Preservation 101
Annotated Bibliography

Compiled 2023
By Margalit Schindler, Pearl Preservation, LLC.

This document supplements material presented during the
Public Art Stewardship Workforce Training Program
in partnership with
Delaware Art Museum, Creative Vision Factory,
City of Wilmington, and Delaware Division of the Arts

Entry Format
"Link to Resource." Author. Institution. Publication Source, Year.
["Abstract, Key Points, Format"]

Hyperlinks appear in blue

Scan QR Code to access digital document with live links

Additional thanks to
2022 FANHS Conference Workshop and Vincent Laudato Beltran (Getty Conservation Institute, GCI)
Julie Wolfe, revised May 18, 2021

Caring for your Cherished Objects. Winterthur. 2021
Funders - American Rescue Plan Act, Delaware Division of the Arts

Format Key	
(PDF)	PDF
🎥	Video
🕸	Website
📘	Book
$	Pay wall
🔍	

Trusted Sources: Who

Groups who produce reliable resources for conservation and chemistry education. Particular series are noted below.

- *This is a list of select resources and does not constitute endorsement*
- *All content should be assessed as to its relevance or appropriateness for a given context*
- *Consultation with a conservation professional is necessary for investigation or treatment of materials*

Conservation

American Institute for Conservation (AIC) Wiki

["The AIC Wiki is sponsored by the American Institute for Conservation with content created by the various AIC Specialty Groups, Networks and Committees. Several of the Specialty Groups had "AIC Conservation Catalogs," a compendium of working knowledge on materials and techniques used to preserve and treat works of art and historic artifacts. The series, begun in 1985 in print format and still in active development, was intended to be updated on an ongoing basis as techniques, technologies, and modes of practice evolve. Placing this content on the AIC wiki platform allows for easy and timely collaborative editing and also provides much broader access to these resources, ensuring that innovative methods and materials are documented and widely disseminated to practicing conservators and conservation scientists. Other groups have documented their knowledge bases directly on this wiki platform. Each section of the wiki may have a different organizational structure and while there is an overall template for many entries, these have been modified to meet the needs of each group."]

Canadian Conservation Institute (CCI)

["The Canadian Conservation Institute (CCI), a Special Operating Agency within the Department of Canadian Heritage, advances and promotes the conservation of heritage collections in Canada through its expertise in conservation science, treatment and preventive conservation. CCI works with heritage institutions and professionals to ensure these heritage collections are preserved and accessible to Canadians now and in the future. These resources on the care of specific types of objects and collections focus on the material properties and vulnerabilities of objects and the ways they become damaged as well as proper handling and storage techniques."]

CCI Notes

"CCI Notes deal with topics of interest to those who care for cultural objects. Intended for a broad audience, the Notes offer practical advice about issues and questions related to the care, handling and storage of cultural objects. Many Notes are illustrated and provide bibliographies as well as suggestions for contacting suppliers. There are currently over 100 Notes in this ever-expanding series written by CCI staff members."

Technical Bulletins

"The Canadian Conservation Institute (CCI) has published more than 30 Technical Bulletins (TB) to assist heritage professionals and institutions in the care and preservation of their objects and collections. Since these TBs contain useful and relevant information for conservation practices, research or reference, we are pleased to provide a majority of them for free. Please note that some titles have been retired and are no longer available due to outdated content."

The Conservation Center for Art and Historic Artifacts (CCAHA)

["CCAHA is a nonprofit, full-service facility with experts in a range of disciplines. We have been providing conservation and preservation services since 1977. Our mission is to provide expertise and leadership in the preservation of cultural heritage. Our conservators repair and stabilize books, photographs, and documents. Our preservation services staff works in the field, providing education programs and helping institutions plan for the future of their collections. We also offer digitization services, fundraising assistance, framing, and more."]

The Documentary Heritage and Preservation Services for New York (DHPSNY)

["Documentary Heritage and Preservation Services for New York (DHPSNY) is a collaboration between two long-running New York programs dedicated to service and support for archival and library research collections throughout the State: the New York State Archives Documentary Heritage Program and the New York State Library Conservation/Preservation Program. In 2016, the New York State Education Department's Office of Cultural Education established DHPSNY to ensure consistent and comprehensive services to the vast network of organizations that safeguard New York's records and make them accessible. The Conservation Center for Art & Historic Artifacts was selected to deliver these services to the community of historical records repositories in New York. Through DHPSNY, New York organizations holding historical records and library research collections will have access to essential training and services, including Archival Needs Assessments, Preservation Surveys, Strategic Planning Assistance, and access to a variety of educational programs."]

YouTube Channel - *"Recorded webinars and lectures"*

The Getty Conservation Institute (GCI)

["An international leader on issues of cultural heritage conservation
A catalyst for research-driven sustainable conservation work
A force for the development of innovative approaches and model conservation strategies
A trusted source of information and education for the cultural conservation community."]

Northeast Document Conservation Center (NEDCC)

["Founded in 1973, NEDCC was the first independent conservation laboratory in the nation to specialize exclusively in treating collections made of paper or parchment, such as works of art, photographs, books, documents, maps, and manuscripts. Today, the Center offers conservation treatment, digital imaging, and audio preservation services, as well as preservation training, assessments and consultations, and disaster advice on collections. NEDCC is a trusted resource worldwide for information on the preservation of paper-based and digital collections."]

Preservation Leaflets

"Comprehensive series of over 50 leaflets with information on a variety of preservation topics organized by the following themes: Planning and Prioritizing, Environment, Emergency Management, Storage and Handling, Photographs, Reformatting, and Conservation Procedures"

National Park Service (NPS): Museum Management Program

["The Museum Management Program (MMP) is part of the National Center for Cultural Resources Stewardship and Partnership Programs that provides national program support functions for park resources and advises the Associate Director, Cultural Resources, Partnerships, and Science, in Washington, DC, on policy. MMP supports development and coordination of servicewide policies, standards, and procedures for managing museum collections, including natural, cultural, archival and manuscript materials. MMP provides staff advice, technical assistance, and professional development pertaining to museum collections acquisition, documentation, preservation, protection, use, and disposal for the National Park Service. MMP develops and maintains a servicewide catalog and other statistics on museum collections."]

Conserve O Grams

"Conserve O Grams are a collection of short leaflets – now numbering over 180 – discussing various museum preservation topics that will benefit both museum staff and interested individuals"

Minnesota Historical Society: Care of Collections – Practical Guidelines

"The Minnesota Historical Society, located in Saint Paul, Minnesota, is a non-profit educational and cultural institutions dedicated to preserving the U.S. state's past, stories, and history. Basic and non-technical guidance on the long-term preservation of cultural heritage collections based on standard museum and library practice, and with an emphasis on preventive care and cost-effective approaches; the first

six topics address general collection needs, while the remainder adapt practice to the needs of particular items depending on their material composition."

Winterthur/University of Delaware Program in Art Conservation: Caring for Family Treasure Series

"The Winterthur/University of Delaware Program in Art Conservation (WUDPAC) is a graduate- level program jointly sponsored by the University of Delaware and Winterthur Museum.Accessible 20-post series sharing tips on caring for personal collections, with each focusing on an object type (e.g., photographs, library collections, clothing) or deterioration agent (e.g., pests)."

Chemistry

Crash Course

["At Crash Course, we believe that high quality educational videos should be available to everyone for free. The Crash Course team has produced more than 45 courses to date, and these videos accompany high school and college level classes ranging from the humanities to the sciences. Crash Course transforms the traditional textbook model by presenting information in a fast-paced format, enhancing the learning experience.

With hundreds of millions of views on our YouTube channel, Crash Course has a worldwide audience in and out of classrooms. While the show is an immensely helpful tool for students and teachers, it also has a large viewership of casual learners who seek out online educational content independently. It has changed attitudes towards education by creating a community of learners who are looking for more than just help passing a test. We hope Crash Course is useful to you, and thanks for watching!"]

Kahn Academy

["Khan Academy offers practice exercises, instructional videos, and a personalized learning dashboard that empower learners to study at their own pace in and outside of the classroom. We tackle math, science, computing, history, art history, economics, and more, including K-14 and test preparation (SAT, Praxis, LSAT) content. We focus on skill mastery to help learners establish strong foundations, so there's no limit to what they can learn next!"]

Compound Interest

["Compound Interest is a site that aims to take a closer look at the chemical compounds we come across on a day-to-day basis, explaining them with easy-to-understand graphics. The site won the Association of British Science Writers' Dr Katharine Giles Science blog award in 2018.The site is run single-handedly by me, Andy Brunning. I'm a chemistry educator based in Cambridge, UK, and create the graphics for the site in my spare time."]

General Chemistry

General Resources

AP/College Chemistry. Khan Academy

Crash Course Chemistry Playlist. Crash Course. 🎥

Organic Chemistry. Khan Academy.

> *["Carbon can form covalent bonds with itself and other elements to create a mind-boggling array of structures. In organic chemistry, we will learn about the reactions chemists use to synthesize crazy carbon based structures, as well as the analytical methods to characterize them. We will also think about how those reactions are occurring on a molecular level with reaction mechanisms. Simply put, organic chemistry is like building with molecular Legos. Let's make some beautiful organic molecules!"]*

AP/College Environmental science. Khan Academy.

AP®/College Art History. Khan Academy.

Specific Resources

The Periodic Table: Crash Course Chemistry #4. Crash Course. 🎥

Making Percent Solutions of Chemicals National Parks Service, Conserve O Gram 6/4, 1993. *(PDF)*

How to Determine Metal Density. Canadian Conservation Institute. CCI Notes N9/10. 2016. *(PDF)*

Guidelines for pH Measurement in Conservation. Canadian Conservation Institute. CCI Technical Bulletins TB28. 2007. *(PDF)*

Material Properties 101. Real Engineering. 🎥

Conservation Ethics

Code of Ethics and Guidelines for Practice updated 2001. American Institute for Conservation.

Stigter, Sanneke. 2016. “Autoethnography as a New Approach in Conservation.” Studies in Conservation, 61(sup2), 227-232. https://www.tandfonline.com/doi/pdf/10.1080/00393630.2016.1183104

[Advocates for autoethnographic description (i.e. first person narration and reflection) as part of the conservation process. Autoethnography creates documentation of historic interest “expressing doubts, fears, and unexpected turns,” and contributes to a better understanding of the work’s biography by clarifying conservation decision making] Free online access #contemporary

Wharton, Glenn. 2016. "Artist intention and the conservation of contemporary art." *Objects Specialty Group Postprints* 22: 1-12. Edited by Emily Hamilton and Kari Dodson, Sarah Barack and Kate Moomaw. http://resources.culturalheritage.org/osg-postprints/wp-content/uploads/sites/8/2015/05/osg022-01.pdf

Scaturro, Sarah. 2017. "A Materials- and Values-Based Approach to The Conservation of Fashion." In *ICOM Committee for Conservation preprints. 18th Triennial Conference, Copenhagen*. Paris: ICOM. https://www.academia.edu/34527057/A_Materials-_and_Values-Based_Approach_to_The_Conservation_of_Fashion free online access.

Indian Arts Research Center. 2019. Guidelines for Collaboration (website). Facilitated by Landis Smith, Cynthia Chavez Lamar, and Brian Vallo. Santa Fe, NM: School for Advanced Research. https://guidelinesforcollaboration.info/

Brown, Ashleigh. 2020. “Being Black in the Arts and Heritage Sector: Paper Conservator Ashleigh Brown Offers a Reflection.” *ICON News*. June 6, 2020. https://www.icon.org.uk/resource/being-black-in-the-arts-and-heritage-sector.html

Henderson, Jane. 2020. “Beyond Lifetimes: Who Do We Exclude When We Keep Things for the Future?” *Journal of the Institute of Conservation* 43 (3): 195–212. https://doi.org/10.1080/19455224.2020.1810729.

WhatisConservation.com

Agents of Deterioration

Understand the 10 primary threats to heritage objects and how to detect, block, report, and treat the damage they cause.

Fire

General

What is Fire? Be Smart, PBS Affiliate. 2015. 🎥

["Why does fire burn? What's the chemistry and physics of a flame? This week, learn about the beautiful science happening inside a flame!"]

What is Combustion? Stile Education. 2017. 🎥

["What are combustion reactions and how do we rely on them?"]

In Conservation

"Agent of Deterioration: Fire." Stewart, Debra. Canadian Conservation Institute, 2018.

["No institution is immune from the risk of fire. Unlike other agents of deterioration covered in this resource, serious damage or total loss of the building, collections, operations, and services can occur. Personal injury — or even death — may also occur. As a result, it is important that fire prevention and fire control be given the highest priority possible. As well, every effort should be made to reduce the risk of a fire from occurring and to minimize its effects. While the cost of doing so may seem prohibitive, the cost of doing nothing may be even greater.

