



American Institute *for* Conservation
of Historic *and* Artistic Works

AIC

42nd Annual Meeting

Conscientious Conservation:
Sustainable Choices
in Collection Care

Abstract Book 2014

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THE AMERICAN INSTITUTE FOR THE CONSERVATION OF HISTORIC & ARTISTIC WORKS

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 (FAIC) supports the preservation of cultural materials through education and research initiatives for conservators and allied professionals. FAIC advocates public appreciation of conservation and the primary role it plays in increasing understanding of our global cultural heritage.

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42ND ANNUAL MEETING

Conscientious Conservation – Sustainable Choices in Collection Care

May 28– May 31, 2014

Hyatt Regency Embarcadero

San Francisco, California

No longer focusing exclusively on treatment, conservation professionals today routinely incorporate preventive measures into the care of cultural heritage. Coupled with the awareness that our work takes place within the larger context of an increasingly interconnected and vulnerable global environment, we have become more dedicated to the issue of sustainability. The new Collections Care Network and the Sustainability Committee combined forces to develop the 2014 meeting program under the theme *Conscientious Conservation: Sustainable Choices in Collection Care*, which will explore how these two concepts are changing the way we practice conservation.

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2014 ANNUAL MEETING

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TABLE OF CONTENTS

<i>42nd Annual Meeting</i>	2
<i>General Sessions</i>	4
Pre-Meeting Discussion Sessions	4
Opening Sessions	5
Closing Session.	8
<i>Concurrent General Sessions</i>	9
Case Studies in Sustainable Collection Care—Track A	9
Engaging Communities in Collection Care—Track B.	13
Exploring Sustainable Preservation Environments—Track C	16
Sustainability in Public Art Conservation—Track D	20
<i>Architecture</i>	21
<i>Book & Paper</i>	27
<i>Collection Care</i>	35
<i>Collection Care & HVAC</i>	38
<i>Electronic Media</i>	42
<i>Health & Safety</i>	49
<i>Objects</i>	52
<i>Paintings</i>	55
<i>Photographic Materials</i>	60
<i>Research & Technical Studies</i>	66
<i>Textiles</i>	71
<i>Wooden Artifacts</i>	77
<i>Joint Sessions:</i> <i>Architecture + Objects</i>	80
<i>Joint Sessions:</i> <i>Objects + Research & Technical Studies</i>	83
<i>Joint Sessions:</i> <i>Paintings + Wooden Artifacts</i>	87
<i>Poster Sessions</i>	91

Pre-Meeting Discussion Sessions

Discussion Session: STASH Flash

Lisa Goldberg, Conservator, Private Practice, and Rachael Perkins Arenstein, Partner, A.M. Art Conservation, LLC

Safe storage for collections is one of the primary goals of preventive care for collecting institutions, and individuals charged with collections care and cultural institutions often face challenges in designing storage and support systems for individual items or collections. Collecting institutions report damage from handling and improper storage or enclosures as significant preservation problems, supported by the Heritage Health Index finding that only 11% of all institutions had adequate storage facilities. There are few established venues for sharing information about the fabrication of supports, containers or systems that provide options for storage and support solutions.

A successful storage solution is the result of numerous choices regarding materials, techniques, time and skill. STASH (Storage Techniques for Art, Science and History collections), a new web-based resource housed on CoOL, sponsored by FAIC and funded by the Samuel H. Kress Foundation, is based on the understanding that the best ideas for safe and sustainable storage and support come from collaborative solutions. This project was precipitated by the need to find a new way to disseminate the older but highly valuable text, *Storage of Natural History Collections: Ideas and Practical Solutions*, originally published by the Society for the Preservation of Natural History Collections (SPNHC), and is designed to gather, organize and solicit new storage ideas. AIC's 42nd Annual Meeting on sustainable choices in collections care provides a forum for continued discussion about these topics.

The session will utilize a lightning round or "Tips" session format as well as guided, audience participatory discussion. Carefully selected short presentations will be given in a format that closely aligns with website entries. These will be followed by small group discussions where individuals from different specialties have the opportunity to talk about the presentations, modifications, materials choice as well as creative ways to carry out these projects. The objective is to help make these solutions more sustainable by evaluating project organization, materials and construction. Members of AIC have experience with a wide range of collections, collectors and institutions, and combining short presentations with shared discussion about storage solution projects within the context of the STASH website will provide the attendees with the opportunity to truly engage in the kind of interdisciplinary conversation that often results in sustainable and conscientious choices.

During this session, participants will have the opportunity to share new solutions, ideas and materials and to develop sustainable and more effective solutions to collections care. The website project is interdisciplinary; the editorial board is composed of representatives from a wide range of allied organizations, and this session will span the range of specialty groups within AIC.

A Socratic Dialogue: 'Energy and Sustainability – At What Cost?'

Dr. W. (Bill) Wei, Senior Conservation Scientist, Rijksdienst voor het Cultureel Erfgoed

The term "sustainability" is the theme of the AIC annual meeting 2014 in San Francisco. Sustainability can have a number of different meanings depending on the context in which it is used. It can refer to energy and cost savings, the "green" museum or "green" conservation, the use and disposal of environmentally friendly conservation materials and chemicals, and even the ultimate meaning of conservation and preservation themselves, that is, extending the life of objects themselves. However, at the annual business meeting in 2013 the word sustainability immediately unleashed a brief but intense discussion on standards for indoor climates in museums, this related to making climate requirements less stringent and thus to reduce energy costs. This should not come as a surprise, as the idea of loosening indoor climate requirements for indoor collections has been a controversial issue for years. The controversy revolves around a number of issues including:

- the desire to cut costs in museums by loosening stringent indoor climate requirements/standards which require expensive HVAC systems
- what the new requirements/standards should be
- what effect these new standards would be on a (partial) collection or specific type of object
- what is the value of efforts and methods to save energy costs for museums and indoor collections, and at what cost?
- is loosening indoor climate requirements bad for a collection?
- what do we mean with the word sustainability?
- what is the value of sustainability and at what cost?

It is proposed that this discussion be held in the form of a so-called Socratic dialogue. This is a structured form of dialogue in which all participants actively contribute. The purpose of the dialogue is not to solve the question at hand, that is, specifically define what sustainability is and what it costs, but to investigate each other's experience and opinions related to sustainability, and to try to determine the essence behind the word. What is it that conservators, conservation scientists, and other cultural heritage professionals are concerned about when they discuss indoor climate requirements, and why is it so controversial? What is the essence of the word "sustainability" in that context? The Socratic dialogue will help the participants understand what is behind the this discussion revolving around energy, sustainability and museum/storage climate, and understand their own points of view as well as those of others.

This Socratic dialogue is the second in a continuing series. It follows up the dialogue on value held at the 2013 annual meeting. The concept of "value" also lies behind the sustainability/energy issue, making the proposed dialogue an ideal follow-up to last year's dialogue. The response to last year's dialogue was quite

positive. The participants were happy that they could openly discuss issues surrounding restoration decisions made in restoration without aggression. One participant summed it up in her essence: “I leave better able to articulate the societal importance of what we do and secure in the knowledge that others grapple with the same issues.”

Opening Sessions

The Long and Winding Road... Effective Advocacy, Fundraising, Networking, & Collaboration: Promoting Sustained Preventive Conservation Globally

Debra Hess Norris, Chair and Professor of Art Conservation and Photographic Conservator, University of Delaware

The preservation of collections connects humanity across an increasingly intersected and confronted global society. As nations struggle with catastrophic natural disasters, warfare, economic collapse, and other crises, the need to preserve our world's tangible and intangible heritage is heightened.

This presentation will share lessons learned from a series of photographic preservation projects organized in collaboration with organizations, agencies, and individuals across the Middle East and in Africa, Latin America, Europe and Asia, (some documented at <http://goo.gl/maps/UL5S7>). In doing so, conclusions will be shared from preservation activities associated with the Middle East Photograph Preservation Initiative (1996 – 2014), the Iraqi Institute for the Conservation of Antiquities and Heritage (2008 – today), and photograph preventive conservation training in underserved regions of the world, including Sub-Saharan Africa (to start March 2014 in Benin), Columbia, Peru, and India. Recommendations will also be gathered via in-depth consultation with leading conservation professionals who have developed and managed global collections care projects outside of photographic materials.

While assessment, education, and research are essential to care for global cultural heritage, final success will ultimately be determined by our collective interpersonal, communication, advocacy, engagement, and fundraising skills. As conservation professionals we have the responsibility to engage with allied professionals, decision makers and the public, and to serve as global ambassadors.

Conservation professionals leading global collection care projects should connect preservation initiatives to reconciliation, energy, environment and economic development, collaborate with established regional partners and not operate in isolation, build visibility through marketing and social media, establish short-and long-term implementation plans, communicate repeatedly and effectively; promote respect, harness passion and creativity, and take risks. Effective collaborative partnerships and external funding are essential. We must use emerging

technologies, train trainers, engage communities, build public awareness, promote shared decision making, and cost-effective preventive care solutions. Poor communication and limited accountability will deter progress. Funding proposals should be well integrated and project monies – secured via effective advocacy and networking from individuals, foundations, corporations, and government agencies – must be invested wisely to ensure sustainability.

Concrete preventive conservation measures – with a focus on education and training – are essential to protect collections that are facing limited preservation resources worldwide. By sharing on-the-ground observations and recommendations, this presentation aims to advance collaborative strategic preventive conservation projects and inspire change.

Social Participation as a Way for Sustainable Projects in Conservation of Worshiping Objects: The Case of Current Mayan Communities in Yucatán, Mexico

Giovana Jaspersen, Conservation and Restoration Coordinator, Instituto Nacional de Antropología e Historia (INAH)/National Institute of Anthropology and History, Merida, Mexico

The paper tackles the experiences of the participative restoration-conservation projects which have been launched to deal with symbolic religious objects in rural populations of Yucatán, Mexico, mostly Mayan-speaking communities. It is posited that, in sociocultural contexts like these, it is impossible to do preventive conservation without handling the situation from a people-oriented perspective. Thus, besides material treatment, symbolic value and social function have to be taken into account, since this is the way to get the society to take charge of future conservation. Since this is the way to get the society to take charge of future conservation, and attain true short and long term sustainability.

Under this work perspective the questions are: How to preserve objects that are used daily and that are valued as symbols and not as matter? How to preserve the matter without prohibitive positions about the use and social function of the objects? How to mediate in the different visions on cultural heritage? How to generate changes that ensure the restored objects would not return to its original condition once the restorers leave the project? How to promote inherited self-management processes in the communities orientated to the future conservation of the objects? How to help without invading or to alter a socio-cultural reality to which we do not belong?

These questions were used in the project as guide to the implemented actions. For example, talks of heritage matter and conservation; talks about the sculptures as a material objects, workshops of training in preventive conservation and risks reduction; community bilingual theatre directed to the understanding of heritage and conservation; assistance and accompaniment in festivities, processions and heritage management

processes; generation of bilingual leaflets on conservation and risk reduction; inclusion of children and students in the project trying to develop a new vision on conservation to the future; etc.

Through the review of these social participation actions, and its results, the paper proposes to promote and understand conservation as a socio-cultural intervention that should turn into a space for mediation. Such mediation should look for sustainable and lasting projects that go further than temporary initiatives of local heritage conservation. This, to achieve that the heritage conservation is a shared work and that all the involved actors understand the responsibility that it implies.

Sustainable Collections Care on a Budget – A New Museum Store for Bolton, UK

Pierrette Squires, Conservator, Bolton Library and Museum Service

The need for a new collections store presented an opportunity to embed sustainability both environmental and economic further into Bolton's museum practise.

The brief was to build a store, increasing access to over 40,000 objects, on a budget of well under £1 million (under \$1.5M). This limited budget covered the entire build, fit out, some additional staff costs and object moves, all to be achieved in less than 2 years.

This paper presents the processes, technologies and ethos used to achieve the brief, whilst improving collections care for every object. Sustainable measures included extensive insulation, re-use of old storage furniture, zoning collections within the building and installation of solar panels. The project is an example of combining modern high tech with low-tech solutions. With no funds in the new store budget identified for sustainable features they would need to be solutions that added no cost to the build. Revenue budgets of the service also had to be considered, with further local authority savings on the horizon ideally the new store needed to cost less to run than the old one.

Bolton Library & Museum Service has a wide variety of collections. Textiles and textile machinery from Bolton's industrial history as a cotton town form a large part of the items housed at the new store. Other collections now held at the store include: Social History, Archives, Egyptology, Ethnography, Geology, Spirit Preserved items, and Decorative Art. This range of objects and material types with weights varying from 10 tons to less than a gram presented a number of interesting collections care challenges.

The new store is seen as hugely positive for Bolton Museum. In a time of recession and depression the Store move has boosted morale, achieved and exceeded all of its goals.

The Chadwick Resource Centre is now viewed as an excellent example of sustainable development. Lessons have been learnt which will be taken forwards in future Bolton Council projects and importantly for Bolton Museum other museums are now looking to us as leaders in sustainable collections care.

Being a Gallery in a Park – Balancing Sustainability, Access and Collection Care

Nicola Walker, Head of Collection Care & Access, Whitworth Art Gallery, University of Manchester; Ann French, Textile Conservator and Collection Care Manager, Whitworth Art Gallery, University of Manchester, UK

The Whitworth Art Gallery, University of Manchester, founded in 1889 is home to nationally designated collections of water-colors, prints, wallpapers and textiles, and has an active collecting policy for contemporary works. It is currently undergoing a capital building development that includes a new extension and a refurbishment of elements of an historic building, increasing its footprint by 30%. As part of the University of Manchester, the Gallery is required by its funding bodies and the Heritage Lottery Fund who have provided the majority of our project funding to meet high energy efficiency and carbon reduction targets. This requirement underpinned a sustainable brief to the architects and accompanying design team that demanded a 10% overall reduction in carbon emissions, energy saving strategies, the introduction of green technologies, and a commitment to achieve an 'Excellent' rating in the UK construction industry sustainable assessment tool, BREEAM. Additionally, it provided institutional motivation to build on existing practices and further embed sustainability within all aspects of Gallery operations.

The paper will focus on four specific areas:

- Re-assessment of temperature and relative humidity parameters for the storage and display of the collections
- A new approach to lighting control and the management of increased daylight into gallery spaces
- Use of modular re-usable display systems and local control of the recycling of materials
- Management of biodiversity, corporate and educational events together with integrated pest management

The first two areas are a result of capital investment coinciding with concern for environmental targets, and providing an opportunity for collection care staff to work alongside a design team to understand and respond to the challenges inherent within the existing building, and to the collection care needs of the objects housed within it. The paper will describe a move away from expensive and unsustainable air conditioning (HVAC) systems to a passive environmental approach by reintroducing natural ventilation, installing earth tubes and ground source heat pumps, making use of the thermal properties of the building envelope and operating conservation heating.

The third area describes a long-standing ability by conservation and technical staff to make creative use of display equipment, previously driven by financial constraints, but now established as a routine reaction to green concerns. This includes the re-use of Panelock exhibition screens and picture display frames, the design and manufacture of a modular mounting system for the display of textiles, multifunctional use of all display equipment, careful waste management practices and the recycling of storage and exhibition equipment to other

local cultural organizations via professional networks.

Fourth, with the Gallery located within a parkland setting, and incorporating both a green and a bio-diverse roof, as well as hosting a wide variety of events and activities (inside and outside), conservation staff find themselves treading a fine line between engaging with green initiatives, continuing to provide access to the collections to increasingly diverse audiences, while maintaining Integrated Pest Management procedures.

Throughout all these various strands, the gallery aspires to a triple bottom line approach, adding economic and environmental factors to finding a workable and sustainable balance between access and collection care. This paper will examine and evaluate the methodologies developed and successfully applied.

Precaution, Proof, and Pragmatism: 150 Years of Expert Debate on the Museum Environment

Foeke Boersma, Senior Project Specialist, Getty Conservation Institute; James Druzik, Senior Scientist, Getty Conservation Institute; Kathleen Dardes, Head, Education, Getty Conservation Institute

This presentation will open with a brief historical overview of how the concept of the “museum environment” has been understood, debated and ultimately absorbed into professional practice since the late 19th century when it was first recognized as a significant factor in the preservation of collections. The authors will review the milestone moments of technical research and experience and will examine in particular the power of expert voices—of conservators, facility managers, engineers, directors—to shape and alter the debate about the museum environment.

The main focus of the presentation will be the radical shift that has occurred in recent years not only in the nature of the debate on the museum environment, but who has instigated it. Seeking universally-accepted guidelines to facilitate loans while also meeting sustainability targets, museum directors have challenged long-held environmental norms espoused by the conservation community. The shift in the debate has placed the burden of proof on the defenders of stringent environmental targets, rather than on those committed to meeting sustainability targets.

This challenge has seen a range of responses from the conservation field internationally. Several professional bodies representing conservators at the national level have launched discussions and taken positions. However, in some areas of the profession there remains a distinct sense of uneasiness and emotion on the matter of new environmental parameters, which some see as having implications both for the safety of objects and for the integrity of the profession. For this reason, the conservation field has seen the environmental debate shift inward. But where are the main voices in this debate, and what are they saying?

The authors will look at how the field internationally is currently dividing itself on this issue and why—and how—experience, perceptions, and uncertainty appear to influence and entrench positions. They will describe the three distinct positions

on the “museum environment” that have emerged, each reflecting a different view of risk: precautionary safety; proven safety; and pragmatic risk management.

Absent irrefutable scientific evidence that would justify change, proponents of the precautionary safety stance adhere to the narrowly defined set of environmental parameters which the museum field has followed for decades, seeing it as the only confirmed path to unconditional safety.

The proven safety stance argues that the conditions actually maintained by institutions have often ranged outside a narrowly defined climatic band, with very few instances of noticeable damage; these de facto conditions are therefore apparently safe.

The pragmatic risk management stance argues that the preservation goal is the minimization of loss due to many causes, and that for each cause, such as an incorrect climate, the decision-maker needs to know the quantitative interrelation between the intensity of the hazard (climate fluctuations), the damage caused (cracks), and the cost of controlling the hazard (financial, environmental, social). Although the proven safety stance can find a place within this perspective, pragmatic risk management actually goes further, recommending that resources go to reduction of the biggest risks, which may in fact not be climate fluctuations.

The authors will expand upon these positions and ask their colleagues to consider their viability in light of current challenges, including the desire for more sustainable practices and for the profession to speak forcefully, but with consensus, on a fundamental area of its responsibility.

A LEED Primer for Conservators: Or, What Should I Do When the Architect Proposes Daylight in our New Galleries?

Scott Raphael Schiamberg, Associate Principal, Perkins Eastman Architects; Rachael Perkins Arenstein, Partner, A.M. Art Conservation, LLC, and Conservator, Bible Lands Museum Jerusalem

LEED (Leadership in Energy & Environmental Design) is a program managed by the U.S. Green Building Council (USGBC) is the primary program that guides the design, construction and operation of high-performance green buildings. The LEED program and the Green Building Certification Institute “provide third-party verification of green buildings. Building projects satisfy prerequisites and earn points to achieve different levels of certification.” LEED certification is increasingly sought by museums undergoing renovation or new construction for the environmental benefits it brings as well as the cache it lends. LEED design goals are used as tools for fundraising and certified ratings are trumpeted in post-opening press releases. At a time when conservators worldwide grapple with reevaluating environmental control guidelines and other elements of the exhibit and storage environment, LEED guided museum projects add additional complexity to the equation of how to create and manage suitable environmental and lighting environments. As museums seek to improve their record on

sustainability, it behooves conservators to understand how to work with the system. An overview of the alternate programs to LEED will also be given to familiarize conservators with the differences.

Working with a project architect to achieve platinum, gold, or silver certification shouldn't feel like an Olympic medal event. This paper will present an overview of the prerequisites and credit systems for the LEED programs most relevant to museums, and will highlight areas which have become points of contention on museum projects. With a better understanding of the program's vocabulary, goals and methods, conservators will be better prepared to discuss with colleagues, administrators and architects the implications of various "green" choices for the long-term care of museum collections.

Quantifying Cost Effectiveness of Risk Treatment Options (aka Preventive Conservation)

Stefan Michalski, Senior Conservation Scientist, Canadian Conservation Institute; Irene F. Karsten, Preservation Development Advisor, Canadian Conservation Institute

The Canadian Conservation Institute has developed a risk assessment method during the last 10 years in collaboration with ICCROM and the national conservation agency of the Netherlands (formerly ICN, now RCE). It is called the "ABC method" after the three components used to calculate risk. A: frequency of events or rate of the process, B: % loss of value to affected objects, C: % of collection value represented by the affected objects. In the last four years, we have done comprehensive risk assessments of various types of heritage institutions in Canada in order to discover what patterns of risk emerge for each type of institution. These patterns will guide our future advice to museums, as well as guide our institute's research.

Our reports make recommendations for risk reduction. One to five options are identified for each risk. Remaining risk for an option is determined by analyzing the risk as if the option has been implemented. The risk reduction for that option is therefore the original risk minus the remaining risk. For each option, initial capital cost and annual maintenance cost are estimated. Initial cost is spread over the time horizon chosen for the institution (default 30 years). Cost-effectiveness is calculated as risk reduction divided by the cost. On average, for a single institution, we have analyzed about 30 risks and 60 options.

Within the three pillars of sustainability—environmental, economic, social/cultural, in business terms the so-called triple bottom line—we have at this point quantified measures to inform the economic indicator (option costs), the social/cultural indicator (risk reduction), and their interrelation (cost-effectiveness).

In the analysis done for a historic house with furniture and objects on permanent display, the method established that the overall risk to collection plus building due to incorrect relative

humidity was lowest if the already minimal winter RH control was only slightly modified. This option was also low in capital and ongoing energy costs. In the analysis done for a large archive, the method allowed us to quantify the benefits of an expensive option (a new facility) that reduced many current risks, and to compare that option to ongoing digitization as a preservation strategy.

We are currently considering how environmental issues can be added in a similarly quantitative manner to the evaluation of options. Already, one is inundated with "green" marketing when researching actual building or hardware options for clients. It is also common for clients to be asking us about "green" options being promoted by their consultants and any layer of government that provides funding, e.g., special grants for switching to LED lighting, but none of this is systematic or quantified. LEED scoring is a check-list rather than a quantified accounting, and at present applies only to new construction. The obvious parameter to consider is carbon footprint, and one of our new staff (S. Lambert) brings experience with this approach.

Closing Session

The 2014 Great Debate at AIC

Moderated by: Richard McCoy, Principal, Richard McCoy & Associates

Building on the rousing success of the 2012 and 2013 Great Debates at AIC, this year's Great Debate will again feature up-and-coming and leading conservators competing in an Oxford-Style Debate format. Back to back debate sessions will be moderated by Richard McCoy.

The Great Debate at AIC will consist of two debate sessions, each with purposely difficult and controversial topics. Members of the two teams are selected from AIC membership; each team's goal will be to win the debate, not necessarily to defend their personal stance on a topic.

Topic rookies will debate: *The most important aspect of conservation practice is no longer the treatment of cultural property.* Rookies Team 1 (Pro) includes Alexandra Nichols, Marie-Lou Beauchamp, and Jena Hirschbein; Rookies Team 2 (Con) includes Tom McClintock, Tessa Thomas, and Kari S. Rayner.

Topic veterans will debate: *AIC is successfully promoting the advancement of recently-graduated conservators in today's work force.* Veterans Team 1 (Pro) includes Thomas M. Edmondson, Paul Himmelstein, and John Burke; Veterans Team 2 (Con) includes Margaret Holben Ellis, Rick Kerschner, and Joyce Stoner.

CONCURRENT GENERAL SESSIONS

Four Tracks on Sustainability

- Track A: Case Studies in Sustainable Collection Care
- Track B: Engaging Communities in Collection Care
- Track C: Exploring Sustainable Preservation Environments
- Track D: Sustainability in Public Art Conservation

Case Studies in Sustainable Collection Care—Track A

Moderators: Mary Elizabeth (Betsy) Haude, Senior Paper Conservator, Library of Congress; Sarah Nunberg, Conservator, The Objects Conservation Studio, LLC

Preserving The Future

Kasey Lee, Conservation Manager, Royal British Columbia Museum; Pamela Lowings, Head of Property Management & Site Development, Royal British Columbia Museum

The Royal British Columbia Museum (RBCM) has been demonstrating leadership in sustainability for decades through research, innovation, community outreach and partnerships, and concrete initiatives that result in reductions in greenhouse gas emissions and prudent use of resources.

Museum staff members have not only embraced sustainable initiatives, but many are passionate about them. Employees commute by alternative forms of transportation. Bicycle racks and a tire pump are available in the loading dock area, as well as change rooms with showers. There are transit pass discounts for employees. Webinars and web chats have replaced many long distance meetings that would have required travel, reducing the carbon footprint.

Facilities upgrades and modifications have included large scale projects such as the installation of new energy-efficient HVAC systems and lighting retrofits, to almost unnoticeable changes such as motion sensor lights and green-certified hand washing products. Widespread recycling and even composting is routine and there are now solar-powered trash compactors on the grounds. From drought-resistant landscaping to recycled paper and building products, sustainable initiatives have grown in number and popularity. A popular feature in the lobby area is a dashboard flat screen that displays the institution's real time energy consumption.

Sustainable collections care has been a challenge. Storing, transporting and displaying collections often use a great deal of non-biodegradable materials that must be discarded when soiled. Still, foam and board recycling is now common. The collections development plan is revisited every year to identify individual objects or even entire sub-collections that are not core to the Museum collecting mandate, are duplicates or are in such poor condition that they serve no purpose. For these and other reasons, deaccessioning can have a positive impact. Likewise, more consideration is given to new acquisitions, taking into

account the time and resources that each accession will cost the institution and the environment. Delivery of loans and materials are synchronized as much as possible to reduce road trips.

Revisiting temperature and relative humidity requirements for specific collections has begun with increased communications between conservation and facilities management staff, resulting in efficiencies and ideas for re-organizing collections storage. Implementation of cold storage for deteriorating archival collections greatly prolongs the life of these media, but at the same time substantially increases the Museum's carbon footprint. To offset this, individual, older energy consuming freezers are being decommissioned and selective retention employed to ensure that only preservation copies are given the Cadillac treatment. Meanwhile, a new digitization office has been established to begin the process of replacing some media that cannot be saved even by low temperatures. Similarly, digitized conservation and collections management documentation, as well as a new digital image repository have significantly reduced demand for paper supplies.

The future of the Royal BC Museum presents even more opportunities for sustainable choices. A Master Plan for the redevelopment of the buildings was released in August 2013. Through dialogue and formal planning sessions, opportunities for on-site power generation, green roofs, grey water recycling, and so on were identified and will become reality as the architectural plans develop. Conservators and collection managers now have an unparalleled opportunity to rethink the equipment and supplies they use, as well as the physical environment in which they work and keep the collections, to further implement sustainable preservation.

As a human and natural history museum, with experts in the areas of climate change and sustainability, it is incumbent upon the Royal BC Museum to be a leader in adopting sustainable programs and facilities, as well as reaching out to the broader community to influence our colleagues and visitors.

Becoming 'Fit for Purpose': A Sustainable and Viable Conservation Department at the British Library

Dr. Cordelia Rogerson, Head of Conservation, British Library

The majority of museums, libraries and archives in the UK are heavily dependent on government funding. The British Library (BL) with a vast and varied collection, numbering 150 million items, is no exception. Funding cuts as a result of the current economic situation has led to reduced resources and capacity and an increasing emphasis on public accountability and efficiency. Whilst resources are being reduced, however, demand for Conservation services at the BL is simultaneously increasing due to digitisation programmes. The Conservation department at the British Library needed to find a solution to sustain impact for treatment of its core collections and to maintain 6 concurrent work streams that contribute to the strategic priorities of the BL.

This paper will explain the approach developed and evaluate the success of the project through statistics of items treated and feedback from BL conservators and curators.

The first step was to go back to basics asking the following:

- Why are the objects being conserved?
- How do they need to function?
- What treatment work is required to enable this?
- Can we do less treatment and still enable the object to function?

An accessible immediate approach was agreed as the best course. Thus the expression 'fit for purpose' was devised to denote that Conservation will only treat what is absolutely necessary. All treatments would be re-evaluated and condensed, or not undertaken.

The reassessment of 7 large existing conservation projects using the 'fit for purpose' approach reduced treatment hours by 3858.5 hours. The equivalent of 2.9 full time conservator posts, which could be reassigned to other projects.

Additionally, new and more meaningful Key Performance Indicators were devised to measure improvement. These KPIs have the added benefit of sustaining the initial emphasis throughout the financial year, acting as a point of focus.

The number of completed quick turnaround treatments has increased by 500% in one year. Recorded statistics show 850 quick treatments completed (with an average 6 hrs treatment) compared with 165 items completed for the previous year. Further evidence of the impact of the approach will be given.

The outcomes of the project go beyond quantitative measures, although these are readily communicated to justify the remaining resources for conservation. In qualitative terms less interventive treatment can arguably be better for the collection. Undertaking more extensive treatments leading to unintentional loss of potential significance had always been a risk and an historic reality. The paper will argue that the concept of retreatability becomes more relevant and can enable more interpretations in the future. Moreover, this disciplined approach determines fewer solvents, detergents and additives are being used. Feedback from curators is generally positive and more sophisticated discussion of significance and value has been generated between conservation and curatorial areas. Conservators are more aware of why items are being preserved and the level of conservation required achieving this.

Securing the Future of Collections in Zimbabwe's National Museums through Preventive Conservation: The Case of Zimbabwe Military Museum

Davison Chiwara, Assistant Lecturer, Midlands State University, Department of Archaeology, Cultural Heritage and Museum Studies

The overall aim of the paper was to establish sound preventive conservation practices to ensure the protection of the collections for posterity.

The objectives of the paper were:

- To examine the museum's policy on preventive conservation
- To assess the storage of collections in store rooms
- To assess the museum's regulation of micro-environmental conditions in store rooms
- To assess the museum's housekeeping practices in store rooms

Data collection instruments used included desktop survey, interviews and observations. The results of the study indicated that the museum has no policy that addresses issues of preventive conservation. Rather it has a draft paper on collections management prepared by its parent organization, the National Museums and Monuments of Zimbabwe (NMMZ) which is yet to be adopted as a policy. However, the draft paper is not clear on how issues of preventive conservation should be addressed. Additionally, the storage conditions are poor as evidenced by makeshift storage structures used in housing the collections. Besides that, micro-environmental conditions within storage areas are not regulated and the problem has been worsened by poor housekeeping practises which saw most collections on shelves affected by dust and pests. It was recommended that the museum should invest in preventive conservation efforts to secure the future of its collections. This is particularly important as there is no a qualified conservator at the museum to carry out remedial conservation on deteriorating collections. Moreover, preventive conservation is cheaper in the long run compared to remedial conservation which requires the services of qualified conservators which the museum lacks. Another recommendation given to the museum was that it should institutionalize preventive conservation by making it part and parcel of the job description of museum staff. This will act as a constant reminder to museum staff about the need to be proactive on preventive conservation thereby ensuring best practices in collections care. Finally, it was also recommended that the museum should formulate a policy on preventive conservation which gives guidelines and standards on issues of preventive conservation thereby leading to a prolonged life span of collections.

Case Study: Implementing a Research-Driven, Sustainable, Preventive Conservation Solution Developed during an Extended Grant-Funded Project

Ralph Wiegandt, Project Conservator, George Eastman House International Museum of Photography & Film; Dr. Nicholas Bigelow, Professor of Physics and Astronomy, University of Rochester

George Eastman House International Museum of Photography & Film is implementing a sustainable preventive conservation solution based on real-time emergent scientific research that portends to dramatically redress an intractable conservation and preservation challenge. This paper specifically charts the

progression of a Save America's Treasures award (NEA-2008) to rehouse its endangered collection of 1,250 daguerreotypes made by the Boston partnership of Southworth & Hawes. Considered to be masters of this first photographic medium, the Museum's Southworth & Hawes collection is the largest holding from a single daguerreotype maker in the world. The grant was straightforward: to survey and photo-document the collection; fabricate 2008 best practices plate packages; place them in high quality cabinetry; and install them in a newly constructed vault with climate control and filtration systems to maintain low relative humidity and ultra-filtered air.

The project has changed dramatically since 2008. The Museum continues to pursue the essential goal of the grant: to provide the best possible preservation conditions for the Southworth & Hawes daguerreotypes. As it turns out, the best possible preservation conditions for the daguerreotype is an inert gas environment. Concurrent scientific research by the Museum, in conjunction with the University of Rochester through an NSF-SCIART award that began in 2010, has conclusively revealed that daguerreotypes are subject to nano-level deterioration, often biological in origin that progresses in a standard air environment, no matter how filtered or well controlled. Considering these results and the sub-standard conditions that were compromising the collection, the Save America's Treasures grant was challenged, mid-stream, to respond to these emerging research results, and responsibly consider the benefits—if not the necessity—of an oxygen and moisture free environment for this project. This research spurred the Museum to innovate a low cost argon charged item-level enclosure system. The specifications include: inert materials throughout; construction design for long-term argon retention; functional ease for access to the interior and safe placement of the daguerreotype; full visibility of the daguerreotype—front and back; an aesthetic appropriate for research and access in an archive setting; durability for handling and access; an external monitoring system to ensure argon retention; and an efficient purging and argon charging design, or re-charging, when deemed necessary by the monitoring data.

The details of this innovation are significant, but the theme of this paper is on the dynamics of adjusting course within a project, within an institution, and the challenge of incorporating emergent research into new sustainable preventive conservation solutions that are without precedent at this scale. Not only is this case-study appropriate to sustainability (ideal environment, economics, and no additional energy demands), but its reach may help embolden our profession to make decisive assessments and adopt new standards and modalities—and especially consensus—in treatments and preservation strategies accordingly. Conservation, in our profession, semantically invokes both conserve and conservative. As demands for sustainable conservation practices increase, we must not let reflexive conservative thinking hinder rapid translation from innovation to adoptable practice. This requires a new paradigm for the field.

Solvents, Scents and Sensibility: Sequestering and Minimizing

Chris Stavroudis, Paintings Conservator, Private Practice

New and modified cleaning systems can sometimes replace traditional solvent cleaning. A number of such systems will be presented and discussed.

The simplest approach to minimizing solvent use in testing is to simply mix very small amounts of solvents very precisely to minimize waste and exposure. The discussion will progress to introducing or re-familiarizing conservators with lesser known and less used solvents that are safer for us and the environment.

A number of very toxic solvents are present as contaminants in many of the solvents we use. These can be present either deliberately, as in the case of denatured alcohol, or as a consequence of the difficulty of separating very similar materials as in the case of ethylbenzene in xylenes.

More sophisticated approaches to cleaning systems will be presented. By modifying water we can occasionally create a cleaning system that can replace a solvent. More often, a hybrid system combining water and solvents in an emulsion can solve a cleaning problem, minimize the amount and exposure to the solvents and often allow safer solvents to be used with the same or better results.

Specifically, oil in water emulsions based on Pemulen TR-2, and water in oil systems like Velvesil and silicone-based micro-emulsions, all introduced to conservation by Richard Wolbers, will be presented and discussed.

These systems are hybrid and while they expose us and the environment to much less solvent, disposal of these systems requires more planning and care. As emulsions contain solvent, they cannot be discharged down the sewer. As they contain water, they should not be put into conventional solvent waste containers. Solvent waste is traditionally stored or disposed of in steel drums. The presence of water in solvent waste must be avoided to prevent corroding of the storage container.

Boxes Inside of Boxes: Preventative Conservation Practices

Robin P. Croskery Howard, Objects Conservator, Ah-Tah-Thi-Ki Museum

Chemical treatments are an inevitable part of conservation practices. However, stabilization of an object is also achieved through other methods. By making the conscientious choice to pursue these avenues, conservators have the ability to protect cultural heritage as well as the environment. Preventative conservation often involves creative and critical thinking about an assemblage or individual object. Climate control and *in situ* conservation are two of the best known examples. Custom housing used on a daily basis is not always considered a part of preventative conservation, rather as a means of

storage. This paper will explore the use of custom housing at the Ah-Tah-Thi-Ki Museum as an avenue of preventative conservation in concert with climate control.

The Role of LED Lighting in an Energy-Efficient Museum

Eric Hagan, Conservation Scientist, Canadian Conservation Institute

Solid-state lighting (SSL) has quickly evolved over the past decade into a competitive alternative to conventional incandescent lamps, by providing comparable lumen output at higher efficiency. In addition, life cycle assessments (LCA) performed by independent sources, manufacturers, and the U.S. Department of Energy indicate that the total environmental impact of LED bulbs from manufacture to recycling after end-use is significantly lower. Energy use over the life-cycle of an LED is estimated at 3–4 times less than that of an equivalent number of halogen bulbs, and currently similar to compact fluorescent (CFL). The energy savings and reduced overall toxicity offered by SSL technology is extremely attractive for a socially conscious museum striving to minimise environmental impact, while caring for their collection. Reducing energy consumption is also necessary for institutions aiming for LEED (Leadership in Energy and Environmental Design) certification through new building construction or retrofit projects. In addition to focusing on energy savings, it is important to carefully compare the performance specifications given by manufacturers with the strict lighting requirements in a museum environment.

The need for high colour quality in museums and galleries inhibited the early adoption of LED bulbs; however, products have recently emerged with visible spectra that closely match incandescent lamps without emitting ultra-violet or infrared energy. The combination of exceptional light quality, lower electrical load, and recent incentives to curb energy consumption has made the transition to LED lighting a benefit for many institutions. For others, the switch to SSL technology has been less rewarding due to the high capital cost and lower than expected performance observed for some products: rapidly diminishing intensity, colour shift, flickering, and general hardware incompatibilities. Many of these negative qualities are avoidable through careful product selection, and proper implementation of SSL; however, the true long-term performance of even the best LED bulbs remains uncertain. The longevity of LEDs will become clearer in the following years as institutions begin to observe lamp performance over a time-scale longer than that currently used for bulb life predictions.

A review of the current state of LED lighting is provided in the context of the needs and expectations of museums. Specifications related to colour quality, light intensity and lamp life, are discussed with respect to manufacturer warranties and third party testing.

Fountains, Art, Design, Preservation and Sustainability

Kathleen M. Garland, Senior Conservator, Objects, The Nelson-Atkins Museum of Art

Fountains are popular and engaging forms of civic architecture, reflecting a desire to celebrate community, as well as an urge for beauty, imagination and creativity in our lives. Fountains are also expensive, and the costs can escalate when a sculpture or other artwork is added to the water feature. Water usage, wastage, pool chemicals, and the maintenance of these water features as art raise concerns about diminishing natural resources. Ultimately inspirational design goals need to be balanced with the ability to preserve and sustain our environment. This paper will address evolving approaches to maintenance, sustainability and design implications for four very different water features at the Nelson-Atkins Museum of Art.

The museum, located in Kansas City, Missouri, which proudly calls itself the City of Fountains, has three indoor fountains and one outdoor fountain, all with accessioned art placed in a purpose-built structure. The oldest piece is a seven-foot diameter Roman marble Fountain Basin, 220 C.E. (31-98). It stands in a working fountain designed in 1932 and is located in a former outdoor courtyard that now serves as a restaurant. While the ancient basin has received conservation treatments over the years, the museum maintenance department cleans the fountain. The circulating water tank is fed from the city water without additional water treatments, and interestingly, this fountain requires relatively little maintenance. A bronze fountain sculpture by Harriet Whitney Frishmuth, *Joy of the Waters*, ca. 1911, cast after 1945 (F96-38/1) was installed in a modern stone and terrazzo pool, with a distilled water tank providing the re-circulated water. This fountain is also in the care of the maintenance department, though the conservation department advised in the construction of the fountain and looks after the sculpture. The museum's most complex fountains include the indoor sculpture by Isamu Noguchi, *Fountain*, 1987 (F99-33/72 A,B) and the large exterior reflecting pool with *One Sun / 34 Moons*, 2002 (2002.6), a collaboration between artist Walter De Maria and architect Stephen Holl. These two artworks were installed as part of a new addition to the museum in 2007, and a co-operative approach to planning allowed for considerable conservation input regarding mechanical design and preservation issues. The Noguchi sculpture is maintained with distilled water, chemicals, UVC lamps, filtration and elbow grease, while the De Maria's water depends on filtration, some chemicals and pool sweeping. The maintenance of these two pools is shared by the engineering and conservation departments with the primary goal of preserving the art work placed in the water. This has required constant monitoring, re-design, cleaning, chemical adjustments and staff-time in an effort to make the preservation of these works more considerate of our resources. Each case study underscores how conservators can and should articulate preservation goals, collaborate with designers, and incorporate sustainable practices, while setting realistic expectations for preservation.

Engaging Communities in Collection Care—Track B

Moderators: Joelle D. J. Wickens, Associate Conservator and Adjunct Assistant Professor, Winterthur Museum, Garden & Library; Peggy Ellis, Professor of Conservation at NYU Institute of Fine Arts and Director of Thaw Conservation Center, NYU Institute of Fine Arts and Morgan Library & Museum

Children as Agents for Preventive Conservation

Jeffrey Hirsch, Director of Cultural Practice, EwingCole; Casey Gallagher, Architectural Designer, EwingCole

Placing collection material on exhibit exposes it to a certain amount of risk, and yet presenting cultural heritage to the public is a part of most institutional missions. This dilemma is made more acute by changes in visitor behavior: attendance often involves large school groups, institutions appeal to new audiences (who may be unfamiliar with the fragility and/or value of collections), and our media-rich environment blurs the real and the replica. With patrons appearing to be the cause of an increasing amount of damage to collections, museum professionals search for ways to protect valuable material while maintaining some level of public access.

Traditional avenues towards a solution, such as employing more guards and docents, add to operational expenses in a time of budget constraints. Cases and vitrines can be expensive and may not align with the goals of exhibit designs. Finding a balance between preservation and access is increasingly a matter of finding a balance between resources and conservation goals.

We suggest that institutions look for allies to teach the importance of conservation and the need for public participation to a broader audience. Particular emphasis should be directed towards children, for this strategy pays at least two benefits:

- Towards the goal of sustainable collections, early lessons in behavior stick with the individual and help ensure a lifelong advocate for conservation.
- Children are effective teachers within the family, extending their understanding of new topics, such as conservation of collections, to parents and siblings.

Children's programs are a vital part of most museum educational programs. Extending the curriculum to include collection care issues brings the public into a deeper understanding of museums and offers a vein of important information to mine for broad-based public programming.

This presentation explains how children can change a family's learning and its attitude towards conservation, drawing on studies that show how an understanding of complex issues, including sustainability, can be extended from children to the rest of the family. The process could be used to help protect collections by increasing public understanding of, and sensitivity to, preservation and the limits of museum resources.

Heritage versus 'Business of the House': Conservation and Collection Care at the Houses of Parliament, UK

Caroline Babington, Collection Care Manager, Works of Art, Houses of Parliament, UK; Lara Artemis, Collection Care Manager, Parliamentary Archives, Houses of Parliament, UK

This talk will focus on the development of conservation and collection care at Parliament through a strong and championed heritage strategy; and by identifying some of the projects and programmes that have helped to embed the care of collections message. We will focus on how we measure the preservation impact for projects; and how we manage these through good communication, high-quality standards within short time scales and limited resources. We have found that the key to success is to be clear on requirements yet adaptable where necessary.

Core activity at Parliament, the home of UK government, is described as the "Business of the House" with both the House of Commons and House of Lords demanding an easily accessible yet well preserved home for our famous legacy. The iconic and listed buildings of the Houses of Parliament include the Palace of Westminster, a UNESCO World Heritage Site. The Parliamentary Estate is also home to an extensive and historic collection of art, textiles, furniture, books and archives, including the original Acts of Parliament. There is an increasing demand for Parliament to be transparent and connect with UK citizens and the world, which is where balancing access with the need to preserve is becoming ever more challenging.

What makes it unusual is that these buildings are in their original working use, and the "Business of the House" takes priority. The real challenge is managing a daily intake of upwards 7000 staff and 1000 visitors who expect to flow through the "corridors of power" without hindrance. The consequence of this is that for many years conservation had been reactive and become a tool to "get things done." Today the approach is more strategic and preventive – knowing the need through research, developing communications internally and externally, effective planning and resource management, managing risk, acting on findings and measuring outcomes.

More recently our focus has been to advocate and embed an awareness of conservation and preservation needs at Parliament through our recently adopted Heritage Strategy and various training and events days. Effective internal and external communications has been a vital part of our success, resulting in collection care having a strong position as the intelligent client during large scale programmes, such as the more recent feasibility study for the restoration and renewal of the Parliamentary Estate; and how Parliaments' policy on environmental sustainability that aims to achieve "Green" targets for Parliament might impact on the longevity of the collections and buildings. Overall our approach has been to maximise resources, agree standards and prioritize. Our long-term goal is to ensure the preservation of this great building and its contents for present and future generations to enjoy.

Between austerity measures and preservation challenges, Parliament has a great undertaking ahead. We are finding our way, but it is a very rewarding time to be here.

Current Conservation Education and Practice: Are They Sustainable?

Paul Himmelstein, Partner, Appelbaum & Himmelstein

This presentation will extend the discussion of sustainability to our own practices and educational models. Several topics warrant investigation followed by recommendations for change.

Examples:

- The nine members of ANAGPIC, the organization of graduate conservation education programs, graduate approximately fifty students per year. Since entry-level permanent full-time museum jobs are exceedingly scarce, many graduates are going into private practice even though they are ill-prepared, and some have difficulty making a living doing it.
- Women students in many programs are 90% or more of the student body, and the AIC membership is about two-thirds women.
- Most of the conservation programs provide complete financial support to all students, regardless of need. Some have already indicated this may not be possible in the near future.
- Students applying to the programs are “encouraged” to do pre-program internships (unpaid) before applying. These internships are often extended over two or even three years.
- The field of conservation has undergone remarkable changes in the past few decades, with greater emphasis on matters other than treatments. Yet the training programs still concentrate on treatments rather than issues such as preventive conservation, environmental control, disaster recovery, and sustainability.

Some questions:

- Can the profession continue along its current paths and still attract top-notch applicants?
- What happens to students who apply repeatedly for training but do not get accepted?
- Will graduates be able to find positions that provide them with reasonable financial return?
- Will the programs be able to maintain their financial support, regardless of need? Should they?
- Are graduates prepared for real-world jobs? Do the programs put too much emphasis on bench-work and not enough on the many other activities conservators now undertake?
- What percentage of AIC members are graduates of programs, and has the percentage increased?
- Why is the student population preponderantly female? What are the consequences of feminization of the field?

It is time for us to take a critical look at how we educate conservators and how current cultural and financial trends affect our profession.

Teaching Preventive Conservation: Preparing Conservators for Understanding Sustainable Choices in Collection Care

Hannelore Roemich, Professor of Conservation Science, NYU Institute of Fine Arts; Steven Weintraub, President, Art Preservation Services, Inc.

While conservators of art and archaeology are traditionally charged with the examination, material analysis, preservation, and treatment of cultural and artistic heritage, today they must also be prepared to engage with specialists in other disciplines on sustainable solutions for a wide variety of situations ranging from energy usage in built museums to preserving historic houses to managing archaeological sites. In order to succeed, conservators must be thoroughly versed in the concepts and practices of conservation, but also be able to understand the complex context of interdisciplinary decision making.

Since 1960, the Conservation Center of the Institute of Fine Arts (IFA-CC), New York University, has prepared students for careers in conservation through a four-year graduate program. Preventive conservation has been identified as an essential professional competency and has become an important focus of all graduate programs in art conservation in the U.S. (Defining the Conservator: Essential Competencies, ratified by the American Institute of Conservation (AIC) Board on May 20, 2003). At the IFA-CC, preventive conservation emphasizes environmental management for storage and display conditions, monitoring the environment, prioritizing preservation needs in large collections, and risk assessment. To balance theory and practice, there is a class project on refurbishing show cases focusing on current and new techniques for evaluating leakage, controlling microclimates, controlling pollutants and energy-efficient lighting such as LEDs.

Teaching preventive conservation cannot be based on a one-dimensional approach. It requires an understanding of a multitude of intersecting disciplines. In addition to the traditional role of recommending safe environmental parameters for collections, today's conservator must work even more closely with facilities managers, engineers, registrars, and architects on establishing conditions that are sustainable in terms of energy and preservation. New lighting technologies require a close collaboration with the exhibition and lighting team. New methods for evaluating and implementing microclimates rely on an understanding of leakage testing and proper use of active and passive RH control systems, an area of expertise that primarily falls within the responsibilities of the conservator. The challenge for training in preventive conservation is to familiarize students with both the decision making process and the application of technical tools to meet these complex demands for selecting sustainable choices in collection care.

Using Webinars to Tackle Conservation Misinformation in Ontario's Community Museums

Fiona Graham, Associate, Goldsmith Borgal & Company Ltd. Architects

Misunderstandings of basic conservation concepts can form a considerable barrier to collection care. Anecdotally, conservators know this to be true. In Ontario, Canada, a recent exercise demonstrated the prevalence of conservation misinformation in the province and its links to challenges in collection preservation. Two webinars were conceived to clarify a selection of conservation concepts and to help museums implement sustainable preventive conservation strategies.

From 2011 to 2013, Ontario's Ministry of Tourism, Culture and Sport audited recipients of museum operating grants to determine whether eligibility criteria were being met. These criteria include basic preventive conservation practices as outlined in the Standards for Community Museums in Ontario. The 190 museums in the grant program completed questionnaires on their adherence to the Standards and submitted them to the Ministry for review. The museums' responses revealed a number of common misunderstandings. These included:

- Conservation in museums consists solely of treatment, with no reference to preventive conservation
- Reducing the risk of light damage consists solely of eliminating ultraviolet, with no reference to visible light or exposure time
- Fluctuating and cool temperatures are inevitably harmful to collections
- All collections need year-round 50% relative humidity
- Monitoring and controlling are interchangeable terms and actions
- Acid-free materials stay acid-free forever
- Controlling pests involves the use of pesticides

It was clear that Ontario's museum community would benefit from a refresher course in collections care. Given the size of the province – over 415,000 square miles or approximately twice the size of Texas – online learning has proven to be a cost-effective and popular option. The Ministry therefore partnered with the Ontario Museum Association (OMA) to deliver two webinars: Conservation 2.0 and Climate Control: What do you really need?

Participation was free and open to all, including museums that are not part of the operating grant program as well as museums in other provinces. The webinars each attracted approximately 60 participants. Participants simultaneously viewed a Microsoft PowerPoint™ presentation and listened live to the conservator discussing the slides. The conservator also answered texted questions in real time. The presentations and audio recordings were subsequently posted to the OMA website where they remain accessible. Feedback has been positive.

The cost of developing and delivering the webinars was relatively low. The only cost to participants was two hours of

their time. The effectiveness of the webinars is already being seen by the Ministry's advisors in their day-to-day interaction with Ontario's museums and will be judged more comprehensively when the Ministry administers its next museum standards audit. As a means of correcting common conservation misunderstandings and thereby promoting more sustainable conservation choices, the webinar appears to be a useful tool.

The Vivekananda Program for Museum Excellence at the Art Institute of Chicago

Allison Langley, Associate Conservator of Paintings, Art Institute of Chicago

In 2012 the Art Institute of Chicago began a four-year partnership with the Indian Government to develop an educational program for mid-career museum professionals, with the goal of improving collections care within Indian museums. The Vivekananda Program for Museum Excellence was named in commemoration of Swami Vivekananda, a revered Indian philosopher who delivered an important speech at the Art Institute of Chicago during the World Parliament of Religions in 1893. Two main topics were chosen as the focus of the program: preventive care and computerized collections management. Working together with the Indian Ministry of Culture, the Art Institute has developed a series of short seminars held in India each summer, as well as longer three-week workshops held at the Art Institute of Chicago each fall, attended by a select group of Indian fellows. Six fellows from major Indian museums and the Archeological Survey of India were chosen by the Indian Ministry of Culture to attend the first workshop in September 2012. This unique, groundbreaking partnership with India has offered many surprises, but ultimately many rewards. This paper will describe the design of the preventive care portion of the Vivekananda Program in detail, including lessons learned from planning the Chicago workshops, and our experiences teaching the first two groups of Indian fellows.

The Conservation Department plays a key role in the development and implementation of the Vivekananda Program: conservators deliver lectures, lead hands-on workshops, provide tours of storerooms, galleries, mechanical rooms, conservation laboratories, and local museums, to introduce participants to a holistic approach to caring for a museum collection. To prepare for the specific interests and needs of each fellow, we designed a comprehensive survey that is completed by program participants in advance of their visits. This aids our understanding of their collections, buildings, staffing, policies, and climate. A key component of the preventive care program is a self-assessment workshop that gives the fellows the tools to carry out a thorough evaluation of their home institutions and to prioritize short-term and long-term improvement projects.

Upon their return to India, the fellows are required to complete tasks related to both the preventive care and collections management portions of the Vivekananda Program. Their

progress is monitored through monthly conference calls and emails with Art Institute staff. This allows us to offer ongoing support and encouragement, and also provides fascinating insights into the challenges faced by our Indian colleagues as they attempt to modernize their institutions. Due to the success of our initial year, the Indian government is sending 8 new fellows for the second workshop to be held in October 2013. Additionally a group of Indian museum directors will be joining the fellows for the initial week of the Vivekananda Program – an important indication that our Indian colleagues value the program and that there is administrative support for implementing positive changes within the participating institutions.

Sustaining the Cultural Community—The Stewardship Resource Center as a Model for Preventive Conservation Training

Laura Hartz Stanton, Director of Preservation Services, Conservation Center for Art and Historic Artifacts; Dyani Feige, Preservation Specialist, Center for the Conservation of Art and Historic Artifacts

Holistic, strategically planned collections care initiatives can help institutions make fiscally and environmentally responsible preservation decisions. For more than a decade the Conservation Center for Art & Historic Artifacts (CCAHA) has guided Philadelphia-area cultural institutions in making thoughtful preventive conservation decisions through its Stewardship Resource Center (SRC). The SRC provides consultation, training, preservation resources, and networking opportunities to participating organizations and in doing so has fostered economically and environmentally sustainable preservation practices throughout the region's cultural community.

Since its founding in 2002 the SRC has worked with more than 70 museums, libraries, archives, and historic sites in the Philadelphia area to define and prioritize preventive conservation needs. Working with CCAHA staff, participating institutions map out their goals through the program's four tracks: Needs Assessment, Preservation Planning, Emergency Planning, and Policy Development. One-on-one consulting is combined with series of structured workshops, allowing staff at the institutions to gain basic preventive conservation knowledge.

Through formal surveys, focus groups, and anecdotal conversations the session presenters have gathered information on how the SRC has fostered economically and environmentally sustainable preservation practices in the Philadelphia region. Data has showed that tiered recommendations help institutions to meet their goals and that the definition of sustainable practice can vary greatly from one organization to another. The collaboration and resource-sharing at the heart of the SRC have created a sense of community and common purpose among varied organizations while allowing individual institutions to meet their specific preservation needs. Participating institutions assist one another with emergency preparedness and response, volunteer cross-training

and sharing, and collaborative grant-funded projects for conservation. This successful resource-sharing has helped institutions achieve their individual preservation goals while strengthening the cultural community as a whole.

Based on SRC recommendations, local cultural institutions have evaluated and upgraded their environmental systems, invested in protective housing materials, and deliberately reorganized their collections storage spaces. Such projects have made these organizations more economically and environmentally sustainable. Short video interviews with staff members from participating institutions will illustrate the value and impact of the program.

This presentation will also discuss how the SRC model can be adapted by conservators in a variety of professional settings. Conservators and preservation staff working in private practice can pursue similar strategies with the various institutions with which they work; staff from larger institutions can find motivation to be leaders in their communities; and staff from small to mid-sized institutions can explore their own opportunities for collaboration, resource sharing, and other cost-saving measures to increase economic and environmental sustainability.

Exploring Sustainable Preservation Environments—Track C

Moderator: Michael Henry, Principal Engineer/Architect, Watson & Henry Associates

Climate and Conflict – The Complex Question of Environmental Conditions in Museums

Richard Kerschmer, Director of Preservation and Conservation, Shelburne Museum; Jerry Podany, Senior Conservator of Antiquities, J. Paul Getty Museum; Julian Bickersteth, Managing Director, International Conservation Services

The issue of sustainable environmental standards and guidelines for museums and galleries has created some divisions in the international conservation community. This paper will examine how this has come about, the background to the positions being taken, whether there really is substantial disagreement, and what can be done to move the profession forward. It will report on the latest work by the joint IIC and ICOM-CC working group on the question of broadening parameters for environmental conditions in museums.

Environmental parameters for museums have been under discussion by the conservation community for at least the last five years, promoted by conservators, building managers and directors alike. Two years ago it looked as though international agreement on the broadening of environmental conditions in museums and galleries to reduce energy consumption, whilst not compromising the preservation of collections, was close. The current reality however is that agreement is still a long way

off, due to strongly held and often polarised views within the conservation profession.

It is acknowledged by many conservators and conservation scientists that existing environmental parameters for collections are based on a blanket approach, and are unnecessarily tight for all but the most vulnerable of artworks (e.g. panel paintings). Major museums and galleries worldwide are recognising this, and institutions such as The Tate, the Smithsonian and the V&A are implementing broader parameters.

However a significant proportion of the conservation profession is not convinced that the risks associated with this change can be safely managed, a position best articulated by the National Gallery in London. Accordingly, consensus amongst conservators internationally is not being achieved.

The talk will include discussion on PAS 198, the UK's Specification for managing environmental conditions for cultural collections. It will look at how conservators can engage in more effective dialogue with building managers on achieving substantial energy savings without major capital investment and without sacrificing preservation quality, whilst safely managing any associated risks to collections. It will also discuss the opportunities for more research on sensitive materials, on microclimate cases, and on how systems can be designed and operated to meet the needs of specific collections.

RH Guidelines: The Risk of Rigidifying an Option

Steven Weintraub, President, Art Preservation Services Inc.; Paolo Dionisi-Vici, Associate Research Scientist, Metropolitan Museum of Art

It is understood within the conservation community that no single RH range is optimal for all objects. It is difficult to know what the safe RH range is for any specific object, and it is even more difficult to provide a wide variety of RH environments based on individual needs. Therefore, it was necessary to determine a general RH condition that provides a low-risk environment for the overwhelming percent of collections on open display and in storage.

In the absence of precise information on RH-related risk, the trend was toward the implementation of a relatively narrow RH range. Over the last two decades, there has been a reevaluation, based on research regarding object response to RH and a greater concern about the negative consequences of providing tight RH control, in terms of monetary cost and impact on the building envelope.

Recently, there has been further pressure to accept a wider RH range in order to accommodate inter-museum loans between institutions that could not meet the narrower RH range preferred by many lending institutions. In addition, a wider RH range is now being considered as a potential "new" guideline for museums because of energy savings benefits.

This has resulted in the consideration within the general museum community for a new RH guideline, allowing for an annual RH range of 40–60%, with limits for allowable RH drift

within this range. This guideline is also in line with the ASHRAE Museum recommendation for "A" Class RH control.

The purpose of this presentation is two-fold:

First, it is important to assess if there is an increase in risk to collections as a result of expanding the acceptable RH range, particularly from 55% to 60% RH at the high end, and to evaluate the degree of risk relative to the benefit of operating at the expanded RH range. Existing data on material behavior, and operational consequences when using a set-point of 55% RH with an allowable drift of 5% will be examined.

Second, it is essential to understand how a new guideline may be interpreted and how it will impact museum environmental system design and operation. So much depends on one's understanding of a "guideline." Is it a "recommended practice that allows some discretion or leeway in its interpretation, implementation, or use" (*businessdictionary.com*), or is it "a principle put forward to set standards or determine a course of action" (*collinsdictionary.com*)?

Ultimately, there is a tendency to oversimplify a complex subject such as risk. It is not an exact science, and there is a danger in rigidifying a recommendation so that it reads like a requirement. It is correct that an excessively restrictive RH guideline that prohibits the loan of objects which are at low risk under broader RH conditions should be reconsidered. At the same time, broadening the acceptable RH range must be carefully considered so that it does not result in a similar rigid adherence, without sufficient regard for potential negative consequences.

Seeing HVAC Requirements and Shortcomings through a Risk Analysis Lens

Robert Waller, President, Protect Heritage Corp.

Three decades of experience striving to set sensible environmental specifications, and responding usefully to out of specification incidents, was accompanied by confusion and frustration. Through that time learning to see HVAC specifications and deviations through a risk analysis lens led to recognizing three kinds of issues. Understanding the differing natures of decision processes related to those three kinds of issue reduced both confusion and frustration. Two issues, set points and fluctuations, are recognized in relevant standards such as ASHRAE 2012 and PAS198:2012. However, a third kind of issue, excursions to extremes, has neither been incorporated into existing standards, nor brought into our general way of thinking about environmental risk to collections.

The January 1998 ice storm affecting Ontario, Québec, and New England resulted in a three-day interruption of electrical power at the Canadian Museum of Nature collection holding facility now known as the Natural Heritage Center (NHC). This resulted in a large upward excursion in temperature in a cool storage facility holding large pelts. In the early summer of 2002, the NHC experienced a single 12-hour excursion to 100% RH.

The latter event was an exceedingly rare, hopefully unique events, brought on by an extraordinary alignment of conditions and operational failures. Nevertheless, recognizing the reality of

these sorts of HVAC failures leading to what are termed here as “excursions to extremes” not only makes our understanding of environmental risks to collections more complete, but also sheds light on how we should best think about assessing and managing the other two issues: set points and fluctuations.

Excursions to extremes are easily seen as risk events for which combinations of likelihood and severity of expected events can be calculated through established risk analysis methods. In contrast, set point or annual average T and RH, or more precisely Time Weighed Preservation Index (TWPI), can equally be seen as an opportunity for increasing a “good” (preservation) or decreasing a “harm” (deterioration). Which reference frame is adopted may depend on the decision context. Fluctuations, or repeated deviations within or beyond specifications, are intermediate in frequency between the continual (or seasonal) issue of set point and the issues of rare excursions to extremes.

