Catalogue Raisonné of Canvas and Panel Paintings, 1946-1994*, published by UC, Berkeley. Paint samples were taken and analyzed from 34 paintings from the 1940s to 1990s for the upcoming GCI publication (2018 release) *Sam Francis: The Artist's Materials*. This in-depth study includes paintings from collections of Beyeler Museum, Basel and the Museum of Contemporary Art, Los Angeles. Through systematic study and analysis, new information has come to light regarding unknown aspects of Francis's practices to form the basis for this study. He enthusiastically used new commercial materials when they became available, and developed his own paints to achieve the saturation of color and desired consistency of paint. Newly discovered and existing photographs of his studios in Bern, New York, Paris, San

Francisco, and Santa Monica, show a range of brands of materials that he used both on canvas and paper including watercolor, oil, acrylic, solvent-based acrylics, commercial acrylic emulsions, inks and custom-mixed acrylic dispersion paints. Before 1960 Francis used oil paints in a viscous medium, often with wax and resins. He began to use acrylic paint in the late 1950s, at times combining acrylic and oil paint with other water-borne media in one painting. This was not part of a structured system of experimentation, but rather he willed his paints to co-exist on the surface regardless of medium. Francis's expansive use of blue paint created a misconception that he used many blue pigments. The extensive pigment analysis identified three blue colors: ultramarine, cobalt and phthalocyanine blue, and an unexpected twenty-one different reds in the works studied. He reinvented the physical act of painting, and made the most of drips, splatters and controlled surface accidents in works of all sizes. He manipulated surface tension of watered down paint and distinct optical and handling properties of acrylic and dispersion paints and created a range of surfaces varying from washes of color, tinted gesso, to pulsating thick orbs. Wet-in-wet and wet-over-dry techniques suggest both an immediacy and interval of time between painting stages.

Understanding artist's materials is a critical part of any conservation intervention. Many of Francis's paintings exhibit highly chromatic surfaces, where chameleon-like colors exhibit metameric color change, in different light sources. Additional atypical effects such as bronzing, fluorescence or opalescence present in Francis works add to a challenging task of color matching of modern synthetic organic pigments. Large passages of exposed white priming make Francis's canvases vulnerable to surface soiling and damage, which presents a constant problem of cleaning his acrylic paintings. In view of the scientific and conservation findings presented in the Tate publication *Modern Paints Uncovered*, it is critical to revisit the practices of aqueous-based cleaning of Sam Francis's paintings. It is our intent to share discoveries in the artist's studio practices to help understand thousands of paintings that make up his oeuvre.

***Split Infinity*, Herbert Aach - The Integrated Inpainting Method for Fluorescent Paint Layers**

Naomi Meulemans, Stefanie De Winter, Giovanna Tamà

In this talk we will discuss the progress of finding a new method for the integrated inpainting of fluorescent paint layers. During the conservation of the fluorescent, monochrome paintings of Herbert Aach's (1923-1985) *Split Infinity* series (1976-77), standard retouching methods lead to negative results. So far we were able to simulate the fluorescent color under stable light conditions, but as soon as ultraviolet increases, the inpainting became more disturbingly visible. Beside these color matching difficulties, its materiality structure differed strongly from the original paint layer. Aach was an artist who made his own pigments and paint-media. The fluorescent paint layers in these series appear very dry, fresco-like and the saturation of the fluorescent pigment in the acrylic medium is much higher than the fluorescent paints sold in art supply stores. Valuable research by Stefanie De Winter

(doctoral researcher (PhD art history) KU Leuven, Belgium) describes the material-technical and the specific visual differences between fluorescent and conventional pigments. Three significant characteristics became apparent during this empiric comparison: firstly, fluorescent pigments age much faster, after 10 years they start to lose their intensity; secondly, they are very transparent, due to their organic pigment composition, which makes mixing them with other colors not possible; thirdly, there are limits in binding fluorescent pigments with media, because of their high transparency they require a very clear medium. In this study, we want to find a new retouching-method that takes into account these specific characteristics and that enables inpainting with fluorescent pigments in the monochrome, fresco-like paint layers of Aach's works. We are currently investigating these specific pigment compositions (used in *Split Infinity* paintings) through pigment analysis (Raman spectroscopy). The results will be compared with the spectra on fluorescent paints researched by Wim Fremout and Steven Saverwyns (KIK, Royal institute for art patrimonium Belgium) and further analyzed with the help of specialized chemists of the University of Antwerp. We are also testing artificially pigment aging processes, to simulate the original age of the fluorescent paint layer to ensure reduction of the fluorescent intensity that is causing the disturbing effect on the total image. For the retouching-media, we are testing dry-looking mixtures, like pastel, gouache and acrylic combined with structuring techniques. In a next phase the acquired information will be used for the case-studies on inpainting of these monochrome paintings. We expect to provide new insights in the understanding of fluorescent paint. This highly needed new method for retouching fluorescent paint layers will assist conservators to better restore and preserve these very bright, high sensitive and fast degrading paint layers.

Oxidized Finger Prints on Rudolf Stingel's Golden, Highly Reflective 'Carpet Paintings'

Mareike Opeña

Italian-born American artist Rudolf Stingel is well known for his monochromatic abstract oil paintings with delicately textured, silver or golden-iridescent surfaces. Since the late 1980s, the artist has developed the technique from solely tulle-textured effects on oil paint to that of incorporating ornamental stencils, now often referred to as his 'carpet paintings.' These paintings are extremely vulnerable to oxidation. Accidental touching during handling will cause the later appearance of dull, corroded stains on these highly reflective surfaces. The metallic enamel paint he used throughout the years to achieve the metallic effect on various colors of oil paint was initially developed for sealing industrial metal appliances. The copper-zinc alloy pigments in this paint have a leafing character, which is based on their disk shape and repellent character when in contact with the non-polar solvents in the paint system (best achieved using Xylene). In a painted film, the pigments will orient themselves in high concentration on the surface (leaving the body of the film pigment-free), and seal the film with a fine, almost solid layer of pigment flakes. This creates a highly reflective, gilded character to the surface. Since the paint was developed for

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industrial purposes only, the durability of its visual properties was of no concern to the fabricator. These special-effect pigments are extremely vulnerable to outside oxidants – whether air borne or physically transferred – as they are not embedded and protected in their binding medium. Consequently, the paint layer will gradually shift from a cool golden tone to a bronzed appearance over time. Fingerprints, water drips or scuff marks further accelerate the oxidation process, turning the surface dull, dark brown or greenish.

At Contemporary Conservation Ltd., we are often faced with these locally oxidized areas, especially on the golden paintings. Normal avenues of treatment – chemical reversibility, physical removal of material, or the addition of material - are not applicable. The corrosion is irreversible; polishing or sanding are only destructive; and even local inpainting or gold-leaf application cannot recreate an sufficiently brilliant appearance. Even though the artist kindly provided samples of his paints, their golden tone no longer matches the naturally aged appearance of the original work. The proposed presentation will tell the story of the investigation undertaken to develop a conservation treatment for these works. Several obstacles were faced, including finding a method to protect the intact, yet naturally aged surrounding, and enacting appropriate health and safety measures when using the paint system which contains mostly Xylene. In an effort to match the gold to the aged condition on a particular work the leafing pigments were artificially aged outside of the paint system. Transferring the treated pigments back into a solvent system revealed the loss of the leafing character of the pigments, which was accommodated by separating the application of binding medium and pigments. Additionally, due to the fact that the paint's recipe was changed in 2004, the artist is now exploring similar tests himself, in order to adjust the system to his desired tone and aesthetic choices.

Vibration-Induced Mechanical Damage in the Canvas Paintings of Georgia O’Keeffe as a result of Road and Air Transport

Dale Kronkright, Vikrant Palan, PhD., Arend Von der Lieth, PhD.

In 2012, the Georgia O’Keeffe Museum concluded a year-long, three venue touring exhibition of 75 canvas works of art by Georgia O’Keeffe. Despite the clear evidence from courier logs and temperature, humidity and shock data loggers that no harmful shock or environmental extremes had occurred in transit, post exhibition examinations and imaging revealed that several works had suffered both new and existing crack and interlayer cleavage propagation. While museum conservators understood that physical and mechanical damage to art in transit is cumulative, existing literature suggested that repeated exposure to low amplitude, randomly generated vibration accelerations commonly encountered in fine art transport trucks and airplanes should pose little danger to works of art. Yet conservators discovered a strong correlation between the number of miles of motor transport with historic and contemporary crack and cleaving propagation in its paintings. Because the museum was traveling its collection far

more frequently each decade than it had previously and because that it had no data on the natural frequency of the paintings in its collections, nor an understanding of the vibration frequencies transmitted by art transport vehicles or attenuated by fine art crates, it began a study to use calibrated three axis accelerometers, laser displacement meters and laser vibrometers to gather a more complete understanding of the mechanics of transit vibration induced-damage in art transit. The museum used acceleration measurements, displacement measurements, discrete cosine transform and Fourier fast transform to understand the power distributions of both facsimile paintings and, ultimately collection paintings, as well as truck beds, walls and various crating and cushioning methods. The findings fundamentally changed the museum’s understanding of vibration induced damage to canvas paintings, the vibration spectral power distribution of fine art transport vehicles, and the successes and failures of framing, backing, crating and loading methods to attenuate vibrations across damage-sensitive frequencies. The presentation will summarize the methods, results, canvas movement visualizations and conclusions of the 5-year study.

The tendency of traditional foam-cushioned wood crates to generate additive interference and amplify canvas displacement excursions at frequencies surrounding the natural frequency of the paintings suggests the need for new engineering approaches for the protection of canvas paintings during transit. Likewise, the vibration damping effects of sealed frame backings and glazing in frames will also be described.

Photographic Materials Session - May 31

Comparison of LED, L-37 Filtered Xenon Arc, and Glass-Filtered Cool White Fluorescent Illumination in the Light Fading and Light-Induced Staining of Color Photographs

Henry Wilhelm, Richard Adams

During the past several years, there has been a large-scale shift from UV-filtered tungsten halogen illumination to high Color Rendering Index (CRI) LED illumination in museums, galleries, archives, and libraries, along with widespread adoption of generally lower CRI lamps in public buildings, commercial establishments, and homes. The majority of light stability information on the indoor fading and staining of analog and digitally-printed color photographs published in the past 30 years has been based on accelerated tests conducted with glass-filtered and UV-filtered Cool White fluorescent illumination. At the present time, for a number of important reasons, Wilhelm Imaging Research, HP, Epson, and Kodak Alaris, among others, continue to conduct accelerated light fading tests using this illumination source.

However, “ISO International Standard 18937:2014, Imaging materials – Photographic reflection prints – Methods for measuring indoor light stability,” specifies L-37 filtered xenon arc illumination for “simulated display in indoor indirect daylight through window glass.” JEITA Standard CP3901A also specifies L-37 filtered xenon arc illumination. Work is currently in progress on “ISO 18937-4, Imaging materials – Photographic reflection prints – Methods for measuring indoor light stability – Part 4: LED Illumination.” Working together with Shigeo Suga of Suga Test Instruments of Tokyo, Japan, Henry Wilhelm is serving as Co-Project Leader in the development of this new ISO standard. Wilhelm Imaging Research, Inc. has designed and constructed new temperature and humidity-controlled accelerated light stability test equipment for LED lamps. This paper will present comparative fading and staining data for a representative group of color photographic print materials, including silver-halide color (chromogenic) prints made with Kodak Alaris Endura Premier Professional Paper and Fujicolor Crystal Archive PDN Professional Paper (also to be discussed is the newly-developed “Improved Light-Stability” Fujicolor Crystal Archive Professional Paper that was publicly announced at the IS&T Digital Printing Technologies Conference in Denver, Colorado on November 8, 2017, and will be commercially introduced in September 2018 at the Photokina trade show in Cologne, Germany); Epson UltraChrome HDR pigment inkjet prints; Epson EcoTank (Epson 664 dye inks) dye inkjet prints; ChromaLuxe dye-sublimation photographs printed on an intermediate transfer paper with Epson UltraChrome DS (dye sublimation) inks and then thermally transferred under high heat at 190–205°C (375–400°F) and pressure (60–80 PSI) for 2–4 minutes onto a rigid, specially coated ChromaLuxe aluminum support; and ChromaLuxe dye-sublimation photographs printed in the same manner with Sawgrass 8-color Sublijet HD Pro Photo

XF dye-sublimation inks. The prints have been subjected to accelerated tests using high-intensity 25 klux LED illumination from SORAA Vivid PAR 38 violet (purple) pump emitter LED lamps with a CRI of 95 and CCT of 3000K (1000 lumen output, 60°FL, 18.5-watt SORAA SP38-18-60D-930-03) with glass-filtered, UV-filtered, and non-filtered (bare-bulb) exposure conditions.

For comparison purposes, prints have been exposed to illumination from single-phosphor OSRAM Sylvania High Output (HO) 4200K Cool White (JIS F-6) fluorescent lamps (made in Canada) with glass-filtered, UV-filtered, and non-filtered bare-bulb exposure conditions. In addition, in ongoing tests, prints have been exposed to xenon arc illumination (equipped with water-cooled Hoya L-37 glass filters and dual IR filters) in a Suga SX75F temperature- and humidity-controlled xenon arc test unit equipped with dual refrigerated chamber air and water-jacketed xenon lamp cooling systems that simulate indoor indirect daylight through window glass, both with and without a UV filter. Illumination levels, sample surface temperature, test chamber temperature, and relative humidity conditions have been maintained as close as possible to the same aim-points. Identical methods of test target measurement and analysis for reporting fading and staining data are employed. Tungsten-halogen and L-37 filtered xenon illumination, however, present a number of difficult technical issues in terms of maintaining uniform sample surface temperatures, moisture levels, uniform illumination levels, and mitigating other factors that can result in poor inter-laboratory agreement between different testing organizations, and this will be discussed in the presentation. The spectral power distributions in the UV, Visible, and IR regions for all of the illumination sources will be given, including the spectral properties of LED lamps based on blue pump emitters and LED lamps based on violet (purple) pump emitters. Related topics that will briefly be discussed include: Lux (a measure of light intensity as perceived by the human eye – and its generally not straightforward relationship to rates of fading and light-induced staining), Color Rendering Index (CIE CRI), IES TM-30-15, Television Lighting Consistency Index (TLCI), Color Quality Scale (CQS), and Correlated Color Temperature (CCT) for LED lamps will be described. Potential differences between blue pump emitter LED illumination and violet (purple) pump emitter LED illumination in terms of their potential impacts on the fading rates of color photographs – and, likely, paintings, watercolors, other works of art, fabrics, books, and historically important documents – will also be discussed.

Evaluation of Hydrolytic Accelerated Aging Protocols on Cellulose Acetate

Carolyn Carta, Katharina Hoeyng, Herant Khanjian, Joy Mazurek, Kristen McCormick, Michael Schilling

A collaborative research project between the Getty Conservation Institute (GCI) and the Walt Disney Animation Research Library (ARL) is investigating the effects of storage environment on stability of animation cels. One aspect includes an evaluation of accelerated aging methods to create aged mockups in parallel condition to naturally-aged cels. For cellulose diacetate (CDA)

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animation cels created between 1940s-1980s, the support material is particularly prone to degradation by hydrolysis and chain scission, while reviewing archival records reveal a variety of storage environments prior to 1996. To date there has yet to be a comprehensive study of CDA reaction kinetics and mechanism of degradation of the problematic art material, nor are there established projections of risk based on specific storage conditions and containment. As part of the evaluation, cellulose triacetate (CTA) and CDA from the Disney ARL collection were compared to thermally-aged set of prepared mock-ups without plasticizers, in order to calculate the rate constant through Arrhenius methods. In some cases CA materials were pre-incubated to ascertain the physical effects of the reaction from within a cel before aging in the CTA industry standard of aluminum/polypropylene (Al/PP) and vapor barrier polyvinyl-fluoride (PVF) heat-sealed bags. This was compared with other cases where CA degradation reaction may be promoted by an environment, by aging within Teflon crimp-lid glass vials with the reactant of water or the catalyst of acid, which is the byproduct of hydrolysis reaction. The depth of penetration of degradation in CA will be assessed by utilizing the rate constant in conjunction with depth-profiling FTIR. Initial results after one month of accelerated aging revealed the Al/PP packaging method resulted in the highest degradation, followed by the glass vials, with the smallest effects seen in the PVF bags. The changes were confirmed by several analytical methods of detecting % acetyl content, including ion chromatography and FTIR. Other key findings of this research indicated plasticizers enhanced the degradation rates in the cels. Moreover, incubation pre-aging enhanced hydrolysis of all these CA plastic films from worst to least: one Molar acetic acid environment, ~85 %RH, and ~55 %RH across all samples analyzed. Initial observations show liquid is trapped between cels when stacked together and aged, but further research will be required to determine the influence of separating each cel in storage. Disney CTA and CDA, and CDA mock-ups aged alongside interleaving, buffered, and box materials aid in assessing the impact of storage materials on CA stability used in the Disney ARL collection. Long term impact of this research is contributing to the understanding of degradation kinetics to assist in predicting CA longevity, as well as providing guidelines for storage conditions and packaging containers.

Platinum and Palladium Photographs: Rediscoveries

Ronel Namde, Constance McCabe

A review of the recent publication and related topics.

Finding a Balance: Conservation of the Dolley Madison Cased Image from the Greensboro History Museum

Monique C. Fischer, Terra Huber

Cased images differ significantly from conventional forms of

paper-based photography. The daguerreotype is distinguished by its metallic composition: a thin copper plate with a highly polished silver surface was vulnerable to marring, abrasion, scratches, tarnish, rust, and corrosion. As a result, cases were constructed from decoratively covered wood or ornamentally molded thermoplastic to protect these fragile images. Conservation of these cased images is complicated. Not only is one dealing with a photographic image but also with leather, velvet, wood, plastic, cloth, metal, glass, and varnish. As a conservator it is important that the conservation and preservation approaches find a balance between the photographic image and its traditional housing. Using the Dolley Madison cased image from The Greensboro History Museum, as an example, this talk will discuss the conservation of the daguerreotype plate and its severely compromised gold stamped blue velvet case that was created in the semblance of a book. Adopting techniques and materials from book conservation as well as objects conservation, the cover was reattached, the spine was repaired and modified to create a safer opening of the case, and missing tray components were recreated using traditional water gilding techniques on wood.

Investigation of Portrait with Applied Oil Color

Abbott Nixon, Luisa Casella

A small painted portrait of Carl Maria Von Weber on a wood support was treated at West Lake Conservators. Analysis confirmed the presence of a silver-based underlying image, bringing particular challenges to the treatment approach. The proposed presentation focuses on the analysis and investigation that was performed in the attempt to positively identify a photographic base and how it was ultimately inconclusive. The decision making process for the treatment that was carried out was informed by the possibility of the presence of a photographic print. High Energy Synchrotron Source XRF analysis confirmed and mapped the presence of silver which could signify either an underlying photographic print or a silver point drawing. Additional microscopy was carried out as well as cross-section analysis but the presence of a protein (gelatin or albumen) that would hone in on determining the presence of a photographic process could not be positively determined. As a private conservation practice, West Lake Conservators has limited access to analytical tools and data processing. After taking the analysis as far as possible through the generous collaboration of local institutions and colleagues, it was prescient to offer the private owner of the object an expedite and practical treatment proposal. Cleaning and consolidation treatment were carried out taking into consideration the possibility of an underlying photographic print with a water-sensitive binder. Although the investigation was ultimately inconclusive in positively establishing the presence of a photographic print and although the treatment that was carried out is not innovative, the process of attempting to characterize an object within the constraints of a private practice has value in itself and may add to the knowledge for further research into the this type of composite structure.

How to Receive and Organize a Collection of 1 Million Photographs at Once? Material and Metadata Discussions

Rodrigo Bozzetti

All over the world during decades newspapers and journalistic groups had formed huge collections of photographs and clippings. This presentation aims to analyze the strategies used and projected to describe the photographic collection of the *Jornal do Commercio* (Comercy newspaper). When this newspaper was closed in 2016 it was the longest in activity in South America, in the same year Instituto Moreira Salles, a cultural institute that stores documental collections, bought the collection of photographs that was gathered by this newspaper. Over 70 years the newspaper collected around 1 million photographs, 700,000 photos and 300,000 negatives, most of them about Brazil. These pictures were stored in file folders that received a thematic title in order to organize the photos in series. Much information about the pictures was registered on the back part; it's possible to identify information such as date, place, photographer, newspaper where it was published and sometimes the full article. In order to catalog this collection, from the hugest series to each photograph, it was necessary to identify ways to transcript all the available data. The 1 million photographs were kept in around 1900 boxes; each of them contained 2 to 120 cardboard files; in the top of these files there is a title that informs which kind of pictures are in the files. In the original organization the collection was divided in two huge series, subjects and personalities; those series were divided into thousands of smaller collections. The first tool used was a scanner that can scan digitized texts and apply OCR, but this scanner wasn't useful and precise in the old cardboard files, because there was no contrast. This pen only has good results in white paper. Then the team started to use a voice recognition software available in any Macintosh operational system. This software, used in Portuguese, reached high levels of precision and helped to make the process of description of the series very quickly. This software couldn't be use in the personality series, because it only works in one kind of idiom, so the team is taking pictures of the cardboard files in order to apply OCR. The digital capture of useful informations for cataloguing and to describe this collection is a strategy to register the documents of the collection in a fast and accurate way. It's also a conservation initiative, because it avoids information and documents disassociation. This set of actions have an important role to insert the cataloguing data in international standard like Dublin Core, Lido and ISAD(G). In addition discussions related to thesaurus, folksonomy and automatic indexing are equally relevant for this works and strategical group of actions.

Photographic Materials Session - June 1

Revealing History with Moisture and Megabytes: Curled Panorama Prints from WWI and WWII

Kim R. Du Boise

This case study presents an ongoing project in collaboration with a military history museum and their archives for the conservation and digital preservation of 150 - 200 silver gelatin panorama prints from World War I (1917 -1918) and World War II (1940 - 1944). This project began in 2011 and work continues as funds are available. Along the way, other work has been requested and some replica digital prints have been made for the Adjutant General's office, the HQ offices, and VIP Officers' temporary housing.

Using example prints of the project, I will explain and illustrate the steps taken from the receipt and documentation of the original photographs, through the humidifying and flattening of the prints, to the repair and/or lining for stabilization. The next steps for the digital reformatting and any digital repair to the photographs will explain the level of capture and files that were requested by the museum's archivist. Finally, the reprinting of the photographs as digital prints in oversized formats will be adiscussed. To date, approximately 30 individual images that were in the original collection have been conserved.

Over the past six years, there have been new donations to the museum and donors have requested copies of the donated prints. The museum has agreed, using some of their funds for this purpose. There have been approximately 7-9 unaccessioned prints that were requested to be reformatted instead of the original group. One of the most interesting of the new prints is believed to be a photograph of the first Airborne Company formed in the U.S. Army.

Sizes of prints ranged from 3"x 12", to 10"x 38", to 8"x 48", and the reformatted digital image files run into the gigabyte sizes. The prints are on neutral tone B&W papers, warm tone B&W papers, sepia and brown toned B&W papers. Some are semi-matte, though most are matte finished papers and all have a baryta coating. A few have the soldier's handwriting on them, showing where the "saloon," mess hall, "my tent," and various companies of a brigade. This presentation will show not only the details of the original materials used in these prints and steps used to conserve them, but will also allow us to put into perspective of the human element that was, and is, a part of war and the preparations. It reveals some of the naïveté that men and societies had when soldiers reported to training for combat during those eras.

Color Records: Wood's Diffraction Process of Color Photography

Zach Long

In 1899 American physicist Robert W. Wood invented a new three-color photographic process utilizing diffraction gratings of different groove spacing. While the process's drawbacks, including the need for a special viewer, relegated it to the laboratory, the

finished plates had the interesting property of displaying natural color without the use of pigments or dyes. The George Eastman Museum collection contains several plates from the inception of Wood's process and more than a dozen from the brief period of commercialization in the first decade of the 20th century. For this project the history of the process was documented and variations within were recorded using photomicrography. A lens system based on original viewing apparatus was then constructed to enable the viewing and photo-documentation of all the images. As the plates rely solely on the diffraction of white light to produce color, the images captured appear essentially as they did when produced over 100 years ago.