Because life safety issues are under the jurisdiction of government authorities, they will not be covered in this section. Instead, it will look at fire safety and protection from the perspective of preserving and protecting cultural property, and collections in particular. While many museums may meet basic requirements for life safety, too often these requirements are inadequate to protect cultural property."]

Fire. AIC Conservation Wiki.

["The threat of fire as one of the Ten Agents of Deterioration is a major concern for all collections and institutions, as well as for the personnel and the surrounding area. While an emergency plan for fires is essential, preventing a fire begins at recognizing what fuels them."]

Baril, Paul. "Fire Prevention Programs for Museums." *Canadian Conservation Institute (CCI) Technical Bulletin 18.* Ottawa, ON: Minister of Public Works and Government Services, 1997. *(PDF)*

Baril, Paul. "Fire Protection Issues for Historic Buildings." *Canadian Conservation Institute (CCI) Notes 2/6.* Ottawa, ON: Minister of Public Works and Government Services, 1998. *(PDF)*

["Hundreds of historic buildings have been completely destroyed by fire because, in the past, protection systems were not available. Unfortunately, serious losses still occur every year. Fire not only damages historic building components, it often destroys numerous irreplaceable collections. Given today's fire protection technology, such losses should not occur. Only through effective fire protection methods will we succeed in preserving our built history for future generations. This Note discusses critical issues to consider when upgrading and installing fire protection systems in historic buildings, specifically in historic house museums."]

National Fire Protection Association. *NFPA 909: Standard for the Protection of Cultural Resources Including Museums, Libraries, Places of Worship, and Historic Properties.* Quincy, MA: 2021.
Available for purchase, or online as a read-only document. Requires free registration.

National Park Service. *NPS Museum Handbook*. Chapter 9: Museum Fire Protection. Updated 2019.

Ogden, Sherilyn. "Protection from Loss: Water and Fire Damage, Biological Agents, Theft, and Vandalism." *Preservation Leaflet 3.1.* Andover, MA: Northeast Document Conservation Center, 1999.

Spencer, Harold L. "Fire Safety 101: A Fire Safety Self-Inspection Checklist." National Parks Service, Conserve O Gram *Conserve O Gram 2/23.* Washington, DC: National Park Service, 2005. *(PDF)*

SPNHC 19th Annual Meeting. "Fire Safety Self-Inspection Form for Cultural Institutions". *Museum SOS: Strategies for Emergency Response and Salvage* conference. Natural History Museum, NY 2004.

Spafford-Ricci, S., and F.Graham. 2000." The fire at the Royal Saskatchewan Museum. Part 2: Removal Of Soot From Artifacts And Recovery Of The Building." Journal of the American Institute for Conservation 39:15–36.

[In 1990 the Royal Saskatchewan Museum in Regina, Canada, suffered a massive fire, resulting in a heavy deposition of soot throughout the museum. The fire recovery involved the interdependent recoveries of the museum building, the museum's public profile and programs, and the collection and noncollection material. The steps in the building recovery were well defined and involved the coordination of cleaning of the building by a commercial cleaning company, with demolition, reconstruction, and restoration by building trades. Cleaning of soot-covered collection and noncollection museum material was carried out in the museum building (while the building was being restored) and in a warehouse. Soot removal involved conventional conservation cleaning techniques and "bulk" cleaning methods. Conservators identified the unique characteristics of soot and developed guidelines for the removal of soot from museum objects utilizing a strict method of progressive cleaning: direct vacuum, followed by dry-surface-cleaning, and then the careful application of wet-cleaning.
The RSM fire was particularly sooty, and conservators spent months studying the peculiarities of handling and cleaning soot-damaged objects and carrying out research into postfire cleaning reports cited in the conservation literature. They were later able to apply this knowledge to the removal of soot from cultural objects involved in other fires. These experiences have refined general salvage and cleaning procedures that are extremely effective in mitigating the damage caused by soot deposition, particularly if the soot layer to be treated has not been disturbed. Recommendations for soot-removal treatments are outlined below, and recommendations for the postdisaster salvage, handling, and temporary storage of sooty objects following a fire are presented in another article in this issue (Spafford-Ricci and Graham 2000).]

Wilson, J. Andrew. "Assessing Fire Risks and Steps Toward Mitigation." Smithsonian Institution.

["This meeting's theme centers on strategies for emergency preparedness, response and salvage. No one should disagree that these important topics need to be included as part of any long range preservation plan. The focus of this paper, however, is to emphasize prevention measures that should be followed to avoid one of the most prevalent threat faced by all cultural institutions - FIRE. No institution is immune from fire. Until the owners/trustees of these institutions develop plans for dealing with the fire threat, they place the building and its occupants, visitors, and collections at risk. The complexity of these plans may vary from a simple evacuation plan, to a fire prevention program, to a more complex plan that includes passive and automatic fire protection systems. Property damaged by floods can often be dried out and restored. Structural damage from an earthquake might be repaired. Stolen property always has a chance of being recovered. Damage from fire, however, is usually permanent and irreparable. More important than the preservation of the museum and its collections, is safeguarding the lives of its staff and visitors. Life safety must always come first. Management must ensure that employees know what to do in the event of a fire."]

Water

General

Water: Liquid Awesome. Crash Course. 🎥

[Hank teaches us why water is one of the most fascinating and important substances in the universe.]

Water & Solutions - for Dirty Laundry: Crash Course Chemistry #7. Crash Course. 🎥

["Dihydrogen monoxide (better known as water) is the key to nearly everything. It falls from the sky, makes up 60% of our bodies, and just about every chemical process related to life takes place with it or in it. Without it, none of the chemical reactions that keep us alive would happen - none of the reactions that sustain any life form on earth would happen - and the majority of inorganic chemical reactions that shape the surface of the earth would not happen either. Every one of us uses water for all kinds of chemistry everyday - our body chemistry, our food chemistry, and our laundry chemistry all take place in water.

In today's Crash Course Chemistry, we use Hank's actual dirty laundry (ew) to learn about some of the properties of water that make it so special - its polarity and dielectric property; how electrolytes can be used to classify solutions; and we discover how to calculate a solution's molarity as well as how to dilute a solution using the dilution equation."]

The Water Cycle. Kahn Academy. 🎥

[How the sun's energy drives the water cycle on Earth.]

Water as Solvent. Kahn Academy. 🎥

[Water as a solvent. Polar solutes. Hydrophilic and hydrophobic substances.]

Hydrogen Bonding in Water. Kahn Academy. 🎥

In Conservation

Agent of Deterioration: Water. Tremain, David. Canadian Conservation Institute. 2018

["This section deals with water in its liquid form, but also includes dampness resulting from condensation and rising moisture. (Visit "Incorrect relative humidity" for information on water vapor.) It identifies the major issues with incidents that cause water damage in collections, and provides strategies to prevent or minimize any occurrence. This section does not describe recovery strategies after damage has taken place."]

Water. AIC Conservation Wiki.

CCAHA. "Freezing and Drying of Book, Paper, and Photographic Materials." Philadelphia, PA: 2012. 🎥

Dadson, Emma. "Salvage." British Library Preservation Advisory Centre: November 2012.

Library of Congress. "What to Do When Collections Get Wet."

National Park Service (NPS). "An Emergency Cart for Salvaging Water-Damaged Objects." National Parks Service, Conserve O Gram *Conserve O Gram 21/2.* Washington, DC: 2002. *(PDF)*

National Park Service (NPS). Health And Safety Hazards Arising From Floods. National Parks Service, Conserve O Gram *onserve O Gram 21/1.* Washington, DC: 2002. *(PDF)*

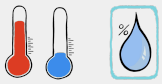
National Park Service (NPS). *NPS Museum Handbook*. Chapter 10: Emergency Planning. Updated 2019.

"Salvage at a Glance, Part I: Paper Based Collections." National Parks Service, Conserve O Gram *Conserve O Gram 21/4.* Washington, DC: National Park Service, 2002. *(PDF)*

"Salvage at a Glance, Part II: Non-Paper Based Archival Collections." National Parks Service, Conserve O Gram *Conserve O Gram 21/5.* Washington, DC: National Park Service, 2002. *(PDF)*

Ogden, Sherilyn. "Protection from Loss: Water and Fire Damage, Biological Agents, Theft, and Vandalism." *Preservation Leaflet 3.1.* Andover, MA: Northeast Document Conservation Center, 1999.

Incorrect Temp & Incorrect Relative Humidity



General

Temperature: Crash Course Physics #20. Crash Course. 🎥

[“Bridges don't deal well with temperature changes. In order to combat this, engineers have come up with some workarounds that allow bridges to flex as they expand or contract. In this episode of Crash Course Physics, Shini talks to us about temperature and the ideal gas law. Also, we figure out how much air is in your car.”]

Kinetics: Chemistry's Demolition Derby - Crash Course Chemistry #32. Crash Course. 🎥

[“Have you ever been to a Demolition Derby? Then you have an idea of how molecular collisions happen. In this episode, Hank talks about collisions between molecules and atoms, activation energy, writing rate laws, equilibrium expressions, reactions mechanics, and rate-determining steps.”]

The Arrhenius equation. Khan Academy. 🎥

[“The Arrhenius equation is k = Ae^(-Ea/RT), where A is the frequency or pre-exponential factor and e^(-Ea/RT) represents the fraction of collisions that have enough energy to overcome the activation barrier (i.e., have energy greater than or equal to the activation energy Ea) at temperature T. This equation can be used to understand how the rate of a chemical reaction depends on temperature. Created by Jay.”]

Relative Humidity Demo 🎥

[“A demonstration of relative humidity for ESC 1110 at Chattanooga State.”]

Relative Humidity Isn't What You Think It Is. SciShow. 🎥

[“Have you ever wondered why 75% humidity in the summer feels sticky, but 75% humidity in the winter feels super dry? Turns out, the common definition of humidity is inconvenient and confusing. But there is a better way!”]

Weather101 🎥

[“Meteorologist Jen Carfagno explains the difference between humidity and dewpoint, two aspects of weather that are often confused.”]

What is a Cloud? Crash Course Geography #10. Crash Course. 🎥

[“In addition to just being beautiful one-of-a-kind panoramas in the sky, clouds can tell us so much about how energy and weather patterns flow around the globe. Today, we'll talk about how clouds form, the three main types (cirrus, status, and cumulus), explain how and why we get rain, and end with a discussion on humidity and how high humidity can feel hot and sticky on a warm day but comfortable on a cold day. So join us and countless people throughout history and look up -- at the clouds!“ Also connects to Smog and Pollution]

In Conservation

Incorrect Temperature. Michalski, Stefan. Canadian Conservation Institute. 2013.

[“Temperature, unlike fire, water, pests, etc., cannot be considered an agent of deterioration — we cannot speak of avoiding "temperature." From a collection risk and deterioration perspective, we must speak of incorrect temperatures. Three practical categories of incorrect temperatures arise. Different collections have different sensitivities to each one. Temperature too high. Temperature too low. Temperature fluctuation.”]

Incorrect Temperature. AIC Conservation Wiki.

["The detrimental effects of incorrect temperature (either too high or too low) are often observed after considerable time has passed and so the slow deterioration that results is often underestimated. Temperature is a measure of heat energy. High temperatures promote faster chemical reactions and so the overall degradation of organic materials occurs more quickly. Temperature is also important in that it directly affects relative humidity, given the same moisture in the air. If the temperature goes up, the relative humidity goes down and vice versa. A fluctuating temperature leads to a fluctuation in relative humidity."]

Incorrect Relative Humidity. Michalski, Stefan. Canadian Conservation Institute. 2013.

["Relative humidity, unlike fire, water, pests, etc., cannot be considered an agent of deterioration – we cannot speak of avoiding relative humidity (RH) – but we can avoid "incorrect" relative humidity. From a practical risk assessment perspective, the many forms of incorrect RH can be subdivided into four types:
Damp, over 75% RH. RH above or below a critical value for that object. RH above 0%. RH fluctuations."]

Incorrect Relative Humidity. AIC Conservation Wiki.

["Relative Humidity is the amount of moisture in the air compared to how much moisture that air can hold at the same temperature. Organic materials all contain moisture; they absorb and give off moisture and try to find a balance between their moisture content and that in the air around them. If the relative humidity (moisture content) in the air goes up, they will absorb moisture and swell, and if it goes down, they will give off moisture and shrink. If this occurs slowly and moderately then no damage will be caused. However, sudden, large and frequent relative humidity fluctuations can cause shrinkage, warping, splitting, and general aging of objects made of organic materials. A sudden increase in relative humidity can cause condensation on metal artifacts, which will promote corrosion."]