Fluctuations can be managed as a “good,” in which case avoidance of fluctuations is the good and more avoidance is better. Adopting this choice is equivalent to adopting the precautionary principle whereby anything that conceivably could cause damage should be managed as if it will cause the perceived damage, until such time as there is clear proof that there is no danger of damage. Alternatively, fluctuations can be managed as a “harm” to be avoided. In this case, an understanding of the vulnerability of a collection to a given T or RH deviation, or pattern of deviations, is required to assess and manage the risk they pose.

Sustainable Collections Care—Integrated Modelling to Address the Demography of Library and Archival Collections

Fenella France, Chief of the Preservation Research and Testing Division, Library of Congress; Nancy Bell, Head of Collection Care, The National Archives; Carlota Grossi, Senior Research Associate, University of East Anglia; Catherine Dillon, Research Associate, Centre for Sustainable Heritage, The Bartlett School of Graduate Studies, University College London, UK; David Thickett, Senior Conservation Scientist, English Heritage; Eva Menart, PhD Student, Centre for Sustainable Heritage, The Bartlett School of Graduate Studies, University College London, UK; Gerrit De Bruin, Head of Conservation, Nationaal Archief, The Netherlands; Jinghao Xue, Lecturer, University College London, Department of Statistical Science; Kalliopi Fouseki, Lecturer, Centre for Sustainable Heritage, The Bartlett School of Graduate Studies, University College London, UK; Kostas Ntanos, Head of Conservation Research and Development, The National Archives, UK; Matija Strlic, Senior Lecturer, Centre for Sustainable Heritage, The Bartlett School of Graduate Studies, University College London, UK; Peter Brimblecombe, Professorial Fellow, University of East Anglia, Norwich, UK; William Lindsay, The National Archives, Kew, Richmond, Surrey, UK

The Collections Demography project (2010–2013) broke new ground by developing a collection model based on the impacts of material composition, environment and use, and by integrating

aspects of how collections are valued by users, for improved decision-making. It is clear that this links closely to the need for institutions to assess the needs of their collections within the current setting of economic, local and global environments, and societal challenges, to proactively address issues of sustainability. International collaborative research involving 6 institutions brought together environmental and material research and integrated this with the societal concept of values we attach to heritage. While there is a substantial body of published research on collection materials and environments, there is a significant need to understand the dynamics of change on collections. In the Collections Demography project the research explored new methodologies of assessing the value of objects in the context of different uses of collections, both qualitatively and quantitatively, to better understand user expectations in relation to library and archival collection care.

A crucial component of the project was a comprehensive public engagement element: interviews with visitors and an attitude questionnaire, distributed at The National Archives (UK), English Heritage, Library of Congress and the Congress Visitor Center. The analysis of 543 responses provides key data on the reflections of stakeholders on the significance of collections, future care and sustainable use of collections. The results indicated how stakeholders defined the lifetime of objects, and their views on the desired lifetime of collections. This provided important input into the Collections Demography model in view of damage thresholds, and helped to define a suitable planning horizon in collection management.

The collections modelling also built on the solid body of existing research on chemical degradation of historic paper and on the impact of the environment. Innovative research was performed to understand the interactions between the environment and paper-based collections, and new quantitative relationships (“isoperms”) were developed linking permanence with environmental data and inherent material properties. New research was undertaken to explore the build-up of wear and tear, enabling collection managers to assess the effect of physical use of collections on the accumulation of damage. The dynamics of these processes was captured quantitatively in “isochrones” that describe the expected collection lifetimes. Additional new research was undertaken to understand the effect of climate change on collections, and demonstrated with two case studies: Brodsworth Hall (English Heritage) and The National Archives, Kew.

The environmental, materials and value research provided evidence to inform the development of a comprehensive collection demographic model, using concepts from economic modelling. As a key deliverable of the Collections Demography, the tool informed the development of holistic collection management guidelines. The collected data informed the collection model of library and archival collections, which are seen as dynamically changing entities. The stock (population) model enables examination and optimization of different collections management scenarios (with respect to the environment, use or intervention), as suggested in recent environmental management guidance.

Sustainability and Environmental Control for the Conservation of the Collections at the Bahia Sacred Art Museum

Griselda Kluppel, Architect, Associate Professor III and Advisor for International Affairs, Federal University of Bahia, Faculty of Architecture

When it comes to museums and collections the idea of sustainability should cover actions ranging such as selecting materials using renewable raw materials, and/or low energy consuming materials for their manufacture, rationalization and reuse of materials and supplies for packaging and storage of the collection, its maintenance, safety and continuous preventive conservation. The studies presented in this paper were carried out in the Sacred Art Museum of the Universidade Federal da Bahia (UFBA) complying with the recommendations from the Conservation Assessment. This assessment, undertaken to guarantee the conservation of collections in hot and humid climates, was held in 1998 in a concerted technical cooperation action among UFBA, The Getty Conservation Institute, CECOR/ UFMG and VITAE – Support to Culture, Education and Social Promotion.

Among the projects carried out we highlight those with environmental adaptation which comprised three different objectives: the treatment of exhibiting halls, the increase of the thermal comfort of the nave of the church, and the environmental control for preventive conservation of the collections storage area. In the exhibition halls three specific and complementary actions were carried out aiming to correct natural lighting conditions of the displayed collection by inserting elements of control in the window openings to block the direct solar radiation and filter the diffuse solar radiation.

In addition, to ensure natural ventilation in the exhibition halls, the system allowed natural light into the halls, thus reducing the use of artificial lighting. A new system of artificial lighting was also implemented, controlled with the help of motion sensors and rationalization of the lamp power, thus ensuring energy saving and conservation of the collection by decreasing the time/lux on the displayed pieces. This also contributed as reduction elements of specific degradation processes in light-sensitive works of art such as polychrome items.

Another action carried out was the development of a mixed ventilation system, both passive and mechanical, aiming to ensure thermal comfort for visitors by decreasing sensation of heat and increasing ventilation; this has also contributed to increase evaporation by convection, allowing the reduction of the moisture content of the air inside the rooms, assisting in preventive conservation of displayed collections.

Also, another step addressed the improvement of environmental quality within the nave of the Santa Tereza Church, creating a passive system of ventilation, by pressure difference, or chimney effect, through the eight round window openings existing in the dome of the transept of the nave, which is still aided by the eight windows surrounding the observation tower that covers it. The proposed passive ventilation aimed at modifying the conditions

of the relative humidity, excessive inside the nave and the walls of the altars, as well as providing better environmental conditions for human comfort during events which are held there.

The third proposal relates to the environmental control developed for the implementation of the new Storage Room making use of passive and mechanical conditioning, by taking advantage of the construction. The major points of leakage and thermal gains were addressed, that is, ceilings, doors and windows. Also some routines were established in order to take advantage of the external environmental conditions in case they were favorable, or otherwise its blockage, in addition to the interspersed use of ventilation and/or mechanical dehumidification to ensure environmental levels recommended to a preventive conservation of the collection.

Additionally the whole system of packaging and storage of the collection was carried out within the most rigorous methods of rationalization and reuse of materials.

Creating Sustainable Preservation Environments – Funding, Process, and Practice

Laura Word, Senior Program Officer in the Division of Preservation and Access, National Endowment for the Humanities; Jeremy Linden, Preservation Environment Specialist, Rochester Institute of Technology; Erin Blake, Curator of Art and Special Collections, Folger Shakespeare Library

Over the last decade, the challenge of creating an appropriate preservation environment for cultural collections has been made even greater as collections professionals are increasingly faced with the need to balance environmental conditions against budgetary shortfalls and institutional sustainability efforts. Even as energy expenditures on the environmental aspects of preventive conservation have come under closer scrutiny, recent research into materials and mechanical systems have highlighted opportunities and strategies to reconcile the seemingly disparate goals of energy efficiency and a quality preservation environment. Started in 2009, the Sustaining Cultural Heritage Collections (SCHC) program of the National Endowment for the Humanities (NEH) has become one of the key resources available for cultural institutions looking for funding and guidance to simultaneously improve the quality and the sustainability of their collections storage and display environments. Since then, a number of grant recipients have used the funding to carefully analyze and dissect the operation of their preservation environments and the mechanical systems that create them, to build stronger working relationships with their facilities and maintenance colleagues, and to identify opportunities for improvement in both preservation and sustainability.

This session will concentrate on exposing participants to three different perspectives of the grant program and its projects – those of the funding agency, the applicant institution, and an

outside consultant – and will reflect on lessons learned and the larger impact of the work done over the last four years. Laura Word, a Senior Program Officer in the Division of Preservation and Access, has been a strong advocate for the program since its inception, and will discuss NEH's goals in offering the SCHC grants, features of strong proposals, and the impact the program has had on participating institutions. Erin Blake, the Curator of Art & Special Collections at the Folger Shakespeare Library, and the Project Manager of the Folger's successful 2009 and 2012 Planning and Implementation projects under the SCHC program, will discuss the Folger's own experiences, from the inception of the project goals and plan, to building a project team with internal and external partners, to using the results of the project to advocate for and improve both preservation and energy consumption. Jeremy Linden, a Senior Preservation Environment Specialist at the Image Permanence Institute, has served as the primary consultant on a number of SCHC projects, including the Folger's, and will discuss the practice of environmental optimization and how improved preservation environments and reduced energy usage can be achieved in a variety of institutions and settings.

The aim of the session is to introduce participants to the possibilities and opportunities that exist for holistic environmental management in a changing climate, to provide them with greater knowledge on what it takes to craft a successful proposal to this unique program, and to reflect on what we have learned as a profession on the potential of marrying preservation and sustainability.

A Technology Platform for Managing Micro-Climatic Conditions in a Museum Environment

Lucretia Kargere, Conservator for The Cloisters, Metropolitan Museum of Art; Marco Leona, David H. Koch Scientist in Charge in the Department of Scientific Research, Metropolitan Museum of Art; Masahiko Tsukada, The National Museum of Western Art; Andrew Winslow, Senior Departmental Technician, Metropolitan Museum of Art; Hendrik F. Hamann, IBM Research, Thomas J. Watson Center; Levente Klein, IBM Research, Thomas J. Watson Center; Marc A. Robbins, Vice Provost for Undergraduate Education, Stanford University; Paolo Dionisi Vici, Associate Research Scientist, Metropolitan Museum of Art; Sergio A Bermudez-Rodriguez, IBM Research, Thomas J. Watson Center; Alejandro Schrott, IBM Research, Thomas J. Watson Center

Wireless sensing technology has made real-time monitoring and management of a museum environment through assessment of the impact of humidity and temperature fluctuations, air pollution, and visitorship on art objects much more feasible. Combining real time analytics tools with high spatial and temporal density sensing, such a wireless platform can provide information over an extended period of time of the environmental fluctuations in the museum galleries. The results can be

used to develop predictive models for optimal art preservation in response to the micro climatic conditions and may also useful to identify the most suitable locations for the display of sensitive art objects. The platform supports physical and statistical models to quantify and to correlate the short and long term responses of objects to environmental fluctuations. A description is provided of the sensing and modeling capabilities of IBM's Low Power Mote platform, a system successfully installed at "The Cloisters," New York's medieval branch of The Metropolitan Museum of Art. For the last two years, more than 2 million measurements across 5 galleries have been made monitoring changes in air quality, temperature, relative humidity, and visitor flow. Analytical models combined with real time data from sensors placed around art objects enables quantified three dimensional representations of gallery environmental conditions. In particular, an air quality analysis, derived from corrosion rates measured by a sensor array and correlated with outdoor conditions and concentrations of gaseous pollutants (SO₂, ozone), will be presented, and a connection with the distinct geographical and operational conditions at The Cloisters will be proposed. In addition, the impact on temperature and humidity fluctuations due to visitorship in a selected gallery will be discussed.

Sustainability in Public Art Conservation—Track D

Moderator: Rosa Lowinger, Principal, Rosa Lowinger & Associates – Conservation of Art and Architecture, Miami/Los Angeles

An Ounce Of Prevention: The Case For Pre-Fabrication Conservation Review Of New Public Art Commissions

Panel: Rosa Lowinger, moderator; Lesley A. Elwood, Principal, Elwood and Associates, Public Art Consultants, Marina Del Rey, CA; Molly Lambert, Principal, Architectural Conservation, Inc., San Francisco, CA; Angelene Campuzano, Senior Public Arts Officer, Metro Creative Services, Los Angeles, CA; Jennifer Easton, Senior Project Manager, Public Art-City of San Jose Cultural Affairs; Amy Green, Principal, Silverlake Conservation, Los Angeles, CA

Works of public art are community investments that need to be cared for and shepherded through the process of construction and implementation just like any other public improvement. At present, many of the nation's leading public art programs are 30 years old and the fact that there was little pre-planning about maintenance and the aging of materials at the time of commissioning is coming back to haunt administrators. This panel gathers a range of experts in the field of public art management and conservation to discuss the ways in which pre-construction vetting of public art commissions creates a more sustainable approach to the long-term care of public art.

Tile Conservation Project of the Sanctuary of Santa Rosa de Lima's Convent (17th Century): Conservation in the Inner World of Religious Orders in Historic Downtown, Lima, Peru

Erika Anticona, Restauradora, Museo de Arte Religioso Catedral de Lima, Peru

The development of a conservation program in a museum, a gallery or a public institution has a series of special conditions according to the planned objectives and methodological goals; even the scheduling for intervention of goods should respect their spaces and functions. But when you adapt this experience to religious orders with more than 300 years old, which have lived 90% of their history in perpetual cloisters, and with populations with a different taste and valuation of art and its history, from the generational point of view, you must deal with a methodology which goes beyond the conservation procedures, strategies, and forms in order to make minority communities (some of them self-excluded from modern world) involved in ways of preventive conservation which are in line with their activities.

For such study case, we submit the Project Conservation and Restoration of Tiles and Ornamental Woodcraft in the Funeral Chapel of Santa Rosa de Lima in the Santa Rosa de las Madres Carmelitas' convent. Santa Rosa is a very important figure for Catholic religion in Peru, as well as for the Dominican Order, since this space is the original cell where she died, which subsequently became the sanctuary chapel, the project's objective.

By request of the Museum of the Cathedral of Lima, the Sevillian tiles had to be maintained urgently, since they showed a high level of damage, due to the fluctuations of walls' humidity, which had not been maintained for decades. Water concentrations appeared and led to the continuous emergence of chloride salts in the tiles patinas, which made the designs unclear. Likewise, the ornamental woodcraft was damaged due to fungus, rotting and xylophages, since the congregation did not prepare intervention measures during the recent years.

With the adequate intervention measures and the stabilization of walls real changes were made; the nuns perceived these changes as positive, but these changes needed to be maintained by other sustainable measures, such as the development of preventive conservation measures, based on talks and motivational operations within their daily routines.

This work proved that the sustainability, along with conservation works maintenance, should be essentially performed by those who primarily own, use and enjoy the monumental artistic goods, since these communicate their history, as well as that of several regions, a history that involves an important community for Latin America.

Basilica of San Sebastian in Manila, Philippines

Christine Leggio, Architectural Conservator, Johnson, Mirmiran & Thompson

The Basilica of San Sebastian in Manila, Philippines, is one of few surviving all-metal cathedrals in the world. It was built in 1891 using innovative, seismic-resistant structural steel construction after the previous three masonry churches on the site were destroyed in earthquakes.

The Basilica differs from other early uses of structural steel in earthquake-proof construction in that every component of the building is composed of steel or iron, with no masonry or plaster whatsoever. To simulate a more traditional appearance, the entire building was faux painted to create the illusion that the church was built of cut stone. Trompe l'oeil figures, painted by some of the country's leading turn-of-the-century artists, decorate the interior dome and side walls. The masonry-less construction and the resulting decorative treatment creates a spectacular effect, yet leaves both the paintings and the metal substrates vulnerable to deterioration because the highly decorative finishes serve as the only protection for the steel from the humid environment. As an unfortunate but unsurprising consequence, the structure is actively corroding, causing damage to the important decorative paintings. The size of the building and the significance of the paintings preclude many traditional treatment options, including preventing corrosion through climate control.

This paper diagnoses the specific causes of deterioration of the paint film by examining the original painting and finishing techniques, mapping and categorizing specific localized and systemic conditions, and evaluating climatic factors contributing to the corrosion of the metal. By determining the approximate rate and extent of the deterioration and by pinpointing its specific causes, this paper serves as a basis for identifying and evaluating potential conservation treatments to prolong the life of the paintings *in situ*.

The Conservation of the Montgomery Monument, St. Paul's Chapel, New York City

Jennifer Schork, Conservation Associate, Integrated Conservation Resources, Inc.

This paper would present the conservation of America's first official monument, the Montgomery Monument, located in the east window of St. Paul's Chapel in lower Manhattan. The monument was commissioned by the Continental Congress in 1776 to commemorate Major General Richard Montgomery who died in the Battle of Quebec during the Revolutionary War. Originally intended for display in Philadelphia's Independence Hall, the monument was created in France by Jean-Jacques Caffieri ("sculptor of the king" to Louis XV), working under Benjamin Franklin's direction. The monument was then shipped to America in several sealed crates where it remained for

the first decade of its life during the final years of the war, until its installation in St. Paul's Chapel in 1787.

The monument is marble and limestone in the baroque and rococo style seen in many monuments in Westminster Abbey, London. It consists of a fine-grained, white-veined gray marble lintel with brackets in the classical triglyph motif. A coarse-grained white marble plaque containing an inscription is mounted below the lintel. Upon the lintel sits a pink breccia column flanked on both sides by limestone decorative carvings. The carvings depict trophies symbolizing liberty, strength, chivalry, and martyrdom. Atop the column sits a limestone pedestal-footed funerary urn with acanthus leaf decorations. A flat truncated variegated marble obelisk serves as the backdrop.

This was the first comprehensive conservation project to be implemented on the monument and being over 200 years old and not properly maintained, was in extreme disrepair.

The project began with archival research of the monument and a design phase investigating its materials and support structure, and their conditions. The unique installation of the monument, placed within a large window frame, provided many challenges to the conservation planning phase. Consultation with an engineer who assessed the support of the monument through impulse radar, metal detection, and fiber-optic borescope, resulted in the decision to fully disassemble it to ensure a long-term repair. Conservators conducted *in situ* testing of cleaning materials and methods. The approach had to take into consideration the various conditions on the numerous materials extant within the monument.

Disassembly allowed for the development of distinctive methodologies for each of these stone varieties. The individual elements of the monument were conserved on site in a temporary workshop.

Archival research and discussions with historians proved critical to understanding the original display intent for the monument and guided the conservation of the stone and metal framework. The conservation implementation, in turn, informed the historic research with physical evidence that was found during disassembly to answer some of the questions about the original appearance of the monument, the materials used, and their authenticity.

This paper will present a visual and descriptive timeline of the conservation including the methodologies and ultimate strategies employed.

Protection of Cultural Sites: The Case of San Pedro y San Pablo Teposcolula, Oaxaca

Vera De La Cruz Baltazar, Professor, School of Architecture of the State University of Oaxaca, Mexico; Cecilia Rodriguez Sanchez Luz; Victor Gaudencio Perez Cruz; Rafael Nicolas Sanchez Reyes

Cultural nominations are meant to safeguard the recipients; however they do not always bring the intended protection. To be successful, nominations need to be the first step of a continuous and permanent conservation process, more so when dealing with

vulnerable urban contexts. The particular characteristics of each monument or site as well as the commitment of the stakeholders, contribute to what happens after the nomination. Heritage protection responds to social realities and to economic and political priorities; in places where there is an array of needs, conservation stops to be considered necessary and nominations do not suffice to spare the cultural heritage of being neglected or even lost.

Oaxaca is a state rich in culture, however, it only possesses two sites recognized by the Mexican government as historic heritage sites, one of them being the City of San Pedro y San Pablo Teposcolula. The fact that Teposcolula is, besides the capital of the state, the only site that has received a government nomination as historic heritage site, reflects its relevance in the region. Teposcolula's physiognomy, landscape, architectural characteristics, and urban structure in general, as well as its XVI century Dominican religious complex were outstanding attributes that had already been officially acknowledged in 1930. Teposcolula's religious complex contains an open chapel unique in the *novo* Hispanic religious constructions. Nevertheless, being nominated was not followed by a strategic plan, but by some unconnected actions. The transformation processes and evolution proper to urban settlements have put at risk some of those attributes that were supposed to be protected. Currently the heritage that has survived is being lost or damaged and an institutional plan has as yet still to be developed.

This contribution is part of a project that aims to have a positive impact on the care of the heritage of San Pedro y San Pablo Teposcolula. It presents the first results of a study that focuses on the architectural heritage of Teposcolula. The study includes the identification, registration and cataloging of the heritage as well as a historic analysis carried out to understand the processes that have generated the urban landscape and preservation conditions observed currently. The relevance and impact of nominations as single actions is questioned and the special characteristics of the community that include poverty and migration are discussed.

Preserving an Endangered Lighthouse: Balancing the Needs of Natural and Cultural Resources

Frances Gale, Senior Lecturer/Conservation Scientist, University of Texas at Austin, School of Architecture

A Texas Gulf Coast lighthouse provided an opportunity to explore options for preserving an historic cast iron structure in an environmentally sensitive area. The lighthouse is located on a barrier island that is co-owned by state and federal agencies and operated as a wildlife management area. Constructed of cast iron plates in 1852, the history of the lighthouse is noteworthy. It was dismantled during the Civil War, and then rebuilt in 1873. Restoration work on the lighthouse, completed in 2003, included construction of a new foundation, rebuilding the

lantern and roof, and applying new protective coatings. However, concerns about severe corrosion of the cast iron plates prompted a non-profit “friends” group to seek our advice.

Our involvement with the lighthouse project began with a review of its history, including documents related to the 2003 restoration work. During March 2013, we visited the site to inspect conditions and discuss possible treatment options. Corrosion of the cast iron plates and peeling and flaking paint were observed on exterior and interior locations. Several types of corrosion were present, including pitting, exfoliation and crevice corrosion. Conditions were severe in many areas. Based on our inspection and additional research, we developed a report outlining possible preservation treatments, and provided our recommendations for moving forward.

We discussed relocating the Matagorda Island Lighthouse, but cautioned the friends group that relocation destroys the relationship between the historic structure and its site. However, our report acknowledged that relocating the Lighthouse to a less vulnerable site would help to stabilize corrosion and extend its service life.

Mothballing – or temporarily closing the lighthouse – was also outlined. Our discussion of this option emphasized the importance of recoating exterior cast iron in areas with corrosion and paint loss to prevent moisture intrusion. As a third option, we outlined procedures for removing all existing coatings and applying a new primer and finish coat system to protect cast iron plates of the Lighthouse.

The fourth option included dismantling the lighthouse to investigate existing corrosion before moving forward with restoration work. We emphasized that understanding the sources of deterioration would help determine the best materials and methods for stabilizing and protecting the historic structure. Disassembly would facilitate paint removal and repair or replacement of severely deteriorated cast iron plates.

Although the fourth option was the most costly, the assessment report stressed the importance of further investigation, and strongly recommended dismantling the lighthouse. This presentation will review the options described, and discuss project requirements of balancing the future of an endangered historic structure with the environmental concerns of the state and federal agencies responsible for a wildlife management area, and limited funding provided by a nonprofit friends group.

Two Views Through the Same Window: Long-Term Preservation Goals for Stained Glass Windows Within the Context of Historic Buildings

Ariana Makau, Founder and Principal Conservator, Nzilani Glass Conservation

This paper aims to present challenges encountered when the conservator must consider building requirements in equal measure to the conservation of a stained glass window.

The preservation of leaded art glass windows, referred to in this paper generally as “stained glass windows” has always been multi-faceted. Broadly placed in two categories: museum objects or functioning components of historic buildings; the criteria of conserving these works of art are project-specific. First and foremost, the windows must be stabilized in order to survive and be appreciated by future generations. But beyond that baseline, the necessities of the two are divergent.

Unlike a museum object that will be conserved once and its condition maintained mostly by a controlled environment with guards or barriers preventing physical interaction with the public; stained glass in an architectural setting must function as a window. As such, it inherently experiences exposure to the public and weathering, which means it will require treatment in the future.

How does one therefore approach these objects with sustainability in mind? Knowing the cyclical nature of this type of preservation, a conservator can make some informed decisions on how to extend times between actions. Conditions of the building immediately surrounding the window, particularly supporting framework, must be considered as integral to the window’s longevity; especially in deciding the order in which needs are addressed. Multi-phase treatments should be components of a whole, rather than conceived and executed in isolation; even if separated by years.

Key factors discussed will be:

- Evaluating the condition of all stained glass windows in the building as a whole, before embarking on treatment of just one – The values of a survey
- Protecting the windows from the environment, while maintaining natural light sources and aesthetics – Is exterior protection necessary? If so, what type?
- Weighing the potential of up-front costs with future return on investment – Cycle: which window is the best project catalyst? | funds are procured | more windows treated | greater awareness by the public

Using three case studies as examples, we will explore preservation strategies for stained glass that seek to balance the potential conflict between art object and building component.

- The “St. Cecilia” window of St. Boniface Church in San Francisco; part of a series of windows created specifically for the church shortly after the 1906 earthquake by the Ludwig von Gerichten Studios of Ohio. The church is a city Historic Landmark.
- Stained glass windows at St. Vincent de Paul, built by Century Stained Glass Studios of San Francisco in 1948.
- Two stained glass windows designed and built by Bruce Porter for the Swedenborgian Church, established in San Francisco on March 17, 1895, and designated a National Historic Landmark in 2004.

All three churches open to the public and based in San Francisco. They welcome tours to AIC Members during the conference.

White Marble in Exterior Environments – Observations of Weathering and Treatments over the Past Fifteen Years

Judy Jacob, Conservator, Historic Architecture, Engineering, and Conservation Center, National Park Service Northeast Region

Over the course of the last fifteen years, I have worked on numerous marble monuments and buildings and in that time, have gained tremendous insight into the relationships between weathering, lichens, biofilms, and treatments.

In locations where fine-grained white marble is exposed to frequent rain, surfaces are slowly eroded. Marble in urban and industrial environments, subject to historic rainfall far more acidic than that of today (prior to the Clean Air Act of 1970), is noticeably more eroded than marble in rural environments. In northern locations, marble subject to a winter covering of snow is noticeably less eroded than that left uncovered.

Over time, with erosion and daily and seasonal temperature fluctuations, the cohesive mass of fine-grained white marble becomes weakened. Surface fissures indicate this condition and fragments of gravestones lying on the ground are often the result of a catastrophic failure where the gravestone could no longer support itself. Often the repair methods used to unite such fragments contribute to another catastrophic failure.

The “pitting” created by surface erosion, and the associated periods of increased surface wetness, provides an environment attractive to lichens and biofilms. Lichen species are environment specific (urban, rural, marine, etc.) and the makeup of a biofilm (algae, fungi, and bacteria cells) is also environment specific. Determining the potential contribution to erosion caused by lichens and biofilms, and the potential protection offered by their covering, are topics that are the subject of current ongoing studies. Observations suggest that in the Northeast, lichens and biofilms do not have an impact on the deterioration of marble.

“Cleaning” marble, whether to rid a surface of atmospheric soiling or lichens and biofilms, is an erosive action. The use of soft scrub brushes and low pressure water will remove calcite crystals—amounts depending upon the extent of surface erosion—from the stone mass. The extent to which “cleaning” removes deteriorative agents and the extent to which it contributes to erosion are also the subjects of current ongoing studies.

Climate change, bringing warmer temperatures and more frequent storms, will have an impact on the erosion rates of marble. As conservators, addressing the need to lower our carbon footprints will have an impact on all treatment decisions. In this presentation, I will be discussing my observations of the relationships between weathering, lichens, biofilms, and treatments and how these relationships can affect treatment decisions. I will also discuss how climate change will affect these relationships and treatment decisions.

Lime-Metakaolin Grouts for Conservation

Norman Weiss, Adjunct Associate Professor, Columbia University, Historic, Preservation Program, GSAPP

Fluid, lime-based grouts for the conservation of historic masonry, mosaics, and plasters have been mentioned infrequently in the literature, and with relatively few details of the experimentation that led to their formulation and use. For non-hydraulic limes, the fundamental dilemma is, of course, that limes cure by carbonation, and cavities to be grouted are places in walls where little or no air is available. Our work of the past several years has therefore focused on the use of pozzolanic admixtures, and in particular on dehydroxylated clay.

The paper describes the technical challenges associated with the development of a lime-metakaolin grout, initially created as part of an engineered “port” anchor system for structural stabilization of deformed walls. Among these challenges are the competing requirements of fluidity and shrinkage, the latter requiring the incorporation of ultra-fine aggregates. Also discussed in detail will be the laboratory evaluation of both plastic and hardened properties, a subject of particular interest in the light of the recent publication of a testing manual by the Getty.

The first engineering use of this low-strength grout was in the fall of 2012, on a massive church tower in the northeastern United States. Since then, a second formulation was created for smaller-scale use by conservators of architecture and sculpture. Study of both lime-metakaolin formulations is on-going, with the potential to create a range of conservation materials, including surface-applied crack fillers, adhesives and repair mortars.

Assessment and Evaluation of Consolidation Methods on Serpentine Stone at the 19th Street Baptist Church, Philadelphia, PA

Kathryn E. Brown, Architectural Conservator, Dan Lepore & Sons Company

Serpentine (serpentinite) is a notably unique building stone from Chester County, Pennsylvania that enjoyed regional popularity. Residential and institutional buildings in and around Philadelphia, New York, Washington, and Baltimore have all been built using serpentine stone from the West Chester quarries. A hydrous magnesium silicate metamorphic rock, its unusual green color and luster expanded the Victorian palette and love of polychromatic masonry popular during the last quarter of the 19th century. However, its generally poor weatherability in the city environment and discontinued availability now argue for greater study of its conservation possibilities. This research examines the composition and performance of weathered serpentine at the 19th Street Baptist Church in Philadelphia, Pennsylvania to determine the possible efficacy of ethyl silicate consolidation treatments in improving stone performance and resistance to weathering.

The 19th Street Baptist Church is an early and important ecclesiastical design by the famous Philadelphia architecture firm of Frank Furness and George Hewitt and one of only a few serpentine buildings that survives in and around Philadelphia due to the deteriorative nature of the stone. Expansive and expensive attempts usually involving replacement with custom pre-cast cementitious renders have been performed in the past to retain the appearance of the stone, yet little research has been conducted on methods to retain the stone itself. The serpentine poses a challenge due to its complex mineralogical and textural composition, narrow range of use, and lack of previous scientific research conducted on the material.

Examination suggests that intrinsic deficiencies in the stone of the 19th Street Baptist Church led to severe exterior and interior building failures. Sections of the exterior serpentine veneer have lost their unit integrity and deterioration of the serpentine appearing as friability and gross dimensional loss, as well as veneer destabilization. Research and testing was informed by a detailed conditions survey of the exterior stone of the church as well as characterization of the stone through petrographic thin section analysis, SEM analysis, and wet chemical methods (acid solubility and salt tests). Physical testing of the stone properties (durability, absorption rates, porosity, etc.) were measured before and after consolidation through water absorption, water vapor permeability, freeze/thaw resistance, and strength by resistance drilling. Considering the nature of the serpentine stone, consolidation was tested to restore material integrity by recreating the inter-granular cohesion the stone lost through weathering without aesthetic alterations. The results of this test program provide recommendations for future conservation options for the 19th Street Baptist Church and other serpentine buildings throughout metropolitan areas in the Mid-Atlantic and South Atlantic regions.

Comparative Study of Commercially Available Rust Converters

Jason Church, Materials Conservator, National Park Service; Sarah B. Hunter; Anna Muto, NCPTT; Mary F. Striegel, Chief of Materials Conservation, National Park Service, NCPTT

NCPTT's Materials Research Program's current research project is a continuing comparative study of rust converters. Rust converters have wide stretching usage in conservation, they are used from the stabilization of iron based museum artifacts and collections to iron architectural elements and iron outdoor sculpture.

Rust converters are designed to be only a single part of an overall coatings system. However, for this study it was decided to only test the converter by itself. This decision was made for two reasons; the first is many museums use the converter as a single coating, especially for outdoor farm and military equipment. The second reason is to evaluate the strength of the converters themselves without the added protection of a paint system.

For this study we used naturally weathered mild steel coupons cut with a mechanical sheer (as to not alter the surface of the metal) to 3 x 6" the size of the QUV sample holders. Each of the front face of the plates was wire brushed to remove loose rust then treated with a rust converter, tested weathered and tested again. The products were evaluated and ranked by rate of failure.

The samples were evaluated by a variety of techniques before being treated with the rust converter, after being treated, and every 250 hours (a total of 1000 hours) of artificial weathering in a Q-lab QUV Weatherometer. The samples were also mounted to a roof top outdoor exposure rack and tested each 30 days. The comparison of outdoor and indoor accelerated weathering was done to try and give some correlation between the weathering types. Samples were exposed to a salt mist in both the outdoor and indoor weathering situations. The salt mist that they were exposed to mimics the salt exposure of an Atlantic coastal setting. The methods for testing the samples are; XRD, laser profilometry, thickness coating measurements, gloss, color, photography, and finally visual ranking.

This presentation will give a brief description of this study Phase 1 (presented at AIC/ASG in 2010) and the final results. However the highlight and bulk of this presentation will be this studies' Phase 2. In Phase 2 we evaluated the best convertor from Phase 1 and added four more commercial available convertors. All samples were exposed to a salt mist to test the rust convertors effectiveness in a marine environment.

The goal of this research is to provide the end user be it home owner, museum conservator, or site manager with the knowledge needed to make an informed decision when selecting a rust converter in both an inland setting and a coastal environment.

The Effect of Primers on the Durability of Paint on Historic Exterior Wood

Carol Chin, Joint Faculty Researcher/Professor of Chemistry, National Center for Preservation Technology and Training (NCPTT) and Northwestern State University; Laura Lee Worrell

Primers and paint make up the protective surface of most wood structures. It is often a struggle to keep paint from peeling, blistering, or lifting from old wood, in part because of changes in temperature and humidity, but also because of poor adhesion to an aged, weathered surface. A more durable coating can mean a reduction in maintenance time and costs, and often less wear on a surface due to less intervention.

This study examined the performance of latex and oil-based primers and a water borne wood stabilizer/conditioner using three commercially-available brands: Pittsburg Paints, Sherwin-Williams, and Zinsser. Benjamin Moore's low lustre finish acrylic paint was used as the top coat in all but the trial that used an all-in-one primer and paint product. A white top coat was used in all trials to eliminate color as a variable. The coating systems included one coat of oil-based primer with two coats of paint,

one coat of latex primer with two coats of paint, one coat of wood stabilizer with two coats of paint, two coats of an all-in-one primer plus paint, and one coat of paint (without primer.) All coatings were applied by brush to salvaged, historic wood siding (approximately 70 years old). The wood was cut into 4.5 by 7.5 centimeter samples and any loose paint was removed from the samples using a simple paint scraper, followed by light sanding. Each coating was allowed to dry according to the manufacturer's instructions. Four trials were conducted for each application. Surface properties of the samples were measured before and after artificial weathering using a QUV Accelerated Weathering Tester. Laboratory tests included the use of a gloss meter, colorimeter, Fourier Transform Infrared Spectrometer (FTIR), contact angle goniometer, and scanning electron microscope (SEM). In addition, 20 individuals examined the samples visually and provided opinions on the condition of the samples after artificial weathering.

Conservation in Action: Conservation of Mural Cartoons in the Public Eye

Claire Titus, *Conservator, New Brunswick Museum, Saint John, New Brunswick, Canada*

“The high light [sic] of the Maritime Art Association convention in Fredericton was undoubtedly the session entitled “Art in Action”, at which an excited public comprising children and grown-ups of all ages had the opportunity of seeing brilliant craftsmen actually at work on their creations.

Miller Brittain was one of the New Brunswick artists featured in “Art in Action”; he worked on his cartoons for the Saint John Tuberculosis Hospital mural in a school gymnasium:

These panels [drawings] practically covered the wall, and — perched on a platform of boards supported by ladders — the figure of the artist could be seen above the heads of the crowd, at work on figures almost twice his own size! From time to time Brittain would stop and smilingly explain to the people below what he was doing, and then he would go back to work just as if he were alone in his own studio.’

—*Kathleen Shackleton, Maritime Art, Volume 2, No. 5. June-July 1942. p 153.*

Can conservators, performing conservation treatment in front of the public, recreate the popular enthusiasm and professional openness reflected in this quotation? Can we earn public and institutional support and funds by doing so? Can we achieve our treatment goals? The author hopes to contribute to the discussion of these questions.

The New Brunswick Museum (NBM) Saint John Tuberculosis Hospital mural cartoons (1941–42), by Saint John New Brunswick artist Miller Gore Brittain (1912–1968), comprise a series of eleven, 9’ x 9’ drawings. The cartoons are both the crowning achievement of Miller Brittain’s pre-war career and are among Canada’s most important 20th century art works. The size and fragility of the cartoons have inhibited public and scholarly access.

As a follow-up to *Conservation of a series of mural cartoons: high hopes on a low budget*, presented to the AIC in Milwaukee in May 2010, this paper continues the story of how a regional Canadian museum has struggled, found momentum and the means to complete an ambitious conservation treatment during a time of fiscal constraint:

- Funding for post-graduate internships provided enthusiastic and skilled conservators to assist treatment development and to complete the conservation treatment.
- The installation of the conservation treatment in an exhibition space helped to raise public awareness and maintain institutional commitment.
- Using a conservation treatment as an exhibition served to bring the discipline of conservation, and the cartoons themselves, to the attention of museum visitors and the media.

- The use of social media, and, scholarly and community partnerships, raised awareness of the conservation treatment and maximized the secondary benefits of the work being done.

This paper will briefly outline and contextualize the mural cartoon conservation project, and describe the methods and results of the NBM’s efforts to achieve public education, mentorship and fundraising goals. Final conclusions will explore the successes and shortcomings of the project.

Preserving the African American Scrapbook Collection of Emory University Libraries

Kim Norman, *Conservator, The Georgia Archives; Ann Frelsen, Conservator, Emory University; Brian Methot, Digital Imaging Technician, Emory University*

Rare scrapbooks that document African American life in the United States from 1890–1975 are being preserved at Emory University in Atlanta, Georgia. With support from a Save America’s Treasures grant, the project is a collaborative effort with the Emory University Libraries Preservation Office, Digital Curation Center, and Manuscript, Archives, and Rare Book Library (MARBL). The grant was awarded through the Department of Interior and the National Park Service in collaboration with the National Endowment for the Arts, National Endowment for the Humanities, and the Institute of Museum and Library Services.

In 2011, Emory began the three-year process of preserving and digitizing our African American scrapbook collection. Thirty-four scrapbooks were slated for conservation treatment, and that number has grown as more African American manuscript collections are processed.

Scrapbooks are like the dirty little secrets of libraries and archives — often restricted from use, without conservation treatment and tucked into vaults awaiting tough decisions. Scrapbooks have been neglected, as they are complex amalgams of multiple types of artifacts assembled in a book format. Ours contained everything from half-inch thick military patches to dance cards with a pencil still attached. Papers and objects are affixed with the entire gamut of adhesives and tapes onto usually brittle pages and bound without regard to the thickness and weight of the contents. Whether turn-of-the-century constructions or 1970’s “magnetic” albums, these scrapbooks posed enumerable preservation questions. In working with the Emory collection, we have developed decision-making processes for treating a variety of scrapbooks.

Historic importance, current condition, and frequency of use are all considered to help inform our conservation decisions about treating the diverse materials in each scrapbook. It is common to encounter multiple adhesives and tape layers in scrapbooks. Removing these materials can be difficult or even impossible, for instance when information is written directly on the tape carrier layer. In our project, time and budget constraints of the grant helped to establish boundaries around this treatment phase,

always foremost in our minds when determining the course of treatment.

The original structure of each scrapbook was digitally photographed to document the initial experience of viewing them. Many volumes required stabilization repairs before digitization could occur. Reassociating loose items, separating glued stacks of paper objects, lifting photographs that had previously hidden important information written on the back, and reformatting some of the more fragile scrapbooks into encapsulated polyester page books meant a second digital capture. Developing efficient hand-offs and documenting workflow between the three library departments was crucial to the project. Cross-training between our digitization and conservation teams for proper care and handling of fragile materials and capturing metadata proved beneficial for everyone involved.

Every scrapbook item—covers, fronts and backs of foldouts, and each layer of (sometimes eighteen!) overlapping items—has been captured, and those digital files eventually will become available to researchers.

The Impact of Digitization on Conservation Activities at The Wellcome Library

Gillian Boal, Head of Conservation and Collections Care, The Wellcome Library

In 2010 The Wellcome Library, Euston Road, London, embarked on a project to digitize all of its Library's holdings. It is now into Phase 2 of the project and plans to be finished in 2015. All treatments in preparation for digitization are undertaken with the aim of stabilizing objects for digitization. Conservation decisions and treatments are based on three basic principles, minimal intervention in the context of a research library, re-treatability and the "fit for purpose" principle.

My illustrated talk describes the Wellcome Library's Conservation and Collection Care approach to the care of its collections during digitization projects. It outlines the considerations needed for the co-operation between all interested parties to facilitate the various types of digitization projects. It lays out the expected level of care and protection while fulfilling the goals of digitizing Wellcome Library's holdings in a safe and timely manner. Condition assessment and preparation for image capture of the collection are carried out by Conservation staff at the beginning of the workflow.

There are two levels of treatment preparation for digitization. Level one can be carried out by trained digital preparers and level two by staff in the conservation studio. The treatment data are held in the Conservation and Collection Care Department consistent with the permanent retention of records related to treatment and assessment of collection items beyond the duration of the project. All conservation data related to the project, e.g. surveys of condition, assessment spread sheets, and treatment records, will be made accessible within the strands of the project.

Conservation and Collection Care is one component in a complex workflow. The greatest risk to any physical object is in the handling, and the nature of the digitization process means that objects are often handled in new ways in new contexts, or with greater intensity. It is the risk of damage or loss from handling that conservation aims to collaboratively mitigate; handling guidelines are written to elaborate on this. These aim to achieve effective communication between different collection areas and stages of the workflow by constantly sharing and updating information.

Communication with all parties involved in the digitization process is key, as is the recognition that each digitization project has a specific value for each of the following variables: the scope of the collection to be digitized; its current physical condition; the demands of the equipment to be used; the experience of the trained personnel involved. All Wellcome Library Staff involved in the digitization process share responsibility for the care and handling of the collection during digitization.

All digitization projects require conservation recommendations for logistics and handling during image capture. The Conservation Team is responsible for ensuring that the necessary training with written guidelines is provided to all personnel involved in digitization, including Wellcome collection staff and outside contractors whom we encourage to submit their own handling guidelines. In practice Conservation and Collection Care is part of the group of advisors during the initial preparation for each digital project. Collection item needs and handling training vary depending on the condition and scope of the selected projects.

Treasure from the Bog: The Faddan More Psalter

John Gillis, Senior Manuscript Conservator, Trinity College Dublin

This lecture tells the story of the recovery and conservation of the Faddan More Psalter, an early medieval manuscript dating from the late eighth or early ninth century, unearthed from a peat bog in Co Tipperary, Southern Ireland, in the summer of 2006. We will look at the methodology behind the recording and dismantling of the fragmented text block and the dewatering of the saturated folia and cover. Many new and exciting discoveries were made during the lengthy and difficult task of conserving this important archeological find, which had survived in an extreme environment for over a millennium and how that same environment was somewhat responsible for its survival. In conservation terms much of the technique was developed through trials as work progressed due to the unique nature of the project, with little in the way of comparative work existing. The four and a half year project saw the manuscript stabilised and has allowed initial study of its contents to commence. The lecturer has commenced further academic study of the manuscript in the form of a PhD to try better understand the materials and methods employed to produce this utilitarian book.

We will examine the content of manuscript, which contains the remains of the 150 Psalms from the Old Testament, including areas of illumination and decorated lettering. We will see the cover in remarkable original condition; possibly the only one of its kind in Western Europe with comparative structures that hails from lands as far away as Egypt. We will also look in detail at some of the surprise features from the cover that have raised more questions than answers but without doubt will play an important role in adding to the history of book making and monastic life in early medieval Ireland.

The Faddan More Psalter is now on display in the National Museum of Ireland as part of the Treasury Display and is rated among the top ten of the Museums collections.

Conservation of Johannes Herolt's *Sermones de tempore*, c. 1450

Harry Campbell, Book and Paper Conservator, The Ohio State University Libraries

Recently acquired by The Ohio State University Libraries (OSUL) Rare Books and Manuscripts Department, Herolt's *Sermones* is a mid-15th century bound manuscript on paper. Herolt (ca. 1386-1468) was a Dominican friar of Nuremberg, vicar of the Katharinekloster, and one of late-medieval Germany's most prolific sermon writers and preachers. This volume includes Herolt's collection of model sermons on topics and themes related to the liturgical year and cycle of saints' festivals. This sermon collection proved to be exceptionally popular, both during Herolt's lifetime and afterwards. It has been estimated that at least 500 manuscript copies of the collected sermons survive today (both complete and fragmentary), and as many as 186 separate editions of them were printed by the year 1500, with another 60 editions printed from the 16th-18th centuries.

OSU's copy had been re-covered sometime in the 20th century in quarter leather and paste paper over thick mill board. Also, at some time(s) in the past 50 years a number of pages had been reinforced with various clear plastic tapes to support areas where the acidic iron gall ink was corroding the paper. In many of these areas tape had been applied to both sides of the leaves. Originally, at least two scribes worked on this manuscript (one working on the temporal cycle, and the other on the Lenten sequence), and the condition of the various inks used ranges from near pristine to extensively corroded. The acidic and deteriorating ink was present on approximately 70 leaves in the last quarter of the text block.

In September 2011 conservators in the OSUL Conservation Unit began treatment that included dis-binding, tape, adhesive residue, and stain removal; mending pages; re-sewing and binding in period style as requested by the curator, using wooden boards, alum-tawed leather for the spine, metal fore-edge clasps and creation of a custom box to house the book and earlier binding components – some of which were from the original 15th century binding structure. The most significant part of

the treatment was the difficult and time-consuming removal of tape and adhesives, followed by reassembly of areas of text where much ink had been lost, leaving only the paper fragments between the lines of writing.

Another interesting aspect of this project, and this presentation, is the collaboration between the conservator and a land owner in southern Ohio for the "harvesting" of the beech wood used for the boards, which was cut from a storm-damaged 150 year-old American Beech tree by the property owner who donated the wood, the milling, drying, delivery and stacking to the Libraries specifically for this project, and for potential use on future binding projects.

Digital Rubbings. Monitoring Bookbindings with the Portable Mini-Dome (RICH)

Dr. Lieve Watteeuw, Illuminare, Centre for the Study of Medieval Art, KU Leuven; Bruno Vandermeulen, CIC, KU Leuven

The RICH project (Reflectance Imaging for Cultural Heritage, KU Leuven, 2012-2015) is creating a digital imaging tool for researching, studying, and exploring material characteristics of library materials produced in medieval and early modern times. In 2005 the module was created for reading cuneiform tablets in the department of Assyriology of the University of Leuven (KU Leuven). With the second generation of the imaging device, the visualization of bookbinding stamps (gold- and blind-tooled, on the back and on the boards of bindings) creates a sharp and exact image of the tooled surface, a "digital rubbing" with the possibility to read, measure, compare and identify occasionally difficult accessible decorations on book covers.

The digital imaging device, IMROD (Imaging Module for Multi-spectral, Reflectance or 2D+) is digitizing with omnimulti-directional lighting and export the result to 2D+. The technique is based on polynomial texture mapping, also known as Reflectance Transformation Imaging (RTI), a technique of imaging and interactively displaying objects under varying lighting conditions to reveal surface phenomena. With RICH the decorative and technical characteristics of manuscripts, paper and bookbindings are documented. The module is a hemi-spherical structure with a single downward looking video camera (28 million pixels). The object to be captured (maximum 180 to 120 mm) lies in the center and is illuminated from computer-controllable lighting directions, through the subsequent activation of multiple white LEDs. The different angles that illuminate the surface of the artifacts are revealing extreme details. Special attention is taken to produce raking light, the illumination at an oblique angle or almost parallel to the surface, to provides information on the surface topography of the book or page. For each illumination an image is taken by the overhead camera, in total 260 images for each object. After processing these 260 images, filters in de visualization system are incorporated in the software. Fine details can be highlighted by the use of specific digital filters, bringing out structures that would not be visible under single illumination

(like shade, contrast, sharpening and sketch filters). By scaling the image, a measuring tool in the software defines the dimension of the stamp and print lines unto 10 micron.

To develop the possibilities for “digital rubbings,” in 2013 a group of medieval and early modern bindings (11th to 17th century) were examined in Flemish Heritage collections (the Museum Plantin-Moretus and Leuven University Libraries). The lecture will discuss observations captured by the visualization system, the development of the database with the online viewer, and the possibilities of “RICH” as a research tool in the art, technical, and the conservation fields.

Conserving the Iraqi Jewish Archive for Digitization

Katherine Kelly, Senior Conservator, Iraqi Jewish Archive Project, National Archives and Records Administration; Anna Friedman, Senior Conservator, Iraqi Jewish Archive Project, National Archives and Records Administration

In 2003, conservators from the National Archives and Records Administration were called in to consult on a group of records and books related to the Jewish community which were recovered from the flooded basement of Saddam Hussein’s intelligence headquarters in Baghdad. The material was beginning to mold and fuse together as it had only been partially dried in the sun before being closed up in metal trunks. Given the lack of resources available in the region to stabilize and preserve the collection, the collection was shipped to the US for these activities to be carried out under the auspices of the National Archives. NARA performed an initial assessment in 2003.

With support from the Department of State to NARA, the final phase of the project was funded in 2011 to hire a team to catalog the material, digitize the rare books and archival materials, and make them available to the public on a dedicated website. Conservation treatment was carried out to permit safe handling, digital imaging, and exhibition of selected items. An exhibition in Washington, DC opened in fall 2013. This paper will discuss the challenges and lessons learned in a large scale mold remediation, conservation, cataloging, and digitization project.

When creating a treatment protocol for this collection, the authors had to consider the large volume of material in the collection, the limited time frame of the project, and the variety of binding and archival formats. The workflow was streamlined to support digitization and provide the best possible image of very compromised records. Physical challenges included widespread mold growth, severe cockling and distortion, and blocking together of pages. Legibility of the text was impaired by surface grime, ink bleeding during the water event, and staining from mold and dirty water. This project did not impose an archival arrangement on the materials, but a member of the conservation team had to establish a page sequence for digitization; a decision which was complicated by the conflicting orientations of Arabic, Hebrew, English, and other languages.

Salvage of Paper Materials From the Flooding of São Luiz do Paraitinga

Fernanda Mokdessi Auada, Teaching Specialist, SENAI National Service for Industrial Apprenticeship

On January 1, 2010, the Brazilian town of São Luiz do Paraitinga, experienced a devastating flood resulting in destruction of most of the city. Many historical and public buildings were damaged including loss of documents from the city’s administrative center. Personal documentations, retirement paperwork, medical certificates, maternity leave, legal records, contracts, and manuscripts were damaged or destroyed by the flood water. These documents from the Municipal Government and Public Ministry are essential for the citizens to receive their state benefits. With the damage and destruction of these documents most of the population lost their legal identity.

The Nucleus for Conservation of Public Files of São Paulo (APESP) and the Nucleus of Restoration–Conservation Edson Motta, laboratory del National Service for Industrial Apprenticeship (NUCLEM-SENAI), worked in conjunction to save these documents. The damaged materials were in three groups: 1) The first group of 800 files of different thickness consisting of 14 linear meters of documents. These date from the 1970s up to today with a variety of paper dimensions, kinds of typing, multiple handwritten inks, printing processes, photos and reprographic copies, 2) A second group was 14 linear meters similar to the first. 3) The third group consisted of 176 files with 3.52 linear meters and with similar damage characteristics.

The first group 1), due to bureaucratic reasons, became accessible after a delay of 26 days after the flood. So, the first group sent to the Archive for salvage was in an advanced state of deterioration, with all documents pasted together with fungus, debris and dried mud inside drawers where the documents had been stored.

The second group 2) was in similar condition and size as the first group.

The third group 3) of materials, due to misinformation, were kept wet in black plastic rubbish bags. They were sent to APESP after three months. As a result, the material was strongly infected by a variety of fungus. Using traditional methods to fight such a big infection, even drying the material, would certainly not give effective results. It would also jeopardize the technicians health as well as future users. Another consideration was the documents would have to be returned to the city administrative center where there was no environmental controls. The poor environment could reactivate the mold growth and the possibility of mold spreading to other areas of the collections. It was decided therefore, to submit the documents to gamma-rays cobalt-60 from a multipurpose compact type from the Radiation Technology Centre for Nuclear and Energy Research Institute (CTR-IPEN). A dose of disinfectant was applied to reduce the bio burden. It is well known that doses used for sterilizing are considered way too high for materials based on cellulose because it degrades them.

Comparing the group 3) with the 1st and 2nd groups which did not receive radiation, it was possible to see many advantages

during the recovery tasks. The radiated materials were easier to clean mechanically, remove spores, process, and separate pasted sheets in spite of their advanced state of degradation.

Other advantages noticed in the radiation process was the elimination of the quarantine period; there was no toxic or residual radioactivity; large quantities and varieties of materials could be simultaneously treated including the transportation package. The radiation procedure is a fast process with acceptable costs as well as being an environmental friendly method. Instead of the traditional manual salvage operation the radiation processes guaranteed 95% recuperation of the documents sent to us.

In Brazil there are few references to salvage work of this size and complexity. Generally there is little information in Portuguese about large salvage operations. We began with no trained salvage workers, without the assistance of a salvage company, nor freeze drying facilities. We had financial constraints and no time to come up with a “big plan” but only what was necessary for a practical course of action. A completely manual method was established to recover these documents. The procedures were all compatible with technical methods and criterias of paper conservation developed at APESP laboratory in Sao Paulo.

In conclusion, the radiation procedure assisted us salvaging the documents of São Luiz do Paraitinga. The treated documents can be returned to the city in a condition that permits them to be used a formerly and to establish the identity of the citizens of the city.

The Conservation of Tiffany Studio Drawings: Finding New Ways to Reconstruct Complex Paper Loss

Marina Ruiz Molina, Assistant Conservator, The Metropolitan Museum of Art

The Metropolitan Museum of Art holds a collection of over four hundred drawings from the workshops of Louis Comfort Tiffany (1848-1933). They include preparatory sketches and presentation designs for windows, interiors, mosaics, and other decorative works. When the Tiffany Studio drawings entered the museum in the 1960s, they offered a formidable challenge, for prior to acquisition the collection had sustained considerable water damage that resulted in extensive mold growth. In addition, many of these drawings are multilayered structures that contain very diverse strata. A simple drawing might include photographic and transparent paper, as well as extremely acidic and fragile elements, such as window mats and backing boards. The damage was so severe that these drawings could not be exhibited or properly studied because they posed a health hazard for the researchers, were aesthetically disfigured, and were structurally unsound.

This presentation focuses on the conservation treatment of a series of Tiffany studio drawings. The case studies showcase various treatment strategies developed to best accomplish structural and visual reconstruction of these works of art. One of the main purposes of these treatments is to provide stability to objects that, because of biological damage, include areas differing

in hygroscopic and mechanical behavior. This paper explores the nature of such behavior and the chemical principles behind the techniques that allow the conservator to stabilize the artwork.

Reconstructions were accomplished through a new method developed in the past years, which allows for the creation of large fills using paper pulp. The fill is cast separately from the object over the light table with the aid of a template and subsequently dried on the suction table. The adhesion of the cast fill, which also serves as reinforcement, is performed on the suction table in two separate steps. In selecting the pulps, the conservator should consider the fiber characteristics that will determine the overall final behavior of the treated art work: the expansion-contraction rate of the healthy paper, the damaged paper, and the selected pulp. Ideally, the pulp will compensate for differences between the two areas. Other variables, such as the opaqueness of the paper pulp, its color, and the amount of fibrillation achieved during blending play a critical role in the selection of the pulp and its preparation.

Finally, several examples of reconstruction of large missing areas of color accomplished through various methods, from coloring paper pulp to toning papers with airbrush techniques on the suction table, illustrate how important it is for the conservator managing these complex conditions to sensibly understand the boundaries of restoration versus conservation on a case-by-case basis within the context of museum exhibition requirements.

Investigation of Historical Japanese Paper: Experiment to Re-Create Recycled Paper from 18th-19th Century Japan

Kazuko Hioki, Conservation Librarian and Asian Studies Liaison Librarian, University of Kentucky Libraries

This presentation will discuss the physical characteristics of recycled paper used for Japanese printed books from the 18th to 19th century, exploring their production methods and historical developments based on the collaborative experiments with the University of Iowa's Center for the Book (UICB).

The majority of conservation practices and studies of traditional Japanese paper-based artifacts have focused on the high end arts such as screen paintings and scrolls, luxuriously printed books (such as Sagabon), and certain ukiyoe prints and paintings. Conservators generally have limited knowledge about the printed books and materials used; however, they are the most commonly found traditional Japanese artifacts in the collections of American cultural institutions. Many of these printed materials were mass-produced and made of poor quality paper, such as recycled paper. Making recycled paper required different source materials (waste paper) and lower papermaking skills than those involved in producing the high quality paper.

Conservators' unfamiliarity with these printed materials has a direct impact on their treatment. For instance, conservators might attempt to treat severely damaged covers of the printed books by disbinding, washing, and lining. This treatment will result in altering the softness and texture of the recycled paper

used for the covers. It also destroys the evidence of the subtle embossed cover decorations which are worn-out on the recto and only traceable on the verso of the covers.

This talk will highlight the findings from my experiment to re-create recycled papers and certain cover decorations with the help of Timothy Barrett and his graduate student Anne Covell at UICB. This experiment was designed to investigate the recycled papermaking processes including preparation methods of raw materials (waste paper), use of additives such as tororoaoi (viscosity agent), ink-removal methods, sheet formation and drying methods. We studied the literature to find information about recycled papermaking processes. We then analyzed the physical traits of traditional Japanese books and interviewed Japanese papermakers for their comments. After a series of trials using Thai kozo to determine recycled papermaking processes, we finally made recycled paper using the 19th century Japanese books as raw material. Sample papers and video recordings from this experiment will be part of my presentation.

This project demonstrates a unique benefit of collaboration with conservators and papermakers. My knowledge of historical paper and chemistry complimented Anne's practical knowledge and experience with papermaking. When the research is limited to a few sketchy historical documents and the remaining artifacts, this type of collaborative experiment is one of the most effective research approaches.

Finally, this research can help us better understand traditional Japanese papermaking in general, its products and its conservation. Our experiment found recycled papermaking could produce relatively high quality paper which was white in color and had a similar texture to the paper made of kozo plant. These findings provide evidence that many paper-based artifacts in the 18th-19th century were most likely made of paper mixed with kozo fiber and waste paper. My research is a step to investigate these important artifacts, and will stimulate further study.

Made of Paper: Robert Motherwell's Collage Materials in the 1940s

Jeffrey Warda, Conservator, Paper, Solomon R. Guggenheim Museum

The American artist Robert Motherwell (1915–1991) had a passionate relationship with collage, producing nearly 900 works over the course of his career. He first experimented with the medium following an invitation by Peggy Guggenheim (1898–1979) to participate in her groundbreaking 1943 collage exhibition at her New York gallery, Art of This Century. Motherwell was instantly drawn to collage and continued to experiment with the process, creating a unique and very personal group of early works in the 1940s.

A technical study of Motherwell's early collage materials was conducted in conjunction with a 2013 exhibition, *Robert Motherwell: Early Collages*, organized by the Solomon R. Guggenheim Museum, New York. This study identifies a refined palette of different papers, paints, and adhesives that Motherwell used

extensively during this initial period of discovery. Motherwell's choice of materials and the techniques he used are also discussed in relation to his experiences as a young artist and the growing shift toward Abstract Expressionism in America in the 1940s. In addition, Motherwell's thoughts on visual changes to his work and the potential for conservation intervention are also presented.

Corita Kent: A Technical Study of a Group of Screen Prints

Harry Metcalf, Craigen W. Bowen Paper Conservation Fellow, Straus Center for Conservation and Technical Studies, Harvard Art Museums

The Harvard Art Museums hold a collection of 79 screen prints by Corita Kent published between 1964 and 1969. It is intended that nearly all of these prints will be included in a group exhibition entitled, *Corita Kent & the Language of Pop*, scheduled for Fall 2015. The prints in the collection span an important period in Corita's life and artistic career. In 1968, after thirty years in the Immaculate Heart community, Corita resigned and moved to Boston to devote herself full-time to printmaking. This moment also marked Corita's decision to use a professional printer to edition her works.

Many of the prints in the collection have daylight fluorescent inks not commonly used by fine art printmakers of the period. Some are also printed on Pellon— a non-woven material containing acrylic, a support unusual to printmaking that presents specific condition issues.

This paper investigates Corita's approach to printmaking and the stability of the materials she used. The research attempts to ascertain suitable display parameters for the collection and examines the efficacy of using a Micro-fading Tester to predict the light fastness of the daylight fluorescent inks. The use of this equipment with such inks presented some unexpected challenges that will be presented, including the role temperature may play.

Indian Coloured Drawings: Modern Repair Techniques for an Album of 19th Century Paintings on Mica

Sarah Reidell, Associate Conservator for Rare Books and Paper, The New York Public Library

Like many uniquely composed albums found in library collections, the two volume *Indian Coloured Drawings* from The New York Public Library (NYPL) prompted a multifaceted treatment plan to safely stabilize and preserve complex materials. Composed from different unknown early 19th century sources, the first volume contains 135 paintings executed in opaque watercolors on mica while the second volume has 44 prints and watercolors on paper. The brittle materials and handling of the library-bound album structures contributed to physical damage and catastrophic media loss, particularly with the attachment methods of the fragile mica paintings. This presentation will describe the application of

treatment techniques and materials more commonly used in other conservation specialties, the establishment of handling protocols to safeguard future access to these unique objects, and the complexities of changing formats from grouped albums to individual housings.