From Here On and Beyond: Researching Objects, History and Collection at The Museum of Modern Art

Lee Ann Daffner

The Museum of Modern Art's 4-year Thomas Walther Collection project culminated in December 2014 with a symposium, Object: Photo print publication, website and exhibition. This material-based study of the Walter Collection is symptomatic of a larger institutional interest in materials characterization that is not confined to a single collection, medium or even institution, but part of an ongoing effort to promote materials-based scholarship at large. Three years hence, assimilation of conservation material content continues at MoMA as well as in related arts fields, as can be seen in curatorial, technical art history and academic initiatives focused on material culture.

In 2005 with the Plane Image: A Brice Marden Retrospective, 2006 with Dada in the Collection, and on a yearly basis since, the department of conservation at MoMA has published formative work on individual artists, or artistic movements, in conjunction with curatorial initiatives. Subjects include work of Pablo Picasso, Bill Brandt, Henri Matisse, Bruce Conner, Francis Picabia and Frank Lloyd Wright, among many others. In 2012, there was a considerable uptick in these studies which now include online publications. Raisononné-style format to artistic studies is increasingly seen as a model.

This presentation will outline the development of MoMA's conservation scholarship, consider how this trend is reflected in and parallel to, sister institution's programming, posit views on the causes of this trend and review resources for these critical investigations.

The Chemistry of Digital Fine Art Paper Yellowing: A Comparative Case Study of Moab Entrada Rag Natural 300gsm and Harman Inkjet Glossy Art Fibre Warmtone by Hahnemühle

Monique C. Fischer, Savannah Butler, Carew Giberson Chen, Arthur McClland, Nina Shevzov Zebrun, Vanya Zvonar

The yellowing of inkjet papers is a documented problem for cultural institutions and the conservation community. This study investigated two commercially available inkjet papers that had yellowed naturally under different conditions. A double-coated fine art paper Moab Entrada Natural 300gsm, developed a yellow stain within one year of printing, after unprotected exposure to light and atmospheric pollutants in a home environment. A roll of Harman Inkjet glossy fine art fibre warmtone paper by Hahnemühle yellowed when the packaging material, a polyethylene bag, was in contact with the paper during shipping. Scanning electron microscopy (SEM), X-Ray Photoelectron Spectroscopy (XPS), Fourier Transform Infrared Spectroscopy (FTIR), and UV-VIS reflection measurements were used to characterize the naturally yellowed papers. Attempts were also made to purposefully drive the yellowing reactions in fresh samples of these papers. Fresh paper samples were exposed separately to short wave UV light, long wave UV light, and NO₂ gas (to simulate atmospheric pollution). The SEM of the cross sectioned papers revealed complex microstructure in the coatings of the papers. Chemical analyses suggest that neither UV nor NO₂ exposure alone were the sole reason of the naturally yellowed paper. The pattern of chemical changes from XPS line scans of cross sections of the naturally yellowed paper suggested that the cause of the yellowing was diffusing into the paper making atmospheric pollutants a more likely cause. We suggest that the increased porosity of inkjet papers may have made them more susceptible to oxidizing gases in atmospheric pollution or outgassing from packaging materials as compared to more traditional paper formulations.

Research & Technical Studies + Textiles
Session - May 31

Fiber and Yarn Cross-section Sample Preparation Methods for Effective Plant Fiber Material Characterization and Identification

Runying Chen, Tom Fink

Fiber cross-section observation is often essential when characterizing and identifying plant fiber artifacts. A number of bast fibers and leaf fibers have very similar morphologies in the longitudinal direction but they differ more distinctively from each other in cross-section features. Most of the existing methods of fiber or yarn cross-section sample preparation, for either light or scanning electron microscopic (SEM) observations, are not designed for handling fragile archaeological materials.

The aim of this research project was to identify and develop effective fiber or yarn cross-section preparation methods which can be used for studying fragile archaeological textile objects. This study compared three fiber or yarn cross-section sample preparation methods for SEM observation including epoxy embedding, modified plastic fiber cross-section plate and free-hand as well as another three methods for light microscopic (LM) observation, including epoxy embedding and ultra-thin cross-sectioning, free-hand sectioning of embedded fiber or yarn sample and Precision Cross-section Microtome. All these methods were applied to the same archaeological textile remains retrieved from an early 16th century shipwreck site. Several known fiber or fiber plant samples were also studied for reference purposes, including hemp, jute, sisal, abaca, stinging nettle and flax.

The SEM results showed that the adoption of a plastic cross-section plate designed for LM usage was the most effective fiber or yarn cross-section preparation method. The plate is cheap and easy to use. Either fiber or yarn samples can be placed into the 1-2 mm holes within the plastic plate using a known synthetic fiber as buffer or protection around the archaeological fiber sample. As to the three methods for LM observation, the most efficient method was free-hand sectioning of fiber or yarn embedded in common slide preparation solution. When dealing with very fragile sample, however, the best method was epoxy resin embedding and ultra-thin cross-sectioning (1 micrometer). This method minimizes sample distortion and keeps the sample intact. However, a phase contrast microscope is needed for observing and imaging the obtained ultra-thin cross-section samples. Based on all the cross-section images obtained from both archaeological textile samples and reference fibers or fiber plant samples, we recommend using yarns to prepare cross-section sample for either SEM or LM observation when possible. The cross-section of yarns could provide not only fiber information but also other plant tissue cell characteristics. The later can be critical when identifying a specific fiber plant. When studying very fragile archaeological textile material, we recommend the method of epoxy embedding and ultra-thin sectioning, although this method is most time consuming. The

other two methods using plastic fiber cross-section plate for SEM observation and free-hand sectioning of embedded sample for LM observation are quick, easy, effective and applicable to most of textile materials. Finally, the results of this project demonstrated again that fiber cross-section study is essential when identifying and characterizing archaeological plant fiber artifacts.

Untangling Indian Hemp: Understanding and Identifying Common Plant Fibers Used by Native Americans in the Woodlands Region

Nora Frankel, Susan Heald, Dr. Thomas Lam

Bast fibers from North American plant species make up a significant portion of textiles produced by Woodlands cultures. These fibers, which are derived from the inner stems of certain plant species, are a traditional and important to many nations in the Northeast and Great Lakes region, yet have received little attention from Western-focused academia. Much of the literature and fiber identification is unclear, incorrect, or based on a Western perspective. Fibers are frequently referred to as "Indian Hemp," which aside from being an inherently problematic term, has several meanings.

This research aims to collaborate with Indigenous community members to identify traditional fiber producing plants and how they utilized to produce textiles. Three Native American experts in fiber preparation were invited to the National Museum of the American Indian Cultural Resource Center to share and discuss harvesting, processing and weaving, as well as the cultural and material significance of these fibers. As an outcome, a handling collection of physical samples as well as polarized light and scanning electron micrographs will be created to aid in understanding of both the macro and micro properties of these materials. The reference collections and appropriate associated cultural information are available to conservators, curators, and Native and non-Native researchers to improve accuracy of fiber identification, enhance material understanding, and reinforce cultural knowledge. Images will also be made available online for wider access. By understanding both the physical and cultural context of materials, conservators can make more appropriate decisions about the care of our collections. Allowing indigenous voices to be the authority on their own cultural heritage not only begins the decolonization process of museums, but enriches the institution as well.

The Norwich Textile Reference Database, A Collections Care Project

Jocelyn Alcantara Garcia, Michael Nix

The city of Norwich, United Kingdom, still produces beautiful and high-quality woolen textiles, although its heyday was between the 14th and 19th centuries. As a result of this active textile industry, garments and fabrics are found in numerous textile

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RESEARCH & TECHNICAL STUDIES + TEXTILES

collections around the globe. In spite of its importance, information regarding dyes, mordants and technologies associated with dyeing practices in the city remain scarce. During the second half of the 18th century, when the trade of raw materials and finished goods was commonplace, merchant manufacturers used pattern books and cards containing textile swatches to facilitate sales and trade. Some of these outstandingly well-preserved pattern books survive. After thorough ethical conversations, a dye-and-mordant database incorporating chromatographic and spectroscopic data is being generated using samples from these pattern books. High-performance liquid chromatography – photodiode array detector (HPLC-PDA) in conjunction with X-ray fluorescence (XRF), has allowed us to identify distinctive dye and mordant combinations, which, in parallel with collaborative historical and archival research, is aiding in understanding the industry's practices. More importantly, this will ultimately support collections care by providing sound scientific information related to textiles' constituent material properties, such as light and moisture sensitivity of certain color components.

A Sizable Sooty Soiled Surface: Analyzing and Evaluating Methods for Surface Cleaning a Large Painted Muslin

Susan Heald, Nora Frankel, Dr. Gwénaëlle Kavich, Annaick Keruzec, Dr. Thomas Lam, Nicole Little, Megan Doxsey Whitfield

Throughout the documentation and treatment of an unusually large painted muslin, analytical methods helped to both characterize the object, and evaluate the efficacy of the treatment. Displayed at the 1893 Chicago World's Fair, the muslin painted by Strike the Kettle (Lakota), a follower of Sitting Bull, depicts multiple scenes including gift giving, cooking, and warriors on horseback. The muslin was treated for the major long-term exhibition, Americans, at the National Museum of the American Indian. Previous extended display in the industrial urban centers of Chicago and New York City resulted in heavy, sooty, lead-containing surface soiling. Prominent tar-like stains in the center had haloed tidelines from an earlier treatment attempt. Pigments, binder, and stain residue were characterized using microscopy, portable x-ray fluorescence spectroscopy (pXRF), attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR), microscope-FTIR, and x-ray diffraction (XRD). Analyses confirmed that common late 19th century trade pigments were used with a proteinaceous binder. All paint colors were evaluated for light stability using microfadeometry, revealing all but one were stable. The black stain was characterized as an oily resinous compound with surprisingly high lead levels. The treatment priority was to reduce the stain and its associated tideline, and disfiguring surface soiling. Vacuuming the muslin through Vellux fabric trapped significant soiling, however the visual impact was minimal requiring additional dry cleaning treatment. Of the four sponges evaluated, the vulcanized rubber soot sponge was most effective though somewhat abrasive based on cleaning tests, microscopy, FTIR, and pXRF. The need for multiple hands working simultaneously over a large surface

area necessitated a systematic approach to ensure consistency. This cleaning methodology produced large quantities of heavily soiled Vellux and sponges, allowing for a thorough study of cleaning mechanisms and soiling characteristics. While the tar-like stain responded poorly to all solvents tested, ethanol and a suction platen successfully reduced the tidelines created by the previous treatment. The treatment methods dramatically improved the muslin's appearance. Final pXRF analyses indicated the soot sponge was more effective at reducing overall lead levels than the use of a Vellux-covered vacuum alone. Portable XRF also detected lead levels on the used Vellux and soot sponges, but not the nitrile gloves, which had implications for material disposal as potential hazardous waste.

RATS and Textiles Roundtable Discussion

Panelists: Dr. Margaret Ordoñez, Mary W. Ballard, Gwen Spicer, Dr. Nancy Odegaard

When TSG and RATS began planning a joint session for the 2018 annual meeting, we met with some resistance because AIC records suggested that there were no individuals who were members of both specialty groups. We've learned since that this is both not true (two of our panelists are members of both) and it's definitely not the case that no one in TSG is doing research, nor because no conservation scientists are interested in textiles. But how can we increase the interactions and strengthen ties between our two groups?

In this panel discussion you will hear from a conservator in a major museum, a current professor, a retired professor and a conservator in private practice. Each will bring a different approach to this topic and offer advice and anecdotes on how they bridge the gap between research and textiles in their profession. Topics of discussion will include: what makes for a good and successful research project? Do all projects have to involve big questions and fancy scientific equipment? How can keeping an open mind, and questioning assumptions lead to new discoveries? What makes projects work? What makes projects not work? We hope that this panel will help our communities forge connections, learn from successes and failures and encourage each other. Audience participation in the form of an open question and answer session will follow.

Panelists:

Dr. Margaret Ordoñez, Professor Emerita, Textiles, Fashion Merchandising, and Design, University of Rhode Island; Conservator, Ordoñez Textile Conservation Services, Camden, TN

Mary W. Ballard, Museum Conservation Institute, Smithsonian Institution, Senior Textiles Conservator, Suitland, Maryland
Gwen Spicer, Spicer Art Conservation, LLC

Dr. Nancy Odegaard, Conservator, Head of Preservation Division, Arizona State Museum; Professor, Department of Materials Science & Engineering, School of Anthropology, American Indian Studies GIDP, University of Arizona, Tucson AZ

JOINT SESSIONS RESEARCH & TECHNICAL STUDIES + WOODEN ARTIFACTS

Research & Technical Studies + Wooden Artifacts Session - June 1

All that Glitters: Visualizing and Characterizing Gold Leaf through Macro-XRF Scanning

Douglas MacLennan, Arlen Heginbotham, Catherine Schmidt Patterson, Nancy Turner, Nathan Daly, Lynn Lee, Yvonne Szafran, Karen Trentelman

The application of gold leaf is ubiquitous in late medieval painting, but our knowledge of how it was applied is based largely on historical treatises and modern practice. Analytical techniques traditionally applied to the study of historic works of art, such as X-radiography and point-analysis x-ray fluorescence (XRF), identify only the presence and elemental composition of the metal leaf at a single point, respectively. MA-XRF scanning has opened up a new avenue of research into the study of gilding materials and techniques by providing unprecedented new insight into visualizing the dimensions of individual gold leaves, differences in how the leaf was applied by various artists and workshops, and the variability of gold leaf alloy compositions available. In addition to elucidating the original artistic creative process, MA-XRF can identify and map restoration interventions using gold leaf, thereby providing new documentation of historic conservation or restoration efforts. Statistical measurement of the dimensions of individual gold leaves provides a new tool for supporting or refuting links between separated components of altarpieces. This poster presents the results of studies from a number of paintings and manuscript illuminations that demonstrate the ability of MA-XRF to elucidate new information about the composition of metal leaf, its application, and its past conservation.

A Contribution Toward the Identification of Wood by Heart-Cut Pyrolysis Gas Chromatography Mass Spectrometry

Madeline Corona, Arlen Heginbotham, Michael Schilling

This paper presents a novel method for conducting wood identification based on chemical analysis using heart-cut pyrolysis gas chromatography/mass spectrometry (HC-Py-GC/MS) to analyze volatile fractions and thermal decomposition products from finely divided wood samples. This method has several advantages over traditional anatomical identification including a significantly reduced sample size (0.3 mg of powder vs. more than 40 mg for traditional thin anatomical sections), and increased ease of sampling. The method also shows promise for successfully discriminating between species that are not separable by anatomical methods. The use of an established analytical technique that is widely found in conservation science laboratories should make this method readily accessible to many researchers in the cultural heritage sector. The use of user-friendly and commercially available

software for the evaluation of the GC/MS data also makes it possible to develop a reference database that can be easily shared and referenced by collaborating researchers. Evolved gas analysis (EGA) was used to establish an optimized furnace temperature that minimizes the production of compounds from the pyrolysis of cellulose and hemicellulose while maximizing the contribution of non-cellulosic components such as lignin and extractives, which are more likely to be characteristic of specific species. The use of a selective sampler system further reduces cellulosic contributions to the chromatograms by diverting evolved gases away from the GC column after 30 seconds of sample residence in the pyrolyzer.

Results were interpreted through comparison with reference standards utilizing F-Search from Frontier Laboratories, which is software commonly used for the identification of polymeric materials and additives in plastics. The software produces a weighted average of the mass spectra of all integrated components in a chromatogram (an INT-SUM spectrum), which can be matched against an established library of standards. Comparison of the chromatograms and statistical evaluation of the INT-SUM spectra by F-Search provided accurate results and eliminated the need for specific compound identification, thus rapidly increasing the speed of data interpretation. F-Search also allows for the exclusion of peaks, which is a feature used to eliminate problematic peaks produced by contaminants such as glues, varnishes or waxes. For this preliminary study, reference samples of 62 wood species commonly found in decorative arts collections were analyzed with the optimized HC-Py-GC/MS method. The resulting chromatograms and INT-SUM spectra were compiled in a reference library. The method was validated by analyzing samples taken from 17th – 19th century objects within the J. Paul Getty Museum collection and comparing the results to identifications made through traditional anatomical study. All of the samples were correctly identified through the combined use of the F-search ranking system and visual comparison of the chromatograms.

Interdisciplinary and Multi-Technique Study of Previous Conservation, Bending Media, and Pigments of an Ancient Egyptian Painted Polychrome Coffin from the Late Period

Mohamed Moustafa, Dr. Medhat Abdallah, Ahmed Abdrabou, Dr. Hussein M. Kamal

This paper describes the scientific investigations of an Ancient Egyptian painted wooden coffin, dating back to late period (664-332 BC). The polychrome coffin was previously restored, and previous plaster fills obscured original surface. The focus of this study is to use a multi-analytical approach to map and identify the pigments used on a polychrome wooden coffin, as well as to provide a deeper understanding of the painting techniques, the condition of the object, identification of wood species, identification of insects founded inside the coffin, previous conservation materials, ground layer and painted layer. Several analytical and observation methods were employed in the identification processes such as optical microscopy (OM), X-ray fluorescence (XRF), X-ray diffraction (XRD),

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and Fourier transform infrared spectroscopy (FTIR). Moreover, the application of technical photography provided useful information about the spatial distribution of the surviving original pigments, in particular visible-induced luminescence, which played an important role to recognize spatial distribution of areas containing Egyptian blue, even if it is in traces or mixed with other pigments. The authors were significantly interested in mapping technical photography (TP), including IR false color with XRF results as a non-destructive method to identify coffin pigments.

Another Look at Conserving a Japanned High Chest

Christopher Swan, Kirsten Moffitt

A growing awareness of East Asian influence in our Western world has spurred a reconsideration of many of the rare American Japanned objects from the first half of the 18th century. Among these is a sometimes celebrated high chest in the Art Museums collection at the Colonial Williamsburg Foundation (CWF). One of only about 15 such Japanned forms known, the bulk of the artistic merit of the cabinet lies in the decoration attributed to Robert Davis of Boston, around the 1730's. Because the iconography of these—mainly Boston made—Japanned objects continues to be something of a mystery among many decorative arts scholars, the material make up has become the obvious necessary foundation to our understanding of such mannerist artistic expressions. In this paper the CWF high chest is presented with an eye toward understanding the original materials and design intent, as well as the reinterpretation of some of these lost and poorly restored elements.

Like many of its cousins, this Japanned cabinet has seen several campaigns of restoration in its lifetime. With time, the raised ornament seems to have failed in many of these surfaces and the multiple restorations appear to have veered further from the maker's vision with each campaign. Some attention will be paid to the choices of material and technique in the restorative process as well. The study and analyses that preceded the on-going treatment featured photography with visible light, ultra-violet, Infra-red, and x-ray. Analyses for materials identification featured X-ray fluorescence spectroscopy, FTIR spectroscopy, SEM with EDX, and visible and fluorescence cross-section microscopy. Combining the findings from these analytical techniques has provided a fairly comprehensive picture of the materials in the surface decoration. They have also revealed a few surprises in makeup, as well as a much-needed road map for the treatment protocol. The project reflects a vital collaboration between the CWF Analytical Lab and Wood Artifacts Lab. Insights gleaned from this exploration and treatment will hopefully inspire other owners to reconsider their objects with the hope of new exhibits and a better understanding of interpretation.

Bringing Back Color: Retouching Faded Furniture with Colored light

Prof. Dr. Maarten R. van Bommel, Federica van Adrichem, Jaap Boonstra

Throughout the centuries organic colorants, both from natural and synthetic origin, were used to stain wood. This application lead to vivid colored objects of which the wood texture is still visible. Colorants can be applied over the complete surface of an object or used especially for marquetry, resulting in multi-colored objects. In addition to the coloring of wood, the natural color of unstained wood plays also an important role in the overall appearance of furniture. The main disadvantage of the use of organic colorants is the fact that they can severely fade in time, this is also true for the natural color of wood. As a consequence, the original appearance is lost to such extent that many museum visitors are not even aware of the fact that numerous pieces of furniture were originally colored; the visitors appreciate the natural, discolored wood and knowledge of how these objects originally looked like is sometimes completely ignored. To obtain knowledge about the original appearance is a great challenge, and it is good to realize that we will never be able to get the 'exact' colors right. However, more insight is required to be able to come as close as possible to the original intention of the makers of these objects. To revive this knowledge is only possible with an integrated approach.

With this presentation, this integrated approach will be discussed. The research involves chemical analysis of the faded material, which is a challenge on its own, to identify the colorants used. The next step is the study of historical recipes and the creation of reconstructions (small mock-ups) based on these recipes to obtain more knowledge of the range of colors possible with the materials used. Degradation research is carried out on some of these colorants to understand their behavior. Finally, faded pieces of furniture were retouched using colored light, projecting a computer image via a beamer on the object in which the faded colors were revived. Although a promising technique, with possibilities to show these original vibrant objects to a large audience, questions arise about the accuracy of the reconstructed colors and the possible change in artistic value. However, it stimulates the discussion between curators, conservators and scientists about the possibilities and limitation of this technique and how to present the objects to the museum audience. Two case studies will be discussed. A group of objects designed by the Dutch architect Piet Kramer in the 1930s which were originally stained with brilliant synthetic dyes and are now heavily discolored were accurately examined and these results will be presented. In addition, preliminary results will be discussed about the retouching of a much more complicated 18th century commode created by Andries Bongen.

Research & Technical Studies Session - June 2

The Human Endeavour: When Source Communities, Conservators and Scientists Collaborate

Dr. Nancy Odegaard

When science and material cultural heritage collaborate, the study may be called archaeometry, technical art history, conservation science, or taphonomy. The research may be about the artist's technique, tools, or component materials; or it may focus on specific techniques such as dating objects, non-destructive analysis; or it may be about the decomposition of materials during the period from deposition to discovery, or it may be focus on the predicting the future preservation risk to objects of art, archaeology, architecture. When conservators work with source communities, it may be called a consultation, collaboration, or contribution. The role of conservators and conservation scientists is very important. This presentation will share examples that illustrate their value when working with source communities under different circumstances.

Big Things Come in Small Packages: The Materials Analysis Lab at Colonial Williamsburg and its Impact Throughout the Foundation

Kirsten Moffitt

In 2014, the Conservation Department at the Colonial Williamsburg Foundation (CWF) established its first-ever Materials Analysis Laboratory to serve the needs of the Foundation's conservators, curators, architectural historians, and historic area tradespeople. Current instrumentation includes an upright microscope for cross-section and polarized light microscopy, a handheld x-ray fluorescence spectrometer (pXRF), an infrared microspectrometer coupled with a conventional light microscope, and a desktop scanning electron microscope with energy dispersive x-ray spectroscopy (SEM-EDS). The creation of this lab at CW was made possible through donor funds coupled with recent advancements in analytical technologies which have led to the development of smaller, more compact instruments with comparable sensitivities to their larger counterparts at relatively affordable prices and with more intuitive, user-friendly software. (This lecture will include a special review of the IR microspectrometer and desktop SEM-EDS for those who may be interested in the advantages and disadvantages of these smaller instruments). Most analyses are carried out by the Foundation's first-ever Materials Analyst, allowing the conservators to focus on their busy treatment schedules. However, with minimal training conservators can use instruments for their own research, as time allows. The Materials Analysis Laboratory has been a major contribution to the work of conservation staff. Case studies will illustrate some of the straight-forward ways

in which having on-site analysis has been an advantage – from minimizing the time spent on empirical materials testing for the reversal of a modern glass repair, or the characterization of exhibit fabrics to assess their eligibility for dyeing. We have found, across the board, that this leads to more effective assessments, treatments, and the development of more appropriate storage environments.

Another department that has embraced the lab is our historic trades program. CWF tradespeople are not simply actors – they are artisans and scholars dedicated to better understanding and mastering 18th c. tools and technologies. Collaborations between the lab with historic trades, using museum collection objects as subjects, makes CW a unique resource for material studies. Tradespeople use historically accurate materials whenever possible and they practice their craft in view of the public, providing opportunities for outreach and education relating to the role of analysis at CWF. Case studies will illustrate the variety of ways in which the lab has contributed to their work – including the study of 18th c. felt hats to identify animal fiber blends for our historic area hat-maker, to determining the color and composition of paints used on 18th and 19th c. tin lanterns in our collection that would be replicated by our tin shop for use in the historic area. As historic area tradespeople engage with the public, they often discuss the evidence provided by scientific analysis. This juxtaposition of modern technology within an 18th century setting gives our guests an unforgettable visitor experience and a new appreciation for the depth of our research.