Dew Point

The Role of Dew Point in Sustainable Environmental Management. Image Permanence Institute (IPI). *(PDF)*

["The Dew Point determines the preservation environment that can be achieved because it determines what combination of Temperature and Relative Humidity can be achieved. Temperature (T), Relative Humidity (RH), and Dew Point are interrelated. Dew Point is typically the limiting factor of a mechanical system's ability to provide a good environment for long-term preservation of collections"]

Dew Point Calculator. Image Permanence Institute (IPI).

["Use the sliders to explore combinations of temperature (T), relative humidity (RH), and dew point (DP) to compare the preservation quality of your environment. Knowing the dew point can help achieve long-term preservation of collection materials for libraries, museums, and archives."]

Environmental Guidelines

"The Ideal Climate, Risk Management, the ASHRAE Chapter, Proofed fluctuations, and toward a full risk analysis model." Michalski, S. 2007. Experts' Roundtable on Sustainable Climate Management Strategies. Tenerife, Spain. *(PDF)*

["The proofed RH or T is the largest RH or T fluctuation to which the object has been exposed in the past or, alternatively, just the lowest and highest RH and T of the past. The risk of further mechanical damage (beyond that already accumulated) from fluctuations smaller than the proofed value is extremely low. If the past fluctuation was enough to cause fracture, the object has fractured, and the crack just opens and closes. When on purpose, such openings are called expansion joints. If the past fluctuations did not cause fracture and the material strength has not changed much, then there is no reason to expect a future fracture in response to the same fluctuations. In summary, if the future climate conditions do not exceed the range defined by past conditions, then the risk of future mechanical damage is negligible. (Risk of increased mold damage and risk from chemical aging damage is not at all the same, and they have their own practical climate control concepts.)

The conventional (late-twentieth-century) approach to climate control specifications for museums has been to find a single target associated with "ideal" conditions and, failing that, to specify "compromise" or "relaxed" conditions. It was assumed that the further one strayed from the ideal target, the greater the damage to the

collections. Despite a steady undercurrent of thoughtful critiques from the very beginning of the climate control boom in museums (e.g., Rogers 1976) this fundamentalist approach to specifications has proven remarkably persistent.

Much of the success of a simplistic approach has nothing to do with whether or not museums actually believe that ideal control is ideal for collections, but with the fact that a single target makes life much easier for architects, HVAC engineers, curators, collection managers, exhibit designers, preparators, and, not least, conservators. I do not mean simply operationally easier in museums where it is achieved but intellectually easier in any museum, whether it is achieved or not.

Many decades have passed since the encouragement of the first magic numbers for climate control in museums—the 60°F, 60% relative humidity (RH) rule of Rawlins, (Rawlins 1942)—and the last three decades have seen widespread implementation of museum climate control "improvements." An entire generation of conservators and conservation scientists have watched the accumulation (or not) of damage in collections modified (or not) by climate control. The next generation faces painful decisions about sustainability. It is time to take stock and to consider what advice to pass on."]

Environmental Guidelines. AIC Conservation Wiki.

["The museum community acknowledges the practical difficulties, high cost and non-sustainability of maintaining flatlined relative humidity and temperature in the exhibition environment, and that a single standard is not suitable or necessary for all collection objects. Currently, the rationale for maintaining the standard of 50 +/- 5% RH is based upon the assumption that drift will occur and that tight control is impossible to achieve. If standards are broadened, it will be crucial to ensure that the needs of individual objects, groups of objects, and sensitive materials are recognized and addressed by the use of microclimates or other mitigation measures. These changes may be at odds with curatorial, design, and aesthetic priorities, but may need to take precedence over them in order to ensure the long-term preservation of collections. Any alteration of standards will demand a greater understanding of case design and the use of microclimates to create appropriate environments for sensitive objects and a demonstration that the measure implemented are cost-effective. Developing alternate standards will require proper evaluation of the moisture content and sensitivities of objects in order to design safe and sustainable environments."]

Environmental Guidelines – IIC and ICOM-CC Declaration. International Institute for Conservation of Historic and Artistic Works (IIC). 2014.

IPI Media Storage Quick Reference. Adelstein, Peter Z. Image Permanence Institute, 2nd edition. 2009. *(PDF)*

["Storage is the single most important factor determining the useful life of modern information media. (For electronic media, copying and format obsolescence are also important, but those issues are beyond the scope of this publication.) The IPI Media Storage Quick Reference (MSQR) attempts to explain the role of storage conditions—that is, temperature (T), relative humidity (RH), and air quality—in the physical survival of photographs, films, audio and video tapes, CDs, and DVDs. Research shows that lower temperature and RH can greatly improve material stability, a fact reflected in the standards published by the International Organization for Standardization (ISO). The ISO standards recommend climate conditions for the storage of specific media, and when possible, these recommendations should be followed. The standards are less helpful, however, when it comes to assessing how a particular environment will affect a collection or deciding on the best environment for storing a collection that contains media of different types—common concerns among collection managers. The purpose of the MSQR is to distill and present, in one publication, the information you need to make informed decisions about the storage of the mixed collections of photographic, magnetic, and optical media in your care."]

Crack Warp Shrink Flake: a New Look at Conservation Standards. Hatchfield, Pamela. 2011. Museum (January-February 2011): 40-53. *(PDF)*

Sustainable Preservation Practices: for managing storage environments. Image Permanence Institute. Rochester Institute of Technology. 2005. *(PDF)*

Cold Storage

"Demystifying Cold and Frozen Storage". Lemmen, Barbara. Webinar for Documentary Heritage and Preservation Services for New York, January 2018. 🎥

Monitoring and Equipment

Environmental Datalogger Quick Comparison Chart. Conservation Center for Art & Historic Artifacts. Updated 2022 *(PDF)*

> *["**If choosing an option with manual data download and processing, CCAHA recommends including a data collection schedule and workflow in your environmental management plan."]*

Museums Galleries Scotland. Introduction to environmental monitoring.

Sustainable environments and passive measures

Cassar, May. Energy Reduction and the Conservation of Cultural Heritage: a Review of Past, Present and Forthcoming Initiatives. International Preservation News no. 55, Dec. 2011.

Providing Safe and Practical Environments for Cultural Property in Historic Buildings – and Beyond. Kerschner, Richard L. 2007. *(PDF)*

Light

General

Introduction to Light. Kahn Academy 🎥

[Light and the electromagnetic radiation spectrum. Wave and particle-like behavior, and how to calculate the wavelength or frequency of a light wave.]

Light: Crash Course Astronomy #24 . Crash Course. 🎥

[Light is a form of energy. Its wavelength tells us its energy and color. Spectroscopy allows us to analyze those colors and determine an object's temperature, density, spin, motion, and chemical composition.]

In Conservation

"Agent of Deterioration: Light, Ultraviolet, and Infrared," Michalski, Stefan. Canadian Conservation Institute, 2018.

["We need light in order to see collections, but light damages some objects. In terms of risk management trade-offs, we must make a decision that minimizes the loss of value due to poor visual access and the loss of value due to permanent damage. In terms of ethics and visual access, we must balance the rights of our own generation with the rights of all future generations. In terms of practical reality, we must generalize across a multitude of such decisions because objects differ in both their sensitivity to light and their visibility. In addition, display spaces in many museums depend on highly variable and poorly controlled lighting. This section examines the components of these decisions and offers some summary guidelines. However, the painful dilemma never disappears — seeing collections well today, and seeing them "well" in the future."]

"Light," AIC Conservation Wiki.

[Light from a museum perspective. Focus on exhibitions.]

"Lighting: Beyond Standards," Heather Hendry, CCAHA, 2020. 🎥

["Light is one of the ten agents of deterioration, making it especially crucial that collecting institutions know how to control and mitigate exposure to light during storage and exhibition. This webinar discusses basic principles of managing light exposure in collections, including identifying light sources commonly found in institutional storage, measuring and understanding visible and UV light values, current standards for light exposure during exhibition, and preventive measures to avoid unnecessary exposure to light. The light sensitivity of materials commonly held in archives, museums, and libraries is also discussed. Several case studies will show how small and large real world institutions have protected their collections. Presenter: Heather Hendry, Senior Paper Conservator, Conservation Center for Art & Historic Artifacts"]

"Recommended Light Levels for Museum Collections." Texas Historical Commission. 2013. *(PDF)*

Monitoring and Equipment

"Choosing UV-filtering Window Films," National Parks Service, Conserve O Gram, No. 3/10, August 2004. *(PDF)*

["In the past 20 years, the market has become saturated with window films with different performance criteria. Some are designed to reflect sunlight and keep interiors cool. Others strengthen glass and help prevent damage from vandalism. Still others filter various parts of the light spectrum. The films that have been of interest in museums are the so-called "solar" screens that filter part or all ultraviolet (UV) radiation. Unfortunately, not all of the solar films meet museum standards, and the product literature available from the manufacturers is very often confusing and sometimes misleading."]

"Environmental Monitoring: Getting Started," Chloe Houseman, CCAHA, 2021. 🎥

["What should you think about when establishing an environmental monitoring plan? What is a datalogger, and how do you select the right one? What are the basic tools needed to implement an environmental monitoring plan? Join Chloe Houseman, Paper Conservator at the Conservation Center for Art & Historic Artifacts, as she explores the importance of managing the environment in collections spaces and offers guidance on how to do so. Presenter: Chloe Houseman, Paper Conservator, Conservation Center for Art & Historic Artifacts"]

"Light Damage Calculator," Canadian Conservation Institute.

["The light damage calculator provides an estimate of the fading of colors exposed to light, based on the best available data."]

Pests

General

Fungi: Death Becomes Them - CrashCourse Biology #39. Crash Course. 🎥

["Death is what fungi are all about. By feasting on the deceased remains of almost all organisms on the planet, converting the organic matter back into soil from which new life will spring, they perform perhaps the most vital function in the global food web. Fungi, which thrive on death, make all life possible."]

Module 05: Insects as Decomposers. Edu Creator's Hub. 🎥

[Playlist. "Without decomposers, dead trees and leaves would pile up in forests, and we would be walking knee deep in dung and animal carcasses. Insect decomposers help to recycle these materials and many others back into the earth, recycling the nutrients to be used by other organisms again. This module unearths the importance of these decomposers to our ecosystem, and even discusses some ways these insects can be used to help solve crimes."]

Integrated Pest Management. Khan Academy. 🎥

[From the perspective of agriculture and environmental science. "Integrated pest management (IPM) is a combination of methods used to effectively control pest species while minimizing the disruption to the environment. These methods include biological, physical, and limited chemical methods such as biocontrol, intercropping, crop rotation, and natural predators of the pests. Integrated pest management (IPM) minimizes disruptions to the environment and threats to human health but can be complex and expensive. Created by Sal Khan."]

In Conservation

"Agent of Deterioration: Pests," Tom Strang and Rika Kigawa. Canadian Conservation Institute, 2022.

["Pests are living organisms that are able to disfigure, damage, and destroy material culture. Microorganisms, insects, and rodents represent the majority of pests affecting cultural heritage. These three subtypes are significant risks in the north-temperate Canadian environment. Other pests, such as roosting birds, molluscs (marine borers), bats, other invasive mammals, lizards, etc., may be significant despoilers in specific locations, but are not as predominant worldwide inside collection spaces."]

"Pests," AIC Conservation Wiki.

["Pests as a Agent of Deterioration risk factor encompass both vertebrates (e.g. rodents and birds) and insects (beetles, moths, termites, etc.). Some also consider mold/mildew/fungi to fall under this category. Organic materials are particularly vulnerable to damage from pests, including furniture, books and papers, feathers, textiles, and plant materials. Signs that pests may be active in a collection space include: the presence of adult pests, their frass, larvae, or eggs; accumulations of powder or other remnants; or damage in the form of holes, "grazed" surfaces, staining, structural weakening, and loss of material. When this reaches the point where measurable loss occurs (be it financial or aesthetic) or it becomes a health issue, a pest issue is present.

In recent years, health and safety concerns have led institutions away from the regular applications of toxic chemicals (pesticides or fungicides) toward greater emphasis on preventative and protective measures that are not chemical based. A combination of these different measures is known as "Integrated Pest Management," often abbreviated to the acronym IPM and is now the recommended approach to pests. This focuses on prevention and monitoring, and, should an outbreak occur, the use of temperature or atmospheric control instead of pesticides."]

MuseumPests.net. Integrated Pest Management Working Group.