Indian Coloured Drawings depict traditional Indian costumes, religious ceremonies, and historical scenes. A hybrid of traditional Mughal and Western styles, paintings on mica were produced in India during the East India Company era (ca. 1780–1858) by unknown local artists for Western patrons as exotic novelties. Few contextual clues regarding their creation, age, arrangement, or manner of entry into the NYPL collections exist. The current two-volume album set, previously unlinked bibliographically in the NYPL catalog, was created by the NYPL bindery during the 1920s or 1930s. Cyclical humidity fluctuations during storage and physical stresses during handling have caused extensive damage and loss to the paint layers, lining adhesive, mica, and paper supports within the first volume. The second volume also exhibited damaging attachment methods and brittle paper. Though the contents of both volumes are visually stunning and have high research value, these condition issues prevented safe access without assuring further catastrophic damage and loss.

The prints and watercolors on primary paper supports in the second volume were successfully treated using traditional paper conservation methods. However, conventional paper repair materials lacked the necessary refractive index, solubility, and adhesive properties appropriate for treating the mica paintings in volume one. After extensive research, materials such as Aquazol [poly (2-ethyl-2-oxazoline)], Paraloid B-72, and BEVA 371 film which are more commonly used in other conservation specialties were selected to ensure that pigment color, saturation, and transparency remained unaltered while paint-mica adhesion and mica-mica cohesion were reinforced. These materials are not only compatible with the original materials but are also easily reactivated, enabling future conservation intervention or exhibition preparation.

Conservation treatment has physically stabilized the watercolors on paper and mica to remove disruptive linings of paper and paste that were symptomatic of early 20th century binding and institutional fashion. Customized individual polyester encapsulations for the paper items and window mats for the mica paintings now protect the fragile media surfaces and allow for safe access by researchers. Though their physical formats have changed, the two volumes have been digitized and are now conceptually reunified in the NYPL catalog and web-based Digital Gallery.

Art on Paper Discussion Session: 'Reintegrating Design/Deceiving the Eye: Compensation Issues for Works on Paper'

Moderators: Nancy Ash, Senior Conservator of Works of Art on Paper, Philadelphia Museum of Art; Scott Homolka, Associate Conservator of Works of Art on Paper, Philadelphia Museum of Art

Compensation for damage and loss in works of art on paper encompasses a broad range of approaches, from the nearly

invisible and often intrusive interventions of Max Schweidler in the early 20th century to contemporary innovations. The nature and extent of compensation is the subject of ongoing debate and ethical reevaluation. During this year's APDG session paper conservators representing diverse philosophies and techniques will give brief presentations on their approaches to compensation. It is our hope that these presentations will help contextualize and clarify the decision-making process, lead to greater introspection about aesthetic issues in paper conservation, and encourage lively discussion about treatment decisions and techniques.

Aesthetic decisions in conservation inevitably are influenced by the philosophy of a period and culture. In the second half of the 20th century, the pursuit of increased transparency in the field and the development of written ethical standards encouraged a shift to greater restraint, which at times may be at odds with the practical demands that conservators face. Clearly many factors influence the extent and intent of compensation. These include audience and use, cultural traditions, and established aesthetic conventions, such as the pristine quality sought in contemporary works compared with the accepted "patina" of age in older works. Moreover, whether we abstain from visual compensation, insert a toned fill, or inpaint on the original support may affect not only the monetary value of a work but how the work is valued—as art object or cultural artifact.

Decisions connected with material limitations and the tenet of reversibility may have broader impact; for example, the divergent conventions regarding compensation in paintings and works of art on paper—e.g., extensively-compensated easel paintings versus comparatively conservatively-compensated paintings on paper. While these conventions certainly are influenced by the limitations of the materials, the pursuit of "invisibility" can be appropriate and achievable in paper conservation. Questions remain, however, about how invisible is "appropriate," and what are the implications of virtually undetectable repairs on scholarship or our understanding and appreciation of the work.

Other persisting issues include the recreation of missing and unknown design elements, the discrete removal of original material toward the goal of stabilizing or visually improving the object, and the dilemma of covering or camouflaging disfiguring stains. Furthermore, a decision to remove old compensations that interfere with the original must be informed by the historic significance and quality of the repair, and any risk to the object during removal. Finally, in recent years paper conservators increasingly are exploiting approaches that may reduce or remove the physical hand of the conservator. Such methods may utilize digital techniques to recreate design elements or employ temporary overlays or fills. Even subtly adjusting display lighting may be the solution chosen to meet the aesthetic needs of an object with only limited conservator intervention. We are eager for your participation in the discussion of this challenging topic and invite you to join us!

Library Collections Conservation Discussion Group: Options for Sustainable Practice in Conservation

Moderators: Justin Johnson, LCCDG co-chair, Senior Conservator, University of Washington Libraries; Danielle Creech, LCCDG co-chair, Associate Conservator and Operations Manager, ECS Conservation – Midwest

This Library Collections Conservation Discussion Group (LCCDG) will explore methods of lightening the ecological and economical footprint of conservation work. The discussion will incorporate voices from both profit and non-profit facilities, and will include both theoretical concepts and practical advice for project implementation.

Discussion Topics:

- Better management of conservation materials to reduce waste and improve reuse of scrap
- Implementation of green waste and/or recycling programs
- Identification of recyclable and/or reusable materials commonly used in conservation
- Reduction of energy consumption and the physical footprint of a lab or studio
- Adaptation of wide scale green initiatives to the conservation lab
- Exploration of recycling myths and realities

It is easy to consider ecological conservation too large or too expensive a problem to be tackled by the everyday conservator. This LCCDG will discuss not only the ecological benefits of sustainable practice in collections conservation, but also the financial benefits to the conservator.

Simple Method for Monitoring Dust Accumulation in Indoor Collections

Bill Wei, Senior Conservation Scientist, Rijksdienst voor het Cultureel Erfgoed

The accumulation of dust in museums and other indoor collections is a basic concern for collection management and conservation. Dust can be found everywhere, even in the best-kept museums with the most modern air conditioning and filtering systems. High levels of dust accumulation mean that showcases and objects must be cleaned more often, which implies higher maintenance costs for a museum, as well as more frequent treatment of objects. Dust also affects the perception of visitors as well as professionals of how well a collection is kept. In the extreme case, years of dust accumulation and poor environmental conditions can lead to degradation of materials.

In 2005, three Dutch museums reported possible problems with “too much” dust in their exhibition areas. Two of those museums were concerned about possible effects of dust raised by construction work occurring right next door, while the third was looking for the cause of a noticeable increase in dust accumulation in and around showcases, and leading to overheating of several projectors. In response to these issues, the Netherlands Institute of Cultural Heritage, now the RCE, conducted a study of dust accumulation in these three museums. An important result of this work was a simple and inexpensive method for measuring the rate of dust accumulation.

The method involves measuring the rate of change (loss) in gloss of standard glass microscope slides and using this as a measure of the rate of dust accumulation. Standard glass microscope slides (e.g. 25 x 75 mm) are placed next to objects or at locations of concern. They have the advantage of being easy to hide or are virtually invisible to visitors. The change in gloss (loss) as dust falls on the slides is measured regularly over a given period of time using a commercially available gloss meter. This data is used to calculate the rate of accumulation of dust over the measurement period.

Chemical analysis of the dust was conducted using energy dispersive spectroscopy (EDS/EDX) in a scanning electron microscope (SEM) by collecting samples on conductive carbon stickers which were placed next to the slides. The area coverage of dust was also determined by image analysis of micrographs of the stickers taken in the SEM. The combination of the gloss measurements and the EDS/SEM was used to determine the source of dust during the accumulation period.

The results of the study show that the rates of change of gloss and area coverage can be directly related to changes in activity in and around the museums. It confirmed earlier research that visitors are one of the main sources of dust in museums. The effect of construction, traffic, and seasonal changes could be seen both as changes in gloss as well as changes in chemistry. Gloss measurements are simple to use, and the analysis of the results can be easily carried out using a simple program, which can be written in, for example, Microsoft Excel.

The measurements are also inexpensive to carry out, requiring only a modest investment for the glossmeter.

The LED Revolution: Reevaluating Criteria and Standards for Museum Illumination

Steven Weintraub, President, Art Preservation Services Inc.

As a result of improvements in technology, LEDs will soon replace traditional electric lighting sources in many applications. The primary drive is economic, due to the high energy efficiency and long life of LEDs. Since the cost of LEDs will continue to drop as performance rapidly improves, the question is not “if” but “when” to make the transition to LEDs. Aside from obvious economic advantages, LEDs potentially offer many options beyond those available with conventional light sources. How can these options be used advantageously in a museum setting where the importance of properly exhibiting objects is balanced by the need to preserve objects and to minimize the risk of light-induced damage?

In order to answer this question, it is useful to consider the meaning of “properly exhibiting” an object from the perspective of the visual experience. Traditionally, the three most important tools used to minimize damage due to illumination were to control the level of visible light, minimize ultraviolet radiation and the rotation of light sensitive materials. Over the last few decades, there have been significant improvements in methods for determining the relative light sensitivity of materials, and in the availability and use of UV monitors and UV filters.

With regard to the control of the level of visible light, the goal has been to maintain an average light level between 50 lux and approximately 200 lux, depending on the relative light sensitivity of the object, a rule that has remained in place for many years. These values are based on the assumption that this is an adequate level of illumination to view a light-sensitive museum artifact and any illumination above this level would cause unjustifiable damage. Is this assumption correct?

Since LEDs offer new tools for the control of color temperature, color rendering, dimming, and unique capabilities for light distribution, the introduction of LEDs provides an important opportunity for reassessing what constitutes an acceptable visual experience and how new technology can improve this experience. One of the most important issues is to more fully understand the visual implications of viewing objects at current conservation approved light levels. It is also essential to take other factors such as color temperature and relative luminance of the surround, to name just two, into account.

The goal of this presentation is to discuss the need for developing a framework for reassessing the “visual experience,” based on a variety of criteria, including conservation concerns. Visual examples will be presented to illustrate the significance of various factors that must be taken into account.

Tracking Cumulative Light Exposure Using The Museum System

Claire Walker, Assistant Painting Conservator, Saint Louis Art Museum; Ella Rothgangel, Associate Registrar and TMS Administrator, Saint Louis Art Museum

In June 2013, the Saint Louis Art Museum opened the East Building, a new wing addition designed by David Chipperfield. The LEED Gold building features skylights and floor-to-ceiling windows and adds 21 new galleries for both temporary exhibitions and permanent collection works. The use of daylight as the primary illuminant in many of these new galleries spurred a shift from using instantaneous light level limits measured in footcandles to a cumulative exposure model using kilofootcandle-hours per year. The Conservation Department established new cumulative exposure guidelines for collections materials and worked with projections from the building's lighting designers to develop an estimate of monthly light exposure based on location. Through collaboration with the museum's TMS administrator, TMS was adapted to create a system for tracking light exposure over time. Fields in the Conservation Module of TMS were re-purposed to accommodate new information needed to determine overall exposure, and reference documents were added as plug-ins for easy access. Additionally, a flag system was created to alert conservators, registrars, and curators of pieces that have received excess exposure. Reports for light exposure were developed to present both the exhibition history and cumulative light exposure for a specific work and the exposure status of groups of objects in the museum. The cumulative exposure model allows for increased flexibility of display parameters, including instantaneous light levels, while emphasizing the need for preventative conservation. This paper will discuss the shift to a cumulative exposure model, the challenges and benefits of working with TMS, and the progress achieved since implementation.

The Ossabaw Island Workshops – Preventive Conservation Training in a Real Life Setting

David Bayne, Furniture Conservator, NY State Office of Parks, Recreation and Historic Preservation

Ossabaw Island, GA, is a near-wilderness, 26,000 acre island. The only access is by private boat. Among the five residents is the 101-year-old former owner, who retained lifetime residency in the Main House after she donated the island to the State of Georgia. Since 2010 four workshops on preventive conservation have been held on the island, three of which have been funded by FAIC through an NEH grant; the Ossabaw Island Foundation has also given significant support for the workshops.

The goal of these workshops is to train conservation students in the precepts of preventive conservation and historic house-keeping. The workshops have used the Main House as the

classroom and laboratory, with students studying the collections and conditions in the house. The workshops have given over 20 participants (both students and instructors) an opportunity to develop and implement housekeeping plans in an historic but uncontrolled environment in a remote setting. The work requires flexibility and practical problem solving by both students and instructors.

In addition to training students, another goal of the workshops has been to train instructors. Three of the four workshops have been co-taught by “emerging professionals,” who synthesized their knowledge from graduate programs and developed teaching techniques to convey this knowledge of preventive conservation to students with much less experience. The instructors and the students share housing and cooking in another historic building on the island. As a result they develop a professional camaraderie, which deepens the learning experiences.

The proposed presentation will be a review of which principles and techniques of preventive conservation have—or have not—been applicable in this setting. The Main House on Ossabaw Island is a historic house even though it may never be recognized as such by an official agency. These workshops have provided an unprecedented opportunity for intrepid conservators to learn about a collection and have input into the very beginnings of institutional conservation and preservation planning.

The Future of Risk Assessment: Developing Tools for Collections Care Professionals

Elizabeth Nunan, Associate Conservator in the Natural Science Collections Conservation Lab, American Museum of Natural History; Lisa Kronthal Elkin, Chief Registrar and Director of Conservation, American Museum of Natural History; Julia Sybalsky, Project Conservator, American Museum of Natural History

Over recent decades, risk assessment programs have played a role of increasing importance in the preventive conservation of cultural property allowing institutions to evaluate risks of all types in a quantitative fashion and then address them through a comprehensive, rational preservation plan. The risk approach is particularly valuable as cost-effective, sustainable choices concerning collections preservation are increasingly required that are based on well-documented, quantifiable needs. Frameworks such as Waller's Cultural Property Risk Analysis Model (CPRAM) provide museum professionals with guiding principles that can be used to develop a program customized to meet specific institutional mandates or goals. However the process of creating and implementing a program based on a generalized model remains a challenging endeavor and can often inhibit collection care professionals from adopting and applying the approach in their institutions.

Since 2005, staff at the American Museum of Natural History have pursued the ambitious goal of evaluating the entirety of the museum's collections—over 30 million specimens and artifacts in storage and on display, as well as library and archival material

supporting the collection. The AMNH risk assessment program is derived from the CPRAM model, modified to address the unique needs of its diverse collections. The AMNH methodology draws heavily on extensive background information acquired through inventory and interview. This information is used to thoroughly characterize the nature of materials under assessment, and to establish statistics describing details concerning collection storage, use and documentation. These details then act as fundamental criteria used in risk estimation.

Both the strength and the challenge in this approach is the enormous amount of data that must be collected and managed. Use of templates, questionnaires, and database systems facilitates this process. A statement of significance is developed for each collection, recording a concise summary of its key values and importance to the institution and acting as a reference point in risk evaluation. Other tools, such as illustrated rubrics, can be used to establish consistent rationale and limit bias in the determination of potential loss in value imposed by each risk assessed.

The methodology in use at the AMNH has bolstered strong results that can be compared through time and across collections, and as such it has helped to ensure that all vested parties feel ownership of those findings. Still, the approach is institution-specific, leaving much to be done in the field at large if risk assessment is to be adopted as a standard approach to collection care planning. Specifically, conservators and collections managers need tools, much like those developed at AMNH that will not only organize and analyze information but will guide an evaluator through the complex risk process. These tools must be applicable to the wide range of collection holding institutions and must be readily accessible. AMNH collection care staff are working toward these goals but will call to the fields of conservation and collections care for support and involvement.

Conservation Assessment at Schloss Leopoldskron in Salzburg, Austria: Promoting Sustainable Choices for the Adaptive Re-use of the Collection and the Site

Rita Berg, Graduate Intern in Paintings Conservation, Brooklyn Museum; Crista Pack, Kress Fellow, Arizona State Museum; Emily Schuetz Stryker, WUDPAC Class of 2013; Cybele Tom, Graduate Intern in Objects Conservation, Bode Museum, Berlin, Germany; Hannelore Roemich, Professor of Conservation Science, Conservation Center, Institute of Fine Arts, New York University; Joelle Wickens, Associate Conservator, Preventive Team Head and Winterthur Assistant Professor, Winterthur Museum, Garden & Library, Winterthur, Delaware

The Schloss Leopoldskron is a Rococo palace located near Salzburg, Austria. From the time of its construction as an estate of the Prince-Archbishop of Salzburg Leopold von Firmian and his family, the castle has passed through various owners, most notably Max Reinhardt. Today the Schloss serves as the setting

for the Salzburg Global Seminar (SGS) and is a national historic monument of Austria.

Frequent changes in the palace's ownership have led to the sale and loss of nearly all original art objects, except for outstanding Rococo stucco decoration and a number of paintings "set into" the walls. The current collection comprises paintings, works of art on paper, furniture, decorative objects, and outdoor sculpture acquired during the last 270 years. The condition of the objects has not been systematically documented. Only fragmentary information and photographic records were available.

The historic collection at the Schloss was the subject of an in-depth two-week survey conducted in the summer 2013 by four graduate students from the New York University and Winterthur/University of Delaware conservation programs and supervised by two faculty instructors. This experience provided the students with a unique training opportunity in conservation assessment and preservation planning. These collaborative projects strengthen the education and training of emerging conservators and should be modeled worldwide. The project was supported by the Samuel H. Kress Foundation and SGS.

The project started with developing survey forms that would allow condition assessments of the main building and a portion of the collections. This included written and photographic records to document the condition of five rooms and selected object types. Agents of deterioration and risk were assessed through a comprehensive look at IPM, storage, security, emergency plans, indoor environment, and the building envelope.

This challenging and highly collaborative project aimed to raise awareness of the Schloss's conservation needs amongst the current owners, staff, and guests, while carefully balancing the building's current function as a multi-use global meeting and event venue. Developing constructive recommendations associated with the need to maintain the daily functionality of this historic site was most challenging. The immediate steps required to ensure site sustainability should include the appointment of a collections manager and the establishment of guidelines for events and outside vendors. These would, for example, clearly outline restrictions, handling and use policies, supervision requirements, and regulations for the use of candles. A successful long-term adaptive reuse plan can maintain the heritage significance of the building and help ensure its survival. Sustainable economic strategies should acknowledge the proceeding decay of the artworks and therefore set priorities for conservation, for example, limit the light levels for sensitive works of art on paper and launch a conservation campaign for the most significant paintings.

The critical analysis of the collection and the site provided in this project will help the stakeholders at Schloss Leopoldskron to embrace the conflict between heritage conservation and adaptive reuse while promoting sustainable choices in collections care.

COLLECTION CARE & HVAC

A Sustainable Future at Tate

Deborah Potter, Head of Conservation, Tate

NMDC and Bizot Guiding Principles: National Museum Directors' Council (NMDC) agreed in 2009 a set of guiding principles for rethinking policy and practice with the aim of minimising energy use. The Bizot Group adopted the Guiding Principles and Interim Guidelines in 2010 and at subsequent meetings they have been further discussed and revised. The last revision was following a meeting in June 2012 when Tate met with conservation colleagues in New York.

The Guiding Principles is to review policy and practice, specifically regarding loan requirements, storage and display conditions, building design and air conditioning systems, with a view to reducing carbon footprints.

Current Approach at Tate: Tate recently endorsed the Guiding Principles and Interim Guidelines of the International Bizot Group in their galleries with Tate Collection. We are working to maintain a stable environment while being more pragmatic and widening the parameters for temperature and relative humidity. We are working to the following parameters in the galleries; temperature 18–24°C, 21°C±3 and relative humidity 40–60%, 50±10 with a maximum cumulative fluctuation of 10% in any 24 hours.

We are implementing an environmental strategy which is appropriate for both the individual buildings and for our collection. Our sites which are Tate Britain, Tate Modern, Tate Liverpool, Tate St Ives and two storage sites all present very different challenges and include a range of buildings. The Conservation and Building Estates Departments at Tate work closely to develop a bespoke control strategy for each building and to implement localised improvements at each site. Our current focus is on Tate Modern; during 2010–2011 we implemented a control strategy with incremental changes to the setpoints on a monthly basis linked to the external environment. We have revised this approach and during 2012 have implemented a control strategy which reviews the internal and external environmental conditions on an hourly basis during the day and in response the Building Management System makes adjustments on an hourly basis during the day and then holds the environment during the night. We are currently reviewing and revising this strategy and will present fully.

Energy Use and Carbon Reduction at Tate: Maintaining the traditional environmental standards of temperature and relative humidity within museums and galleries is energy intensive. We estimate that one third of our total electricity consumption is used to cool, humidify and circulate air in our gallery spaces. Reductions in energy use and carbon footprint at Tate have been achieved through using more efficient air-conditioning plant, upgrading controls and reviewing control strategies. In the future, the use of renewable and low carbon energy sources within for example the planned extension to Tate Modern, will reduce

carbon emissions from gallery conditioning further. However, revising the approach to environmental control standards has the potential to bring the most significant carbon and cost savings both to the organisation and the environment, investigating ways to move forward with this.

Joint UK Estates & Conservation meetings: Very successful bi-annual meetings have been convened by Tate since April 2011, with the aim of enabling open dialogue on energy reduction between Conservation and Estates colleagues and to move forward on sustainability issues. This is a very useful forum and model to use. We are currently working on Bizot energy questionnaire to gather more energy and carbon data and would present on our findings.

The Road to Sustainable Environmental Management of Storage Conditions at The National Archives

Kostas Ntanos, Head of Conservation Research and Development, The National Archives, UK

In 2006 the Collection Care Department (CCD) launched a series of initiatives that continue to inform the environmental management at The National Archives (TNA). This chain of events was the catalyst for a positive step change in environmental control, and with this a reduction in energy use.

The comprehensive climate mapping of TNA's repositories in 2006 and the subsequent deployment of an extensive radio telemetry environmental monitoring system in 2007 provided the evidence to improve environmental conditions in storage, whilst meeting government targets for a reduction in CO₂ emissions and energy use.

Given the large number of variables that influence environmental conditions in the repositories, in 2009 TNA embarked on a collaborative project with the Centre for Sustainable Heritage, University College London to create a computer model of TNA's 3 largest repositories.

The aim of the project was to develop and deliver a computer based building energy and environment (temperature and relative humidity) simulation model of the Q1 repositories at TNA site in Kew. The purpose of the model was to examine options in maintaining an appropriate preservation environment while reducing the building energy load in line with TNA's sustainability targets and capital investment strategy.

Sixteen different scenarios were examined using the model, from adjusting the operation of the HVAC system, to blocking windows and increasing the amount of material in storage. The model predicted that adjusting the thermostat and the humidistat set points seasonally, there was the potential to reduce energy load by an estimated 43%, while at the same time improving the quality of the preservation environment. This was considered the most favourable and feasible scenario, and was implemented in combination with weekend shutdowns of the HVAC system.

TNA's Estates & Facilities Department (E&F), in close collaboration with the Collection Care Department upgraded and developed the HVAC and Building Management System to deliver the proposed changes. By early 2013, three years after the project was initiated the target of 25% reduction in CO₂ emissions by 2015 was exceeded.

The close working collaboration between CCD and E&F is the cornerstone of successful environmental management of the repositories.. Evidence gathered in support of decision making for environmental management, coupled with willingness to learn new specialist' languages, made what could have been an ineffective relationship, a very successful one.

This presentation will discuss the changes that were implemented and the evidence that were used to support them, the difficulties encountered and the outcomes of the new environmental control strategy.

Sustaining Collections: Putting Theory into Practice

James Reilly, Founder and Director, Rochester Institute of Technology; Lois Olcott Price, Director of Conservation, Winterthur Museum, Garden & Library; John Castle, Director of Facility Services, Winterthur Museum, Garden & Library; Thomas A. Sherwood, Senior Account Manager, Limbach Company; Don K. Rowe, President, Green Energy Controls

In September of 2012, Winterthur received a grant from NEH's Sustaining Cultural Heritage Collections, the culmination of a year of intensive planning involving Winterthur's Conservation and Facilities Departments, Limbach Engineering & Design Services and the Image Permanence Institute. The Winterthur Museum had undertaken several efforts over the last decade to develop energy saving protocols, but was consistently frustrated by the inability of monitoring systems to provide reliable real-time environmental information that would insure collection safety. The preparatory year involved an extensive general survey of Winterthur's HVAC systems undertaken by Limbach that resulted in a proposal with specific mechanical, monitoring and control upgrades. Due to the size of the project, Winterthur funded most of the mechanical upgrades and turned to NEH to help fund the monitoring and control segments. Our ambitious NEH proposal committed Winterthur to:

- Survey, document and upgrade antiquated monitoring and control systems throughout three major collection buildings.
- Make real-time data and controls on all mechanical system components available wirelessly to all networked staff 24/7.
- Use the real-time wired and wireless environmental data automatically loaded into IPI's e-Climate Notebook to effectively monitor environmental conditions in collection areas making data available to all networked staff 24/7.
- Use the mechanical and environmental data collected to develop significant energy saving protocols that also

maintained collection areas within environmental parameters that would not compromise long-term preservation.

As we near the end of the project, AIC provides an opportunity to present preliminary findings, results and challenges from the perspective of the four major participants: Lois Olcott Price, Director of Conservation, John Castle, Director of Facilities, Limbach, and Jim Reilly, Director of IPI. The interactive format of panel presentations followed by discussion will allow other institutions considering similar, highly beneficial projects, to benefit from Winterthur's experience in both planning and implementation. Major findings include:

- The labor-intensive HVAC system survey revealed many surprises to both facilities and conservation staff and explained issues noted by staff in the past. Limbach has commonly found similar unidentified but critical issues in other conscientious and well-maintained institutions.
- The importance of an accurate real-time monitoring and control system for museum systems that, with chillers and reheats, is inherently highly inefficient without active, real-time control strategies.
- Collection staff and other participants must learn each other's language and collaborate closely to develop effective energy saving protocols that also insure the safety of the collection. Inevitable "trade-off" decisions must be made jointly.
- The project should NOT depend upon pre-set environmental parameters or use them as project goals.

With energy savings projected at over 20%, this project has the potential to significantly reduce Winterthur's carbon footprint and allow resources to be used for other mission critical activities that enhance its ability to improve collection access and deliver meaningful exhibits and programs to its audience as well as to protect its collections.

Managing Collections Environments in Historic Buildings in the Arizona Desert

Nancy Odegaard, Conservator and Head of Preservation Division at the Arizona State Museum and Professor in the Department of Materials & Engineering, the School of Anthropology, and the Drachman Institute; Teresa Moreno, Associate Conservator, Arizona State Museum

The Arizona State Museum (ASM) occupies two buildings in the historic district of the University of Arizona campus in Tucson, the "Old Museum" (1935) and the "Old Library" (1926). The buildings are listed on the National Register of Historic Places. Though purpose built, the aging buildings did not receive air conditioning until the late 1940s and their mostly antiquated mechanical systems are not adequate to maintain stable and reliable environmental conditions for the preservation of collections in the climate of the American Southwest, which includes the local Sonoran Desert, the Mogollon Rim, Chihuahuan Desert, and the Colorado Plateau. Determining what are actually appropriate environmental conditions for collections from these

areas has been a particular challenge. Traditional published guidelines are seldom appropriate or achievable in this climate without exorbitant cost and energy expenditure.

Over the years specific ASM collections have been targeted for storage (Save America's Treasures visible vaults for Pottery and Basketry) and exhibition (Paths of Life passive climate control cases) improvements based on vulnerability of material type and cultural significance. Incremental improvements to the building envelope (insulated window panels) and mechanical systems (the visible vaults, conservation lab and temporary gallery) have been implemented as funds permit, and are based on monitoring, survey and studies conducted since the 1980s. Three specific building improvement projects that have addressed museum exhibits and collections storage needs will be discussed.

Tucson's unique desert climate is beneficial in many ways, but the limitations of the museum's mechanical systems present many challenges for preservation of our varied archaeological, ethnographic, library, archive and photographic collections. Our current strategy involves close collaboration with ASM collections curators and administrators and University of Arizona Facilities Management to prioritize building improvements and mechanical system upgrades and optimize the function of existing systems until funds can be raised to replace them. While not ideal, this is a reality that many smaller and less well-funded institutions are faced with on a regular basis. This paper will perhaps provide some guidance on how to tackle large scale environmental upgrade projects one small step at a time.

Establishing Sustainable Preservation Environments at the Library of Congress

Nancy Lev-Alexander, Head, Collection Stabilization Section, Library of Congress

The need to balance cost, sustainability and preservation stewardship is a primary and ever increasing concern at collecting institutions throughout the world. The US Library of Congress is addressing this concern by evaluating environmental requirements for collections storage throughout the institution, while identifying opportunities to adjust mechanical system operations to reduce energy consumption without compromising long-term collections preservation.

Since January 2010, the US Library of Congress Preservation Directorate has worked collaboratively with facility managers and external consultants, to conduct a mechanical system modification in two, nearly identical, large stack areas of the John Adams Building, which together hold approximately 13,000,000 volumes on 12 deck levels. By piloting a programmed shut-down of all mechanical system operations for 7.5 hours each night, coincident with automated lighting shut-off, we have identified an opportunity to save up to 31% on HVAC operating costs per year without significantly reducing long-term preservation or exposing the collections to immediate risks associated with climate extremes. In addition in one area we extended the

shutdown to include a full 24-hour shut down on Sundays when the Library is closed thereby significantly enhancing the potential yearly operating savings. After four years we have collected and analyzed data that confirm that the nightly shut down modification results in minimal meaningful impact on preservation quality of the collection storage environment when all components of the HVAC system are operating properly. Conversely we have identified operational reasons for adverse environmental trends that are not related to the shut down and have identified methods of reviewing data to determine whether operational fault or the shut down itself is responsible for the excursion from target climate conditions. Finally, Preservation staff are collaborating with facility managers and consultants to review other collection areas in the Library's Capitol Hill complex to identify the risks, benefits and limitations (duration or seasonal) in adopting additional shut down operations to save energy.

This presentation will provide an overview of the environmental assessment program in place at the Library of Congress and show how data collected over time was used to identify locations for the first shut down locations described and to weigh the preservation consequences of mechanical adjustments. The presentation will also provide details of critical factors investigated before and during the trial, describe how we achieved the level of interaction needed between preservation and facility staff, and discuss our method of projecting preservation outcomes and savings potential.

Developing Sustainable Storage for the Science Museum Group UK: The Hemcrete Museum Store (HMS)

Marta Leskard, Conservation & Collections Care Manager, Science Museum, UK

The Science Museum, the National Railway Museum, the National Media Museum and the Manchester Museum of Science and Industry have their main reserve collections storage facility on a repurposed WWII airfield an hour west of London, in Wiltshire. Here are stored large and mid-sized objects from the science, technology, industrial, communications, transport, space and medicine collections as well as textiles, fine art, archives and library materials.

Collections are stored in eight 1930's hangars, two 1940's brick buildings and one 1990's purpose-built store on the 545 acre site. The hangars are unheated and only one has any insulation. The brick buildings have been upgraded with added insulation and wood-chip boiler heating. The purpose-built store has insulation, vapour barriers and oil-fueled conservation heating. High relative humidity levels are an issue in the unheated hangars but can also be a problem in the other buildings.

A small Conservation and Collections Care team on site is responsible for the preservation, remedial treatment, storage and movement of the objects; the buildings and systems are maintained by the national Estates team.

Performance indicators, based on the "10 Agents of

Deterioration” (Robert Waller 1994) and updated UK environmental standards (PAS198:2012), are used to assess storage conditions. Storage areas are graded for materials and types of object. Rehousing objects based on this system has meant that many of the less stable have been stored in more suitable conditions without increasing need for air conditioning and mechanical systems. Resources have been directed at targeted areas in an attempt to save money without reducing standards of care.

In 2010 it became essential to develop an environmentally-controlled yet sustainable store on the Wroughton site. Suitable space was needed for a nationally important archive as well as 80 large wooden ship models, 25 horse-drawn carriages and the Science Museum’s framed art collection.

A conventional store had been built inside a hangar to house archival materials; heated by a wood-chip boiler, it has been costly to run with poor relative humidity control. With knowledge of passive building techniques gained from workshops, lectures and research, an innovative use of traditional building materials was chosen for the new build, to go in the remaining hangar space. A much-reduced heating and ventilation system was installed after modelling supported the decision. The building was completed in June 2012 and, although there were a number of issues, predominately with the building management system, by May 2013 it was running at less than a third of the cost of the conventional store. From May to September 2013, the building itself moderated the relative humidity without recourse to the air handling system, with an average 60% RH and fluctuations of less than 2% over 24 hours.

To date, HMS has won three major awards in the UK for sustainability and innovation in building and heritage.

Research into sustainable building methods for museum storage continues at Wroughton with the development of the University of Bath BRE Centre for Innovative Construction Materials’ new research park and a part-time PhD presently being undertaken by the author.

Some Trends in Examining Six Years of Utility and Climate Data at the Museum of Modern Art

Jim Coddington, Agnes Gund Chief Conservator, Museum of Modern Art; Ana Martins, Associate Research Scientist, Museum of Modern Art; Chris McGlinchey, Conservation Scientist, Museum of Modern Art

Seasonal trends in New York City weather patterns are compared to the museum’s consumption of electricity, gas, and steam between 2006 and 2013. Two locations are compared: the main campus in Manhattan on 53rd Street and its storage facility in Long Island City, Queens. The former uses primarily electric and steam while the storage facility electric and gas. Climate data was obtained during the same time period with a frequency of at least twice an hour from a weather station in Central Park operated by the National Oceanographic and Atmospheric Administration (NOAA). For the period examined there is a relatively abrupt rise in relative humidity in the Spring and a more gradual drop to

lower humidity beginning in late summer and continuing through most of winter. Using conversion factors recommended by the local utility it was possible to plot the three different energy sources on a single graph in terms of kilojoules (KJ). At the museum’s main campus the highest consumption of energy takes place during the winter to provide heat and humidity. However, at the storage facility the largest amount of energy is consumed during the summer and is primarily related to reheating dehumidified air.

Research on Mechanical System Shutdowns in Collection Storage Areas

Jeremy Linden, Preservation Environment Specialist, Image Permanence Institute

This session will discuss the methodologies and final results of a four-year experiment into the use of mechanical system shutdowns as a method to achieve significant reductions in energy use in cultural institutions without compromising the preservation quality of collections environments. Research has shown that environmental conditions (temperature and relative humidity) are the most significant factors that impact the lifespan of cultural materials held by institutions. Mechanical systems in cultural environments are therefore frequently designed to run continuously in order to maintain the desired environmental conditions, often resulting in a high cost both monetarily and in energy consumption. Altering these conditions through changes in HVAC operating schedules is a risk many institutions have been hesitant to take.

The findings of the research show that the impact of shutdowns varies depending a number of factors, including geographic location and building structure, but that at each experimental site a shutdown routine was found that could successfully reduced energy consumption—sometimes by as much as 40%—without sacrificing the quality of the preservation environment. In addition the research identified practices that informed a number of related subsidiary questions, including how to identify good candidate spaces for shutdowns, identifying the tools and methodology necessary for energy and preservation environment analysis, and the efficacy of various process management models. In addition to the final findings in both preservation and energy impact, this session will also discuss some of the unexpected lessons learned during the process as well as some beneficial side effects of the research and energy analysis at several of the institutions.

This four-year experiment was federally funded by the Institute for Museum and Library Services, and conducted by the Image Permanence Institute (IPI) at the Rochester Institute of Technology and their partner Peter Herzog, principal of Herzog/Wheeler & Associates, a Minnesota-based energy consulting firm. The experimental partners for the research were the Birmingham (AL) Public Library, Cornell University, the New York Public Library, the University of California, Los Angeles, and Yale University.

Museum/University Collaborations in Media Conservation Research

Glenn Wharton, Clinical Associate Professor, Department of Museum Studies, New York University; Deena Engel, Clinical Professor, Department of Computer Science, New York University

Media art conservation requires many forms of research to implement strategies for long-term preservation. Standard research includes investigating original playback equipment, staying abreast of emerging audio, video, and software technologies, and communicating with artists about technologies they use and their exhibition preferences. Media conservation also requires primary research to develop strategies for new technologies that artists use in their production. Museums are well served by establishing relationships with local universities to conduct some of this research. Academic faculty and students can assist media conservation in many ways, from answering technical questions to engaging in more extensive collaborations.

In this presentation the speakers describe research relationships developed between Media Conservation at the Museum of Modern Art (MoMA) and New York University (NYU). Over the past seven years a number of collaborative projects and courses facilitated needed research for the museum and provided learning opportunities for students in the Courant Institute of Mathematics, the Moving Image Archive Preservation Program, the Museum Studies Program, and the Institute of Fine Arts. One case study will be featured, in which undergraduate Computer Science students from NYU researched and documented software-based works in MoMA's collection.

Glenn Wharton will describe the research program developed at MoMA that led to these collaborative relationships. He will illustrate the first section of the presentation with examples of collaborative research projects between the university and the museum.

Deena Engel will describe the research conducted by students on software-based art, along with her work to establish the research program within the Courant Institute of Mathematics.

XFR STN: Operating an Open-Door Media Conservation Lab

Walter Forsberg, Audio-Visual Conservator, XFR STN; Ben Finoradin, Digital Repository Manager, The Museum of Modern Art

For three months during the summer of 2013, New York's New Museum of Contemporary Art played host to a public, open-door, artist-centered media conservation laboratory called XFR STN. Derived from a project proposal to preserve the massive collection of video materials produced by the Monday/Wednesday/Friday Video Club, XFR STN sought to address the wide need for artist access to media migration and recovery services. Throughout its ten-week run, XFR STN offered artists the opportunity of scheduling three hour appointments

with trained technicians to recover work from a wide variety of obsolete analog video and digital media formats. Moreover, the project sought to eliminate the prohibitive costs associated with such migration services, addressing the fact that many artist's media-based materials will not survive beyond their lifetime if they have not already achieved commercial success.

The XFR STN project also inherently addressed issues of distribution, scale, and the economics of preservation for small institutions. By partnering with the Internet Archive to host all digitized material, XFR STN offered a nuanced approach to common institutional challenges surrounding the cost and maintenance of a long-term digital repository, while twinning conservation of material with widespread public access to resulting preserved content.

This paper will offer a practical case-study surveying the nuts and bolts of such a lab; detail the day-to-day logistics of running a public and appointment based service; provide background on streamlining metadata capture and processing; outline pedagogical approaches and educational outreach to artists and the public; and relate practical and technical lessons learned throughout the course of the exhibition. The presenters will also enumerate strategies by which XFR STN rallied institutional support and expertise from a wide array of cultural organizations' preservation departments to realize the project's equipment and resource needs. The aim is to provide guidance through which other institutions may build upon for the successful operation of similar conservation recovery services.

Unstable Archives

Jo Ana Morfin, Variable Media Art Conservator, National School of Conservation (ENCRyM), Mexico City, Mexico

The concept of "Unstable Archives" makes reference to archival collections assembled by artistic materials in electronic and digital media.

The notion of "Unstable Archives" suggests two types of instability. The first one is with regard to their material instability, that is, the short life span and obsolescence of "carriers" or storage devices, formats, as well as playback equipment and hardware. While the second type of instability, makes reference to their "accidental" ontology, conceptualization and use, and by this I mean, their continuous fluctuation in the context. That is, their move from the archive to the museum, and vice versa.

This paper will introduce several examples of Unstable Archives. Each case attempts at discussing main topics with regard to the preservation of Audio-visual and Digital Heritage. The presentation is structured in four themes: General concerns in the caring of "Unstable Archives", Digitalization, Digital Preservation, and Accessibility.

On the first section, I will discuss some general problems faced by the responsible of AV archives. Generally speaking, small and non-collecting cultural institutions share the same concerns, that is, they all face with the lack of enough funding, time and

resources to manage their documentary collections. In most cases, there is a shortage of qualified staff, little knowledge in providing long-term access to, as well as a lack of reliable strategies for preserving technology-related documents. Often, mixed media archives have not been stored correctly nor do they have adequate management, conservation, and disaster plans. More importantly, the variety of media types and formats are becoming obsolete and inaccessible.

The second part will address the issues with regard to digitalization. The emphasis will be placed on projects that were not well planned and how the “digitalization fever” has led to unsustainable choices. On the third section, I will present a basic introduction about digital preservation and the general guidelines for managing and preserving digital objects. Finally, the last part of the presentation will focus on the topic of accessibility. I will highlight the characteristics of a sustainable and robust platform to disseminate and preserve audio-visual materials.

Given the lack of professionalization in the field of AV and Digital preservation in Mexico, it is urgent to highlight the challenges, and to address possible sustainable practices aimed at ensuring the preservation of these materials. Due to the increasingly number of archival collections that hold electronic and digital materials, institutions must develop strong, interoperable and sustainable strategies, tools and models aimed at preserving our technology-related documentary heritage.

‘At Your Microservices’: A Roadmap to Preserving Digital Objects

Siobhan Hagan, Audiovisual Preservation Specialist, University of California, Los Angeles Library; Gloria Gonzalez, Digital Archivist at UCLA Library Special Collections; Dawn Aveline, Preservation Officer, University of California, Los Angeles Library

Increasingly, the UCLA Library is producing and collecting a wide variety of digital objects and collections. We are the stewards of archival audio and video files digitized from analog magnetic tape; video files produced with cell phone cameras by activists; email correspondence of professors and literary authors; social media accounts; computer-aided design architectural files; amongst many other types of reborn digital and born-digital files. Along with the sundry nature of these digital collections comes a diverse set of preservation risks and needs. This session explores this wide-ranging set of preservation issues from the perspectives of the Head of Preservation at the UCLA Library, the Audiovisual Preservation Specialist, and the Special Collections Digital Archivist.

The Head of Preservation will present the organizational role of preservation and collections care in building collaborative methodologies between the various departments and expertise required for effective digital stewardship.

The AV Preservation Specialist will discuss the specific digital preservation issues stemming from the recently created in-house

AV reformatting lab and large-scale outsourced AV reformatting projects. The crux of the issue is size: roughly one hour of analog video reformatted to digital files is 100 GB. With one of our recent smaller collections, this left us with approximately 11 TB of 120 digital video files to preserve. On the other spectrum, a collection of 2,000 born-digital cell phone videos was only 10 GB. With only one full-time AV staff member, one part-time graduate assistant, and a handful of interns, these files and their accompanying metadata require a detailed preservation plan that is as automated as possible.

With the aim to address digital preservation holistically, the Digital Archivist will demonstrate the “micro-curation service framework,” which offers a variety of services to meet the many needs of our organization. Micro-curation services (or micro-services) are individual automated services designated “micro” due to their granularity. This modular approach with self-contained services including metadata creation, file identity, fixity, replication, and storage, allows for flexibility in ensuring the preservation of digital objects.

Imaging Digital Media for Preservation with LAMMP

Matthew McKinley, Digital Project Specialist, University of California, Irvine Libraries

Hardware/Software obsolescence and bit-level corruption pose a serious threat to the ongoing accessibility of digital media storage devices both magnetic (floppy and ZIP disks) and optical (CD/DVD, USB drives). The Legacy Archival Media Migration Platform (LAMMP) was developed to rescue potentially valuable digital content from rapidly aging digital media formats. LAMMP automates the generation of bit-for-bit disk images suitable for preservation as well as disk and file-level metadata for future appraisal and access. Beyond basic preservation, there is also great archival value in reliably capturing the work environments of digital content creators. Migrating media to a digital image format and ingesting into a digital repository ensures its continued authenticity for future investigation, emulation and access. Built on open-source software, digital forensics tools and a combination of modern and legacy hardware, LAMMP is low-cost and highly customizable. Along with disk image and metadata generation, LAMMP performs essential digital preservation workflow tasks such as virus checking, hash checking, and file extraction. Finally, automation via Linux command line tools and shell scripting allows for non-technical staff to perform the LAMMP preservation procedure for most common digital media formats. The paper will cover the development of LAMMP, hardware and software specifications, lessons learned and next steps.

Creating a Preservation and Access Framework for Digital Art Objects

Madeline Casad, Associate Curator, the Rose Goldsen Archive of New Media Art, Cornell University Library; Desiree Alexander, Collections Analysis Assistant, Goldsen Archive; Dianne Dietrich, Librarian, Cornell University

In February of 2013, the Rose Goldsen Archive of New Media Art, part of Cornell University Library's Division of Rare and Manuscript Collections, received a \$300,000 grant from the National Endowment for the Humanities to develop Preservation and Access Frameworks for the complex digital media art objects in its holdings.

The test collection includes more than 300 interactive born-digital artworks created for CD-ROM, DVD-ROM, and web distribution, many of which date back to the early 1990s. Though vitally important to understanding the development of media art and aesthetics over the past two decades, these materials are at serious risk of degradation or obsolescence, and unreadable without legacy computers and software.

The goal of our project is to create a scalable preservation workflow to ensure the best feasible access to these materials for decades to come, and also contribute to the development of coherent best practices in the area of preserving complex media collections.

In May of 2014, we will have completed our first year of the project. Our presentation will provide an overview of our project's aims, strategies, and desired outcomes, update on progress so far, and describe some recurring and idiosyncratic technical challenges we've encountered along the way. Some additional topics we would like to share and discuss include:

- The development of digital collections hand in hand with archival repositories and complex-media delivery systems at a large-scale institutional level
- Establishing assessment criteria for emulation strategies, especially in research archives
- Determining "best feasible" access—that is to say, developing an access plan that acknowledges the real limitations of staff time and technical capacity and aims to maximize the breadth of conservation outcomes.

Luncheon Keynote: Sustainably Designing the First Digital Repository for Museum Collections

Ben Fino-Radin, Digital Repository Manager, The Museum of Modern Art; Dan Gillelan, AtoM Product Manager, Artefactual Systems; Kara Van Malssen, Adjunct Professor, NYU MLAP, Senior Consultant, Audio Visual Preservation Solutions; Juan Montes, Chief Technology Officer, The Museum of Modern Art

For three years, the Museum of Modern Art has worked to design and build the first digital repository for museum collections

(DRMC). The goal of the system is to assist time-based media conservators in providing sustainable collections care to variable, time-based media and digital artworks in MoMA's collections. The DRMC's foundation is in international standards and Best-practices for long-term digital collections management, thus sustainability has been inherent in the design of the system from the outset. This mission of long-term viability and sustainability extends to every aspect of the project from the interdepartmental and interdisciplinary team of advisors at MoMA that steered the project, to the fundamental involvement of outside field experts, and the decision to work with and adapt existing, widely-adopted open-source software. This paper will study the DRMC itself as a tool for conservators, which provides much needed digital collections care, as well as the decisions made at every stage of design and implementation that contribute to the long term sustainability of the DRMC itself.

For AIC's 42nd Annual Meeting, this paper will be presented as a panel discussion among the four co-authors, emphasizing the interdisciplinary and collaborative team that was crucial to the DRMC's success as a viable and institutionally sustainable resource.

An emphasis will be placed on project management, collaboration, usability testing, and standards compliance with particular attention paid to the underlying open-source software that lies at the core of the DRMC. The paper takes the position that the needs of an institution are best and most sustainably served through understanding the existing ecology of open-source development and research, and finding ways to contribute to and expand existing tools a design philosophy that extends to all facets of the DRMC. At the time of the 2014 Annual Meeting, the DRMC will be in its first public beta phase, allowing for the a public demo of the system.

Sustainable Digital Preservation for Audiovisual Content

Linda Tadic, Executive Director, Audiovisual Archive Network

Preserving digital time-based media and born-digital art is resource-intensive. Digital content can be the result of analog to digital transfers, or be born-digital. To preserve these works into the future, conservators must be familiar with proprietary file formats, systems used to create and render content, and production workflows behind content creation. Performing managed digital preservation actions are more complex than with static content: files are larger, making fixity checks and storage requirements intensive; the analog-to-digital preservation process must be carefully tracked through metadata; and proprietary formats must be migrated to newer generations or open formats while being mindful of content file interdependencies. Many museums and custodial institutions, as well as the creators themselves, lack infrastructure and staff expertise to perform managed digital preservation actions on this content. This paper will provide an overview of the issues surrounding preserving digital time-based

media, and describe the Audiovisual Archive Network (AVAN), a non-profit digital preservation service for educational, arts-based, cultural heritage, and government organizations and also for individual creators.

The California Audiovisual Preservation Project: A Statewide Collaborative Model to Preserve the State's Documentary Heritage

Pamela Jean Vadakan, Coordinator, California Audiovisual Preservation Project, University of California, Berkeley Library

National studies of the issues related to preservation and access of media holdings by the Council on Library and Information Resources (CLIR), the Library of Congress as well as the research survey of special collections and archives conducted by OCLC Research Group underscore the magnitude of the challenges facing cultural heritage institutions. Primary source sound and moving image recordings of the 20th century are seriously endangered by physical deterioration, lack of playback equipment, and rapidly advancing format obsolescence. Preserving them, including addressing metadata needs, potential rights issues, and technological complexities of audiovisual materials and the digitization processes, can be intimidating. Few institutions have the staff resources to begin preservation planning and very few have in-house facilities to accomplish audiovisual preservation work.

The California Audiovisual Preservation Project (CAVPP) is a preliminary example of how a collaborative model can work as one proactive solution to many of these challenges. It is the first statewide initiative in the country to collaboratively facilitate access and accomplish audiovisual preservation work most individual organizations are unable to undertake. The Project helps libraries and archives move from the analog to the digital age. Perhaps most importantly, it teaches libraries and archives how to help themselves with their audiovisual preservation challenges. Based on best archival practices for moving image and sound preservation, the CAVPP establishes low-cost, practical, standards to guide partner institutions through the preservation planning process, from collection assessment to selection to description to digitization to metadata management to quality control to long-term storage and online access, and brings to light hidden media collections via the Internet Archive (IA), a repository that is freely available for non-profit, educational use. To date the California Light and Sound (CLS) collection includes 700 previously endangered, historically significant audiovisual recordings, contributed by 23 museums, archives and libraries across the state.

This session will discuss how the CAVPP is developing a collaborative, increasingly sustainable, statewide audiovisual preservation infrastructure.

Filling in the Gaps: Finding Your Way to Conscientious Curation and Preservation of Born Digital Collections and Objects

Jason Evans Groth, North Carolina State University Libraries Fellow, North Carolina State University Libraries

The OCLC has, since 2012, released three reports that attempt to “Demystify” born digital for collection managers. The release of these reports and the positive response to them offer more proof that the archive and conservation world is not on the brink of but is, rather, firmly facing the challenge of how to deal with born digital collections and objects. This is no surprise to many collection managers, but it is a reminder that plans need to be made immediately to start appropriately caring for this material.

Media archivists predict that legacy video and audio formats provide preservationists a 10-15 year window to safely and completely migrate content to a more manageable form. Data – floppy disks, hard disks, USB drives, CD-Rs, etc. – is at least as volatile – if not more – than heartier media formats that came before it. Knowing that the clock is ticking can be motivating, and the OCLC reports attempt to foster that motivation into a plan. They, however, are just the starting point, and overworked collection workers who are, perhaps, not keen on learning command line operations at a born digital workstation may not put these quickly degrading, already obsolete (in terms of software) collections at the top of their list to process appropriately and quickly. While they are incredibly helpful and provide an overview of mandatory tools for born digital curation and preservation, they are written for a broad audience and, because of that, do not address some of the finer points of this potentially confusing, time consuming, and, thus, often passed-over work

This presentation, which will draw from a two-year born digital curation initiative at NC State which started in 2013, attempts to fill in the gaps for institutions and individuals who know there is a problem, who have read varying reports, and have stopped short at creating their own born digital workflow because of the complexity of the issue. It will discuss the reality and reliability of readily available tools and how to tap in to the expertise of a relatively small but growing Community of Practice. A discussion of digital media storage, born digital workstation creation, ingest workflow, appraisal, arrangement and description, access, and keeping the objects safe while performing this work at NC State will give just one example of how one institution has begun dealing with the challenge that born digital presents. Unfortunately, machine and software obsolescence will not wait for us to solve this problem, and this is not a problem that will be resolved easily or quickly. Luckily there are enough resources – both written and in the form of librarians, archivists and conservators working hard to mitigate these issues – to address this challenge head-on.

Sustaining Playback Through Techno-Archaeology: A VTR Refurbishment Project

Michael Angeletti, Moving Image Digitization Specialist, Stanford University Libraries

To those archivists working with magnetic media, it is apparent that all analog tape formats face veritable extinction in the long term. Not only are the physical carriers at risk, but the machines used to play endangered tapes are also facing extinction.

Audiovisual archives may have access to legacy videotape machines, but no way of restoring them for use in video reformatting. Using a recently completed refurbishment project at Stanford Media Preservation Lab as an example, the presentation will focus on how archivists can take steps to refurbish their old videotape machines, enabling them to handle the antique video in their collections, as well as consider acquisition of new collections containing valuable but at-risk videotape. Through detailing the process of refurbishing an EIAJ videotape machine (Sony AV-3650), attendees will gain insight into why these old machines are costly and problematic to repair and maintain. It will also cover basic processes related to the handling, treatment and playback of this open-reel video format still commonly found in archival media collections.

Based on examples from the project undertaken at SMPL, the presentation will highlight some of the pitfalls in finding parts and repairing or making new parts, as well as the advantages of working with legacy equipment specialists.

Adding capability for in-house playback of these machines can have a direct effect on the way that money is allocated for video reformatting work in archives where there isn't funding available for outsourcing to a vendor. Replicating the work examples from the session would require an in-house reformatting program, however, for those without a working video lab, the presentation will offer a valuable look into the challenges faced by media preservation vendors and other institutions.

The A/V Artifact Atlas: Creating a Common Language for Audiovisual Errors

Hannah Frost, Services Manager, Stanford Media Preservation Lab, Stanford University Libraries; Moriah Ulinskas, Preservation Program Director, Bay Area Video Coalition; Jenny Brice, Preservation Coordinator, Bay Area Video Coalition

For original archival audiovisual materials, the recorded signal must be reformatted in order to remain accessible. During playback and reformatting, errors become apparent, but how can we determine if an error is inherent to the original recording, was the result of an imperfect transfer, or the result of file corruption? How can we tell if it is a sign of equipment malfunction or media damage and how do we know if it can be remedied?

Conservators working with audiovisual content need to

be able to reliably identify such errors, but often lack formal training in audio and video engineering and may not be familiar or comfortable with its terminology. The need to understand and communicate about technical anomalies is particularly important when working with reformatting service providers.

The A/V Artifact Atlas (AVAA) addresses these challenges. Originated by the Stanford Media Preservation Lab and the Bay Area Video Coalition (BAVC), the A/V Artifact Atlas is a community-oriented living glossary of video and audio reformatting errors and artifacts, with vetted descriptions, proposed remedies, and the goal of producing a common language for media preservation professionals. The AVAA URL is: <http://preservation.bavc.org/artifactatlas>.

In this session we will present the AVAA, highlighting special efforts underway, including a NEH-grant funded initiative led by BAVC, to enhance the Atlas contents and extend its utility as a resource for educators, students, and practitioners. We will also give a brief demonstration of QCTOOLS, an open-source software tool developed to identify common reformatting errors, which is being developed in conjunction with the AVAA.

Life After Tape: Collecting Digital Video Art

Joanna Phillips, Associate Conservator of Contemporary Art, Solomon R. Guggenheim Museum; Agathe Jarczyk, Media Art Conservator, Studio for Video Conservation (Owner), Switzerland

The shift of artist video towards file-based formats and the approaching obsolescence of digital videotape challenge collecting art institutions in regard to the preservation, storage and display of contemporary video artworks. In the previous era of digital videotape, the museum's choice of master formats, migration cycles and storage parameters was guided by established archival standards and best practices. Importantly, tape formats also defined the image geometry of the recorded video and ensured its compliance to broadcast standards and its compatibility to standardized playback and display equipment.

In art production today, many artists make use of the rapid advancement of consumer technology and no longer rely on (semi-)professional, vendor-supported production and post production. As a result, artist video files arrive at the museum in an abundance of different codecs, containers, frame rates and pixel resolutions. Artists' use of proprietary formats, especially of proprietary codecs, raises the concern of limited file sustainability. In addition, the quality of mastering of artist video can reflect differing levels of technical expertise, and in some cases artist-provided files might be operational only on a computer, but are incompatible with standardized video playback and display equipment in the galleries. The latter can necessitate reformatting the artist-provided, native master files—a measure that touches on the notion of authorship and authenticity and can create an ethic dilemma for the conservator. In this context it has to be discussed how far the museum interferes with the

artistic process when making sustainable format recommendations or stipulations regarding acquisition deliverables.

Regardless of the question which file-formats to acquire, museums must develop protocols and implement workflows for quality and condition checking video files. Not only may the artist's video lack established standardization, but different playback and display environments have a severe impact on the visual rendering of digital video. Thus, when defining a reference for the quality and condition of video artworks, conservation has to consider determining factors such as the computer's graphic card, the player software and the display technology. In addition to evaluating the video content, conservation must adopt digital preservation standards and establish procedures for metadata creation, checksumming and redundant server storage.

This paper is based on a joint research initiative between the Solomon R. Guggenheim Museum and the University of the Arts Bern (Switzerland). It identifies the challenging factors of collecting video art in digital file form and discusses possible approaches and tools the museum can employ to ensure the quality and integrity of the digital video material that enters its collection.

Conservation of Time-based Media Before Acquisition or: How I Learned to Stop Worrying and Love HD Video

Peter Oleksik, Assistant Media Conservator, Museum of Modern Art

Sustainable choices in collection care, when applied to time-based media, are constantly evolving. This technological area requires the collaboration and active engagement with a variety of individuals and industries. Focusing on the ever-shifting medium of digital video (in particular, so-called "high definition"), this presentation will highlight how working closely with curators, artists, and media professionals at the pre-acquisition phase is imperative to the long-term storage and care of this material. Case studies of recent acquisitions by different curatorial departments at The Museum of Modern Art will highlight the variability of this media and how to make sustainable conservation decisions before the work even enters the collection. In addition, attention will be paid to particular workflows and best practices in both the acquisition and long-term conservation phases in the life of such artworks, as well how these phases are dependent on each other.

Establishing Time Based Media Conservation at the National Galleries of Scotland; Creating More in Times of Less

Kirsten Dunne, Paper Conservator, National Galleries of Scotland

The National Galleries of Scotland (NGS) houses a collection dating from the Renaissance to the modern day over three main sites in the city of Edinburgh, Scotland. Six conservators working across paper, paintings and frame conservation care for over 85,000 objects including 20 time based media works in the core collection. In 2012 the opportunity arose for one of the paper conservators to begin to establish time based media within the disciplines covered by the department. This paper will look at the approach taken and the aims, challenges and solutions proposed and addressed along the way.

With no history of this discipline at NGS, the initial challenges were for the conservator involved to gain the specialist knowledge required to enable rapid yet sustainable decision making and to create an effective conservation role where one previously did not exist as this area of the collection was being actively acquired and displayed by curatorial colleagues. In times of financial constraint, economically viable choices and solutions needed to be found within the boundaries of existing work programs to address not only the backlog of documentation and preservation decisions but to deal with new acquisitions and loans into the collection. Documentation formats needed to be developed alongside correct NGS procedures and these processes needed to be integrated into core working practices across all departments involved. An organic, rolling program of development was created and a multi-disciplinary working group established, chaired by the conservator, to bring together key staff with the aim of establishing the necessary lines of communication essential to the success of the project. The conservators' role has often been to ensure that all parties involved are communicating effectively and making the best ethical decisions possible.

The Media Matters in Art project website was used as a key source of guidance and from this documentation templates and draft processes were evolved to meet the NGS specific context. Trials of the documentation and procedures are being undertaken using the loan and exhibition program and the related opportunities are being used as training for the conservator involved. Creative solutions have been found for the necessary professional development and next steps include creating a preservation management plan.

This paper will describe the process to date and present several models currently being considered for further development including use of a shared services scheme with the National Library of Scotland, access to further professional development through a shared collection with Tate, an Equipment Sharing Network currently being piloted at NGS and the use of a professional freelance register.

From Infancy to Adolescence: Growing an Electronic Media Conservation Program at the Denver Art Museum

Kate Moomaw, Assistant Conservator for Modern and Contemporary Art, Denver Art Museum; Sarah E. Melching, Silber Director of Conservation, Denver Art Museum

Since 2006, the staff at the Denver Art Museum have been working towards establishing a comprehensive program for the care of its variable media collections. This paper will focus on electronic media, namely the preservation of video, audio, digital image, and software-based artworks in the collection, the initiatives and accomplishments to date, and future goals, as well as how institutional support for the program was garnered.

The Denver Art Museum holds electronic media in both its fine arts and design collections. There are 64 video, audio, digital image, and software-based artworks in the fine art collections. The majority of these artworks were given to the museum by collectors, so few were acquired directly from galleries or artists. The works came to the museum beginning in the 1980s in a variety of formats and states of preservation.

In addition, there are 600+ electronic media works in the design collection. These came to the museum through an agreement made in 2007 with the American Institute for Graphic Arts. Since then, the DAM has been the repository for the award-winning entries made to the AIGA's annual competitions, dating back to 1984. The digital-based holdings are anticipated to grow considerably with each annual gift.

Rigorous steps towards establishing protocols began in 2010 for *Blink!*, the exhibition in which 55 electric and electronic media artworks were on display. Of those works, 38 were drawn from the museum's collection. The experience of preparing the works for *Blink!* both reinforced the need for a systematic preservation program for this class of artworks and really moved the program forward.

Since *Blink!*, the museum has dedicated space and equipment to an electronic media preservation lab and a systematic migration program for video works in the fine arts collections has begun. Collaboration with a range of colleagues of varying expertise has been crucial in establishing protocols for documentation and preservation, including Non-Exclusive Licensing Agreements, review of media and determining formats for preservation and display, as well as developing relationships with outside vendors.