Investigating Conservation Materials for Painted PMMA: Comparing Aging Environment Impact with Nano Thermal Analysis

Donald Sale, Dr. Angelica Bartoletti, Dr. Laurent Bozec, Dr. Marianne Odlyha

Nanothermal Analysis (nano-TA) was used to investigate glass transition temperature (T_g) behaviour of butyl methacrylate resins proposed as conservation materials for painted PMMA. Samples of the resin mixture 1:1 Paraloid B-67 / Paraloid F-10 (isobutyl methacrylate / n butyl methacrylate or piBMA / pnBMA) were aged in a range of environments involving artificial and natural museum light and elevated temperatures, and stored with naturally aged control samples. Differences in surface T_g were identified with nano-TA even with no apparent changes to the appearance, color, or transparency of the samples. Nano-TA revealed a trend in surface T_g of the BMA media related to the aging environment; a similar trend was identified using Dynamic Load Thermal Mechanical Analysis (DL TMA). Samples exposed to UV filtered sunlight in a museum window for 14 weeks had a relatively high T_g, similar to the high T_g of the samples aged in the most extreme artificial conditions involving cycles of intense artificial light and elevated temperatures. These findings present a compelling warning for the conservation and preservation of synthetic media in art and design. The relatively short exposure to filtered sunlight caused no changes to the appearance or colour, but significantly raised the T_g of the BMA media, suggesting increased

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polymer cross-linking, decreased solubility and altered long-term stability. Samples exposed to ambient artificial museum light for 16 weeks appeared to raise the T_g above that of the dark-aged control samples. The apparent rise in T_g suggests photodegradation in a relatively short period equivalent to a temporary exhibition, even when followed by decades of dark aging. From these samples, surface characterization at the nanoscale appears sensitive to photodegradation of the surface, which may differ from the sample-averaged data of bulk analysis. This investigation highlights the advantages of nano-TA for T_g characterization of synthetic polymers used in art and conservation. These include minimal sample preparation for surface analysis at nano-scale resolution of a wide range of materials including multi-layered polymer films, and paint and varnish media. Multiple measurements, in this case 40, can be taken rapidly on a surface, and differently from bulk thermal analysis, samples are altered but not destroyed. In this study, nano-TA contributed to the understanding of BMA aging when used as an artists' or conservation material, and the development of assessment protocols and preservation strategies involving artificial and natural aging.

The Use of Nano-Indentation to Mechanically Characterize Embedded Artists' Materials

Ashley Freeman, Dr. Michal Lukomski, Vincent Beltran

The Managing Collection Environments initiative at the Getty Conservation Institute focuses on research questions and practical issues relating to the control and management of collection environments in museums. Providing an evidence-base for the effect of environmental conditions on historic materials has long been a challenge for the conservation field, due to both the inherent complexity of the materials and the uncertainty in the mechanisms at play in environmentally-induced change. Understanding the mechanical properties of cultural heritage materials is a fundamental aspect of establishing effective preservation methods. Conventionally, the mechanical characterization of artists' materials is performed by uniaxial or biaxial tensile testing and typically requires a large quantity of macro-sized samples. Having access to sufficient numbers of historic materials that satisfy this sample size requirement is impractical if not impossible when working with museum collections. As a consequence, the applicability of macro-mechanical testing in the conservation science can be limited. In contrast, small scale engineering techniques such as micro- and nano-indentation allow for the characterization of sub-millimeter samples taken from real works of art, rather than relying wholly upon much larger laboratory-prepared samples intended to mimic historic materials.

These engineering techniques open a new perspective on the systematic analysis of the probabilistic distribution of mechanical properties of artists' materials. They also allow for the analysis of ageing factors which can alter the mechanical properties of a material. The primary focus of this study is the application of micro- and nano-indentation to investigate the effect of an embedding process on the mechanical properties of cross-sectional samples of acrylic-based paint. As a precursor to the analysis of

historic samples, a systematic investigation of embedded samples was performed to assess the role of sample size, surface roughness and structural compliance of the embedding resin. Material characterization was conducted at ambient laboratory conditions using an Ultra-High Resolution Nanoindentation Tester (Anton Paar) equipped with a Berkovich (three-sided pyramidal) diamond indenter. Load-displacement tests were carried out on embedded and free-film samples to evaluate the quasi-static and dynamic behavior of the acrylic-based paint to better understand its deformation response. Mechanical parameters which are used for describing the stiffness of a material, such as the elastic behavior of a material (storage modulus) and the ability of the material to deform under constant load (creep), were obtained for cross-sectional samples and compared with results for the acrylic free-film. Results indicate that instrumented indentation can be successfully used as a stepping stone towards an improved understanding of mechanical properties of embedded artists' materials and, consequently, allow one to better define the conservation needs of art objects.

A Collaborative Study of Sari Dienes' Plaster Works

Ainslie Harrison, Annette Fritsch

Sari Dienes, a highly innovative 20th century female artist working in a range of media, has gone largely unrecognized until recently despite the documented influence she had on her male contemporaries including Robert Rauschenberg and Jasper Johns. Since the recent re-discovery of her impact on the 20th century art scene, museums and collectors have begun to acquire her artwork, including a series of mixed-media pieces utilizing plaster casts of manhole covers. In 2016, the Kunstmuseum Basel purchased *Snowflake Circle*, while the Virginia Museum of Fine Arts (VMFA) acquired *Star Circle*, with the goal of finally exhibiting this important yet overlooked artist's work.

As Dienes' sculptures had not been previously studied, her materials and techniques were almost entirely unknown. Preparation of these artworks for exhibition provided the first ever opportunity to carry out a technical study of Dienes' plaster cast assemblage pieces. Without published research to refer to, conservators at the Kunstmuseum Basel proposed a collaboration with the VMFA to share information gathered from the study of each of their two works. Conservators at each institution examined their respective artworks and performed a range of analyses including FTIR, XRF, UV imaging, X-Radiography, and microscopy. A broken manhole cover cast from the same series that was housed in the archives of the Sari Dienes' foundation was also examined. The information gathered from this collaborative study was used to inform two key questions: 1) How do Dienes' plaster casts fit into a greater art historical context? And 2) How to stabilize these two artworks for exhibition?

While both museums were eager to install their newly acquired Dienes artworks, examination of *Star Circle* and *Snowflake Circle* after removal of their gallery frames revealed a range of condition issues affecting their stability, including a bowing polystyrene

foam board support and flaking plaster. The collaborative research project guided the stabilization efforts with the goal of finally presenting these works in the museum next to the male artists she inspired.

In addition to aiding in the stabilization of the two artworks, this research also informed the curatorial question regarding the role Dienes played in the adoption of plaster casts as a component in mixed media artworks. Materials analysis and archival research offered new insight into the possible chronology for Dienes' plaster cast assemblage works, thus helping to elucidate her role in the history of art.

Colors of *Jazz*: Identification of the Colorants in Henri Matisse Gouaches Using a Noninvasive Approach

Ana Martins, Tiffany Tang, Abedalnour Haddad

In the last two decades of his extraordinary career, Henri Matisse created a remarkable body of work known as the Cut-Outs. He worked intensively with scissors and sheets of papers painted with vibrant gouaches, cutting shapes that he would then assemble to recreate lively figurative or abstract compositions. One of the earliest and most emblematic works of that period is the *Jazz* illustrated book published in 1947 by Tériade, a renowned editor of artist books in Paris. Matisse began creating the twenty circus themed cut-outs to be used as maquettes for the book in 1943. He insisted the vibrant colors of the cut-outs should be translated into the printed book, and this was ultimately achieved by the printer Vairel using Linel gouaches and the pochoir printing process. Hardly any information has been reported or published however about the composition of these particular gouaches or their properties, in particular their lightfastness; even though the artist himself was aware of the fragility of some of the colors like the pinks and the violets.

In the preparation stages of a major exhibition at MoMA in 2014 dedicated to Henri Matisse: The Cut-Outs, the conservation department received the generous donation of a "reference set" of 79 samples taken from leftovers of original painted papers preserved by the artist's family and representing presumably the full range of colors he used. This set of reference samples was submitted to an exhaustive analysis to identify and characterize all the colorants present, to evaluate their lightfastness by microfading, and to build a reference library of spectral fingerprints acquired by XRF, FTIR, Raman, FT-Raman, SERS, ATR-FTIR, micro-FTIR, reflectance-FTIR and reflectance visible spectrophotometry. This study set is also being used to devise and validate a noninvasive protocol for the identification of the colorants in actual Cut-Outs. The current noninvasive methodology was applied to examine the nineteen different colors in the *Jazz* portfolio of twenty pochoirs in the MoMA collection. Most of the colorants present were identified successfully based on species or elemental markers detected by reflectance-FTIR, XRF analysis and spectrophotometry. Obtained results nevertheless reveal that a few of the colors that are repeated across different plates have the same tonality,

but contain different colorants, suggesting that gouaches from different manufacturers were potentially used. Moreover, not all the gouaches in the *Jazz* portfolio could be matched to samples in the reference set, implying that it is incomplete. The reference spectral libraries compiled so far is therefore being expanded by studying other Cut-Outs in the MoMA collection and in other institutions, and by analyzing pure gouaches taken from paint tubes or paint brochures from the same period.

Tracing Back: How Trace Elements in Smalt and Ultramarine Used by 17th Century Dutch Artist Jan Steen Start to Shed Light on the Chronology of his Oeuvre

Sabrina Meloni, Dr. Ralph Haswell, Dr. Onno de Noord, Dr. Annelies van Loon

Jan Steen (c. 1625-1679) is one of the best-known artists of the Dutch Golden Age. Although he painted many different subjects, he is most famous for his genre paintings with merry companies. One key feature of his extensive oeuvre remains elusive: its chronology. Only 10% of his works were dated by the artist. Steen was prolific, he worked in different cities, and his painting style and techniques varied. This has made dating his paintings complex and problematic. Jan Steen's oeuvre of about 400 paintings provides a unique opportunity to mesh traditional art history with new investigative techniques to reconstruct the chronology of his work and gain more insight into the materials and techniques he used over the years. The research started with the fifteen paintings by Jan Steen in the collection of the Mauritshuis. They are nicely spread out over the years that Jan Steen was active. This group of paintings is enlarged with researching dated paintings in his oeuvre from other collections, with the aim of using these as a marker for the rest of his oeuvre. So far 37 paintings by Jan Steen have been studied in depth. This number is still growing, and complemented with the study of paintings by his contemporaries from the cities where he worked. Our hypothesis is that he influenced, and was influenced by the artists around him, and that he may have adapted his materials and techniques to local artistic traditions.

In addition to the infrared photos and X-rays, a small number of paint samples have been taken from the paintings, and analyzed with SEM-EDX. Various point measurements have been carried out and for all the cross-sections elemental maps have been created. While it was initially thought that studying the color and pigment composition of his ground layers might shed a light on the city in which the paintings were executed and hence give it a place in the chronology of his oeuvre, the focus has shifted during the research. Next to the study of the ground layers, certain pigments in his paint layers are now studied in more depth. By looking at trace elements in his blue pigments, like smalt and ultramarine, two pigments Steen used a lot, we found some promising results considering the chronology. A rather new tool in the study of paintings to get more information out a large number of data is the use of a statistical database. By doing multivariate analyses

on a chosen data set the correlation between variables can be found which without this analyses will be overlooked. For Jan Steen paintings it turned out that by putting the trace elements found in the pigment smalt he has used, but also the smalt used by contemporaries, in a statistical database, clusters of paintings were formed after the multivariate analyses, which could be correlated to the cities where he worked. These results are very promising and give already more insight into the chronology of his work. This research will now be extended with his use of ultramarine.

Differential Stability of Cadmium Yellow Paints in Picasso's *Femme*

Douglas MacLennan, Austin Nevin, Alan Phenix, Daniela Comelli, Catherine Schmidt Patterson, Gianluca Valentini, Herant Khanjian, Joy Mazurek, Markus Gross, Laura Rivers, Karen Trentelman

Pablo Picasso's *Femme* (c. 1908; Beyeler Foundation, Basel, CH) is an oil study related to *Les Demoiselles d'Avignon*. A collaborative, multi-analytical, technical examination of the painting was carried out to answer questions about the artist's materials and technique during an important, but relatively understudied, period of his career. Of particular technical interest were two yellow passages: a visibly degraded cool lemon yellow and a seemingly intact warm yellow. To understand the nature of the degradation, and to better assess the risk of further alteration, the physical structure of both yellow paints were assessed by visible-light and UV microscopy, and the chemical composition characterized by ESEM-EDS, GC-MS, and μ FTIR. Although cadmium sulfide (CdS) and barium sulfate were present in both yellows, the overall elemental composition, size, and distribution of particles suggested two different commercial paint preparations. Visible-light and UV microscopy of prepared cross sections revealed a distinctive boundary between the altered lemon yellow paint towards the surface and an unaltered zone below. Detectably higher concentrations of known CdS alteration products – cadmium carbonate, cadmium sulfate, and cadmium oxalate – were identified by μ FTIR in the altered region of the degraded lemon yellow paint. These results suggest the paint underwent photo-oxidative degradation, resulting in both a surface discoloration and the breakdown of the physical structure of the paint film. In contrast, the warm yellow paint samples showed no such evidence of deterioration. In order to map and better characterise the optical emission of the paint and its degradation additional analysis was carried out using in situ fluorescence lifetime imaging (FLIM) of the whole painting, and time-resolved photoluminescence microscopy of microsamples. Analysis revealed significant differences in the fluorescence decay, band gap, and trap state luminescence emissions between the intact and degraded cadmium sulfide yellow across the painting. The results enhance our understanding of degradation pathways present in *Femme*, which is expected to help guide the painting's future preservation. Moreover, data suggest that fluorescence lifetime imaging may provide a non-invasive mechanism for monitoring the state of preservation of cadmium sulfide painted layers.

Constructivism Strands and Concrete Art in Brazil – The Materiality of Form

Luiz A C Souza, Maria Alice Castelo Branco, Yacy A. Froner, Giulia Giovani, Rita L. Rodrigues, Alessra Rosado

The aesthetics of Brazilian Concrete Art is characterized by visual and technical experimentations within the context of the post-WWII conceptual-artistic relationship and the then-contemporary “aura” of modernity, which was itself driven and supported by the industrial development in the country. The present paper presents the results of the research carried on the materials and technology of construction of paradigmatic works of art of the concretism period in Brazil, belonging to the following collections: Pinacoteca of the State of São Paulo; Museum of Modern Art – MAM – Rio de Janeiro; Collection Tuiuiu (owned by Luis Antonio de Almeida Braga) – Rio de Janeiro; and the Pampulha Art Museum, in Belo Horizonte – Minas Gerais. The objects are studied under a methodological approach based on the principles of Technical Art History, as part of the J. Paul Getty Trust Project Pacific Standard Times – Los Angeles/Latin America – Getty PST LA/LA. The project partners are based in the USA – Getty Conservation Institute; Argentina – Universidad San Martin; Brazil – LACICOR – Conservation Science Laboratory, these last two with research grants kindly supported by the Getty Foundation The Brazilian Project Coordination is headed by the LACICOR – Conservation Science Laboratory team, based at CECOR – Center for Conservation of Cultural Heritage, at the School of Fine Arts of the Federal University of Minas Gerais, in Belo Horizonte, Minas Gerais, Brazil. At the School of Fine Arts, besides undergraduate courses in Arts, Fashion Design, Multimedia, Dance, and Conservation-Restoration Bachelor's Degree, we also have a Graduate (Master and Ph.D.) Program on Arts, with a research line in conservation of cultural heritage.

The working methodological approach combines knowledge and traditional tools already used in the Art Historical research, with scientific methods of analysis of materials and scientific imaging documentation techniques. The results contribute to a better understanding of the historical, political, social and economic context of the creative period between the years 1950-60's in Brazil. The case studies described represent original knowledge regarding the art production in Brazil at this specific period, 1950's - 1960, centered in the relations between matter and appearance, as well as involving the permanence in time of the works of art and the search for the most appropriate forms of access, exhibition and conservation-restoration processes. Diverse types of then “modern” binding media have been found by chemical analysis (PY-GC-MS, GC-MS, FTIR), such as nitrocellulose, alkyd, and PVA, as well as oil and oil-resin mixtures—including, in some cases, the use of beeswax as an extra component added to the main oil binding medium. Alkyd paints, for example, have been identified in fourteen out of a total of thirty-one paintings studied from these collections. For this presentation in particular we present the results of our studies on works by the following artists: Lygia Clark, Helio Oiticica, Waldemar Cordeiro, Judith Lauand, Willys de Castro, Hermelindo Fiaminghi, Ivan Serpa, Mauricio Nogueira de Lima, Aluisio Carvao, Milton da Costa. Ω

Sustainability Session - June 2

Access to Shared Knowledge: Developing a Sustainable Workflow for Archiving Collaborative Engagement Documentation at NMAI's Conservation Department

Diana Gabler

Collaborative engagements with Native artists and other community members give conservators insight into the meaning of tangible and intangible cultural heritage and inform conservation practice. This presentation introduces a newly developed workflow for archiving documentation from such collaborative engagements at the National Museum of American Indian (NMAI) and presents the underlying thought processes and challenges. Such engagements may happen through consultations, workshops, or place-based education; the goal is to develop long-term relationships. Over the past two decades, the NMAI Conservation Department has held numerous collaborative events and compiled copious amounts of documentation of the department's work with Native stakeholders and other experts. Documentation materials include mostly born-digital media such as photographs, transcripts, and audio and visual files. While analog references in form of project binders have been accessible in NMAI's conservation library, the associated digital media was held on CD's and a shared network drive - difficult to access, organize, and use. This project began with an evaluation of these assets, which revealed that although existing documentation is extensive, there are no active protocols to systematize and archive collaborative engagement documentation to ensure maintenance, accessibility, and utility for Native stakeholders, researchers, and the museum.

Developing a standardized protocol for the documentation of NMAI's conservation consultations and new routines for media production will contribute to a targeted documentation approach that allows for structured outcomes. Utilizing Smithsonian's Digital Assets Management System (DAMS) to archive those assets that are not object-based but provide context for collections, will ensure long-term accessibility of the media and if appropriate, allows for delivery of assets for external use in the future. The systematic use of NMAI's Collections Information System database (CIS) will lay the foundation to locate specific object-based information from collaborative engagement events.

The workflow developed for this project allows for anyone in the conservation department to document and archive ongoing and future collaborative engagement events as part of a routine process. The goal is to provide a useful model for other institutions engaged in similar collaborative efforts.

A Collaborative Web Platform for Designing Green Museum Storages

Estelle De Bruyn

Could the characteristics of small-scale institutions (SSIs) – the necessity of social innovation, the need for cost-effective solutions – help us designing sustainable practices in the preservation field? We compared recent methods for enhancing preservation conditions. Some promote preventive conservation practices (e.g.: RE-ORG¹), others advocate a transition towards sustainability (e.g.: The Green Museum by Sarah Brophy²). The methods were selected for their newness, low price, the existence of case studies and their applicability in the SSIs context. Our aim was to help SSIs professionals to assess their problems of storage in a sustainable way. We created *Réserve durable*, a collaborative website, to share our analysis.

Cornerstone of the museum's mission, the storage is a place where preservation requirements justify high financial costs and energy consumption³. At the same time, cultural institutions worldwide are missing financial, human and time-related resources. SSIs situations are usually even worse. Furthermore, coming EU laws will leave no choice to cultural institutions but to invest in nearly-zero-energy buildings (NZEB) for building or renovating their facilities⁶. Despite the fact that several tools for implementing green practices are available, and despite the advantages that "Going green" could offer them, sustainability is often at the bottom of the SSIs priority list.

Thanks to a survey addressed to Belgian SSIs, we defined their characteristics and needs in terms of conservation practices. That led to the creation of *Réserve durable*⁷, which compares the above methods in light of the survey results. We propose a reflexive model of SSIs management combining "Going green" and state-of-the-art preservation methods such as RE-ORG.

¹ RE-ORG – Tools for Museum Storage Reorganization and Documentation Systems, RE-ORG project website (online) (available on: <http://www.iccrom.org/section/preventive-conservation/re-org>, consulted on July 26, 2017).

² Brophy (Sarah), Wylie (Elizabeth), *The Green museum, a primer on environmental practice*, Altamire Press, Danvers, 2008, 226 p.

³ A recent study led by the Image Permanence Institute (IPI), showed that the HVAC system consumption costs by itself \$20k to \$50k per year for a 900 m² museum floor space. Image Permanence Institute, *IPI's Guide to: Sustainable Preservation Practices for managing storage environments, version 2.0*, Image Permanence Institute (IPI), New York, 2012, p. 3.

⁴ ICCROM, UNESCO, "ICCROM – UNESCO International Storage Survey 2011, Summary of results", 2011, on the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) website (online) (available on: http://www.iccrom.org/sites/default/files/ICCROM-UNESCO%20International%20Storage%20Survey%202011_en.pdf, consulted on July 26, 2017).

⁵ According to Gaël de Guichen, expert at ICCROM for 47 years. DE GUICHEN (Gaël), "Reorganizing Museum storage : an 80-year journey... and still a way to go!" in International RE-ORG Seminar, Reconnecting with Collections in Storage, Institut Royal du Patrimoine artistique (KIK/IRPA), Brussels, September 28-29, 2016.

⁶ Directive PEB (2010/31/UE), LUE, 2010, art. 9.

⁷ *Réserve durable* (online) (available on: <https://reserve durable.miraheze.org/wiki/Accueil>, consulted on July 26, 2017).

Digital Collections Storage: Surveying The Landscape

Ben Fino Radin

The year 2018 finds the field of Time-Based Media Conservation in a key moment of transition and growth. With the 20th anniversary of AIC's Electronic Media Group having recently past, and the decade-old programs of Time-Based Media Conservation at pioneering institutions now at a point of maturity, a new wave of small- and medium-sized institutions and other art world stakeholders are beginning to come online and address the aspects of institutional growth and evolution that are required in order to properly care for Time-Based Media Art. A significant challenge for these stakeholders – some of which have already been actively collecting for decades – is the establishment of digital collections storage. Art storage is a high-stakes endeavor from a risk perspective, and architecting viable long-term digital storage solutions requires a specialist skillset. Perhaps the most challenging dimension of this new area of stewardship, however, is its long-term financial implications. On the ground, there is a broad spectrum of ways in which art-world stakeholders – institutions, galleries, collectors, artists – are finding the balance between digital preservation best practices, and financially and operationally sustainable solutions. The aim of this paper is to provide a snapshot of where the field stands in 2018, providing a rigorous and statistics-driven survey of how art-world stakeholders are meeting this new challenge, and where they are in their journey towards digital collections storage.

Change in Collection Management Strategy with Climate Change Phenomenon in Thar Desert

Vikram S. Rathore

In developing countries, where in general museums and private art collectors do not have facilities of climate control system for their art heritage collection, they keep collections either in storage or in display galleries to face surrounding climate and get acclimatize for years. The Western part of India comes under thousands of miles of Thar Desert and it is dotted with several large and small museums including family museums and art heritage galleries with highly valuable and rare heritage collection. Dry climatic conditions in this region have been a major advantage for art heritage as it slows down deterioration process and minimizes biological activities; as a result, precious art heritage including sensitive paper objects survived for so many years even without climate control system. But for the last several decades, weather in this region is changing very fast and the Thar Desert is drifting away from its dry climatic characteristics and becoming wetter year by year, raising concern for all walks of life, including art heritage collections. Every year regular increase in rainfall is pumping excess moisture in air and soil and creating favorable condition for more biological activity and art material deterioration. In this alarming situation of climate change, all respective museums and art collectors need to pay attention and go through fresh collection management strategy and create an action plan to cope with this lethal change and save precious heritage for the next generations.