["The MuseumPests Working Group (MPWG) is a group of collection managers, conservators, entomologists and other professionals interested in issues surrounding the implementation of integrated pest management in museums, libraries, archives, and other collection-holding institutions. The MPWG is a civic organization working for the benefit of the cultural heritage community." Identification & Resources are especially useful]

Integrated Pest Management. American Museum of Natural History.

["Preventing natural science specimens and material culture constructed from organic matter from being attacked and damaged by pests is a major challenge of collection management. In storage and display facilities, some of the most common pests are insects.

In the past, pest management usually involved regular applications of pesticides to collection items and areas. Health and safety concerns have led institutions to move away from this approach in favor of non-chemical preventative and protective measures. These include upgrades and repairs to building structure; installing better cabinetry; improved control of temperature and humidity in collections areas; removing food and other organic materials from collection areas; more effective monitoring; and treatment of outbreaks through freezing or anoxic environments. Using these different measures in combination is known as "integrated pest management."]

Introduction to Integrated Pest Management. Marcus, Gillian. DHPSNY, 2017. 🎥

["This webinar provides an introduction to Integrated Pest Management (IPM) for cultural institutions. Topics include the basic principles of prevention, monitoring, identification, and response/recovery, as well as resources for setting up a pest management program."]

Detecting Infestations: Facility Inspection Procedure and Checklist. Strang, Thomas J.K, Canadian Conservation Institute (CCI) Notes 3/2.1996. *(PDF)*

["The presence of insect pests in a museum is indicated by a variety of signs (casings, frass, cocoons, etc.). While the actual living organisms may be visible in various stages of development, the signs of activity are usually detected first.

There are two basic modes of detecting insect infestations: active, where someone inspects likely areas and objects; and passive, where a trap collects pests or indicates their presence. The latter mode, however, still requires someone to inspect the traps, to record the findings, and to follow up on the problem.]

Pollutants

General

A Brief Guide to Atmospheric Pollutants. CompoundChem.

[Infographic diagramming common pollutants and their sources.]

Pollution: Crash Course Ecology #11. Crash Course. 🎥

["Hank talks about the last major way humans are impacting the environment in this penultimate episode of Crash Course Ecology. Pollution takes many forms - from the simplest piece of litter to the more complex endocrine disruptors - and ultimately, humans are responsible for it all."]

Acid Rain. Kahn Academy. 🎥

[Acid rain and deposition is due to nitrogen oxides and sulfur oxides from anthropogenic and natural sources in the atmosphere. Nitric oxides that cause acid deposition come from motor vehicles and coal-burning power plants. Sulfur dioxides that cause acid deposition come from coal-burning power plants. Acid deposition mainly affects communities that are downwind from coal-burning power plants. Acid rain and deposition can lead to the acidification of soils and bodies of water and corrosion of human-made structures. Created by Khan Academy.]

Indoor Air Pollutants. Khan Academy. 🎥

["Indoor air pollutants can come from natural sources, human-made sources, and combustion. Common natural pollutants include radon, mold, and dust. Common human-made pollutants include Volatile Organic Compounds (VOCs) and formaldehyde. Common combustion pollutants include carbon monoxide, nitrogen oxides, sulfur dioxide, particulates, and tobacco smoke. Created by Khan Academy."]

Off Gassing: 5 Things You Should Know. Gokce Capital. 🎥

[A basic overview of off-gassing from a household and health perspective. These ideas can also be applied in museum settings. Off-gassing peaks early on and decreases over time. This means older materials will have lower off-gassing levels than newer materials. Consider how these pollutant vapors could interact with museum objects.]

Air Changes Per Hour (ACH) Explained. Water Solutions of Long Island. 🎥

In Conservation

Agent of Deterioration: Pollutants. Tétreault, Jean. Canadian Conservation Institute, 2021.

["Pollutants are grouped into a range of compounds that can have chemical reactions with any component of an object. Pollutants can be gasses, aerosols, liquids or solids of either anthropogenic or natural origin, and they are substances that are known to have adverse effects (negative consequences) on objects. Deposits of solid particles are considered pollutants, and while they may not necessarily cause damage, they are recognized as altering the aesthetic aspects of the objects. In some cases, fine particles deposited on an object's surface can be strongly bonded.

In a museum, there are three modes of action for pollutants to reach objects and cause deterioration. In the first mode, the pollutants are airborne; in the second, the pollutants are transferred between two materials at points of contact; as for the third, it is intrinsic, in that the pollutant already exists, as part of the materials composing the object, or is formed during chemical reactions on or within it."]

Pollutants. AIC Conservation Wiki.

["Pollutants can be generated both and outside and inside buildings. Many pollutants known to cause human health problems can also cause damage in collections. The two general types of pollutants that contribute to

the deterioration of museum collections are particulates and gasses. These can be airborne or transferred by direct contact."]

Hatchfield, Pamela, *Pollutants in the Museum Environment*, 2002. London: Archetype Publications. "Pollutants," AIC Conservation Wiki, https://www.conservation-wiki.com/wiki/Pollutants

"Pollutants and Collections," Conservation Center for Art & Historic Artifacts, Philadelphia, PA, 2018, "Guides and Fact Sheets," https://ccaha.org/resources/pollutants-and-collections . *(PDF)*

Society of American Archivists, *Preservation Bookmarks, Meet the Agents of Deterioration: Pollutants.* https://www2.archivists.org/sites/all/files/Pollutants_Bookmark_SAAPreservation.pdf *(PDF)*

https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/technical-bulletins/pollutants-museums-archives.html

"Buffered and Unbuffered Storage Materials," National Parks Service, Conserve O Gram, No. 4/9, July 1995. *(PDF)*

["Buffered paper products have an alkaline reserve, or buffering agent, added during production to alter the pH. Buffering protects the museum object against migrating acids. Calcium carbonate and magnesium carbonate are the common buffering agents. Because this alkaline reserve depletes over time, storage containers that were once acid-free can become acidic."]

"Dust Covers for Open Steel Shelving," *NPS Conserve O Gram*, No. 4/2, July 1993.

["Dust harms objects in two ways. It acts as an abrasive that can wear away surface detail, and it attracts and catalyzes moisture and gaseous pollutants to form acidic solutions that cause chemical deterioration. Fortunately, dust can be controlled. For artifacts on steel shelving, protection is achieved by using dust covers. Dust covers block the openings of shelving units, thereby preventing dust from coming in contact with the objects."]

Tétreault, Jean, "Control of Pollutants in Museums and Archives". *CCI Technical Bulletin*, no. 37. Canadian Conservation Institute, 2021.

"Monitoring for Gaseous Pollutants in Museum Environments," Grzywacz, Cecily M. The Getty Conservation Institute. 2006. *(PDF)*

["In its broadest sense, a pollutant is a substance that has a detrimental effect on the environment or on something of value (including health) and is present in the atmosphere in amounts greater than natural concentrations, primarily due to human activity. Cultural property inside museums can be threatened both by outdoor pollutants, such as gasses from car exhaust that make their way into buildings, and by pollutants generated from sources within museums, such as fumes from cleaning products. In most situations, indoor-generated pollutants pose a greater risk to collections than outdoor-generated pollutants. Typically, this is because the indoor source is in close and continuous proximity to objects. A wide range of materials, from textiles and works of art on paper to pigments and leather bindings, are at risk of damage from gaseous pollutants."]

Physical Forces

General

Reaching Breaking Point: Materials, Stresses, & Toughness: Crash Course Engineering #18. Crash Course. 🎥

["Today we're going to start thinking about materials that are used in engineering. We'll look at mechanical properties of materials, stress-strain diagrams, elasticity and toughness, and describe other material properties like hardness, creep strength, and fatigue strength."]

Stress vs strain curve. Khan Academy. 🎥

["What happens if you stretch something beyond its elastic limits? In this video, we will explore the regions beyond the elastic limits. We will take a steel rod and keep stressing it until it breaks. We will draw a graph of stress vs strain and explore all the different regions of it. Created by Mahesh Shenoy."]

Collisions: Crash Course Physics #10. Crash Course. 🎥

["COLLISIONS! A big part of physics is understanding collisions and how they're not all the same. Mass, momentum, and many other things dictate how collisions can be unique. In this episode of Crash Course Physics, Shini sits down to lead us through an understanding of collisions. Plus, she brings along our old friend Sir Isaac Newton."]

In Conservation

Agent of Deterioration: Physical Forces. Marcon, Paul. Canadian Conservation Institute, 2018.

["Physical force can damage objects directly by causing rotation, deformation, stress, and pressure. It may also damage objects indirectly by causing collision between objects or object parts. Damage from physical force ranges from imperceptible hairline fissures and minute losses, to large-scale effects such as crushing objects, collapsing floors, and, in extreme cases, destroying buildings. Five important force-related effects are: impact; shock; vibration; pressure; and abrasion. Some of these effects are closely linked."]

Physical Forces. AIC Conservation Wiki.

["Examples of damaging physical forces may include those that are fast and catastrophic including both natural disaster and human error (such as earthquakes, or bumping or dropping an object), or slower acting with minor but repeated opportunity for damage (such as improper handling during research and educational use, or vibrations from nearby construction). Physical force is also a risk for artifacts that do not have proper support on exhibit or in storage and may sag or become misshapen, or for objects that are not properly padded in boxes or drawers and may roll around when moved."]

Thieves & Vandals

General

SASK Museums: https://saskmuseums.org/blog/entry/agent-of-deterioration-8-thieves-and-vandals

CCAHA Security Webinar: https://www.youtube.com/watch?v=_Kz2N025cQw
Security Strategies & Policies

Museum Security Network: https://www.msn-museumsecuritynetwork.org/

NYSA Example Closing Procedures. New York State Archives. *(PDF)*

> *["The purpose of the closing procedure is to ensure that all staff and members of the public have vacated the archives facility prior to closing. At 4:45pm each business day, a security guard reports to the research room to assist staff conducting the closing rounds. Rounds begin at 4:55pm and are completed by 5:15pm. Rounds itinerary includes all spaces in the archives facility, both public and staff only. Rounds are conducted by archives managers or other authorized staff along with the security guard."]*

NYSA Key Control Guidelines.New York State Archives. *(PDF)*

> *["Although electronic access control systems are used today in larger archives, many smaller repositories continue to rely on mechanical keys to control access to their holdings storage and other secure areas. All repositories should have a documented process for issuing keys. Procedures will define the roles and responsibilities of staff involved in managing keys as well as criteria for issuing keys to selected individuals and expectations of staff entrusted with keys."]*

Dissociation

General

Collections Rationalisation. SHAREMuseumsEast. 🎥

["What is Collections Rationalisation and why would you want to do it? Watch this short animation and begin the first steps to organizing your collections. Once you have watched the film, you might want to explore the Museums Code of Ethics, the Museums Association's Disposal Toolkit, and SHARE Museums East's Collections Rationalisation: Planning For Action where you will find supporting templates for developing your own rationalization plan and policy. Animation by TopBox Media for SHARE Museums East."]

In Conservation

Agent of Deterioration: Dissociation. R. Robert Waller and Paisley S. Cato. Canadian Conservation Institute, 2019.

["Dissociation results from the natural tendency for ordered systems to fall apart over time. Maintenance processes and other barriers to change are required to prevent this disintegration. Dissociation results in loss of objects, or object-related data, or the ability to retrieve or associate objects and data. This agent affects the legal, intellectual, and/or cultural aspects of an object as opposed to the other 10 agents of deterioration, which mainly affect the physical state of objects. This could be thought of as the metaphysical agent. Another unique characteristic of this agent is that loss in value to one or a few objects within a collection can reduce the value of the collection as a whole."]

Custodial Neglect. AIC Conservation Wiki.

["Custodial neglect is the only one of the Ten Agents of Deterioration that is non-physical in nature, although the effects of neglect manifest themselves physically. One type of custodial neglect occurs when active care is not taken to preserve the collection or when information and practices on collections care are not current. The second type of custodial neglect is the disassociation of collection objects and their records. Ensuring that collections records are properly kept and maintained is of the highest priority."]

Collections, Catalogs, and Clouds: How to Choose a Collections Management System. DHPSNY. 🎥

["Choosing a Collections Management System (CMS) can be daunting for any institution. Every institution has different needs for a CMS and there are lots of great systems on the market. When choosing a CMS, everything from staff size and make up, to hardware capabilities, to public use must be considered. No one wants to end up with a CMS that does not suit them five years down the road. This workshop can help any sized institution be prepared to choose potential contractors and have meaningful conversations with them by providing tools for you to define what your institution needs, find potential CMS contractors, and ensure you are prepared to work with them. Presenters: Julie Kemper, Curator for Object Learning, Kentucky Historical Society & Bill Bright, Curator, International Museum of the Horse"]

Waller, Robert. *Assessing and Managing Risks to Your Collections* (excerpt). The International Institute for Conservation of Historic and Artistic Works, 2013.