Controlling Hazardous Collection Materials

Anne Kingery-Schwartz, Objects Conservator, Private Practice, Kathryn Makos, Industrial Hygienist, (Ret.) Smithsonian Institution; Kerith Koss Schrager, Objects Conservator, Private Practice

When considering the sustainable care and management of collections, the health and safety of the conservator and other collections stewards should be a primary concern. Studies have demonstrated that the potential for adverse effects associated with exposure to artifacts with inherent or acquired toxicities can be mitigated through preventative measures, engineering controls, and proper training. Hazardous objects include those made with toxic materials (e.g., under-bound heavy metal based pigments, radioactive minerals); materials that may become more toxic once they are deteriorated or damaged (e.g., tin-mercury amalgam in mirrors, asbestos art plaster, degraded medicinals); objects with acquired toxicity (e.g., pesticide residues, mold), and objects with flammability or physical restrictions (e.g., gunpowder, heavy artwork, sharpness/breakability).

Conservators working with these objects should be aware of the risk and be able to assist in providing a safe environment to anyone who may come in contact with them. An Occupational Safety and Health Plan, developed and supported by both managers and staff, can protect persons from task and collection-based risks by ensuring that staff relies on disciplined safe working practices.

The AIC Health & Safety Committee has outlined specific procedures to help create a collections-based risk management plan for the safe handling of hazardous objects. A plan must include: 1) known or suspected inherent or acquired hazards, including post-collection treatments or legacy hazards, 2) methods for alerting users that objects are hazardous, 3) conditions requiring access restrictions for cabinets or collections, 4) legal requirements for disclosing known or suspect hazards to the recipient of an object including repatriated items, 5) legal rights to request hazard disclosures from lenders or collectors, 6) decontamination and/or disposal of hazardous materials, 7) effective storage area cleaning, 8) prevention of inadvertent contamination, and 9) alteration of treatment goals based on the known hazards.

In developing and implementing a risk management plan, it is important to recognize that collections management offers workplace exposure scenarios that are unique and often well below the radar of most safety experts. Therefore, clear dialogue is necessary to best describe museum operations and conservation tasks to health professionals and discuss how specific test methods can be used without damaging collections. Once the commitment is made to create a proactive safety program, the technologies of hazard control are well-developed, often inexpensive, and easily accessible. Numerous public health and safety resources exist to help conservators assess hazards, develop, and implement a risk management plan. These include easily accessible web-based information, such as directories of professional organizations' safety consultants, information on pro-bono

services, and links to occupational medical clinics. Safety investments are not just a legal requirement, but also a positive factor in productivity.

Unintended Consequences of Persistent Residual Vapor-Phase Chemicals within Collection Storage

Catharine Hawks, Conservator, NMNH, Smithsonian Institution; Kathryn Makos, Industrial Hygienist, (Ret.) Smithsonian Institution

USEPA Method TO-15 monitoring, via specially-prepared evacuated canisters and analysis by gas chromatography/mass spectrometry, detected thirty-nine ambient volatile/semi-volatile organic compounds within several hundred collection storage cabinets at the National Museum of Natural History. Both empty and filled cases, with different pesticide treatment histories were selected, representing anthropology objects, vertebrate zoology specimens, photographs, collection documentation, and periodicals. All concentrations detected were in the parts per billion (ppb) range. Possible sources include both past treatment chemicals and structural/atmospheric agents: pesticides/fumigants; preparatory preservatives (ethanol, benzene, chlorinated degreasers); wood degradation; varnishes, paints, cleaners; freons; and halogenated and aromatic hydrocarbon byproducts.

Persistent residual vapor-phase chemicals, even at the ppb level, poses often unintended adverse effects, not only on the objects and specimens, and their users, but on the storage furniture itself. Some pesticides such as paradichlorobenzene (1,4-dichlorobenzene) and naphthalene re-crystallize on collections and storage equipment, resulting in a continual vapor equilibration within a cabinet and a potential inhalation exposure upon case opening. Both are classified as "reasonably anticipated to be a carcinogen" by the U.S. Dept. of Health and Human Services, National Toxicology Program. Organic chemicals penetrate and absorb into wooden storage furniture and paper-based storage supplies, and adsorb on metal, glass, and other non-absorptive materials. Data suggests that empty cases can be a detectable "sink" for these chemicals long after initial contamination. One type of collateral damage from these chemicals is a sticky residue that adheres insect carcasses and other frass onto the surfaces of storage furniture. This stubborn residue requires intensive post-treatment labor to remove from storage equipment, or if unsuccessful, results in expensive cabinet replacement.

The survey data warrant the need for a conservation science analysis of the detected chemicals to determine the most likely sources in order to develop targeted and efficient mitigation plans.

Responsible and sustainable collection care practices include a sound Integrated Pest Management (IPM) program with pro-active risk reduction to prevent infestations. Use of toxic chemical pesticides should be banned or severely restricted, as

lasting residues not only impact life safety and collections, but also contribute to environmental pollution. Pest inspection, quarantine and treatment of incoming collections before they enter storage, and where warranted, measures such as freezing, heat treatments (with vapor capture filtration) and anoxia are activities well documented as to their efficacy in pest eradication.

A management-endorsed safety plan for preventing adverse human exposures to legacy chemicals would emphasize Chemical Hazard Communication, safe handling methods, HEPA-filtered vacuum cleaning of case interiors and workspaces, and minimizing exposures by removing objects to an examination table instead of working inside the opened cases. These measures also reflect good collection care practices.

Recommendations also include accelerated disposal of cases, particularly porous wooden cases, that house or formerly housed objects treated with hazardous chemicals, and segregated re-housing of treated objects from non-treated ones to prevent cross-contamination.

Solvents, Scents and Sensibility: Swapping - Solvent Substitution Strategies

Chris Stavroudis, Paintings Conservator, Private Practice

Solvents will be briefly introduced with a summary of their relative health and environmental dangers. Absent mechanical controls to protect the conservator (but not necessarily the environment) from exposure, we all strive to use the safest solvents/solvent systems in the safest way and yet still function. Applying Hansen solubility theory to the task of finding solvent mixtures that can be used to substitute for the least bio-friendly solvents will be presented and discussed.

A simple review of solubility theory will be presented to put the discussion of solvent substitution into context. The three component forces that are active and make solvents liquid rather than gases will be reviewed as will the concept of aromaticity.

The thermodynamic underpinnings of solubility theory (Hildebrand solubility theory) will be very briefly introduced as a preface to discussion of Hansen solubility parameters.

The three dimensional Hansen space will be discussed where solvents are represented as points in the space and solutes are represented as spheres. Mixtures of two solvents are represented by a line between the two points and mixtures between three and more points will be discussed and demonstrated.

The Teas diagram, solvents and mixtures of solvents will be discussed. The advantages and limitations of the Teas diagram will be presented and demonstrated.

Medical Evaluations for Museum and Collection Care Professionals

David Hinkamp, Co-Director Health in the Arts Program, University of Illinois at Chicago and Cook County Hospital; Ruth Norton, McCarter Chief Conservator, The Field Museum

Museum and collection professionals work with a number of well-known health hazards and conditions that can cause health risks and disease. Most physicians are poorly informed about the hazards faced by these professionals and may have little understanding of the workplace risks they face. A growing body of literature is available to help improve this understanding.

This session will focus on evaluating collection and conservation workplace hazards, with an emphasis on maintaining work histories, methods and records of chemicals used, in order to best communicate that information to a healthcare provider. This information is an important tool in designing and scheduling an appropriate health care surveillance to assess and prevent health problems related to these exposures. The session will also look at appropriate physician groups for these evaluations, including the field of Occupational Medicine. Several case studies from The Field Museum, Chicago, will be presented illustrating the benefits of collaborating with health care professionals.

As was common practice in the 19th and 20th centuries, residual pesticides were applied to collections in efforts to protect the collections from, primarily, arthropod and rodent damage. A number of Field Museum conservators over the last 25 years contributed to a history of pesticide usage at the museum, particularly the Anthropology collections. Safety procedures were developed by the Museum collections and conservation staff and the Museum occupational health and safety officer, and relied heavily on procedures used in other institutions with similar collections. Tests and evaluations by conservators, industrial hygienists and medical professionals over the last 12 years have led to a better understanding of what pesticides are likely to be found, where pesticide hazards are likely to be found, what exposure levels have been detected in staff and facilities, and what improvements in staff procedures can further reduce risk. The program was a cooperative effort between medical professionals and museum staff, who provided information on pesticide history, collection handling and personal protection procedures, results of all prior testing, and access to observe staff work environment and procedures. Medical professionals developed and implemented the test programs, provided and interpreted results, and prepared recommendations on improvements in facilities and work practice. Communication during test development, implementation and sharing of results was critical to the effectiveness of the program and the comfort level of staff both during testing and in the results.

Another case study addressed the problem of lead-based paint on a Maori House which is on open display and is culturally intended to be touched. A mitigation program was developed, involving conservation treatment to isolate lead

paint, and a testing program to monitor treatment effectiveness. Conservation staff, industrial hygienists, the Museum safety officer and medical professionals successfully collaborated to solve a health and safety problem with additional layers of public exposure prevention and working with traditional owners (the Maori community).

Sustainability for the Conservator: Mold Remediation

Chris Stavroudis, Paintings Conservator, Private Practice

Whether it's a musty basement or a natural disaster, mold is a common challenge for the conservator that should be approached with care. This talk will highlight the key steps conservators need to take to protect themselves when working with mold or moldy artworks. The AIC Emergency Committee will present lessons learned and techniques used for Hurricane Sandy recovery at the Cultural Recovery Center in Brooklyn, New York.

Ergonomics in Collection Care

David Hinkamp, Co-Director Health in the Arts Program, University of Illinois at Chicago and Cook County Hospital

Ergonomics, the study of humans and the workplace, has been an important contributor to the understanding of the causes of musculoskeletal disorders in the workplace. These disorders including strains, sprains, tendinitis and related injuries are under-recognized hazards of collections work and are made worse by some aspects of museum workplaces and tasks.

Collections professionals often work in awkward and sustained positions in order to assure the integrity of collections. These positions and stresses have been recognized in manufacturing and service industries as major causes of musculoskeletal and neurological disorders that can cause temporary and permanent disabilities. Unlike employees in these other industries, collections workers may not have access to training, equipment and information to prevent these disorders. In addition, collection professionals have been known to disregard symptoms and safety concerns in order to meet exhibition or other deadlines ("The Show Must Go On Syndrome").

Basic lessons from ergonomics about risks and prevention of these disorders in office work and specialized collections settings include understanding musculoskeletal cumulative trauma disorders (pathology and inflammatory reactions), their causation, and prevention. Case studies illustrate the ergonomic issues and recommended solutions in collection care activities.

Collaborative Study and Preservation of Coastal Alaskan Native Material Culture with University Students, Museum Staff, Alutiiq Scholars and Artists, and the Visiting Public

T. Rose Holdcraft, Conservator and Administrative Head of Conservation, Peabody Museum of Archaeology and Ethnology at Harvard University; Sven Haakanson, Associate Professor, Department of Anthropology; University of Washington-Seattle, and Curator of Native American Collections, Burke Museum; Judy Jungels, Assistant Conservator, Peabody Museum; Ellen Promise, Samuel H. Kress Conservation Fellow in Objects, Isabella S. Gardner Museum; Fran Ritchie, Andrew Mellon Object Conservation Fellow, National Museum of the American Indian (NMAI); Patricia Capone, Associate Curator, Peabody Museum

In 2010, the Alutiiq Museum and Archaeological Repository in Kodiak, AK and the Peabody Museum of Archaeology and Ethnology in Cambridge MA began a jointly conceived grant project to conserve Alaska Native ethnographic items. During an earlier project which involved NAGPRA implementation, Alutiiq representatives and Museum staff identified the potential for collaboration in the care and treatment of significant and threatened Alaska Native items. This presentation will share some of the challenges and solutions; for example, overcoming the physical distance of the two cultural institutions, finding fiscally sound approaches to ensure public-accessibility to project activities, and integrating academic learning opportunities with the project's methods and theoretical framework.

The project was shaped to include two on-site visits with Alutiiq consultants and frequent electronic communications through Skype sessions. Through a seminar course, University students interacted and explored new ways of learning through a variety of avenues: class lectures, research into historical and contemporary anthropological museum studies, readings and discussions on ethics of museum stewardship and one-on-one exchanges with Alutiiq representatives. Students researched donor and collection histories of objects, participated in indigenous technology hands-on workshops as well as conservation presentations and practicums on collections care issues, documentation and materials research. Alaska Native consultants were likewise involved in their local Alaska communities in sharing resources and knowledge from the developing study of the Alutiiq collections and this was reflected back in their involvement at the Peabody Museum. A working space within an exhibition gallery was designed to serve multiple purposes three afternoons each week for two years, conducive for student classes and exchange with consultants, professors, museum staff and with the visiting public. Students' object-based research papers were developed and shaped by interactions with all participating constituents.

Conservation methods were likewise directed in new ways through available perspectives of the Alutiiq consultants, analytical results from approved material sampling and by the students' research papers. Project flexibility ensured ongoing sharing

between and with Peabody conservators and Alutiiq colleagues about respectful preservation and conservation approaches. Conservation stabilizations and treatments of kayaks and kayak-related objects were collaborations with our colleagues. Conservators collaborated to implement goals of the Alutiiq scholars to better characterize or identify wood, plant, hair and skin materials. Some of the resulting and ongoing connections could not have been envisioned at the outset especially as regards analytical research findings. Strengthening technical investigation of cultural material through broad inclusivity across physical, structural and cultural differences has achieved greater synthesis creating a framework for focusing resources and perspectives for continuing collaborations. The project and ongoing partnership has created a process of collaboration that continues to serve our communities and mutual goals as educational and research institutions

Pine Pitch: New Treatment Protocols for a Brittle and Crumbly Conservation Problem

Nancy Odegaard, Conservator and Head of Preservation Division, Arizona State Museum, and Professor, Department of Materials & Engineering, School of Anthropology, and the Drachman Institute; Marilen Pool, Basketry Project Conservator, Arizona State Museum; Christina Bisculca, Conservator and graduate student, Materials Science and Engineering Heritage Conservation doctoral program, University of Arizona; Brunella Santarelli, graduate student, Materials Science and Engineering Heritage Conservation doctoral program, University of Arizona; Madeleine Neiman, Third Year UCLA/Getty Graduate Student Intern, Arizona State Museum; Gina Watkinson, Conservation Assistant, Arizona State Museum

The use of Pine Pitch as a coating has a long tradition. Various trees of the *Pinus* genus exude a thick liquid that can be heated and applied hot as a coating to American Indian baskets to make them watertight.

An item-by-item conservation survey and storage upgrade project funded with a Save Americas Treasures award provided access to over 4000 ethnological and over 20,000 archaeological baskets in the Arizona State Museum collections. Within the ethnology collections, over one hundred pitch coated baskets were survey examined. Nearly all were determined to be extremely unstable due primarily to severe oxidation of the pitch. Surfaces were characteristically cracked, crizzled, brittle and crumbly. Entire surfaces at risk of imminent loss, often accompanied by small zip-locking bags of crumbs placed inside the baskets, revealed an urgent conservation need.

To prevent ongoing surface loss, these baskets were given conservation treatments mid-survey as triage. The treatments allowed the baskets to be moved on and into their new storage location without further damage and loss. This improved curatorial access for cultural location determination and initiated a study of further analysis and research on the materials of this technology by the conservation lab.

Designing a conservation treatment for so many similar examples prompted the development of protocols. A fine mist of ethanol was tested and used effectively to reactivate the damaged pitch and stabilize the basketry surfaces. Efficient and effective techniques for cleaning and securing the difficult surfaces during the process involved the use of brushes, Teflon film coated swabs and Kimwipes saturated with ethanol.

Self-sampled particles from all baskets were analyzed with Fourier transform infrared spectroscopy (FTIR). Standardized protocols were developed to analyze bulk samples, resinous extracts and inorganic fillers to note correlations with cultural, regional, temporal and stylistic differences. These were collected with documentary information in the conservation database during the survey.

Conservation surveys have evolved greatly over the years at the Arizona State Museum. The conservation database provides more reliable information for researchers, curators, and conservators than the old catalog cards and the collection information system database. This is because the standardized information has been entered recently and by conservators focused on the entire basket collection. The survey, treatment, and analysis of the pine pitch baskets has allowed us to see patterns of manufacture among different cultural groups; changes in weaving techniques, container shape, and design use over time and geography; and sense of the expected forms of deterioration within museum collections. The project also informed our examination of archaeological examples of pitch coated items.

Conservation at 33 1/3 RPM: The Treatment of an Attic Trefoil Oinochoe

Tony Sigel, Conservator of Objects and Sculpture, Straus Center for Conservation and Technical Studies, Harvard Art Museums

Ancient vessels missing a third of their original fabric present complex ethical and technical challenges to conservators; such was the case with a 5th century BCE oinochoe in the collection of the Harvard Art Museums. The decorative painting features a woman playing a barbitos, a type of lyre associated with leisure and revelry. Its modern history begins sometime before 1903, when Henry Hucks Gibbs, Lord Aldenham of England, acquired it and lent it that year to an exhibition at London's Burlington Fine Arts Club. The vase scholar John Beazley described it in 1939 as having "a mouth and neck hardly original, which had disappeared when I saw it, in bits, some years ago; was sold at Sotheby's the year before last; and has since been cleaned and restored." It is likely that he was describing the condition in which the vessel entered the Harvard museum's collection.

Now unstable and with substantial, broadly overpainted losses in the body, close examination revealed that the neck, shoulders and handle were all fabrications of an earlier restoration. Removal of the overpaint also revealed considerable damage inflicted by previous restorers to the original slip painted decoration, by filing down the surfaces and edges of numerous

sherds in an effort to make them fit together.

In different kinds of institutions and collections an object with such substantial losses could legitimately be treated in several different ways, and I will discuss the rationale for the different possible approaches to treatment that were considered. Curatorial research and documentation of a similar vase by the same potter in the collection of the British museum helped establish convincing evidence of the vessel's original form. Armed with scale drawings and photographs, I reconstructed the oinochoe to a high state of completion and finish. I used a combination of conventional and novel techniques to re-create the complex neck, trefoil spout and handle, based upon a close study of their original material and techniques of formation. I'll discuss and demonstrate in these techniques in video clips, which include methods for the assembly and alignment of poorly fitting sherds, shaping and forming of replacement elements using a 1970's record turntable—complete with pitfalls to be avoided—the mold-making and casting of elements with complex inner and outer shapes in simplified, one piece molds, and inpainting techniques and strategies. I'll also discuss the rationale and methods of compensation for damage caused by earlier restorers.

Restoration by Other Means: CT scanning and 3D Computer Modeling for the Re-Restoration of a Previously Restored Skull from the Magdalenian Era

J.P. Brown, Regenstein Conservator, Field Museum of Natural History; Robert D. Martin, A. Watson Armor III Curator of Biological Anthropology, Field Museum of Natural History

The Cap Blanc skeleton was discovered in France in 1911 by a workman who struck it in the head at least once with a pickaxe while lowering the floor of the recently excavated rock shelter at Cap Blanc. The skeleton proved to be a Magdalenian era human and was subsequently acquired by the Field Museum in 1927. The skeleton was initially displayed with the fragmentary skull, but, in the early 1930's, the skull was reconstructed under the direction of Dr. Gerhardt von Bonin of the University of Illinois.

In 2012, we were able to use a mobile CT scanner to image the bones of the skeleton, including the skull. Upon examination of the scans, it became apparent that some features of the skeleton's splanchnocranium (sloped brow, small orbital cavities, and projecting nasal bones with large nasal opening) were anatomically incorrect, perhaps due to a self-consciously primitive restoration of the skull. We briefly considered reversing the 1930's reconstruction and using the original skull fragments to produce a more anatomically realistic reconstruction, but the importance of the specimen and the robust nature of the adhesive and gap-fill used in the 1930's reconstruction made the risk of damage while reversing the restoration unacceptably high. We therefore attempted to restore the skull to a more anatomically feasible state by converting the CT scan to a 3D software model showing each fragment in its current alignment,

and then repositioning the fragments in software to produce a new restoration which could be viewed in software. We then 3D-printed the new reconstruction for further study.

In this paper we discuss the methods and software used for segmentation and repositioning the fragments, the problem of arriving at a definitive reconstruction by this method, some commentary on 3D printing as a long-term preservation problem and our final results.

Conserving Stringed Sculpture: The Treatment of Henry Moore's *Mother and Child*

Nicole Ledoux, Samuel H. Kress Objects Conservation Fellow, Straus Center for Conservation and Technical Studies, Harvard Art Museum

Objects with tensioned string elements are found in many types of collections, ranging from fine arts sculpture to scientific and historic models. Deterioration and damage to these vulnerable elements in the form of fraying, breakage, and loss of tension can render these pieces undisplayable. This paper presents the treatment of Henry Moore's stringed sculpture *Mother and Child* in the collection of the Harvard Art Museums.

Upon entering the collection, the string elements of *Mother and Child* were in very poor condition, with eleven of the twelve strings broken and one large section missing. This paper discusses aspects of the sculpture's fabrication and outlines the various considerations involved in deciding whether to replace or repair the damaged strings. I will also describe in detail the development and execution of a treatment technique for repairing the original strings using wheat starch paste and Japanese tissue paper.

Testing and Implementation of Microclimate Storage Containers for Small Metals and Plastics

Dana K. Senge, Assistant Conservator, National Park Service Intermountain Region Museum Services Program

This paper will present microclimate storage research recently conducted by conservators in the National Park Service (NPS) Intermountain Region Museum Services Program. Museum collections in the Intermountain Region encompass artwork, historic objects, prehistoric and historic archeological objects, and natural history specimens. Included in these collections are metals and plastics that are sensitive to the environment. Microclimates have been used in various forms to protect these materials while on exhibit and in storage.

We have been reassessing microclimates currently used in the NPS Intermountain Region and researching improved methods. This has included reviewing microclimate storage methods used in museum collections throughout the United States, Canada, and Europe. Our research has examined general access to the

fabrication materials, ease of creation, ability to maintain a climate, ease of use to access objects inside, and maintenance cycles. This paper summarizes our research and testing to date.

Illumination For Inpainting: Selecting an Appropriate Color Temperature

Steven Weintraub, President, Art Preservation Services Inc.

Traditionally, many conservators have preferred daylight, and specifically northern daylight, as the preferred source for inpainting. Unfortunately, the availability and control of northern daylight limits the amount of time, and the location in which it can be used as the primary source of illumination. Therefore, supplementary and alternative sources of illumination for inpainting are necessary. What are the essential characteristics of northern daylight that make it a preferred source? What criteria should be used to select viable alternative sources of illumination?

This presentation will analyze the key components that make daylight a preferred source for inpainting, including such characteristics as color temperature, color rendering and light distribution. It will also take into account the fact that many artifacts will ultimately be exhibited at a color temperature that is extremely different from northern daylight and how this should influence the selection of an inpainting light source.

A primary focus of the talk will be the importance of selecting an appropriate color temperature with adequate color rendering properties. In order to illustrate the importance of color temperature and how appearance is altered at different color temperatures, a live demonstration of this phenomenon will be presented.

The goal of the presentation is to suggest that there is an underlying technical basis for color temperature selection that takes into account the fact that objects may be exhibited in a variety of different color temperatures. Most importantly, normal conditions of exhibition generally utilize a warm color temperature source whereas inpainting with northern daylight is done at a very cool color temperature. Research published by the author in conjunction with the National Institute for Standards and Technology will be described which will provide the basis for a theory regarding color temperature preference and its significance in the selection of an appropriate inpainting source.

Notes on the Treatment of Cracks in Paintings

Mary Gridley, Paintings Conservator, Cranmer Art Conservation, Inc.

Some cracks and small distortions that disrupt a paint film cannot be categorized as threats to the health and stability of the entire piece, yet they can have a profound influence on our aesthetic appreciation of the artwork, particularly in abstract paintings where the subtlety of the surface is the artistry. There is little in the literature about the treatment of these small but prevalent irritations, yet in my experience during 20 years of private practice treating Contemporary paintings, it is clear that

they represent a disproportionate source of anguish for artists, viewers and owners.

The talk will consist of three parts:

1. A brief look at the history of treating cracks by lining or other means, whether such treatments were successful, and how they have shaped subsequent treatments.

2. A very practical demonstration of a method for treating cracks in paint films that we have been practicing in our studio for some time, including a discussion of the chemical and physical changes wrought by the treatment, our successes and failures, and what can be learned from those. This part of the talk is an expansion of a paper given in London in 2006 (see below for link to the paper), detailing several new variations adapted to different paint surfaces and types.

3. Some observations on our tolerance of damage, and how that varies with the age and type of object under consideration.

Unmaking Your Mark: An Investigation into the Removal of Pencil from Unprimed Cotton Canvas

Samantha Skelton, Paintings Conservation Fellow, Winterthur/University of Delaware, Program in Art Conservation; Richard C. Wolbers, Associate Professor, Coordinator of Science and Adjunct Paintings Conservator, University of Delaware; Tatiana Ausema; Bartosz Dajnowski; Dr. Jan Marczak; Dr. Antoni Sarzyński

Pencil marks present a great challenge to removal when applied, purposefully or otherwise, to textiles such as unprimed cotton canvas. This problem is relevant to textile conservation as well as the conservation of contemporary paintings, where unprimed canvas is frequently left exposed, such as in the works of Morris Louis, Robert Goodnough, and Kenneth Noland. Errant, accidental marks and those applied intentionally as acts of vandalism are equally problematic. Pencils are generally comprised of low quality amorphous graphite, an electrically conductive semi-metal allotrope of carbon, pressed together with clay. When used to write, the powdered crystalline flakes of graphite break off; when this occurs on canvas, these powdery flakes become entrapped in the fiber and thread bundles, and are difficult to remove without compromising the structure of the fabric. Methods of safe removal were tested including laser ablation, mechanical removal methods, and reversed microemulsion cleaning agents including siloxane systems. The effectiveness of the method of removal was determined by visual results, the hand of the fabric, and microscopic examination to check for fiber damage and discoloration. Mechanical removal proved ineffective and impractical, and an appropriate microemulsion system could not be found that would not compromise both the aesthetic and the hand of the canvas. Successful results were only obtained with laser ablation at 532 nm; other wavelengths tested (266 nm, 355 nm, and 1064 nm) did not give satisfactory results. Ageing tests on the ablated canvas samples are forthcoming.

Eclectic Materials and Techniques of American Painters: 1860-1910

Lance Mayer, Conservator, Lyman Allyn Art Museum; Gay Myers, Conservator, Lyman Allyn Art Museum

During the course of writing two books on American painters' techniques, the authors have compiled and interpreted first-hand descriptions of techniques from artists' notebooks, painting manuals, periodicals, suppliers' catalogues, letters, diaries, and interviews. This talk focuses on the diversity of methods used during the period 1860-1910, when increased numbers of Americans traveled to various parts of Europe for instruction, resulting in an explosion of transplanted techniques. The influence of French teachers was especially strong; painting over brown underlayers, as Thomas Couture advocated, sometimes produced problems when paint became more transparent over time. A British handbook on technique that was edited for an American audience by Susan N. Carter reflects the influence of Couture on Americans and the diversity of approaches toward adding media at this time, as well as giving insights into Americans' special relationship with the pigment chrome yellow. The painter Elizabeth Boott wrote letters that shed light on techniques used in Couture's studio and in William Morris Hunt's classes in Boston, as well on Frank Duveneck's practice, in Munich, of adding medium copiously and applying extremely glossy varnishes. Hunt and his pupil Helen Knowlton were important as teachers and authors; Hunt's comments on the darkening of the works of William Page were perceptive, but both Hunt and Knowlton reflected the growing unfashionability of caring too much about technique as the century neared its end. Other trends of this period include changing views on the aging of paintings, and a growing love of varying techniques simply for the sake of variation.

Some of the earliest artists' advice columns, published under the editorship of Montague Marks in the magazine *Art Amateur* during the 1880s and 1890s, are useful in providing details of techniques at that time. These columns document, for instance, Thomas Dewing's use of extremely thin, matte varnishes; the growing popularity of the shellac-based Soehnée's varnish as both a retouching and a final varnish; and the surprisingly early beginnings of the tempera revival in America. Another important, little-known source is a series of interviews by DeWitt McClellan Lockman, who asked his fellow painters the kinds of detailed technical questions about topics like varnishing, pigments, and added media that tell conservators (for once!) what we really wanted to know. The Lockman interviews give insights into many topics, including changing varnishing practices and evolving ideas about adding medium, the increasing use of kerosene and other petroleum-derived solvents, and the growing influence of the controversial French author J. G. Vibert, whose many idiosyncratic theories included a preference for petroleum solvents and for zinc white over white lead. Albert Abendschein is an author who is still little known, but who had an influence on painters of the Ashcan school among others. His 1906 book documents

many trends of this period, including the growing tempera revival and experiments with wax that spilled over from murals to easel painting; wax and commercially-produced paints containing wax and/or non-drying petroleum fractions were used by a number of American painters around the turn of the century.

Conserving Spanish Colonial Paintings – Finding the Divine in Conservation

Cynthia Lawrence, Owner/Paintings Conservator, Lawrence Fine Art Conservation

This paper will present a summary of some of the varying materials employed in the creation of Spanish colonial paintings, including support systems, image media (such as cochineal and shell inlay), and surface coatings (related to European and American paintings from comparable time periods); and will discuss possible overlap of condition issues and treatment options with other painted objects. The poor state of condition these paintings are often in will be reviewed, and examples of the examination and treatment of specific paintings presented. Finally, a suggestion of how the treatment of Spanish colonial paintings may apply to the present field of conservation in general will be offered.

Oil Paintings on Metal Support: Study, Intervention and Challenges

Mónica Pérez, Conservator, National Center for Conservation and Restoration, Chile

The Paintings Conservation Laboratory of the National Center for Conservation and Restoration (CNCR) was requested to restore part of a collection of paintings belonging to the Museo O'Higginiano y de Bellas Artes, from Talca, a city in the center-south of Chile. The interesting thing was that all of them were oil paintings on metal support. This was the first time the Paintings Conservation Lab had to face the intervention of objects of this kind, so the conservation and restoration of these paintings became the opportunity to learn about an unknown topic, and also to face the challenge of performing the appropriate treatments to ensure the future existence of these works of art.

These paintings were bought in Europe by the end of the XIX century, and later donated to Talca's Museum. Three of them are medium sized (62 x 78 cm. approx) and the other two are smaller (25 x 19 cm. approx). It is believed that at least three of them are Flemish paintings, since one is signed by Flemish artist Willem Van Herp (XVII century), and there is another one with very similar characteristics but not signed, while a third one is different in iconography, but similar in other aspects. The small ones could be American instead of European, but they are still being studied. The painting that is signed by Van Herp is dated in 1655, what makes it the oldest object that has been treated in the Paintings Conservation Lab.

The paintings have been photographed, non-destructive analyses were performed (UV photographs and IR reflectography), and samples were taken to identify the painting technique and materials. In addition, metal supports were analyzed through X-ray fluorescence to know its composition: four of them are copper plates and one is an iron-tin alloy.

In addition, a wide research was made to understand the technique used by Flemish artists in the making of paintings on these supports, that are so different to canvas, and to collect information on the most appropriate methods and materials to restore paintings with these characteristics. Some of the damages are distortions of the support, ground and paint film losses, abrasion, lack of adhesion to the support, corrosion, yellowing of the varnish, previous interventions in bad condition and over-paints that cover big areas. In addition, two of them had cradles, which showed lack of adhesion to the copper plate in some areas. It is believed that environmental conditions may have contributed to the damages, because Talca is a dry and hot city in summer, and cold and humid in winter, so the paintings will be returned with recommendations on proper exhibition and deposit conditions.

In order to perform treatments in the proper way, prototypes were made with copper plates, to make tests of adhesion, consolidation, fillings and chromatic reintegration. At present we are working in cleaning and consolidation, and then the other stages of the restoration will be executed.

Aspects of Painting Technique in *The Virgin and Child with Saint Anne* Attributed to Andrea Salai

Alan Phenix, Scientist, Getty Conservation Institute; Sue Ann Chui, Associate Conservator, J. Paul Getty Museum

The Virgin and Child with Saint Anne attributed to Andrea Salai, an associate of Leonardo da Vinci, came from the Hammer Museum at the University of California Los Angeles to the Paintings Conservation Department at the J. Paul Getty Museum for study and treatment in preparation for an exhibition at the Musée du Louvre. Dated to 1500–1524, it is a scale version of the same subject painted by his master now at the Louvre, and was almost certainly created in Leonardo's studio. *The Virgin and Child with Saint Anne* has come down to us in remarkable condition from both a structural and aesthetic point of view. The panel has been virtually unaltered since it was constructed and the paint surface remains very much intact with only a few discrete losses. This paper will describe aspects of the painting technique for which analysis of cross-sections greatly enhanced our understanding of it. Some of the interesting findings include a methodical approach to the paint build-up with the occurrence of intermediate varnish layers, and evidence of a textile and the hand used to manipulate blue and red glazes.

A Hangover, Part III: Thomas Couture's *Supper After the Masked Ball*

Fiona Beckett, Director's Trust Fellow in Paintings Conservation at National Gallery of Canada; Clowes Paintings Conservator at Indianapolis Museum of Art

Depicting the aftermath of a carnival-esque episode in the infamous and glamorous Maison d'Or, Paris, Thomas Couture's *Supper After the Masked Ball* could be described as itself suffering from poor judgements, a tendency to excess, and weakness for immediate gratification. A painting now important to art history and notorious in its day, it nonetheless spent the last 90 years in storage, largely ignored except for episodes of invasive treatments – two linings and at least two campaigns of cleaning and restoration. The painting is once again under treatment, now at the National Gallery of Canada.

This is not an uncommon story for objects in many collections today. As art market prices rise beyond levels most museums and collectors can manage, objects with problematic histories often become an area of focus. We are frequently faced with the legacy of decisions and common practices within conservation made at a time of development, where historic, craft practices were confronted by practitioners at the limits of their understanding, employing new procedures.

In *Supper After the Masked Ball*, beyond at least two partial and selective cleaning procedures, the treatment sought to undo critical changes wrought by glue-paste and wax-resin linings, leaving a large painting (180 x 228cm) de-lined and not re-lined. The conservation involved a series of structural and restoration treatments to both the painting and its stretcher. Partly, this treatment occurred because the verso of the canvas was used by Couture, as was his habit, to test tint combinations and paint consistencies for other paintings, possibly in a teaching context within his atelier – information typically now lost. This treatment also occurred in part because it is common practice today – attempting to reverse changes made by our forefathers – both in the museum sector and in the realm of private practice, where recovery of 'authentic' objects can bring broad benefit and is seen as profitable and desirable. In doing so, we likely bring further issues, both beneficial and potentially problematic, to the fore. This presentation elucidates a methodology for confronting key structural issues clumsily sidestepped by traditional lining practices, using Couture's *Supper After the Masked Ball* as a case-study.

In addition to the treatment of the painting, the original Beaux-Arts frame for the painting was also restored, having spent nearly a century off the painting, stored in its shipping crate. The restored painting and its frame will be the subject of a focus exhibition at the National Gallery of Canada and the Vancouver Art Gallery, with web-based content focusing on the essential role of conservation, and additionally on the importance of professional development of emerging conservators through sponsored fellowship initiatives. The painting is expected to make a full recovery from its hangover.

The Pied Piper of Hamelin: Color and Light in Maxfield Parrish in the Palace Hotel, San Francisco

Harriet Irgang Alden, Director/Senior Paintings Conservator, ArtCareNYC/A Rustin Levenson Company

In March 2013, news broke that the Palace Hotel in San Francisco would be selling its historic 1909 Maxfield Parrish wall painting at auction in New York City. Due to the public response the owners responded to the community and made the decision to keep the painting. Already en route to New York when the reversal came, the owner decided to proceed with the previously planned surface cleaning to be done on the east coast. The conservators at Rustin Levenson Art Conservation Associates were contracted for this treatment having cleaned and conserved Parrish's 1906 New York City wall painting, *Old King Cole*, in the St. Regis Hotel. The opportunity to examine and analyze *The Pied Piper of Hamelin*, which has never been lined or had its original varnish removed, was a rare and fruitful endeavor. New information about Parrish's materials and methods were discovered. The surfactant used for surface cleaning was water-soluble, readily biodegradable, and is considered an alternative by the EPA's DfE and CleanGredients, 2011. In addition, an alternative to organic solvents was found when testing methods for removal of a non-original alkyd layer.

Piet Mondrian: Technical Studies and Treatment

Ana Martins, Associate Research Scientist, Museum of Modern Art; Cynthia Albertson, Assistant Conservator, Museum of Modern Art

Dutch artist Piet Mondrian was born in Holland in 1872 and trained at the Rijksacademie. His work of the 1890s was influenced by the contemporary styles of the day: the Hague school, the Amsterdam Impressionists, and Symbolism. Shortly after a 1905 van Gogh exhibition at the Stedelijk Museum, Mondrian's work transitioned to Neo-Impressionism or "Luminism", where he explored color and contour. By 1909 he would have his first retrospective at the Stedelijk where he was regarded as a leader of the avant-garde. Studying the style of the day he embraced the transition from Luminism to Cubism and moved to Paris in 1912. He immersed himself in the café and salon scene with fellow artists such as Léger, Rivera, and Braque. He would travel back and forth from Holland to Paris, until the outbreak of World War I would force him to stay in the Netherlands. From 1917 to 1920 he painted experimental works and wrote for van Doesburg's *De Stijl*, where in an autobiographical account of his own painting career he expressed, "Only the primary colors—red, blue and yellow—filled in with white and black were required in order to express universal light." Returning to Paris in 1919, he wrote *Le Néo-plasticisme* in 1920. He continued to write and to paint throughout the 1920s

and '30s and was exhibited throughout Paris, Germany, the Netherlands, and the United States. As the second World War approached he moved to London in 1938 and finally New York in 1940, where he died in 1944 at the very height of his career.

With 25 of his works, spanning from 1902 to 1944, the Museum of Modern Art holds the most comprehensive collection of paintings by Mondrian in North America. For the last four years the conservation department has continued to utilize ever developing technology to study Mondrian's sixteen oil paintings through examination, documentation, technical analysis, re-treatment, and inter-museum collaboration with colleagues such as conservators and curators at the Gemeentemuseum Den Haag. Technical examination including imaging, X-radiography, Reflectance Transformation Imaging, and X-ray fluorescence spectroscopy with multivariate analysis have been carried out on the majority of the collection. This research is presenting stratigraphic elemental palette information, transitions in his type of paints and medium, a plethora of compositional changes, as well as evolutions in his paint layering technique.

Many of Mondrian's post-1917 works have exhibited cracking and paint lifting due to intra- and interlayer cleavage of ground and paint. In the past these instabilities warranted lining treatments. The information gleaned through this technical evaluation is expected to produce data that may correlate current and past condition issues with the artist's material choices and application techniques. Ultimately the collective documentation will be migrated to a Mondrian database to provide the MoMA as well as other institutions and art historians with a more comprehensive understanding of this critically important body of Piet Mondrian's work.

Refining Style: Technical Investigation of an Early Work by Georges Pierre Seurat in the Maurice Wertheim Collection

Dina Anchin, Paintings Fellow, Straus Center for Conservation and Technical Studies

Throughout his career, Georges Seurat devoted himself to the current color and aesthetic theories of his time. Early on, he began applying these theories to canvas, fine-tuning both his technique and selection of materials, culminating in his mature style, pointillism, around 1886, exemplified by *A Sunday Afternoon on the Island of La Grande Jatte*. This study investigates an early work by Seurat, *Vase of Flowers*, c. 1878 – c. 1879, in the Harvard Art Museum's Wertheim Collection, painted around the time he quit the École des Beaux-Arts in Paris in 1879. A number of recent studies (Kirby, Jo. et al. 2003; Herbert and Harris 2004) have characterized Seurat's later style, technique, and material choices; there is, however, a dearth of material about his earliest works. The goal of this study is to gain a better understanding of Seurat's early technique and style, especially when compared to his later works.

Overall, the painted structure of *Vase of Flowers* is complex and shows just how much forethought and planning Seurat invested in a painting. One facet of his layering system in *Vase of Flowers* is prominent brushwork throughout most of the composition that has no correlation to the painted objects within the composition. Cross-sections reveal that this texture is not in the ground, but rather in between paint layers: it is part of a layering system that involved abrading the top paint layers to reveal certain colors side by side. Cross-sections, SEM-EDS analysis and mock-ups helped to better understand this process. Furthermore, compositional changes and reworking of the composition visible in the X-ray may indicate *Vase of Flowers* was only a study, never considered a finished work.

Seurat was a meticulous artist, using materials and methods of paint application as a means of integrating theoretical concepts into his paintings. In *Vase of Flowers*, he was experimenting with a number of different techniques, though there is reason and theory behind every choice. *Vase of Flowers* can be viewed as a stepping-stone in Seurat's career, as he works toward Pointillism.

The Reconsideration of a Reattribution: Pierre-Edouard Baranowski by Amedeo Modigliani

Elise Effmann Clifford, Head of Paintings Conservation, Fine Arts Museums of San Francisco, deYoung Museum

The attribution of the portrait of Pierre-Edouard Baranowski by Amedeo Modigliani in the Fine Arts Museums of San Francisco (FAMSF) has been questioned on several occasions during its thirty-year history in the collection. Long complicated by the active market for forgeries of the artist's work that arose soon after his death in 1919, Modigliani scholarship has been marked by a general wariness of previously unpublished works. FAMSF painting's omission from earlier catalogues of the artist's oeuvre, gaps in its provenance, and its relationship to another well-known depiction of the sitter cast doubt in the minds of some experts, and the portrait was formally demoted to "attributed to" status in the mid-1990s.

Prompted by the family of the original donor to revisit the attribution of FAMSF's painting, a new technical study took place in 2011-2012. It was found through the examination and comparison with works by the artist in other collections that many of the idiosyncrasies of the painting that were initially taken as signs that it is not authentic are the very reasons for a favorable attribution. In the course of the study, the enormous influence that bias can play in our approach toward research was recognized. In this paper, the case for the restoration of the portrait's status will be discussed and the subjective nature of visual perception will be explored.

Preserving Ernest Hemingway's Photograph Albums and Scrapbooks at the Finca Vigía

Monique Fischer, Senior Photograph Conservator, Northeast Document Conservation Center; M. P. Bogan, Director of Book Conservation, Northeast Document Conservation Center

For over ten years, the Northeast Document Conservation Center (NEDCC) has been working with conservators at the Finca Vigía, Hemingway's house in Cuba where he lived from 1939–1960, providing advice, training and aid in preserving its paper-based archives. The collection includes manuscripts, letters, over 3000 photographs, scrapbooks, photograph albums, art collections, maps and a 9000-volume library that contains rare first editions of his books and those of other famous writers. Even though the entire collection is important to the home's history, the focus of this paper is the conservation of four significant albums that document Hemingway's acceptance of the 1954 Nobel Prize in Literature for *Old Man in the Sea* and the subsequent making of the movie. These include the photograph albums Homenaje Nacional and Recuerdo...1956, and scrapbooks Nobel Prize Telegrams and Drawings for Storyboard for the Movie Old Man and the Sea.

Photograph albums and scrapbooks are multifaceted items that require the expertise of not only a book conservator but also paper or photograph conservators. The conservation of these objects is complicated even when working in a climate controlled lab with abundant and available supplies. Add the traditional challenge of conserving albums to working in a tropical climate without environmentally controlled facilities, lack of space, language difficulties, and lack of material, and the challenges are magnified. This paper explores the importance of Hemingway's albums and scrapbooks to the collection, the difficulties overcome to develop and implement appropriate and successful conservation treatments, and the satisfying partnership with our Cuban colleagues at the Finca Vigía.

Fototeca Pedro Guerra: Conservation of the Photographic Archives

Cynthia Cruz, Coordinator of conservation and digital area, Fototeca Pedro Guerra, Facultad de Ciencias Antropológicas de la Universidad Autónoma de Yucatán

The Fototeca Pedro Guerra is part of the School of Anthropological Sciences of the Universidad Autónoma de Yucatán, México. The majority of its holdings are photographic processes from wet collodion to color negatives. There are a few prints: from albumins to gelatin printing proofs and recently, piezography prints of the Fototeca files.

One of the great challenges has been the preservation of negatives in tropical climates. The city of Mérida, Yucatán is located South of the Tropic of Cáncer, with a hot and humid climate; the average temperature is around 86°F with RH humidity of 70%

to 90% during the rainy season. The hottest months are April and May, where temperature could reach up to 104°F.

These climatic conditions represent a great challenge and take a large amount of economical resources of the institution in charge of preserving the archives. For this reason, a special archive storage area was built in 1985 to improve the environmental conditions. Two AC units and one dehumidification extractor were purchased later to keep the environmental conditions of the archive storage area at 64.4°F and the RH at about 30–40% all year long.

The storage area has a gate to prevent the direct entry of air. The interior has four rooms; two of them to preserve negatives on glass support, one for film and the last one has a freezer and it is where other activities take place.

In the presentation there will be a discussion of damages to negatives and the actions designed to preserve them. Additionally, there will be a discussion on freezing cellulose nitrate film and cellulose acetate film.

Examination of an Anti-Fungal Agent to be Used on Photographs

Yoko Shiraiwa, Paper and Photograph Conservator, Private Practice

The Great East Japan Earthquake and Tsunami in 2011 caused tremendous damage to photographic materials. Many of them were water damaged and left untreated for months. As a result they were found with microbial deterioration leading to the dissolution of the gelatin binder and damage to the support, at times making them very difficult to recover or conduct further treatment. As an emergency response procedure for preventing mold on photographs, the authors examined the use of Hokucide R-150 (an aqueous solution of chloromethylisothiazolinone and methylisothiazolinone), as an anti-bacterial and anti-fungal agent. It is easy to prepare and can be used as a solution either by immersion or by spray.

Anti-fungal effect of Hokucide R-150 was confirmed by inoculating standard strain of non-tonophilic (*Aspergillus niger*) and absolute tonophilic (*Aspergillus penicilloides*, *Eurotium herberiorum*) fungi found on photographs damaged by Tsunami. Isolated strains were inoculated and cultivated on group of paper disks treated with Hokucide R-150 and compared with untreated paper disks used as a control. As a result of cultivation, fungal growth was prevented in the paper disks treated with Hokucide R-150 solution. To obtain a satisfactory result of its anti-fungal property, concentration of 1.0% Hokucide R-150 in water is recommended. Surfactant is added to Hokucide R-150 solution for even dispersion and reducing surface tension. A survey has been done on non-ionic surfactants to be used safely on photographs and effectively with Hokucide R-150. Samples of surfactants have been tested with colloidal silver detector film.

The effect on photographs by Hokucide R-150 solution has been studied and tested. Samples used were step tablets of Cyanotype, Albumen print, Gelatin Silver P.O.P., Gelatin Silver

D.O.P., colloidal silver detector film, and Macbeth Color Checker Color Rendition Chart (Chromogenic process). Reflection density and CIE L*a*b* values were measured before and after immersion as well as after artificial aging for 7 and 14 days under controlled condition. Transmission density was measured for colloidal silver detector film at same stages.

As a result of the examination, water damaged photographs can be effectively protected from fungal growth by using Hokuside R-150 solution. Artificial aging test provided acceptable results and this could be an alternative method to be used where freezing and drying may be difficult to conduct just after the disaster.

Digitization as a Tool for Preventive Conservation and a Key Role for Sustainability

Yasmine Chemali, Manager, The Fouad Debbas Collection

Cultural institutions are committed to a long-term preservation of their collections and information that help communities to understand their heritage. The Fouad Debbas Collection, a private collection of photographs based in Beirut, Lebanon, has developed policies that guide both the management and the access to the artifacts themselves and to their information. While the latest activities of this private institution stressed on the importance of preventive conservation, especially through an optimum environment control (climate, light, housing and storage), today, the target is the public and how to meet its needs. A collection such as the Fouad Debbas Collection encompassing more than 40,000 images from the 19th and the mid 20th centuries (albumin prints in albums or gathered in portfolios, glass plates and lantern magic slides, stereoscopic views, cabinet cards, engravings and maps) is a major national asset and a legacy for future generations.

The question of sustainability is then a challenge: how can it be incorporated into the cultural areas of the Lebanese society which every generation has already suffered political instability, war and conflicts?

Lebanon, and the region at large, lacks any serious governmental structures and institutions capable of protecting and preserving the region's cultural heritage. Moreover, the Damocles sword of a new armed conflict haunting Lebanon and the instability of the region are so many risks that threaten the Lebanese and Middle Eastern heritage. In this context, the Fouad Debbas Collection has received lately a grant from the British Library and the Endangered Archives Programme in order to digitize, catalogue and index a representative sample of the collection: the photographs of the Bonfils studio, established in Beirut from 1867 to the 1910s. The Bonfils Debbas collection is clearly an invaluable document registering the history of a region at a crucial crossroads in the wake of great historical upheaval that was about to sweep the region and bring about the Modern Middle East as we know it.

Preservation of Deborah Luster's *One Big Self*

Theresa Andrews, Conservator of Photographs, San Francisco Museum of Modern Art

This talk will address some of the details of the pre-accession and post-accession process, exhibition and preservation of Deborah Luster's *One Big Self* and the complexities and enthusiasm of collecting this challenging work.

Louisiana artist Deborah Luster's *One Big Self* was acquired by the San Francisco Museum of Modern Art (SFMOMA) in 2003 and was exhibited in 2004. *One Big Self* consists of 287 individual 4" x 5" black and white portraits of prisoners from the Louisiana prison system. Each portrait is hand-coated with liquid photograph emulsion applied to anodized aluminum plates. The portraits are displayed in three drawers of a custom-made steel desk with an attached light and one hand-made book. Each portrait is inscribed on the reverse with personal information about the inmate; including prison issued ID number, date and place of birth, number of children and their work role at the prison.

One Big Self is an interactive work. The visitor is invited to become involved by approaching the desk, opening the heavy steel drawers and removing any number of individual portraits from the drawers. The light on the desk allows the visitor to examine each portrait closely and read the inscriptions on the reverse, gaining further knowledge about the prisoner. The artist did not want the visitors to wear gloves, as this would have detracted from the intimacy involved in the visitor experience.

One Big Self reaches beyond accepted formats for the presentation of photography and presents exhibition and preservation challenges. *One Big Self* is unique in SFMOMA's photography holdings because of its important interactive component. Prior to bringing this complex work into the collection, very thorough pre-accession research was undertaken to determine how SFMOMA could successfully and appropriately exhibit this work while honoring the artist's intent that requires the individual photographs to be handled. The research involved conversations and interviews with Deborah Luster and is in keeping with SFMOMA's initiative to actively engage with living artists. An open and ongoing dialog with artists allows for a unique understanding of works entering into SFMOMA's collection. This practice is instrumental in keeping with the artist's intent, the integrity, exhibition and preservation of their work. The pre-accession and accession process involved conservation, curatorial, registration and the education departments at SFMOMA.

Condition Documentation and Monitoring of an Exhibition of Daguerreotypes at the State Hermitage Museum

Jiuan Jiuan Chen, Assistant Professor of Conservation Imaging and Technical Examination, Art Conservation Department at Buffalo State College; Tatiana Sayatina, Head, Laboratory for Scientific Conservation of Photographic Materials, The State Hermitage Museum; Paul Messier, Head Conservator, Paul Messier, LLC

From December 7, 2011 to February 5, 2012, the State Hermitage Museum produced a major exhibition entitled *The Age of the Daguerreotype: Early photography in Russia*, displaying significant daguerreotypes from its collection with major loans received from the Museum of the Russian Literature Institute of the Russian Academy of Science and the Library of the Russian Academy of Arts. One of the first large-scale photography shows at the Hermitage, the exhibition was considered a breakthrough, displaying for the first time many objects of significant artistic, historical and cultural value. Curated by Dr. Natalia Avetyan of the Hermitage's Department of Russian History and Culture, the exhibition received wide recognition and awards from the Committee of St. Petersburg Culture and the Vladimir Potanin Foundation.

This exhibition also was notable from the standpoint of being the first major display of daguerreotypes following Young America: The Daguerreotypes of Southworth & Hawes which was organized by the George Eastman House and the International Center of Photography. This exhibit traveled to three venues from June 17, 2005 to April 9, 2006 and the showed more than 160 daguerreotypes from 37 major institutions and collectors. Carefully documented, changes to some plates occurred during this exhibition, including the development of a white haze. Subsequent research led by the Metropolitan Museum of Art, a lender to Young America, demonstrated contact with chlorine-containing compounds can cause silver to be re-deposited on the surface of daguerreotype plate upon exposure to ultraviolet radiation and light.

Cognizant of this research and its implications, the newly formed Laboratory for Scientific Restoration of Photographic Materials (within the Department of Scientific Restoration and Conservation) at the Hermitage Museum, as part of its involvement in an ongoing FAIC-Mellon initiative in photograph conservation, developed and implemented a unique system to document the condition of displayed items before, during and after exhibition. This system primarily relied on precisely controlled and repeatable photographic documentation combined with a tablet computer-based system for daily inspection of the plates while on display in the galleries. This work was combined with active monitoring and recording of temperature, relative humidity, light intensity and duration. Careful examination of the documentation before and after exhibition indicated there were no obvious, visible, changes to the plates as a result of display. However, existing deterioration

products on the interior of cover glasses showed changes in size, distribution and amount. This work clearly demonstrates the dynamic nature of the microclimate within a daguerreotype case or passe-partout. The presentation will focus on the documentation system, display monitoring protocols and an examination of results following exhibition.

Key Components of the Recent Major Revision of ISO 18902 Imaging Materials — Processed Imaging Materials — Albums, Framing and Storage Materials

Daniel Burge, Senior Research Scientist, Rochester Institute of Technology

ISO 18902:2013 *Imaging materials — Processed imaging materials — Albums, framing and storage materials* is a recent and major update to ISO's specification for selecting non-reacting enclosures for hardcopy image collections. Due to the many revisions of the document over the last five decades, the standard had become difficult to understand as well as implement. Rotating committee memberships and evolving imaging technologies over time has led to deviations in the standard's original purpose, audience, and scope. Past revisions have been iterative with provisions being inserted, modified, or removed often without full consideration to the overall usability of the document by all stakeholders. The results have been specifications that are sometimes redundant (e.g. KAPPA Number and alpha-cellulose content), unclear (e.g. no upper limit for buffer concentration in papers), or required tests without clearly defined pass/fail limits (e.g. no minimum tear resistance value). Additionally, supplemental questions such as the applicability of the standard's provisions to digital hardcopy or if recycled papers are safe (either pre- or post-consumer) needed to be addressed. Finally, ISO specifications usually detail a specific protocol for reporting; however, the previous ISO enclosures' standards have not. Material suppliers were therefore allowed to present information as they saw fit making comparisons between products often difficult. A two year project within the ISO committee on Physical Properties and Permanence of Imaging Materials led to the most recent version with significant improvements that address all of these problems. It is hoped that these improvements will encourage greater usage by both the producers of storage and display materials as well as end users. This can only benefit all parties involved. The purpose of this talk will be to review the changes and discuss the ways these may impact how institutions select and use their enclosures.

Technical Investigation of Environmental Concerns for the Exhibition of Diazotypes at The Metropolitan Museum of Art

Katherine Sanderson, Assistant Conservator of Photographs, The Metropolitan Museum of Art; Margaret Wessling, Fourth-Year Student, Conservation Center, NYU Institute of Fine Arts; Greta Glaser, Owner, Chief Conservator, Photographs Conservation of DC

Diazotype prints are known to exhibit significant color change over time, which presents concerns for prints held in museum collections that may enter the exhibition rotation. The nature of the color change is not well understood, although it is presumed that both light exposure and environmental factors play a role. Given the relative absence of technical study on this subject, research was carried out at The Metropolitan Museum of Art to better understand how these factors influence change in diazotypes. Student interns Greta Glaser and Margaret Wessling carried out separate experiments on historic and modern diazotype samples leading up to the important exhibition of Francesca Woodman's mammoth diazotype print, *Blueprint for a Temple*. The experiments focused on the effects of light and humidity on color change in the diazotype samples, quantified by spectrophotometric measurements with an X-Rite 968 spectrophotometer. Microfading was performed on the historic and contemporary samples to determine whether results varied when light was isolated as the factor of change. Finally, color and environmental monitoring were performed on *Blueprint for a Temple* before and after exhibition, and the real-time data were compared with the experimental results.

The presentation will outline both experiments performed on the historic and contemporary diazotype samples and present the results and conclusions. The results from microfading tests will also be delivered, along with the real-time results from the exhibition of Francesca Woodman's *Blueprint for a Temple*. All of the data will be considered for the development of exhibition recommendations for diazotype prints in museum collections.

The Kodak Dye Transfer Process – How Eliot Porter Captured Color

Tatiana Cole, Fellow in Photograph Conservation, Amon Carter Museum of American Art

The Kodak Dye Transfer process was the most successful and popular variation of photography's dye imbibition, three-color assembly process. Materials were manufactured from 1945 until 1993, after which practitioners were limited to either using stockpiled materials, or trying to produce their own. Today, Kodak Dye Transfer prints are highly valued and considered to be relatively stable, but only a handful of practitioners remain.

A study was conducted at the Amon Carter Museum of American Art on the Kodak Dye Transfer process and the archive of American color photographer Eliot Porter

(1901–1990). Porter used the process as his primary medium for the entire period it was being developed and improved, thus making his archive an ideal sample group for the study of Kodak Dye Transfer materials.

This presentation will focus on the technical development, characterization, and conservation treatment of Kodak Dye Transfer materials. It will discuss the changes in manufacture of the paper base and dyes, and physical characteristics associated with these changes, such as paper surface textures and gloss, UV fluorescence, and baryta content. Results will be presented on tests of the effects that various common treatments potentially have on Kodak Dye Transfer materials; treatments such as surface cleaning, tear mending, and reducing planar distortion.

Findings from this study will provide conservators, archivists, and curators with historically interesting and practical information. The goal is to help the community more precisely identify and characterize Kodak Dye Transfer and other dye imbibition type prints, and inform conservation treatment of these kinds of materials.

A Comparative Study of Handheld Reflectance Spectrophotometers

Katherine Sanderson, Assistant Conservator of Photographs, The Metropolitan Museum of Art

There is an increasingly varied selection of handheld spectrophotometers available on the market with multiple configurations and price points. Although having more choice is generally a positive development, determining the right piece of equipment to purchase can be challenging, particularly when faced with the problem of data continuity when replacing an older unit.

This talk presents a comparative study of a group of handheld reflectance spectrophotometers manufactured by two leading companies, X-Rite and Konica Minolta. The impetus for the project comes from two sources. One is to determine the best unit to replace the spectrophotometer still in use in the Photograph Conservation Lab at The Metropolitan Museum of Art. The other is to evaluate the variation in data gathered using multiple spectrophotometers on a standardized set of measurement samples with the goal of better understanding the practical margin of error among this range of instruments. An additional objective of this work is to establish standard in-house practices for spectrophotometer use leading to improved color communication between departments within the Museum and, potentially, between institutions.

The group of spectrophotometers comprises units with 0°/45° and spherical configurations, as well as a range of apertures. Measurements will be taken with each spectrophotometer on a range of samples. For data comparison, the older spectrophotometer will also be included in the measurements, as well as a bench-top spectrophotometer equipped with an external remote diffuse reflectance accessory probe in the Department

of Scientific research at The Metropolitan Museum of Art. Measurement samples include the 130 color squares represented on the X-Rite Digital SG Color Checker, a standard X-Rite ceramic tile, and a group of photographic and painted samples with a variety of surface characteristics. Associated software will also be evaluated.

Characterization of a Surface Tarnish Found on Daguerreotypes Under Shortwave Ultraviolet Radiation

Krista Lough, 3rd Year Student, Buffalo State College, Program in Art Conservation

A characteristic fluorescent tarnish can be observed on some daguerreotypes under shortwave ultraviolet radiation. The fluorescence can be seen in several distinct patterns: edge tarnish, rings, and continuous films. The tarnish has been observed on the fronts and backs of daguerreotypes on electroplated and roll-clad plates. The tarnish also can be seen on the backs of brass mats and on mat bevels. The fluorescent tarnish was observed on heavily tarnished plates as well as plates that showed minimal tarnish. In some cases the fluorescence corresponded to brown staining on the daguerreotype under normal and specular illumination. Test plates were created based on early experiments by Lee Ann Daffner (1996) and Claire Buzit Tragni (2005). A fluorescent tarnish, similar to the tarnish seen on historic plates, formed on bare copper plates exposed to a solution of sodium cyanide. Dispersive Raman spectroscopy, scanning electron microscopy (SEM), and X-ray diffraction (XRD) were applied to characterize and identify the fluorescent compound on the test and historic plates. Raman spectroscopy identified the characteristic peak for copper cyanide, CuCN, at 2172 cm^{-1} . Elemental k-ratio maps of the SEM analysis indicated an increase in copper, carbon and nitrogen in the area of fluorescence. Powder XRD was capable of identifying the copper cyanide compound on a test plate but was not sensitive enough for detection on a historic daguerreotype. Cyanide could have been introduced to the daguerreotype process by at least six different historical procedures in its creation as well as restoration. Shortwave ultraviolet radiation thus can be added to the methods of characterization in any long term monitoring program of daguerreotypes' stability.

Retouch Practices Revealed in The Thomas Walther Collection Project

Lee Ann Daffner, Andrew W. Mellon Foundation Conservator of Photographs, Museum of Modern Art

This presentation will discuss the results of a four year study of materials practices of photographers in The Thomas Walther Collection Project at The Museum of Modern Art. A wide

variety of retouch was observed on photographs dating between 1911 and 1942, some of which appeared to be original, others that may have been added later. Materials and techniques will be discussed and the findings shared and the resulting impact of these findings on current scholarship reviewed.