**Joint Research and Technical Studies + Textiles
Session - May 31, see page 89.**

Textiles Session - June 1

A Lot of Nitpicking: Documentation of Tom Welter's Painted Silk Battle Flag Encapsulation Method and Materials

Ann Frisina

Reconsidering the history of conservation is not solely about how things have been treated. Instead, by examining the decision-making process, which forms and informs future conservation treatments, we can gain context to fully understand and assess previous work. Tom Welter began to develop a method to encapsulate fragile silk battle flags in 1964 after a 3-day tutorial with conservator Katherine Scott. While Welter was very talented as an artist and mechanic he had no prior experience in textile conservation. The encapsulation treatment he developed, while invasive by today's standard, was performed on more than 200 painted silk battle flags throughout the country. Innovative in application Welter's ultimate goal of treatment was not just to consolidate but to make the flags available for use. Within this paper, a detailed documentation of the procedure developed by Welter will be revealed. Materials such as surfactants and adhesives will be identified. All information documenting the treatment procedure will be based on Welter's personal journal entries, written treatment documentation, physical evidence, and an oral history provided by his daughter Nancy Cyr. It is hoped that by documenting Welter's encapsulation method, conservators and curators will be better informed to preserve these fragile silk battle flags.

The Mortlake Horses: A Collaborative Approach to the Conservation of 17th-century British Tapestries at the Metropolitan Museum of Art

Alexandra Barlow, Olha Yarema Wynar

In preparation for the fall 2019 re-opening of The Metropolitan Museum of Art's renovated British Galleries, Associate Conservator Olha Yarema-Wynar and Assistant Conservator Alexandra Barlow completed the long-term conservation treatment of the seventeenth-century tapestry *The Destruction of the Children of Niobe* (#36.149.1) from the English Mortlake workshop. This tapestry is one of two within The Met's collection from The Horses, a set which depicts riding horses found in Ovid's *Metamorphoses*.

The Destruction of the Children of Niobe, measuring approximately twelve feet by twenty feet, is impressive in size and image. Past restoration efforts of this large artwork are visible throughout the piece, and within this one tapestry exists numerous examples of the techniques used in the history of tapestry preservation. The most recent treatment was informed by an understanding of these historic techniques and the skill and experience of the

conservators. Stimulating conversations with curators at The Metropolitan Museum of Art also influenced the treatment by helping to determine the aesthetic vision for the tapestry. These discussions presented a challenge on how to accommodate the vision of the curators with the conservators' decisions about stabilization needs and the tenets of current conservation philosophy.

For both conservators and curators, historic repairs are a valuable document of prior methods. They provide an understanding of changes in technical skill, the effects of restorations, and the shifting viewpoints on the value of tapestries. The conservators working on this project were able to survey in detail these previous techniques. This presentation discusses both the methods that have proved stable, as well as those that have caused additional conservation issues over time. While many of the historic insertions are strong and discrete, earlier use of darning and mending stitches have caused distortions to the surrounding areas. It was only after careful dialogue and discussion on the stability of the textile that these previous repairs were documented, removed, and updated. Time was also a consideration throughout the entire treatment.

The 2016-2017 treatment involved both conservation and restoration stitching, as well as a combination of both handwoven fabric used for reproduction gallon borders and commercially available fabric for stabilization and the lining.

As a case study, this presents the examination of one object and how its materials and techniques provide critical annotation to the history of the preservation of tapestries.

Confronting Challenges and Considering Consensus in the Conservation of 18th-Century Fashion

Marina Hays

This paper and presentation will focus on the conservation of an eighteenth-century French court dress and the research that this work inspired. Undertaken during a Fellowship at the Costume Institute, the treatment was an opportunity to consider broadly the conservation of garments from this time period. While there is no set of conservation methods or ethics unique to eighteenth-century costume, a collection survey of that century's womenswear revealed certain patterns of degradation and common issues relating to both treatment and display. For example, how should conservators approach garments that have been altered, as so many eighteenth-century garments have been? Questions like this became the basis of a larger study of fashion conservation practice, drawing on both literature review and interviews with conservators in the United States, United Kingdom, and France. These not only provided an understanding of the range of possible solutions for the problems posed by eighteenth-century garments, but also shed light on a more abstract question: to what extent is there (or is there not) a consensus among conservators as to best practice for the conservation of fashion objects? Furthermore, do differences in approach lie along personal, institutional, or geographic lines?

Practical Applications of Conservation and Restoration Strategies for Historical Clothing in Uncontrolled Historical Houses

Prof.Dr. Harby E. Ahmed

Some Egyptian historic houses are now used as museums, many of which are uncontrolled in their environmental conditions, such as Saad Zaghoul house (House of Nation), which cause undamaged damage to historical clothing. This research deals with the restoration of the dress of Safia Zaghoul (Wife of Saad Zaghoul) as an example of the condition of historical clothing in historical houses. The dress is two parts; the first is the outer part and the second is an inner jacket of black color (Industrial dye). The dress was made from silk and cotton fabrics. There are many separate parts and lost pieces in the dress. It was observed that the stitching was separated and it contained stain and dirt. A close examination of the historical cloth was undertaken in order to develop a plan of conservation treatment such as FTIR, XR-D. In addition, light microscope and SEM were used to identify the kind of fibers, their condition and surface morphology. The effects of cleaning materials on the natural dyes were tested. Fixing and support all the separated parts was done before cleaning. Dry cleaning was used to remove resistance stain and dirt. Mannequins are made with standard and free acidity materials. The mannequins were lined and then the dress (the inner part - the outer part) was placed. The missing parts have been completed. The method of exhibition will be discussed. Photographs are included to document the conservation process

The Use of Paper-based Materials for the Treatment of Plant Fiber

Anoek De Paepe, Marieke van Es, Siska Genbrugge

The collection of the Royal Museum for Central Africa (AfricaMuseum) encompasses a broad range of objects that contain plant fibers. Those plant fibers are sensitive materials which can damage easily due to handling, light exposure and fluctuations in relative humidity and temperature. Consequently the fibers of the objects are often discolored, deformed or broken and multiple objects are actively shedding fibers or suffer from “baldness.”

Some plant fiber objects selected for exhibition in the renovated AfricaMuseum were too degraded to be displayed. The plant fibers were treated with paper materials in order to stabilize the objects and improve their readability. Multiple products can be grouped under the term ‘paper based Materials’, such as Japanese tissue, archival grade paper and cellulose pulp. These materials are not commonly used in textile conservation. The products have specific sets of characteristics that can be applied to the divers treatments of objects, ranging from structural fills to thin protective coatings. Paper fibers are strong, light-weight, flexible and they can be toned with well-known conservation grade paints and dyes to mimic the appearances of the original object. The versatility of the paper based materials will be demonstrated through several treatments that are on the verge between the disciplines of textile, object and

paper conservation.

This paper will focus on multiple case studies carried out by the conservation lab of the AfricaMuseum. For the treatment of two African plant fiber masks, Japanese tissue and Arbocel 400 were used for loss compensation and fiber support. Furthermore Japanese tissue has been used as a substitute for plant fiber cord, with well be documented through the treatment of a dance costume made from knotted plant fiber. Thick bands of Japanese paper also proved to be the ideal support for the support and stabilization of the woven plant fibers from a burial mat. An even thicker band of conservation grade paper paperboard was used to recreate pieces of the waistband from a skirt made out of thick plant fibers. A short overview will be given of other African objects that were treated with paper material such as drums, figurines and string instruments.

Japanese tissue, conservation grade archival paper and cellulose pulp have become staple materials in the conservation lab. The variety of the papers and cellulose pulp available is huge and their versatility can be even further adjusted by the choice of dye/paint and adhesives or through additions of other materials. Paper based materials have often proved to be the perfect fit for the treatment of the diverse collection of the AfricaMuseum; were conservation is a cross-discipline between objects, textile and paper conservation.

The Hidden Codex: A Discussion of Loss of Cultural Heritage of the History and Religion of Indigenous People and its Impact on Mesoamerican Studies through the Examination of a Possible Newly Discovered Original Mixtec Codex

Kelly H. Gross, Loren Jeffries, Roger Sexton

The problem is that historically significant artifacts are being ignored and their cultural heritage lost. This occurs largely because of the difficulty some, but not all, experts have in recognizing the value in something new or undiscovered. The Hidden Codex is a case in point. This artifact is a single work on plaster and fiber mat in vivid color likely by a single artist and measures 122 cm by 30.5cm. It has been well researched. Carbon dated at 1650 C E, the codex pigments were made from all natural materials in the La Mixteca region of Oaxaca in Mexico. Previously unknown, it is not one of the only eight known Mixtec codex artifacts in the world but instead represents the only Mixtec divinatory almanac, referred to as a Tonalamatl, now known to exist. It portrays five deities and is calendrical in nature with borders of the traditional 13- day pictorial sequencing as seen in some of the other 8 known Mixtec codex examples. But unlike the others, it portrays the rituals and festivals of the indigenous religion. Normally other researchers would continue to study and duplicate the findings. Instead, what is happening is that a cultural history is being lost in an attempt to enforce a traditional orthodoxy: That no new codex artifacts can be discovered. Any attempts to contradict this thinking are met with claims from the archeology establishment that the authors are promoting reproductions or forgeries. This

paper explores the Hidden Codex research on both sides and presents an objective picture including provenance documents of source location and history. Insight is provided into the codex's pictorial use of calendar-based events and rituals on a cultural basis. Finally, the results of EDS and FTIR analytical testing are presented along with pigment photomicrographs and a discussion of the indigenous construction and its importance historically. The significance of this research is that it presents what could possibly be the only known codex that was never in the hands of the Spanish. This paper also presents the possibility that the indigenous people continued to practice their religion under Spanish occupation, contrary to popular opinion.

Textiles Session - June 2

Application of Multispectral Imaging in the Practice of Textile Conservation: Documentation, Investigation, and Communication

Kisook Sub

Thanks to advances in digital imaging and its increased availability, Multispectral Imaging (MSI) is becoming a useful tool in conservation. Photography with different ranges of radiation such as IR, UV, and X-ray has been widely used in conservation. What recent development in MSI offers more of than those conventional images is based on digital imaging technique. Higher reproducibility which otherwise tends to be subjective to users and set-ups, can be attained by standardization in capturing and processing images using digital cameras and imaging programs. This consistency is critical when using visual information as analytical data. MSI requires relatively simple and inexpensive set-ups with a range of radiation sources and filters. A set of images is produced by systematically recording reflective and luminescence radiation from an object through the spectra of ultraviolet, visible, and infrared light in controlled settings. Each image maps different information from the object. It has been a challenge to translate this visual information and find its applications in conservation practice. Analyzing the luminescent component of an object under UV light has been used as a non-destructive analytical technique to identify some materials. In the past, the majority of studies on analyzing visual information from MSI was done with paintings and sculptures. In this presentation, I will explore MSI of various types of samples and textiles from the collections of The Metropolitan Museum of Art, discussing information that each spectrum provides. Based on our knowledge of conventional IR and UV images, textiles of different materials and conditions will be chosen to demonstrate information as diverse as possible provided by MSI. Images taken under UV light show a wide range of visual information including colors. Textile conservators have used UV light to detect condition issues and luminescent materials on the surface, such as dirt, stain, additives and some organic colorants. Some dyes are known for their specific luminescence under UV light and there are indications that more materials show specific patterns of luminescence. In order to

have any analytical conclusions, we need sufficient information that can be comparable and communicable. I expect this imaging technique will help us to collect standardized data by recording the intensity and color information systematically. MSI has already proved to be an excellent mapping method by providing a holistic view of an object showing the distribution of certain material or condition. Depending on the user's purpose, images of different spectra can be merged or highlighted by using false color technique which manipulates red, green, and blue components for stronger visual effects. I hope more analytical use of MSI is possible. If we can identify or even categorize materials on textiles based on visual information under certain radiation, we would be able to instantly provide necessary support for their preservation. I wish to collaborate with other conservators to create a platform where we can exchange and share information to discover MSI's potential applications in textile conservation.

Pointing in the Right Direction: Identifying Technological Features to Orient Navajo Textiles

Betsy Burr, Dr. Nancy Odegaard, Delana Joy Farley, Ann Lane Hedlund

This talk includes the findings of a technical study on Navajo handwoven textiles. Our research identifies key markers in fabric construction to aid in determining the textiles' original orientation on the upright frame loom during weaving and, by extension, the actual top, bottom, front and back of the textile. These physical markers could easily be mistaken as damage, wear, repairs or other condition issues, making their identification particularly important. Additionally, identifying the orientation is significant for proper placement of museum labels; appropriate positioning for documentation and exhibition, and to aid researchers and weavers studying collections. Key features may also be potentially useful for identifying the work of individual weavers across an assemblage, and to discern the weaver's hand even after items have been traded and collected. While there is an extensive literature on Navajo weaving and textiles, little to no attention has focused on documenting and interpreting these technological markers in order to establish the textiles' original orientation. Rather, publications on technology have focused on distinguishing Navajo from Pueblo, Spanish American and Mexican textiles, and determining a chronology based on construction, materials, and design. To address this gap in the literature, our technical survey includes a sample of Navajo dresses, blankets, ponchos, and rugs, all woven on a frame loom and ranging from the mid nineteenth to twenty-first centuries. We provide discussion and visual examples of a number of telltale technological traits and evaluate their effectiveness in pointing a viewer in the right direction. From this project, we provide a workflow and documentation form to use in discerning the top from bottom, and front from back in Navajo textiles.

Taking the Strain: Strain Monitoring to Inform Tapestry Conservation and Display

Frances Lennard, Maggie Dobbie

An innovative research project at the University of Glasgow, “From the Golden Age to the Digital Age: Modelling and Monitoring Historic Tapestries,” is using techniques from the field of engineering to provide information on conservation techniques and display methods for tapestry. While textile conservation procedures grew out of traditional repair techniques, since the 1960s the field has been characterised by a more scientific approach including a greater understanding of textile properties, the use of new materials and more refined conservation techniques. However to date there has been only a small amount of research into the physical and mechanical properties of historic textiles or their associated support materials.

This project builds on work at the University of Southampton which showed that digital image correlation can be used to give highly visual information on the strain experienced by tapestries on display – strain maps can indicate areas at highest risk of damage and inform decisions about conservation treatments. As different traditions of tapestry conservation across Europe and the USA employ a range of different stitching methods, our current project is applying this technology to compare the effectiveness of a range of interventive treatments. This will provide tapestry conservators with additional data to complement visual information from the tapestry and to help them in selecting appropriate treatments. The researchers are also looking at tapestry display methods, including the use of slanted supports, which are becoming much more common for tapestry in Europe. Testing will demonstrate the degree of support provided by the slant, and the role of friction from the material covering the slanted support. The paper will report on the most recent project results, comparing data from model tapestries, and building on work to date which is already showing unexpected effects of hanging tapestries from Velcro® hook and loop fastener. The project team, from the Centre for Textile Conservation and Technical Art History and the School of Engineering in Glasgow, are working closely with textile conservators from Glasgow Museums as they prepare tapestries for display in the refurbished Burrell Collection in 2020. We have recently carried out monitoring of a 16th century tapestry before and after conservation treatment, and the results will be included in the discussion. A newly woven tapestry at Stirling Castle – one of a set modelled on the Unicorn tapestries in the Metropolitan Museum of Art - is also being monitored over a period of years, and this is informing improvements in the monitoring technique.

A Bridge Between Science and Archaeology in Studying Tutankhamun’s Hassock

Nagm El Deen Morshed Hamza

A unique category of bead-work, found in the tomb of Tutankhamun, the hassock, or small pillows. The footstool was made of cloth filled with bran. On the cloth an elaborate pattern

of bead-work, in blue, green, red, yellow and white disc beads. The composition and the technology of the hassocks are the most complex of Egyptian bead-work. This hassock presents the analysis of Social aspects in this period from interesting by decoration of bead-work and also the unique technological solutions.

The aim of our research first is to describe the beading techniques from the analysis of the fabrication and pattern of bead-work, also to give an insight in time spent in production and on the effort put into this hassock. The identification of botanic remains assemblage from hassock. Photographic documentation with Dino-Lite Digital Microscope (USB) for beads and bran remains, also drawing and illustration was used to document the materials used, the pattern, the beading technique and type of beads used in a beaded fabric. Dino-Lite Digital Microscope (USB) talks all measurements diameter, thickness, length and width for both beads and bran remains. Archaeopotanic study is very important in this part of our research which gives us more details about the technology and bran used in footstool in the new kingdom which was identified from *Hordeum* Species. Multispectral imaging (MSI) technique was used on the different color beads, allowing us to analyze it non-destructively and with great results from each color. Multiple analytical and examination techniques were carried out on the beads and bran, such as optical light microscope, scanning electron microscopy (SEM), X-Ray diffraction (XRD) and portable X-ray fluorescence spectroscopy (pXRF). pXRF is best suited to minor and trace elements for this XRF is used to determine the elemental composition of the beads and to infer their original color. Scanning Electron Microscope (SEM) is able to distinguish the glass phase from the texture of the grains, giving information on the thickness of the glaze and of the buffer layer. Optical microscope gives us more details about the thickness and characterization of glaze layer.

Joint Textiles + Wooden Artifacts Session - June 2

Sofa, So Good... Conservation of a Mid-19th Century Children’s Sofa

Daniel Kaping, Jonathan Thornton

The conservation treatment of a small mid-19th century sofa with horsehair upholstery has been performed in this project, with the primary goals of: stabilization, reduction of visual disruption from damage, and retention of original material. This has involved utilizing fill materials and repairs where possible in contrast to traditional reupholstering techniques. Secondary to these goals, analysis and imaging have been performed in order to more closely understand the materials involved in the construction of the sofa, its intended purpose (likely as a child’s plaything), and in hopes of uncovering some of its history and origin. Analytical techniques such as: transmission Fourier transform infrared microscopy, pyrolysis gas chromatography mass spectrometry, and polarized light microscopy have helped to reveal information about the sofa’s materials. Imaging techniques such as: X-radiography, long

wave ultraviolet radiation induced visible fluorescence, reflected infrared imaging, and imaging using a scanning electron microscope were also useful in this fashion and provided insights into date of construction, period of use, and repair history. Keywords: Children's furniture conservation, mid-19th century sofas, haircloth, horsehair upholstery

A New Approach to an Old Problem: Comfort and Minimally Invasive Upholstery

Chris Shelton

In a museum setting, comfort is not a consideration in producing minimally invasive upholstery. In fact, being uncomfortable guards against furniture use, particularly in a house museum setting. For private collectors who use their furniture in the home, however, this is unacceptable. For almost two decades, the standard approach has been to protect the fragile historic frame with a new, custom-fit, wooden, inner frame that can be upholstered instead to take the strain of traditional webbing, horsehair stuffing, and/or springs. This is more successful on larger furniture which can mask the weight and bulk of a supplementary frame and are often more deeply stuffed. Unfortunately, there have been few options for smaller furniture other than rigid plywood decks with a minimum of padding.

Using a new technique, however, we have been able to apply a very conservative approach to delicate side chairs and reduce the number of fasteners and steps involved in producing remarkably comfortable upholstery compensation. This technique uses relief cuts in the thin plywood deck to create a spring effect which mimics the feel of traditional webbed upholstery. The impetus for this technique was the treatment of a set of twelve high-style dining chairs fabricated by Thomas Seymour in Boston c. 1810. These chairs were to be reupholstered with tufted leather seats and a stylish stitched French edge profile that was integral to their interpretation. This would be both labor-intensive and destructive to the frames in traditional upholstery. Adding a separate inner frame would protect the chair but make it heavy and even more costly. Instead a single layer plywood deck cut to be flexible in the center and accommodate the button ties was used to span over the seat rails. Using this new technique was simple, with the benefit of removing the strain and distortion often caused by taught webbing. The resulting conservation saved the client labor on each chair versus traditional upholstery, while also providing a comfortable, conservative, historically accurate compensation. The chairs have been in moderate use for over ten years now. A set of six Duncan Phyfe lotus-back dining chairs from about 1840 were conserved in our shop using the same technique. This set of curvilinear seats was able to be made functional using this technique in spite of the fact that the seat rails were so damaged from years of upholstery that the rails would have needed partial replacement to have been upholstered traditionally.

Textiles Session continued - June 2

Let There Be Light? An Investigation into Light-Induced Changes of the Early Synthetic Aniline Dye Magenta Under Indoor Lighting Conditions

Michelle Hunter, Anita Quye

A major development of the 19th century was the discovery of synthetic textile dyes. The first group was the aniline or coal tar colors, derived originally from chemicals in tar products from combusted coal. These novel dyes gained popularity as they became more economical and efficient than natural dyes, in some instances created brighter and more striking colors. Magenta, also called fuchsine, was one of the first synthetic dyes to gain major commercial success. This vivid red-blue dye was on the market in 1859, the same year that Perkin's mauveine, an aniline purple, eventually gained major commercial success.

Magenta proved popular for trims and costume embellishments, as well as whole garments. Despite being highly sensitive to light, magenta was desired and accepted as a fashion color until the end of the nineteenth century. It was also useful to the industrial dyers for shading. Today when conservators and curators consider displaying a mid- to late-19th century red-blue textile, there is an expectation is that the dye may be magenta and that the color could fade quickly.

Since light is essential for viewing color, striking the balance between preserving the textile color and providing object access is paramount. This also becomes problematic when the definition of "quick fading" is unclear. Additionally, accounts of magenta fading are historical and in regard to sunlight, not modern museum indoor lighting conditions. All this leads to us asking fundamental questions about the light-sensitivity of magenta in various museum-lighting environments, and how careful should we be when exposing these objects to light?

This paper presents a case study conducted at the University of Glasgow Centre for Textile Conservation and Technical Art History (CTCTAH). It investigates light-induced color and chemical changes of magenta dyed textiles exposed to indoor lighting environments typical within a collection setting. Silk and wool fabrics dyed with commercial magenta (basic form) were exposed in real-time to different scenarios for six weeks. Changes were measured using a spectrophotometer and ultra high performance liquid chromatography coupled with photo diode array detection (UHPLC-PDA). Results indicated that lighting, even in 'safe' workrooms and controlled displays can induce color and chemical changes in magenta. Knowledge and awareness that color and chemical changes are possible for magenta within a museum workroom environment are the first steps in addressing the problem of long-term preservation of these objects.

Ambient Analysis of Historic Textiles by DART-MS

Regina Baglia, Mary Ballard, G. Asher Newsome

Ambient analysis methods are critical tools in the field of conservation. Direct analysis in real time- mass spectrometry (DART-MS) is a relatively new ambient analysis technique. The DART ion source utilizes a heated helium gas stream to desorb surface molecules on the sample which then enter a coupled high-resolution mass spectrometer. DART-MS has been used for many different applications, but recent literature in the field of conservation has focused on dye analysis of historic textiles. In this work, we present our data from DART-MS analysis of historic textiles in rare dye swatch books from the Dibner Library of the History of Science and Technology collection. Our data suggests that DART-MS can detect compounds associated with textile processing, which may provide some insight into the complexity associated with historic textile production, use, and degradation. This presentation will discuss preliminary findings.

*Wooden Artifacts Session - May 31***Inside the Frames of Stanford White: A Technical Study***Tess Graafland*

Stanford White (1853-1906) is well-known as an architect at the architectural firm of McKim, Mead & White in New York, where he was a partner from 1879 until his unexpected death in 1906. Although he was best known for his architectural work and interior designs, The Metropolitan Museum of Art holds over a dozen picture frames that were designed by White. A technical study of Stanford White frames in the Metropolitan's collection was carried out by the author as part of an Annette de la Renta Junior Fellowship in the Department of Paintings Conservation.

Seven frames, designed between 1889 and 1900, were examined using various analytical techniques, to complement existing studies which focus mainly on stylistic elements and on White's professional relationships and collaborations. Just as his interior designs, White's frame designs can be placed in the context of the late nineteenth-century Aesthetic Movement, which included an array of styles, resulting in highly artistic and aesthetized designs with a great variety of decorative elements. The frames were designed for specific paintings that were painted by White's contemporaries, many of whom were his personal friends. White held close tabs on his frame designs, whether unique frames matching specific paintings or standard designs. Neither client nor frame maker was allowed to execute his frame or ornament designs without his permission.