"New Agent of Deterioration – Dissociation." Kierstead, Karin. Association of Nova Scotia Museums blog. Written Feb 21, 2011.

[""Dissociation results in loss of objects, object-related data, or the ability to retrieve or associate objects and data. The principal means of control against the risk of dissociation is establishing and complying with policies and procedures meant to document and control the acquisition and movements of objects. The ability to exercise professional discipline to abide with these policies and procedures through periods of great productivity pressures is often the risk-limiting factor for dissociation. Where appropriate and adequate

policies and procedures are not instituted and respected, dissociation will likely be the greatest risk to a collection." ~from CCI's website"]

Dig It With Raven (YouTube Channel). "DISSOCIATION- The Agents of Deterioration (10/10) | Art Conservation 101." June 18, 2020. 🎥

Documentation

Photographic Documentation

Optical Instruments: Crash Course Physics #41. Crash Course. 🎥

> *["How do lenses work? How do they form images? Well, in order to understand how optics work, we have to understand the physics of light. In this episode of Crash Course Physics, Shini talks to us about optical instruments and how they make magnification possible."]*

Imaging Wiki. AIC Conservation Wiki.

> "*This section will focus on specific imaging techniques for conservation and cultural heritage documentation including information on terminology, applications, tools, workflows, and bibliographies."*

Visible Light Imaging. AIC Conservation Wiki.

PMG Examination and Documentation. AIC Conservation Wiki.

Guide to Digital Photography and Conservation Documentation $

> *"Table of Contents. Workflow. Equipment. Camera Settings. Image Processing. Storage And Backup of Electronic Records. Photographic Techniques for Conservation. Appendix."*

How to Photograph Objects Using a Grey Card : Photography Basics. eHowArtsAndCrafts. 🎥

Written Documentation

Preservation Glossary, CCAHA. 2021. *(PDF)*

> *[A resource with text and images that explains useful preservation language including damages & condition, materials and collection care terminology. The Preservation Glossary was created in March 2022 by the Conservation Center for Art & Historic Artifacts in partnership with Archives for Black Lives in Philadelphia as part of the Community Stewardship Program.]*

BPG Written Documentation. AIC Conservation Wiki.

Basic Condition Reporting. Southeastern Registrars Association.

Rowman & Littlefield, 2015. Utah Museums Association. Condition Reporting Basics.

Object Materials

Stone and Plaster

What Are Rocks and How Do They Form? Crash Course Geography #18. Crash Course. 🎥
> ["*From towering mountains to pebbles along a river, the Earth is made of a huge variety of rocks. In today's episode, we're going to follow the rock cycle of a piece of granite in the Himalayan mountains, and as you'll see, every rock has a far-reaching story to tell often millions of years in the making.*"]

Understanding Minerals [Updated, 2019]. Mike Sammartano 🎥

Stone and Plaster. Canadian Conservation Institute.
> *["The following resources provide information on the care and storage of stone and of plaster, which are both inorganic materials. Objects made of stone and plaster are often considered to have fewer problems than objects made of organic materials. However, it is still essential to properly care and store them to prevent damage so that they can be enjoyed for many years."]*

Introduction to Stone Carving Tools and Techniques Minneapolis Institute of Art 🎥

Curatorial Care of Ceramic, Glass, and Stone Objects. National Parks Service. *(PDF)*
Care of Objects Made of Plaster of Paris. Canadian Conservation Institute. CCI Notes N12/2. 2007.
Care of Alabaster. National Parks Service, Conserve O Gram 15/1. 2000. *(PDF)*
Care of Inuit Carvings. Canadian Conservation Institute. CCI Notes N6/9. 2016.
Care of Argillite. Canadian Conservation Institute. CCI Notes N12/1. 2007.

Ceramic and Glass

“Objects made of ceramics and glass come from the clay and mineral deposits in the ground below us and in the natural world around us-from the aluminum, silicon, and iron in our soils to the salt in our oceans and potassium in our forests. Ceramics and glass as material classes are often grouped together because of their similarity in material makeup. They also both require the use of extreme heat in the form of kiln firing or furnace working in order to be made into the precious objects we collect for display, use, and enjoyment in our homes and institutions.

When we think of objects made of ceramics and glass, the number one vulnerability that might come to mind is breakage. We have all had that moment when we dropped something and waited that split-second for the inevitable, excruciating crash. Hopefully, the object was replaceable or you knew a conservator to call. The devastation of breaking ceramics and glass is one type of physical damage that can occur. Ceramic and glass objects can also crack and break for other reasons, such as the thermal shock that occurs when pouring hot tea in a ceramic mug that has been outside on a cold day.

Because of the way ceramic and glass objects are made, they can inherently contain built-up stresses inside their structures. Think of a ceramic that is made by forming wet clay on a spinning wheel or of a gather of molten glass being spun on a blow pipe. The molecules in both cases are being forced to align in certain ways, and then, in the case of the ceramic. They are dried out and fired in place; in the case of the glass, they are cooled in place. If the drying out, firing, or cooling happens for too long, not long enough, or is done too quickly, stresses can build up within the body of the ceramic or glass that make it even more vulnerable to break-age. If bumped in the right way, a ceramic or glass object may crack or break entirely, even if the bump did not seem hard enough to cause that kind of damage. In rare cases, a ceramic or glass object may break or crack spontaneously while sitting on a shelf.

Other forms of physical damage include scratching and abrasion, which often result in the loss of decoration layers. Common forms of decoration on ceramics include colored slips (dilute clay) and glazes, and common forms of decoration on both ceramics and glass include enamels (colored glass fused atop the glass or glazed ceramic) and gilding. Although not as common, ceramics and glass may also be decorated with "cold" paint and gilding, which means these decoration layers are not fired on and are even more at risk of loss by abrasion.

Regarding their chemical vulnerabilities, ceramic and glass objects are generally stable with regard to changes in the environment however. There are a few exceptions. For one, exposure to acids, such as acidic foods, can cause a chemical breakdown of the surface of a glass or glazed ceramic. In the case of ceramics, and depending on the porosity (porous earthenware vs. non-porous hard-paste porcelain), disfiguring staining material can enter through crazing (a fine network of cracks in the glaze) and penetrate a porous ceramic body. Also with porous ceramics, salt permeation can be a vulnerability. Certain salts, such as sodium chloride (table salt), can enter a porous ceramic when dissolved in water. Upon drying, the salts will crystallize, thereby growing in size and causing physical pressure within the body of the ceramic. This is the same phenomenon that happens with salt crystallization in the exterior walls of stone and brick architecture and can sometimes cause extreme forms of flaking, spalling, and breakage of the ceramic and decoration layers.”

- Lauren Fair, Caring for You Cherished Objects: The Winterthur Guide, 2021.

Metals & Ceramics: Crash Course Engineering #19. Crash Course. 🎥

[“Today we’ll explore more about two of the three main types of materials that we use as engineers: metals and ceramics. We’ll discuss properties of metals, alloys, ceramics, clay, cement, and glass-ceramic materials. We’ll also look at the applications of our materials with microelectromechanical systems and accelerometers.”]

Caring for Ceramics and glass. Canadian Conservation Institute.

[Glass and ceramic objects have been produced for thousands of years for both functional and decorative purposes. They are very hard and brittle and can easily crack or break on impact. In certain instances, some of these objects can also be damaged by improper light, humidity and temperature. Generally, the most important precaution is to avoid situations that could cause breakage. The following resources provide information and advice on how to care for ceramic and glass objects." Also begins with a section understanding the composition of these materials.]

Ceramics. AIC Conservation Wiki.

["Ceramics are objects made from clay (or clay mixed with other materials) that are subjected to high heat. This application of heat causes irreversible changes within the clay body, rendering the form permanent. Ceramics can take the form of pottery (utilitarian vessels), sculpture, casting cores for bronzes, or architectural elements such as tiles, pipes and bricks.

Generally speaking, ceramics are brittle and weak under shearing or tensile stresses but very strong under compression. In addition, they can withstand very high temperatures and are not prone to chemical erosion. They consist of both crystalline and amorphous phases, though the ratio of these phases is determined by the specific mineral composition"].

Glass. AIC Conservation Wiki.

Care of Ceramics and Glass. Canadian Conservation Institute. CCI Notes N5/1. 2007.
Curatorial Care of Ceramic, Glass, and Stone Objects. National Parks Service. *(PDF)*
Five Steps to Safe Shipment. Canadian Conservation Institute. CCI Notes N20/3. 2021.
Removing Dust from Ceramic and Glass Objects. National Parks Service, Conserve O Gram 8/1, 1993. *(PDF)*
Preservation of Low-Fired Ceramic Objects. National Parks Service, Conserve O Gram 8/3, 2002. *(PDF)*
Caring for Your Treasures – Ceramic and Glass Objects. American Institute for Conservation of Historic and Artistic Works. *(PDF)*
Dusting Guidelines for Stone Objects and Interior Architectural Features. National Parks Service, Conserve O Gram 15/2, 2000. *(PDF)*
Care of Objects Decorated with Glass Beads. Canadian Conservation Institute. CCI Notes N6/4. 1994.
Long-Term Effects of Acid-Cleaning Archeological Ceramics. National Parks Service, Conserve O Gram 6/6, 1999. *(PDF)*

Metal

“Of the many wonderful qualities most metals have, including strength, malleability, ductility, and the ability to take a polish or patina, they are also inherently vulnerable to several key factors that make caring for them slightly more complicated than other inorganic materials.

Physical vulnerabilities include scratching, denting, tearing, loss of plating, loss of paint or coating, and complete or partial detachment of component elements. These types of condition issues can be the result of natural use over time, improper storage and handling, or particularly aggressive prior restoration methods. When a metal object shows signs of physical deterioration, it will likely require structural conservation treatment, and a conservation professional is best suited to assist.

Chemical vulnerabilities of metals include their reaction with components in the environment such as moisture (e.g., high relative humidity) and pollutants (e.g., organic acid vapors). The main condition issue associated with chemical vulnerability, however, is corrosion. All metals are reactive, some more than others. Gold is considered to be a "noble" metal, which means it is the least reactive to chemicals in the environment. Iron, on the other hand, is quite reactive. In practical terms, if you were to place an iron object and a gold object inside a wet chamber for one day, the iron would corrode significantly while the gold would likely not change at all. Some common forms of corrosion on metals include:

Silver tarnish: Black in color. The major component is silver sulfide, formed by silver metal reacting with atmospheric sulfur, a common component of our post-Industrial Revolution atmosphere.

Lead corrosion: Dark gray to white in color. A common form is lead acetate, formed by lead reacting with acetic acid in the environment, such as that from a wooden display cabinet.

Copper corrosion: There are many types that range in color from green to blue to red, reacting with various components of the atmosphere, including oxygen alone. "Bronze disease," for instance, refers to a particular form, copper chloride corrosion, most often found on marine archaeological artifacts or where salt water contamination is suspected.”

Iron corrosion: There are many types, but colors range most commonly from red to orange to black, reacting with many components of the atmosphere, including oxygen alone.”

- Lauren Fair, Caring for You Cherished Objects: The Winterthur Guide, 2021.

Metals & Ceramics: Crash Course Engineering #19. Crash Course. 🎥

[“Today we’ll explore more about two of the three main types of materials that we use as engineers: metals and ceramics. We’ll discuss properties of metals, alloys, ceramics, clay, cement, and glass-ceramic materials. We’ll also look at the applications of our materials with microelectromechanical systems and accelerometers.”]

Metals. Canadian Conservation Institute.

[“Throughout history, metals have been widely used for functional and decorative objects, such as tools, weapons, jewelry, sculptures, coins and medals. Metal objects need proper care to prevent or minimize corrosion and other types of damage. The following resources provide information and advice on how to care for them.”]

Metals. AIC Conservation Wiki.

[“Metals conservation is the conservation and preservation of cultural materials with metallic properties. Objects can include pure metals, metal alloys, corrosion products, or composite artifacts. Metals most often

encountered in conservation include gold, silver, copper, iron, lead, tin, nickel, zinc, aluminum, chromium, titanium, and their alloys."]

Science & Environmental Facts : Why Does a Magnet Attract Iron?. Ehowgreen.