Laszlo Moholy-Nagy: Characterization of his Photographic Work at the Art Institute of Chicago and his Working Practices

Mirasol Estrada, Andrew W. Mellon Fellow in Photograph Conservation, Art Institute of Chicago

A fundamental understanding of the history of László Moholy-Nagy's body of work is incomplete without a thorough understanding of his working practices. Photography was central to his aesthetic and gave the direction to many of his non-photographic activities. Hence, this project encompasses a comprehensive study of his photographic work. This study includes the characterization of the physical properties and the materials analysis of the prints, crossing paths with historical and archival research. The characterization is achieved by making use of different illumination sources and observation tools. Non-invasive scientific analysis with X-ray fluorescence spectroscopy (XRF) and reflectance Fourier Transform Infrared Spectroscopy (FTIR) (In collaboration with the Conservation Science Department at AIC) complements these observations. This study aims to establish the basis for the history of the materials choices and working practices made by the artist throughout his life.

Moholy-Nagy, groundbreaking artist and one of the precursors of the German Bauhaus, came to Chicago in 1937. He was invited by the Association of Arts and Industry to direct the New Bauhaus, which later became the Institute of Design. There, he created a stimulating, experimental environment for the photographic arts. His legacy and the influence he had on the students remain to this day, as he is a key figure in the history of American Photography.

The Collection at the Art Institute of Chicago has a modest, but representative group of Moholy-Nagy's photographic work; ranging from straight photographs, solarizations, photocollages, *cliché verre* to and most significantly, photograms. These photographs show a wide variety of formats, tonal ranges, finishing surfaces, coatings, paper tints, notations and signatures. Why is Moholy-Nagy's body of work so diverse? Which photographic processes did he use to express particular ideas? What were the motives for his material choices? What was the master's influence on his pupils (whose work is also reflected in the AIC collection)? These are some of the questions that have been tackled by this investigation.

The procedures and results of more than two years of research carried out during an in-depth study at the AIC on this topic will be shared in this talk.

Technical Characterization of the Diane Arbus Archive

Nora Kennedy, Sherman Fairchild Conservator of Photographs, The Metropolitan Museum of Art; Janka Krizanova, Research Scholar in Photograph Conservation, Metropolitan Museum of Art

This talk will provide an update of research on the Diane Arbus Archive, acquired by The Metropolitan Museum of Art in December 2007. Primary objectives of this project include an overview survey, identification of treatment needs, characterization of photographic papers used by Diane Arbus, and further investigation into Arbus' use of stabilization processing. Working closely with colleagues in other institutions on characterization techniques, we hope to create a resource for a deeper technical understanding of the work by this important American artist. Existing written documentation by the artist, oral history and research into the technical literature will be combined with physical evidence, paper fiber sampling and analysis, micro-raking surface mapping, macro RTI, XRF analysis of image and baryta layers, to shape a thorough history of the artist's oeuvre from a technical viewpoint. The entirety of this artist's archive offers an unparalleled opportunity to create a thorough technical resource of great importance to the history and preservation of the Archive as well as to photographers, collectors, conservators, and photography dealers internationally. This project will serve as a model for other institutions with photographer's archives in need of characterization and preservation.

Characterization of Platinum Prints: Comparative Study of Platinum Prints in the Museum of Fine Arts, Houston Collection and the Early 20th Century Kodak Platinum Samples

Saori Lewis, Assistant Conservator, Photography, The Nelson-Atkins Museum of Art

Nine platinum print samples produced by Kodak in the turn of the 20th century are studied using a variety of photographic documentation techniques, micro-raking texture analysis, X-ray fluorescence spectroscopy (XRF), and spectrophotometry. These are commercial samples of platinum print papers Eastman Kodak Company marketed between c.1902 and c.1910, and they are identified by their product names printed within the image or stamped on verso. Ten platinum prints from the Museum of Fine Arts, Houston are selected for comparative study. Based on the characteristics of the papers identified through a series of analysis, the print by Gertrude Käsebier, Lucille Tomajon is found to be a close match with the Kodak Etching Sepia, Smooth paper.

An Examination of Light-Induced Color Change in Anoxia and Hypoxia Using the Microfading Tester

Vincent Beltran, Assistant Scientist, Getty Conservation Institute; James Druzik, Senior Scientist, Getty Conservation Institute; Christel Pesme, Museum Lighting Consultant, Freelance; Dr. Andrew Lerwill, Research Scientist, Image Permanence Institute

The exposure of cultural heritage artifacts to light represents one of the fundamental agents of deterioration in the museum setting. Mitigation of light damage to an artifact is typically achieved by limiting the intensity and duration of light exposure. As a consequence, the visitor's viewing experience may be diminished by dim lighting conditions or lost when an artifact is placed in storage when nearing a pre-determined light dosage.

The housing of light-sensitive artifacts in reduced oxygen microenvironments, however, may serve to reduce the rate of light damage, for which color change is often used as a proxy. While several research groups have explored the effect of oxygen on color change for various materials, widespread use of reduced oxygen environments as a means of limiting light damage has been constrained by a) a limited dataset of anoxic color change results that has been clouded by a small sample subset which exhibit accelerated color change in such conditions, and b) the lack of readily available and affordable technology for establishing reduced oxygen microenvironments.

This study will focus on the expansion of the anoxic color change dataset by employing a micro-fading tester (MFT) to examine light-induced color change of a varied sample set in a reduced oxygen environment. Sample types exposed include organic dyes, gouaches, and natural history materials. In addition to inducing color change with the use of a high-intensity xenon lamp, the MFT is capable of simultaneous and continuous color measurement, allowing for an examination of the kinetics of color change.

The anoxic color change results obtained with the MFT will also be compared to previous results from a similar experiment in which an overlapping sample set was housed in anoxic conditions and exposed to halogen lamps using a traditional lightbox protocol. While acknowledged that the spectral power distribution and light intensities of the xenon and halogen lamps are different, a quantitative and qualitative comparison of results generated by exposure to the relatively experimental MFT and the more conventional lightbox method will advance our understanding of the relationship between the two experimental techniques.

Concealable Strain Sensing Monitoring and Modeling of Relative Dimensional Changes in Art Objects

Alejandro Schrott¹, Levente J. Klein¹, Joseph Sloan^{1,2}, Sergio A. Bermudez¹, Hendrik F. Hamann¹, Constantina Vlachou-Mogire³, Mika Takami³, Kate Frame³

¹IBM Research, IBM T. J. Watson Research; ²Johns Hopkins University; ³Conservation and Collection Care, Historic Royal Palaces, Hampton Court Palace

A novel method has been developed to assess and to predict strain deformation of art objects responding to environmental fluctuations. The method uses a Giant Magneto-Resistance (GMR) sensor, which allows micron scale displacement monitoring with respect to a fixed small magnet, and without the intervention of a stress/strain tensor relationship. The small GMR sensor and magnet sizes make concealed sensing more practical while safer for art objects. Short and medium term weather forecasting and its impact on building indoor environment, coupled with physical models of building insulation envelope, can help predict object deformation and response to environmental changes. Thus, sensor placed near/in art object and relying on a wireless communication platform provide a powerful tool for measuring and predicting temporal deformation of wooden and textile objects in response to local temperature and relative humidity fluctuations. The discussion will focus first on a laboratory case study, in which the dimensional changes of wood test vehicles subjected to sudden humidity changes, at constant temperature, inside a controlled environmental chamber were measured. This will be followed by addressing the collaboration with the Conservation and Collection Care department of the Historic Royal Palaces. The latter, aims at monitoring environmental risks for the Tudor tapestries at Hampton Court Palace, UK. The deployment of the sensors on the "The sacrifice of Isaac," Henry VIII's tapestry in the Great Hall at Hampton Court Palace, and current real time results will be discussed.

Furthermore, we will discuss an iterative numerical method for non-linear effects correction that provides improved accuracy and the measurement is used to generate a simple elastic model of textile deformation. The method is relevant to develop schemes and integrate them into analytic models to address risk management across different geographies and offer a tool for helping to revise existing standards.

Accurate Measurement and the Quantification of Surface and Material Property Change Using New RTI and AR Techniques

Mark Mudge, AUTRE, Cultural Heritage Imaging; Mark S. Drew, Professor of Computing Science, Simon Fraser University; Carla Schroer, Founder & Director, Cultural Heritage Imaging; Mingjing Zhang, Graduate Student, Simon Fraser University

This presentation examines new open source software that will dramatically improve the accuracy of the results generated by Reflectance Transformation Imaging (RTI) and Algorithmic Rendering (AR).

RTI and AR use the same set of empirically captured photos. This photo set is acquired with a fixed camera and subject. Each photo is taken with the illumination source in a different position. The positions evenly sample incoming light directions over the surface of an imaginary hemisphere over the subject.

Cultural Heritage Imaging (CHI) and a team at Simon Fraser University (SFU) will demonstrate new ways of using RTI data. The new RTI algorithm produces colors, self-shadowing, and specular highlights that exactly match photographic ground truth. The team removes one of the photos from the RTI set and synthetically generates a new photo from the same light position. The SFU team has used many different subjects to convincingly demonstrate their synthetically built photos exactly match the attributes of the removed photo. The new algorithm can generate accurate shadows and highlights associated with any incoming light direction.

The SFU algorithm generates highly accurate surface shape information. In RTIs, surface shape information is recorded as a field of surface normals. This field represents the spatial orientations of the subject's surface at the locations corresponding to the photo's pixels, which represent it. This orientation data determines the direction of light reflectance off the surface of the imaging subject, produced by an interactively pointed virtual light.

The SFU research algorithm uses a radial basis function to separate shadows and highlights and weights them according to their intensity. The algorithm also creates a third set of pixels, which have neither shadows nor highlights. The normal field is calculated per pixel using the pixel samples from this third set. The calculation of normal directions can be significantly misdirected by the presence of shadowed and highlighted pixel samples. Normal direction calculations using pixel samples without shadows and highlights produce highly accurate normal fields. These normal fields accurately represent the topology of the imaging subject's surface. These normal fields can also be integrated to create full 3-D geometry representing the subject's surface.

When this geometry is measured, it will yield accurate results. Once the subject is represented in a measurable form, subsequent RTI data sets can be transformed into measurable 3-D representations, which enable the accurate quantification of surface shape change. Measurement of surface color and material characteristics, such as shininess, can also be quantified to track their changes over time.

These new tools are being integrated into existing CHI open source software for building and viewing RTI's. CHI collaborators at Princeton University are building the photometric stereo, 3-D geometry building, open source software into the AR toolkit. An overview of new features to RTI and AR tools will also be presented.

These tools have the potential to dramatically improve the quantification of change of humanity's legacy under the stewardship of the conservation community.

Unwrapping Layers in Historic Artworks: Virtual Cross-Sections with Pump-Probe Microscopy

Tana E. Villafana, PhD Student in Physical Chemistry, Duke University; William P. Brown, Chief Conservator, North Carolina Museum of Art; John K. Delaney, National Gallery of Art; Michael Palmer, National Gallery of Art; Warren S. Warren, James B. Duke Professor of Chemistry, Professor of Radiology, Biomedical Engineering, and Physics, Duke University; Martin C. Fischer, Assistant Research Professor, Duke University

The layering structure of a painting contains a wealth of information about the artist's choice of materials and working methods; information which leads to greater understanding of past cultures and can provide conservators with a better means of how to preserve that culture. The study of such three-dimensional (3D) structure has generally required the physical removal of a cross-section sample, which is then characterized by a plethora of analytical techniques. While current noninvasive techniques, such as x-radiography, infrared reflectography, ultraviolet visible fluorescence photography, Raman, reflectance imaging spectroscopy and x-ray fluorescence intensity mapping, provide important information about a painting, these techniques cannot provide quantitative depth information. Conservation scientists are exploring 3D imaging techniques that would avoid invasive sampling, such as confocal x-ray fluorescence (XRF), absorption near edge structure imaging (XANES), optical coherence tomography (OCT) and terahertz imaging, but these are research tools and not yet in common use. Unfortunately, no single technique can provide the resolution, penetration, chemical specificity, and ease-of-use for broad use in the conservation field.

Optical microscopy is both non-invasive and yields high-resolution, but conventional linear optical contrast is limited in use for studying artist pigments due to absorption in the pigments and scattering from other materials in the paintings. In similarly scattering samples, such as biological tissues, optical nonlinear imaging has been utilized to obtain high resolution 3D images. Established nonlinear imaging, such as two-photon fluorescence and second- or third-harmonic generation imaging, has had some success in studying binders, varnishes, or wood in musical instruments, but applications in cultural heritage are sparse because most inorganic pigments do not fluoresce or generate harmonic light.

Recently we have developed an optical nonlinear imaging technique, pump-probe microscopy, to image the biological pigments hemoglobin, eumelanin, and pheomelanin which are present in skin cancer and ocular melanoma. Extension of pump-probe microscopy from biological pigments to artist's pigments has yielded promising preliminary results, however, achieving pump-probe contrast in fine arts objects is more challenging than skin because the artist's palette has a much greater variety of pigments than those present in skin. Here we show that by tuning to appropriate choices of wavelength and pulse parameters we can obtain *in-situ* 3D imaging of paintings with molecular specificity. We generated virtual cross-sections in mock-up paintings with clear distinction between mixed and layered stratigraphy with pigment specificity. We also imaged an intact 14th century painting, *The Crucifixion* by Puccio Capanna, leaving no visible signs of damage. Although we focus mainly on historic paintings, our approach can be applied to a wider range of cultural heritage objects, such as pottery or statuary, and provide information relevant to current areas of interest in conservation science.

A Closer Look at Early Italian Panel Paintings Session: Imaging Cross-sectional Paint Samples from the Walters Art Museum

Zachary Voras, PhD Student, University of Delaware; Kristin de Ghetaldi, PhD Student, Winterthur/University of Delaware Program in Art Conservation; Tom Beebe Jr., Professor, University of Delaware; Eric Gordon, Head of Painting Conservation, The Walters Art Museum; Karen French, Senior Conservator of Paintings, The Walters Art Museum; Pamela Betts, Private Practice; Glenn Gates, Conservation Scientist, The Walters Art Museum

The early development of oil painting techniques before the age of Leonardo has brought about questions relating to materials that were used by these early Italian painters. Recent advancements in technology and data interpretation have allowed scientists and conservators to explore inorganic and organic materials found in early Italian paintings. Sophisticated imaging techniques provide complementary information to conventional methods of analysis, such as cross-sectional staining, Fourier-transform infrared spectroscopy (FTIR) and gas chromatography-mass spectrometry (GC-MS), all of which are routinely employed in today's museum and institutional laboratories. Collaborative efforts between the conservation department at the Walters Art Museum and the University of Delaware have revealed new directions in cross-sectional analysis of 15th and early 16th-century Italian panel paintings. Imaging time-of-flight secondary ion mass Spectrometry (ToF-SIMS) was used in the identification of binding media and inorganic pigments in samples collected from a total of three paintings in the Walters's collection, ranging from Giovanni di Paolo to Raphael. While the technique does require sampling, ToF-SIMS can be coupled with high resolution spatial

imaging to map pigments, proteins, and oils in paint samples that have been stored for nearly half a century. This has allowed the authors to use existing cross-sections in new research to identify paint materials, techniques, and degradation products. Spatial "maps" of binding media and pigments present in cross-sections may help to shed light on workshop practices, attributions, and other topics associated with provenance.

Free Fatty Acid Profiles in Water Sensitive Oil Paints: A Comparison of Modern and 15th Century Oil Paints

Joy Mazurek, Assistant Scientist, Getty Conservation Institute

A novel, two-step procedure using for quantifying the percentage of unbound fatty acids (free fatty acids plus pigment soaps and salts) and total fatty acids of oil paints by gas chromatography/mass spectrometry (GC/MS) was developed. The following samples were analyzed in this study: Bocour Bellini oil tube paints; Winsor & Newton student-quality oil paints (1953-1992); paints made at the Museum Conservation Institute (MCI) with cold-pressed linseed oil (1992-1999); Winsor and Newton artists-grade oil paints (1990-1999); Duro artists' oil paints (1960s); tube paints collected from among Clyfford Still's studio materials which included tube paints from Bellini, Weber and Grumbacher (assumed to pre-date 1980); Clyfford Still paintings (1940-1970); and various mural and panel paintings. Marker compounds for specific drying oils were detected in Clyfford Still's studio tube paints. All of the Bellini paints and the Weber paint sample contained 12-hydroxystearate, which is found in castor oil-derived products. The Talens tube paint contained ricinoleic acid, which is also present in castor oil, but is also used in some modern synthetic pigments. P/S values were less than 1 in all of the Grumbacher Permanent Oil Color artist's-grade tube paints, which is unusually low.

In this study, the percent fatty acids and percent hydrolysis of oil paint is reported for Bellini oil paints, Winsor & Newton student-quality oil paints that are sensitive to water, Duro oil paints and tube paints from Clyfford Still's studio, as well as several other oil paintings including: *Virgin and Saints* by Ubaldo Gandolfi (1758), *Annunciation* by Bartolomeo Cesi (1515), *Waterlilies* by Monet (1914-26) and *Mural* by Jackson Pollock (1943). The results revealed that water sensitive modern oil paints have very little if any free fatty acids, possibly due to the presence of driers or a chemical modification. Some of the other tube paints analyzed in this study had zero percent free fatty acids, regardless of the age of the paint, and water sensitivity. Several paintings from various mural and panel paintings from the 16th to 18th century (Italian) as well as modern paintings were analyzed for free fatty acid profiles and were compared to reference data from tubes and handmade paints. The data presented here supplements the traditional fatty acid ratios for oil identification by adding an additional level of characterization from the free fatty acid profiles.

Luncheon Keynote Seeing Double: Leonardo's *Mona Lisa* Twin

Dr. John Asmus, Research Physicist, Physics Dept., University of California, San Diego

It is a curious fact that Leonardo da Vinci painted two versions of what have become his most celebrated artworks. Most notable of these famous pictures are his *Virgin of the Rocks* (London National Gallery and Louvre), *Virgin and Child* (Hermitage and Munich Alte Pinakothek), and *The Virgin and Child with St. Anne* (London National Gallery and Louvre.) For centuries there has been speculation concerning the possible existence of a second *Mona Lisa*, as well. Countless *Mona Lisa* copies have surfaced through the ages and several have been advanced as the long-lost *Second Mona Lisa*, only to be dismissed after failing scientific or historical scrutiny.

Twenty-three years ago the heirs of the late Joseph Pulitzer asked me to examine a painting known as the *Isleworth Mona Lisa* that was in the family collection of fine art. This invitation was extended in response to my ten-year study of the varnishes and pentimenti of the Louvre *Mona Lisa*. My studies led to the conclusion that the intricate geometrical principles employed in the two paintings were identical even though individual features are different in both size and proportion. Thus it was clear that the Isleworth portrait was not a mere copy of the painting in the Louvre.

Subsequently, the Isleworth painting has passed every scientific test available in art conservation science from radiocarbon dating to digital-image age regression. It has emerged that Leonardo painted the Isleworth piece around 1503 and the Louvre portrait around 1513. This discovery settles a protracted debate among art historians as to whether Leonardo painted the *Mona Lisa* in 1503 or 1513. Both dates are correct, but for different paintings.

Development and Testing of a Reference Standard for Documenting Ultraviolet Induced Visible Fluorescence

Jennifer McGlinchey Sexton, Conservator of Photographs, Paul Messier, LLC; Jiuan Jiuan Chen, Assistant Professor of Conservation Imaging and Technical Examination, Art Conservation Department at Buffalo State College; Paul Messier, Head Conservator, Paul Messier, LLC

Near ultraviolet induced visible fluorescence (UV/visible fluorescence) is a non-invasive characterization technique used extensively by conservators across all media and specializations. Among many applications in the field of conservation and beyond, this technique is commonly used to identify variations in surface, reveal previous restorations, date materials, and identify resins and pigments. Documentation of this work provides an important record of cultural material and is a powerful tool for guiding conservation treatment and historical research.

Despite extensive use and application, standardization of UV/visible fluorescence documentation presents challenges due to numerous inherent variables. Variations in hardware, software,

radiation sources, filtration, workflows and user interpretation pose significant challenges. As a result, there is little basis for comparing UV/visible fluorescence documentation across institutions and conservation labs.

This presentation will discuss the development and beta-testing of new reference standards and imaging protocols that have been formulated and tested by UV Innovations Inc. (a project of Paul Messier, LLC) to address the need for standardization. Under development since 2006, the Target-UV™ and UV-Grey™ are useful for the calibration of documentation equipment and accounting for all significant variables. The system uses a set of grey values, in the form of a UV/visible fluorescent grey card and documentation target, to set white balance and correct exposure. Prototypes were completed in January 2013 and tested to determine efficacy and the potential for standardization. Eight institutions in the U.S. and Europe participated in a round robin blind test. Each site was sent the prototype reference standards, filters, and the same set of items to document using UV/visible fluorescence. Resulting images were compared visually and using RGB data.

Testing confirmed there is a high degree of variability in current approaches to UV/visible imaging and that documentation made to existing standards is almost meaningless in terms of comparison across sites. The test also demonstrated that the calibration of imaging equipment, using the UV-Grey™ and Target-UV™, in conjunction with standardized filtration, provides more accurate documentation of fluorescent color and intensity as well as permitting disparate sites and users to create comparable images. Data derived from the resulting images show a four to five fold reduction in image variability across the test sites. Additional discussion will focus on next steps including potential options for manufacturing and marketing the reference standards.

Recommendations for the Standardization of Digital Radiography of Cultural Heritage Materials

E. Keats Webb, Digital Imaging Specialist, Smithsonian Museum Conservation Institute; Dr. Blythe McCarthy, Andrew W. Mellon Senior Scientist, Freer Sackler Department of Conservation and Scientific Research

Digital radiography is a technique developed and advanced by the medical and nondestructive evaluation and testing (NDE and NDT) industries. This has included the articulation of standards for the handling, storing, and transmitting of information produced by medical and NDE imaging – Digital Imaging and Communications in Medicine (DICOM) and Digital Imaging and Communication in Nondestructive Evaluation (DICONDE), respectively.

As it has done with other techniques developed in scientific contexts, the conservation field has adopted digital radiography as a tool for non-destructive investigation of cultural heritage materials. Without the funding and demand coming from the medical and NDE fields, however, we have not had the resources to create and develop our own standardization. We do have

the option of adapting the previously established DICOM and DICONDE to create standards that support conservation and cultural heritage imaging work.

This presentation outlines an effort to initiate the conversation about the development of standardization in digital radiography, as applied to the imaging of cultural heritage materials. Information on setups and workflows gathered to-date from museums currently using digital radiography, as well as aspects of DICOM and DICONDE as models for metadata standards and other key components, will be discussed. The goal would be to create a resource for cultural heritage professionals using digital radiography, and a reference for museums transitioning from film-based radiography to this powerful digital imaging tool.

X-ray Micro Tomography Analysis of Western Red Cedar Secondary Phloem

Peter McElhinney, Postgraduate Fellow in Conservation of Museum Collections, Smithsonian Institute's National Air and Space Museum; Benjamin Ache, Production Manager, Micro Photonics, Inc.; Nicole Little, Physical Scientist, Smithsonian's Museum Conservation Institute

The secondary phloem of the Western red cedar (*Thuja plicata*) is used by Native American and Canadian First Nation communities of the Pacific Northwest coast in the production of cultural material. Analysis of Western red cedar secondary phloem tissue identified bio-mineral distribution patterns and variations in the structure of inner and outer tissue which may contribute to condition issues encountered in historical cultural material. X-ray micro-tomography of secondary phloem tissue identified known mechanisms of deterioration not readily visible with other examination techniques including cleavage of phloem layers along linear, tangentially arranged parenchyma and sieve cell tissue, and disruption of parenchyma and surrounding cells in semi-functional middle tissue and non-functional outer tissue. The data also indicated the presence of a relatively dense material distributed throughout phloem ray parenchyma and intercellular spaces, and concentrated in areas of cell disruption. In an effort to further characterize this dense material, transverse sections of phloem samples were analyzed with SEM-EDS; spectral peaks for calcium, likely indicative of calcium oxalate crystals were identified in these areas. These data suggest a link between bio-mineralization and abscission mechanisms in Western Red cedar phloem tissue, which may play a role in the shedding and tissue deterioration typically associated with movement and manipulation of historical material.

Elemental Identification of Pigments used in Traditional Bark Paintings from Arnhem Land, Groote Eylandt, and the Tiwi Islands

Georgina Rayner, Postdoctoral Fellow in Conservation Science, Straus Centre for Conservation and Technical Studies; Narayan Khandekar, Senior Conservation Scientist, Straus Center for Conservation and

Technical Studies, Harvard Art Museums; Katherine Eremin, Patricia Cornwell Conservation Scientist, Straus Center for Conservation and Technical Studies, Harvard Art Museums; Rita Giannini, Cranfield Forensic Institute, Cranfield University; Andrew J. Shortland, Cranfield Forensic Institute, Cranfield University

Harvard Art Museums are undertaking a major investigation into traditional bark paintings from Arnhem Land, Groote Eylandt and the Tiwi Islands; locations in the Northern Territory of Australia. This study is focusing on the pigments used by Aboriginal artists and is the first major analytical survey of bark paintings from the late 19th to 20th century.

These naturally occurring pigments contain a wide range of elements in varying amounts, characteristic of pigment types such as ochres, clays and mineral blacks. An earlier study conducted at the University of Western Australia demonstrated that laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) can be used to group pigments from various regions around the Australian continent according to the distribution of trace elements. Our study focuses on the trace element differences in a more closely defined region of Australia, namely the Northern Territory. To identify the pigments we are using LA-ICP-MS alongside complimentary techniques, including scanning electron microscopy (SEM), Raman and Fourier transform infra red (FTIR) spectroscopy.

The samples in this study include natural deposits of pigments, obtained from recorded historical expeditions and collected directly by the authors in consultation with local artists, as well as approximately 200 samples from 50 bark paintings collected from galleries and museums from Canberra, Sydney and Melbourne. The paintings were all chosen because they used traditional methods and materials and spanned over 100 years, with the location and date of painting being known for some examples. For instance, Melbourne University's sampled paintings all come from the same community on Groote Eylandt and date to 1941-1945. A sample of each paint color present was collected to provide a statistically valid database of the range of natural pigments available from the 1870s to 1980s. The opportunity to compare samples from paintings with samples of natural raw materials from sites around Arnhem Land, Groote Eylandt and the Tiwi Islands provides us with a unique opportunity to trace the geographical origin of the pigments. It is anticipated that this will shed new light on the movements of raw materials through trade.

Initial results from a small selection of paint samples have illustrated subtle differences in elemental composition. This has given us the ability to differentiate between pigments of the same color with different mineral compositions, and identify regional differences within black pigments. Groote Eylandt has large manganese ore deposits and samples of black pigment from the region are uniquely rich in manganese. Variation in manganese content has also been observed in red and yellow pigments from different regions and may indicate use of different shades, as observed elsewhere with natural sienna or umber pigments. The study is ongoing and will be included in the catalogue for an upcoming exhibition at Harvard Art Museums opening in January 2016.

Sustaining Embedded Knowledge in Textile Conservation and Textile and Dress Collections

Mary Brooks, Director, MA International Cultural Heritage Management, Department of Archaeology, Durham University

Textile and dress collections and textile conservation would seem to have much to celebrate at the moment. Exciting new projects are in the pipeline, such as the British Museum's World Conservation and Exhibition Centre (opening 2014), the Victoria & Albert Museum's Clothworkers' Centre for Textiles, Fashion Study and Conservation (opening 2013) while the Queen Sirikit Museum of Textiles, Bangkok has recently opened its doors. Conservators also appear to be energized by an expanded vision for the role for heritage conservation, using their technical expertise and knowledge to preserve collections, enhance understanding and engage the public in this previously hidden process.

Further investigation, however, reveals a somewhat different position. Textile collections in the UK regions, despite some notable exceptions, are being adversely affected by reductions in central and local government funding. The UK Museum Association is tracking the loss of specialist curatorial posts, including textile curators. Despite the great drawing power of textile and dress exhibitions, the invisible expertise which enables such displays appears to be being eroded. This paper will therefore focus on this threat to the long-term sustainability of textile and dress collections and the risk of loss of embedded collection knowledge for curating and conserving. Without such expertise, effective planning for collection development and preventive care cannot be sustained.

This discussion of the tensions between our self-image of our profession and discipline, our changing roles and the problematic reality of institutional experience, recognition and funding is intended as a positive contribution to the debate on the future role and impact of textile conservation. It will argue that the study of textiles and dress is still not regarded as a serious discipline and explore the impact of this, including gendered views of textile collections and their audiences. Even when posts are secure, few textile specialists, either curators or conservators, become higher level museum managers so decision-making and choices about collections and recruitment are often made by those without insight into the potential of textile and dress for telling stories through objects and engaging different publics interested in history, science, trade and politics. It is all too easy for textile and dress collections, requiring specific specialist display and storage, to slip off the priorities list when museums are besieged by other pressures. Attitudes to textile conservation, still sometimes perceived as an expensive technical block rather than a skilled process, will be examined.

The paper will conclude with some thoughts on how these complex issues could start to be addressed in order to sustain embedded expertise and influence-decision making. It will be

illustrated with a case study drawing on the Monument Fellowship held by the author at York Castle Museum. Designed to capture and transfer specialist knowledge from previous staff members, the 'Talking Textiles' Fellowship aimed to enhance understanding and encourage dialogue with, and discovery by, colleagues who had not previously engaged with these collections. This contributed to the broader aim of enhancing public understanding and enjoyment of the textiles and dress collections thus demonstrating their value to the museum.

Blown Up: Collaborative Conservation and Sustainable Treatment for an Inflatable Dress

Chandra Obie, Textile Conservator, Cincinnati Art Museum

Innovative and unusual fashion design calls for innovative and unusual approaches to textile conservation. This paper will discuss one such approach which was the result of a process of consultation and collaboration, combining the expertise of several fields to develop a treatment that was not only effective, reversible, and stable, but also sustainable for the long-term use and exhibition of a piece of fashion art.

For Issey Miyake's "pneumatic dress" (circa 2000), the artist's intent was blown up by its inability to blow up. The dress features inflatable, beach ball-like sleeves, which no longer held enough air to achieve an inflated appearance. In addition to the "normal" parameters of textile conservation, the dress came with some unique ones: first, while the dress will eventually be accessioned at the Cincinnati Art Museum, its current owner wishes to wear it a few more times, adding the challenge of wearability to its care; second, the sleeves' materials include polyester, nylon, and polyurethane with vinyl inflation valves, adding the challenge of intrinsically unstable materials; third, as a recent artwork, it was in excellent repair except for the glaring aesthetic problem of its wilted sleeves.

The conservation treatment was a collaboration between the textile conservator, the objects conservator, the curator, and the owner, balancing the unique concerns of each and drawing on their fields of knowledge. Other conservators were consulted via the Conservation "DistList" and by phone and email. Plastics specialists were consulted on the current and anticipated future degradation of the materials. The owner contacted the Issey Miyake flagship store and another owner of a similar piece. Research and consultation continued during treatment and the treatment approach evolved in response.

Ultimately, the sleeves were filled with polystyrene beads inside a polyester gauze bladder inserted and filled through the inflation valve hole. After filling, the inflation valves were tacked back in place. The original aesthetic appearance of the dress was regained, complete with the final touch of the original vinyl inflation valves even though the dress could no longer be inflated with air. The owner came to the museum for a fitting and the dress was declared wearable again, despite some added weight from the filled sleeves. The polystyrene bead treatment

prevents the necessity for re-treatment in the future because as the polyurethane film degrades, the correct shape of the sleeves will remain, supported in position by the filling, making this a sustainable treatment for a problematic and continuously deteriorating material. The dress is stable enough to wear on an evening out on the town, but will enter the collection of the Cincinnati Art Museum as an exhibitable work of the fascinating fashion art of Issey Miyake.

A Case Study Using Multi-band and Hyperspectral Imaging for the Identification and Characterization of Materials on Archaeological Andean Painted Textiles

E. Keats Webb, Digital Imaging Specialist, Smithsonian Museum Conservation Institute; Rebecca Summerour, Andrew W. Mellon Fellow in Textile Conservation, National Museum of the American Indian

Looking beyond the visible using spectral imaging techniques including infrared reflectography and ultraviolet-induced visible fluorescence have been standard practice for conservation professionals since the 1930s. These techniques are relatively accessible to many museum professionals and have become routine in research and conservation for the characterization and differentiation of materials. Some institutions with imaging and color science staff with high-end spectral imaging equipment have the advantage of creating and processing large spectral data cubes that provide complex information for the identification of materials. Combining a lower resolution hyperspectral camera with a higher resolution DSLR camera modified for multiband imaging may present a more accessible imaging option to aid identification and characterization of materials in cultural heritage objects. This paper presents a case study in the combined use of multiband and hyperspectral imaging for investigation of the materials and manufacturing techniques of four archeological Andean painted textiles from the collection of the National Museum of the American Indian. The goals of this project are to explore a more accessible spectral imaging option, present a technique that can be used on a wide variety of cultural heritage objects and investigate the possibility of offering new insights that previous routine imaging did not provide. A Surface Optics Corp SOC710 hyperspectral camera is used in addition to a modified DSLR with bandpass filters. The four painted textiles are a subset of a larger project investigating the materials and manufacturing techniques used to create twenty-one archeological Andean painted textiles.

Analysis of Organic Dyes in Textiles by Direct Analysis in Real Time—Time-of-Flight Mass Spectrometry

Cathy Selvius-DeRoo, Research Scientist, Detroit Institute of Arts; Ruth Ann Armitage, Professor, Eastern Michigan University

The analysis of an organic dyestuff on an historic textile is met with the challenges of chromophore detection at very low concentration in a minute sample from an object of cultural significance susceptible to degradation. Historically, organic dye analysis has been achievable by methods including: high performance liquid chromatography (HPLC) often coupled to additional analytical tools, surface-enhanced Raman spectroscopy (SERS), and various mass spectrometric methods. The drawbacks of these methods are their requirements for either time intensive dye extraction procedures or nanoparticle preparation protocols. This presentation introduces DART-TOF (direct analysis in real time – time-of-flight) mass spectrometry as a novel method for organic chromophore analysis in natural fibers. High resolution time of flight mass spec with direct analysis in real time ionization is very rapid, possessing the requisite sensitivity to identify organic colorants in less than 1 minute. Furthermore, analysis by DART mass spec typically requires no extraction of the dye prior to analysis, and is accomplished with fiber samples less than 0.5 cm in length, weighing no more than 1 mg. In our initial exploration of the technique, we conducted analyses of dyestuffs as powder, in solution, and in botanical source materials. Further development involved the creation of dyed fiber reference materials. To date, more than 40 dye colorants have been identified by DART-TOF mass spec, representing the following classes of dyes: quinones (anthraquinones and naphthoquinones), flavonoids, indigoids, carotenoids, tannins, and curcuminoids. We have successfully identified organic dyes *in situ* in fibers from historic textiles including rugs, tapestries, and Huari garments. Recently, DART-TOF was used to confirm the anecdotal account regarding the dyeing history of the Civil War era Sam Davis coat in the collection of the Tennessee State Museum. These findings demonstrate that DART-TOF mass spectrometry has potential as an additional tool in the challenging analysis of organic dyes and possesses the requisite sensitivity and the advantage of simplicity without the preparatory requirements of other techniques.

From North to South: The Conservation of Civil War Costume from the Tennessee State Museum

Howard Sutcliffe, Principal Conservator, River Region Costume and Textile Conservation

In November 2013 Tennessee commemorates the 150th anniversary of the death of two important figures in both the Civil War and state history; General Patrick Cleburne and Sam Davis, “the boy hero of the Confederacy.” The Museum holds the

kepi that General Cleburne was wearing when he was killed in the Battle of Franklin and the great coat worn by Sam Davis, a Confederate courier who was caught and executed by Federal Troops.

The conservation of the artifacts was supported by the Tennessee Chapter of the Sons of Confederate Veterans (SVC) for events taking place at the Museum and off site. The two objects were both in very fragile condition and their conservation was considered an act of commemoration by the SVC. This paper will detail the conservation and analysis work undertaken and the management of a project that had to balance so many stakeholders and interested parties.

General Cleburne's kepi was the first object to be worked on. Following examination on site and the submission of a treatment proposal, in-depth discussion of the treatment protocol between the conservator and curator ensued to assess the long-term consequences of treatment. The curator was very concerned that conservation should be minimal, enough to aid future preservation but not change the character of the object, and be sustainable in terms of the longevity of the materials being used, thereby reducing the need for future interventions. Preventive conservation was of course a critical aspect of the project, as a new mount was required to fully support the kepi on permanent display and also allow easier handling when necessary.

Sam Davis served in various combat roles in the Confederate army. As a courier for Coleman's Scouts he was captured wearing a makeshift Confederate uniform and in possession of Union battle plans. Part of that uniform was a Union wool greatcoat that had been given to him by his mother. In very poor condition, dirty, structurally unsound and having been "souvenired" consultation took place to determine what condition issues should be treated and what important information should be left in place. As was the case with the kepi, there was concern that intervention be kept to a minimum and that all materials used for the conservation and the new mount be long-lasting.

Towards the end of the War, with supply routes to the South limited the use of Union uniform parts by Confederate armies became commonplace. Family lore states that Sam's mother had over-dyed the originally sky blue Union coat with a brown dye to make it appear more like a confederate issued coat. The truth to that story has always been in question and the origin of the coat is central to the legitimacy of his eventual execution, so an integral part of the project was to try and solve the mystery using Direct Analysis in Real Time – Time of Flight Mass Spectrometry, a newly developed method for identifying organic dye chromophores in natural fiber textiles.

Improved Analytical Technique for the Study of Ancient Tyrian Purple

Zvi C. Koren, Professor & Director, The Edelstein Center for the Analysis of Ancient Artifacts, Shenkar College of Engineering, Design, and Art

Curators and conservators need to know what they get themselves into when ordering analyses of organic colorants on culturally important heritage objects. They are often confronted with the following dilemma: to destroy or not to destroy? That is, to perform analyses that will ultimately destroy the sample analyzed or to utilize a method that does not alter the original object in any way. This is especially relevant to the study of archaeological artifacts, which often consist of small fragments. Unfortunately, some analysts' claims that their methods involve "non-destructive testing" (NDT) are in some cases either misleading or erroneous. A true NDT method can be termed "non-invasive," whereas micro-destructive or nano-destructive methods – depending on the scale involved – can be simply referred to as "invasive."

Additionally, museum officials should not be automatically enticed by the razzle-dazzle of impressive-sounding acronyms, such as, FAB, DESI, DART, HRMS, TOF, SERS, and even DAD, which have been used for the analyses of historic colorants. The high-tech world of sophisticated chemical instrumentation has permeated into the field of analytical research of natural colorants. However, the advancement in the sophistication of electromagnetic chemical techniques does not automatically imply that their application to the study of ancient colorant sources is also advanced, or even useful. There are fundamental problems with these spectrometric methods for the analysis of organic dyes and pigments that museum officials should understand, and these will be addressed.

The optimum analytical method to be used in the analysis of organic dyes and pigments is the high performance liquid chromatographic (HPLC) technique, which must be preceded by a correct dye micro-extraction procedure. Though this method essentially destroys the sample, it is nano-destructive and more than any other method extracts the maximum information regarding the origin of the dyestuff used. This method has been successfully used on such minuscule samples as single dissected fibers from a yarn, whereby the dye quantity was on the order of a nanogram – a billionth of a gram!

This talk will emphasize the dye analysis results on molluscan-purple pigments from the following historically important archaeological sources: (a) an intricate Late Roman-Period polychromic textile from Egypt; (b) a Roman-Period Royal Purple weave belonging to King Herod found atop the Judean Desert palatial fortress of Masada in Israel; (c) a 2,500-year old marble jar of King Darius from ancient Persia; and (d) other historic examples that shed light on the fashionable colors of kings and biblical priests.

Managing Sustainability of Light Sensitive Collections

Stefan Michalski, Senior Conservation Scientist, Canadian Conservation Institute

Can some of the concepts that emerge from thinking about global sustainability inform our field, especially the dilemma of managing unavoidable deterioration such as light damage? Top-level definitions of sustainability are couched in terms like intergenerational equity, very much like the top level goals of heritage conservation. In the end, however, sustainability of materials comes down to two very different kinds of things: finite resources and systems. Finite resources, such as oil, cannot actually be sustained at all, they can only be made to last as long as possible. Systems, such as ecosystems, recyclable minerals, clean water, are sustainable. The particular “individuals” in these systems are not sustained; they are replenished by a sustainable system.

Museums recognize their finances and human resources as sustainable systems, but not so much the collections. If we take a long view of museum collections, however, perhaps we can find both kinds of things: finite resources and systems. The priceless, the unique, the special, are finite resources. But perhaps collections that have many items in a class, e.g., “19th century quilts” can be considered systems, and therefore sustainable even if the individual items are not. On an obvious level, a collection that acquires new things in better condition is sustaining itself (but more often simply expanding.) Are there more subtle forms of sustainability?

Consider a “19th century quilts” collection. It is considered ethical to “rotate” and “rest” light sensitive collections. Is this “sustainable” practice? Consider two scenarios. One is a rotation scenario; each object is “rested” after display. For simplicity, consider that at any time, half is resting, half is displayed. The other is a “fixed” scenario; half is permanently on display, half permanently in the dark, except for scholarly study and documentation purposes. From a risk management perspective, i.e., total loss of value, these two scenarios are more or less equivalent until the colours are gone in the displayed quilts of the fixed scenario, since in the rotation scenario half the colour is gone across all the quilts (actually it would be more than ½ since colour fades faster at the beginning, but ignore that). Both scenarios fade “1/2” the collection colours during this first phase. More time passes. The fixed scenario remains static, the displayed quilts look old, true, but the shape, form, textures, sewing, etc., and durable colours, remain on display. Plus one has the unfaded quilts for accurate reproduction by whatever new holographic technology appears. In short, one sustains ½ the sensitive collection colours for the rest of time. In the rotating scenario, nothing is pristine, and colours continue to be lost, until one has no sensitive colours left. Neither scenario is sustainability as ecosystems understand it, that kind of sustainability would require museums to admit that their collections are not static, that as the colours die in 19th century quilts, new colours will be acquired in 20th century textiles, ad infinitum. But at least the “fixed” ½ scenario sustains ½ the 19th century quilts forever.

Relying on the Kindness of Strangers: Gathering Information for the Treatment of a Suit of Japanese Samurai Armor

Anne Battram, Upholstery Conservator, Biltmore Estate

Until 1854, Japan had been completely closed to trade with most western nations for over two centuries. When the Edo Period came to an end in 1868, the new regime opened the country up to trade with the West, leading to its subsequent modernization. Beguiled by its exotic yet traditional culture, George W. Vanderbilt travelled there in September 1892 when he received a special invitation to attend birthday celebrations for the Emperor. During his ten week visit, Mr. Vanderbilt bought many souvenirs, filling thirty-two crates with objects ranging from fine Satsuma porcelains to one thousand festive paper lanterns. Amongst his prizes was a suit of Samurai armor, an object which quickly became a popular item for American collectors and whose popularity has come full circle again. The armor had been displayed at various times over the years in Biltmore house, being relegated most recently to storage. The Samurai armor was included in an exhibition, opening in spring of 2012, which highlights the many objects which Vanderbilt and his family acquired during their years of travel.

As a conservator who specializes in upholstery, this author typically relies on each piece of furniture to provide most of the relevant information concerning its treatment needs. The lack of familiarity with Samurai armor, and the culture from which it came, required going outside of the normal sources of information to identify the materials, the various components of the armor, and their relationship to each other. This paper will briefly discuss how information was gathered and the basic treatment steps which enabled this object to be brought to display condition.

Working with Limited Resources: Improving Storage Conditions for Archaeological Textiles at University of Concepción

Francisca A. Lucero Juez, Textile Conservator, University of Concepción

This project focused on the conservation strategy for a collection of archaeological textiles at the University of Concepción, in Chile. This was the author's dissertation topic for the degree of MPhil Textile Conservation at the University of Glasgow.

The collection was donated to the University in the 1970s: a total of 33 textiles including both large textiles and some small fragments. A rare example of poor documentation and storage conditions, there is no information regarding the textiles' provenance, and it is likely that they come from various different sites, due to the different characteristics of each object. Chilean archaeologists are very thorough regarding their findings; the lack of information suggests the textiles were not found by archaeologists but rather someone entirely unfamiliar with the

process that decided to donate these textiles to people who could care for them.

Graduates from the University carried out a project in 2010, “Placing value on the University of Concepción archaeological collection” (Puesta en valor de la colección arqueológica Universidad de Concepción). The project was funded by the National Fund for Cultural and Art Development (Fondo Nacional para el Desarrollo Cultural y las Artes – FONDART), and focused on the fulfillment of minimal preventive conservation measures for the collection of archaeological objects in store at the University. However, the textile collection was not included in this initiative, as there were no specialists available at the time and funding was very limited.

In Chile, textile conservation is a small field. There is little information available regarding current measures to improve the condition of textiles by means of preventive conservation, and usually no funding comes to this kind of projects because they are not fully understood by the people who review them. There is also a lack of available materials for use in conservation, because the market is small and no local production exists for acid-free materials or appropriate equipment. This requires the use of alternative materials that have not yet been thoroughly tested, and the importing of materials and equipment from Europe, making conservation projects more expensive than in more developed countries.

The University is once more focusing its efforts on improving the collection’s condition, and the author has prepared a conservation strategy according to the needs of the textile objects as well as the needs of the University to ensure these objects are known, valued and learned from. Not only will the storage conditions be improved, but a new database system will be designed to include the textiles in the University’s inventory as well as to allow students, scholars and the general public to access the collection.

It was hoped that by June 2014 Francisca would be working directly on the collection. Sadly, no funding was obtained for this project for 2014; it will be attempted to apply once more in the next period.

Assessing Colorants by Light

Courtney A. Bolin, Post-Graduate Fellow, Smithsonian Museum Conservation Institute; Mary W. Ballard, Senior Textiles Conservator, Smithsonian Institution; Scott M. Rosenfeld, Lighting Designer, Smithsonian American Art Museum and Renwick Gallery

The purpose of this research is to address light spectra of different lighting sources used in museums with special attention to colorants. How different spectra of light effect historic textiles is an emerging topic in conservation. This subject is especially important because of the rapid introduction of LED (light emitting diode) lighting to save energy and the renewed architectural interest in using natural light. To deal with the topic of color flare, fading and dye degradation to understand the effects of spectra on textiles,

research on the dye’s response to light is underway.

From previous research it is known that mordant, dye stuff and fiber all contribute to the light-fastness of color on textiles. Customized dyed standards have the possibility of monitoring degradation caused by narrow band light energy. Thus, the light properties of lamps will be juxtaposed against mordants, dyes and substrates in order to reveal connections between spectrum and color degradation.

This project will examine spectral power distribution (SPD) characteristics of lamps. When an exhibit is lit, it is important to understand the characteristics of the SPD produced by a lamp and the light properties that cause degradation to the colorants. These factors are more specific than monitoring the general, total illuminance (lux-hours) of light received by textiles during the length of an exhibit. By closely examining relative energy peaks of light and the effects of spectra on dyes, a new perspective is offered to museums for bulb selection that minimizes damage to dyes. This research seeks to provide textile conservators with a means to monitor textile displays more effectively and to eliminate common misconceptions associated with LEDs.

In Consideration of the Thangka

Denise Krieger Migdail, Textile Conservator, Asian Art Museum

By examining the history of the storage, display, and conservation of thangkas over 50 years at the Asian Art Museum, San Francisco, it is possible to trace an evolution in conservation philosophies and in the efficacy of preventive and sustainable care.

In 2003 with the move from Golden Gate Park to our current home in San Francisco’s Civic Center Plaza, the storage design shifted from free hanging, paintings-style storage to flat-drawer storage with full support. Further changes followed, based on conservation concerns regarding the thangka’s complex structure: frequently fragile silks weighted with rods, and central images often executed with lean paint. In order to minimize overall movement and reduce stress to both fabrics and paint layers, Conservation designed support boards for both handling and display. These boards have evolved alongside storage, installation, and materials concerns. Methods of manufacture have shifted from stitched mounts to pin mounts, and currently, in an effort to reduce material usage, the support boards are constructed using an interchangeable magnetic system comprised of reusable backing boards and magnet bars.

Concurrent with the changes in storage and support systems, conservation approaches have also shifted: thangkas are treated as a whole. Damaged veils are no longer removed, and care is taken to support original fabric surrounds in addition to the central painted (or embroidered) images.

Using stock materials and creating a modular mounting system that can be adapted to each rotation reduces the department’s need to continually purchase new materials and reduces waste at the end of each exhibition. The thangkas are continually

supported both during rotations on their magnet mounts and in storage on their horizontal shelving units. Through working with the collection and institutional display needs, Conservation has established a routine that sustains the thangkas, allows for their safe display, and minimizes their overall handling.

Stressed about Pests? A Panel-led Discussion on Integrated Pest Management

Moderators: Bernice Morris, Patricia Silence, Rachael Arenstein

Integrated Pest Management (IPM) is becoming increasingly accepted by museums as a vital part of their conservation and collection care practices. IPM's comprehensive and proactive approach emphasizes pest prevention to avoid the need for drastic remedial action. The panel members will present their own diverse experiences, and then will facilitate an audience-wide discussion about the challenges presented by pests to textile and other collections.

Patty Silence, Conservator of Museum Exhibitions and Historic Interiors at the Colonial Williamsburg Foundation (CW), will discuss the challenges of implementing IPM in a large institution with historic and contemporary structures. CW's current program developed out of a one-year inter-departmental collaboration to develop a request for pricing (RFP) for a pest control contract and resulted in a Foundation-wide program, managed by a conservator and a full-time IPM technician. She will share how an all-inclusive, holistic program has saved money and time, reduced pesticide use, and most importantly improved conditions for collections, from individual items such as textiles and furniture to entire buildings.

Bernice Morris will share her experiences as IPM Coordinator at the Philadelphia Museum of Art (PMA). She will discuss the development of a written IPM policy and the challenge of making the best use of monitoring data. She will also present the systems put in place at the PMA for preventing infestations in its costume and textile collection.

Rachael Arenstein, currently the conservator at the Bible Lands Museum Jerusalem but a former conservator in private practice at A.M. Art Conservation, will speak about challenges she has seen as a consultant working with small to mid-size museums in developing pest management programs, and the resources that the IPM Working Group has developed to meet those needs.

Improving the Legibility of Faded Handwriting on Furniture by Digital Modification of Infrared, Ultraviolet, and Polarized-Light-Filtered Photographs

Christine Schaette, Assistant Furniture Conservator, Museum of Fine Arts, Boston

During an ongoing review of American furniture at the MFA Boston, a team of curators and conservators discovered a number of unrecorded inscriptions on the objects. In many cases, the writing was worn, abraded or unintentionally reduced by sanding of surfaces. Darkening of the wood substrate and fading of writing media added to the challenge of deciphering the handwritings. Additional technical examination was required to visualize the faded inscriptions. The information contained in these inscriptions and markings can be invaluable to our curators as they study and research the provenance of furniture in their collection.

Infrared photography has been used for years to help read inscriptions on furniture. While the technique is useful for revealing remnants of writing materials containing carbon, it appears to be less applicable for tracing other media. But cabinet makers also used chalk, ink and pointed tools to mark their work.

The search for suitable examination techniques for these less researched writing media led us to experiment with different kinds of illumination and digital modification of images. UV-induced fluorescence was found to improve legibility of faded inscriptions written in ink. An inscription of chalk, which was heavily abraded, became visible by using the relief tool available in Adobe Photoshop.

Our initial results from using various photographic techniques were put into context by comparing research of other conservation disciplines related to writing materials, and to a more systematic approach.

The experiments were undertaken mostly by using the standard digital photography equipment in our lab. Our old and cumbersome digital infrared camera was retired, and a regular DSLR camera was refitted by a specialized company to serve for near-infrared and reflected UV photography.

The general image quality of photographs was also improved by using polarized filters on lenses and light sources. This reduced the glare of the wooden substrate underneath the inscriptions, and gave a better image overall.

With these little modifications to our photography routine and minor improvements to our equipment, we achieved noticeably better raw files. Processing with imaging software benefitted from the better initial quality of the photographs.

While many conservators most commonly use image processing software for color correction and adjustment of contrast and sharpness, there are many more digital tools in software such as Adobe Photoshop. Together with professional photographers at the MFA, a variety of options was explored to further enhance traces of inscriptions captured in digital images.

The combination of different photographic and software applications improved the legibility of inscriptions handwritten in media other than pencil. Several case studies will be presented to demonstrate the results of our research.

Rococo Drama – Dry Ice Cleaning the Ormolu Mounts of the Augustus Rex Writing Cabinet

Catherine Coueignoux, Furniture Conservator, Oakstreet Conservation

The Augustus Rex writing cabinet was made c.1750 for Augustus III, Elector of Saxony, possibly by Michael Kümmel, based in Dresden. The Victoria & Albert Museum acquired the cabinet in 1977. It had been completely restored and the ormolu mounts were regilded, though not recoated.

The cabinet's bright appearance was at odds with the other objects in the gallery into which the cabinet was put on display. To remedy this difference, a thick layer of black-pigmented waxy material was applied to the mounts and surrounding wood. Thirty years of London dirt and grime blown in by the climate control system then settled into this layer.

In 2011 the cabinet was brought to Furniture Conservation for treatment during the renovation of the Europe 1600-1800 Galleries. As it would be one of two star objects highlighted in the Galleries, the curators wanted to bring Rex back to its Rothschild-era state of gleaming beauty.

The treatment of the one hundred and fifty ormolu mounts was particularly challenging. They are of the highest quality and detail, with incredibly fine chasing. The intractable wax was impossible to remove from the tiny crevices of the surface, and attempting to do so was not only overly time-consuming but caused damage to the regilding on the high points.

It was decided to clean the mounts with dry ice. This technique employs tiny pellets of dry ice (solid CO₂) which are shot at the surface with the use of compressed air. The dry ice instantly sublimates upon contact with the surface, expanding by five hundred times and thus mechanically removing any soft surface coating. One major advantage of this technique is its "greenness," as it utilizes recycled CO₂ instead of the gallons of solvent which otherwise would have been required.

The treatment was successful, removing the unsightly wax from the crevices of the chasing and leaving behind a clean but appropriately aged surface. Examination under magnification revealed that no damage had been caused to the gilded surface, some of which was highly burnished. In addition, cleaning of the one hundred and fifty mounts was accomplished efficiently and at low cost.

While dry ice was a good choice in this case, it is not appropriate for every surface or for every cleaning problem. Further study is warranted as well to confirm on a molecular level that no damage is being caused to the object surface.

Review and Interpretation of X-rays of Construction Details of American Seating Furniture

Gordon Hanlon, Head of Furniture and Frame Conservation, Museum of Fine Arts, Boston

Over the past few years the Furniture and Frame Conservation lab at the Museum of Fine Arts, Boston has taken the opportunity to X-ray furniture and particularly chairs as part of their conservation examination and treatment. This project was initially motivated as part of a study to understand the history of a pair of Philadelphia side chairs from 1760–75 possibly by Benjamin Randolph in the museum's collection which have been the focus of two fascinating articles by furniture historians published in 1972 and 1998 which discuss the authenticity and possibly modifications to these chairs. Examination of the X-rays of these chairs, which revealed conventional mortise and tenon joinery, raised the issue that we had no comparative material to compare them too. We therefore decided to follow up this initial study and to continue to more routinely X-ray furniture so that over time we can build up a comprehensive database of construction techniques employed in American furniture.

This talk will illustrate some of the findings of the study and in particular the introduction of dowels during the 19th century. It will also discuss the difficulties of X-raying furniture and the problems of interpretation of X-rays which due to the nature of furniture and the placement of X-ray film often introduce distortions into the X-rays. The long term aim of this project is that as more data is collected and analyzed we may see some patterns of construction at different points in time or in different regions or shops. This would help to further our understanding and knowledge of furniture making in general but would also provide us with a database of X-rays for use during the examination and authenticating of furniture. Ultimately it would be ideal if X-rays from different museums and institutions could be compiled into a central database to broaden the depth of the study.

The Conservation of 'The Cattails,' a Royal Sleigh at Versailles (circa 1740)

Christopher Augerson, Proprietor, Augerson Art Conservation

The third WAG paper in a series on sleigh conservation at Versailles, this talk will focus on the conservation treatment of the sleigh "The Cattails." Made for Louis XV, it was used during snowy winters in the park at Versailles as late as the reign of Napoleon I. Its unusual construction, of papier-mâché over a wood substrate, and decoration of elaborate aventurine lacquer, posed special treatment problems. Conservation involved the development of a new fill material, tested with artificial aging in 2005 at the French national Center for Research and Conservation of Graphic Documents (CRCDG).

A second program of research involved analysis of the

polychrome decoration. This employed fluorescence microscopy, Fourier Transform Infrared (FTIR) spectroscopy, Scanning Electron Microscopy-Energy Dispersive Spectroscopy (SEM-EDS), Gas Chromatography-Mass Spectroscopy (GC-MS) and High Performance Liquid Chromatography (HPLC). The original lacquer was seen to contain, in some areas, flakes of an alloy of silver and gold. Other areas were originally decorated with gold leaf, silver leaf, and green luster gilding. A later lacquer, also discussed in this paper, is now the visible; it likely dates to the late 18th century and has darkened with aging.

The careful conservation of the sleigh and all 18th century coatings will be discussed. This included the stabilization of wood, papier-mâché and lacquers, and the re-establishment of adhesion between all three.

The paper will also review the properties of the new fill material, containing cotton paper fibers and calcium carbonate-coated, hollow acrylonitrile micro-spheres in an acrylic emulsion. As the treatment was conducted in 2005–2006, it is now possible to re-evaluate the results of treatment after several years. As predicted by aging tests, the fill material remains stable and successfully allows movement of the wood with changes in RH, without disruption of the papier-mâché, lacquer or inpainting.

What Lay Beneath – Revealing the Original Exuberant Painted Decoration of an 18th century Painted Pennsylvania German Shrank

Scott Nolley, Head, Fine Art Conservation of Virginia

An example of the 17th century Pennsylvania German style of cabinetmaking, a rare painted shrank, or cupboard, discovered in 2007 proved to be a unique surviving example of the genre, and one of a few examples possessed of its original painted decoration. Acquired by Chipstone Foundation and scheduled to be exhibited in partnership with the Milwaukee Art Museum, the unique form had endured exposure to fire, a complex history of attention ranging from day-to-day housekeeping to well-intended, albeit inexperienced, restorations. Shortly thereafter, in the early 1800's, the cabinet was completely repainted using a monochrome casein-bound paint.

Cross-sectional analysis, pigment identification and micro chemical analysis aided in the characterization of object substrate and applied decoration layers. What was clearly a robust pattern of surface decoration – a structure of rich faux burl members framing white presentation panels detailed with vibrant arabesques of brush-applied color – remained obscured beneath a substantial and seemingly intractable accumulation of lead white pigment dispersed in an aged proteinaceous binder.

This presentation gives a brief history of the shrank as a particular German cabinet form, and the curatorial discussion and conservation analysis that led to the decision to remove the 19th century overpaint and reveal the painted decoration original to the ornate cupboard.

We Can Fix It But Should We? Take 2, Part Two – The Treatment of *Mr. Chips*

Tad D. Fallon, Principal, Fallon & Wilkinson, LLC

This paper is the second installment of a two-part paper first given at the Wooden Artifacts session of the AIC annual meeting in 2013, and will discuss the journey and decision making process that ultimately guided the treatment of *Mr. Chips*.

A local private collector approached the Studio of Fallon & Wilkinson LLC in late 2012 to consult on the treatment of a contemporary piece made by California-based studio furniture maker and wood sculptor John Cederquist (born August 7, 1946).

The piece, titled *Mr. Chips*, is a “Kosode” form two-door cabinet, and had sustained severe UV damage with significant fading of the originally colorfully dyed surface design elements. The surface decoration included a Mickey Mouse Arm using a traditional wood plane, inlaid wood shavings falling from the tool, checkerboard “parquetry,” geometric clan signs, and Japanese writing. The inside of the cabinet was protected from the UV exposure and subsequently retained the wonderful rich color and surface characteristics that had disappeared from the front of the cabinet.

The client’s request was to conserve and restore the vibrant dye and ink colors and surface topcoat to the now faded areas, particularly on the large front of the cabinet, which is shaped like a life sized kimono.

As conservators, occasionally we are asked to undertake treatments that ultimately may have complex professional, ethical and market valuation considerations, and these issues become a large part of the equation when dealing with Contemporary Art.

A year in the making, there were a series of research and technical developments that ultimately informed the treatment strategy and guided the treatment of *Mr. Chips*. By using a “guided studio assistant” approach, with the full cooperation of both the Artist and his Studio Assistant, *Mr. Chips* was additively restored and re-coated using the Artists original materials and techniques. This paper will discuss the Artist involved process and treatment in depth.

JOINT SESSIONS: ARCHITECTURE + OBJECTS

Luxor Temple Fragment Conservation Project: Case Study

Hiroko Kariya, Epigraphic Survey, Oriental Institute, University of Chicago, and Objects Conservator in Private Practice

My talk will present an overview of conservation work undertaken over the last 18 years at Luxor Temple, Egypt, treating inscribed sandstone fragments and concurrently managing the temple site where they were stored and later displayed. I will discuss issues unique to the project; protection of a massive number of semi-portable fragments and making them accessible at one of Egypt's most popular tourist attractions. Finally, I will include challenges posed by Egypt's continuing political instability.

Luxor Temple is located in the ancient site of Thebes, which was mainly built in the 14–13th century BCE. A blockyard on the grounds of the temple currently holds over 40,000 inscribed sandstone fragments originally used to build the temple walls and other structures in the vicinity. The fragments had been quarried and cut into small sizes for reuse as a building material from late antiquity through the 19th century. Thousands of such fragments were excavated during the 1950s and '60s by the Egyptian antiquities organization, and these were stored directly on soil contaminated with saline groundwater.