After his death the standard designs, documented with photographs, molds and samples, continued to be fabricated. Copies of his frames were made as well. His elaborate frame designs with distinctive, often architectural ornaments, are fascinating works of art that had not been extensively studied technically. This paper will present the results of the technical study. It will discuss observations about manufacturing processes, such as the use of joints associated with cabinetry and the use of copper wire in cast ornaments. Moreover, it will address the originality of the surfaces, such as the direct application of gilding on a wooden substrate, without a gesso preparation. The technical results are complemented with findings from archival research at the Avery Architecture and Fine Arts Library (Columbia University), which holds correspondence on numerous of White's projects. The interdisciplinary approach of technical and archival research is especially valuable whenever material aspects of the original frames are lost, covered or altered. This study has provided valuable insights in American frame making towards the end of the nineteenth century. As an architect and designer in America's Gilded Age, Stanford White elevated frame making to a form of art. Examining the technical aspects of White's frame designs also adds to the growing appreciation of frames as art objects in their own right.

A Case Study of the Examination and Conservation Treatment of a Mid-18th century American Made Chair, and the Processes of Recreating Missing Carved Elements Using Traditional Methods*Christine Storti, Claire Burns, Gordon Hanlon*

In 1857, Thomas U. Walter designed the chairs and desks that would furnish the Hall of Representatives for the 35th United States Congress. Designs for the chair were completed in the spring of 1857, and an order of 262 chairs was split between two separate manufacturers. The deadline for the chairs was December 1, 1857. The MFA, Boston acquired one of the 262 chairs in 1980. The armchair's structure was stable, but the surface was in very poor condition and there was extensive loss of the decorative carved wood molding. The chair was missing molding on both front leg corners, and the entire length of molding under the proper left seat rail. The molding had a beveled edge design with a carved heart and dart pattern on the top surface. Due to the large quantity of the missing moldings, it was decided that fills would be carved from oak to match the surviving molding. In order to draft and carve the fills, an examination was carried out to understand the original methods used to make the chair. This included identifying which parts were machine-made versus handmade. During a visual examination, it became apparent that the chair's frame was machine cut, and the decorative elements were hand carved. X-ray analysis confirmed that majority of the hand carved molding was simply glued to the main frame. This evidence supported the idea that the chair was part of an assembly line production system. Several attempts of the fills were made using different degrees of machine and hand tooling.

Creating the fills using traditional methods proved to be very successful. It also revealed the skills and shortcuts of the original manufacturer. There was very little historical documentation about the chair in the museum records. However, it did state that the attributed maker was Bembé and Kimbel, a New York City based company. During the mid-18th c., the Bembé and Kimbel company was well established and greatly acclaimed for their high quality of handmade furniture. Based on the evidence found during the chair's initial examination, suspicion arose over the attributed maker of the chair. Further investigation led to the second manufacturer that helped complete the large order of chairs. The Desk Manufacturing Company of Philadelphia was contracted to help fulfill half of the order. The company was commissioned because they advertised their fast, large scale machine manufacturing techniques. The evidence of the chair's construction, as well as additional historical documentation, helped confirm that the MFA's chair was made by The Desk Manufacturing Company of Philadelphia. This investigation of the materials helped reveal the methods and techniques of the original makers, and helped provide evidence towards the correct authentication. It also helped with the process of using traditional methods to create large fills. A full case study of the conservation treatment will be presented to discuss this investigation and the results of using traditional materials as part of the treatment.

Thomas Sheraton's 'Red Oil'

David Bayne

Thomas Sheraton in *The Cabinet Dictionary* (1794) published a recipe for "red oil" that he recommended for use on mahogany. In 1996 the furniture lab at Peebles Island Conservation Center recreated red oil for use on a reproduction mahogany table. The table was a copy of the original and was placed in the same room with the same light exposure as the original table. This project was reported out to WAG in 1997 and again in 2011 as an example of how original finishes might have changed in appearance during the lifetime of the first owners.

In 2017 it was noticed that the cleaned surfaces of some 18th c. English chairs were remarkably like the available red oil sample boards from the 1996 project. With UV light and UV microscopy the similarity was also strong. Could the cleaned surfaces on the chairs be intact examples from the 18th c. of the use of Sheraton's red oil?

As it worked out, new chairs were commissioned to round out the set of older English chairs. Since the evidence suggested that red oil was used as the original finish, Sheraton's recipe was used on the new chairs. The result made it possible to compare the lurid appearance of brand new 18th c. chairs to their appearance after 250 years. More intriguing is that the red oil formula may contain a UV fluorescent ingredient that might make it possible to identify this finish in other situations.

Joint Research and Technical Studies + Wooden Artifacts Session - June 1, see page 91.

Wooden Artifacts Session - June 2

The Interdisciplinary Approach in the Conservation of Wooden Objects of the Museu do Ipiranga

Rogério Ricciluca Matiello Félix, Fabiola Zambrano Figueroa

A historical museum can contain in its collections infinite sources of research. The Museu do Ipiranga, administered by the University of São Paulo, has focus on the history of the Brazilian society with objects of personal use, furniture, documents, photographs and also paintings. A vast collection of attractive wooden furniture draws attention to the quality and diversity of materials, and brings out an important history of material culture since 18th century. In 2012, a specific research line was created for the conservation of wooden furniture, with the objective of defining protocols and methodologies for documentation, conservation, packaging, transportation and restoration of these objects. The work counted with professionals of the conservation of painting, paper and metal and involvement of the areas of Chemistry, Physics and Biology. The university environment favored the involvement and availability of experts and students in researches of the objects

collections, material on culture and characterization of materials. On this occasion, we present the research taken on six wooden objects, between 17th and 18th century: a bed (A); chairs (B), (C) and (D); chest (E) and chest (F). The identification of the wood species by the macroscopic method of the wood anatomy and the characterization of the pigments were carried out using analytical techniques. The obtained results allowed to show important informations of the objects that are useful to guide the conservation actions and curatorship in the museum. In relation to the documentation, it was possible to relate the place of origin and the period of preparation of each object, according to the phyto-geographic information of the wood species. The work was carried out by a Biologist anatomist of woods with the methodology of sampling defined in agreement with the experts of Conservation of the Museum. At this presentation, it also will be showed an innovative research of the history of use and demands of brazilian wood specimens, showing the paths and origins of these native materials until the 18th century. This methodology and research presented here will be extended to other collections of objects in wood and vegetable fibers as a tool for the preservation and understanding of the collections in the Museum.

Reproducing Decorative Furniture Inlay by Digital Means

Hugh Glover, Sarah Pike

As the earlier specialized skills for making intricate inlay and marquetry become less practiced, digital cutting methods continue to develop and become more accessible. We incorporated three digital processes, waterjet, laser, and CNC, to reproduce small repeating inlay patterns on two pieces of mid-1880's furniture.

One furniture piece was an aesthetic style worktable made by George Schastey & Co., NY, for which multiple similar pieces of brass and zinc veneer, each about 1/2" x 3/4" x 1 mm thick, were reproduced by waterjet. For the second furniture piece, a pair of Greco-Pompeian style piano stools made by Johnstone Norman & Co., London, four similar monograms were replicated, using CO2 laser to cut three densities of wood, and CNC milling for mother-of-pearl parts.

This is a broad description of the furniture and their conservation treatments, a comparison of the digital cutting processes, and an overview of basic terminology useful for collaborating with fabricators when similar projects are being considered.

Tilia and Tilt-A-Jet: Abrasive Jet-machining Towards the Treatment and Re-mounting of a Grinling Gibbons Overmantel

Karen Bishop, Mary Wilcop, Marcus Brathwaite, Beth M. Edelstein, Colleen Snyder

A wooden overmantel by English master sculptor Grinling Gibbons (1648-1721) in the collection of the Cleveland Museum of Art was studied and treated in preparation for its exhibition in

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the museum's British Galleries, the first time it will be on display in nearly a decade. The overmantel, an assemblage of limewood carvings imitating flowers, fruits, and foliage, is part of a larger group of decorative carvings made in 1675-1677 for Cassiobury Park, the country house of the first Earl of Essex near London. Cassiobury is notable for being among the first historic homes in England to feature what would become Gibbons' signature style of contrasting light-colored bare wood carvings nailed directly onto dark oak paneling, highly novel at the time.

The goal of examination and treatment was to stabilize the overmantel for installation and to regain some of the surface qualities that made Gibbons' carvings so innovative. Measuring nearly 8 ft² when assembled, the large overmantel was in poor condition both structurally and superficially, in part due to its having been previously mounted onto a painted quarter-inch plywood backing. The old mounting system was visually distracting and the long, thin boards flexed during transport and installation, causing the sections of the limewood carving – some of which were only attached to one another by a single nail – to grind against one another. Moreover, installation required placing drills in between carved sections in a way described by one art handler as “terrifying.” The surface was darkened, unevenly glossy, grimy overall and featured multiple mismatched replacement pieces. Examination and research into the history of the carvings revealed multiple campaigns of coatings, strippings, and re-coatings, as well as at least one instance of complete disassembly and rearrangement of the individual sections. The treatment allowed conservators the opportunity to perform materials analysis on the carvings, including wood identification through cross-section analysis, and analysis of the coating layers through cross-section, Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy paired with energy-dispersive X-ray spectroscopy (SEM/EDS). Treatment of the surface involved an overall cleaning and gloss reduction, while structural treatments included separating large swags into smaller sections, securing loose elements, consolidation, and the replacement of some missing parts of the carving. After the carvings were removed from their old mounts, a new mounting system was developed in collaboration with the Larry Sears and Sally Zlotnick Sears think[box] center at the campus of Case Western Reserve University. High-resolution images of the carvings' versos were taken and used to create two-dimensional digital mount patterns in Adobe Illustrator. The authors trained with think[box] staff to operate the center's new OMAX 5555 abrasive waterjet cutter to design and cut precisely-shaped mounts from 1/8th-inch thick aluminum. The new mounting system allows the large carvings to be more easily moved and installed and are nearly invisible to the viewer on display, permitting the work to regain its original, nailed-to-the-wall aesthetic.

An Experimental and Practical Study of Some Gap-Fillers for Wood and Wooden Antiquities

Dr. Hany Hanna

Experiments and tests have been conducted to test some gap-fillers to determine their suitability for restoration of archaeological

wood, wooden objects, and decorated wooden antiquities (such as carved, incised, engraved, turned and paneled wooden antiquities and artifacts, which include furniture, sculpture, frames, iconostasis, etc.).

1. The Tested Materials: The tested gap-filler includes several compounds of filler materials and binding materials: 1. Filler materials such as Calcium Carbonate powder, Zinc Oxide powder and Beech wood dust. 2. Binding materials such as animal glue, Arabic Gum, Poly Vinyl Acetate emulsion, Paraloid (Acryloid) B72, Primal AC 33, Araldite PY 1092 with hardener HY 1092, Silicons. The experiments have been applied to several decorated wood species such as Teak, Sidder, Pine and Beech.

2. The Testing Work: The testing includes studying the materials properties such as: 1. The handling behaviors during and after application such as easiness of preparation, easiness of shaping, ability of adherence to application tools, shape stability, setting time, shrinkage, cracking and changing in color after dryness. 2. The carving, cutting and sanding ability after dryness. 3. The painting, coloring & dyeing ability (with different sorts of colors and dyes such as watercolors, water dyes and alcohol dyes) before & after sanding. 4. The pH, weight and mechanical properties such as compression, tension and static bending (modulus of rupture and modulus of elasticity) before & after accelerated heat ageing. 5. The effects of the accelerated heat aging to the gap-filler and its properties such as mechanical properties and weight, as well as studying the changes to the tested materials regarding dehydration, cracking, brashness & fragileness, erosion & corrosion and changing in color.

3. Results and Conclusions: The best results were achieved using a gap-filler consists of “Beech wood dust as a filler, and Primal AC 33 as a binding material”, that appeared to be most useful for restoring the gaps, holes and cracks and for creating replacement for missing wooden details. This compound are almost neutral (pH = 6.8 – 7.3 and became 6.6 – 6.9 after accelerated heat ageing that has been done at 110° for one month). It is also easy to be shaped, does not flow during application, good to be treated with tools as spatula and to hold a required shape. In the same time, it has good setting time (20-25 minutes); and when dry; it does not color, discolor or disfigure the wood in contact with it and easy to alter its appearance by carving, sanding and painting. It does not cracked or shrunk, does not discolor, it is easy to be compressed (1.900 (kPa) and became 1.800 (kPa) after accelerated heat ageing) and it is easy to be removed when required. The chosen gap-filler have been used in restoration of some wooden antiquities, filling of gaps holes and cracks and for creating replacement for missing wooden details. In this paper, the experimental work conducted with the complete results and examples of the practical applications will be described in details with comparative and analysis display.

Joint Wooden Artifacts + Textiles Session - May 31, see page 102.

1. An American Icon in Plastic: The Technical Analysis, Study, & Treatment of a Early Edition 1959 Barbie

Dr. Odile Madden, Marci Jefcoat Burton, Morgan Burgess, Dr. David Hunt, Ellen Pearlstein

An early edition (c. 1959) polyvinyl chloride Barbie™ doll afflicted with bleeding autograph ink and white leg efflorescence was studied with chemical analysis and computed tomography to understand her construction and symptoms. Comparison with a second Barbie™ of slightly later manufacture (c. 1960) shows how the early design of Mattel's flagship toy was refined including a shift from all-PVC construction to body parts of different plastics and associated changes in mold design.

Contrary to a more frequently encountered "sticky leg syndrome," wherein plasticizer migrates from the PVC to the surface as a tacky liquid, this doll exhibited a waxy white stearate bloom from the mid-thighs to the ankles. In addition, the doll was autographed by Ruth Handler, the original designer of Barbie™ and a cofounder of the Mattel Corporation. Her signature and the date are now barely legible, as the once sharp lines of ink have migrated within the PVC plastic.

The dolls were imaged with computed tomography, multi-spectral imaging, and X-radiography, and the composition of their component parts was discerned with X-ray fluorescence (XRF) spectrometry, Fourier-transform infrared (FTIR) spectroscopy, and Raman spectroscopy. Collectively, this information helped the team decide whether the compound exuding from the 1959 doll's legs has an ongoing function in the plastic, whether its utility was limited to the manufacturing phase, and whether it will recur. Once the stearate was identified, the decision to treat or remove the waxy bloom from the Barbie™ could be rationalized and achieved.

2. Electroplated Silver During a Re-Lacquering Campaign at Winterthur: Treatment and Analytical Insights

Tia Polidori, Katelyn Rovito, Dr. Rosie Grayburn

The Conservation of Silver and Copper Alloy Objects project is part of a multiphase institutional initiative to treat objects in Winterthur Museum's diverse collections prioritized by greatest conservation need. Winterthur Museum, Garden & Library received IMLS funding to support a two-year project to remove aged or failed lacquer coatings, polish, and coat approximately 500 of its most vulnerable silver objects, to continue analytical research related to silver surface corrosion, and to commence new research on corrosion and coating issues.

Most of the time tarnish is easily removed from a silver surface with a mild abrasive; however, polishing the silver in this way permanently removes the most superficial layer of the precious metal. This is commonly considered acceptable if the silver in question were to be lacquered, which would protect the object for up to 30 years by making aggressive polishing campaigns unnecessary. However, unlike silver, silver-plated objects have an extremely thin display surface of silver and a more substantial substrate of a base metal. Objects that have been electroplated are particularly prone to mistreatment as the precious metal display surface is merely atoms thick and can be removed during a single polishing campaign. For delicate electroplated surfaces, technicians at Winterthur have been using a newly developed

acidified thiourea gel cleaning system. However, uncertainty regarding the efficacy of thiourea on a copper substrate has encouraged the IMLS team to research other methods for cleaning electroplated silver. Initial treatment results will be presented here.

The silver-plating method employed on an object will likely determine the treatment of the surface. As a result, the Scientific Research and Analysis Laboratory at Winterthur Museum has been conducting parallel research into ways of differentiating plate methods. ED-XRF (energy-dispersive x-ray fluorescence) spectroscopy was performed to determine object elemental composition. Alpha and beta x-ray emission lines are absorbed differently by surrounding elements after emission: the deeper the element or the thicker the layer on top, the more the ratios are affected. In order to semi-quantify the thickness of the plate, Cu-K ratios were used to measure the absorption of these emission lines by the silver plate. For example, during cleaning tests performed on an Argand lampshade, the thinness of the silver film and the fact that it was easily removed by abrasive cleaning all indicated the presence of an electroplated film. By analyzing the XRF data in the aforementioned way, the shade showed a silver plate thickness of much less than 1 μm , which was clearly different in plating technique from the rim, the shade support and the Argand lamp body, which was already confirmed as Sheffield Plate. Electroplate is generally found to be much less than 5 μm , although can be built up to more. It was therefore found that XRF can be used to quickly and non-destructively gauge possible plating techniques.

As more plated objects are analyzed as part of this project, a database will be accumulated in order to inform thickness variations across plating methods.

3. Theophilus on the Hardening of Steel Files

Katrina Zacharias, Jonathan Thornton, Aaron Shugar

Casehardening is a technique developed to harden the exterior of low carbon content steels for objects such as hand tools or gun parts. Historic descriptions for the process of casehardening are rare. In his 12th century treatise *On Divers Arts*, Theophilus Presbyter presents one of the earliest, most complete explanations on the process of hardening small files. Traditionally it is thought that carbon is mainly responsible for the hardening of the metal surface, however, a question has arisen on the role of nitrogen in the process. In this experiment, Theophilus's casehardening method was recreated and the samples produced were analyzed to determine if the method was one of carburization or nitrocarburization.

Casehardened samples were analyzed by optical microscopy using a Zeiss Axio Imager. Microstructures of possible nitrides were found in each fired sample though it is not possible to definitively confirm them. While the presence of nitrogen cannot be absolutely confirmed in these casehardened samples, the goatskin used in the recipe was found to be one possible source of nitrogen. Scanning Electron Microscopy (SEM) analysis and Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) Spectroscopy were utilized to verify and measure the presence of nitrogen.

4. Investigating the Renaissance Marriage Chest: A Study of the Methods and Materials Used in the Construction of Two Florentine Cassoni from the Workshop of Paolo Uccello

Sydney Beall, Irma Passeri, Dr. Anikó Bezur

The Yale University Art Gallery has in its collection two rare examples of 15th-century cassoni from the workshop of Paolo Uccello (Florence, 1397-1475): a cassone front panel, depicting *The Triumphal Entry of Titus and Vespasian into Rome* (ca. 1430), and a complete cassone with painted panels depicting *The Battle of the Amazons Before the Walls of Troy*; and female allegories of *Faith and Justice*; with its original lid, which features a reclining female nude on the interior (ca. 1460). Initial investigations of the cassone and the cassone front panel indicated the need for in-depth technical research that would inform and support their restoration treatments. In 2016, technical examinations of both works were performed in preparation for the forthcoming conservation treatment of the painted panels.

Through visual examination, infrared and ultraviolet photography, reflectance transformation imaging (RTI), micro x-ray fluorescence spectroscopy, x-radiography and stereo radiography techniques, the materials and methods used to construct the cassone and the preparatory and paint layers techniques could be identified. These investigative techniques, which most importantly confirmed the presence of original 15th-century nails in all corners, show that the cassone has maintained its structural entity and essential dimensions despite several 19th-century additions. In addition to structural changes, these techniques have also informed several alterations made to the painted surfaces and have shed light on the overall conservation history of the cassone.

Technical research of the cassone has helped to better understand cassone panel fragment, in terms of its preparatory and paint layers, conservation history, and dismemberment. Comparisons of these two works, each created at early and late periods in Uccello's career, not only speak to the changes and consistencies in Paolo Uccello's workshop(s), but also help to elucidate our understanding of other 15th-century cassone panels.

The preliminary results of our technical investigation will be discussed in this poster with a focus on the artist materials and techniques encountered in these two 15th-century cassoni.

5. Preserving the *Texas Chainsaw Massacre*: Leatherface

Olivia Primanis, Morgan Burgess

The mask used in the 1974 horror classic, *Texas Chainsaw Massacre*, is housed in the Harry Ransom Center at the University of Texas Austin. The mask was made from a latex rubber and meant to resemble human flesh – a grisly prize of the film's cannibalistic villain. Over time, the mask has become fragile and brittle, losing its original flexibility. It was determined that a supportive mount should be made in an effort to improve long term storage and display options. However, the mask could not withstand the pressure of most traditional casting materials which could be used to obtain the interior topography of the mask. By exploring the uses of photogrammetry, laser scanning, 3D digital modeling and 3D printing, we were able to create a support for the mask. The digital model of the underside of the mask was printed and

a support was made using the 3D print out rather than the original mask. In doing so, we made a custom mount for the fragile mask without the risks involved with excessive handling.

6. Ain't No Mountain High Enough: Treatment of a Board Game with Iron Corrosion

Lauren Calcote

While trained to work with different types of materials, conservators are sometimes presented with composite objects that are outside their area of expertise. The Newberry Library has some unusual board games in their collection that aren't always made out of materials a book conservator is accustomed to. The Newberry recently acquired the 1955 board game "Mt. Everest" that includes a 3-dimensional folding mountain for the game board, designed so that magnets in the playing pieces stick to the board as the players "climb" the mountain. While this was an innovative idea at the time, the long term consequences of layering an iron sheet in the middle of the board were not considered.

Now that the iron in the board is rusty, the board is delicate. The mountain is flaking apart at the corners and appears to have staining due to chemical reactions between the paper and iron. Stains are also present in portions of the box that were in contact with the board. The presence of iron precludes treatment with water as migration of iron ions would be detrimental over time, and the board would not survive an attempt to wash and chelate the rusted metal. Book and paper conservators usually work with iron in the form of iron gall ink or impurities left in the paper from contaminated water. While many lessons are transferable to this situation, most of the treatment procedures are not. Local objects conservators with experience working with metallic iron will be consulted for their experience treating corroded iron. The Newberry's mission is to preserve items while also making them accessible to the public in the reading room. Particularly delicate items are more difficult to treat because they may be used more than would be ideal for their preservation. The condition of the board prevents patrons from assembling the original mountain without damage. In order to preserve the original, a facsimile will be created using archival materials so that library users can still get an idea of how the game was designed. The poster will focus on the tradeoffs between the need to preserve the game and allow researchers to experience the game using as many of the original components as possible. It will also explain the treatment conducted on the original (incorporating collaborative expertise) and the methods and materials used in constructing the facsimile.

7. Cadmium Plating in Scientific and Technological Collections

Arianna Carini Johnston, Lauren Horelick

Cadmium plating is a common surface treatment that has been used to protect iron alloys in military, automotive, aerospace, and other industrial fields throughout the 20th century. Cadmium is in limited use today due to its toxicity. The surface coating industry and military have made efforts to find suitable, safer alternatives, but none can replace the combination of cadmium's unique characteristics as a single, cost-effective plating system. Cadmium serves as a sacrificial layer that preferentially corrodes before the substrate. The yellow- and white-colored

corrosion products are loose and powdery thereby posing health and safety risks to those who come into contact with them.

During a survey of the collection at the National Air and Space Museum (NASM), more than 2100 objects were identified as having active cadmium corrosion and in need of immediate stabilization. Unfortunately, there is a paucity of information on how to identify, characterize, treat, and safely dispose of cadmium corrosion in the Conservation and Collections Management literature. While the dangers and deterioration of cadmium pigments have been explored in analysis of painted surfaces, to date only one conservation-focused article has endeavored to understand why metallic cadmium corrodes in technological collections. The limited, yet continued, use of cadmium in military and aerospace applications will continue to be problematic as NASM and other history and technology museums continue to collect. This poster will present the case study of a treatment methodology carried out on World War II era aircraft equipment. It will also present techniques for characterizing cadmium corrosion and provide practical health and safety guidelines for its treatment and disposal.

8. Mercuric Chloride Reduction on Feathers

Stephanie Cashman, Dr. Aaron Shugar

Pesticides have historically been used in the museum environment to prevent, repel, destroy or mitigate pests in order to preserve collections. Many of these compounds, particularly heavy metal pesticides, are toxic to humans as well as pests (Pool et al. 2005). While heavy metal pesticides are no longer used in the museum environment their presence is acutely felt within collections as they do not dissipate and remain on treated artifacts (that may not be labeled as such), which can cross contaminate adjacent object (ibid). What might be more concerning, handling items treated with heavy metal pesticides presents a potential risk to those in contact with these collections. X-ray fluorescence spectroscopy (XRF) and scanning electron microscopy energy dispersive spectroscopy (SEM-EDS) were used to analyze feathers treated with mercuric chloride on twentieth century Kachina figures from the Buffalo Museum of Science. Six feathers were selected for treatment and three pesticide mitigation methods were compared. Two sample sets were solvent cleaned on a vacuum suction platen; one set with ethanol and the other with isopropyl alcohol. Another set was washed in a deionized water bath. The feathers, used blotters and wash water were analyzed to evaluate the movement of the mercuric chloride and effectiveness of these mitigation methods.