Pourbaix Diagrams 🎥

["*In electrochemistry, and more generally in solution chemistry, a Pourbaix diagram, also known as a potential/pH diagram, EH–pH diagram or a pE/pH diagram, is a plot of possible thermodynamically stable phases of an aqueous electrochemical system. Pourbaix Diagrams plot electrochemical stability for different redox states of an element as a function of pH.*"

Copper Alloys

The Cleaning, Polishing, and Protective Waxing of Brass and Copper. Canadian Conservation Institute. CCI Notes N9/3. 2007.
Preventing and Treating the Dezincification of Brass. Canadian Conservation Institute. CCI Notes N9/13. 2019.
Caring for Outdoor Bronze Plaques, Part I: Documentation and Inspection. National Parks Service, Conserve O Gram 10/4, 2005. *(PDF)*
Caring for Outdoor Bronze Plaques, Part II: Cleaning and Waxing. National Parks Service, Conserve O Gram 10/5, 2005. *(PDF)*

Iron

Care and Cleaning of Iron. Canadian Conservation Institute. CCI Notes N9/6. 2007.
Video – Time-lapse Video of Deterioration: Two Iron Keys, Incorrect Relative Humidity and Pollutants. Canadian Conservation Institute. 🎥
Tannic Acid Coating for Rusted Iron Artifacts. Canadian Conservation Institute. CCI Notes N9/5. 2013.
Mechanical Removal of Rust from Machined Ferrous Surfaces Canadian Conservation Institute. CCI Notes N9/8. 2007.

Silver

Silver – Care and Tarnish Removal Canadian Conservation Institute. CCI Notes N9/7. 2007.
How to Make and Use a Precipitated Calcium Carbonate Silver Polish. Canadian Conservation Institute. CCI Notes N9/11. 2016.
Caring for Silver and Copper Alloy Objects. National Parks Service, Conserve O Gram 10/2, 1999. *(PDF)*
Understanding how silver objects tarnish. Canadian Conservation Institute.

Other Topics

Storage of Metals. Canadian Conservation Institute. CCI Notes N9/2. 2007.
Basic care – Recognizing metals and their corrosion products. Canadian Conservation Institute.
Recognizing Active Corrosion. Canadian Conservation Institute. CCI Notes N9/1. 2007.
Time Capsules. Canadian Conservation Institute. CCI Notes N1/6. 1995.
Lead in Museum Collections and Heritage Buildings. Canadian Conservation Institute. CCI Notes N1/8. 2010.
Identifying Archaeological Metal. Canadian Conservation Institute. CCI Notes N4/1. 2007.
Basic Care of Coins, Medals and Medallic Art. Canadian Conservation Institute. CCI Notes N9/4. 2007.
Care of Objects Made of Zinc. Canadian Conservation Institute. CCI Notes N9/9. 2007.
How to Determine Metal Density. Canadian Conservation Institute. CCI Notes N9/10. 2016.
Care of Paintings on Ivory, Metal, and Glass. Canadian Conservation Institute. CCI Notes N10/14. 2015
How to Test for Copper and Lead. Canadian Conservation Institute. CCI Notes N17/3. 2016.
How to Test for Iron and Nickel. Canadian Conservation Institute. CCI Notes N17/4. 2016.
How to Test for Gold and Tin. Canadian Conservation Institute. CCI Notes N17/6. 2019

The Care of Musical Instruments in Canadian Collections. Canadian Conservation Institute. CCI Technical Bulletins TB4 1982.
Care and Preservation of Firearms. Canadian Conservation Institute. CCI Technical Bulletins TB16. 1995.
Threaded Fasteners in Metal Artifacts. Canadian Conservation Institute. CCI Technical Bulletins TB17. 1997.
Metals and Corrosion: A Handbook for the Conservation Professional. Canadian Conservation Institute.
Understanding flash rusting. Canadian Conservation Institute.

Plant Materials

“Readily available in the environment, organic materials have been used worldwide for millennia to create objects of art and daily life. They are made from the once-living tissues of plants and animals. Synthetically produced rubbers and plastics also fall under this category, since they, too, are organic in nature. Organic materials are found in collections of all types, whether they are fine and decorative arts, objects from indigenous cultures, modern and contemporary art, or natural history specimens. Some are more prone to deterioration than others but with proper care can be maintained in good condition for many years.

Plant Materials

The basic building block of plant materials is cellulose, a complex carbohydrate that forms plant cell walls. Many species of plants are well suited for creating art and artifacts. Their roots, stems, wood, branches, leaves, bark, and even seeds have unique properties that can serve wide-ranging uses. Basketry is quite common, but many other types of objects can be made as well: tools, containers, musical instruments, sculptures, and ornaments, to name a few. After harvesting, some degree of processing is generally necessary before plant materials can be fashioned into objects. For example, leaves and stems can be soaked and heated to soften them, remove extraneous compounds, or aid in extracting fibers. Wood can be split into long. thin splints for weaving. Colors can be changed through sun-bleaching or dyeing, with the final appearance of an object further altered with paints and other finishes. Although they serve an important purpose, many of these processes compromise the long-term stability of the plant materials.

Objects made of plant materials vary in their sensitivity. A sturdy wood sculpture may need nothing more than a stable environment and periodic dusting to remain in good condition. Baskets and other items made of finer, thinner materials, are more susceptible to damage. They may exhibit discoloration and embrittlement as they degrade and acidify from exposure to air, light, and cycling relative humidity.

Pliable materials can stiffen and become impossible to flex without cracking or breaking. Dirt and dust can easily become trapped within porous surfaces or the interstices of a weave and be difficult to remove. Soft baskets can collapse under their own weight, and objects hung by their handles or other vulnerable areas can eventually break from the prolonged tension. Proper support and display strategies are key in these kinds of situations. A common past practice was to "feed" baskets with waxes or oils. Although this may temporarily restore sheen, it should be avoided, since it confers no long-term benefit and may cause new problems as the applied materials themselves deteriorate.”

- Lara Kaplan, Caring for You Cherished Objects: The Winterthur Guide, 2021.

Basketry

Caring for basketry and plant materials. Canadian Conservation Institute.

> *[“basketry and objects made of plant materials have existed for several thousand years. Many of these objects can be found in private homes as well as museums. Since they can be damaged by light, humidity, water, pests and improper storage and handling, it is important to ensure specific care is taken to preserve these objects.”]*

Care of Basketry. Canadian Conservation Institute. CCI Notes N6/2. 1988.
Storage Supports for Basket Collections. National Parks Service, Conserve O Gram 5/1, 1993. *(PDF)*

Wooden Objects and Furniture

Wood Material-How wood is obtained, its properties and objects made from wood material. Superkids Gurukul. 🎥
["Wood Material How wood is obtained, its properties and objects made from wood material || "]

Basic care – Furniture and objects made of wood. Canadian Conservation Institute.
"Wooden furniture has been around for several thousand years. Although museums house many beautiful examples of antique furniture, most of it remains in private hands and homes. To safeguard this furniture as it is passed from one generation to the next, proper care is essential."

Basic care – Wooden masks
Care of Canoes, Kayaks and Umiaks. Canadian Conservation Institute. CCI Notes N6/3. 1989.
Totem Poles Displayed Indoors. Canadian Conservation Institute. CCI Notes N6/7. 2008.
Totem Poles Displayed Outside. Canadian Conservation Institute. CCI Notes N6/8. 2008.
Care and Cleaning of Unfinished Wood. Canadian Conservation Institute. CCI Notes N7/1. 2016.
Care of Furniture Finishes. Canadian Conservation Institute. CCI Notes N7/2. 2017.
The Care of Musical Instruments in Canadian Collections. Canadian Conservation Institute. CCI Technical Bulletins TB4. 1982.
Cleaning Wood Furniture. National Parks Service, Conserve O Gram 7/1, 1993. *(PDF)*
Waxing Furniture and Wooden Objects. National Parks Service, Conserve O Gram 7/2, 1993. *(PDF)*
Protecting Wood with Preservatives and Water Repellants. National Parks Service, Conserve O Gram 7/3, 1993. *(PDF)*
Upholstered Furniture: Agents of Deterioration. National Parks Service, Conserve O Gram 7/4, 1993. *(PDF)*
Silicone in Furniture Waxes and Polishes. National Parks Service, Conserve O Gram 7/6, 1993. *(PDF)*
Emergency Treatment for Water-Soaked Furniture and Wooden Objects. National Parks Service, Conserve O Gram 7/7, 1993. *(PDF)*
Biological Deterioration & Damage to Furniture & Wooden Objects (Smithsonian Museum Conservation Institute)

Animal Materials

Feathers, Horn, and Quills

“Structures arising from the outer layer of skin are common in the animal kingdom. Some, like horn, tortoiseshell, hooves, and claws, are hard and tough; others are softer and more flexible, such as hair, feathers, and porcupine quills. Although outwardly different, they are all made of keratin, a strong and resilient protein.

In addition to its toughness and stability, keratin is thermoplastic. meaning that it becomes malleable with heat and will retain a new shape upon cooling. This useful property allows keratinous materials, especially the harder varieties, to be pressed or molded into different forms. Horn can be flattened into sheets and cut into panels, veneers, and buttons or shaped into spoons, cups, and innumerable other utilitarian and decorative objects.

Tortoiseshell (which despite the name is obtained from sea turtles) is similar to horn in its working properties and uses, but its rarity and beautiful pigmentation patterns have made it a more expensive material. historically reserved for luxury goods. An early goal of the plastics industry was to imitate costly materials such as tortoiseshell. Some faux tortoiseshell looks just like the real thing but has very different ageing properties, so it is important to identify properly. Horn and tortoiseshell are relatively durable, but they are still sensitive to environmental fluctuations and can warp and crack, especially if cut into thin veneers that are constrained, as may be the case with inlays or linings. Highly decorative in form and color, feathers are a popular choice for accessories such as hats, bags, and jewelry. They have many practical purposes too, such as pen quills, dusters, arrow fletching, and fans.

Feathers become increasingly fragile over time and can easily crease or break. Fading of light-sensitive pigments and dyes is another serious concern. Feathers and other soft keratinous materials are also extremely prone to insect damage. Despite their toughness, horn and tortoiseshell can be readily attacked as well .”

- Lara Kaplan, Caring for You Cherished Objects: The Winterthur Guide, 2021.

Leather, Skin, Fur, and other Keratinous Materials

Skeletal Materials: Bone and Ivory

“Skeletal materials such as ivory and bone are composed of calcium-containing minerals embedded in a collagen matrix, a combination that provides both strength and resiliency. Ivory comes from teeth or tusks, which are simply elongated teeth. Elephant ivory, like tortoiseshell, has been valued as a high-end material, but ivories from other animals such as walrus, whale, and hippo are also commonly used. Teeth grow in distinct layers and are dense and fine-grained. Bones tend to be more structurally uniform and are generally more porous to allow for the passage of tiny blood vessels. Each can be used to make a wide variety of objects, from humble sewing needles to ornately carved sculptures.

Ivory and bone will both expand and contract in response to changes in relative humidity. Ivory is at higher risk of cracking because of its layered structure, but both are vulnerable if movement is restricted (FIG. 6). Surfaces can bleach from light exposure. They can also darken or yellow due to oxidation of oils and other organic constituents. This type of patina is often considered desirable for older pieces and may even be mimicked with a dye or coating. Ivory especially can benefit from being displayed or stored in a case or cabinet, which will protect it from light and environmental changes.

Shell is made mostly of calcium carbonate with only a small amount of organic material. It forms the protective exoskeletons of various invertebrates, such as mollusks and snails. Shell is often used decoratively, as in jewelry and inlays, but can also be incorporated into tools and utensils. While less sensitive to environmental changes than ivory or bone, shell can react with air pollutants--specifically sulfur dioxide from car exhaust and volatile organic acids released from certain types of wood-and develop a powdery surface, a condition called Byne's efflorescence that can be quite destructive over time. Storage in wooden drawers or cabinets should therefore be avoided. If a shell surface does become compromised, contact a professional conservator to assess the problem and recommend appropriate corrective actions.”

Leather, Skin, and Fur

“Many materials can be made from the skin and internal soft tissues of animals. Rawhide, parchment, leather, and fur are skin-based. Gutskin -a thin, translucent material- is made from intestinal linings. Strands of sinew (tendon) are used to make thread and cordage. All these materials consist primarily of the protein collagen, which forms networks of microscopic fibers that give skin and other soft tissues their characteristic strength and flexibility.

Any number of techniques can transform the raw material into durable products. Rawhide, a rigid and tough material, requires little more than careful cleaning, scraping, and drying under tension to create, but it remains highly sensitive to moisture.
This is in large part due to the crucial step of tanning, where the protein structure of skin is chemically altered by soaking in a tanning solution. Various tanning methods have been used throughout history to create different types of leather. One of the most common is vegetable tanning, an ancient technique found the world-over that utilizes plant extracts (tannins) as the tanning agent. The vast majority of modern leather is made by chrome tanning, a form of mineral tanning developed in the late nineteenth century. Faster, cheaper, and producing a more resistant leather, it quickly replaced vegetable tanning shortly after it was introduced.