During the 1970s and '80s, the Epigraphic Survey of the Oriental Institute, University of Chicago (Chicago House) documented approximately 2,000 inscribed fragments from this collection. They started a conservation project in 1995 after witnessing some of the fragments disintegrating into piles of sand. The initial project focused on documenting, treating and monitoring the 2,000 registered fragments, but rapidly expanded to include tens of thousand of inscribed fragments. Over time, the conservation project went through a number of phases to meet a variety of needs; from small scale treatment and monitoring to large scale emergency protection and finally to site management including reconstruction of temple walls and creation of an open-air museum.

Key challenges to the project were limited time, materials, treatment facilities and storage space. Adapting local resources for use on site as well as close cooperation with the local authorities contributed to the success of the project. We believed that increasing public access and promoting understanding and respect for the site and its artifacts would also have a positive impact on the site itself.

In addition, I will briefly discuss new challenges raised by the 2011 revolution and on-going turmoil in Egypt. Like any contingency planning, a systematic, practical and sustainable site management program is even more necessary at sites vulnerable to political instability. When site management planning prioritizes building strong cooperative relationships with the local community and professionals, there are direct, positive effects on daily site security and long-term sustainability.

The Cultural Production of Tourism at Lake Tahoe: Exploring How Cultural Heritage Preservation is Impacted by Tourism

Catherine Magee, PhD student, Department of Geography, University of Nevada

This paper explores the connection between tourism and cultural heritage preservation. Our goals as heritage conservation professionals use scientific investigations and research to better understand material culture itself and how best to preserve it. Education and scientific illumination is just one end result of our work. Our work, the real end result of what most of us do, is for tourists, enticing people to visit our museums, national parks, archaeological sites, and historic buildings both in reality and virtually. We are involved in the cultural production of tourism and tourists sites, though we may not conceptualize our work in this way.

This paper explains and explores this connection between tourism and cultural heritage conservation using familiar world heritage sites and my research at Lake Tahoe, USA, as examples. The goals are to highlight these concepts and illuminate the wide ranging impacts and responsibilities we as heritage preservation professionals have beyond the actual physical preservation of our cultural heritage.

Conservation Realities and Challenges: from Auto Regulation to Imposition at Archaeological and Historical Sites in Colombia

Maria Paula Alvarez, Director, Corporacion Proyecto Patrimonio

Through examples taken from my work experience at archaeological and historical sites in Colombia, I will address two issues that impact sustainability and practice in cultural heritage preservation.

First, how complex political and economic realities affect decision-making for and the implementation of conservation projects, and how those realities lead to heritage sites becoming self-regulated. An example is the archaeological site of Pueblito, or sites like Fuente de Lavapatas or la Chaquira rock art site in the archaeological area of San Agustín.

Second, how the limits imposed by the political and economic context open different possibilities for conservation practice. An example is the mandatory cleaning of pictographs in the Archaeological Park of Facativá that will determine how the site is managed; or the political public protests in Bogota that forced us to apply anti-graffiti coatings on outdoor sculpture and monuments and initiate research on this topic.

Considering these arguments, it becomes clear that the preservation of cultural heritage is subject to its context, not only conditioned by so-called deterioration factors, such as the environment and human and biological activity. Preservation is

highly vulnerable to political and economic decisions. Understanding these forces and being able to affect the resulting issues can lead to better heritage management and results that will become more sustainable for the preservation of monuments and sites.

The Development of Treatment Protocol at the Watts Towers Conservation Project

Frank Preusser, PhD, Senior Conservation Scientist and Project Manager, Los Angeles County Museum of Art; Sylvia Schweri-Dorsch, Associate Conservator, Watts Tower Conservation Project, Los Angeles County Museum of Art; Blanka Z. Kielb, Assistant Conservator, Watts Tower Conservation Project, Los Angeles County Museum of Art

This paper details the investigation and testing of treatment options for a complex sculptural site, the Watts Towers. Since January 2011, the Los Angeles County Museum of Art (LACMA) has worked under contract to the City of Los Angeles on the conservation of the Towers, a National Historic Landmark site. Created by Sabato Rodia between 1921 and 1954, the Towers are considered a masterpiece of “outsider art.” They consist of eight sculptures constructed of scrap iron covered in Portland cement and scavenged glass and tile fragments, sea shells, stones, and other material. LACMA’s mandate is to update the site’s conservation and maintenance protocol through written guidance, as well as provide daily preservation maintenance.

LACMA’s monitoring program has helped identify some of the primary causes of deterioration, including vibrations and thermal stress. Cyclic patterns in the movement of cracks and fragment loss has prompted the decision to pursue flexible repair materials whenever possible. Polymer modified mortars, elastomeric crack fillers, and a range of adhesives were first evaluated offsite in terms of performance and aesthetics; the best candidates were then tested onsite in pilot treatments. Subsequent and ongoing monitoring of these treatments has allowed the team to further refine their materials selection and application methodology. The team’s approach and candidate conservation materials for mortar fills, crack fills, and ornament stabilization will be described.

Developing a Modern Approach to Historic Preservation for a Modernist City: The Columbus, Indiana Story

Richard McCoy, Principal, Richard McCoy & Associates, adjunct faculty, Johns Hopkins University

In June of 2013, I was hired by the City of Columbus, Indiana, to create a preservation plan for the “Columbus Arts District.” The Arts District encompasses much of the downtown area in this city of 45,000 residents. Columbus is a remarkable city with a well-recognized history of supporting Modern architecture,

design, and public art. In such a city, one would expect some kind of city or county oversight of preservation, but there has never been a formalized mechanism for the preservation and conservation of the area’s historic assets.

Well known by architectural aficionados, Columbus is seen by many as a design pilgrimage. It now boasts seven National Historic Landmarks, all of which are post war, Modern buildings; the most recent listing was Myron Goldsmith’s 1971 glass-walled Republic Newspaper building. The city’s commitment to these cultural assets has continuously garnered it national attention and a modest but solid tourism base.

This paper will present an account of my work developing a preservation plan that balances preservation, conservation, and design management issues. The goal of this plan is to create a system of preservation that is not prescriptive, but instead encourages the continuation of the kinds of projects that have been appearing in the city for the past 70 years. Demonstrating the importance of advocacy and education about what makes Columbus so special has been at the heart of my work.

Preservation Planning and Mid-Century Modern Materials: Tools to Promote Strategic and Sustainable Building Conservation

Lacey Bubnash, Architectural Conservator, Architectural Resources Group; Katie Horak, Senior Associate, Architectural Resources Group, adjunct lecturer, School of Architecture, University of Southern California

The conservation of Mid-Century Modern building materials and architectural features can be challenging and unpredictable due to the experimental and non-traditional nature of many materials. Preservation planning tools such as Historic Structure Reports and Cultural Landscape Reports can provide a framework for identifying and prioritizing architectural repairs and conservation treatments. Using preservation planning to approach material conservation can prevent the loss of historic fabric and promote sustainable and fiscally-responsible treatment options.

The Village Green, also known as Baldwin Hills Village, provides an exemplary case study for how preservation planning tools can effectively manage architectural conservation on a large scale over a long period of time. Built between 1941 and 1942, The Village Green is located in Los Angeles, California and is nationally recognized as a pivotal and progressive experiment in multiple-family housing. The product of architects and planners Reginald John, Lewis Wilson, Edwin Merrill, Robert Alexander, and Clarence Stein, the site has been designated as a National Historic Landmark with 162 contributing structures. Architectural Resources Group completed a Historic Structure Report and Mills Act application for The Village Green in 2010, which was subsequently awarded a Mills Act Property Tax Abatement Program contract from the City of

Los Angeles. The completion of a Cultural Landscape Report for the property is currently in progress.

The Modern era was a time of rapid technological and scientific advances, resulting in the wide introduction of many new and inexpensive, but often experimental materials. Design features were frequently changed or adapted with the intent to improve living or working conditions. The Village Green is a product of 20th-century mass production techniques, new building materials, and progressive theories of housing design and urban planning. Special consideration may be needed to provide conservation treatments that are in keeping with those materials and philosophies, and proactive preservation planning tools can efficiently address potential issues.

This paper will discuss the completion of this series of planning documents and how conservation decisions were approached within the process. Focus will be given to planning tools and documents, decision-making criteria for maintenance, conservation and repair, and specific Modern materials that pose special challenges.

JOINT SESSIONS: OBJECTS + RESEARCH & TECHNICAL STUDIES

Ultraviolet Induced Visible Fluorescence and Chemical Analysis as Tools for Examining Featherwork

Ellen Pearlstein, associate professor at the University of California, Los Angeles, and founding faculty member in the UCLA/Getty Program in Archaeological and Ethnographic Conservation; Melissa Hughes, PhD Student, Department of Chemistry, UCLA; Joy Mazurek, Assistant Scientist, Getty Conservation Institute; Christel Pesme, Museum Lighting Consultant, Freelance; Renée Riedler, Conservator, Weltmuseum Wien; Molly Gleeson, Rockwell Project Conservator, University of Pennsylvania Museum of Archaeology and Anthropology

Feathers are found in cultural heritage and scientific research collections of tribal arts from the Americas, Africa, and the Pacific as well as in contemporary art, European and American 18th and 19th century fashion, and in taxidermy and ornithology specimens. While museum conservators routinely evaluate feathers by looking at insect damage and mechanical wear, as well as fading as evidence of light exposure, examination of feathers for visible fluorescence under an ultraviolet source is atypical. Recent research by both the authors and bird biologists indicate that nondestructive ultraviolet fluorescence examination can provide valuable information about the identification and pigmentation of feathers found in museum collections, but must be used with caution as both light exposure and adventitious materials may compromise fluorescence. The authors also evaluate different methods of chemical analysis for detecting light induced chemical changes in feathers.

Recent research conducted jointly by UCLA and the Getty Conservation Institute illustrated the importance of identifying feather pigmentation systems in the design of a preventive strategy. The difference in susceptibility to fading of undyed feathers can be a tenfold dose depending on the colorant systems present in the feather and the emission spectrum of the light. Feathers with color derived from the scattering of light through small-scale feather structures are known to be more light stable than feathers with coloration based on biological pigments. A number of feather pigments, including psittacofulvins found only in red and yellow pigments in birds in the Psittaciforme family, as well as porphyrins found in rusty brown owl plumage, may be identified by their specific ultraviolet induced visible fluorescence. The Psittaciforme family includes culturally significant birds such as parrots and macaws and cockatoos, whose plumage comprises not only red and yellow feathers but also green feathers colored by mixtures of structural colors and psittacofulvins.

Feathers that are not directly fluorescent may still undergo appearance changes under an ultraviolet source as a consequence of light aging. Such changes are not readily measured colorimetrically as they may result in chemical and not appearance changes. The authors will describe a variety of analytical techniques applied to light aged feather samples in order to present the most sensitive methods for detecting chemical changes that parallel fluorescence changes.

Coping with Arsenic-Based Pesticides on Textile Collections

Jae Anderson, MS Candidate, Materials Science and Engineering, member of Navajo tribe; Martina Dawley, PhD Candidate, American Indian Studies and Assistant Curator for Native American Relations, member of Hualapai and Navajo tribes; Delana Joy Farley, Collections Manager, Himdag Ki, Tohono O'odham Tribe, member of Navajo tribe; Werner Zimmt, Museum Fellow and chemist; Nancy Odegaard, Conservator Professor; all are members of the Conservation Laboratory at the Arizona State Museum, University of Arizona, Tucson, AZ

This paper discusses the development of a protocol for testing and removing arsenic pesticide residues from textiles. This research was conducted by a team at the Arizona State Museum Conservation Laboratory, and funding from a National Center for Preservation Training and Technology (NCPTT) grant partially supported the purchase of equipment, supplies, and a stipend for a graduate student assistant. The project included the following activities.

- Scholars of Navajo textiles and Navajo weavers were consulted as the project was developed.
- The entire collection of Navajo textiles was surveyed with a pXRF instrument. A protocol for the testing procedure was developed to make this task both efficient in sometimes difficult storage access conditions and useful to the project to develop a removal method.
- A protocol for arsenic removal was based on the results of testing. A series of tests using arsenic treated samples (doses based on typical amounts found during the survey on ASM collections). Variations in washing technique including time, temperature, pH, and agitation were tested, and samples were pXRF tested before and after.
- Wash water samples were also tested for arsenic and values were compared with the washed textile samples. A circulating pump system was devised to pull contaminated wash water into a capture filter for arsenic and recycle the water.
- The system was tested on samples and then on a cataloged museum textile.

Development of the methodology and results of this treatment protocol will be presented.

Blue, Red, and Wound All Over: Evaluating Condition Changes and Cleaning of Glass Disease on Beads

Robin O'Hern, Andrew W. Mellon Fellow, National Museum of the American Indian; Kelly McHugh, Objects Conservator, National Museum of the American Indian (NMAI)

This paper will present the results of two surveys focused on the condition and treatment of deteriorated glass beads in the collection of the National Museum of the American Indian (NMAI).

Glass deterioration occurs when hygroscopic alkali components of the glass migrate to the surface and form salts. The leaching of alkali components leaves a silica enriched surface layer, which is vulnerable to further deterioration. Environmental parameters, glass composition and manufacturing processes, contact with other materials, and previous use of the object can all affect the deterioration process. Due to the large number of beaded objects at NMAI, glass disease is a collection-wide condition issue. Two targeted collections surveys were therefore carried out to monitor condition change and treatment results for at-risk beads. To assess changes in condition over time, a selection of objects originally surveyed in 1999 were re-surveyed in 2013. Ninety percent of the beads had no visible change to the deteriorated glass over fourteen years. A second survey was conducted to evaluate whether treatment options used for blue and red beads – cleaning with water, ethanol, 1:1 water:ethanol, or mechanical cleaning – had different long term results. Red and blue beads with records of deterioration were chosen to create a relevant subset and because the previous condition change survey had identified those colors as most likely to deteriorate.

The results of both surveys will be presented, including trends indicating which beads were most likely to develop glass disease. Several factors stood out, including color and manufacturing technique, both of which are directly related to glass composition. Wound beads – as opposed to drawn beads – also had much higher rates of deterioration, likely due to the generally lower concentration of stabilizing calcium oxide (CaO) and the use of potash (K₂CO₃) as the alkali constituent. Additional information about the bead compositions gathered through x-ray fluorescence spectroscopy will also be presented. The identification of beads most likely to have or develop glass deterioration and the long term success of treatment will help prioritize conservation resources.

Technical Study and Conservation of the ‘Bat Wing Ship’ (the Horten Ho 229 v3); Background, Challenges and Surprising Discoveries

Lauren Anne Horelick, Objects Conservator, Smithsonian Institution’s National Air and Space Museum; Malcolm Collum, Chief Conservator, National Air and Space Museum; Jennifer Giaccai, Conservation Scientist, the Smithsonian’s Museum Conservation Institute; Peter McElhinney, Postgraduate Fellow in Conservation of Museum Collections, Smithsonian Institution’s National Air and Space Museum; Russell Lee, Curator, National Air and Space Museum; Anna Weiss, Postgraduate Fellow in Conservation, National Air and Space Museum; Odile Madden, Research Scientist, Smithsonian’s Museum Conservation Institute

The Bat Wing Ship, also called the Horten Ho 229 v3 is a one-of-a-kind, World War 2, German jet-powered aircraft that is part of the collection of the Smithsonian National Air and Space Museum (NASM). The aircraft was built as an experimental prototype and employed an unconventional combination of the

most advanced technology of the time, paired with the use of traditional materials such as plywood. Its unique design has also promoted a vibrant debate over the origins of secret war-time technology. This is due in part to its tailless design, similar to current aircraft that utilize stealth technology, coupled with a published statement by designer Reimer Horten, who claimed to have added radar-absorbing carbon to the adhesive mixture in the plywood skin. Despite decades of speculation and conjecture, to date no attempt has been made to analyze the physical evidence to support or refute this claim, or to study the many other innovative uses of experimental materials and fabrication techniques.

The aim of this research is to present tangible evidence, derived from a technical study, to clarify the historical record. Through the analysis of original materials performed in collaboration with the Museum Conservation Institute, the technical study focused on identification of the aircraft’s plywood construction, adhesives, plastics, and paints. The study utilized a variety of analytical techniques such as; Raman Spectroscopy, Fourier Transform Infrared Spectroscopy, Scanning Electron Microscopy, Polarized Light Microscopy, Gas Chromatography/Mass Spectrometry, and 3D-microscopy.

The technical study also served to develop a stabilization methodology in preparation for the aircraft’s movement across state lines from its storage location in Maryland, where it has been since 1952, to NASM’s new Udvar Hazy Center in Virginia, where it is slated for assembly and display. Due in part to its deteriorated condition, NASM has never exhibited this now 68-year-old aircraft.

This talk will conclude with an illustration of how the Horten Ho 229 v3 fits within the established protocols that the NASM Conservation Unit has developed for defining levels of aircraft restoration. Conservation’s ethical guidelines oftentimes conflict with traditional aircraft restoration methods. This project presents an opportunity to discuss the many shades of gray that exist between the traditions of full restoration and the governing philosophies of Conservation, which value the preservation of authentic materials.

Animation Cels: Conservation and Storage Issues

Kristen McCormick, Manager of Art Collections and Exhibitions, Walt Disney Animation Research Library; Getty Conservation Institute co-authors: Michael R. Schilling, Senior Scientist and Head of Organic Materials Laboratory; Miriam Truffa Giachet, Visiting Scientist; Joy Mazurek, Assistant Scientist; Herant Khanjian, Assistant Scientist; Tom Learner, Senior Scientist

This paper presents the results of collaborative research undertaken to study the technical properties, degradation, and preservation of animation cels. Traditional animation came about in the early 20th century and by the end of the same century was disappearing with the introduction of the digital age and

digitally-created animated films. Left behind is an art form that holds the characters of our childhood: Pinocchio, Cinderella, Snow White – painted on thin transparent polymer sheets of cellulose esters such as cellulose nitrate, cellulose acetate and more recently polyester. These plastic sheets, known as “cels”, are the artwork that was then photographed to make the animated films.

Animation cels present conservators and scientists with a host of challenges, such as buckling, yellowing and off-gassing of the plastic due to hydrolysis and oxidation, whereas the gum-based paints are prone to cracking, flaking and delamination. Cellulose ester photographic films are stored in very cold environments to slow deterioration rates, but it is not clear that these conditions would be safe for animation cels painted with gum-based paints, because colder storage may be detrimental to the paints. Another challenge is assessing whether pollutant sorbents would be beneficial for removing off-gassed products. Would microchambers such as *passé-partout* mounts minimize or exacerbate the impact of fluctuating external environments? Additionally, the paints and plastic sheets may respond differently to the storage conditions, resulting in delaminating and flaking of the paints. Finally, research into flaking and delamination is sorely needed to aid in developing a proven method of reattaching paint while retaining the integrity of the work.

With little systematic investigation in this area, and a significant collection of American cultural history at risk, collaborative research was undertaken to begin examining the properties and dynamics of this medium. Disney’s large collection of cels, the diversity of production years (1930’s to 1980’s) and the various cellulose materials provided ample sampling material for this study. The collection includes cels stored in uncontrolled environments, as well as cels stored between 62–65 °F.

Characterization of the cels by multiple instrumental techniques to assess polymer composition, aging behavior and plasticizer distribution was a critical part of the initial phase of this research. Identification of polymer type using Fourier-transform infrared spectrometry (FTIR) was helpful for differentiating cellulose nitrate cels from those made from cellulose diacetate, cellulose triacetate and polyester, because visual classification of cels is not always accurate. Pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) revealed unique plasticizer mixtures in the diacetate and triacetate cels, and evidence of hydrolysis of the acetate polymer and phthalate plasticizers. Estimates of the degree of acetylation by portable FTIR, bench-top FTIR and GC/MS were compared in order to assess the accuracy of the measurements and the suitability of non-invasive FTIR. Finally, the volatiles trapped inside the *passé-partout* mounts were studied by GC/MS in order to determine the usefulness of this storage method.

Animation cels represent an important and unique cultural legacy of the 20th century. Undoubtedly, the key preservation issue is finding the optimal environment to decelerate the degradation of this material. Further research towards that end is planned, building upon this analytical investigation.

Managing Construction-Induced Vibration in the Museum Environment

Anna Serotta, Assistant Objects Conservator, Sherman Fairchild Center for Objects Conservation, Metropolitan Museum of Art, and adjunct professor, NYU Conservation Center; Andrew Smyth, Professor of Civil Engineering and Engineering Mechanics, Columbia University

This case study from the Metropolitan Museum of Art presents risk assessment methods and preventive conservation strategies for potential vibration-induced damage in museum settings. In the spring of 2012 the Museum began a large-scale renovation of galleries, offices and storage areas in The Costume Institute, which is located directly below the galleries of the Egyptian Art Department. Vibration from construction activities poses a serious risk to museum objects, and the fragile nature of objects in the Egyptian galleries makes this collection particularly vulnerable. In order to safeguard the collection, a project team including curatorial, collections management, and conservation staff, in collaboration with a group from the Department of Civil Engineering and Engineering Mechanics at Columbia University, worked together to assess the risk to the collection on an object by object basis and developed a range of preventive conservation strategies. This presentation will discuss the methods and procedures that were developed not only to protect the artworks but also to allow visitors continued access to as much of the collection as possible during the work period.

Prior to the renovation, tests were carried out to determine the amount of vibration that would be caused by the demolition of both structural and non-structural elements in the construction zone. Different tools and demolition methods were tested in various locations to assess which would create the least vibration; at the same time techniques for mitigating vibration were evaluated. The implementation of these mitigation solutions, which included isolation of objects and pedestals with Sorbothane® and other vibration-dampening materials, will be discussed. Testing also revealed that shelf design and pedestal shape and material contributed significantly to the degree of vibration amplification. Case studies will be presented that illustrate the response of particular installations to vibration and specific solutions devised for each scenario. For some objects, isolation was not possible; de-installation decisions and logistics will be presented.

During initial testing, a monitoring system to measure vibration levels and to automatically communicate this information to the project team was developed; this system, which used wireless communication, was implemented throughout the effected galleries prior to the start of demolition. Automated alerts were sent via email or SMS (text) message to the project team when defined vibration velocity thresholds were exceeded. The corresponding vibration event signals were recorded on a central server for reference and review. The vibration sensors were placed on gallery floors, directly on objects, or on shelves and pedestals and display case decks. The rationale for the general vibration thresholds used in the project, which were adjusted

depending upon the sensor location and context, will be discussed. The quantitative feedback provided by the vibration monitoring system was augmented with daily observation and regular hands-on assessment of vibration levels throughout the two-year project.

Although much information was gained through limited initial testing, the actual construction project often produced unexpected vibration and consequently mitigation solutions had to be adapted. Observations about the response of objects, installations and the building itself to various demolition and construction activities will be shared. The dynamic nature of the construction project required great flexibility, and constant dialogue between all members of the project team, the Construction Department, and contractors was essential to the overall success of this project.

JOINT SESSIONS: PAINTINGS + WOODEN ARTIFACTS

Lost for One Hundred Years: The Conservation of a Unique Polychrome Neoclassical Pulpit in Upstate New York

Alexander M. Carlisle, Supervising Conservator, Historic New England

The picturesque stone Fort Herkimer Church is the oldest church remaining in the “Leatherstocking” district of upstate New York. Although the church likely began its existence as part of the original defenses of Fort Kaouri (Fort Bear), assembled around the homestead of the Herkimer family during the French and Indian War, the current structure began as a single story stone building in 1767.

During the Revolutionary War, Fort Herkimer was rebuilt as a defensive stone and earthwork perimeter to protect the church. Later, in the years between 1812 and 1814, a second story was added to the church and the interior was refitted. At that time a new church pulpit was installed. The church is located on the south side of the Mohawk River/Erie Canal, and during the construction and later reconstruction of the canal, the surrounding defensive walls were dismantled and repurposed in the canal works.

By the 1960’s the church had reached a state of neglect and deterioration. However, a local funeral director named Donald Fenner recognized the historic value of the site and began a forty year long program of restoration beginning in the 1970’s. By 2006, largely through private funding, the church had been carefully stabilized and decayed architectural elements restored.

As one of the last tasks of this long project, the pulpit was being prepared for a new coat of white paint using disk sanders, when the painting crew began to uncover a complex polychrome decorative scheme. Excited by this discovery the crew continued working, uncovering much of the original paint layer before realizing that the process was not without collateral damage.

This presentation will discuss the challenges of removing the remaining white lead overpaint and identifying and restoring the original, and unique, polychrome surfaces.

Painted Totem Poles at the American Museum of Natural History: Treatment Challenges and Solutions

Samantha Alderson, Conservator in the Anthropology Division, American Museum of History; Judith Levinson, Director of Conservation, American Museum of Natural History; Gabrielle Tieu, Associate Conservator, American Museum of Natural History; Karl Knauer, Collections Conservator, George Washington’s Mount Vernon

Object conservators at the American Museum of Natural History (AMNH) conducted a project focusing on the treatment of a large collection of monumental wooden carvings from the Northwest Coast (NWC) from 2011–2013. Approximately 80 carvings, many of which are painted, were collected between the 1880s and 1920s and have been in open display in the museum for over a century.

Many of the carvings had significant condition issues resulting from a combination of factors, including deterioration due to original installation in the wet environment of the NWC, and long term open display at AMNH without climate control or protective barriers. Heavy dust accumulation resulting from high visitorship necessitates regular surface cleaning of fragile wood and painted surfaces. Previous undocumented interventions by museum staff prior to the establishment of a conservation laboratory had also contributed significantly to both structural and surface problems.

Because of its scope, this project posed a number of practical and logistical constraints requiring both creativity and adaptability to successfully address. Planning and execution were often complicated by staff and budget limitations and the large size and number of objects involved. Challenges encountered and solutions generated will be addressed, including addressing ethical issues appropriately with limited resources, development of efficient documentation and low-tech rigging and moving techniques, and investigation of complex structural and surface issues within the limitations of the project. Treatment procedures that adapted and streamlined standard wood treatment protocols for consolidation and fills were developed, as were controllable cleaning systems for the fragile and complex painted surfaces.

Modern Materials and Practice in Gilding Conservation

Hubert Baija, Senior Conservator of Frames and Gilding, Rijksmuseum Amsterdam

This paper wants to share with colleagues how the guiding principle of reversibility has been translated into the practice of frame and gilding conservation during the past quarter century at the Rijksmuseum in Amsterdam. With a plethora of synthetic materials available it is often hard to see the forest for the trees. It sometimes leads to overly complicated approaches, or to clinging to just that one favorite material even though the case at hand may not call for just that.

In a field where art history and material sciences overlap, different opinions about treatment approaches and end results are inherent. This is not a problem but a pleasure to participate in. The presented case studies will touch upon the technical aspects of restorations as well as frequent communications with other conservators and with curators. Collaboration with colleagues has traditionally taken place within a rather large forum of conservators and curators, especially within the paintings department at the Rijksmuseum.

The presentation intends to shed light also on reasoning and common sense that have led to the choice of contemporary media for gilding restoration like for example aquazol, plectol and acrylics in combination with traditional materials such as rabbit skin glue, shellac, dextrin or gum Arabic. Economy of means is important, not just in terms of the cost of labor and materials, but also as a process with its own beauty and appeal. Usually there

is more than one approach possible to approach a conservation project. Individual preferences and talents of the conservator are also valid factors in deciding on a treatment approach. For example, in restoring or part of a sculpture, or ornamentation, one colleague prefers to restore by carving a missing piece out of wood while another is more expedient at modeling it out of papier mâché. The end result of both approaches can be equally effective and convincing if done with skill and finesse.

Case studies include the conservation and restoration of picture frames and a gold ground panel painting by Lorenzo Monaco (*Stigmata of the Holy St. Francis of Assisi*; ca.1420). Some frames are still original to their paintings. The discussed frames are connected to works by the following painters: Cornelis Kruseman (*Piety*; frame & painting 1823), Georgius Johannes Jacobus van Os (two large pendant still lives; frames & paintings 1817 and 1818), Pierre Prud'hon (*Portrait of Jan Schimmelpenninck and His Family*; frame & painting 1801-1802), Ludolf Bakhuysen (frames 1661), Cornelis Engebrectsz (*Christ in the House of Mary and Martha*; frame & painting 1515-1520), Master of the *Conversazione di Santo Spirito* (*Madonna and Child*; frame last quarter 15th C.).

With special thanks to Camille Marchand from The Netherlands, David Beaudin from North Carolina, Lea Wegwitz from France and Satu Rantala from Finland, who contributed to the work in several of the case studies to be presented.

An Historical Overview of Panel Paintings and Their Structural Treatments at the Walters Art Museum

Karen French, Senior Conservator of Paintings, Walters Art Museum

Almost a quarter of the Walters Art Museum's approximately 2500 paintings are on wooden panel supports. These range from the early 12th up to the 19th Century and come from Northern and Southern Europe, Ethiopia and Thailand. A number of the panels are in a fairly pristine state but most have received a variety of structural treatments by many different hands over the years. Some had undergone major work in Europe prior to entering the collection, while others received treatments at the Walters both before and after the introduction of climate control to the buildings; including the infamous "wax tank" treatments. Damage to the substrate caused by these treatments, sometimes in combination with inherent vice and climate issues, often had a harmful effect on the paint layer resulting in paint loss. Several of these treatments have resulted in increasingly challenging problems for the conservator as we look for practical solutions to structural problems with panel paintings.

Surveying the Walters panel collection allows for an historical overview of structural treatments to panel paintings, both in Europe and North America, and illustrates the evolution of more conservative methods of treatment concomitant with the development of better climate control and a new philosophy that recognizes the importance of the wooden support to the artwork as a whole.

Long-Term Hygromechanical Monitoring of Panel Paintings

Paolo Dionisi Vici, Associate Research Scientist, Metropolitan Museum of Art

In the debate about safe climate ranges, the majority of scientific literature concerning the reactivity of wooden objects which supports the new proposed guidelines has been carried out in laboratory conditions, assuming that the characteristics of the sample can be safely extrapolated to real size objects. Some field measurement campaigns have been carried out in an attempt to detect the most irreversible damage element, the crack, although there is probably more to investigate regarding the long term warping of real objects under fluctuations. This paper will focus on the latter aspect.

Case studies monitoring long-term warping of panel paintings have been conducted for many years. The mechanical monitoring has been combined with microclimatic logging, in order to provide quantitative information directly related to the environmental conditions; these data are useful to validate mathematical models that eventually may predict the long-term behaviour of objects.

The climate fluctuations can have both temporary and permanent effects on hygroscopic objects and they are a potential cause of damage.

Although there is long-term evidence of the generally positive effects of a microclimate within the standard range of allowable fluctuations, we lack wide experimental data regarding the effects of broader ranges on real objects over a long period of time.

Panel paintings are useful in representing the complexity of possible reactions.

Due to the specificity of each artwork, both from its structural point of view and from its previous microclimatic history (for the most part totally unknown), the analysis of an artifact's response to short- and long-term variations can supply useful information about its "individual" sensitivity to the exhibition microclimate, suggesting the adoption of more or less rigid parameters.

The benefits of such an approach are many, both from the preventive conservation point of view and as a support for conservation interventions. The methodology can be useful in monitoring objects in transit and to evaluate the effects of structural interventions.

Due to the size of the instruments employed, the methodology is minimally invasive. Since it is placed on the back of the support, the device can also be used while the object remains on exhibition without disturbing visitors and, thanks to recent improvements, it can be easily detached and exactly repositioned without affecting the quality of measurement.

From the scientific point of view, widening the data-base of monitoring experiences would benefit the understanding of this sensitive issue in the conservation of panel paintings.

Recent Developments in the Evolution of Spring-Loaded Secondary Supports for Previously Thinned Panel Paintings

George Bisacca, *Conservator, The Metropolitan Museum of Art*; M. Alan Miller, *Assistant Conservator, The Metropolitan Museum of Art*

Warped panel paintings were commonly treated in the 19th and early 20th Centuries by thinning the panel to increase flexibility and to obtain a flat surface on which to attach a cradle. As is well known, the sliding cross-members frequently became blocked and accumulated stresses eventually caused cracking, splitting, and other deformations of the panel. Subsequent treatments often require removal of the cradle in order to repair the splits and adjust the surface curvature. After treatment, the panels are often too fragile on their own without additional secondary support to increase stability. The need for increased stability while still allowing for expansion, contraction, and cross-grain flexing of the panel during humidity fluctuations eventually led to the use of springs.

Springs were first used in the design of secondary supports for panel paintings in Italy in the mid 1970's. Research began at the Istituto Centrale del Restauro in Rome and later continued at the Opificio delle Pietre Dure in Florence.

In recent years, new designs for controlling movement in wood panels have been developed at The Metropolitan Museum of Art. This paper will review the most recent designs of the spring mechanisms themselves as well as refinements to certain characteristics of the support strainers.

Panel Painting or Furniture? Ethical and Philosophical Conundrums in the Treatment of a Wooden Chest Lid from Germany

Kari Rayner, *Graduate Student in Paintings Conservation, Conservation Center of the Institute of Fine Arts, New York University*

The collection of the Wallraf-Richartz-Museum in Cologne, Germany includes a late medieval panel painting depicting *Scenes from the Life of Jesus Christ: The Two Banquets*. Originating from Cologne and dated around 1450, the panel once formed the cover of a wooden chest, and its two sides are today extraordinarily different in appearance, function, and condition. The recto, which would have been on the inside of the chest and only visible upon opening the lid, resembles an altarpiece depicting highly detailed figurative scenes from the life of Christ; the verso, or outside of the chest, is painted more modestly and consists simply of a monochromatic red paint layer with decorative gilding.

Owing to its exterior position and functional nature, the decorative verso has sustained a greater amount of wear and shows significant signs of use. Moreover, when the lid was separated from the body of the chest, the hinges were removed from the verso, the panel was framed as a painting, and the recto

with the figurative scenes was treated as the primary work of art: this side has been carefully preserved and retouched. Meanwhile, the verso was subjected to sub-par treatments, poor-quality conservation materials, and neglect.

For the double-sided display of the panel in the context of its original function in the exhibition “The Painters’ Secrets: Cologne in the Middle Ages” taking place from September 20 2013 – February 9, 2014, the verso required treatment during the summer of 2013. The extreme discrepancy in condition between the two sides necessitated the methodical development of a restoration concept prior to treatment.

The major questions throughout the treatment centered on the level of intervention appropriate in order to reflect the functional nature of the object, while bringing the verso to a condition more akin to that of the recto and to a state of preservation more consistent with the other works within the exhibition. Treatment decisions were required that reflect the work’s original function as well as its recent history as a painting, while acknowledging the physical changes it has experienced over time. Specific challenges included developing a philosophy of retouching exposed ground, exposed raw canvas, large areas of loss, and loss to the gilded pattern.

This paper will treat the historic use and context of the object and provide information regarding its materials and construction. More importantly, it will develop an overview of the ethical and practical considerations of the restoration of this object, as well as present a summary of several similar case studies. The treatment philosophy is proposed as a potential model for complex objects with similar challenges.

Window of Opportunity: The Restoration Project of the Ghent Altarpiece

Bart Devolder, *Painting Conservator, Royal Institute for Cultural Heritage (KIK-IRPA)*

The Ghent Altarpiece by Jan and Hubert van Eyck (1432) is one of the most iconic works of Western Art as it embodies the birth of new skills and vision. It is still housed in Saint Bavo Cathedral (Ghent), the site for which it was created. Here it is seen by thousands of visitors a year. In October 2012, a five-year 1.2 million Euro restoration project by a team of conservators from the Royal Institute for Cultural Heritage (KIK-IRPA) began for this work.

A painting with this level of cultural importance could not be taken off view for an extended period of time. The decision was therefore made to conduct the three-phase treatment in a gallery in the Museum of Fine Arts Ghent behind a large glass window so the public could follow every step. This approach created the need to inform the visitors who are not accustomed to witnessing conservators at work. The window maintains a barrier but with its transparency, it creates new opportunities for engagement. How can the demystification of conservation work influence the perceived value of painting conservation and

collection care? In what new ways can information exchange happen in this specific situation? Are there chances for misunderstanding or negative misinterpretation on the part of the museum visitor?

This paper will address the early experiences of conservators who, by working in the public eye, take on unforeseen responsibilities and challenges. These conservators must find the equilibrium between assisting with public outreach and conducting the treatment; all this while maintaining constant dialogue with the different partners and safeguarding a strict deadline for the project.

The author will explore these experiences in this very specific and complex project in the hope they can be useful and instructive for similar undertakings in the future.

The Analysis and Reduction of an Intractable Coating for the Panel Painting by Lluís Borrassà, *Christ Before Pilate*

William P. Brown, Chief Conservator, North Carolina Museum of Art; Dr. Adele De Cruz, Adjunct Associate Professor of Chemistry, Duke University

The deterioration of an early 15th century panel painting (originally from an altarpiece since dismembered) attributed to the Spanish artist Lluís Borrassà, has been studied to devise a method to remove intractable restoration materials from the painting, particularly on the blue robes of the Christ figure, which appeared black.

Many panel paintings from the 14th to 16th centuries have come down to the present day with the original colors altered by previous restoration. This is especially true in the blue robes of Christ or the saints in which lapis lazuli or azurite blues are the primary pigment. Historically, the blue pigments are loosely bound and easily abraded when subjected to traditional solvent cleaning methods typically used for the removal of soot, wax, and natural resin varnishes. Often compounding the problem is the consolidation of the paint layer with animal glues and later with drying oils, which have often cross-linked and darkened, in some cases to almost black. This is further complicated by the addition of restoration paint and glazes to cover losses and abrasion.

This is the case with the Borrassà, where the blue robe of Christ looked essentially black. A half century ago in an unsuccessful attempt to correct the problem and conceal additional damages to the painting, a restorer applied a pigmented varnish of a dark amber color. The toned varnish imparted an overall uniform tone to the painting and cosmetically obscured the existing damages. In the current treatment, solvent methods were effective in removing the toned varnish from the painting, but not the composite layer of old consolidant, cross-linked drying oil, and restoration from the blue robes and other blue passages in the composition.

After extensive analytic studies the intractable restoration

layer was identified by conservation scientists from the University of Pisa in conjunction with Duke University using GC/MS, FTIR, Scanning Electron Microscope and Microanalysis. The materials in the composite layer were identified as a combination of cross-linked drying oil and animal glues combined with natural resin varnish tinted with pigment. Testing was carried out successfully with the Er:YAG laser and the encrustation was removed or substantially reduced leaving intact the original lapis pigments.

This presentation will consider the analytic findings and demonstrate the Er:YAG laser methods for removing intractable materials without causing damage to the original surface. The Er:YAG laser operates at 2.94 microwatts, using pulsed laser energy to vaporize debris. The laser energy is confined to a surface depth of no more than a few microns, providing a natural barrier to energy penetration into underlying layers.

(01) Review of Shipping Containers as Storage Options for Cultural Properties and Suggested Low-Cost Solutions for their Improvement, Phase I

Geneva J. Griswold and Ayesha Fuentes, third year students, UCLA/ Getty Program on the Conservation of Archaeological and Ethnographic Objects

Metal shipping containers are often used for short and long-term storage of cultural materials and archives in post-disaster remediation, as well as in areas with limited permanent storage solutions. While shipping containers are widely available and inexpensive, their lack of climate control may catalyze deterioration unless modified. This study seeks to develop guidelines for the preparation, installation, and maintenance of metal shipping containers to be used as storage facilities. These guidelines are based on the extended monitoring of several such containers *in situ*, literature review, consultation, and the results of a survey of cultural heritage professionals with experience using these containers in a variety of storage contexts. Proposals for future container prototyping - to be developed based on the results of this initial research - prioritize the development of an efficient, low-cost, low-tech protocol for optimizing the performance of shipping containers as storage facilities.

Case studies and anecdotal evidence cite the use of unsealed and non-insulated shipping containers as post-disaster storage solutions; however, the containers have been noted to cause more damage than was previously present, due to moisture infiltration, temperature fluctuation, pest infestation, or lack of security. A literature review of previous research reveals a significant lack of published data on this topic. As such, this project particularly seeks to build upon Ted Ling's shipping container trial for records storage (2002), by identifying materials and methods for use in storing other collection types in diverse climate zones.

During this study's first phase, the stability of shipping containers' interior conditions were assessed by monitoring temperature and relative humidity over time in two differing climatic locations: Venice, CA and Bremerton, WA. The results of this monitoring regime will be presented in relation to weather and climatic conditions from these areas, and interpreted for insight on the relative stability of these spaces. Additionally, this data set will serve as the control against which the insulating capacity of materials will be assessed. This paper will also present the results of a survey conducted to evaluate conservators' and allied professionals' experiences with the use of shipping containers, perspectives on the containers' shortcomings and strengths, as well as their priorities for improvement. In coupling the survey results and consultation with conservation resources such as Timothy Padfield's *Humidity buffering of building interiors by absorbent materials* (2011), we seek to identify common, inexpensive materials most effective in stabilizing the interior environment, both for short or long-term use.

The project's next phase seeks to realize an inexpensive and technologically accessible option for communities to better maintain their cultural materials and to provide a risk assessment-based guideline for creating storage solutions that is legible to both conservators and non-specialists alike. Future research will

include materials testing and further experiments, including the use of buffering materials (e.g. cardboard, Styrofoam) as insulating layers, solutions for increased ventilation, exterior structures or tarpaulins, painted exteriors, and other modifications. We intend to present this research to the AIC community during its first phase in order to solicit feedback and suggestions so as to guide further study.

(02) RTI in Paper Conservation: A Review of Current Practices and Applications

Angela Campbell, Assistant Conservator, and Lisa Conte, Assistant Paper Conservator, at the Sherman Fairchild Center for Works on Paper and Photograph Conservation, The Metropolitan Museum of Art

The careful study of the surface topography of a work of art on paper is a critical component to understanding and protecting the object as a whole. Routinely, conservators have relied on multiple raking light images to glean detailed visual information about the surface of both the support and the medium/media on its surface. But with the development, in 2001, of Reflectance Transformation Imaging (RTI) by Cultural Heritage Imaging (CHI), a non-profit organization based in San Francisco, paper conservators have been better able to digitally capture and analyze the subtle three-dimensionality of paper-based objects. RTI involves capturing 30-50 images of an object, all with the same light source (for example, a remote flash) positioned at a different angle for each individual image. Using the software built by CHI, the series of images are then compiled and enhanced to generate a detailed three-dimensional recording of the object, which can provide visual data about the object which is not apparent under normal light or by a single angle of raking light.

Despite the significant potential of this technology for the documentation and analysis of paper-based objects, it has not been uniformly embraced and implemented by paper conservation labs. This poster presents an overview of the technique's usefulness and will address what types of documentation projects it best supports. Focusing on objects in the Metropolitan Museum of Art's collection that were documented using RTI technology, we will highlight specific instances where RTI has proven beneficial. The documented works in the Metropolitan Museum's collection were selected for their diverse topographies and include an 18th-century French blackwork print, a 19th-century Surimono woodcut print, and a 20th-century American screenprint as well as several objects with painted surfaces. With this research, we hope to provide conservators a broad understanding of how this technology can influence conservation practices and be of use to our field.

(03) The Role of Temperature on the Loss of Physical and Optical Properties of Newsprint: An Assessment of Deacidification and Subzero Freezer Storage for the Long-Term Preservation of Newspapers in their Original Form

Henry Wilhelm, co-founder and director of research at Wilhelm Imaging Research, Inc.; John Baty, Assistant Research Professor and Heritage Science for Conservation Scientist, Johns Hopkins University; and Andrew Han, Materials Science and Engineering Student, Johns Hopkins University

Many cultural heritage papers are composed of groundwood and other high yield pulps, and it is important to develop a better understanding of their permanence properties and the treatments and storage conditions necessary for their preservation. A Canadian study undertaken between 1994 and 1997 largely disproved the hypothesis that lignin, on its own, promotes the mechanical degradation of paper, and accordingly in 2000 a National Standard of Canada for permanent paper was approved, specifying no upper limit on lignin content when optical properties are not an issue. When optical properties are important, the standard specifies a maximum of 1% lignin, in accord with the ANSI/NISO Z39.48 standard, because the supporting research had affirmed the hypothesis that lignin content promotes discoloration during aging, even in the absence of light. However, significant questions remain on the role of lignin in paper aging, including the compatibility of lignin-containing papers with deacidification treatments.

Rather than consider the preservation of papers composed of high-yield pulps as a whole, the present study was designed to contribute to our broader understanding by focusing on newsprint, and the options available to preserve newspapers in their original form. This involves a study of the loss of physical and optical properties as a function of temperature, and the benefits afforded by deacidification.

Representative samples of newsprint were taken from issues of *The New York Times* in the Wilhelm Imaging Research/Smithsonian newspaper preservation collection and subjected to accelerated multi-temperature Arrhenius tests outlined in "ISO 18936:2012, Imaging Materials – Processed Colour Photographs – Methods for Measuring Thermal Stability." Arrhenius tests enable the extrapolation of changes in optical and physical properties over a wide range of temperatures (e.g., ambient room temperature, refrigerated temperatures, and subzero freezer temperatures). Because newspapers contain both text and monochrome and color images, it is appropriate to evaluate them using an imaging standard. Moreover, since ISO 18936 calls for 50% RH, it is in generally in accord with the TAPPI T 544 humid aging standard, with the exception that multiple temperatures are used. Additionally, these tests can be performed side-by-side with the ASTM D6819-02 sealed vessel standard, but again employing several temperatures. Yellowing and other discoloration of the papers at each temperature was measured in the near-UV and visible spectrum, and physical deterioration and weakening of the papers was evaluated using "TAPPI Test Method T 511 om-08, Folding Endurance of Paper (MIT Tester)" and "TAPPI

Test Method T 414 om-98, Internal Tearing Resistance of Paper (Elmendorf-Type Method)." In addition, molecular weight analysis using gel permeation chromatography was conducted.

Samples of deacidified newsprint were also included in the study, both to evaluate the efficacy of such treatments with newspapers stored at ambient room temperatures and to compare the cost-benefits of non-aqueous deacidification vs. cold storage.

With the advent of the Internet and the widespread adoption of computers and mobile smartphones and tablets, the worldwide distribution of news has rapidly shifted away from the traditional newspaper. The newspaper industry is in a state of precipitous decline, the more than 500-year history of this decisively important form of communication is coming to an end, and the physical artifact that we know as an unbound, folded paper newspaper printed on inherently low-stability newsprint is vanishing. It is therefore important that representative selections of newspapers in every country in the world be preserved in their original form.

This research is a joint effort of Wilhelm Imaging Research, Inc. and the Center for the Image in Grinnell, Iowa; and Heritage Science for Conservation, the Department of Conservation and Preservation – the Sheridan Libraries and University Museums, Johns Hopkins University, Baltimore, Maryland.

(04) From Pen to Press to Paper— McCutcheon's Political Cartoons and How They Were Printed

Allison Holcomb, Conservation Fellow, Northwestern University Library

The drawings of John T. McCutcheon, a Chicago area cartoonist, were translated from pen and ink to print using the commercial technology developed over the course of the 19th century. McCutcheon's cartoons, drawn between 1889 and 1949, were published and republished in a range of newspapers, books, and periodicals through a variety of different methods. His work as a graphic artist serves to highlight the overlooked art of reproducing illustrations for relief printing in the wake of wood engraving.

Northwestern University Library is home to more than 400 of McCutcheon's original drawings. Examination of them during a survey and rehousing project allowed close documentation of the materials and the way in which they were used. With these works as a starting point it is possible to trace the steps from drawing, to the production of a photographic relief plate and duplication. Marks of the processes used are evident in the construction and deterioration of the drawings themselves and the characteristics of the final prints.

Most of the drawings were for publication in newspapers which were printed cheaply and quickly. They would have been executed first as photographic relief etchings. These swift, undetailed drawings make use of dense, black, matte ink on dimensionally stable illustration board adhering to the precepts of contemporary instruction manuals. The bold nature of a drawing with little reliance on detail lent itself to the multiplication of plates by the stereotype process which often created imperfect replicas or obliterated finer elements.

Some drawings are marked with exes through blank spaces and instructions to use pre-made dot patterns to fill areas of the

drawings in the final illustration. The evidence shows a disregard for the original drawing as art object and a clear trend towards the functionality of the materials and the way in which they were used. Other drawings by McCutcheon were executed with more care on textured paper with dry media, creating the illusion of gradations in tone without the use of halftone screens.

This poster will illustrate the technology behind the printing methods used, highlighting the evidence in both McCutcheon's original drawings and the final prints.

(05) Preserving Decorative Metalwork at the Legislative Assembly of Ontario

Fiona Graham, MAC, CAPC, CAHP, Goldsmith Borgal & Company Ltd. Architects

The Legislative Assembly of Ontario is the seat of government for the province of Ontario, Canada. The 1893 Richardsonian Romanesque building occupies a symbolic and central position in downtown Toronto. At 450,000 square feet and five stories, it is brimming with fine finishes including murals, wood veneer, marble, stained glass, brass, bronze and painted iron. Decorative metalwork includes interior and exterior railings, light fixtures and staircases. As with all pre-modern public buildings, these elements were originally maintained by an army of cleaners. A janitorial crew of four currently handles the work.

This particular project began as a typical contract to a heritage architect to investigate the heritage value of the decorative metalwork, to assess the condition of the metalwork, and to make recommendations for any repair or restoration work. In this instance, the architectural firm charged its in-house architectural historian and conservator with the task. Several large-scale conservation treatment projects were identified but most condition issues were minor and deemed to be the result of inappropriate maintenance practices. The primary recommendation for preserving the decorative metalwork was for a conservator to develop a maintenance manual and to train the janitorial staff in how to best clean the various types of metalwork.

In keeping with the author's philosophy on preventive conservation, preserving the majority of the metalwork was not a matter of doing something extra, but rather a different way of doing what was already being done. Using the right products in the right way, and only when necessary, would save time and energy as well as improving preservation of the original material. It would, in short, be sustainable. What might not be sustainable or ethical would be to continue the practice of waiting until the condition had worsened to an unacceptable state and then placing the heritage element on a list of conservation projects to be contracted out when the necessarily substantial monies became available. The Legislative Assembly appreciated the desirability of preservation through proper maintenance. Nevertheless, putting this approach into practice could prove difficult in a large organization where heritage preservation is carried out by contractors on a project-by-project basis, and is administratively entirely separate from the functional work of housekeeping. The key could well be the personal pride the cleaners take in their work.

Two years have passed since the cleaners received training

and detailed instructions on how and when to clean different metal elements. The conservator is now evaluating the results of these efforts, hoping to show that this simple preservation plan is indeed sustainable.

(06) The Development of an Aqueous Gel Testing Procedure for the Removal of Inorganic Salt Crusts

Annelies van Loon, Laura Eva Hartman, Andrew Mellon Paintings Conservation Fellow, Metropolitan Museum of Art, Julia van den Burg, Carol Pottasch, Ralph Haswell

With the closing of the Royal Picture Gallery Mauritshuis for expansion and renovation, the opportunity was taken to study and treat the decorative ceiling and chimney paintings by Antonio Giovanni Pellegrini (1675-1741) located in the *Golden Room* of the Mauritshuis. During treatment of the Pellegrini paintings a visually disturbing, grey surface haze was noticed beneath the varnish, which became more pronounced and disfiguring after the varnish was removed; appearing as if the paintings were covered with a grey/brown veil. In order to determine the nature of the haze, SEM-EDX, FTIR, and DT-MS analyses were carried out in collaboration with the laboratories of Shell Nederland. Results indicated that a complex inorganic salt crust layer had formed on the surface of the paintings, most likely a result of past environmental conditions when the paintings were still in an unvarnished state, and when the galleries were heated by coal stoves. Based on analysis, the major elements of the crust layer on the ceiling paintings are likely present in the form of lead (II) sulfate and potassium sulfate (or a mixed salt), with the addition of calcium oxalate.

As this layer significantly altered the artists' original intent – Pellegrini is known for his use of bright pastel colors that were now completely disguised by the grey veil – its removal was greatly desirable. This paper explores testing of aqueous gels in order to determine a safe cleaning procedure for the removal of the inorganic salt crusts on the surfaces of the Pellegrini paintings. It specifically addresses the methodology of testing, which involved the use of test panels as well as both empirical testing and chemical analysis to evaluate the efficiency of the cleaning gels and their effect on the original paint surface. It also addresses how this research enabled us to come to a better understanding of the salt crust and the underlying original paint, and ultimately make better-informed treatment decisions during the conservation treatment of the Pellegrini paintings.

(07) Adhesive Smackdown: Consolidating a Synthetic Leather Wrestling Costume

Alison Castaneda, Conservator, Textile Conservation Workshop

Of all the materials left for the conservator by the modern age, synthetic leather is perhaps the most multifaceted. It can be found in high-end designer wear, beanbag chairs, chemical labs and thrift stores. Equally thought of as humane, tacky, advanced and passé, the only thing certain about it is that it has evolved greatly since its inception. Despite advances in technology, however, its innate vices

guarantee it will make regular appearances in conservation labs.

Polyurethane (PUR) is one of the most commonly used materials for modern synthetic leather, and is inherently flawed. Oxygen, light, and moisture all contribute to its decay within decades of production. Between 2002 and 2006 the Netherlands Institute for Cultural Heritage conducted the PUR Research Project, studying the manufacture, use, degradation and conservation of polyurethane foam. This study is the basis of Thea van Oosten's book, *PUR Facts: Conservation of Polyurethane Foam in Art and Design*. Although the study concentrated on its use in sculpture, variations on the tested treatments could be applied to the textile field because of the foam-like physical structure of polyurethane synthetic leathers.

The centerpiece of this poster will be a garment sent by World Wrestling Entertainment (WWE) to the Textile Conservation Workshop. It served as ring entrance gear for now Hall of Famer, Shawn Michaels. It is a highly theatrical garment, replete with mirrors, chains and crosses. The synthetic leather was powdering and flaking badly with very limited amounts of the polyurethane "skin layer" remaining on the nylon knit substrate. When considering which adhesives could be used to consolidate the garment, the following parameters were used: the adhesive had to be strong enough to withstand minimal handling while retaining the original flexibility and sheen of the textile. It had to be able to nebulize well, as the ultrasonic nebulizer was deemed the best delivery method to fully penetrate the flakes without moving them around. Lastly, it was preferable that it be soluble in either water or minimally toxic solvents. Considering these factors, as well as which adhesives had been found successful in the PUR sculpture treatments outlined in *PUR Facts*, the following five adhesives were selected for trial: Ethulose, Gelatin, B72, Plextol B500 and Impranil DLV. Mock-ups were created in order to test these adhesives for suitability. Detached flakes taken from the bottom of the transport box were placed on samples of newly purchased nylon knits and adhered with different concentrations of the five selected adhesives. Only B72 and Impranil DLV adhered the heavy flakes to an acceptable degree and of the two, Impranil DLV left the nylon substrate more flexible. These results, combined with the excellent recommendations it received in *PUR Facts*, led to Impranil DLV being used to consolidate the wrestling costume. After consolidation, the PUR synthetic leather skin layer was successfully re-adhered to the nylon substrate with minimal to no change in sheen or flexibility. Although the costume cannot be displayed on a mannequin, a customized storage box allows it to be safely viewed and studied.

(08) Study and Treatment of Coastal Alaskan Native Kayak Models at the Peabody Museum of Archaeology and Ethnology, Harvard University

Judy Jungels, Assistant Conservator, the Peabody Museum of Archaeology and Ethnology, Harvard University

The Harvard Peabody Museum, Cambridge, Massachusetts, and the Alutiiq Museum and Archaeological Repository, Kodiak, Alaska, recently collaborated to study and conserve several

nineteenth-century full-sized skin-covered kayaks and over one hundred associated Alaska Native ethnographic objects. This two-year project was partially funded through a grant from the Save America's Treasures Program and included a public-interactive conservation workspace located in one of the museum's galleries. The project allowed the rare opportunity to fully study objects from the Alaska Native collections in the Peabody Museum and to consult with Alutiiq colleagues to build knowledge of Alaska Native technologies. Material analysis using X-ray fluorescence (XRF), matrix assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-ToF-MS) and polarized light microscopy enabled better understanding of the technology of these objects. As part of this project, the museum's collection of twenty small skin-covered kayak models from various Alaska Native groups were studied and conserved. Historical and technical information on the kayak models was gathered through research into the museum's archives, discussion with Alaska Native consultants, a review of current literature, and material analysis. This poster discusses the collection and donor history, cultural affiliation, materials and technology, and preservation of these kayak models.

(09) Evaluating and Choosing Sheer Overlays

Camille Myers Breeze, Director and Chief Conservator, Museum Textile Services

Textile conservators have employed sheer overlays for stabilization and preventative conservation since the early days of our field. An overlay is a sheer material placed on the object's surface with the goal of protecting the object and/or changing the object's appearance. The benefit of a sheer overlay is that it can provide immediate stabilization, as well as preventative protection, and is easily reversible, except when applied using an adhesive. As such, it is one of the first treatment tasks that interns at Museum Textile Services learn. In an effort to create a standard protocol for evaluating and selecting sheer overlays, I created a Sheer Overlay Score Card based on the three main categories of sheer fabrics listed in Chapter VI of the Textiles section of the AIC Collaborative Knowledge Base (AIC Wiki): nylon net, silk crepe-line, and polyester sheers (e.g. Stabiltex®). The Sheer Overlay Score Card allows our staff to weigh the relative pros and cons of each sheer material based on sets of variable and non-variable factors. Its functionality was tested at the Campbell Center for Historic Preservation Studies, where I teach a class called "Textile Stabilization Using Sheer Overlays," and was found to be useful for students at all levels. With increased understanding and competency in choosing and using sheer overlays, conservation technicians and collections-care specialists are able to achieve an advanced knowledge of this skill. This interactive poster will allow viewers to touch samples of many sheer overlay materials, vote for the material they most often use, tell us where they find these sometimes-evasive materials, and take away a copy of the Sheer Overlay Score Card.

(10) Verdigris Pigment Properties and Degradation Studies: Part I

Lynn B. Brostoff, Senior Scientist and the Analytical Services Liaison, Preservation Research & Testing Division, the Library of Congress; Cynthia Connelly Ryan, and Alessandra Gambardella

Until about the 19th century, the synthetic green pigment called verdigris offered artists an important alternative to the use of malachite, a natural copper mineral, or the use of mixtures of blues and yellows. Verdigris could be made from a plethora of recipes that date as far back as antiquity and basically consist of the corrosion of copper metal with acetic acid derived from vinegar, wine, or other fermented substances. True verdigris is thus a copper(II) acetate salt, although different recipes result in a range of compounds that may be categorized as either basic or neutral copper acetates, along with contaminant salts such as basic copper chlorides [Scott, Taniguchi, Koset, *Reviews in Conservation* (2001)]. Experiments with verdigris synthesis and paint media mixtures by numerous authors and professionals have shown that verdigris pigment has a range of associated colors, from bright teal-blue to dark green [Kuhn, *Artists' Pigments* Vol. 2, 1993]. Differences in water of hydration in copper acetate salt(s) is likely to play an important role in these color variations, although this has not been established. While the fresh pigment is crystalline and fairly straightforward to characterize by X-ray diffraction (XRD), Raman spectroscopy, and thermal analysis [Scott et al. 2001; de la Roja, Baonza, San Andres, *Spectrochimica Acta Part A*, 2007, Musumeci, Frost, *Spectrochimica Acta Part A*, 2007], it tends to lose crystallinity and otherwise react upon exposure to different environments. For example, it is often remarked that a color change from blue to green occurs in air in the first month after manufacture. Verdigris can also alter to a muddy green-brown over time. Exposure to high heat, including from artificial aging conditions or a 785 nm laser, can cause decomposition of verdigris to black CuO or other compounds, which can complicate studies using these conditions. The causes of these color changes have not been systematically studied nor defined in terms of natural aging mechanisms in media other than oil.

Regardless of its make-up, after several centuries *in situ* on a work of art, aged verdigris is often difficult to analyze due to loss of crystallinity and, as been hypothesized, possible reaction with the binding medium [Banik et al., *Mikrochimica Acta I* 1981, Scott et al., *Studies in Conservation*, 2001]. As a result, identification of verdigris is often based solely on the presence of copper and lack of detection of other pigments, as well as the commonly evidenced copper-induced paper degradation in book illustrations and maps. Verdigris was also often mixed with yellow pigments, which further complicates its identification.

This paper presents initial results of a Library of Congress study that seeks to define chemical properties and transformations of verdigris pigment as they occur in environments pertinent to their occurrence on paper-based artifacts. In particular, the study aims to clarify stages of chemical alteration in verdigris pigment in different environments, including exposure to light, heat, humidity, pH, and gum arabic and proteinaceous media or coatings, before the compounds become amorphous and discolored. This paper will present analytical results obtained from both experimental and historical samples of verdigris by XRD, Raman, and UV-Vis analysis.

(11) Transformation of Personal Grooming Tools into Paper Perforating Pens

Grace Owen-Weiss, Associate Conservator for Book and Paper, The New York Public Library, Barbara Goldsmith Preservation Division

Conservators commonly use needles and scalpels to cut intricate shapes from paper for filling losses in paper artifacts. This method is slow and often stressful on the hands. The Crayola Cutter, sold as a toy for children, uses a wand fitted with a retractable needle to perforate paper, so that it can be pulled apart without the use of scissors. Some conservators have adopted it for cutting fills. The concept of the cutter is ingenious. In practice, however, its lack of power and awkward design prevent it from being considered a serious tool. The quest began to find a hand-held power tool that produces similar results without any of the issues. A design for a device seen on the Internet, made by prison inmates, came surprisingly close. It is a home-made tattoo gun, created by fitting a sewing needle to the shaft of a battery-powered spin toothbrush. The spin toothbrush actually operates in a linear motion, in that when a needle is attached to the shaft, it can punch a series of holes in paper, as the Crayola Cutter does. In fact, toothbrush tattoo guns are available for purchase over the Internet. They are fitted with a professional grade tattoo needle and are marketed to breeders for tattooing identification numbers inside the ears of show animals. Unfortunately, both toothbrush devices proved too bulky to hold comfortably in the hand and manipulate. Modifying a smaller, more ergonomically designed appliance became the next logical step. Personal grooming tools such as nose, ear, and facial hair trimmers were selected because they are small, powerful and many operate in a linear motion. The grooming tools of choice, each powered by an AA or AAA battery, can be modified using parts from a mechanical pencil, and a sewing needle. Two versions, the larger for heavier weight papers, have been designed and built. The paper perforating tool, with a cloth-covered Neoprene pad (mouse pad) used as a cutting base, handles like a pen. It can be used effortlessly to draw a series of small holes in a fluid motion. The perforated line is then pulled apart to create a feathered edge. The beauty of these tools is that they can be used on a variety of paper thicknesses. The poster will provide illustrated instructions on how to make two perforating pens from two models of trimmers presently on the market, and offers suggestions on how to use them in conservation treatments.