9. An Experimental Gel-Based Treatment of Iron Gall Ink Corrosion Halos: Sodium Metabisulfite and Diethylene Triamine Pentaacetic Acid Solution in Agarose Gel

Kelly Conlin, Dr. Alison Murray, Rosaleen Hill

A research project was carried out at Queen's University to determine the effectiveness of an agarose gel-based treatment of iron gall ink corrosion halos using reducing agent sodium metabisulfite and chelating agent diethylene triamine pentaacetic acid. The ink fabricated for this experiment contained the metal ions of iron, copper, and zinc to increase the amount of visible corrosion, as well as replicate historic inks that have metals other than iron in them. The experimental

treatment accounts for the chelation of the copper and zinc ions from the paper substrate along with iron, which cannot currently be done using the widely accepted calcium phytate treatment, as phytate is iron selective. The effectiveness of this experimental treatment was primarily determined using qualitative methods of analysis. Photographic documentation, ultraviolet fluorescence, optical microscopy, scanning electron microscopy-energy dispersive X-ray spectroscopy, and electron probe microanalysis were the techniques that yielded the most useful results. Color spectrophotometry and pH measurements of the sample swatches yielded results that support observations made with the aforementioned techniques. Unfortunately, inductively coupled plasma atomic emission spectroscopy, the main technique that would have confirmed the success of the treatment, did not yield results because of unknown error. Though no definite conclusions could be drawn on the effectiveness of the treatment, suggestions for future research and potential treatment procedures can be considered based on the results from the qualitative analyses.

10. Unfinished Thoughts: Conserving Working Documents and Preserving Transitory States in Library and Archive Collection Materials

Quinn Morgan Ferris

Starting with their earliest lessons in book binding history, most library conservators become familiar with the notion of “temporary” or “incomplete” bindings over the course of their careers.

These volumes—which have been unceremoniously sewn or stitched into a wrapper, or else tacked into an inexpensive and utilitarian cover—are destined to wait ad infinitum for a full and finished binding that may have at one time been promised, but will truly never come. Temporary bindings often are a cause for consternation when considering treatment, since they are usually quite old (dating from anytime between the 15th to the 19th century), don't include high quality materials, and rarely have a particularly robust level of protection for their text blocks. One nice feature of the temporary binding, however, is that at least its printed content is typically complete, representing a finished intellectual work which has been released for consumption into the world—however shabby its exterior may be.

But, what if the intellectual work was unfinished? What if the value of a document stemmed from its lack of finality, the fact that it was paused forever, mid-thought, mid-sentence? What if it was, in fact, the content and not the form that was “incomplete”? The last half-decade has given rise to a codified genre of “transitory” art—a visual documentation of our modern societies in flux. For much longer, we have relied heavily on “transitory documents”—works that capture our thoughts in a moment of generation, transition, evolution or solidification. These works, too, can often be found on the bench of library conservators. Whether it is in the form of a hand written draft of a famous work, a private notebook or planner, or a historic document repurposed to make a brand new edition, preserving “working documents” in a state of perpetual incompleteness requires a shift in traditional conservation approach. The primary challenge of the conservation of “working documents” is that they have multifaceted material characteristics that make a straight path towards a traditional treatment impossible. What do you do with and 16th century imprint cut apart and re-arranged by an 18th century scholar? Composition books are cheap and accessible vessels for the thoughts of poets, but

how do you repair a minimal binding in the process of failing without obfuscating the intentional damage inflicted by its creator? Moreover, when treating objects that are both archival and ephemeral (still without being archived ephemera), to what degree do you camouflage the conservation work that you do and what do you reveal? If called upon to stabilize a “working document” that has clearly had a long career, how do you strike a balance between access and authenticity? Though the questions raised by this category of object are complex and endless, this presentation will aim to consider the possible answers through treatment case studies completed on equally complex—if not infinitely interesting—objects from the collections of the University of Illinois and the University of Virginia libraries.

11. Conservation in a Changing Climate: Examining the Effects of Ocean Acidification on Submerged Wooden Artifacts

Annabelle Fichtner

Increased atmospheric carbon dioxide concentration is not only one of the leading factors of global warming, but also one of the leading contributors to continuing ocean acidification. The historic average for ocean pH is 8.2, but since the onset of the Industrial Revolution, this has decreased to 8.1. It is projected to reach a pH of 7.6 by 2100 if current concentration trends continue. Much research has been done by biologists and nature conservationists to address the effects this acidification could have on sea life. However, little research has been conducted on the effects ocean acidification has and could increasingly have on the degradation of underwater archaeological sites and remains.

This study examines the effects of increased acidification on the preservation of waterlogged wooden artifacts, by examining sample degradation using SEM after prolonged submergence in solutions of varying acidities. These solutions are prepared to match the pH levels of past, present, and projected oceanic conditions. The study focuses on the effects of increased ocean acidity on woods commonly used in historic ship construction, specifically oak, cedar, and pine. It also draws on published climate projections to identify areas where sites are most at risk of increased degradation due to ocean acidification.

12. A Preliminary Evaluation of Lining and Surface Patching Techniques for Doped Aircraft Fabric

Lauren Gottschlich, Lauren Horelick

Doped fabric is ubiquitous on historic aircraft found in the collection at the National Air and Space Museum (NASM). Doping is the practice of applying a waterproof coating to fabric, which also serves to shrink the material over a rigid structure. A doped surface is traditionally made of multiple coats of clear cellulose nitrate, acetate, and/or acetate butyrate applied over a cotton or linen fabric. These cellulosic resins, known as aircraft dope, have a limited usable lifespan once applied to flight surfaces as dictated by their material properties. As these resins age, they become brittle and shrink, sometimes cracking or splitting in the process.

Because of the requirement for scheduled inspections of the structures beneath, doped fabric materials have long been considered dispensable and are expected to be replaced or patched during routine operational maintenance or restoration. Restoration practices

for patching localized damage entails the application of patches with new dope according to strictly defined methods illustrated in the FAA Advisory, AC43.13. This irreversible application of new dope can lead to further damage to the surrounding areas as the fresh dope shrinks. Traditional restoration practices can compromise the authenticity of the aircraft through the re-fabrication, removal, or covering of battle damage, historic finishes, and original art. Alternative options to preserve original doped aircraft fabric in situ through lining and surface patching techniques require further research as these topics are not well published in the field of conservation. NASM conservation is currently deviating from long-established restoration protocols to develop new methods to preserve original fabrics. New processes being explored include full lining of fabric components and employing localized patches using conservation fabrics and adhesives. Visible surface patching from the exterior is necessary in many instances due to constraints of the aircraft structure. In cases where lining is required, it provides much needed support to damaged and structurally weakened doped fabric. Over the last two years, NASM conservation treatments of aircraft fabric included the application of surface patches with nylon gossamer and Lascaux 498 HV and full lining of doped fabrics with BEVA 371b onto Ceconite 102 (a polyester fabric).

This poster assesses these past treatments and explores two additional adhesives (methylcellulose and a wheat starch paste/sturgeon glue blend) as potential surface patching materials. The patching and lining materials were tested using t-peel and lap/shear tests as evaluation tools to determine adhesive/bond strength. The goal of this research is to identify reversible and stable materials and techniques to replace traditional methods of restoration.

13. Sticking With It: Following up on HSC’s Effort to Develop a User-driven Adhesives Database

Molly K. McGath, Andrea Hall, Patricia McGuiggan

This past fall, the Heritage Science for Conservation group at Johns Hopkins University hosted a one day workshop, Adhesives in Conservation: Bridging the Gap between Industry and Conservators, with the aim of gathering information from participants towards developing a user-driven adhesives database. Through talks and break-out groups, intentions around data and functionality desired in an adhesives database were discussed. Two surveys were administered, one before and one after the workshop, that gathered data on different aspects of adhesives selection and use in conservation. These results were paired with the data gathered at the workshop to inform database design and implementation. The details of the workshop, survey results, and a prototype adhesives database design are presented here.

14. Radiation Therapy for Cultural Heritage: Gamma Radiation in Disaster Response

Molly K. McGath, Jenn Foltz Cruickshank, Andrea Hall, Patricia McGuiggan

Disaster Preparedness Planning requires knowledge of the materials in a collection, their value, and information on the best treatments available. Often, treatments can only mitigate damage done to collections, following a disaster. In some instances, there are few options and treatment only allows for a window of time when the materials can then

be digitized, or otherwise documented. The degree of damage, the size of the collection impacted, or the urgency of the disaster may require the use of techniques that otherwise are not typically used within the field. The use of such methods is exceptional and, as such, requires scientific investigation before the treatment needs to be used. This project addresses one such emergency treatment: the use of gamma radiation, and its immediate effects on materials within archive and paper-based collections. A set of surrogate materials was treated with gamma radiation to test how this treatment affects the materials. Colorimetry and attenuated total reflectance-Fourier transform infrared spectroscopy were employed to discern if the materials underwent chemical change, and to discern which materials underwent the most change.

15. Frass-tacular!: Textile Conservation Techniques Adapted to the Stabilization of Moth-Damaged Aircraft Fabric

Meghann Kozak, Lauren Anne Horelick

Historic WWII bombers have not typically been the subject of innovative textile conservation treatments. However, a unique opportunity arose while the National Air and Space Museum (NASM) was evaluating 50 fabric panels used to insulate the Museum's Martin B-26 Marauder, better known as Flak-Bait. This particular aircraft is most noteworthy for having flown over 200 successful missions during WWII and is one of the most authentic and historic aircraft in existence. The overall preservation goals for this aircraft are to stabilize as much original material as possible, reverse previous restoration efforts, and celebrate historic battle damage.

The fabric panels that line the interior of Flak-Bait are only found in the front, or nose section of the aircraft. The majority of the panels are constructed from dyed fulled wool fabric, lined on the reverse with a thick layer of undyed cotton batting. This fabric structure is machine-sewn around a support border of perforated aluminum strips. Cadmium plated steel buttons are fed through the perforations in the aluminum boarder strips thereby securing the panels to the aircraft's interior walls.

The nose section of Flak Bait had been on display for forty years during which time the insulating fabric panels suffered a severe webbing clothes moth infestation, followed by a heavy-handed restoration to hide the moth damage. This earlier restoration effort utilized large adhesive-applied fabric patches to cover losses from moth damage that were then spray painted in-situ to match the surrounding fabric. Other condition issues affecting the textiles include embedded corrosion, light damage, accumulated frass, and areas of additional moth damage resulting in structural instability. This poster will serve as a case study of how textile conservation techniques were used to stabilize and aesthetically re-integrate original interior fabric panels that would otherwise have been completely replaced. The techniques employed include experimentation with rigid gels and CO₂ for adhesive reduction, needle- and wet-felted loss compensation, solvent cleaning for overpaint reduction and dry cleaning methods to remove frass. This poster will also discuss how the treatment decision-making process was influenced by a comprehensive understanding of these composite objects. The panels' history, condition, range of materials and the proposed display environment influenced the treatment decisions.

16. Using SEM to Examine Metal Threads from the King's Bed (1672) at Knole House

Erin E. Murphy

This research report presents the results of a morphologic and compositional study of 4 different metal threads set-aside after a 1974-87 wet cleaning. These threads are from the "King's Bed," a late 17th century royal bed, now at Knole in Kent, England. Although the "King's Bed" is not currently in need of cleaning or restoration, analysis of the Knole House threads should help in determining the best plan for future conservation treatment. The threads were examined via SEM-EDS to confirm their elemental composition and morphology and provide an update on their condition.

Multiple readings, both point and box field, were taken on each sample with an effort to sample all places that looked different (dark, light, scratched, edge, field...). The surface on the gold gilded samples was scratched and exhibited varying degrees of brightness. For these areas, multiple points on each sample were tested and the surface 'mapped' along lines to investigate if the composition varied between bright and dull areas or if corrosion products could be detected. Also a cross-sectional sample was prepared to investigate, if possible, the thickness of the gilded layer. Some readings at 10 and 7 kV were also attempted on the gold gilded surfaces in an effort to see if this could also give any insight into the thickness of the gilded layer. All threads were silver; one solid, and 3 with metal foil wrapped silk cores. The solid silver thread showed tooling striations indicating manufacturing by drawing, while high gold readings suggested possible gold gilding. The other threads were of cut metal foil wrapped about silk cores. However, their surface striations suggested different manufacturing methods. Attempts (including cross sections and low kV readings) were made to determine the thickness of the gold gilding while the EDS line-mapping tool helped correlate visual evidence with elemental composition. It was hoped that more information could be gleaned about corrosion products, but the threads appeared very clean, with scant evidence of either dust/dirt or Ag₂S or AgCl corrosion products. No information was available on the detamishing process 50 years ago. The very thin layers of gold gilding should be of interest as it is possible that the solid silver thread was gilded at one time. If so, this may have been removed during the previous cleaning. This SEM-EDS examination provided significant information on the manufacturing method and composition of the metal threads.

17. Challenges in Documenting Historic Finishes During Construction at the Enoch Pratt Free Library, Baltimore, MD

Brooke Young Russell

Enoch Pratt Library serves as a case study, demonstrating the challenges of completing time-pressure paint investigations in the midst of the construction phase. EverGreene was contracted to determine the original decorative scheme in seven spaces and rooms on the second floor of the library. Decorative finishes, particularly on a large scale project such as this, communicate with one another. Though the rooms are different, colors often overlap, and schemes and patterns can be repeated throughout to create a cohesion between rooms.

At the Pratt Library, research and precise documentation became increasingly difficult as selective demolition and renovation activities

created tremendous time pressures during the study. In addition to the current renovation project, many of the walls had been previously demolished, and ceilings were significantly perforated with post-historic mechanical systems and lighting. In some cases, it was impossible to review conditions to clarify issues raised during sample examination, and in-situ reveals had to be matched immediately, because the finishes would no longer exist shortly after they had been examined. Recommendations often had to be made on the spot, making client interest and interaction a key part of the process. Combining physical investigations with archival research, conservators were challenged to document colors and composition of stenciling as well as freehand decorative and figurative work on plaster walls and ceilings, even as ongoing demolition reduced the contextual evidence in historic spaces. Each new discovery revealed by the investigation added perspective to the design process, which was driven by a desire to honor the historic decoration while accommodating present-day aesthetic tastes. Keeping lines of communication open between the conservation team, the design team, and the building owner was crucial in the selection of colors and decorative motifs for the renovation process.

18. The Use and Effect of Pickering Particle Emulsions and Cyclomethicone Cleaning Systems in the Treatment of Hair in Water-Sensitive Composite Objects

Amaris Sturm

Keratinaceous materials, including animal hair, have long been used in the manufacture of utilitarian and art objects. The cleaning of composite objects constructed of hair attached to water-sensitive material now presents a challenge to conservators. In recent years Pickering particle emulsions and cyclomethicone have been used with great success in the cleaning and protecting of water-sensitive painted surfaces. Through a case study of the treatment of a 19th century hearth brush (1958.2326) from the Winterthur Museum collection, this research assesses the use of Velvisol™ Plus emulsions and D4 cyclomethicone, also known as D4 silicone solvent, in the aqueous cleaning of natural hair bristles attached to a wooden substrate. To test the effectiveness of Pickering particle emulsions and cyclomethicone in the treatment of hair, a soiled hair sample from the Winterthur hearth brush was trisected. One section was left uncleaned; a second cleaned with 10% deionized water in Velvisol™ Plus and D4 cyclomethicone and left unrinsed; and the third cleaned with the same solution and rinsed with D4 cyclomethicone. The three samples, representing the hair before, during, and after cleaning, were analyzed using scanning electron microscopy- energy dispersive spectroscopy (SEM-EDS), secondary electron imaging, and false color elemental mapping to assess the ability of the emulsion to remove embedded grime, to identify residual cleaning agents, and to visualize possible damage to the hair structure. Results showed the Velvisol™ Plus emulsion effectively cleaned the hair with minimal residues and no damage to the hair's microstructure. The cleaning system was then applied in the treatment of the Winterthur hearth brush. The complete cleaning method included saturating the bristle bundles and wooden bristle board with silicone solvent to prevent the emulsion from absorbing into the wood and preventing the swelling and trapping of residues. The Velvisol™ Plus emulsion was then applied by brush and cosmetic sponge and rinsed from the surface with additional applications silicone solvent. This treatment method

showed a drastic macroscopic improvement to the hair's color, sheen, and pliability based on overall visual examination after treatment. A Pickering particle emulsion cleaning system combined with cyclomethicone masking of sensitive material is a promising method for the treatment of hair in composite objects, allowing for careful and controlled cleaning of soiled keratinaceous materials.

19. Cosmetics as Artifacts: The Analysis and Conservation of a 1930s Theatrical Makeup Kit

Mary Wilcop, Jonathan Thornton, Nathan Eddingsaas

A 1930s era theatrical makeup kit in the collection the Buffalo Museum of Science was analyzed and treated at the Garman Family Art Conservation Department at Buffalo State College. The kit, contained within a tinplated-steel L. Leichner brand expandable makeup box, was tightly packed with 105 individual items that included: paper, metal, and glass containers of powder- and cream-based cosmetics that had broken, spilled and smeared; insect-eaten wool crepe hairs; makeup-stained cotton balls; degrading plastics; and paper documents, including a hand-written journal with notations made in lipstick. The kit was gifted to the museum in 1983, where it had since remained in storage. Discussions with the curator lead to the idea that the kit, while not typical of the museum's collections, could nonetheless serve as an interesting launching-off point into science for visitors interested in cosmetics or the theatre. A treatment philosophy was developed that would approach the kit as an "archeological artifact," with the goal of maintaining the kit's original appearance as it was assembled by its owner. Materials analysis, treatment and preventive conservation strategies were employed in tandem to stabilize the object group for display and storage.

Materials analysis was performed to gather information about the components of the make-up kit that could be used to inform decisions about treatment and display. Significantly, the box's strong "old makeup" odor was considered a potential concern to both to the paper and metal components in the box and to other objects housed near it. The questions posed for the first phase of analysis were: what types of volatile organic compounds (VOCs) comprise this strong "old makeup" smell? Could these components be problematic to other materials? In collaboration with the Rochester Institute of Technology, solid-phase microextraction headspace analysis (HS-SPME) was performed on the unopened box and some components, to detect volatile and semi-volatile species present. In a second step, experiments to replicate a "low fi" approach to non-invasive VOC analysis were performed in the BSC science laboratory. Pellets of sorbents were tested for their ability to adsorb VOCs from a two strong off-gassing objects and low temperature pyrolysis was performed to desorb analytes for gas chromatography-mass spectroscopy analysis (py-GC-MS).

A third phase of analysis began with research into the history of theatrical cosmetics to lend context to the historical moment from which the items emerged. This is best emblemized by the greasepaints, the main group of objects in the kit and the precursor to modern-day foundation. To characterize colorants, six pink greasepaints in the kit were sampled for analysis that combined X-ray fluorescence (XRF), Fourier transform infrared spectroscopy (transmission-FTIR), optical microscopy (OM), polarized light microscopy (PLM), and selective py-GC-MS.

In the treatment phase, extensive collaboration from across the BSC conservation department was solicited in order to approach a

variety of object types including: mends to sprung three-dimensional paper containers filled with cosmetics, fills in broken glass jars, stabilization of a hand-written journal, and fabrication of missing metal components.

20. An In Depth Treatment Study of Humidification and Flattening in Paper Conservation

Kesha Talbert

This presentation will provide an overview of an in depth study of humidification and flattening of paper based artworks/artifacts conducted during a Cathleen A. Baker Fellowship at the University of Michigan Library. Humidification and flattening of paper is one of the most fundamental components of a book and/or paper conservator's practice, and while it may seem basic or rudimentary the finesse required when selecting the techniques, materials and methodologies to employ in a given situation should not be discounted. When it comes to determining the appropriate procedure for reducing planar distortions in a paper support Material Matters! Factors inherent to the paper itself including the fiber type, processing, sheet formation and finishing affect how the paper will react with the environment and in treatment; by isolating variables and using a standard set of sample papers that reflect a wide range of paper supports typically seen in museum, library and archival collections a more comprehensive understanding of the treatment process can be achieved. The primary aim of this project was to combine a thorough literature review with personal interviews with practicing conservators of various career levels and training backgrounds to formulate a series of practical experiments which would inform my personal knowledge of the subject. Comparative data—both quantitative and qualitative in nature—in the form of dimensional measurements, observations of surface texture and planarity and efficacy provide insight into manipulating the vast array of humidity delivery systems coupled with restraint drying set-ups to achieve the desired outcome. In the end there is no silver bullet, there is no one “go to” system that will work for all papers in all situations but there are ways to tailor most any system to achieve the goal for each paper.

21. Mass Deacidification Carrier Fluid Selection to Protect Media

La Verne Lopes, Kent John, and John Baty

In order to build an alkaline reserve in paper that neutralizes acids already present and protects against acids adsorbed in the future, most mass deacidification processes use a liquid carrier to deliver alkaline particles or solutes. While certain mass deacidification carrier fluids in use today are inert, others are toxic, flammable, and odoriferous. A few significant carriers (heptane, HMDS) are industrial solvents capable of changing the appearance of susceptible media. Although vendors using more aggressive fluids screen collections for media compatibility, given the hundreds of thousands of artifacts undergoing mass deacidification yearly, we can expect loss of historic and artistic content. We have performed several experiments, taking thousands of measurements in the CIELAB color space to quantify the color change of an increasingly large number of relevant media (highlighters, stamp pad ink, colored pencils, markers) on relevant acidic (book and bond) papers. Measuring before and after mechanical action while submerged

in relevant mass deacidification carrier fluids in use today (perfluoro-hexane isomers, heptane, and hexamethyldisiloxane—HMDS) gauges their susceptibility to color change during treatment. We concluded that perfluorinated hydrocarbons seldom if ever cause noticeable changes in color density of even of the most fugitive media. By contrast heptane and HMDS produce changes noticeable to the human eye. Therefore, carrier chemistry is an important though underappreciated criterion in the selection of mass deacidification methods.

22. Nothing is Ever Simple: A Case Study in Flexible Project Management for Archives Conservation

Alexander Bero

Project parameters can change substantially from initial planning once work begins, particularly with large archival collections. In this case, several changes required a re-evaluation of the methods, processes and techniques used. The size of the collection tripled, staff discovered significant mold damage, and environmental conditions truncated treatment time. This poster will describe how I was able to adjust treatment processes and techniques to accommodate rapidly changing project needs. The legal records of the Leo Hershkowitz Collection (TAM 415) were initially thought to be the simplest of three collections to be treated as part of the Gardiner Project. This evaluation was based on staff experience with tri-folded legal documents and what eventually proved to be an extremely biased sample used in initial project planning. Once I began treatment, I discovered that the 150 boxes of the collection were larger than originally thought, tripling the size of the collection, that the paper was more brittle, and that many more inks were present than the sample indicated. Archives staff discovered extensive mold contamination when they began to inventory the collection, prompting me and other conservation staff to conduct an emergency survey of the material, revealing that 10% of the collection had extensive mold contamination. The initial workflow had to be entirely re-written. In order to manage the increased volume of work I triaged treatment steps, eventually using minimal surface cleaning and passive flattening. I ruled out humidification due to the variety of inks present, so flattening was performed only with the lab's ambient seasonal humidity, meaning flattening was unexpectedly confined to the wetter spring and summer months as the lab's HVAC system is unable to provide humidification in New York City's dry winter months. As this was only one of three collections I was responsible for, there were not enough staff hours to cope with the mold, so I collaborated with an outside vendor who was able to perform mold remediation as well as some of the cleaning and flattening to NYU Libraries' specifications. By maintaining a flexible approach to project management, and adjusting treatment plans throughout the process, the project is on track to meet goals despite serious initial setbacks.