Skin, leather, and related materials are especially vulnerable to the ravages of time. The main culprits are oxygen, light, and pollutants, which lead to weakening, stiffening, and embrittlement. Some leathers, especially vegetable-tanned leathers from the mid- to late nineteenth century, undergo acidic changes, also known as red rot, which significantly worsens their deterioration (FIG. 3). As they age, skin and leather items that were once flexible can take on permanent folds or deformations, and weight bearing components may no longer be structurally sound. Similar to baskets, proper support and mounts are needed to prevent damage. Once deteriorated, all skin materials will be susceptible to water damage, no matter how they were originally processed. Repeated wetting can wash out tanning agents and also cause staining, hardening, and shrinkage. Insect damage is a concern as well. especially for furs or other items that still have hair.

As with "feeding" baskets, there is a popular misconception that applying leather dressings will keep leather objects strong and supple.Such a process may be beneficial for new objects in active use, but it can cause irreversible damage on historic objects since the components of these products break down over time, especially if they have been applied excessively. Surfaces can become dark and sticky or harden and flake off, and a white haze (called a bloom or spew) can develop and be difficult to remove. Leather in good condition is best left alone.”

- Lara Kaplan, Caring for You Cherished Objects: The Winterthur Guide, 2021.

Leather, Skin, and Fur. Canadian Conservation Institute.
[“Museum collections often include objects made of leather, skin or fur. With proper storage and care, these materials can be maintained in good condition for many years. The following resources provide information and advice on how to care for leather, skin and fur objects.”]

N6/4 Care of Objects Decorated with Glass Beads. Canadian Conservation Institute. CCI Notes (1994)
N8/1 Removing Mould from Leather. Canadian Conservation Institute. CCI Notes (2016)
N8/2 Care of Alum, Vegetable, and Mineral Tanned Leather. Canadian Conservation Institute. CCI Notes (1992)
N8/3 Care of Mounted Specimens and Pelts. Canadian Conservation Institute. CCI Notes (2015)
N8/4 Care of Rawhide and Semi-Tanned Leather. Canadian Conservation Institute. CCI Notes (1992)
Time-lapse Video of Deterioration: Parchment and Iron Key, Incorrect Relative Humidity
Internal Supports for Buckskin Clothing Storage. National Parks Service, Conserve O Gram 5/3, 2011. *(PDF)*
Leather Dressing: To Dress or Not to Dress. National Parks Service, Conserve O Gram 9/1, 1993. *(PDF)*
An Easy-To-Build Museum Saddle Mount. National Parks Service, Conserve O Gram 9/2, 2009. *(PDF)*

The Care of Leather and Fur (Connecting to Collections Care – AIC Online Community, 2015)

Natural History Specimens

Caring for natural history collections. Canadian Conservation Institute.

N1/7 Mercury in Museum Collections. Canadian Conservation Institute. CCI Notes (2002)
N6/1 Care of Ivory, Bone, Horn and Antler. Canadian Conservation Institute. CCI Notes (1988)
N6/5 Care of Quillwork. Canadian Conservation Institute. CCI Notes (1991)
N6/9 Care of Inuit Carvings. Canadian Conservation Institute. CCI Notes (2016)
N8/3 Care of Mounted Specimens and Pelts. Canadian Conservation Institute. CCI Notes (2015)
External links
Agents of Deterioration That Threaten Collection Specimens (Canadian Museum of Nature)
Bone, Antler, Ivory, and Teeth (PDF format) (Minnesota Historical Society)*(PDF)*
CanOSH | Canada's National Workplace Health and Safety Website
Conserve O Grams – sections 2 and 11 National Parks Service, Conserve O Gram (National Park Service) *(PDF)*
Detecting Pesticide Residues on Museum Objects in Canadian Collections—A Summary of Surveys Spanning a Twenty-year Period (PDF format) (Society for the Preservation of Natural History Collections)*(PDF)*
Ivory, Bone, Antler and Horn (Pitt Rivers Museum)
Quills, Horn, Hair, Feathers, Claws, and Baleen (PDF format) (Minnesota Historical Society)*(PDF)*
Residual Pesticides (American Museum of Natural History)
Resources – Residual Pesticides (MuseumPests.net)
Respirators – Respirator Selection (Canadian Centre for Occupational Health and Safety)
Society for the Preservation of Natural History Collections
The Care and Handling of Ivory Objects (Smithsonian Museum Conservation Institute)
The Care of Feathers (PDF format) (Bishop Museum)*(PDF)*

Rubber and Plastics

The earliest industrially manufactured rubbers and plastics began as chemically modified natural materials. Vulcanized rubber was invented in the 184os, followed by cellulose nitrate in the 186os and cellulose acetate in the 18gos. The first fully synthetic plastic, phenol formaldehyde (Bakelite), was patented around 1910. Many of today's familiar plastics, such as acrylics (Lucite and Plexiglas), polyvinyl chloride (vinyl), polyurethane, polyethylene, and polyester, were developed during World War I and II, with others following over the course of the twentieth century. Plastics can be produced as molded forms, sheets, foams, fibers, films, and coatings, making them incredibly versatile. As a result, they are ubiquitous in everyday objects, jewelry, and collectibles and find frequent use in modern and contemporary art.

It is a common misconception that plastics will last forever. Although some are more stable than others, they will all degrade eventually. How and when this happens depends on the type of plastic in question and the specific additives it contains. Discoloration, stickiness, deformation, embrittlement, cracking, and splitting are all signs that a plastic is deteriorating (FIG. 7). The conservation of plastics remains an evolving area, as deterioration mechanisms become better understood and new treatment strategies are developed. Keeping plastics in a cool, dark, stable environment will help increase their lifespan. Many plastics in good condition can be safely cleaned with water and a soft cloth, but even this may be damaging. It is therefore best to consult a conservator to determine the best course of action.

The Polymer Explosion: Crash Course Engineering #20. Crash Course. 🎥

> *["We're continuing our look at engineering materials with third main type of material that you'll encounter as an engineer: polymers. They're made of long, repeating chains of smaller molecules known as monomers and today we'll explore their strange history of polymers and the things that contributed to how we use them today."]*

Rubber and Plastics. Canadian Conservation Institute.

> *["Museum collections contain many types of plastics and other modern materials, which deteriorate in different ways and at different rates. These resources explain how to identify, care for and store such materials in an effective way to reduce their deterioration and the deterioration of surrounding objects."]*

Care of Objects Made from Rubber and Plastic. Canadian Conservation Institute. CCI Notes N15/1, 1997.
Display and Storage of Museum Objects Containing Cellulose Nitrate. Canadian Conservation Institute. CCI Notes N15/3, 1994.
The Beilstein Test: Screening Organic and Polymeric Materials for the Presence of Chlorine, with Examples of Products Tested. Canadian Conservation Institute. CCI Notes N17/1, 1993.
The Diphenylamine Spot Test for Cellulose Nitrate in Museum Objects. Canadian Conservation Institute. CCI Notes N17/2, 1994.
Saving the Twentieth Century: The Conservation of Modern Materials (1991)
External links
Care and Identification of Objects Made from Plastic. National Parks Service, Conserve O Gram 8/4, 2010. *(PDF)*
Care of plastics (Museum of Design in Plastics)

Paper-based Objects

“Paper is a miracle, and it is everywhere - in ancient tombs in China, in the packaging of our personal mobile devices, and in the staggering varieties of digital prints available today. Even with rapid changes in technology and electronic media, paper endures as a primary support for works of art such as prints, drawings, pastels, watercolors, and mixed media. Delicate and porous, it is supremely sensitive to the artist's pen, pencil, brush, and printing plate. Despite its seeming fragility, paper survives in museum collections and on the walls of our homes. What can we do to preserve and care for our collections at home? With an understanding of the unique qualities of paper, its manufacture, its strengths, and its vulnerabilities, there is much that can be accomplished.

The miraculous nature of paper has much to do with its two major ingredients: cellulose, the most abundant organic polymer in the world, and water. These two substances have a tremendous chemical affinity for each other, promoting the strong fiber bonds that allow for the formation of a sheet of paper. Early European and North American handmade papers consist solely of paper fibers suspended in water and laid down on a wire screen by the "vat man," a highly trained craftsman tending a vat of pulp. These early papers were made from rags, generally linen, collected and carefully sorted by quality. The rags were chemically decomposed by being soaked in lime and physically "beaten to a pulp' by wooden hammers or, later, mechanized metal beaters. Seen today, some of these early rag papers, such as the ones dating from the thirteenth-century mills of Fabriano, Italy, are in remarkably good condition -still strong, flexible, and relatively bright.
Why are papers from centuries ago in such good condition while our paperbacks only decades' old are now brown and sometimes crumbling?
One major reason is manufacture. Papers made from rags have long paper fibers, which create strong bonds and strong sheets. They were also processed with lime, a source of calcium, which is good for our bones and for paper. These early papers were sometimes given a coating of gelatin sizing to provide strength and waterproofing, allowing them to be written upon with fluid inks or other aqueous media. While some good-quality artists' papers are still made from rags with gelatin sizing. Many commercially produced papers today have no such advantages.
Mechanization of the nineteenth century brought many changes to paper, including papermaking machines and new types of sizing that could be implemented on an industrial scale. Alum- rosin sizing, which came into general use after about 1830, was successful as a sizing agent for the machine age but also introduced acid to the paper. Acids are known to contribute to the hydrolysis of cellulose, shortening the cellulose polymer and resulting in weak and brittle sheets. Other sources of acids include bleach and acidic sulfite processing, or the breaking down of the pulp with acids rather than lime.
The last quarter of the nineteenth century saw one other major development -the introduction of wood pulp to papermaking. Wood fibers, while also made of cellulose, are shorter than the earlier rag fibers, yielding weaker sheets. Wood fibers, if not chemically purified, contain lignin, which also contributes significantly to the discoloration and yellowing of paper. Although the “era of acidic papermaking,” has left troves of crumbling paper in its wake, all is not lost. There are steps we can take to protect works on paper and to slow the effects of time, environment, and inherent vice from manufacture.”

Paper-based Objects. Canadian Conservation Institute.

> *[“Books and paper objects are very susceptible to damage caused by light, heat, pests and physical forces. With proper care and storage, these objects can be displayed and kept in museums, libraries and archives for years. The following resources provide information and advice on how to care for paper and books.”]*

Time Capsules. Canadian Conservation Institute. CCI Notes N1/6, 1995.
Psocids or “Book Lice”: A Warning of Dampness. Canadian Conservation Institute. CCI Notes N3/4, 1998.
Making Protective Enclosures for Books and Paper Artifacts. Canadian Conservation Institute. CCI Notes N11/1, 1996.
Storing Works on Paper. Canadian Conservation Institute. CCI Notes N11/2, 1995.
Glazing Materials for Framing Works on Paper. Canadian Conservation Institute. CCI Notes N11/2, 1996.