(12) Recent ASHRAE Standards and Research on Gaseous Phase Air Filtration with Applications for Conservation Environments

William Lull, President, Garrison/Lull Inc.

In the past few years, ASHRAE has promulgated standards and completed research that concerns gaseous contamination and control, with direct bearing on how heating, ventilation and air-conditioning (HVAC) systems can help meet the goals for conservation environments. This paper reviews these published standards and research for how they are of value in creating better control over gaseous contaminants to protect collections.

ASHRAE Standards 145.1 and 145.2 provide a standard method for testing gas-phase filtration on most target gases for improved collections environments. Standard 145.1 is a method of testing granular media, while 145.2 tests whole filtration assemblies. Unfortunately, using these standards requires specification of the gases involved, and each have compromises in their methodology. The paper discusses how to make effective use of these standards in application.

ASHRAE Research Project 1557 tests six typical media types against four typical contaminant gases: ozone, formaldehyde, nitrogen dioxide, and toluene, using a Standard 145.1 test assembly. However, RP1557 tests at different concentrations and with a different basis of run time. Most media manufacturers test their products at very high concentrations, several parts per million (PPM), when the typical application for their media is in the low parts per billion (PPB) level. RP1557 is specifically designed to compare media performance at high and low inlet concentrations. In this way the traditional method of performance testing with high PPM concentrations can be verified against low PPB concentrations more commonly found in applications.

However, perhaps the most interesting part of RP1557 is the very consistent testing of the representative samples against the four challenge gases. This gives an objective side-by-side comparison of the performance of media, with some surprising results. Much of the conventional thinking about how to best filter the air for offending gases to protect collections needs to be revisited.

(13) Evaluation of Consolidants for Leather with Red Rot: The Search for a Natural Material Alternative

Caitlin Mahony, third year graduate student, the UCLA/Getty Program in Archaeological and Ethnographic Conservation; and Ellen Pearlstein, Associate Professor, University of California

Inspired by an interest in finding both a natural material alternative as well as a successful treatment approach to powdering leather surfaces on a Native American object, a comparative study of two novel treatment materials and two established consolidants for leather with red rot was undertaken this past year as part of a Master's thesis for the UCLA/Getty Conservation Program. Natural material consolidants have been demonstrated to be preferred by tribal members for use on materials other than leather. One of the materials tested as a potential consolidant was *neri*, an aqueous mucilage most commonly extracted from the roots of the *aibika* plant that is used in the traditional production of Japanese paper. The other material selected was chitosan, the main derivative of the natural polymer chitin, which has recently been applied in treatments of archaeological silk and paper. The performance of these potential materials as leather consolidants was compared against the performance of established modified organic consolidants, i.e. mixtures of Cellugel and Klucel G with the acrylic wax SC6000. The study focused on evaluating each material's consolidation performance, the visual and physical changes observed on the leather, and the chemical stability of the consolidant following heat and light aging. Although *neri* proved to have excellent chemical stability, it is not recommended

for leather due to unavoidable water content and unsatisfactory working properties. Though chitosan had no adverse effects towards the appearance and feel of the leather, it is not recommended as a consolidant until further research is conducted on its chemical stability. The Klucel G with SC6000 mixture had great application properties but the wax component is questionable due to the opacity change of the aged wax. Cellugel demonstrated the most desirable properties in performance and chemical stability; therefore it was selected as the consolidant for the treatment on the Native American object. Experimental results indicate that the natural materials evaluated may be recommended as alternatives to synthetic consolidants following additional research.

(14) An Investigation of Painted Wood Shields from 3rd Century Dura-Europos

Anne Turner Gunnison, Assistant Conservator of Objects, Yale University Art Gallery; and Irma Passeri, Associate Conservator of Paintings, Yale University Art Gallery

The Yale University Art Gallery has in its collections three painted wood shields, excavated in 1934 at the Hellenistic, Parthian, and Roman site of Dura-Europos, in present day Syria. Dated to about 256 AD, the shields serve as extraordinarily rare examples of ancient painting techniques on wood supports, depicting what have been previously identified as a warrior god, and scenes from the Trojan War and the Amazonomachy. While a 1941 review in the *American Journal of Philology* of the 1939 publication *The Excavations at Dura-Europos: Preliminary Report of the Seventh and Eight Seasons of Work* projected that these shields "will take an important place in the history of ancient art," there has been little to no study of these significant finds.

Initial investigation of the three shields indicated that a comprehensive study would elucidate invaluable information about panel painting techniques used in the ancient world. Through visual examination, high-resolution infrared and UV photography, as well as x-radiography, preparatory layers, fragments of textile and plant fibers glued directly to the support and possible underdrawing were identified, and the wood substrate better understood. Objectives of a first phase of further study include: analyzing and identifying the materials present, including pigments, preparatory layer, binding medium, adhesives, textile and plant fibers, as well as the types of wood used to construct the shields; finding evidence for construction techniques, preparation of the wood support, and historic context and use; and reading the contemporary written treatises on painting and comparing the data collected to the materials cited in these sources. The shields were treated in the field post-excavation. Most significantly, the surfaces were consolidated with PVA, as indicated in treatment and analytical records from 1935. Currently the shields are in a variety of conditions, with the painted and preparatory layers the most fragile and prone to loss. Planning conservation treatment in consultation with curators and scientists and treating the shields as necessary to preserve these delicate surfaces is a priority.

Because archaeological wood, and more specifically painted wood, rarely survives, these shields serve as exciting research possibilities for the advancement of understanding painting practices from the ancient Roman world.

(15) Uncovered and Unconventional: Preserving Works on Paper and Photographs on Open Display

Nina Quabeck, Paper Conservator, Kunstsammlung Nordrhein-Westfalen

Prior to the mid-20th century, works on paper and photographs were traditionally presented in the relative protection of a frame or showcase. The past fifty years, however, brought about a great change in the way art was conceived, created, and presented. Today, artists often choose to expand the boundaries of materials and formats. Consequently, enclosed display is frequently not an option for modern and contemporary works on paper and photographs.

The preservation issues of uncovered works on paper were first researched as part of the author's Samuel H. Kress Fellowship which was carried out at the Fine Arts Museums of San Francisco in 2007 to 2008. As part of the study, a general survey involving specialists caring for modern and contemporary collections in the US and Europe was conducted. The collection of the host institution was scrutinized for works on paper intended for open display and several of those examples were examined, re-housed or treated in the museum's paper lab.

Further examples of unconventional works on paper and photographs were encountered since the author's return to the Kunstsammlung Nordrhein-Westfalen, in Düsseldorf, Germany, in 2008.

As a final case study, the Wolfgang Tillmans exhibition held most recently at the Kunstsammlung, incorporated not only a mass of uncovered chromogenic prints, but also a number of large-format inkjet prints. In this project, the combination of the object's requirements with artist's and curator's wishes challenged traditional paper conservation practices. An exhibition consisting almost entirely of works requiring open display put us on the front lines in this battle to develop preservation strategies for these fragile objects and changed everyone's expectations for the installation, display and maintenance of an exhibition.

(16) Earthquake Mitigation: Adapting the Collections for Seismic Activity at The University of British Columbia Museum of Anthropology

Stephanie Johnson, Master's candidate in Arts Management, University of Oregon; Ida Pohoriljakova, Emerging Object Conservator

During the summer of 2013, Collections Management Intern Stephanie Johnson and Conservation Intern Ida Pohoriljakova at the University of British Columbia Museum of Anthropology collaborated on an earthquake mitigation project in collections storage. The project was presented to them as a joint effort between the two disciplines with the aim of improving the safety of the collections. The project took place in an area of the Museum of Anthropology's (MOA) Three Dimensional Storage that houses Chinese ceramics. These improvements are a continuation of the Renewal Project, a grant-enabled initiative that resulted in a significant transformation to the entire museum, including completely

new collections storage areas. The goal of the earthquake mitigation project was to create a new housing that would significantly improve the outcome in the event of an earthquake. The task at hand was to establish an economical and systematic strategy for storage that will continue to be incorporated throughout the entire collection of three-dimensional objects.

Prior to the implementation of the mitigation project, the Chinese ceramics were stored in compactor shelving units without adequate support. The storage materials primarily consisted of acid-free tissue paper, pillows, snakes, and Coroplast® boxes. While these materials are suitable for storage, they would not provide sufficient support in the case of an earthquake. The project required the use of a method that was cost, time, and resource effective. As a result of these pre-requisites, off-cut scrap materials from other museum projects were recycled for this task. An original design of a grid system created from Blueboard, Plastazote® foam, and Hollinger Metal Edge trays for small and medium-sized objects and Coroplast® boxes for large objects was adopted. Consequently, this design provided a flexible and adjustable solution that secured objects from jostling as in an earthquake. In all, one unit, which holds 150 objects on seven removable trays and five shelves, was rehoused.

The outcome of the initiative produced an accessible, flexible, secure and aesthetically pleasing storage solution. In five weeks' time, a creative method that fulfilled the needs of both collections management and conservation was achieved from initial problem-solving to implementation. Collaboration between the two departments provided the opportunity for knowledge-exchange with the common objective of preserving the collection. It is believed that the success of this project rests on this partnership.

(17) The Key to Sustaining Conservation: Student Leadership & Community Outreach

Louise S. Beck, Kate L.M. Becker, Miriam Orsini, and Leslie Stephens, Master's candidates in Conservation for Archaeology and Museums, Institute of Archaeology, University College London

Conservation as a profession requires collaboration amongst heritage professionals and community members, an interaction which is often exemplified in a university setting. The unique combination of students, professors, university collections, and strong communities allows for sustainable collaborations and beneficial outreach experiences. When conservation derives from a place of mutual advancement, the outcome is not only material preservation, but the beginning of a relationship which will help to guarantee the sustainability of the collection and the conservation profession. This scenario was the foundation of a collaborative project undertaken at University College London in the spring of 2013. Four previously damaged glass radiography tubes and valves from the University's Medical Physics collection were identified by the curator as at risk of loss and/or further damage if not conserved. However, related objects already existed within the collection in a more complete form, leaving scarce resources for the conservation of those in poor condition. Thus, the ideal solution was to involve the UCL conservation students in the treatment. Four students were selected to conserve

the objects and use them as part of their assessed coursework. The unique opportunity offered by peers treating a similar group of objects allowed us to share the experience with the general public through a blog, thereby showcasing conservation methodology and techniques. The benefit of public outreach lay in increasing awareness of conservation and informing the public about the inherent individuality of treating objects. In writing the blog posts, the students themselves were able to collaborate and discuss treatments, verbalizing the process of prioritization and the interplay of values in an informative manner that illuminated the conservation decision making process. The partnership produced stabilized and legible objects, advanced the education of conservation students, and engaged a wider London community. Maximizing the number of shareholders involved in conservation projects ensures not only the professions' sustainability but also the sustainability of the conservation action itself. The project provides a model for future collaborations which extends beyond the sphere of university training programs.

(18) Conservation of a 17th-Century Chinese Painting by Ding Yungpeng at the Missionary Ethnological Museum in the Vatican Museums

Minah Song, Senior Paper Conservator, and Marianne de Bovis, NEA Fellow in Paper Conservation, Conservation Center for Art and Historic Artifacts

This paper describes the conservation treatment of the 17th-century Chinese painting *Lohan riding an ox* by Ding Yungpeng (active 1584–1638) from the Missionary Ethnological Museum in the Vatican Museums. The treatment was carried out in 2011 by Minah Song while on a fellowship funded by the William Penn Foundation at the American Academy in Rome and Marianne de Bovis, an intern at the museum at that time. The paper also provides an overview of the Museum's Asian collections.

The unique Asian collections at the Missionary and Ethnological Museum are not well known to art historians and conservation professionals. The collections were created in 1925, after a special exhibition of numerous art works and curio, sent by the Missionary Congregations from outside of Europe. Some artifacts were eventually returned but some remained at the museum and became a part of the museum's permanent collection.

The conservation practice in the Missionary and Ethnological Museum focuses on preventive conservation; thus, the treatment is usually limited and the funding is outsourced. Certain projects, however, are occasionally chosen and funded by donors, so more extensive treatment can be performed. *Lohan riding an ox* by Ding Yungpeng—one the most famous painters of Buddhist subjects during late Ming Dynasty (1368–1644)—was one of these projects. The painting was executed with Chinese ink and gouache on a primary fabric support of a mixture of cotton and linen. The painting was lined with two layers of brown paper. Scientific analysis was done using infrared spectrometry and microscopic analysis for identification of fibers of the painting support and lining support, and the lining adhesive. The treatment included

lining removal, consolidation of red paint, washing and lining.

The conservation treatment of this painting represents an interesting case, illustrating how conservation professionals with different backgrounds approach each step of treatment. Each step of conservation treatment of the painting was carried out after discussion among conservators. The project was also challenging in terms of balancing between principles of conservation at the museum, dictated by the limited budget and materials, and general conservation practice of Asian materials.

(19) Applying New Techniques on a Traditional Adhesive for Book Conservation

Marjan Anvari, Manuscript Conservator; Roozbeh Mafi, PhD Candidate Chemical Engineering Department McMaster University

Eremurus is a reversible plant-based adhesive which easily dissolves in water with an acceptable flexibility, strength, stability over a long period of time, good aging characteristics and does not cause shrinkage on paper. Moreover, due to the absence of organic solvents using this natural adhesive does not affect the cellulosic substrate. These wonderful characteristics attracted traditional conservators not to reject using this adhesive over many years. Using an adhesive which mimics the properties of the original glue is another reason of preferring the use of natural adhesives over the synthetic ones. A major disadvantage of using Eremurus glue is that it forms dark amber stains on paper after drying due to its impurities.

Purification of Eremurus, according to a procedure has been already employed for naturally occurring polysaccharides, successfully led to a clear, gel like glue which can be used in conservation of books and cellulose based materials. The purified Eremurus glue showed enhanced adhesion to cellulosic materials without showing any discoloration in the substrate or the bonding film and improved flexibility. It can be a promising, strong adhesive which does not release any organic solvents and has a very good compatibility with cellulosic substrates.

(20) Documentary Heritage Conservation in Mexico: A Perspective on the XXI Century

Diana Noemi Velázquez Padilla; Thalía Velasco Castelán; Tania Estrada Váladez; Marie Vander Meeren; Jeniffer Arlett Ponce Fernández

In Mexico, the preservation of documentary heritage is a culturally important area due to the large number of properties and their historical value. Yet, little government support is given to this task, as Federal resources are allocated to other political issues. This is the context in which CNCPC (National Coordination for Cultural Property Conservation) documentary heritage conservators perform their work.

Given the need of a comprehensive panorama of the documentary heritage, a National Plan of Documentary Heritage Conservation is going to be implemented in 2014, which will define and implement the conservation policy guidelines.

Furthermore, conservators have come to rely on the following principles with increasing certainty:

- Instead of following models developed in other countries, we strive to find our own strategies that are adequate to the particular problems of our socio-economic context, as well as optimizing the use of accessible materials and resources that are more compatible with our heritage.

- Prioritize preventive conservation. In addition to being ethically preferable, it is a more efficient medium and long term strategy, compared to expensive, short range projects. When dealing with deteriorated and restored property, it is essential to design conservation plans. In the Santa Maria Acapulco project, where church property was severely damaged by fire, the training of community members was instrumental in establishing new conservation measures for the restored goods.

- It is necessary to develop networks with local, regional and international institutions to exchange experiences and knowledge. This also aims to counter the centralization of institutions in Mexico. In addition, our country can continue to be an important bridge between institutions and professionals from different countries. A case in point is the ICCROM – LATAM course, which has been held in Mexico for restorers of all Central and South America.

- One fundamental preventive conservation strategy is raising awareness on the heritage value at different levels: from the appropriation of assets by the community to academic research. Often, the usage needs clash with the conservation measures imposed by a specialist, but it becomes important to respect the dynamics of use that give meaning to the properties. For the stabilization project of choir books from the National Museum of Viceroyalty, minimal intervention of the books was made, but the most important step was the digitalization of the heritage for its dissemination and to protect it from manipulation, which is difficult because of its size.

(21) Reflections on the Conservation of the Choir Books Collection of the National Museum of Viceroyalty (Tepetzotlán, Mexico)

Tania Estrada Valadez, Assistant Conservator and Restorer in Graphic Documents, Graphic Documents Department, National Coordination for the Conservation of Cultural Heritage, Mexico City; and Diana Noemí Velázquez Padilla, Conservator in Private Practice, Mexico City

The collection of 92 choir books of the National Museum of Viceroyalty is one of the largest and most important in Mexico, because of their rarity, manufacture and cultural-historical values.

Although it is known that they are rare and therefore valuable, it was not until 2012 that the National Coordination for the Conservation of Cultural Heritage (CNCPC) of the National Institute of Anthropology and History (INAH), started to work on a in a two stage plan conservation project.

The poster includes some considerations around the decision-making in this project, which is a crucial moment where we contemplate the values, context and the extent and amount of books in the collection, as well as the use they have today.

Consequently, sometimes these considerations could be a restriction on the management and acquirement of financial

resources instead of being a practical tool. Besides, although nowadays there are more specialists in this area, the lack of personal related to the amount of collections that needs conservation or stabilization is another problem.

The criteria used to develop the project of stabilization were based on two main aspects: the actual use of the collection as researching sources or museum objects and the minimal intervention.

Thus, some questions we made ourselves were: should we have to restore books instead of preserve them to keep the evidence that shows manufacture and history data? Which are the values that prevail for this kind of books? Which are the ways to disseminate them for their best understanding and assessment?

From this perspective, there's one last question: Under which foundation it is constructed the decision-making? If we attend and prioritize only on the analysis of the intangible and tangible aspects, then the object has the last decision.

(22) Conserving Tape In, Around, and Under Paintings: Recent Case Studies from Modern and Contemporary Paintings Collection at the American Art Museum

Jessica Ford, Winterthur Graduate Intern; Tiarna Doherty, Chief of Conservation; and Amber Kerr, Paintings Conservator, Lunder Conservation Center, Smithsonian American Art Museum

Tape is commonly used by modern and contemporary artists in the painting process and in the final presentation of their work. In the painting process tape is most commonly used to help delineate forms and allow for the artist to create a hard edge. Conservators are often able to discern where this was done. In some cases tape serves to adhere collage elements and may be a collage element itself on a painted surface. In addition, tape may be found which was applied in order to serve as a temporary repair, by the artist or someone else, on a work of art. Painters also use different forms of tape to cover tacking edges and create a clean edge to their work. All of these uses of tape present unique challenges in conservation treatments.

At the American Art Museum conservators have recently explored different approaches to conserving tape as part of treating a number of 20th-century paintings. Conversations with artists and curators have helped inform treatment. Recent treatments have included consolidating and restoring areas of lost tape; addressing paint loss associated with tape applied as an underlayer; and removing tape from paintings.

Paintings presented include Michael Goldberg's *Sardines* (1955), which has two types of tape that play a prominent role in the composition. Masking tape was partially covered with subsequent paint layers, and the tape delaminated and curled away from the surface in some areas in response. Filament tape was applied on top of the paint, and it has discolored and become brittle with vulnerable edges.

Freddy Rodriguez's *Amor Africano* (1974) is a painting where tape was left under some of the borders of the artwork. The tape was used in a traditional way associated with hard-edge abstract painters; however, Rodriguez was criticized for this practice

when he returned to his native Dominican Republic from New York in 1976 as proof that he didn't know how to paint. Paint is now delaminating from the underlying tape layer at the edges of the work.

Arturo Rodriguez's *Sin Título* (1998) has black tape covering the tacking margins and on the edges of the display surface that was applied by the artist as a framing device. Handling caused areas of loss, delamination and distortion to the tape.

The thought processes behind each treatment approach for these examples of tape in, around, and under 20th-century paintings are shared to encourage discussion and to provide a reference for similar situations encountered by conservators.

(23) Contemporary Analog and Digital Color Photographic Prints: Dye and Pigment Print Process Descriptors, Naming Conventions, Dating, and Permanence Characteristics

Henry Wilhelm, Co-founder and Director of Research, Wilhelm Imaging Research, Inc.

Drawing on many years of research associated with *The Wilhelm Analog and Digital Color Print Materials Reference Collection – 1971 to 2014*, this paper describes the wide range of color print processes that comprise the modern era of color photography which began in 1935 with Kodak's introduction of Kodachrome transparency film and the companion Kodak Minicolor print process announced in 1941, both of which utilized images composed of cyan, magenta, and yellow dyes formed by a process known as chromogenic development using external couplers. These products were followed by a large number of color transparency and color negative film and print systems from Kodak, Agfa, Ansco, GAF, Fuji, Konica, 3M, Ferrania, and others. Photographers, galleries, and museums have variously referred to color prints made by these dye image processes as: Type C Prints; Type R Prints; Chromogenic Prints; Color Coupler Prints; Silver-Halide Prints; Lightjet Prints; Lambda Prints; Digital Type C Prints; Digital C Prints; Digital Chromogenic Prints; Duratrans; Digital Duratrans; and brand-associated names such as Ektacolor Prints; Kodak Prints; Crystal Archive Prints; Fujiflex Prints; Duraflex Prints; Endura Transparency Display Material; and so forth. In recent years, many of these print materials could be exposed with an enlarger or contact printed in an "analog" fashion, and the same print material could also be digitally imaged with scanning RGB laser or LED light sources (which can also produce monochrome images on color papers), further adding to the confusion about what the prints should properly be called. Face-mounting to acrylic sheet, lamination, and various types of print coatings have further complicated the naming situation.

Likewise, dye image prints made by the silver-dye-bleach process and dye-imbibition prints have been described using a variety of names, some brand-associated and some with names describing the image formation process.

Digital inkjet processes began entering the photography market in 1991, with dye image prints made on a wide variety of papers by Nash Editions and others using Iris Graphics Printers. A

few years later, affordable desktop and large-format inkjet printers were introduced by Epson, Hewlett-Packard, and Canon, which were soon followed by Brother, Kodak, Agfa, HP-Scitex, Mutoh, Mimaki, Roland, EFI-Vutek, Durst, swissQprint, Canon-Oce, Fuji, Noritsu, and other manufacturers. Inkjet printers with improved stability pigment inks came into the market in 1998 and by 2006 most professional and fine art photographic prints were being made with pigment inks, often with printers utilizing six, eight, ten, or even twelve inks. Water-base aqueous pigment inks were later supplemented by solvent-based inks, UV-curable inks, dye-sublimation inks (used with a transfer process for both prints on fabrics and on treated aluminum-base "Metal Prints"), and aqueous Latex inks. Unlike earlier color print processes, inkjet prints can be made on a very wide variety of substrates, including cotton-fiber fine art papers, RC photo-base papers, plastic supports, and fabrics. UV-curable ink prints can be made with rigid panels, including large sheets of acrylic plastic, aluminum, glass, plywood, and other materials.

In part because the inks and supports used to make inkjet prints are supplied as separate parts of the printmaking process, there are essentially an unlimited number of combinations of inks and supports, which has in turn greatly complicated the description, dating, and naming of these prints.

This paper proposes a simplified list of process descriptions and naming conventions that reconcile usage by photographers, museums and galleries, and the manufacturing industries. The proposed naming conventions distinguish between prints with images made with dyes and those made with pigments. Lists of non-recommended (but commonly used) names are also given. The permanence characteristics of the various processes and guidelines for their preservation are discussed.

(24) Disaster Response Ten Miles out to Sea

Nina Roth Wells, Founder, Nina A. Roth-Wells LLC; and Lauren R. Lewis, Paintings Conservator in Private Practice

Monhegan Island, located 10 miles off the coast of Maine, has been a haven for both weekend painters and famous artists for over 100 years. The Monhegan Museum (founded in 1962) has a fine collection of artwork by artists such as Robert Henri, Andrew and Jamie Wyeth, Rockwell Kent, George Bellows and Edward Hopper, as well as many objects related to the history and culture of the island. The museum, which is only open to the public in summer months, faces many challenges, including keeping gallery spaces and storage vaults safe for the works, dealing with unpredictable weather and the difficulty of getting professional assistance to the museum when needed.

Labor Day weekend 2013 brought stormy weather to Maine. Lightning struck the top of Lighthouse Hill on Monhegan, where the museum is located. Although the museum was spared a direct hit, the strike wrought havoc with the electrical systems on the island and caused the museum's fire suppression system to deploy. The system was a state of the art waterless DuPont FM200 system, and the museum was assured that the material released was completely volatile. Unfortunately, when the gas was deployed, corrosion products from the iron pipes were dispersed throughout the galleries and offices, coating everything with a

fine dust of iron particles.

This paper will describe the disaster response of two intrepid painting conservators on the coast of Maine. We will discuss the challenges of working onsite, commuting by ferry and working on the harsh island environment. We will discuss the materials and techniques used to treat the 35 paintings in the gallery. Finally we discuss chemical analysis of the particulate matter sampled from the paintings at various stages of cleaning. These samples should help us to evaluate the efficacy of both the dry and aqueous cleaning methods used during the project.

(25) Preservation Scientific Reference Sample Collections: Sustainable Assessment of Collection Materials Deterioration

Fenella G. France, Chief of the Preservation Research and Testing Division, Library of Congress

The development of a reference database of scientific samples in the Preservation Research and Testing Division (PRTD) at the Library of Congress has been an ongoing development to create a web-accessible shared scientific sample collection for addressing collection management challenges. The physical collection known as the “Center for Library Analytical Scientific Samples” (CLASS) includes a range of heritage materials: paper, parchment, fibers, pigments, colorants, modern media (compact discs, magnetic tapes, lacquer discs), and fugitive media (twentieth century inks and pens), with the range of materials expanding. These samples comprise not only original sample materials, but both naturally and accelerated aged materials, where accelerated samples are aged for longer consecutive periods of time, but at conditions much closer to ambient. The samples created establish a matrix of aging scenarios enabling a range of degradation mechanisms (temperature, relative humidity, light, pollutants, treatments) to be assessed and analyzed from exposure to controlled environmental and treatment parameters. Scientific reference samples are tested (generally) non-invasively on a range on instrumentation so complementary data pertaining to the same sample can be generated. Instrumentation includes but is not restricted to; spectral imaging, Raman and Fourier infrared spectroscopy, X-ray diffraction, UV-VIS spectrometry, scanning electron microscopy (SEM), gas-chromatography – mass spectrometry (GC-MS), direct analysis in real time (DART) mass spectrometry and ion chromatography (to name the most common analytical methods).

The associated digital data files “Center for Library Analytical Scientific Samples – Digital” (CLASS-D) expand the utility of non-destructive scientific analyses for cultural heritage research, yielding enhanced preservation data and greater access to structured research data. The creation of the online presence expands the capability of this initiative, with the digital component allowing international access and sharing. To support archiving of digital products with consistent quality, PRTD has established standard workflows for data management. The primary goal of CLASS-D was to encourage interaction between and ease of use of data. To test the CLASS-D database, a prototype was completed using example entries from the reference sample collection with representative example scientific analyses. These included both

sample and analysis records; where a sample was designed as a record of a research sample, and an analysis record was designed to correspond to a single instance of a test or analysis. Further data collection on a range of materials an instrumentation types was included in the prototype.

To date a large portion of the extensive physical collection data has been transferred to the CLASS-D database. Based on the prototype, some changes were made to the data model and application. It was apparent that the analysis record needed to be simplified to accommodate a single analysis or a group of related analyses of a single type. Each analysis record needed to have a single structured archive of data files associated with it that complied with strict standards for structure and content. A tool was also needed to ensure that the database could accept bulk uploads of XML data for large data sets. Significant discussions were held with users and potential users both internal and external to the Library, including scientists, conservators, curators, researchers and information specialists. Discussions with colleagues underlined the need to support standardized capture of preservation research data in order to enable better collaboration, sharing of data and best use of resources in the current economic environment. The initiative towards standardization of scientific research data collection will assist sustainability of collections care and management, and advance our knowledge of complex environmental degradation mechanisms.

(26) Undoing the New: Conservation of 21st Dynasty Egyptian Coffins and Impact of unsustainable treatments in the 20th century

Elsbeth Geldhof, Owner, Blue Tortoise Conservation; Jessica Hensel; Casey Mallinckrodt, third-year Intern, the UCLA/Getty Program in the Conservation of Archaeological and Ethnographic Materials; and Jonathan Gratton

After their discovery and excavation in 1893, several mummy coffin sets of the Bab el-Gasus corpus, comprised of fifteen objects, were given to the Rijksmuseum van Oudheden, Leiden, the Netherlands, among seventeen international institutions. The polychrome mummy coffin sets originally belonged to Priests and Chantresses of Amun, in the Deir el-Bahari area during the 21st Dynasty.

Since arrival in the museum, many coffins, lids and mummy boards have had up to four different restoration phases. Incompatible materials introduced as fills, adhesives, and coverings have caused problems far beyond the inherent deterioration of the 3,000 year-old materials with the result that most of these objects ended in storage, un-exhibited, for at least sixty years.

Conservation treatment carried out on three of the artifacts exemplify unsustainable 19th and 20th century interventions, the complex resulting damage, and the strategies that were undertaken in this project to mitigate the damage and secure the objects.

The Vatican Coffin Project is a collaboration between the Vatican Museums, the Louvre, and the Rijksmuseum van Oudheden that investigates and preserves the Bab el-Gasus coffin sets in a coherent and sustainable way. At the Rijksmuseum van Oudheden, research commenced in 2011, but actual treatment

was initially limited to five months in Summer 2013 and took place in front of the public as part of an exhibition, requiring careful prioritization of phased treatments.

In this presentation three treatments will be described that exemplify the damaging impact of non-sustainable and undocumented practices, how those interventions directed decision-making in the current conservation campaign, and the solutions that were chosen.

The complex and highly intervening restoration history of the objects, was directive in choosing a high standard of reversibility of the materials added as well as any new active conservation performed. As examples, we choose our treatment of a shattered mummy board with giant wax fills, an outer coffin lid with three different fill materials covering large areas of original surface, and objects suffering from flaking paint due to unsympathetic impregnation of cracks in the wood supports.

These treatments provide examples of the impacts of non-sustainable interventions, the decision-making process, and the conservation solutions that reduce damage, secure the objects and allow them to return to exhibition.

(27) Untitled Project: A Cross-Disciplinary Investigation of JODI's *Untitled Game*

Lisa Adang, MA candidate, Bard Graduate Center in Decorative Arts, Design History and Material Culture, Conservation Fellow at Rhizome, New Museum

The Belgian-Dutch artist duo JODI have long been appreciated for their pioneering browser-based artworks that exploit the materiality of the internet as an artistic medium. A less explored aspect of their practice is software modification through which they transform commercial game software by way of alterations to its code. Guided by the attempt to understand JODI's artistic intent, this investigation looks closely at specific changes the artists enacted to the original code of *Quake*, and frames the resultant modifications formally through analysis of the code and its corresponding graphical and interactive elements in *Untitled Game* (1996-2001).

Moving out from this highly concentrated mode of observation, this investigation also seeks to record the researcher's procedure in observing and documenting *Untitled Game*. This includes a discussion of the forensic tools used for this purpose, and an exploration of emulation as a strategy for experiencing obsolesced software, including detailed qualitative comparisons of various access strategies. It considers how the use of emulation applications changes interaction with "legacy" software and reframes such artistic content within an additional technical apparatus.

It is concluded that the use of an emulator to experience *Untitled Game* is in-line with JODI's vision for the piece, especially because of its inherent reliance on participant-side technology. In this way, the artists accept a multiplicity of viewing conditions through their free distribution of the software, downloadable at www.untitled-game.org. The un-updated (obsolete) software, technologically linked to an older operating system, necessitates an extended access strategy such as emulation to experience the work. Thus, the procedure undertaken in this investigation communes with JODI's own working methods, running parallel to their process of creation through its shared emphasis on code.

(28) Disaster Recovery and Sustainable Choices—Cologne City Archive: Five Years after the Collapse, Which Decisions for the Future?

Marion Verborg, Paper Conservator and Lab Manager, Cologne City Archive

After the collapse of the Historical Archive of the City of Cologne in March 2009, around 95% of the archival material was salvageable. About 30 shelf kilometres of numerous important collections of records representing historical continuity lay among tons of sand and rubble on the afternoon of the 3rd of March 2009. The archive housed 1,000-year-old records documenting regional and national history, among those about 65,000 charters on paper and parchment, and close to 2,000 manuscripts. The building in Cologne-downtown contained original manuscripts of, among others, Albertus Magnus, Napoleon Bonaparte, Jacques Offenbach, Giuseppe Verdi, Karl Marx, Heinrich Böll and Konrad Adenauer.

The entirety of these unique and non-reproducible historical accounts needs to be identified, re-registered, re-organized, conserved, and preserved immediately for future generations. The salvaging procedure and primary care operations were both successfully completed in August of 2011. During this step, an estimated 15% were slightly damaged, while 50% sustained medium damage and 35% were heavily deteriorated. Damages vary from small scratches on paper or parchment to huge holes in entire books.

We are currently developing and improving conservation and preservation measures in a temporary off-site building established after the disaster. At present, a team of more than 45 conservation technicians and 20 conservators work on these projects. Other institutions are involved in varied partnerships as well.

One of these projects is the treatment of the 3,000 metres of archive material collected in a wet condition and cleaned of dirt and ground soil at a rinsing station after the collapse. These documents were frozen and are currently stored at -26°C in a freeze storage unit near Cologne. Vacuum freeze dried units are currently used in varied places in Germany. Once dried, the documents are put through the cleaning process carried out on site.

Typical daily projects include: identification, registration, condition report, conservation dry surface cleaning (phase including dry surface cleaning, metal pieces removal, copy of unstable materials, removal of plastic materials, etc.), quality control, categorization (depending of possibility of direct or indirect use), digitization, and rehousing. These are the main steps in the recovery process. The process is still evolving, using feedback from co-workers to improve our system and make better decisions regarding sustainability and collection care. In our case, the term "conservation" describes a course of action that, considering the need of treating very large amounts of material and the need to prevent further damage, does not aim to restore aesthetic appearance, but aims to stabilise documents so that they can go back into use, be it in their original or in digital format.

Another project is the unmounting, dry surface cleaning, minor repair and remounting on conservation quality material of the middle-age charters on parchment. Taking advantage of other institutions' experience with mounting of parchments, we

developed a housing process to improve preservation on a very long term basis.

Many other projects are also created on site, among others un-mounting and cleaning of large format books and photo conservation. Insect monitoring and climate control are our priority as well.

Coordination of all these projects is challenging, and requires some non-conservation specific skills, communication of which is of primary importance. Every choice must be the result of a balance between budget options, material/time availabilities, and effective management of personnel.

(29) Study of pH-Sensitive and Reversible Aqueous Acrylic Coatings for Cultural Heritage

Amanda J. Norbutus, Postdoctoral Fellow in the Department of Chemistry, Villanova University

Transparent coatings can provide additional stability and protection to outdoor heritage, such as historic buildings, public murals, and sculptures. Recent tightening of VOC (volatile organic content) regulations in the United States have limited the variety of coatings permitted for outside application and preservation use and impacted the use of solvents during conservation treatments. Coatings that are applied with the use of organic solvents, such as mineral spirits acrylics, may be “grandfathered in” for use by government officials, as was the case as the 2011 restoration of Michael Webb’s St. James Church. Older solvent-based coating systems require the application of additional solvent to remove the aged, brittle, or physically degraded surface coatings, which can present a roadblock to receiving a VOC-exemption when conservation of cultural heritage is performed outside. VOC exemptions are gradually becoming more difficult to obtain and are often issued on a per treatment basis. The development and study of aqueous-based coating systems is in direct response to the increasing demanding path for approval of organic-coating systems on conservation work sites.

pH-sensitive ethyl-methylmethacrylate and methyl-methacrylate co-polymers from the medical coating industry are combined with different ratios of plasticizers and UV protective additives to create stable, non-yellowing, reversible coatings. The coating can be applied in a slightly basic aqueous solution and then can be removed using an aqueous solution within the pH sensitivity range. The manipulation of copolymer concentration and other additives result in a range of pH sensitivity (pH 5.0–7.5) that may prove useful as a sacrificial or protective coating for artworks, particularly outdoor public murals that require coating renewal every 10–15 years.

(30) Prioritizing Treatment in Collections Conservation Using Shared Resources

Jennifer Hain Teper, Head of Conservation Department, University Library at the University of Illinois at Urbana-Champaign

Library preservation and conservation programs are at the precipice of transformation – with the increasing availability of digitized content, as well as the development of shared print repositories,

our perceived obligation to the preservation of individual print copies at an institutional level is shifting to a more shared model – but how is this influencing our day to day practices? This poster presents the data collected from a 2012 survey of preservation and conservation programs in academic and research libraries in North America and interprets that data to show how the availability of digital surrogates, libraries’ increasing consideration of shared print holdings, and the perceived value of scarcely held content are all influencing selection for the conservation treatment of general collections. It will also touch on the successes and failures of a pilot currently underway at the University of Illinois at Urbana-Champaign’s University Library to apply these data to incoming repairs from our general collections in order to better prioritize limited resources.

(31) More than Meets the Eye: Eularian Video Magnification Applications for Conservation Research

Karen L. Pavelka, Lecturer, School of Information; Lorrie Dong, Doctoral Candidate, School of Information; Artemis Harbert, Michael Nugent, Benjamin Philbrook, and Elizabeth Seiple, Masters Candidates, School of Information; Sarah Hunter, Masters Candidate, School of Architecture; all at The University of Texas at Austin

Eularian Video Magnification (EVM), a technique and tool developed by The Massachusetts Institute of Technology Computer Science and Artificial Intelligence Laboratory and Quanta Research Cambridge, Inc., allows researchers to view movements that are not visible with the naked human eye. Through EVM, researchers can apply spatial decomposition and temporal filtering to video sequences to amplify subtle variations in the signal. EVM was developed for non-invasive medical monitoring (e.g., determining pulse rates and respiratory motion), but may have some useful and exciting applications in conservation.

Although paper can often appear to be unmoving, we know that paper fibers respond to changes in relative humidity, resulting in movement and stress across the sheet and the cockled pattern that appears on aged papers is reflective of this movement. But a sheet of paper does not necessarily behave predictably or evenly across its surface and those differences are hidden from human sight. EVM offers an innovative way to monitor the physical changes that happen to materials over relatively short spans of time.

In a preliminary evaluation of EVM use for paper conservation, the authors have applied the online EVM tool to study the movement of various types of paper in response to changes in relative humidity. Using high-definition video in conjunction with EVM, the researchers were able to capture subtle movements across sheets of several types of paper, working first with highly responsive papers like glassine, and then focusing on the more subtle movements of handmade papers. Furthermore, they experimented with the different video processing variables in order to exaggerate both temporal and spatial aspects of the video. As a result, the authors were able to see with various degrees of success the sometimes surprising patterns that emerged in the materials. This paper will present the results of the study to date, as well as offer best practices for using EVM, and explore other possible applications.

(32) Pulp Addiction: The Use of Dry Cast Pulp for Seamless Repairs in Works on Paper

Debra Evans, Head of Paper Conservation at the Fine Arts Museums of San Francisco; Victoria Binder, associate conservator in paper conservation department at the Fine Arts Museums of San Francisco

Filling losses with wet pulp is a tried and true paper conservation operation, which involves reprocessing existing paper into a slurry in a blender. Leftover wet pulp is typically stored in jars or poured into a lump to dry, for future use. At the Legion of Honor, paper conservators have instead cast pulp into a collection of small sheets of paper, creating a visual library of paper tones. This reprocessed paper is easier to shape and is more “carve-able.” Once made it is an excellent product to have on hand for immediate use.

Dry cast pulp repairs do not require wetting of the object and can be easily removed. Using a library of dry cast pulp, seamless repairs can be done more quickly than traditional shaped repairs. The result is usually far superior. This poster will depict how dry cast pulp can be easily used to fill losses, make more “invisible” mends, and camouflage dirty tears and stains.

(33) Cast Pulp Paper—An Alternative to Traditional Repair Materials for Infills in Book and Paper Conservation

Renate Mesmer, Eric Weinmann Head of Conservation at the Folger Shakespeare Library; Jennifer Evers, book and paper conservator, advanced intern at the Folger Shakespeare Library.

Cast pulp paper can be a viable alternative to traditional repair materials such as long-fibered Hanji or Washi papers or wet paper pulp. Asian papers can be too strong as an infill material, too transparent, and may unsuccessfully match the characteristics of a handmade Western paper. However, wet paper pulp is rarely an option when working on bound or water-sensitive materials.

Cast pulp paper repairs are often more aesthetically pleasing, especially when adhered to wove papers. The pulp can be made from a variety of materials, such as linen and cotton handmade paper. The paper is beaten in a blender and then cast with a modified deckle box or on a suction table. Cast pulp paper can easily be shaped to the outline of a loss by using a waterbrush, and further refined with a scalpel or sanding stick. An infill can also be pre-cast in the shape of a loss, making the repair more efficient when treating multiple leaves exhibiting the same area of damage.

This poster will show how cast pulp paper can easily be produced in a conservation lab using inexpensive materials and standard equipment, and will demonstrate the results of this technique.

(34) Conservation Documentation with Digital Mapping

Kisook Suh, Assistant Conservator, Department of Textile Conservation, The Metropolitan Museum of Art

Like other types of information relating to artwork in museums,

conservation documentation is at present in transition from analogue to digital format. This paper will discuss current issues relating to the digitization of conservation documentation, focusing in particular on pictorial information used in textile conservation. Digital photography in high resolution has been used successfully to record far more information than the previously available photography by showing artwork at the level of actual scale, often magnified to microstructure. However, even highly developed digital photography cannot replace diagrams that selectively render crucial information about the condition or treatment of artwork. Many of the technical limitations that conventional diagrams have can be overcome by adopting digital mapping technique.

Conservation documentation of textiles involves different levels of information: from microscopic images of fibers to overall images; from the treatment of stabilizing a single yarn to supporting an entire oversized textile. More advanced tools are required to visually record different scales of conservation work. In particular, various levels of treatment information are difficult to be integrated with conventional diagrams. In place of drawing diagrams to map details on printed images, digital mapping programs can be used more efficiently for conservation treatment documentation. Digital mapping can be achieved as precisely as mapping the treatment of a single element of an oversized textile on a true-to-size scale high-resolution image.

Digital techniques not only have allowed us to have conservation documentation in digital format, but also have improved the quality of information that the documentation presents. Then there is always the question of “How much documentation is worth doing?” While aiming to perform the best practices in a given situation, of course with compromise, conservators find the significance of conservation documentation in the broad meaning of sustainable conservation practice. Because no conservation treatment is meant to be totally final, comprehensive documentation clearly will play a critical role in allowing conservation practice to be more “sustainable” or continue to grow in the future.

(35) Chinese Polychrome Lacquered Wood Vessels from the Asian Art Museum: a Technical Study

Amy Y. Tjong, Project Conservator, Katherine A. Holbrow, Head of Conservation, and Mark Fenn, Associate Head and Objects Conservator, Asian Art Museum

A group of Chinese lacquered wood objects, characterized by bands of alternating colors, have been stylistically dated to the Song through the Qing dynasties (960 CE-1911 CE) by historians. This material was examined using a range of analytical and imaging techniques including visual and microscopic examination, x-radiography, XRF analysis, ultraviolet and infrared imaging for a comprehensive catalog. The research results presented here focus on some of the unique technical features seen in certain identified types.

The AAM owns a diverse collection of lacquer ware that includes examples of rare, virtuoso and well-preserved specimens

of little known lacquer types, and carved polychrome lacquer is unusually well represented. While some technical information is available on objects decorated with lacquer, carved polychrome lacquer in particular remains far from understood for several reasons. First, art historical literature and curatorial opinion have struggled to define carved polychrome lacquer as a stylistic group. Second, carved polychrome lacquer is one of the more complex lacquer techniques to master, requiring the utmost in skill and precision by craftsmen.

This study of carved polychrome lacquer, carried out in conjunction with a museum research catalog of Chinese lacquer-ware, offered the opportunity to contribute additional information to the corpus of lacquer studies. A goal of the research was to use imaging and instrumental analysis to survey this large group of lacquerware and identify unique construction details among the different types.

(36) Garlic on Dutch Copper Plate Paintings from the 16th to 17th Centuries

Nicole Schmidt, Student, Buffalo State College class of 2014; Corina Rogge, Andrew W. Mellon Research Scientist, Museum of Fine Arts, Houston and the Menil Collection

Artists' treatises from the 16th and 17th centuries recommend the application of crushed garlic or garlic juice onto the copper plate as a preliminary treatment before beginning to paint. While art historians often cite these treatises, no analytical work has positively identified garlic in historic oil paintings on copper or established what role garlic may have played to warrant its recommendation. The objective of this research is twofold: to determine a suitable method for identifying garlic within a painting and to investigate possible reasons behind its use. Mockups of copper oil paintings (with or without garlic ground layers) were made utilizing pure pigments in linseed oil and either aged naturally or subjected to one month of artificial aging at 80°C and 60% RH. Fourier transform infrared spectroscopy (FTIR), staining, and pyrolysis gas chromatography mass spectrometry (py-GC-MS) were used to test for the presence of garlic. Preliminary results show that FTIR and staining of cross sections are ineffective at identifying garlic, but py-GC-MS analysis reveals the presence of 2,5-dimethylfuran, a carbohydrate marker compound present in fresh garlic juice, in fresh or aged garlic juice on copper, and in the natural and artificially aged paint samples on garlic ground. We propose that this species could serve as a marker for the presence of garlic in historic copper plate paintings. No differences in paint adhesion between aged mockups with or without garlic were noted, but we observed differences in pigment stability between these samples. Smalt, a pigment sensitive to oxidative discoloration, turns brown within a relatively short period of time when painted out on bare copper, but shows a lesser amount of discoloration with the garlic ground layer, suggesting that one reason for the use of garlic may have been to protect sensitive pigments.

(37) Consolidant Application for Polyurethane Ester Foam: The Treatment of a Headset from NASA's Skylab Missions

Marci Ann Jefcoat, Pre-program Student; Lauren Anne Horelick, Objects Conservator, National Air and Space Museum; Nicole Little, Physical Scientist, the Smithsonian Institution's Museum Conservation Institute; Jennifer Levasseur, Museum Specialist, Department of Space History, National Air and Space Museum

Polyurethane (PUR) foam is found as a component of many composite artifacts in the National Air and Space Museum (NASM) collection. We find PUR foam on head-sets, flight helmets, aircraft seat cushions, and as instrument packing material. PUR foam is highly susceptible to degradation, and when it begins to deteriorate can transform into a fragile crumbly powder. This type of deterioration causes severe material loss and disrupts the interpretation of the artifacts' intended use, and often results in the complete loss of the artifact.

The most comprehensive studies in conservation to date illustrate the successful use of either Impranol® DLV/1 for PUR ether foams, and aminopropylmethyl-diethoxysilane (AMDES) as a consolidant for PUR esters. However, these studies focus on fine art collections and do not concern themselves with technical or scientific material culture artifacts. Additionally, the studies focus on nebulization or immersion application techniques. Immersion is not a viable option for the types of composite artifacts containing PUR foam in the NASM collection. In our research we found that initial attempts at nebulization only deposited either a thin film or a thick layer of consolidant onto the surface of the foam, leaving the untreated interior soft and crumbly. The need to identify a workable application technique for PUR foam consolidants became relevant when the NASM conservation lab was presented with a collection of headsets from the Skylab era (c. 1970's). Each of the headsets have PUR foam ear cushions in varying states of deterioration.

This poster will present a case study for the treatment of one Skylab era headset with deteriorating PUR ester foam. To consolidate the fragile foam of this composite artifact it was necessary to determine the maximum thickness of the foam to be treated, followed by identifying the best methods to ensure that only the foam was consolidated with the Impranol® DLV/1. This poster will illustrate the series of experiments carried out on samples of PUR foam from the NASM collection dating to approximately the same era as the PUR foam on the Skylab headsets. These experiments ultimately helped to determine the best treatment methodology, which was then used to treat the headset.

(38) Map It Out: Visualising Data For Sustainable Collections Management At The National Archives UK

Sarah VanSnick, Preservation Manager, The National Archives UK; Kostas Ntanos, Head of Conservation Research and Development, The National Archives, London

To facilitate truly sustainable choices in collections management an in-depth understanding of the collection, storage areas,

display facilities and access level are essential. For large collections this requires the gathering and interpretation of large quantities of data. In recent years the Collection Care Department at The National Archives UK (TNA) has developed thematic data maps that present visually some of our large sources of data about our collection and storage environment. These visual tools have permitted TNA to suggest and implement improvements that are both better for the collection and sustainable.

Environmental mapping of TNA's storage was achieved using paper-based isoperms to illustrate environmental conditions in a single map. Creating the maps monthly clearly illustrated the seasonal cycle of TNA's main storage area. This information was key to informing subsequent projects and the development of our new seasonally adjusted set point schedule. This schedule provides an improved environment for the storage of the collection and delivers substantial energy savings over the traditional use of constant set points for the HVAC system throughout the year.

TNA has also created maps that link a number of different data sets to storage locations by shelf number. 'Collection maps' which colour-code material types across storage, are important evidence for exploring the possibility of zoning the collection according to material type and allow tighter environmental control for more vulnerable parts of the collection, for example photographic materials. The map has been instrumental in establishing a dedicated area for photographic collections operating at cooler and drier conditions.

This mapping tool was successfully used to illustrate the number of deliveries to our reading rooms from each shelf in storage and documented where our most popular records were stored. These maps will now inform changes to our storage cleaning regime. Knowing which areas host more activity will allow TNA to concentrate its cleaning in those areas resulting in a more efficient and effective cleaning programme.

Conservation professionals and the institutions they work for collect data routinely, but mapping offers the ability to look at the data differently. By harvesting, using and presenting data in innovative ways, TNA has been able to make sustainable collections management decisions as a result.

(39) The Humming Bird 2: Using Fosshape as an Alternative Backing for Fiber Art Sculpture

Marissa Stevenson, Jason Depriest, Suzanne Hargrove, Toledo Museum of Art

Fosshape is a common material used in the costume and theater industry. It is a nonwoven fabric made of low melting synthetic polyester fiber that can be manipulated into a permanent form when exposed to heat (200°F range). Fosshape will conform to an underlying surface to create a firm custom fit support that can be sewn in place. In 2009, the Textile Museum in Washington, D.C. utilized Fosshape to construct invisible costume mounting structures (Amnéus and Miles, JAIC 2012). At the Toledo Museum of Art, Fosshape was considered as a possible support for The Hummingbird 2, a hemp and sisal wall sculpture by Magdalena Abakanowicz. The sculpture consists of a three-dimensional woven panel with four vertical slit openings. Additional knotted

and wrapped forms create large three dimensional surfaces that come from the back through a center opening. The sculpture's top and bottom contain cut pile wefts that are looped into the warp to create a hair like surface appearance. Consequently the artwork has wide ranging undulating peaks and valleys. The original mounting structure consisted of a simple wood frame which was tacked to the weaving with ½" staples in four areas at the top and did not provide adequate support. The extreme irregular surface planes and attached wood frame created support and mounting issues. Fosshape was considered an ideal textile friendly (or textile compatible) material as an auxiliary rigid support for both the sculpture and its existing wood frame.

First a mockup was designed to insure the procedure would work. Based on its success, a cast model was created of the back of The Hummingbird 2 by placing it face down on an appropriately padded support with an isolating layer of Dartek, a transparent cast nylon film that is free of surface coatings and plasticizers. Plaster bandages were applied to make the model. Once set the plaster model was used to construct the Fosshape. A sheet of Fosshape was cut to fit the model with an additional 6" allowance. It was then manipulated to fit the model using a Rowenta Superpress 050 steamer and tacking iron. The steam process was started at the center working to the edges so the Fosshape would shrink consistently to fit the cast.

Sandbag weights were applied after heating to reinforce the shape. Additional strips of Fosshape were added where needed for extra support. The Hummingbird 2 was then suspended between two supports so the front and back were both accessible. The molded Fosshape panel was then fitted to the back of the wood frame and artwork. Transmitted light was used to trace the vertical openings and outlines of The Hummingbird 2 onto the Fosshape. The Fosshape was removed and these areas were cut out. The edges of the cut openings were covered with orange cotton archival fabric and sewn to the Fosshape so that the material was not visible.

The molded Fosshape was sewn to The Hummingbird 2 using four rows of vertical basting stitches (approximately ½" in length, 2 ½" apart) with 100% cotton 100m Gutermann thread while the sculpture was suspended for access to the front and back. The Fosshape was also attached to the wood frame with screws. Finally the excess Fosshape was trimmed off along the wood frame. (Should this process be done again, a barrier layer such as fine 100% polyester or muslin would be used between the Fosshape and the artwork as the Fosshape has a textured surface.)

Through this process Fosshape has proved to be a viable resource to conservators as it has potential to be utilized in a variety of circumstances as a custom support structure. This material can be utilized to create supports for treatment as well as structures for mounting and storage. Fosshape is an easily manipulated material that is not only cost effective but a firm, supportive alternative to traditional backing and mounting.

(40) The Digital Portfolio in the Conservation Field

The Emerging Conservation Professionals Network

(41) The Use of Cyclododecane as a Temporary Fixative for Loose Surface Media on Paper to Allow Mechanical Conservation Treatments

Marie-Lou Beauchamp, Paper Conservation Student, Queen's University

Cyclododecane (C₁₂H₂₄) has been used in the field of conservation for almost two decades. In the paper speciality, its use has mainly been oriented towards its properties to act as a temporary fixative for aqueous treatment of soluble media. In artefact conservation, cyclododecane is mostly used to secure fragile artefacts during movement and transportation. This study proposes to use cyclododecane spray as a temporary fixative for loose surface media, like pastel, to secure the pigments during mechanical conservation treatment on the verso of the object. The application of cyclododecane may allow the conservator to perform treatments like mechanical backing removal, surface cleaning and flattening under light weight. Samples will be created by applying pastel on paper and then applying a coating of cyclododecane. Then, the samples will be submitted to a smudge test, based on the ASTM Standard Test Method for Determination of Abrasion and Smudge Resistance of Images Produced from Business Copy Products. After sublimation of the cyclododecane, assessment of the change in colour and glossiness will be made with colorimeter and glossmeter. UV photography and reflected photography will be used to detect any smudging, abrasion or pigment transfer from the sample during the test. It is expected that a film of cyclododecane applied on the media would protect it from disruption, smudging, smearing and crushing during test. Since the conditions of experiment would place a greater stress on the samples than a conservator would normally put on an object during treatment, the hypothesis is that a commercial cyclododecane spray can act as a temporary fixative to perform mechanical treatments on pastels drawings.

(42) Multispectral and Computational Imaging Methods for Documentation of a 19th Century British Landscape Painting

Taylor Bennett, Intern, Digital Diagnostic Specialist, Kept Art Restoration, San Jose, CA; Ken Boydston, President, MegaVision, Inc., Santa Barbara, CA; William A. Christens-Barry, Ph.D., Principal Scientist, Equipoise Imaging, LLC., Ellicott City, MD

This poster presents the application of multispectral imaging and computational imaging methods, including Reflectance Transformation Imaging (RTI) and photogrammetry, to document a 19th century British painting of the Giudecca Canal and Santa Maria della Salute in Venice, Italy (920 millimeters [mm] x 1,020 mm or 36 inches x 50 inches). These imaging techniques were chosen with consideration for the long-term preservation and reuse of the data using well-documented, open-source standards. They have been adopted by conservation departments at several major museums and used for such open scholarship projects as the Archimedes Palimpsest Project (<http://archimedespalimpsest.org/about/>) and the Antikythera Mechanism Research Project (<http://www.antikythera-mechanism.gr/>). Rapid developments of computational photography methods and improvements in digital imaging equipment have made these techniques highly portable, available to independent conservators, and applicable to cultural heritage *in situ*, outside of an institutional research setting. These methods provide a detailed digital data set documenting the condition of the painting and forming a basis for further analysis and scholarship regarding the artist's technique and use of materials.

Multispectral and computational image sequences were captured in an overlapping mosaic pattern to obtain a ground sample resolution ranging from approximately 350–500 pixels per inch (ppi) over the entire painting surface, and up to approximately 2,000 ppi for some details, resulting in over 120 gigabytes of raw images. Multispectral reflectance images of the painting were captured in twelve discrete wavebands ranging from approximately 350 to 1,000 nanometers (nm), including one ultraviolet (UV), six visible, and five near-infrared (NIR) wavebands. Fluorescence images were captured using UV and blue excitation wavelengths in conjunction with emission filters, and visible-range images were captured using both bidirectional and unidirectional lighting to provide additional textural information. The spectral imaging system consists of two lighting arrays with individual light-emitting diodes (LEDs) for each waveband, a camera with a 50-megapixel monochrome charge-coupled device (CCD) sensor, and a custom 120-mm focal length lens designed to maintain focus over the range of wavelengths for precise image registration. Controlling the wavelengths of the light source reduces the potential for photochemical damage to the subject and allows better image resolution than is possible using the alternate method of using a broad-spectrum light source and placing filters on the camera lens. The absence of a color filter array on the sensor allows the reflectance and fluorescence data for each waveband to be registered and compared, per-pixel, without introducing errors from the demosaicing process common to most color (RGB) digital cameras. The individual wavebands can be viewed and analyzed individually or in combination, for example, to allow accurate color rendition, reveal areas of damage and subsequent repairs, and help distinguish original from later pigments.

RTI obtains surface shape information from a sequence of typically 30–50 images captured while varying the direction of the light source in a hemispherical pattern. The sequence of images is computationally processed to calculate the direction of the normal vector perpendicular to a plane tangent to the surface at each pixel. The resulting RTI file can be viewed using software that allows the viewer to virtually manipulate the light direction on a computer monitor, and also provides a variety of algorithms to change the reflectance properties of the surface to make fine textural details (for example, brushstrokes, impasto, and craquelure) more visible. The data collected for an RTI sequence can be reprocessed as newer software tools become available. The open-source software used for this project includes RTIBuilder and RTIViewer, available from Cultural Heritage Imaging (<http://culturalheritageimaging.org>).

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(43) Conservation of a 17th Century Baroque Oil Painting as a Collaborative Research and Instructional Tool

Kristen Watts, Department of Chemistry, Villanova University; Emily Wroczynski, Winterthur/University of Delaware Program in Art Conservation; Maggie Bearden, Pre-program student/Undergraduate degree in Art Conservation, University of Delaware; Amanda Norbutus, Department of Chemistry, Villanova University; Kristin Deghetali, PhD Program in Preservation Studies, University of Delaware; Anthony Lagalante, Department of Chemistry, Villanova University

The opportunity to conduct *in situ* analysis in tandem with ongoing conservation efforts does not frequently present itself, especially in conjunction with educational outreach. *The Presentation of David to King Saul after Slaying Goliath* (12' x 19', oil on canvas), a 17th century oil painting attributed to Baroque master Pietro da Cortona, originally hung in Nemi Castle outside of Rome until the mid-20th century. During World War II, the painting was exposed to the elements after a bomb damaged the roof of the castle. In the 1950s, Princess Eugena Ruspoli donated the painting to Villanova University. After an initial restoration campaign in 1956, the painting has reverted to its pre-restoration state. The current conservation campaign will seek to restore the painting and understand the failure of the 1950s restoration.

A two-year campaign to restore the painting has begun at the university incorporating both technology and methodologies that were unavailable during the previous conservation campaign. Villanova University is using this project to provide an educational opportunity regarding art conservation and history to its students and the surrounding community. An interdisciplinary team composed of a private paintings conservator, two conservation interns, and members of the Villanova chemistry and art history departments are acting as collaborators. The conservation effort will be performed in an open forum, in a room dedicated partially to the painting and partially as a common area for the students at Villanova where they will be able to study and observe the conservation team as they work on the painting. Members of the Villanova chemistry department specializing in preservation science and analytical chemistry are conducting research (utilizing XRF, SEM-EDX, DESI-MS, etc) into the artist's original materials and as to why the degradation after the 1956 restoration campaign occurred so rapidly. At the same time, Art historians at Villanova are investigating the history of the painting and the artist. All team members will blog throughout the project using a variety of social media (Twitter, Facebook, Instagram, YouTube, etc.) to engage the public and promote awareness about the painting. Regularly scheduled tours of the painting will be given during treatment hours with panels highlighting key aspects as to the conservation research currently underway.

This painting will be utilized in many classes on Villanova's campus, providing an opportunity for liberal arts students to see chemistry in a non-traditional way, and for chemistry students to see a practical application of science to the arts. This includes public demonstrations of XRF as a tool to monitor the cleaning of the painting by examining the levels of zinc present on the surface from previous overpaint. This poster will highlight the various avenues of public outreach involved in the conservation project of *David and Goliath*.

(44) History Unfolded: Conservation Treatment and Housing of 18th-Century Printed Paper Fans

Annie Wilker, Paper Conservator, The Huntington Library, Art Collections, and Botanical Gardens

Thirty-three folding paper fans were recently acquired by the Huntington Library's department of early printed books. These fans, all produced by fan manufacturers in England during the second half of the 18th-century, share characteristics with bound collection—they contain significant amounts of printed text, represent a convenient method of storing reference information, and are three-dimensional, composite objects that were intended to be handled. The purpose of this poster is to describe the production, condition, treatment, and housing of these fans.