23. Biblio-Archaeology: A Codicological Inventory, Condition Survey and Preservation Needs Assessment of Pre-Modern Codices and Incunabula in the Rare Books and Manuscripts Collection of the OSU Libraries

Danielle Demmerle

For the Undergraduate Summer Library Research Fellowship, I

conducted condition surveys, a codicological inventory and preservation needs assessment of 48 pre-modern codices and 98 incunabula in the Rare Books and Manuscripts Library (RBML) of the OSU Libraries. In my proposal I planned to assess all physical features, general condition and the preservation needs of each item under the supervision and guidance of OSU Libraries' Book and Paper Conservator, Harry Campbell and the OSUL RBML Curator, Eric Johnson (my supervisors). I researched the fundamentals of building and operating a condition survey by reaching out to those who have had years of experience in conservation. I quickly became accustomed with the subject matter and created a reference document of descriptive elements that guided me through each evaluation which I adapted into my condition survey design. Upon the completion of the condition surveys I created a catalogue that would help organize 146 bound items from the RBML and guide faculty and students through the data. While it is designed to provide concise information, the individual condition surveys of each item can provide greater (or additional) detail. Condition work for special collections often go overlooked, but I was able to create a strong foundation for the recorded conditions of bound medieval manuscripts and incunabula in the RBML. I look forward to the hands-on conservation work that Harry Campbell has pre-approved for the manuscripts and incunabula that are in need of attention as part of my job as a student assistant technician in the Conservation Unit. I am hopeful that the condition and needs assessment survey I designed specifically for the RBML will become standard practice, and continue to be used to record physical aspects for future acquisitions, as well as provide an informative source for augmenting item records in the OSUL online catalog.

24. Pineapple Paper - A New Material from Taiwan for Paper Conservation

Ting-Fu Fan

This article will introduce "Pineapple paper," which was developed and produced in Taiwan since 1970. In Eastern conservation field, there are several types of paper that are well-known by conservators, such as Minogami and Kozo Paper from Japan and Xuan Paper from China. With the increasing variety of paper material and their unique characteristics, new conservation papers are being considered using to enrich the choices for conservators and to meet different conservation needs. Pineapple Paper was produced to conform to this requirement.

Pineapple Paper is made in a process similar to traditional Xuan Paper. It presents Taiwanese environmental characters and integrates environment protection. This paper not only has the characteristic of visual pure color and elegant quality of traditional Xuan Paper but also a paper strength advantage as similar to Japanese paper. In addition, it shows little deterioration or discoloration after aging test procedures. In recent years, Pineapple Paper is starting to be accepted and used by Eastern painting and paper conservators in Taiwan for conservation and preservation. Furthermore, it was also made specially for a famous Chinese artist, Chang Dai-Chien.

In the poster, we will also introduce the production process of Pineapple Paper, its paper characteristics and conservation case studies. We hope that paper conservators not yet aware of this material will now have one more choice in their paper material cabinet for future conservation work.

25. The Conservation of Textile Linings and Seal Cords – With a Little Help From Textile and Paintings Conservation

Solange FitzGerald

This project confronts the often varying and complex problems encountered in book and paper conservation: the need to establish a minimal conservation treatment solution that remains sympathetic to the original document. In this case, two objects were treated adopting and adapting textile and painting conservation techniques, which here have been successfully applied for in situ treatments on two archival paper and parchment documents with textile components:

- IR 130/41/22 - a nineteenth century paper map lined with linen, torn with big losses in the fabric
- E 24/18/1 – a sixteenth century parchment charter with a large wax pendant seal, with split silk braided cords.

Both objects are part of the collections of the National Archives, the official archive for the UK government for England and Wales. Both identified as being "unfit for production," due to their fragile physical state after a condition survey completed in 2010. With such fragile objects, it is expected that the treatment process from beginning to completion will be both testing and time consuming. As the traditional method of removing the original linen lining from the verso of paper maps would have severely affected IR 130/41/22 original structure, an in-situ treatment was devised from a method usually applied to cotton canvases in paintings conservation: the thread by thread tear mending, a variation of the Heiber technique. This in-situ treatment method successfully provided the means to retain all elements of the original map while at the same time stabilising the map allowing it to be accessed, once again, by the public. The damage associated with E 24/128/1, a sixteenth century parchment charter with a large wax pendant seal on degraded silk braided cords is a common problem within many collections. This provided the conservator with the challenge to retain the original structure of the silk cords while still attached to the seal and the parchment charter.

The chosen treatment is an adaptation on the sewing cord repair of fifteenth century incunabula as published by Birgit Speta in 2003. In the case of the charter E 24/128/1, each of the original silk braided cords were partially broken and holding on only by individual silk threads. The treatment involved the addition and securing of new silk threads to the split original threads in order to stabilise the whole cord. For this, preliminary tests were undertaken in order to establish an appropriate choice of repair materials and repair procedures. The threads were secured in place supported by new cotton and silk threads, the chosen adhesive Lascaux 498H provided strength and at the same time sufficient flexibility to allow for the threads to be re-braided and stabilise what remained of the original cord. This method provided a way to retain all elements of the original silk cords while remaining attached to the parchment charter. The treatment solutions for the map and the charter proved to be highly successful in making the objects once again accessible to the general public, whilst maintaining their historical structure."

26. Colorimetry with a Camera: Determining Shifts in the CIE-L*ab Color Space with a Digital Camera and a Color Card

Andrea Hall, Molly K. McGath, Patricia McGuiggan

Colorimetry, which can characterize color shifts in cultural heritage objects, is a well-established technique in conservation. Colorimeters, however, can be costly and require proprietary software to use. The aim of this project was to develop a methodology that facilitates the use of a digital camera and color card as a low-cost alternative to a colorimeter. By color correcting using the neutral grey (RGB: 200, 200, 200 / L*ab: 80.6, 0.004, -0.009) a set of baseline RGB values were taken from blue wool standard cards. These RGB values can be converted to CIE-L*ab values to determine color shifts over time comparable to the data produced by a colorimeter. This method can be used by any conservator with a camera, a standard color checker and an image processing program.

27. The Permeation of Vapors through Polyethylene Terephthalate (PET) films

Patricia McGuiggan, Andrea Hall, Molly K. McGath, Bill Minter

Polyethylene terephthalate (PET) films, aka Mylar® or Melinex®, are widely used materials within conservation. One of the most common uses of these films is for encapsulation. Our studies have shown that water can permeate through the PET whereas formic acid vapor permeates at a much slower rate and acetic acid vapor permeates even more slowly, if at all. The rate of permeation is dependent upon the molecular diameter of the vapor. The varying rates of penetration have a two-fold impact. One, they can act as a protecting layer against some hazardous volatile compounds within polluted environments. Two, they can trap hazardous volatile compounds within enclosures, creating a microenvironment which maybe hazardous to cultural heritage objects. The data suggests that deacidification should be performed prior to encapsulation.

28. Art or Awful: The Preservation and Conservation of Graffiti

Stephanie M. Hoagland

Graffiti is a drawing or inscription made on a wall or other surface, usually without permission, so as to be seen by the public. It's done for many different reasons like self-expression, boredom, or disrespect. When does graffiti go from an act of vandalism to be immediately removed, to an artful expression which should be saved and shared? Graffiti has a long and proud history dating back to Ancient Egypt, Greece, and the Roman Empire. The oldest graffiti at Pompeii is a simple Gaius was here, or more precisely, "Gaius Pumidis Dilphilus was here" dated October 3, 78 B.C. It is a classic that stands the test of time, as anyone familiar with Kilroy knows.

Graffiti comes in many different forms: from carving in stone, spray paint on a brick wall, marker on a marble statue, pencil on walls, etching on glass, to stickers on everything. Although graffiti has become an accepted art form, there is still a wide chasm between work exhibited in a museum and work done without the permission of the property owner. The National Park Service has two documents related

to the removal of graffiti: Keeping it Clean and "Preservation Brief 38: Removing Graffiti from Masonry" both dating to 1995. But information and guidelines on the preservation of graffiti is scarce. Papers have been presented on the conservation of murals and graffiti-style street art, but what about graffiti that was created just as an act of defacement?

What makes some graffiti worth saving while other requires swift removal? It is easy to be fascinated by graffiti left by a Rear Admiral of the British Navy on the Temple of Dendur in 1817, and less so by the spray-painted tag found on your garage. Is there really a difference between Keith Haring's mural "Once Upon a Time" in the men's bathroom of The Lesbian, Gay, Bisexual & Transgender Community Center and the penises that (for reasons unknown) boys love to draw on any vertical surface? Although many factors go into the decision to remove or preserve, some of the most important are age, context, and the artist. Graffiti exists in our public spaces, our communities, and our streets. It can be thoughtful, crude, political, humorous, simple, artistic, territorial, offensive, creative, or a combination of these. Can conservators work together to create guidelines and standards for the preservation and conservation of graffiti? Or is it like many issues of conservation where the answer is "It depends?"

Jablonski Building Conservation, Inc. has worked on several graffiti-related projects including the preservation of pencil graffiti on wallpaper in a museum, protection and conservation treatments to a spray-painted graffiti mural in a previously industrial neighborhood, and the removal of offensive graffiti from the side of a church. This presentation will discuss how each of these projects required us to stop and think about the consequences of removal versus preservation.

29. On a Roll: A New Artifact Support Approach During the Treatment of Cannons

William Hoffman

Supporting and rotating heavy and cumbersome objects throughout the treatment process can present a real challenge. This problem is especially true when it comes to the conservation of cannons. The awkward size, shape, and weight of cannons makes it difficult to conduct surface cleaning and coating because work can only progress so far before the objects have to be turned over. This task is often carried out by having the objects elevated on wooden blocks which enables them to be carefully rolled over by hand to expose a new side to work. This process can be time consuming, requires the participation of several staff members, and can lead to surface abrasion of the objects and/or recently applied coatings. Therefore, when the conservation staff at The Mariners' Museum and Park in Newport News, Virginia, was asked to treat several cannon within the museum's collection, it provided an opportunity to develop a new support approach. This led to the fabrication of a wheeled mount that held the cannons in an elevated horizontal position while at the same time through the use of a bearing system allowed the objects to be freely rotated. The use of the new support device during the conservation of the cannons resulted in a much easier and safer treatment for both staff and objects.

This poster will provide an overall description of the construction and operation of the new support structure as well as highlight how the system could be modified for use with other kinds of large objects.

30. Using Open Source Software as New Media Artworks Restoration Method and Evaluate its Pros and Cons: A Case Study of New Media Art Collection of National Museums in Taiwan

Tzu-chuan Lin

In recent years, New Media Art has become one of the mainstreams Art trend in Taiwan. As museum starts to collect those artworks, how to preserve and conserve the New Media Artworks also becomes a challenge for those Contemporary Collecting Institutes. Comparing to the New Media Art preservation and conservation pioneers, such as U.S. and some European countries, it seems Taiwan has started a little bit late. Due to the lack of experience, when National Museums in Taiwan face the challenge, there are rarely no in-field references to consult.

This is a case study about the restoration of a New Media artwork, *Goang-ming Yuan, The Reason For Insomnia, 1998*, which its original software malfunction that trigger the interaction between the artwork and the audience is no longer capable to debug the software error. During the research, there are already some Contemporary and New Media Art conservation team from U.S. and European countries chose Open Source Software as a tool to conserve these kinds of artworks. In this conservation project, museum members also decided to migrate the original Software to Open Source Software. After the migration, the works has return to its original function and able to exhibit again. This research focus on the New Media Art collection of National Museums in Taiwan, try to use Open Source Software as a technical method to conserve New Media Artworks, and evaluates its superiority and risk that may cause from the method.

31. Degradation Makers of Cellulose Acetate During Aging

Dr. Liu Liu, Dr. Lukasz Bratasz

Being the first cellulose derivative put into commercial production, CA (cellulose acetate) is a material that was used extensively in the 20th century by the film industry as well as by artists to create fine and decorative art. Compared with traditional material used in cultural heritage, cellulose acetate is a chemically unstable material resulting in shrinkage and deformation even at room temperature (such as *Little Large Glass* by Marcel Duchamp, Yale University Art Gallery). The material may have suffered from severe degradation when visible changes are found. It's important to have proper evaluation of its condition. Currently, scientists are concentrating on case studies instead of systemic research. In light of this situation, based on the literature review, several chemistry analysis methods have been applied in this research in order to find the degradation causes or agents during cellulose acetate degradation at different scales. Modern scientific methods such as SEM, FTIR, GPC and XRD are used to explain degradation makers of cellulose acetate, providing support in the aspect of evaluation of the material's degradation. The results showed deformation, curling and newly formed pores with micrometer-scale diameters appear during the processing of degradation. The change of crystallinity differs from samples with different plasticizer content and artificial ageing in different conditions. The molecular weight experienced a significant decrease during aging, while the molecular weight distribution didn't see the same trend. Data from FTIR proves the characterization vibration bond changes.

It should be highlighted that the peak attributes to unbound water appears during ageing. Data from TGA-FTIR proves that the amount of thermal volatile material decreases during degradation. The trend is more significant with higher plasticizer content. Thermoporometry based on DSC analysis is an efficient method to characterize the pore structure in porous materials. Results from DSC and SEM shows that pore size of 7nm was found in all cellulose acetate samples; the diameter increases with the scale of degradation. Cellulose acetate with 20% plasticizer content has bigger pores compared to cellulose acetate (7.892 nm-9.347 nm). Interestingly, new pores with radius of 2.255nm appear in cellulose acetate with 20% plasticizer content. For the first time, a systemic research has been applied to investigate degradation makers, the results offer scientific support for cellulose acetate study as well as related micro-climate design.

32. Conservation of *The Spirit of Sunday in Shaw* by Billy Colbert; Challenges of Treatment Design and Execution for Oversized, Contemporary, Multimedia Artwork

Kristen Loudermilk

This poster will present the treatment of an oversized, contemporary, multimedia artwork in the collection of the Walter E. Washington Convention Center in Washington, D.C. *The Spirit of Sunday in Shaw* by Billy Colbert is a varnished and screen printed artwork on two found photographs printed on RC paper and attached to separate aluminum panels using a pressure-sensitive adhesive. The aluminum panels are attached with screws to a wood and aluminum framework for display and installation. Commissioned for the space, the artwork has hung in the Washington Convention Center since 2003. Shortly after installation, the artwork developed large, snaking, draw-like distortions across the surface that cyclically worsened and improved every summer and winter until they were permanently held in place just four years after installation. In addition to these distortions, one of the aluminum panel supports was warped, bulging outward at the central join of the two panels. These problems compromised the stability and visual integrity of the artwork, thus necessitating conservation treatment. Consultation with the artist in addition to a collaboration between, paintings, photography, and paper conservators allowed for a multidisciplinary approach to be developed. An extensive testing phase was implemented, not only to examine the solubility parameters of the materials, but to design methods that would be effective in treating the artwork. This phase included the creation of mock-ups to determine how the artwork could be re-assembled if removed from the aluminum panels. In addition to defining an appropriate treatment, it was necessary to discuss the cause of the distortions in the support and what steps would be required to prevent them from recurring. With all the data gathered, confident that conservation intervention would stabilize the support and significantly improve the visual appearance of the artwork, a treatment was designed and executed to remove the varnished and screen printed RC paper from the aluminum support, eliminate the distortions, modify the aluminum panel and framework support, and finally re-attach the artwork back onto the aluminum panels and framework. While art in public spaces is often subject to less than ideal conditions for preservation, the Washington Convention Center was willing to collaborate with conservators to improve the installation location and maintain a more consistent display environment for the artwork.

33. The Wild West Comes to Southern Maryland: The Conservation of Three Solder Dot Cans from Deadwood, South Dakota

Francis Lukezic

Located at Jefferson Patterson Park and Museum in Southern Maryland, the Maryland Archaeological Conservation (MAC) Laboratory is a tailor-made, state-of-the-art facility where conservation, archaeological research, and curation of Maryland's archaeological collections occur. The MAC Laboratory not only conserves the State's archaeological collections but also provides conservation services and guidance to Cultural Resource Management firms, government agencies, non-profit organizations, and museums throughout the United States. Over the past few years, the MAC Laboratory has steadily built a rapport with the City of Deadwood, in South Dakota, while conserving a variety of historic artifacts from their archaeological collections. In September of 2016, the City of Deadwood sent three metal solder dot cans with paper labels to the MAC Laboratory for conservation treatment. Each cylindrical can has a lead soldered seam along the side, a lead solder-filled hole in the lid, and are likely made of tin-plated iron. The cans are part of a collection of artifacts that were unearthed during the relocation of a historic structure, known as the Fountain House, within the city in March of 2015. The cans arrived at the lab with a corroded metal surface and stains and soil partially obscuring the fragile and fragmentary paper food labels that were still in situ. The artifacts presented a unique conservation challenge, as the paper labels had to be detached entirely from the metal can in order to treat the materials separately. Each material required a different approach to cleaning and stabilization. This poster will highlight the collaborative nature of the project and the techniques employed to conserve these uncommon archaeological objects.

34. Integrated Approaches to the Conservation of Multi-Component Systems: A Case Study with Dog Tags

Emily Ma, Olivia Primanis, Ellen Cunningham-Kruppa

This study examined the components of a set of dog tags from the movie *Deer Hunter* in the De Niro collection at the Harry Ransom Center. More specifically, this entailed the development of a set of analytical techniques to identify the composition of all item components along with the subsequent development of a long-term housing and exhibition solutions. Robert De Niro represents one of the most prominent actors in modern film, and many of his works a snapshot of the American identity throughout the latter half of the 20th century. The De Niro Collection at the Ransom Center subsequently represents an all-encompassing archive, housing materials with a wide variety of compositions, all of which have shown differing degrees of degradation, particularly those composed of plastics. The dog tags in particular represent one of these items, comprising two metal dog tags attached by a chain enclosed in a plastic covering. This enclosure was a typical characteristic of tags assigned during the Vietnam War, the setting of the *Deer Hunter* movie, to silence the metal during combat and protect it from the humid environment. Ironically, this plastic covering has contributed most to the degradation of the item, with leaching contributing to the corrosion of the metal underneath. The challenges of the project ultimately came down to finding the proper

pieces of equipment to effectively identify the composition of the dog tags along with their covering, as well as the source of the exudate. We chose methods with an eye towards applications to similar projects and mixed compositions. The project utilized a combination of Infrared Spectroscopy along with Gas Chromatography/Mass Spectrometry to identify the main composition of the plastic covering along with the liquid present at the interface between the tags and their enclosing. This was combined with X-ray Fluorescence to identify the metals in the tags themselves along with any oxides forming at their surface. This has not only allowed the discovery of the source of the degradation, leaching of phthalate plasticizers, but also begin to identify methods of cleaning the metal underneath as well as saving the plastic so important to the context of the piece.

35. Optimizing Paint Cross-Section Preparation for Modern and Contemporary Art: A Case Study

Thomas Lam, Stephanie Barnes, Elle Friedberg, Jia-sun Tsang

Big Egg (1968) by Ed Clark is a large oval-shaped abstract painting on canvas, created while the artist was working in France. The painting is from the National Museum of African American History and Culture (NMAAHC) collection and underwent technical study and conservation at the Museum Conservation Institute (MCI). Clark is known for his technique of painting with the canvas on the floor, pouring and splashing many thin layers of paint and pushing them around with a large broom. Much of the paint surface has a matte and chalky appearance. *Big Egg* was originally thought to be acrylic, but preliminary analysis showed the underlying paint layers to be water sensitive and the pigments to be bound in polyvinylacrylate (PVAc) with a possible ethylene co-polymer. Currently, the painting is on view at the Visual Art Gallery at NMAAHC. This study is a continuation of research conducted in 2015-2016 on un-embedded paint samples from *Big Egg* with ATR-FTIR and Hirox microscopy. In this study, a paint cross-section embedding and polishing technique was developed to further the binder and pigment analysis of each paint layer with FTIR chemical mapping and SEM-EDX. This research is part of broader investigations by the authors with the goal to optimize paint sample preparation for modern and contemporary art. The paint cross-section methodology is as follows: 1) embed the paint sample in Bio-Plastic® 2) mount the embedded sample on double-sided silicon tape onto a glass slide 3) place the paint layers parallel to the glass slide 4) ensure strata of paint is fully on view when the sample is released from the mold 5) use metal tube as mold, 3/4" in diameter cut to 3/4" height 6) coat the interior of the mold with silicon grease 7) a negligible amount of resin exists between the paint sample and silicone tape resulting in minimal polishing 8) dry polish with MicroMesh 8) use Hirox reflective bright field to confirm paint sample surface topography.

The analysis of the paint cross-sections starts from the least invasive technique, ending with the more invasive method—from Hirox microscope examination to FTIR mapping (measured in reflectance mode) to SEM-EDX. Using the methodology listed above, a paint cross—from *Big Egg* was analyzed and 13 layers of paint were observed. The thickness, inorganic elements, and binder of each stratum was examined by FTIR mapping and SEM-EDX. Water-sensitive PVAc paint in *Big Egg* was confirmed by ATR-FTIR on non-embedded paint and FTIR mapping of the embedded paint cross-section. This result supports the treatment selection of water-based consolidant, water-based inpainting material, and the choice of Beva film as a lining

adhesive. Fully polished paint cross-sections ready for analysis can be prepared within a day. The application has been extended to include egg tempera paint, photographs, and polychrome. This cross-section preparation expands the instrumental analysis capability from one paint sample, maximizing the information gathered. Future work includes more comparative experiments with ion milling systems to improve the paint surface quality and further organic material analysis with FTIR-mapping.

36. Fire Hazard of Traditional Potteries with Polyester Overlay Plywood

Mei Tu, Jay Hsieh, Patricia Huang

Fire poses one of the greatest threats to irreplaceable cultural heritage. While ensuring human safety is of uttermost importance, fire and rescue departments and cultural heritage institutions have also endeavored to understand the impact that museum fire has on the exhibits. So far, a list of possible risk factors has been drawn, but no empirical analysis has ever been carried out on any of the factors. As different materials react to the changes of temperature and humidity differently, this paper selects pottery, a commonly seen material, for our examination. We will first identify the possible risk factors for the exhibits when museums catch fire. We then choose high-temperature and smoke as the research subject and conduct experiments on four types of Taiwanese traditional potteries (two types traditional Chinese handmade teapots, Zisha clay and Taiwan red-clay teapot) for tolerance testing. The possible complication that wooden exhibition cases may cause for the above-mentioned potteries is also considered. Based on the experiment results, this paper will make rescue priority suggestion for pottery type exhibits in museums. It is hoped that the research will make contributions for museums to make fire safety and evacuation plan, and preventive conservation in the future.

37. Archiving for the Museums Using the Ultra-High Resolution Scanning System

Jay Arre Toque, Ryota Magara, Maasaki Taniguchi, Koji Okumura, Masahiro Toiya, Yushihide Shimbata, Ari Ide-Ektestabi

On May 18, 2015, the Bridgestone Museum of Art, Ishibashi Foundation (Tokyo, JAPAN) closed its doors in preparation for the construction of a new building, presenting us with a unique window of opportunity for performing ultra-high resolution scans of the museum's most valuable paintings. The Ishibashi Foundation Collection includes more than 2,600 works of art. The core of the collection consists of 19th century Impressionist paintings from France, 20th century Western art, Japanese Western-style paintings, and so on. While the museum was closed to the public, an ultra-high resolution digital archiving project was undertaken for conservation of artworks and digital exhibitions. The museum chose to use scanners manufactured by Sabia Inc., developed at the Advanced Imaging Technology Laboratory of Kyoto University for its large-scale digitization project. The Ultra-High resolution imaging is on the rise in the field of digital archiving of cultural heritage. Conventional commercially available systems are both time consuming and costly for museums and galleries. However, by using a high resolution scanner which is particularly designed to address the limitations of conventional techniques, we

could reduce both time and cost significantly. We have brought the scanners to universities, museums, and temples around the world and has digitized thousands of works. The main feature of the scanner is its excellent portability, so it can be carried around to the site and the scanning time is very shorter compared to other available technologies.

The scanner features a dual line camera head which can take simultaneous visible and near infrared images. This unique feature offers greatly reduced the acquisition time unlike conventional imaging techniques where these two types of images must be acquired separately. The light sources used were a visible LED and near infrared LED (~850nm spectral peak). The cameras were two line CCD cameras. One camera was filtered using a UV/IR cut filter while the other camera was filtered with an IR filter. At the Bridgestone museum scanning project, the scanning resolution was 1000dpi (~39 pixel/mm). There were over 100 oil paintings digitized belonging to the collection of Bridgestone Museum of Art at the Art Research Center in Tokyo and it only took around 10 days to acquire multiple types of ultrahigh resolution images which include symmetrically-lit visible images, specularly-lit visible light images and near. In this Bridgestone Museum project, these paintings represent the best of the best in their collection. The paintings vary in sizes the largest of which is around 2 x 2 m. In this paper, we present the result of our scanning and share some insights on how to do a large-scale ultrahigh resolution digitization projects within a practical budget and time limit. Our more than 10 years of experience in digitizing large objects would be of interest to the museum community who are planning to do a similar project. We would also share how we can use these ultrahigh resolution images for studying the material and techniques used in the artworks for conservation and preservation efforts.

38. You're Printing What? Where? The Material Stability and Safety of 3D Printing Thermoplastic Polymers for Fused Filament Fabrication

Neelam Bharti, Fletcher Durant

The rapid growth and adoption of 3D printing technologies has or will soon bring a new generation of printed polymer objects into our collections. With almost half a million printers shipped in 2016 alone, 3D printed objects are likely to stay with us for as long as the polymers last. While 3D printing encompasses a variety of distinct processes, fused filament fabrication (FFF) is the most popular and accessible 3D printing technology, utilizing a heated nozzle head to deposit layers of polymer into a computer generated design. FFF is widely used in museums, arts, and educational settings as a low-cost teaching tool. At the University of Florida (UF), we have printed exhibit mounts, archaeological replicas for classroom use, and prosthetics for a children's charity. Despite the widespread adoption of FFF technology, little testing has been done to either understand the stability of the thermoplastic polymers used in these printers or potential health ramifications of bringing industrial production methods to a desktop printer. To better understand the long-term stability of the variety of polymers compatible with the 3D printers at UF, the UF Libraries are undertaking Oddy testing and Photographic Activity Testing on the commercially available polymers to understand their long-term stability for possible use in collection storage and display. In parallel with the material testing, we will be measuring the emission of ultrafine particles (UFPs) during the printing process. UFPs and

volatile organic compounds (VOCs) impact indoor air quality and may be a potential health risk to users. The results of this testing will help conservators make key materials decisions for the health and safety of our collections and our creators. Materials testing will provide insights to potential hazards entering collections as well as potential tools for use in creating custom housings and exhibit mounts. Understanding the emission of UFPs during printing can help guide room and ventilation design to minimize potential health risks to conservators, artists, and other makers.

39. Stone-panelled Red Lacquer Wooden Table Excavated from King Lu's Tomb of Ming Dynasty and its Lacquer Technique Study

Dr. Jianlan Wang, Mr. Junping Xu, Mr. Yunpeng Wang

The earliest-known Chinese lacquerware is a wooden bowl dating back to 7000 years ago, the era of Neolithic, which lacquer was regarded as waterproof function with decorating fine objects artistically. With the development of sophisticated lacquer process for thousands of years, the manufacture of lacquerware during Ming Dynasty have reached the summit in art and techniques, favoured by the privileged class as which is symbolic of social status, power and wealth. The tenth son of the first emperor (ZHU Yuanzhang) of Ming dynasty, ZHU Tan (1370-1389AD), King Lu, whose tomb was found in Mt. Jiulong at Zoucheng, Shandong Province. More than 1100 funerary objects, including guard of honour figurines, lacquerwares, costumes, and furniture have been excavated and have provided precious material for further study of the ritual system together with clothing and furniture styles, of early Ming Dynasty. It has also revealed that the lacquerwares of Ming Dynasty have transformed functional usage of earlier period into ornamental purpose like for household exhibition. In order to better understand the lacquer craft of the stone-panelled red lacquer wooden table (see Fig. 1) in the past and restore and preserve this valuable artefact particularly the lacquered-wooden part with appropriate treatment, scientific exploration has been conducted before and during the conservation process. SEM-EDAX, XRD and FT-IR are main methodologies were applied to investigate fallen fragments of the red lacquer wooden table. The cross sectional analysis of the lacquer sample elucidated that, apart from the substrate, is composed of three layers, e.g. ground layer, finish layer, and surface layer (red lacquer film layer). Characterisation of lacquer film has shown that raw Chinese lacquer and cinnabar (HgS) added as the pigment, were mixed for the manufacture technique. Structure of polysaccharides has also been detected via IR and further analysis has suggested the support layer is made of fibres which might be derived from hemp. The fibre netting is believed to strengthen the whole furniture purpose, as well as increase the porosity of the item for gripping more layers of lacquer. Infrared spectrum has also indicated that tung-oil, a popular additives for manufacture lacquerwares during that time, was missing, not added during the lacquer-making process. Elemental analysis and X-ray diffraction suggested that quartz (SiO₂) were added, and the well-rounded quartz particles showed they might have been artificially ground and then added into the lacquer as a filling to increase the hardness. Historical documents may not be able to fully explain the initiative in technical evolvement of the lacquerwares and how aesthetic taste of that time influenced and reformed the lacquerware's manufacture process and artistry; nevertheless cultural objects would provide nuggets of information to unlock the past, how lacquerwares

had been juxtaposed with contemporary architecture, furniture and furnishings to reach a visual harmony and ideal. Less practical and prone to decorative, may reflect social and economic development and state of that era.

40. Extraction and Analysis of DNA from Renaissance-Style Prepared Paper

Karina C. Åberg, Rhonda K. Roby, Manija A. Kazmi, Thomas Huber, Thomas P. Sakmar

Our overall goal is to test the hypothesis that biological material, including ancient DNA, can be extracted from 500-plus-year-old Renaissance artworks such as written folios and metalpoint drawings. We report here the preliminary results of a multidisciplinary technical and scientific research study where samples of modern "prepared" paper were analyzed. An IRB-approved human subjects protocol was initiated to allow us to collect saliva samples. The saliva samples were then used to fabricate prepared paper samples according to Cennini's original description of methods (Broecke, L., "Cennino Cennini's Il Libro dell'Arte: A New English Translation and Commentary with Italian Transcription," London: Archetype Publications, Ltd., 2015). We then developed techniques to extract DNA from homogeneous samples of the prepared paper. Using real-time quantitative PCR (polymerase chain reaction, RT q-PCR), we measured the sensitivity of the extraction methods and determined whether the DNA that can be extracted is suitable for DNA sequencing. We determined that DNA from the cells in human saliva used to prepare paper could be extracted quantitatively from various paper types, and that the DNA can be amplified and detected using RT q-PCR. From a 1.2-mm "punch biopsy" we achieved the theoretical detection limit of 6 picograms of DNA, which corresponds to the amount of DNA in one human epithelial cell. On average, the DNA yield from a punch biopsy from the prepared paper is the equivalent of about 7 cells. We have begun to test aged specimens and will further study the inhibitory effects of metalpoint media, paints, resins, glues, waxes, etc. to human DNA testing. We will also employ single-cell Next-Generation sequencing (NGS) in order to obtain genomes from DNA extracted from the paper samples. In summary, we report preliminary results that provide a basis for developing a minimally-invasive method to analyze artworks, such as drawings on Renaissance-prepared paper. The methods we develop are applicable to studies of authentic artworks and paper documents from various periods. Conservation scientists using UV, XRF and X-ray technologies to study artworks should consider that under certain conditions, UV light and X-rays damage DNA, thereby forever removing the possibility of extracting artists' DNA and other biological information from works on paper or other substrates.

41. Rising from the Ashes: The Conservation and Treatment of Paper Support Objects with Large Loss and Burn

Jen Jung Ku

Burn is not a common deterioration in the cultural relics of paper base. Burn may be from the process of material made or the bad collection environment, like the mounting or storage made by the bad materials. "Mazu" journal's first issue collects by National Museum of Taiwan Literature, has a large part loss and burn on the book cover

and pages, there is over half of the book cover missing that the item is so weak and unstable. Since this object is one evident of special regime conversion in Taiwan, it's very important in cultural change, the history of literature and book binding. Therefore, this paper will use present digital printing out technology to restore this important journal, and will make contribution for the condition and consider treatment of the burned object. "Mazu" is a Japanese journal published during the period which Japan colonial Taiwan. "Mazu," the name of journal, is the goddess of the sea from the Taiwan traditional belief, and the content of journals is the poems and novels all surrounded by this theme. The magazines are hand binding by the editor, Mitsuru Nishikawa, due to his personal hobby for beauty of the binding and limited book, and publishing for those who collect books. It's also the first one literature magazine which is combined of literature with art and printing technology. The illustrations of book are the print works all about Taiwanese folk and religious themes, and the pages are Asia handmade paper, on the endpaper stick a sheet of "paper money", which used to be in the ceremony of Taiwan's Traditional Belief. "Paper money" base is made of straw fiber, and d decorate with gold leaf and red prints, and is incensed with fire to sacrifice to gods in East Asian traditional belief which is meaning for communicate with god and pray for blessings. In this journal, paper money is meaning the decoration of book ticket. The deterioration of this book is serious that the burn, brittle and lose the full cover and pages. The paper supports are dark brown color, and the water stain, tide line on the paper outward diffused from the spine as the center. It's easily broken and peeling off since burn and brittle when doing the treatment, and that makes it extremely difficult during all the conservation treatment with the choice of treatment materials also have many considerations. At the same time this paper also the basic scientific analysis for burn part of the paper, and compensation large missing by using Asia mounting lining technique with inkjet printing out technology to maintain the texture of the cultural relics and visual continuity.

42. Cooperation with Different Backgrounds for Monument Protection: How Deep Can We Interfere with the Monument?

Eva Lisiecka

A social initiative, connecting people of different professions, formed in order to save wooden monuments. The responsibilities are divided between the Departments of Wood Conservation and Architecture of the Warsaw University of Life Sciences, and the Androlli Foundation. A team from Wood Conservation Department prepared the assessment of the technical condition of the monument. Another team from Architecture, attempted to save the original monuments' substance and proposed a new form of adaptation for the Wooden Villa. The enthusiasts of old wooden architecture from the Andriolli Foundation researched the history of the building and took care of the legal aspects. In other hand work on a historic wooden building forces on conservator to make detailed analysis and research of the conservation status of structural and decorative wooden elements. The conservation program must take into account the historical destiny of the building, but also the requirements of modern construction. It often involves the need to adapt it to new conditions. The paper presents also the problems that a conservator has to solve to preserve as much historical substance as possible in order to adapt to new needs and, above all, to take care of the safety of users of modern facilities. How deep he can interfere in

historical substance to protect them? The aim of the presentation is to present our experiences of cooperation between different organizations focused on saving a wooden building and conservation dilemma which they met. The reflections are presented on the Gurewicz Pension located in the Otwock in Poland.

43. Laying with Tiffany: Conservation of the Swan Memorial Glass Mosaic at Woodlawn Cemetery

Ewa Lisiecka, Agnieszka Mielnik

The glass designs of Louis Comfort Tiffany and his studio were unparalleled in American art of the late 19th and early 20th century. Less known, but no less significant were the studio's architectural mosaic and monument designs. Historians have begun to research commissions but much remains to be done on the original fabrication and conservation of this work. The Swan Monument was designed by Tiffany Studios and installed in Woodlawn Cemetery in 1914. The mosaic was commissioned from Tiffany by Helen M.W. Swan for her late husband Charles. The first phase of a conservation study on the monument documented current conditions, analyzed materials and fabrication, determined deterioration mechanisms, and identified potential conservation methods. The canopy style monument is ten feet tall and composed of Tiffany granite, a variegated pink granite quarried in Braintree, MA. A 2'8 1/2" x 6'11" art-glass mosaic panel fills the central panel of the structure and is covered by a shallow portico. The scene is likely influenced by Pre-Raphaelite imagery and depicts an angel guiding a woman into a heavenly landscape. The composition is enhanced by the dramatic curvature of the angel's wing and by the artisan's usage of the firm's infamous iridescent glass on both the angel and the idyllic countryside to emphasize their celestial quality. The memorial is unique among the large collection of Tiffany Studios' works found in Woodlawn, in that its mosaic is open-air and readily visible to the public, and it is one of only a small number of extant memorials of its kind in the United States. The exposure of the mosaic contributes to its surface decay and the loss of many of the glass tesserae over the past century. Records from Woodlawn Cemetery indicate that the memorial began shedding glass and needed repair less than four years after installation. Over the years, some tesserae were recovered and replaced during repair campaigns while many others were lost. Consequently, the mosaic now has significant areas of loss and many areas of the remaining glass display corrosion and conchoidal spalling from prolonged contact with water and other damaging substances. XRD analysis determined that the original backing material was made of Keene's cement, a gypsiferous, hard plaster, and was reinforced with metal bars. SEM and SEM-EDS were used to analyze the surface topography and chemical makeup of samples of degraded tesserae as well as to analyze the effect of a micro abrasive treatment to remove a thin layer of corroded glass from the tessera surface in an effort to expose the fully-saturated, colored glass underneath. Removal of this thin layer of color-leached silica on affected tesserae and re-coating with a protective layer of Acryloid B-72 returns the glass tesserae to their original appearance and protects their surfaces from future exposure. Conservation of the monument based on testing results is currently underway. The extant art glass is being stabilized, detached tesserae re-attached, and missing tesserae will be cut and replaced in-kind from donations of similar sheets of Tiffany glass when available.

44. Bold Will Hold: Investigating Artist Materials of Classic American Tattoo Flash

Laura Moeller

This research will explore the materials and methods behind the creation of North American paper-based tattoo artifacts from the 19th and 20th centuries. As the folk art canon arguably includes tattoo ephemera, the conservation of these works on paper deserve attention for best practice based on materials, techniques and historical use. These objects include flash (the drawn and printed designs for tattoos), stencils and sketchbooks which intersect as industrial art during the time of their creation, to highly collectible artworks in and outside the tattoo community at present. Vintage flash sheet designs range from rudimentary to ornate in their execution. Although similar images depict ageless themes of love, life and loss, one flash sheet showcasing representations of heartbreak is not the same as another sheet of broken hearts. Artist materials used to create these objects vary widely and invite exploration. The paper objects surrounding the tattoo industry of the past, such as hand-painted business advertisements and flash sheets, were created using an assortment of materials that encompass different substrates, surface coatings, adhesives, pigments and dyes. Most frequently these objects were heavily handled, tacked directly to walls and pork-chopped, the process by which specific designs were cut to be collaged with others on a single sheet. Due to their environment of constant use by artists in stationary shops or more itinerant set-ups, physical damage is common. Signs of structural and cosmetic degradation include water damage, nicotine stains, aged varnishes, paper loss and media disturbances. As a conservator who treats these objects, I have observed that tattoo historians and tattoo history collectors can have different conservation goals. To inform a treatment course for these artworks, if any, it is necessary to compile more studied information regarding the materials and their original context. This project aims to gather and organize findings to build case studies by working directly with original materials. Non-destructive analysis using X-ray fluorescence (XRF) will be exercised. Sourcing archival materials in addition to interviewing current practitioners of this art form will help support a continued dialogue that can help acquaint other conservation professionals to preserving these historical artworks.

45. The Two Layers Technique for Supporting and Assembling Severely Damaged Composed Sandals of King Tutankhamun

Safwat Mohammed, Hadeel Khalil

This study discusses the conservation of a pair of composed sandals of king Tutankhamun which considered unique and one of the kind, made of three principle materials; leather, gold and papyrus. Some conservation treatments were applied on the sandals at the discovery process in 1922 which caused rigidity, fragmentation and darkness in the leather, buckling in the golden belts that surround the base, golden ornaments felt of the sandals as a result the sandals were categorized as a material for study and not for exhibition. a full documentation study was applied by digital photography and Auto-Cad program for making deterioration map for the sandals. Some microbiological test swaps were taken to test the sandals beside some investigations and analysis were executed; FTIR for identifying previous conservation materials and XRF for recognizing the metal type used in manufacturing of the

sandals. Then several steps of conservation were applied; mechanical cleaning and consolidation for each piece of fragment. In order to prevent any possible new damage for the fragments the reassembling of the fragments was tried first by Photoshop before the actual procedure as each pair of matched fragments were signed with special symbol, the pieces then were adhered by Klucel G and support of Japanese paper. The Japanese paper was died first with a natural black dye to make the support suitable in color with the sandals but still can be recognized. A second layer of acid free cardboard was used to support the sandals from the bottom without adding adhesive. The conservation treatments extended the lifetime of the sandals and stabilized their condition. For the correct dealing and handling of the previous sandals, a plexi glass holder was designed as a final step.

46. Emulating Horizons (2008) by Geert Mul: the challenges of intensive graphics rendering

Claudia Roeck (See Electronic Media session for abstract)

47. Preserving Stephan von Huene's electronic artworks by means of bit-stream documentation

Sophie Bunz (See Electronic Media session for abstract)

48. Steam Heat: Use of High Heat/Low Pressure Cleaning System on 19th Century Funerary Monuments at Green-Wood Cemetery

Neela Kusum Wickremesinghe, Georg Schmid

During the spring of 2016 Green-Wood Cemetery and the Kärcher company began a collaboration under the company's cultural heritage program. Kärcher is a leader in the European pressure washer and steam cleaning world, this project was their first in the United States. Two mausoleums and one large monument were chosen for cleaning. All monuments were white American marble, most likely from the east coast. All exhibited deterioration and soiling due to biological growth, gypsum crust build up and lack of routine maintenance. After small tests were completed in March of 2016 Kärcher teamed up with Green-Wood to complete all the cleanings in May of 2016. The cleanings took approximately seven days. The steam machine was originally formulated to clean large engines and other industrial components, however its gentle pressure and lack of chemicals makes it a unique conservation tool. Green-Wood was able to gain on site knowledge of the steam cleaning methods as well as low pressure abrasive techniques to continue the conservation efforts after Kärcher returned to Germany.

This presentation will follow the Green-Wood restoration team and the Kärcher specialists through the conservation of the three monuments, describe the testing methods, best practices in the field, trouble shooting, and next steps.

49. Smudges, Snakeskins, and Pins, Oh My!

R William Bennett III, Nora Lockshin (See Concurrent General Sessions - Natural History Collections track for abstract)

50. Application of the Sewn Boards Binding for Field Books and Pocket Journals

R. William Bennett III, Nora Lockshin

The Smithsonian National Museum of Natural History, the Smithsonian Institution Archives (SIA), and Smithsonian Institution Libraries have collaborated since 2010 on the Field Book Project, involving cataloging, preservation survey and assessment, conservation treatment, digitization and creation of an innovative crowd-sourced Transcription Center in order to make widely available our vulnerable, unique, scientific manuscript and other archival documentation held in a variety of contexts within our collections and research departments. The physical nature of field books at the Smithsonian varies widely in their size, media, format, and orientation over almost two centuries of scientific record keeping, making for a fascinating overview of structures (commercial and ad-hoc), styles, and secret surprises found in these sometimes intimate journals. Catalogers, collection managers, and volunteers from all over the world have reacted to and realized that these records, besides supporting original location evidence of a natural specimen collected, often hold much more unique contextual content. These include visual observations of color and behavior, hand-drawn maps, and notes on environmental conditions that may fill out missing data in the environmental record. Beyond their original purpose, the authors' entries also reflect humanity via the occasional tasty recipe, remarks upon life in the field, and also bear witness to societal and political changes, the stresses of which sometimes become remarkably poignant through observable changes in handwriting and care taken in writing personal correspondence. This presentation will review guidelines and best practices that SIA has preferred for stabilizing, preparing, and conserving our original field books prior to and after digitization. Key to the core concept of connecting collections, special care is taken to identify and preserve in-situ inclusions (such as the eponymous moulted snakeskin) and other physical evidence that can be further linked to accessioned specimens. While low-tech minimal preservation actions can allow the collections manager to preserve these with a minimum of fuss, at times, the materiality of a field book can interfere with access, or cause great risk to the content, such that disbinding may be considered. Reversing vigorous prior interventions has been an especial challenge, where we advocate for the productive application of the sewn-boards binding as a useful tool in the archive and library conservator's kit as an excellent option for conservation rebinding (see also Natural History Collections Session presentation and related poster #50: Smudges, snakeskins, and pins, oh my!).

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Farris Wahbeh, Benjamin and Irma Weiss Director of Research Resources, Whitney Museum

Christopher Wallace, Artist/Lithographer/Educator

Dr. Marc Walton, Research Professor of Materials Science and (by courtesy) Art History, Senior Scientist, Northwestern University/Art Institute of Chicago

Yunpeng Wang, deputy director of department of modern analysis, Shandong cultural relics protection and restoration center

Xiaozhen Wang, Student, Zhejiang University

David Watkinson, Professor (Conservation)/ Deputy Head of School, School of History, Archaeology and Religion, Cardiff University

Andrew Watt, Armature Maker/Projects Coordinator, National Gallery of Art

Dr. Dean Webster, Professor and Chair of Coatings and Polymeric Materials Department, North Dakota State University

Dr. George Wheeler, Senior Scientist, Highbridge Materials Consulting

Megan Doxsey Whitfield, Andrew W. Mellon Fellow in Object Conservation, National Museum of the American Indian

Paul Whitmore, Director, Aging Diagnostics Laboratory, Yale University Institute for the Preservation of Cultural Heritage

Carola van Wijk, Photographer, Rijksmuseum

Caroline Wilkinson, Director, Liverpool School of Art & Design

Meghan A. Wilson, Preservation Specialist, Library of Congress

Stefanie De Winter, PhD student, University of Leuven

Joan Wright, Bettina Burr Conservator, Asian Conservation, Museum of Fine Arts, Boston

Junping Xu, Director of department of object conservation,

Mamiko Yasuda, Research Associate, Tokyo University of the Arts, Taito-ku, Tokyo, Japan

Nina Shevzov Zebrun, Student, Harvard University, Department of Chemistry and Chemical Biology

Dr. Richard Zettler, Associate Curator-in-Charge of Penn Museum's Near East Section, Penn Museum

Hui Zhang, Associate professor, Department of Applied Chemistry, University of Electronic Science and Technology of China

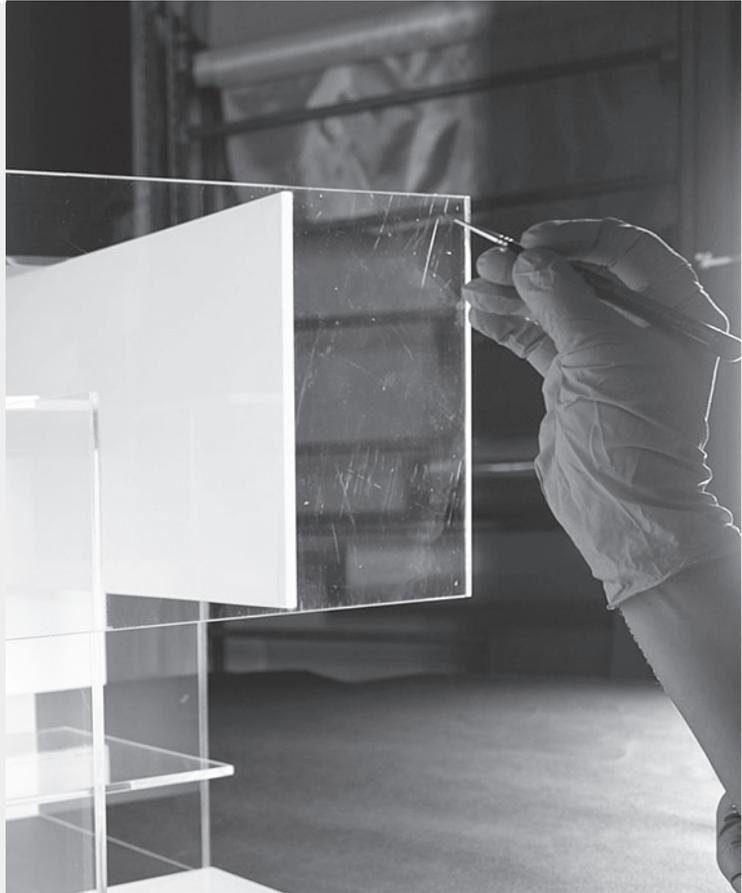
Vanya Zvonar, Student, Harvard University Department of Chemistry and Chemical Biology

NOTES

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Image: Carrying out scratch-filling treatment on Wilderom's *Vrijstaande Constructie K.U.B.1*, 1974 (RCE Collection) consisting of several pieces of white and transparent PMMA sheets glued together. Courtesy: Cultural Heritage Agency of the Netherlands (RCE). Exploring materials and methods to repair plastics is a component of the GCI's Preservation of Plastics project.

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