Paper fans from the 18th-century were mass-produced and ephemeral in nature, allowing people from all levels of society to keep up with rapidly changing trends at little expense. Much more than fashion accessories, however, these fans serve as documents that shed light on the social and political history of the period. Their printed text often functioned as memory aids and included almanacs, song lyrics, dance steps, rules for parlor games, and the details of current and past events.

In the Huntington's collection, the most typical fan design consists of a semi-circular leaf constructed from two sheets of thin, antique laid paper mounted to plain wooden sticks. The leaf generally includes line or stipple engraving with a strip of metallic foil along the top edge. More elaborate fans feature leaves with hand coloring and sticks of bone embellished with paint or faux jewels.

Few paper fans from this period have survived, but those represented in the Huntington's collection are in stable condition. However, the inherent stress of opening and closing the fans has presumably caused tears along folds and some flaking of paint media; significant staining exists where wood sticks are in contact with paper. Other issues include corrosion of metallic foils, the likely presence of mildew, and extensive previous repairs which interfere with the mechanical action of the folding fans.

Treatment of the fans was complicated by the folded nature of their supports and by the need to limit moisture to prevent warping, bleeding, and corrosion. Paint consolidation, non-aqueous mending, tape removal, and mildew reduction were completed as appropriate. Various housing options were then considered. While an open position could lead to warping of the sticks and flattening of the leaf, a closed storage position requires additional mechanical stress for viewing. Because the fans are structurally stable and have been digitized to reduce handling, the decision was made to store them closed in custom-made housings. Conservation treatment of the printed paper fans stabilized them for future use, while a closed storage position protects the objects, saves staff time, and reduces necessary storage space.

(45) Roy Lichtenstein's Time Magazine Cover of Robert F. Kennedy: His Working Method

Rosemary Fallon, Paper Conservator, Smithsonian's National Portrait Gallery

The Smithsonian National Portrait Gallery (NPG) holds approximately 2000 objects of original art created for reproduction on the covers of Time magazine. In 1968 Time commissioned pop artist, Roy Lichtenstein to do two covers at the same time: an image of Robert F. Kennedy (RFK) during his presidential campaign and the other, a smoking gun, for a feature story on gun violence. Mr. Lichtenstein rarely accepted commissions or did portraits but RFK had mobilized the anti-war movement with his campaign and the artist admired his energy. Mr. Lichtenstein accepted the magazine commissions although he thought the process a bit too commercial. This amused him because some critics thought his art work too commercial. RFK appeared on the May 24, 1968 cover and was assassinated a few weeks later. Ironically the image of the gun ran on the cover shortly after.

The color film overlays created for the RFK cover were selected by Portrait Gallery Chief Curator, Brandon Fortune and Curator of Prints and Drawings, Wendy Wick Reaves for their exhibition, Face Value scheduled to open in April 2014. This selection prompted further examination of the preparatory drawings and associated materials for the magazine cover. The Lichtenstein Foundation did not have detailed information about the drawings for this work and was interested in documenting all associated materials. While meeting together with Avis Berman, researcher for the Lichtenstein Foundation, Jim Barber, NPG Curator of the Time Collection, and Wendy Wick Reaves, NPG Curator of Prints and Drawings, the group began to piece together the artist's process for creating this compelling image of Robert Kennedy but questions remained and required more research.

This poster will address the artist's process and materials used to create the magazine cover with images and text. The artist's method was similar to the way he approached his paintings whereby the drawings described the final design for the art work. Lichtenstein began with photographs of Kennedy and then worked out the design in a series of black and white preparatory drawings, photo reproductions, photographs and collage. There is one, black and white key drawing on illustration board and four, black and white overlay drawings on translucent paper executed in felt tip markers over graphite pencil, some with brushed, matte paint and collage elements. The key drawing was reproduced and served as the underlay image for the overlay drawings created for each separate color. The sixth object is a collage, mock-up of two photographs with hand applied color and a sample of Lichtenstein's printed dot paper. The four color film separations (cyan, magenta, yellow and black) were created from the drawings for each color plate. In 1989 Time magazine asked Lichtenstein to make a color lithograph of the final design for the NPG possibly due to the instability of the materials of the film overlays, the only extant example of the final design other than the magazine.

(46) Life Cycle Assessments of Museum Loans and Exhibitions: Four Case Studies at the Museum Fine Arts, Boston

The Sustainability Committee, The American Institute for Conservation (Geneva Griswold, Betsy Haude, Christian Hernandez, Sarah Nunberg; Robin Ohern, Denise Stockman, Melissa Tedone, Jia-Sun Tsang); Sarah Nunberg, The Objects Conservation Studio, LLC; Pamela Hatchfield, Robert P. and Carol T. Henderson Head of Objects Conservation at the Museum of Fine Arts, Boston; Matthew Eckelman, Assistant Professor in the Department of Civil and Environmental Engineering of Northeastern University

The American Institute for Conservation of Historic and Artistic Works (AIC) and the Museum Fine Arts, Boston (MFA) commissioned Northeastern University (NEU) environmental engineering students under the direction of Dr. Matthew Eckelman to study the environmental and economic impact of museum loan and exhibition practices. This project grew from discussions concerning the potential benefits and risks of changes in climate guidelines for museum loans. Further consideration of loan activities led to examination of not only electricity used for environmental control, but also the materials and energy required to transport art for loans and prepare gallery space for exhibitions. Treatment materials were also examined, beginning a systematic evaluation of the environmental impact of the resins we use. Since the 1990s, industry has used the life cycle assessment (LCA) tool to evaluate actions, economic impact, inefficient energy use and waste management. Once hotspots are identified, libraries, museums, private practitioners, archives and heritage institutions can effectively work towards environmental, economic and socially sustainable goals when caring for collections.

Four LCAs were commissioned for this project. LCA 1 compared efficiencies of the cost and life cycle of halogen lamps with light emitting diode (LED) lamps in a single MFA gallery. This study concluded that in addition to long term cost savings, LED use results in lower environmental impact, lower eco-toxicity and fewer human health indicators than halogen lamps. LCA 2 considered the materials and environmental impact related to loan preparation and shipment to two different venues. Plexiglas™ vitrines, gallery lighting and climate controls were responsible for approximately one third of the carbon emissions from the exhibition preparation phase. Crate and Plexiglas™ reuse as few as four times would significantly lower the loan carbon impact. However, the highest environmental impact of all loan phases proved to be the carbon foot print of the courier who travels two round trips for every one object round trip and has more than three times the impact of the art transport. LCA 3 addressed cost and energy savings resulting from the temporary shutdown (coasting) of air handling equipment for one newly constructed gallery at the MFA. The study found that turning off the air handling systems for 12 hours nightly achieved a 21% (daily) reduction in cost and electricity use. LCA 4 compared silane stone consolidant with Acryloid B-72 in a 1:1 acetone/ethanol solution, and Acryloid B-72 in xylene for treatment of a Romanesque church façade in the MFA collection. The study considered the ecotoxicity, human toxicity, acidification, and global warming potential of each system and concluded that silane use results in a significantly

higher impact in every category, even recommending the B72/xylene system over the silanes.

LCA is a useful tool, dependent on the practitioner's knowledge and the consumer's commitment to sustainable work habits and lifestyle. Studying the impact of our actions will allow us to make educated decisions and consequently achieve more sustainable, responsible best practices.

(47) Multispectral Imaging (MSI) with a Modified Monochrome DSLR Camera

Jiuan Jiuan Chen, Assistant Professor; Dan Kushel, Emeritus SUNY Distinguished Teaching Professor; Graduate students: Amanda Chu; Ellen Davis; Jena Hirshbein; Jennifer Johnson; Zachary Long; Colleen O'Shea; Dawn Planas; Erica Shuler; Liz Sorokin; and Christina Taylor, Art Conservation Department, Buffalo State College

UV-vis-IR modified single-lens reflex cameras (DSLRs) have been used by conservators and museum photographers to record the reflective response of artifacts in UVA, visible light, and near IR. The sensors in these cameras are modified by the removal of the IR blocking and anti-aliasing filters allowing for imaging in these three spectral regions with the use of appropriate lens filtration. In these cameras, the sensor's RGB color filter array (CFA) is left in place to permit standard color photography. The CFA, however, makes it impossible for the camera to record the precise spectral response of each pixel site because each pixel is covered by a red, blue or green filter.

The removal of the CFA, in conjunction with appropriate lens filtration (or subject illumination) to control the specific wavelengths reaching the sensor, will permit the camera to record the actual spectral response of the subject's surface as recorded by each pixel. An additional advantage of a modified monochrome camera is improved imaging in the UVA and NIR because the CFA attenuates in these regions. Imaging is improved most significantly in the UVA region because the blue and green CFA filters and the pixel microlenses (removed with the CFA) absorb UVA strongly.

The MSI system at the Art Conservation Department at Buffalo State College employs a monochrome Canon EOS Rebel T3i (600D) DSLR camera modified by Maxmax.com. With its supplied Canon EOS Utility software, easy and convenient computer image capture control is permitted. For MSI work, the camera is used with a Coastal Optics UV-VIS-IR Apo 60mm Macro Nikon-mount lens with a Rayqual Nikon-to-Canon-EOS adapter. The lens is apochromatic from 315nm to 1100nm and thus requires no focus adjustment when imaging outside the visible region. This is extremely advantageous since this eliminates the image size changes that occur with focus shifts thus making perfect registration easy to achieve when stacking image sets or creating false-color images.

A set of fourteen Andover narrow bandpass filters is used to control the wavelength range reaching the lens. (Visible and IR filters are 10nm bandwidth; UVA filter is 25nm bandwidth.) The set consists of 25mm diameter filters with peak transmission wavelengths of: 365, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, and 1000 nanometers.

The filters are mounted in a computer controlled Finger Lakes

Instrumentation CFW-3-20 20-slot motorized filter wheel. The camera lens is positioned closely behind the filter slot opening to minimize vignetting.

The poster will describe and illustrate this MSI system. MSI images of various artifacts and false-color images made from selected MSI images will be presented along with commentary on how these images augment our understanding of the artifacts.

(48) Moulds on Photographic Techniques and Maps Stored: A Case of Study

Sofia Borrego, Chief of the Preventive Conservation Laboratory / Researcher and Preservation Specialist, National Archive of the Republic of Cuba and Alian Molina

Filamentous fungi—so called “mould”—are important agents of biodeterioration in documentary heritage stored in archives, libraries and museums. Fungi are able to live at low water activities; they are perfectly adapted to indoor environments and thrive in microclimatic niches caused by condensation, lack of ventilation or water retention by hygroscopic materials. Fungi spoil valuable documents mechanically, chemically, degradation of organic components and aesthetically. For these reasons, the aims of this research were to isolate the fungi on different photographic techniques and maps from XIX century, to identify the principal fungal genera and species and to determine the metabolic characteristics of the fungal strains detected to degrade the different compounds which composed the documents analyzed. For this study six photographic techniques and four maps without evidence of fungal affectation were analyzed. The photographic techniques were two tobacco leaves engraved, one poplar leaf engraved, one ferrotype, one glass negative and one photo in paper with albumin emulsion. The maps were two in paper support and two in textile support. The samples were performed from 1 cm² of surfaces of each document with sterile and wet swabs. The swabs were immersed in 1 mL of sterile distilled water and serial dilutions were made. The dilutions selected were inoculated on Petri dishes containing Malt Agar to isolate the fungi. The dishes were incubated and the fungal strains grown were isolated and identified. The cellulolytic, proteolytic and amylolytic activities and the production of acids and pigments of the fungal isolates were qualitatively determined. The different techniques of photos and maps are stored at low temperatures and relative humidity (about 21°C and 51%). They are kept clean and preserved in the furniture and in appropriate wrappers. However, the concentration of the fungi on photos ranged between 101 - 103 CFU/cm² besides on maps the concentration ranged between 101 and 102 CFU/cm². The predominant fungal genera on the all documents were *Aspergillus*, *Penicillium*, *Cladosporium*, *Eurotium* and yeast genera *Candida* was detected too. The 100% of the fungal strains isolated were capable of degrading cellulose and excrete acids. The protein and starch were degraded by 70% of the strains and some pigments were excreted by 50% of them. These results demonstrated that fungi are present on the documentaries materials even if they are clean and in good conservation conditions, so if the temperature and relative humidity increase sharply and remain high for several days the biodeterioration of these documents could start.

(49) Oil on Paper: New Challenges for Two Specialties

María Soledad Correa, Paper Conservator, Centro Nacional de Conservación y Restauración, Recoleta, Chile

Conservators of the Painting and Paper Conservation Laboratories from the Centro Nacional de Conservación y Restauración de Chile (CNCR) were faced for the first time with the challenge of treating two oil paintings on paper. Each specialty contributed their own expertise and experience. A multidisciplinary team (a conservation chemist, a photographer, and representatives from the owner institutions) headed by conservators from the two specialties, was assembled. The objective was to investigate the material properties of the objects, their historical context, their value, their uses, and the owners' and specialists' expectations. With the information gathered, intervention criteria and areas of study were established according to the needs of each particular case.

The oil painting *Portrait of Pilar Garfias del Fierro* painted by Raymond Monvoisin in 1844, is part of the permanent exhibition of the Museo Histórico Nacional (MHN) and was admitted to CNCR as medium size oil on canvas. During the identification process, it was discovered that the support was made of paper hidden under a protective layer of fabric attached to the back of the paper. The specialists were forced to consider specific issues posed by this technique. Given the lack of experience of the painting conservators with paper, the paper conservators were asked to collaborate, and a bibliographical search on the topic was carried out. Unfortunately the results were limited and inconclusive. This is the scenario in which the working team had to begin the intervention.

The structural stability of the object and the appropriate aesthetic reading of the image were compromised by the severe damage. The painting showed brittle support, severe distortions of the surface, missing areas, tears, inappropriate inpaintings, and a yellowish varnish. During the treatment many difficulties were faced, which led to a need to perform invasive treatments that had previously been dismissed.

During the development of the final stage of treatment, the Museo Nacional de Bellas Artes (MNBA) requested from the CNCR an urgent intervention for a small sized oil on paper, *Dido y Eneas*, painted by Ernst Kirchbach. After spending years in storage and with no attached historical information, this work was selected for exhibition in the near future. The painting showed surface dirt, significant missing areas, support distortions and a yellowish varnish. The experience with the *Portrait of Pilar Garfias del Fierro* became a fundamental starting point to meet this new challenge, which resulted in a different and successful treatment proposal.

The poor and outdated bibliographic information available and the unsuccessful attempts to contact professionals that had faced similar experiences, proved to be a major constraint in the development of the treatment. These issues are the main reason we wish to disseminate information on our experiences. We seek to encourage discussion and to provide support for those who face similar challenges.

(50) Changing Habits: From the Fumigation Chamber to IPM Practice

Ana Carolina Delgado Vieira, Research Specialist, Conservation & Restoration Area, Museu de Arqueologia e Etnologia – Universidade de São Paulo

In September 2012 the Conservation Laboratory staff of the Museu de Arqueologia e Etnologia (MAE / USP) in Sao Paulo, Brazil identified an initial moth infestation (*Tinea murariella* Staudinger, 1859) in the ethnographic collection. This unfortunate circumstance, despite the serious consequences, has opened a scenario of various "new" possibilities within the institution.

Like many others museums, the MAE / USP still owns a fumigation chamber acquired many years ago. This chamber until recently had been operated by museum staff using hazardous chemicals such as methyl bromide, ethylene oxide, carbon tetrachloride and phosphine. Despite of daily battles against insects, the museum staff was hesitant to stop using pesticides to rely on Integrated Pest Management principles.

However, in long ongoing discussions, the museum conservators were able to demonstrate that maintaining this practice would continue to cause considerable damage to the staff, the environment and the collection. Therefore, it would be legitimate to say, that this severe moth infestation was the primary catalyst to finally abolish toxic chemicals and look for alternative disinfection methods.

This poster describes the evolution from toxic to non-toxic pest control by means of anoxia nitrogen treatment. In addition to this recent approach, we report on how the institution is taking its first steps towards the implementation of an Integrated Pest Management Program to ensure the safeguarding of its collection.

(51) Conservation Challenges: The Art Museum of the Banco de la Republica of Colombia Reinstallation Project

Ingrid Frederick, Preventive Conservator, Banco De La Republica, Bogota, Colombia

The Art Museum of the Banco de la República of Colombia houses the most important public collection of modern and contemporary art of the country.

It was created in 1957, and today contains close to 5,000 artworks. The project of re-installation of the Permanent Collection, which currently exhibits near to 800 artworks in 2735 square meters, started three years ago and was opened at the end of June past.

This project implied a series of conservation challenges, which have been addressed since the planning of the project, both during and after its completion. It includes the criteria and decision-making processes, which have been reconsidered in order to ensure the preservation and enjoyment of these works exhibited to the public.

This presentation intends to show the experience of the re-installation of the museum galleries from the conservation perspective, and the implications in the negotiation of priorities among the curatorial and museography needs and intentions.

First, the number of works on exhibit tripled compared to the previous installation of the permanent collection; as a result, a great number of artworks needed to be prepared in order to “bring them to light”; in addition other works, already on exhibit, had to be revised and once again prepared. Furthermore, in regards to a number of special works, new exhibition ideas had to be reinvented or created, in order to mount them to walls and showcases. All these new requirements went along with the curatorial intentions of communication towards the public, which demanded “new” ways of looking at already-known artworks, in relation to the variety of techniques, materials and time period.

Another factor that implied a challenge in terms of conservation was the re-design of the exhibition spaces, which required the environmental conditions assessment and control of new areas and showcases.

In addition, the responses of conservation were transformed according to the inevitable changes occurred between the planning period and the real installation process, where the limited time and resource factors put to the test our capacity of reaction in diverse scenarios. Finally, we plan to present the challenges of after the installation giving the nature of this project.

(52) Tzauhtli, the ideal textile adhesive? A Natural Alternative to Adhesives used in Textile Restoration

Lilian García-Alonso, Professor and Materials Analyst, National School of Conservation ENCRyM; Lorena Román, Senior Textile Conservator, INAH; Rodrigo Buentello, Materials Professor at the National School of Conservation ENCRyM; Alejandra Corona, Professor of Textiles, National School of Conservation ENCRyM

Tzauhtli is a pre-Hispanic adhesive obtained from the mucilage contained in orchid bulbs. This was used in the center of Mesoamerica in the creation of feather mosaics, and later, during the colonial period as a binder for the production of corn stalk pulp used in making light figures of Christ, musical instruments and edible sugar figures.

Currently, working with Tzauhtli is almost unheard of, partly due to the complexity of the extraction of the material and also because the orchids that contain the mucilage are increasingly difficult to obtain and are often protected to prevent exploitation and possible extinction.

In 2002 in the textile conservation seminar and workshop at the ENCRyM, the senior conservator Lorena Román Torres worked on the conservation of a very significant feather mosaic from XVI century, the Cristo Salvador del Mundo from the National Museum of Viceroyalty. During the research process for the preservation of the piece, it was learned that the adhesive used in its creation was the orchid mucilage known as Tzauhtli. It was then found that despite the age of the piece and its natural aging process at all levels the adhesive remained unaltered. Through this, it was also discovered that the Tzauhtli was a natural and reversible adhesive, colorless, innocuous, non-toxic and due to its characteristics, compatible with natural fibers.

Lorena Román and her team continued to study the adhesive properties of Tzauhtli, and in recent years, remarkable progress

has been made: various species of orchids have been grown for extraction of mucilage and various methods of extraction have been performed. This year we have conducted tests such as spectrophotometry, hydrogen potential measurement, density, viscosity, surface tension, weathering, solubility, tensile strength, accelerated aging and yellowing tests, all these efforts to test the quality of the adhesive and to determine whether the Tzauhtli today can become the ideal alternative for the conservation of textiles, especially for highly deteriorated silks.

For the first time this poster presents for the first time to conservation specialists with the results of the tests carried out on the *Prosthechea citrina* adhesive applied to samples of silk. These complex and complete tests are rarely performed on an adhesive of this nature with the goal of identifying the best qualities of Tzauhtli as an adhesive for conservation. In addition, this study promotes the care and cultivation of the orchids and is intended to initiate collaboration with people dedicated to the growing of *Prosthechea citrina*. Through this cooperation, we will promote the use of organic materials for conservation and initiate a research with of other orchid species in combination with other materials for the Tzauhtli to be used in conservation of other materials such as wood, most textiles, paper and more.

(53) Collection Management against the Clock

Norma Juliana Jimenez, Conservator and Museologist, Museo De La Independencia – Casa Del Florero, Bogotá, Colombia

The Museum of Independence – Casa del Florero is a museum that focuses on the time of the Independence of Colombia, mainly from the second half of the 18th century until the present. The museum is located in the main square of Bogota, next to the President's Palace, the Major's Office, the Congress, the Palace of Justice, the Cathedral and several other public offices of the country. Some of the main topics of the museum are: Contexts of the independence from Spain, social actors involved in the independence, history of the house, consequences and legacies of this social movements, among others. Apart from that, there are at least three temporary exhibitions every year dealing with different themes that are related with the concepts of independence and citizenship.

The museum was created in 1960 by the Colombian Academy of History and donations from other museums and private collectors. Today, the museum's collection contains around 4,470 pieces (mainly historic documents, paintings, sculptures, drawings, photography, furniture and textiles).

The museum is located in a colonial house (recently restored) and some additions made in 1960 for the creation of the museum (more exhibition rooms and a garden).

For the commemoration of the bicentennial of the independence of Colombia, the museum was completely renovated; the building was restored, as well as the whole exhibition concept and design.

The renovation project was initially formulated for an 18 month period (including all preventive actions required to properly conserve the collection), but due to several bureaucratic, economical and political problems, the time was reduced to 3 months.

During this short time, we had to document the entire collection for the registrar (photographs, conservation status, general maintenance of all parts and conservation actions on some parts etc.), design and order manufacture of all the boxes and special conservation units for the move and storage of the collection during the renovation, and finally, pack everything to move to a remote location that fulfilled all conservation and security requirements.

I want to share my experience during this difficult process, highlighting all the quick and practical conservation decisions that had to be made in record time in order to move all the collection before they started the renovation work on the house. I would like to point out the problems, things to be avoided, remedial processes and recommendations for future projects of the same characteristics.

In short, I want to share the best practices followed by the museum even at times when time and reality go against ideal procedures, effectiveness and even common sense.

(54) Analysis of Decay Rates of Paper Samples Naturally Exposed in Library Environments in a Subtropical Location

Eduardo Krüger, Associate Professor, Technological University of Paraná; and Clara Fritoli

Several environmental factors affect paper degradation. Air temperature and relative humidity are among the most important. Under inadequately controlled environmental conditions they can trigger biological, chemical, and physical processes which can accelerate degradation. The goal of this study was to investigate how different cyclical (24 hour cycles) and seasonal variations in air temperature and relative humidity affect paper degradation; it also tried to determine which climatic conditions contribute to greater rates of degradation. In the study, two types of paper were exposed to different natural microclimate conditions, indoors and outdoors, at two university libraries. One of the libraries is located in Curitiba, Brazil (25° 30' S, 49° 20' W, 910m above mean sea level) and the other is located in Caiobá, Brazil (25° 49' 03" S, 48° 32' 34" W, on the sea coast). The period of natural aging was 24 months (July 2010 - July 2012), with a mid-term data collection. Microclimate data were recorded at 1 hour intervals, with data loggers. The paper samples were placed in ventilated acrylic boxes (41x41x16cm, 4mm thickness). The acrylic had a UV filter coating (to control light exposure) and the box was provided with charcoal filters (to control exposure to pollutants). The rationale was to limit the environmental impact on the paper samples almost exclusively to air temperature and relative humidity. The box was used indoors and outdoors; the outdoors box was placed in a Stevenson screen, as used in standard meteorological stations. The theoretical indices PI (Permanence Index) and TWPI (Time Weighted Preservation Index), which quantify the effects of temperature and relative humidity on paper life expectancy were used for comparison with observed degradation rates in the lab. For this, chemical tests were performed to measure viscosity and pH. The results of the chemical tests correlated well with the theoretical TWPI predictions.

(55) Small Island Realities: The Good, the Bad and the Ugly of Conservation and Collections Management Practices in Barbados

Nerys Rudder, Collections Manager (Self Employed)/ Object Conservation Student, the Blue Road Art and Design Consultancy, Barbados / Cardiff University, United Kingdom, St. Andrew, Barbados

This poster will highlight the environmental, economic and social costs and benefits of practicing interventive and preventive conservation and collections management in the Caribbean with real world examples highlighted in Barbados.

Small island developing states have particular needs, restrictions and social obligations that may not be applicable to larger countries. Lack of funding and research and networking opportunities, as well as locality and shipping costs all impact on collection management practice. Identifying, communicating and addressing these issues not only assists practitioners within these regions but also helps to contextually place these concerns for the profession as a whole. Subjects to be addressed will include:

- Lack of maintenance programmes for outdoor sculpture and the knock-on financial affects (The bronze statues of Karl Brodthagen)
- Effect of elevated light, rh and temperature and the costs of controlled environments (Air conditioned stores versus cross ventilation)
- Obtaining archival material for treatment and storage (Cost effective medium term storage of paintings)
- The consequences of pests infestations and chemical deterrents (Non-existent COSHH and Health and Safety in the Caribbean)
- Benefits of social media and public education programmes (the National Art Gallery Project Education programme)
- Local supplies and practices that cut down on transport/energy/economic costs (Macgyver conservation that cuts costs but not corners).

(56) Preventive Conservation of Ensembles: Moorish Pavilion and Collections at Fundação Oswaldo Cruz

Carla Maria Teixeira Coelho, Architect, Fundação Oswaldo Cruz, Rio de Janeiro, Brazil

Fundação Oswaldo Cruz (Fiocruz) is an institution linked to Brazil's Health Ministry, created in 1900 with the goal of fighting the great problems in the Brazilian public health care system. Its headquarters are located in the neighbourhood of Manguinhos, in the north zone of Rio de Janeiro.

The Moorish Pavilion, headquarters of Fiocruz, was built between 1905 and 1918 to house the activities of the institution (laboratories, library, museum and offices). Listed by Instituto do Patrimônio Histórico e Artístico Nacional as a Brazilian architecture treasure, the building follows the trend of architectural composition of the late 19th and early 20th century in Brazil - Eclecticism - revealing influences of Moorish architecture. It is

located high on the slopes of the terrain of the institution, next to Guanabara Bay and to Avenida Brasil – pathway that receives daily a very large number of vehicles crossing the city. The city of Rio de Janeiro has a tropical climate, with averages around 80% of relative humidity and temperature of 24°C.

The building houses important collections, such as the Rare Books Section of the Biomedical Sciences Library (about 40.000 volumes of works in the areas of natural history, biological sciences, medicine and public health, published between the 17th and 20th centuries); the Entomological Collection (approximately 5 million insects collected since 1901 by the first scientists of the institution); and part of the Museological Collection (laboratory equipment and scientific objects). The combination of the building and the collections housed in it make for an interesting example for reflection on how to act to improve the conditions of the set in a balanced manner, arising from a concern for the coexistence of historic structures and the artifacts within them as defined by the New Orleans Charter.

In the 1990s, a chilled water air conditioning system was installed in part of the building. Fifteen years after deinstallation of the HVAC system a preliminary assessment indicated conservation problems in the building and the collections, and human comfort issues. In order to improve the preventive strategies related to the conservation of the ensemble, and to support the renewal of the HVAC system, a multidisciplinary team carried out a conservation assessment of the building and the collections. The work was based on the methodology developed by the Getty Conservation Institute and previously used in other Brazilian institutions, which proposes an integrated analysis of the macro-climate, the building, the collections and organizational aspects influencing their preservation.

The research included the development of diagnostic conservation of the building and collections, environmental monitoring and assessment of areas of custody holdings and the establishment of conservation strategies. This work aims to present the results of this research and its consequences. The information collected is being used to support sustainable actions regarding the building and the collections, such as the development of a preventive conservation plan; and the design of a new HVAC system, less intrusive to the building and appropriate for the collections.

(57) Conservation of Special Collections - Ludwig von Mises Library, Guatemala

Marisol Zuniga Lau, Collections Coordinator, Ludwig von Mises Library, Guatemala City, Guatemala

The Ludwig von Mises Library at the Universidad Francisco Marroquín in Guatemala City has a special collections room named José Cecilio de el Valle. The collections are available to students, teachers and researchers, and national and foreign visitors upon written request. Those who consult the collections must comply with the regulations of the library; the materials may be viewed exclusively inside the collections room, where backpacks, bags, briefcases, meals, drinks, pens, notebooks are not allowed, and with paper and pencil for notes provided by staff. Photocopying and flash photography are not permitted. The person in charge of the room accompanies patrons entering to

consult materials at all times.

The following collections that were donated to the library from the families of important people are available for viewing in the collections room:

- José Cecilio del Valle collection: Contains 1,800 published books dating from the 16th to the 19th century. Included are the main liberal economists, classics, books about law, religion, literature, social sciences, in English, Spanish, French, Latin, Greek, and Italian. Each volume is important both for its content and for the beauty of the bindings of the time, the illustrations and the typographic arts employed in printing. The Lexicon Graecolatium of Coradum Gefnerum and Arnoldum, Arlenius, is the oldest in this collection, dated 1548. A copy of the first Universal Encyclopedia of Denis Diderot and Jean ALEMBERT, 1782-1783 is also part of this collection.
- William H. Hutt collection: Hutt was a very important, Neo-Keynesian economist. His collection contains 543 books, including writings by Keynes, and most of the books have his own annotations.
- Carlos W. Elmenhorst collection: Elmenhorst was a collector of maps and books of travelers by Mesoamerica. The collection consists of 593 books. The maps are displayed on exhibition in the library. The collection includes books of cartography, geography, history and stories of voyages of exploration in the Mesoamerican region.

In consideration of the age of books and its historical value, special measures have been taken to conserve them. The room is designed for storing these collections with special shelves and doors that allow the air circulation in the collections. There is also air conditioning and continuous monitoring of the humidity and temperature. We applied preventive conservation to very damaged books housing them inside acid-free boxes. All the materials that were use are designed for conservation. Every year we receive advice from specialists, who work for the restoration and care of the collections of ancient books.

In 2008, the library launched an agreement with the Internet Archive. We are in the process of digitizing the books about Guatemala and Central America history. The oldest book that has been digitized dates to 1619. Currently the digitized books are available to researchers, students and anyone who wants to consult the materials on the site www.archive.org.

(58) Investigation into Microclimates within Storage Boxes of Archival Records

Hannah Clare, Conservation Manager – Research & Development, The National Archives, UK; Rachel Farmer, Trainee Preventive Conservator, the Heritage Lottery Fund's 'Skills for the Future' Programme; Kostas Ntanos, Conservation Science Manager, The National Archives (UK)

The National Archives (TNA) is the official archives of the UK government. It holds almost 1000 years of recorded history at its site in Kew, London. The collection is stored in 15 repositories, the three main ones are in the 1978 building referred to as Q1; 12 are in the 1996 Q2 building. The larger Q1 repositories are comprised of open plan areas of approximately 6500 square meters

each. The environment in this space is controlled by a vast air conditioning (HVAC) system which is both complicated and increasingly costly to operate and maintain.

As part of the move towards sustainable heritage management The National Archives has switched its environmental control to a pattern following seasonal drift. This allows the humidity and temperature set points within the repositories to increase in summer and decrease in winter, which has resulted in significant reduction in the amount of energy needed to control the repository environment. As part of this change it was decided that more investigation into the microclimates within the storage boxes was needed to ensure that the humidity levels were still acceptable. Previous experiments had raised concerns that the hysteresis effect combined with fluctuations in humidity could lead to a slow increase in humidity within the boxes.

This project aimed to investigate whether ambient RH fluctuating above the set point, gradually drives the RH inside boxes higher, which will have implications in the implementation of seasonally adjusted set points.

Boxes containing sample archive material and data loggers were placed inside an environmental chamber and the humidity increased and decreased according to a predetermined pattern to establish how the microclimate inside the boxes reacted. The first experiment examined the result of RH rising by 20% for 48h and returning to set point for 48h before repeating the cycle. In the second experiment an oscillating pattern of RH that overall followed the annual seasonal drift was applied. The third RH pattern fluctuated between various points cycling between long periods at a high humidity and shorter periods at a lower humidity. The boxes were tested individually and then stacked tightly together to mimic their condition on the shelves in the repository.

This project is on-going and part of a wider programme of work at The National Archives, which aims to improve preservation environments in storage, whilst meeting Government sustainability targets. This poster will report on the findings of the initial 3 cycles of experiments, which will influence the focus of future investigation. The project was undertaken by a 'Skills for the Future' Preventive Conservation Trainee. The 'Skills for the Future' programme is funded by the Heritage Lottery Fund, a UK funding body, and lasted for 18 months based at The National Archives and The Tate.

(59) The Restoration of a Roman Urn with Free Running Erbium: YAG Laser, at 2.94µm: Science in the Service of Art

Adele DeCruz, Professor, Duke University; Alessia Andreotti, Researcher, University of Pisa, Italy

The cleaning of a Roman funerary urn, 67-100 CE: Acquired by the St. Louis Art Museum in 1922, and never exhibited because of the intractable encrustation on the surface of the marble was sent to the conservation laboratory at Duke University for cleaning with the free running Erbium: YAG laser at 2.94µm. During the testing it was discovered that the encrustation was a combination of organic materials, which over the millennia had transformed to oxalates.

The Roman Cinerary urn was incrustated with an intractable layer of calcite that covered the decorative area of the body of the marble surface. None of the traditional conservation methods for cleaning the surface was effective in removing the dark crystal structure.

In a number of areas located over the surface of the urn, round or oval black fungi nests had eaten in to the marble. Laser ablation was able to remove these nests and follow into the stone to remove the embedded fungi. A bright white flash of black-body light occurred during the ablation process that is a reaction to Er:YAG laser ablation of the thick cell wall of the fungi, which are comprised of long chain polysaccharides that are made up of many C-OH bonds

A literature review of Roman burial customs gave an indication that the encrustation on the marble surface was caused by the oxidation of organic materials that were applied to the surface of the urn on the anniversary of the death of the person whose ashes were interred in the urn. The intent of these rituals was to assure abundance in the afterlife.

The Er:YAG laser at 2.94µm in the mid-infrared corresponds to a strong absorption peak in the infrared spectra of OH- or NH-containing organic molecules. The energy of photons at this wavelength excites bond vibrational stretching mode. Any substance containing a high concentration of -OH bonds at its surface has a strong affinity for photons at 2.94µm, and confines the absorption of these photons to a surface depth of no more than a few microns. An object's organic contaminant, which either contains the --OH bonds or has been treated with a thin liquid film (water, alcohol, -NH) immediately before lasing, acts as a stain of relatively high concentration and very high absorption, providing a natural barrier to energy penetration into underlying layers. Laser ablation offers a gradual, homogeneous, cleaning which enables the conservator to complete the cleaning using mild solvent mixture, which in themselves are not effective in removing the encrusted materials.

Raman, Scanning Electron Microscope, Gas Chromatographic Mass Spectrometric, Emission Spectroscopy are analytic techniques used to identify the degraded materials as well as marble structure.

(60) Mitigating and Containing Damage during Emergency Clean-up: Protocols, Guidelines, Standards and Regulations

Karen H. Kahn, Art and Environmental Restoration Consultant

Last fall, Hurricane Sandy hit the East Coast with devastating effects. Not only did it destroy lives and livelihoods of people who lived and worked in its path, it destroyed or severely damaged buildings and their contents, including valuable art and collectables. Millions were uninsured or under-insured for the damage which ensued. Hurricane Sandy had particular impact on the New York City art community: its galleries, museums, private collectors and artists. Owners and occupants of damaged properties, and volunteer helpers, were faced with the daunting task of salvage and recovery.

While art organizations, foundations, restorers, museums, and patrons of the arts rallied to support the art community, offering

space where art could be stored, stabilized, evaluated and cleaned, few knew where to begin, the guidelines to follow, the hazards that would likely be present and the steps needed to be taken to avoid harmful exposures and the significant risk of cross-contamination to areas outside of the damage. Potential contaminants in buildings which have experienced floods are mold, lead and asbestos found on interior building materials and pesticides where crawls paces and basements have been impacted. Objects of art in flooded buildings may also contain a variety of harmful chemicals which, when in contact with water, may create potential hazards to salvage and recovery teams, and to the restorers of the art who are unaware and uninformed of their potential hazardous exposures.

Guidelines published by public and private agencies related to disaster clean-up are oversimplified, often misleading and uninformative; they do not adequately address the hazards of the emergency response, nor the danger that removal, transport and storage of impacted property will contaminate otherwise clean environments and unknowingly expose people to microbial and chemical hazards.

This paper will take a critical look at the guidelines available to owners, insurers, volunteers, art conservators/restorers and contractors involved in the clean-up of disasters from agencies such as FEMA, the Red Cross and Studio Protector. These guidelines will be compared to industry standards of care for mitigation and restoration of flooded buildings published by the International Institute for Cleaning and Restoration Certification (S500 and S520) and regulations of NIOSH and OSHA.

An immediate hands-on approach to salvaging buildings and works of art may be unavoidable in the aftermath of a disaster, but those involved in such activities should still be able to identify the types of materials likely to be hazardous, know the basics of handling contaminated materials and the minimum precautions which need to be taken to protect art, building structures and human health.

State of the art guidelines and protocols should be in place to provide adequate assurance that restoration of buildings and works of art proceed in such a way as to better mitigate and contain contaminants during disaster clean-up. An essential first step to developing informed guidelines and protocols is by understanding the strengths and deficiencies of the available published reference materials.

(61) The IMAT: A New Performance Tool for Heat Transfer and Innovative Applications for Art Conservation

Nina Olsson, Nina Olsson Art Conservation, LLC, Portland, OR; Tomas Markevicius, Tomas Markevicius Restoration Center, Vilnius, Lithuania; Kate Seymour, Head of Education, Stichting Restauratie Atelier Limburg, Rue Ceramique, Maastricht, Netherlands; Laura Amorosi, Via del Moro, Florence, Italy; Lorenzo Conti, Borgo delgi Albizi, Florence, Italy; Erika Borovikovaite, Chief Conservator, Lietuvos Dailės muziejus - P. Gudyno Restauravimo Centras, Rūdninkų g. 8, Vilnius, Lithuania; Helmut Meyer, CEO, THM Nano, In der Follmühle, Odenthal, Germany; Rocco Furferi, Assistant Professor,

Department of Industrial Engineering, University of Florence, Italy

The creation of new improved conservation materials and sophisticated instrumentation is of fundamental importance in the advancement of the best practices in the field of art conservation. Yet the tools currently available to conservators for heat transfer, an essential element for success in most structural treatments of paintings, works on paper, textiles and other cultural heritage assets, has remained relatively unchanged in recent decades.

The Intelligent Mobile Multipurpose Accurate Thermo-Electrical Device (IMAT) Research Project (2011-2014), now at mid term, responds to this oversight, filling a critical gap in the conservator's toolbox for an instrument that provides accuracy, selectivity and portability when application of heat is required.

The IMAT Project has advanced cutting edge technology of carbon nanotubes while designing a series of innovative, state-of-the-art precision instruments for mild heating, designed specifically for art conservation, in the form of ultra thin profile, lightweight, flexible, transparent and breathable mats. The heat source in the laminated mats is a carbon nanotube film, custom-designed to perform within the conservation field's operational parameters by nanotechnologists in the project consortium. The mats are driven by a programmable mobile touch screen console, also custom designed by the project, that gives the operator unprecedented control over the temperature and heating cycle, and allows the conservator to achieve a more nuanced and customized heating treatment that corresponds better to the current demands of our field. Although the IMAT is designed to provide uniquely uniform and steady heat up to the temperatures customarily required to activate thermoplastic conservation materials, of particular interest is the unsurpassed accuracy of the device at low temperature ranges (75°-125°F/24°-52°C), opening new possibilities in treatment methodology. Breathable mats have been designed to permit the migration of vapors and airflow so often used in combination with mild heating in treatments.

The portability and low energy consumption make the IMAT an ideal multi-use instrument for work both in the field and in the laboratory, indispensable for *in situ* treatment, treatment of large-scale works, work in locations with limited power capability, in areas of limited access or in emergency response conditions. In addition, an important goal of the project is to provide a performance tool that is also cost accessible.

The core of the project's consortium is formed by art conservators, who have been involved during the design, development and field-testing phases so as to gain the best insight into design improvements, to optimize the range of potential applications of the IMAT and to formulate new conservation methodology associated with the new technology. The paper will include case studies of innovative applications of the IMAT in treatments by the consortium's field-testing partners.

Several examples of the IMAT will be available for conference participants to review in person.

(62) Conservation Treatment of Large Books with Colored Illustrations; Or, Can We Wait For The Magic Bullet?

Bill Minter, Book Conservator in Private Practice

Books with fine art illustrations are the ultimate challenge for the book conservator. Some books, such as Audubon's *Birds of America*, are routinely disbound and the plates are housed individually for preservation. Other books with illustrations and related text must however remain intact. As the paper and the bindings in these volumes continue to deteriorate, there is a need to preserve all of the materials in a sound manner. This is the case with John Gould's 1837 set of the *Birds of Europe*. For this book, the structural problems were addressed in a unique manner with a new cloth inner hinge secured with thread in the form of a staple; additionally a set of special lightweight boxes were constructed to rehouse these large and heavy leather volumes. The real question, however, is a consideration of near-future treatment to slow the deterioration of the paper in these magnificent volumes: from a casual observation, the paper is already getting brittle. Treatment options will be considered and discussed.

(63) Recovery and Discovery: A New Look at an Old Pot

Katie Belton, Pre-Program Intern, Arizona State Museum; Dr. Werner Zimmt, Museum Fellow, and Dr. Nancy Odegaard, Lead Conservator, Conservation Laboratory, Arizona State Museum

Pothunters in the Southwest have a long history of pillaging archaeological sites in search of treasure. In the process, it is not uncommon for pots to break and the pieces to be crudely reassembled with adhesives. Reassembly often results in left over rubber bands and staining from tape residues. Frequently, these artifacts end up in boxes as record-less sherds and partially reconstructed vessels. This project began with one box provided by the Arizona State Attorney General's office where it had been intended for use in a law enforcement sting, or a carefully planned operation involving deception.

This poster illustrates the conservation treatment of an indented, corrugated Mogollon jar, which arrived in a box with 128 sherds at various stages of reassembly. The sherds were completely covered with masking tape and excess polyvinyl acetate emulsion adhesive (probably Elmer's white glue). The vessel, dating between 1150 and 1300 CE, comes from an ephemeral period in northern Mogollon culture when large, brownware vessels with all-over indented corrugation were characteristic. These vessels vanish from the archeological record by 1400, and we have yet to understand why.

The conservation treatment began with removal of the masking tape. Volunteers worked to carefully remove the upper layers of tape using tweezers. With some of the sherds revealed, several were selected to study their magnetism, to distinguish among sherds belonging to the main pot and those from different vessels. Analysis using FTIR was performed to further characterize the tape residue that had severely stained the ceramic, as well as to characterize the adhesive that was generously used to reconstruct portions of the vessel. Solvents were selected to remove the residues. Finally, the vessel was reconstructed.

(64) New Approaches in Comprehensive Mold Remediation & Recovery

Elise Yvonne Rousseau, Principal Conservator Textiles, Historic Objects & Decorative Arts, Art Conservation de Rigueur et Anoxia Abatement Solutions

This poster will follow several extensive treatment case studies of 17th & 18th c. Baroque and Rococo Italian Furniture, Decorative Arts, and Painting collections to exemplify how conservators can identify and recognize when active fungal-microbial, bacterial-microorganism and concomitant pest infestations are occurring. Collections today are ever more under the threat of Climate Change with seasonal temperature and humidity spikes and associated events such as floods, hurricanes, and wild fires. What are the specific protocols for the implementation of disaster preparedness, remediation and recovery of contaminated collections and storage facilities. How to approach contamination in mixed storage collections. New practical and efficient strategies in conservation science approaches and treatment recommendations for successful remediation and recovery, necessary materials and supplies will be explained in thoughtful detail.

Beginning with a basic fundamental outline of what bioaerosols, fungi, bacteria, mycotoxins, volatile organic compounds and microbial microorganisms are, and how they affect indoor environments? What are the potential hazards and consequences impacting various collections, materials and human health from direct contact, handling and treating objects? Delineating protocols for personal protection equipment, so that both staff and volunteers can protect their respiratory and pulmonary health. Identifying the particular species strain is an important initial step.

Discussing options for methods of accurate testing and sampling, such as ATP bioluminescence rapid hygiene swabbing, petri dish culturing, tape lifting and airborne sampling for colony forming unit counts (CFU's). The resulting lab data from the mycelium, hyphae and spore counts can accurately identified harmful molds species, such as: *Aspergillus*, *Alternaria*, *Cladosporium*, *Penicillium*, and *Stachybotrys*. Understanding the biological science of mycelium branching, germination and spore blooming cycles is imperative to prevent reinfestation or cross contamination.

How to stage quarantine and isolation work spaces that segregate dirty to clean treatment operations. Establishing the "New and Next Generation" appropriate baselines for dehumidifying, dehydration, dry vacuum flash freezing, CO2 anoxia oxygen deprivation tenting, non-contaminant transfer hepa-vacuuming procedures, surface cleaning, antiseptic disinfecting solutions for topical surface cleaning and clean storage encapsulation. Also, what are the least invasive treatment procedures for drying and blotting.

Materials and supplies needed to carry out remediation and recovery, or how to decide which "used" storage materials can be salvaged, or must be discarded. What precautions must be taken to prevent infestation from exacerbating, or worse, spreading to other objects in the collections, storage and exhibits. How not to take the contamination home with you!

Mold, microbial microorganisms and pests must be addressed as contaminants, a contagion that has the potential for ongoing damaging life-cycles widespread throughout collections. Handling

any seemingly minor situation properly is imperative, so as not to wind up with an expensive emergency to clean up later. Appropriate treatment programs for effective assurance that mold/mycelium cellular structures have fractured and cannot reproduce is a mandate to be followed in a most exacting manner. Preventative conservation planning cost little in comparison to the expense of disaster recovery and potential health hazards that will ensue from a fungal infestation passively allowed to proliferate.

(65) Photoshop® Assisted Spectroscopy – An Economical and Non-Destructive Method for Tracking Color Shift

Kristi Wright, Contract Conservator, National Library of Medicine, National Institutes of Health Department of Health and Human Services; Holly Herro, Conservator, National Library of Medicine, National Institutes of Health Department of Health and Human Services

Color shift in fugitive media and media substrates is a conservation concern across several disciplines. Established methods for predicting the degree to which a medium is sensitive in a given environment may require expensive equipment and cause damage to the object being tested. As the result of a multi-phase study to (a) determine the chemistry of ballpoint pen ink; (b) identify the extent of ballpoint pen ink color shift as a result of light damage and oxidation; and (c) safely re-house the original research of the National Institutes of Health's first Nobel Laureate Dr. Marshall Nirenberg, the conservation staff at the National Library of Medicine have developed Photoshop® Assisted Spectroscopy.

Photoshop® Assisted Spectroscopy is a non-destructive method for tracking color shift using only a scanner and an image processing program such as Adobe Photoshop®. It is a relatively simple method that could potentially be incorporated into conservation documentation and digitization procedures across disciplines. While it does not predict color shift on an object, it assists in monitoring and provides valuable condition information to collection custodians. When properly executed, this method can detect color shift before it becomes visible to the human eye. The poster will demonstrate the Photoshop® Assisted Spectroscopy methodology and provide a summary of how the methodology was used to determine an appropriate re-housing environment for Dr. Nirenberg's research.

(66) Infrared Fluorescence Analyses of Louise Herreshoff's Paintings in Relation to CdS Degradation Issues

Samuel Florescu, Riley Hampsch, Erich S. Uffelman, Patricia A. Hobbs, Jennifer L. Mass

Cadmium yellow (cadmium sulfide, CdS) degradation is a significant problem causing conservation and treatment issues in turn-of-the-twentieth-century paintings by such notable artists as Henri Matisse, Edvard Munch, and Georges Seurat. These issues include fading, discoloration, flaking, and spalling of the affected paint layers.

Louise Herreshoff Eaton (1876-1967) was an American

painter who was receiving commissions by the age of nineteen and continued working until 1928, when the death of her Aunt Lizzie caused her to abruptly stop painting. Herreshoff studied art in Providence, RI, with Mary C. Wheeler and then travelled to Europe to make the grand tour. She studied painting in Paris, first under Wheeler, and then under Raphael Collin. She also studied under Jean-Paul Laurens at the Ladies Academy of the Julian. By her mid-twenties, her paintings were accepted for international exhibition in both the Paris Salon (1900 and 1903) and at the National Academy of Design (1900) in New York. Her paintings, nearly all of which are in the University Collections of Art and History at Washington and Lee University, were rediscovered by the world at large in a 1976 exhibit at the Corcoran Gallery of Art in Washington, DC.

Because she quit painting precipitously and subsequently stored her paintings in her attic, her paintings present unusual condition issues. Many of her paintings have been exposed to far less light during their lifetimes than those created by Henri Matisse and his early modernist contemporaries. Consequently Herreshoff's colors are, for the most part, still bold and vivid. However, due to poor humidity and temperature control for several decades, and due to some aspects of her technique, several of the paintings are exhibiting significant paint adhesion problems (including flaking, spalling, and cracking). Given that many of the paintings need conservation treatment, and given W&L's participation in the international team of scholars led by Dr. Jennifer Mass (spearheaded by the Barnes Foundation, the Lenfest Foundation, the Winterthur Museum, and the University of Delaware) who are studying cadmium yellow photo-oxidative degradation, the Herreshoff paintings have become increasingly interesting in terms of their state of preservation relative to paintings by Matisse, Van Gogh, Munch, and others. Thus, we have already reported a study of the paintings by portable X-ray Fluorescence Spectroscopy (pXRF) in Applied Physics A.

Here, we report preliminary studies of the Herreshoff paintings employing UV-induced IR fluorescence. This methodology is simple to execute, because all that is needed is a source of UV illumination at approximately 365 nm, and a digital camera with its IR-blocking filter removed and a visible light-blocking filter attached. The poster will correlate CdS-containing regions of the paintings determined by pXRF with the UV-induced IR fluorescence work to attempt to show possible qualitative pigment degradation status in the fluorescence intensity, as has been proposed by Van der Snickt et al. The Lenfest Foundation has been crucial in supporting the multi-institutional collaborations involved in this work and in encouraging undergraduate participation in the projects.

(67) Hand-colored Photographs: History, Identification and Research

Janka Križanová, Research Scholar in Photograph Conservation, The Metropolitan Museum of Art

When first introduced in 1839, the daguerreotype process was admired for its definition, clarity and beauty, but it was also criticized for its lack of color. The Swiss painter, printer and daguerreotypist Johan Baptist Isenring introduced the first hand-colored daguerreotypes in 1841. From this early date in the history to the 1960's, many new monochrome photographic processes were introduced. When color photography became the dominant photographic medium in

the 1960's, hand coloring of monochrome photographs diminished to become a method of image modification used by only a few photographers. After their first introduction, each of these monochrome processes (salted paper, albumen, collodion, gelatin, platinum, and so on) were made available in hand-colored or overpainted forms. That satisfied, at least partially, the desire of a photography-loving public to have color in photographs. Many major photograph studios employed full-time or part-time colorists, and coloring of photographs become an important part of the photograph industry. Photographic supply houses started to offer coloring sets, and a number of photograph coloring guidebooks, manuals and articles were published in the photographic literature. Techniques of color application differed between photographic processes and coloring media also changed from natural pigments and dyes to fugitive aniline colors to modern and highly stable organic pigments and dyes. As a result of all these changes in photographic processes and coloring materials, many of today's Slovakian museum photograph collections contain a certain number hand-colored photographs that are usually stored and exhibited together with other photographs, but that may have very different light stability compared with standard monochrome images. To develop a modern methodology for long-term storage, exhibition and conservation treatment of hand-colored photographs, we have to be able to identify not only the underlying photographic process, but also the chemical nature of colorants and binders used.

One part of non-destructive research involves closer examination of 19th and 20th century hand-colored photographs. Non-destructive XRF and FTIR analysis reveals the composition of applied coloring media. Augmenting this investigation of the photographs themselves is the cataloging, examination and analysis of original 19th and 20th century coloring sets. Reference sets were created using historic coloring pallets on different photographic processes for analytical comparison with original hand colored photographs. These sets were created under the supervision of Dusan Stulik in the laboratories of the Getty Conservation Institute.

(68) A Lesson Learned from Lucy: An Alternate Format for the Loan Condition Report

Ronald Harvey, Conservator/Principal, Tuckerbrook Conservation LLC; Dr. Nancy Odegaard, Dr. Vicki Cassman, Sofia I. Barron

Lucy, also known as AL 288-1, included several hundred pieces of bone representing about 40% of the skeleton of a female *Australopithecus afarensis* that was discovered in 1974 at Hadar in the Awash Valley of Ethiopia. The complex fossil comprised of 76 individual pieces was the star of a recent 5-year traveling exhibit. The fossil elements required condition documentation at every venue. Information that could be easily, efficiently, and accurately, compared by the conservator, registrar and collection specialist was needed prior to each installation and de-installation as well as during packing and unpacking.

It was obvious during the original assessment that the cumbersome and interpretative nature of traditional written documentation would limit an accurate assessment of each element in the collection due to the complexity of language and allowance of time.

High resolution digital photographs, taken during the first assessment, followed by annotations consisting of key words and color coded lines to highlight details of condition were added to the digital photographs using Photoshop. When used for condition reporting, the photographs, viewed on a laptop, provided views of the individual fossil annotated elements. Zoom capability was used to review details that were of particular concern.

(69) Thermally and Photochemically Re-Workable Epoxy Adhesives for Use in Artifact Repair

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Polymeric adhesives such as acrylics and epoxies are commonly used for the reconstruction and repair of ceramic and glass artifacts. Currently used epoxies have superior strength but are non-reversible after they have cured, making any important structural artifact corrections impossible. We have therefore tailored two separate epoxies. One is reversible by administering heat and the other by ultra violet light, transforming the cured epoxy from the solid to the liquid state so that it can be removed without adverse effects. This quality of reversibility utilizes the desirable mechanical properties of epoxies and adapts them to benefit the conservation community as a new application. The purpose of this project is to study the chemical, mechanical, and working properties of such epoxies specifically in relation to their use on artifacts.

Our approach was to incorporate Diels-Alder thermal weak-links or coumarin dimer photochemical weak-links into epoxy resin. At a given temperature or given wavelength, these weak links sever to convert a solid epoxy into liquid, a process which can be reversed to form a solid epoxy again. Such bonds provide the potential for re-workability and removal if necessary. The cured epoxies were tested for mechanical tensile strength using an MTS Criterion Electromechanical testing system and the ASTM D1002-10 standard. Chemical properties of the epoxies were fully characterized via NMR, ATR-FTIR spectroscopy, HR-MS spectroscopy, TGA, and MDSC analysis, and the curing properties optimized using four commercial hardeners. All ceramic substrates were characterized prior to epoxy application using xeroradiography, SEM, water contact angle analysis, and boiling water analysis (ASTM C20-00, 2010) to understand porosity, pore distribution, and wetting abilities. We investigated the practical properties of these thermally re-workable epoxy adhesives for use on glass and ceramic artifacts by collaborating with conservators at the Arizona State Museum and reworking cured epoxy material. Through such tests we were able to show that these adhesives can be easily re-worked and act as a useful new tool for object conservation.

(70) Criteria for Assessing the Preservation State of a Heritage Site on Snow Hill Island, Antarctica

Gabriela Ammirati, J.B. Ambrosetti Ethnographic Museum, School of Philosophy and Literature, Buenos Aires University, Buenos Aires, Argentina

The goal of this work is to present an integral approach to the evaluation of the preservation state of a heritage site as part of a bigger context (geographical, environmental, historical, etc.).

In this framework, the author presents the tasks performed to determine the conservation status of the hut used by the Swedish expedition led by Otto Nordenskjöld in early 1902 until late 1903, located at Snow Hill Island, in the Antarctic Continent.

This cabin was brought disassembled by the expedition members, and was reassembled at the site in order to function as a shelter during the investigations. Later, it was abandoned. Since 1979, Argentina, with support from Sweden, became involved in the preservation, restoration and maintenance of this heritage site.

In January and February of 2013, an evaluation was made of the conservation state of this hut, based on theoretical and methodological criteria that contemplate that a heritage site, in this case an immovable heritage asset, cannot be taken as a single entity, isolated or static.

In principle it should be noted that the object of our study has a history of original use and another of historical subsequent uses. Once this object has been studied, it will be possible to understand the changes that may have had suffer through time, changes that could manifest themselves in the preservation state.

These changes may be due to human interventions made during the original use, the interventions made after use, or the modern preservation and restoration works.

In this analysis we have considered use of this site at the present time and in the future. This use and its consequences must be taken in consideration during future preservation activities.

Another topic to be considered is the construction materials and the manufacture techniques of the heritage asset. It should put the focus of the study in the deterioration state of this materials and the manufacture, to determine what problems could derive of at the present time and in the future, and how it could affect the preservation of the asset.

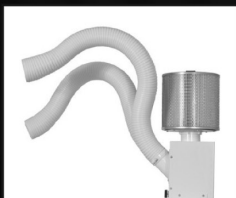
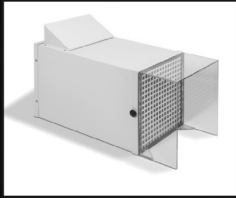
Finally, it is of great importance to contextualize this heritage with the environment where is located. It is necessary to understand the surrounding environment, how it affects the preservation state now, and how this environment can change in the short, medium and long term; ultimately how the changes will influence the state of the cultural heritage in time.

It is important to stress that these analytical approaches, although can be taken separately, are interrelated and complementary.

The preservation state evaluation of a cultural heritage asset based on this theoretical approach will firstly be able to provide more trustworthy data, taking into account the multiplicity of possible deterioration causes—in the past, present and future. Secondly, it will help establish solutions for the present dilemmas, based in criteria derived of broad spectrum observations.

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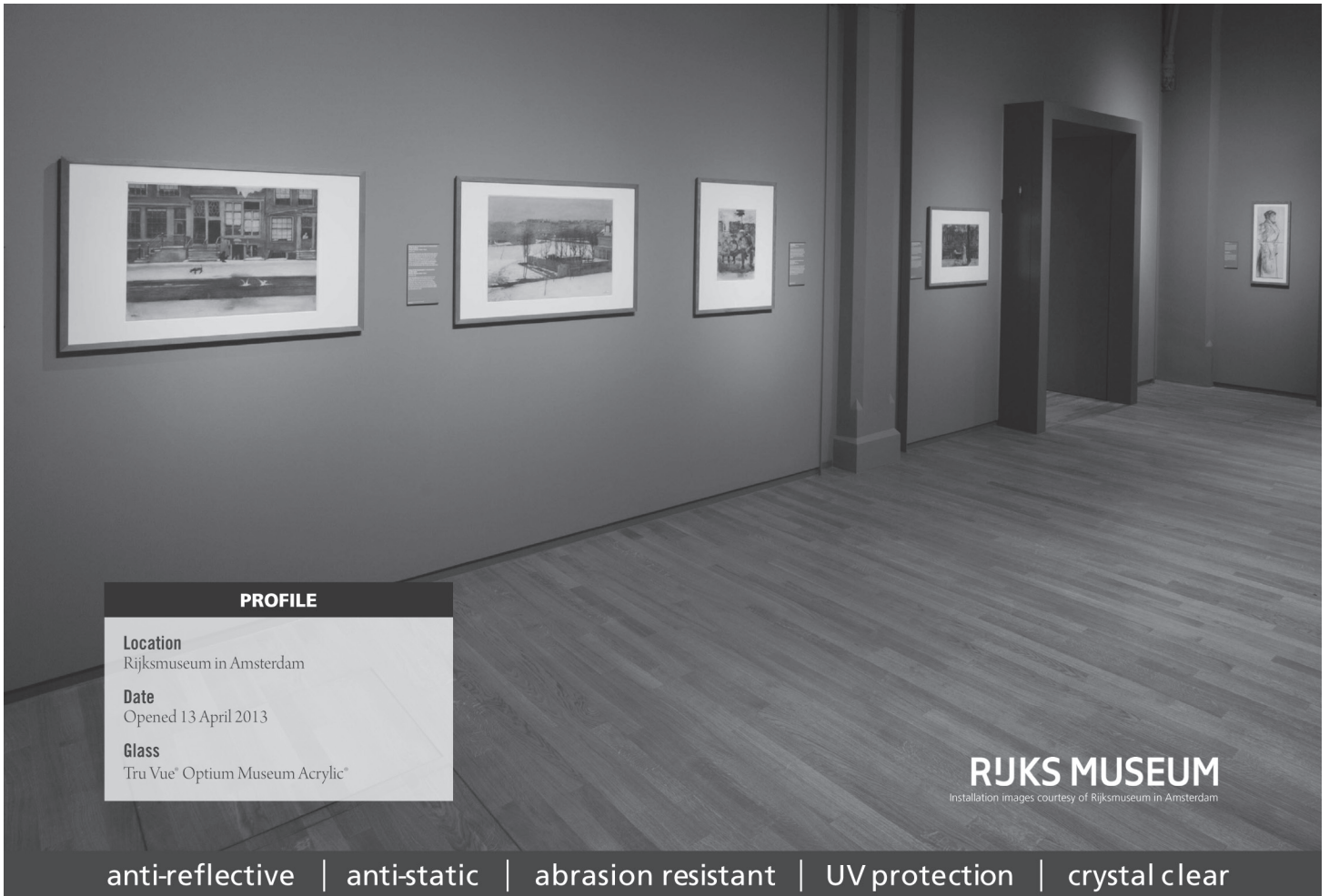
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