Wheat Starch Paste. Canadian Conservation Institute. CCI Notes N11/4, 1993.
Matting Works on Paper. Canadian Conservation Institute. CCI Notes N11/5, 1997.
Removing Paper Artifacts from Their Frames. Canadian Conservation Institute. CCI Notes N11/6, 1993.
Basic Care of Books. Canadian Conservation Institute. CCI Notes N11/7, 1995.
Display Methods for Books. Canadian Conservation Institute. CCI Notes N11/8, 1994.
Framing Works of Art on Paper. Canadian Conservation Institute. CCI Notes N11/9, 1995.
Encapsulation. Canadian Conservation Institute. CCI Notes N11/10, 1995.
Dry Methods for Surface Cleaning of Paper. Canadian Conservation Institute. CCI Technical Bulletins TB11. 2001.
The Stability of Photocopied and Laser-printed Documents and Images: General Guidelines. Canadian Conservation Institute. CCI Technical Bulletins TB22. 2000.
Guidelines for Humidity and Temperature for Canadian Archives. Canadian Conservation Institute. CCI Technical Bulletins TB23. 2000.
Water Quality for Treatment of Paper and Textiles. Canadian Conservation Institute. CCI Technical Bulletins TB24. 2001.
Guidelines for pH Measurement in Conservation. Canadian Conservation Institute. CCI Technical Bulletins TB28. 2007.
Other CCI resources on this topic
Basic care – Books
Basic care – Globes
Basic care – Paper documents and newspaper clippings
Looking at Paper: Evidence and Interpretation (1999)
External links
What Makes a Book Rare?. National Parks Service, Conserve O Gram 19/1, 1993. *(PDF)*
Care and Security of Rare Books National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/2, 1993) *(PDF)*
Use and Handling of Rare Books National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/3, 1993) *(PDF)*
Archives: Preservation Through Photocopying National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/4, 1993) *(PDF)*
Removing Original Fasteners from Archival Documents National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/5, 1993) *(PDF)*
Attachments for Multi-Page Historic Documents National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/6, 1993) *(PDF)*
Archives: Reference Photocopying National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/7, 1993) *(PDF)*
Judging Permanence for Reformatting Projects: Paper and Inks National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/14, 1995) *(PDF)*
Storing Archival Paper-Based Materials National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/15, 1996) *(PDF)*
Housing Archival Paper-Based Materials National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/16, 1996) *(PDF)*
Handling Archival Documents and Manuscripts National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/17, 1996) *(PDF)*
How to Care for Bound Archival Materials National Parks Service, Conserve O Gram (PDF format) Conserve O Gram 19/18, 1996) *(PDF)*
A Phase Box for the Protection of Books National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/23, 2001) *(PDF)*
How to Preserve Acidic Wood Pulp Paper National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 19/24, 2001) *(PDF)*
Planning and Managing a Microfilming Project for Preservation and Access. National Parks Service, Conserve O Gram 19/25, 2008. (PDF format) *(PDF)*
Caring for Private and Family Collections (Northeast Document Conservation Center)

Image Permanence Institute
Paper Conservation Catalog (American Institute for Conservation)
Preservation Leaflets (Northeast Document Conservation Center)

Photographic Materials

Housed on phones and hard drives, in family albums, in frames, and in boxes of all sizes and qualities, photographs surround us. These treasured artifacts celebrate our lives and times and those of our ancestors; they document our world and connect cultures. Formed by the action of light on a sensitized surface, photographs made from traditional processes-such as albumen, silver gelatin, and chromogenic color-can deteriorate rapidly over time by fading, cracking, staining. and yellowing. More recent digital print or hardcopy processes popular after the 1990s, which use commercial inks and toners, may also be sensitive to abrasion, dye bleeding, delamination, and discoloration.
No matter the process, many photographs are irreplaceable, and it is important that we care for them properly. Throughout the history of photography, a dizzying array of print and negative processes have been developed involving materials such as metallic silver, platinum, pigments, organic dyes, and printing inks and toners that absorb and scatter light, thereby creating the images we see.
Caretakers of photographic collections should become familiar with the photographic processes represented within their collections. Knowing when each process was commonly used, the method of manufacture. and the primary deterioration characteristics of each can help in identification and promote a better understanding of their care (FIG. 1).
All photographic materials are vulnerable to deterioration when exposed to damaging display procedures, improper storage, careless handling. or adverse environmental conditions. High temperatures and relative humidity levels combined with dirt, dust, pollutants, and pests will rapidly accelerate deterioration. A basic understanding of these factors is critical to the long-term preservation of irreplaceable photographs.

Photographs. Canadian Conservation Institute.

> *["Museums, libraries, galleries and archives collect and preserve all manner of photographic materials, such as black and white or color prints as well as digital images. Personal collections generally also contain a broad range of photographic print and negative materials. All are subject to deterioration from inappropriate storage, handling and display conditions. For example, high humidity and temperature, air pollution and light exposure can all cause photographs to deteriorate. Though many are inherently chemically unstable and deteriorate readily, there are many things that can be done to ensure the long-term preservation of these images. The following resources provide information and advice on how to care for photographs."]*

Care of Encased Photographic Images. Canadian Conservation Institute. CCI Notes N16/1, 2007.
Care of Black-and-White Photographic Glass Plate Negatives. Canadian Conservation Institute. CCI Notes N16/2, 2007.
Care of Black-and-White Photographic Negatives on Film. Canadian Conservation Institute. CCI Notes N16/3, 2007.
Care of Black-and-White Photographic Prints. Canadian Conservation Institute. CCI Notes N16/4, 2007.
Care of Colour Photographic Materials. Canadian Conservation Institute. CCI Notes N16/5, 2007.
Processing Contemporary Black-and-White Photographic Films and Papers for Maximum Permanence. Canadian Conservation Institute. CCI Notes N16/6, 2007.
Making Mounting Corners for Photographs and Paper Objects. National Parks Service, Conserve O Gram 14/1, 1993. *(PDF)*
Storage Enclosures for Photographic Prints and Negatives. National Parks Service, Conserve O Gram 14/2, 1993. *(PDF)*
Chronology of Photographic Processes. National Parks Service, Conserve O Gram 14/3, 1993. *(PDF)*
Caring for Photographs: General Guidelines. National Parks Service, Conserve O Gram 14/4, 1997. *(PDF)*
Caring for Photographs: Special Formats. National Parks Service, Conserve O Gram 14/5, 1997. *(PDF)*
Caring for Color Photographs. National Parks Service, Conserve O Gram 14/6, 1998. *(PDF)*
Caring for Photographs: Special Monochrome Processes. National Parks Service, Conserve O Gram 14/7, 1998. *(PDF)*
Caring for Cellulose Nitrate Film. National Parks Service, Conserve O Gram 14/8, 2004. *(PDF)*
Identification of Film-Base Photographic Materials. National Parks Service, Conserve O Gram 14/9, 1999. *(PDF)*
Cold Storage for Photograph Collections – An Overview. National Parks Service, Conserve O Gram 14/10, 2009. *(PDF)*

Cold Storage for Photograph Collections – Using Individual Freezer Units. National Parks Service, Conserve O Gram 14/11, 2009. *(PDF)*
Cold Storage for Photograph Collections – Vapor-Proof Packaging. National Parks Service, Conserve O Gram 14/12, 2009. *(PDF)*
Contracting for Reformatting of Photographs. National Parks Service, Conserve O Gram 19/12, 1995. *(PDF)*
Preservation Reformatting: Inspection of Copy Photographs. National Parks Service, Conserve O Gram 19/13, 1995. *(PDF)*
Caring for Blueprints and Cyanotypes. National Parks Service, Conserve O Gram 19/9, 1995. (PDF format)
Salvage at a Glance, Part I: Paper Based Collections. National Parks Service, Conserve O Gram 21/4, 2002. *(PDF)*
Salvage at a Glance, Part II: Non-Paper Based Archival Collections. National Parks Service, Conserve O Gram 21/5, 2002. *(PDF)*

Textiles and Costume

Textile and Costume. Canadian Conservation Institute.

> *["Textiles and costumes are some of the most sensitive objects in a museum collection. They are susceptible to damage from heat, light, incorrect humidity, pests and pollutants, as well as from improper handling, storage and display. The following resources provide information on caring for textiles and costumes."]*

Textiles and the Environment. Canadian Conservation Institute. CCI Notes N13/1, 2013.
Flat Storage for Textiles. Canadian Conservation Institute. CCI Notes N13/2, 2008.
Rolled Storage for Textiles. Canadian Conservation Institute. CCI Notes N13/3, 2008.
Velcro Support System for Textiles. Canadian Conservation Institute. CCI Notes N13/4, 2008.
Hanging Storage for Costumes. Canadian Conservation Institute. CCI Notes N13/5 2009.
Mounting Small, Light, Flat Textiles. Canadian Conservation Institute. CCI Notes N13/6, 2009.
Washing Non-coloured Textiles. Canadian Conservation Institute. CCI Notes N13/7, 2009.
Applying Accession Numbers to Textiles. Canadian Conservation Institute. CCI Notes N13/8, 2008.
Anionic Detergent. Canadian Conservation Institute. CCI Notes N13/9, 2008.
Stitches Used in Textile Conservation. Canadian Conservation Institute. CCI Notes N13/10, 2008.
Natural Fibres. Canadian Conservation Institute. CCI Notes N13/11, 2008.
Storage for Costume Accessories. Canadian Conservation Institute. CCI Notes N13/12, 2009.
Commercial Dry Cleaning of Museum Textiles. Canadian Conservation Institute. CCI Notes N13/13, 2008.
Testing for Colourfastness. Canadian Conservation Institute. CCI Notes N13/14, 2008.
Mould Growth on Textiles. Canadian Conservation Institute. CCI Notes N13/15, 2008.
Mechanical Surface Cleaning of Textiles. Canadian Conservation Institute. CCI Notes N13/16, 2010.
Conservation Framing of Embroideries and Other Flat Textiles. Canadian Conservation Institute. CCI Notes N13/17, 2010.
The Identification of Natural Fibres. Canadian Conservation Institute. CCI Notes N13/18, 2008.
A Small Backlit Suction Device for Treating Textiles. Canadian Conservation Institute. CCI Notes N18/4, 2010.
Water Quality for Treatment of Paper and Textiles. Canadian Conservation Institute. CCI Technical Bulletins TB24. 2001.

Other CCI resources on this topic

Basic care – Carpets and rugs
Basic care – Quilts
Fabric of an exhibition: An Interdisciplinary Approach (1997)
Agents of deterioration
Basic requirements of preventive conservation
Handling heritage objects
Light damage calculator

Guidelines for pH Measurement in Conservation. Canadian Conservation Institute. CCI Technical Bulletins TB28. 2007.
Creating a Microclimate for Oversized Museum Objects. National Parks Service, Conserve O Gram 4/4, 1993. *(PDF)*
Storage Techniques for Hanging Garments: Dust Covers. National Parks Service, Conserve O Gram 4/15, 2001. *(PDF)*
Dry Cleaning Museum Textiles. National Parks Service, Conserve O Gram 16/2, 2000. *(PDF)*
A Simple Storage Mat for Textile Fragments. National Parks Service, Conserve O Gram 16/3, 2001. *(PDF)*
Synthetic Fibers in Costume Collections. National Parks Service, Conserve O Gram 16/4, 2002. *(PDF)*
Flag Rolling and Storage. National Parks Service, Conserve O Gram 16/5, 2009. *(PDF)*
Salvage at a Glance, Part V: Textiles. National Parks Service, Conserve O Gram 21/8, 2003. *(PDF)*

Painting and Polychrome Surfaces

Paintings. Canadian Conservation Institute.

["Fine art objects, such as paintings and outdoor murals, can be fragile; however, it is possible to preserve them by taking or avoiding a number of actions. These resources look at the vulnerabilities of paintings and certain artworks displayed outdoors to specific agents of deterioration. They also provide environmental and display guidelines as well as advice on how to prepare paintings for transit, handling and hanging."]

Cleaning Paintings: Precautions. Canadian Conservation Institute. CCI Notes N10/1, 2016.
Making Padded Blocks. Canadian Conservation Institute. CCI Notes N10/2, 2016.
Storage and Display Guidelines for Paintings. Canadian Conservation Institute. CCI Notes N10/3, 2017.
Environmental Guidelines for Paintings. Canadian Conservation Institute. CCI Notes N10/4, 2017.
Emergency Treatment of Water-damaged Paintings on Canvas. Canadian Conservation Institute. CCI Notes N10/5, 2017.
Condition Reporting – Paintings. Part I: Introduction. Canadian Conservation Institute. CCI Notes N10/6, 1993.
Condition Reporting – Paintings. Part II: Examination Techniques and a Checklist. Canadian Conservation Institute. CCI Notes N10/7, 1993.
Framing a Painting. Canadian Conservation Institute. CCI Notes N10/8, 1993.
Keying Out of Paintings. Canadian Conservation Institute. CCI Notes N10/9, 1993.
Backing Boards for Paintings on Canvas. Canadian Conservation Institute. CCI Notes N10/10, 2017.
Condition Reporting – Paintings. Part III: Glossary. Canadian Conservation Institute. CCI Notes N10/11, 2017.
Removing a Painting from its Frame. Canadian Conservation Institute. CCI Notes N10/12, 2017.
Basic Handling of Paintings. Canadian Conservation Institute. CCI Notes N10/13, 1993.
Care of Paintings on Ivory, Metal and Glass. Canadian Conservation Institute. CCI Notes N10/14, 2015.
Paintings: Considerations Prior to Travel. Canadian Conservation Institute. CCI Notes N10/15, 2015.
Wrapping a Painting. Canadian Conservation Institute. CCI Notes N10/16, 2015.
Know Your Paintings – Structure, Materials and Aspects of Deterioration. Canadian Conservation Institute. CCI Notes N10/17, 2017.
Other CCI resources on this topic
Conservation guidelines for outdoor murals
Varnishes: Authenticity and Permanence: Abstracts
Framing a panel painting 🎥
Time-lapse Video of Deterioration: Oil Painting, Incorrect Relative Humidity 🎥
External links
Storage Screens for Paintings National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 12/1, 1993) *(PDF)*

AV Materials

Electronic Media. Canadian Conservation Institute.

["Electronic media (such as optical discs, magnetic tapes and disks, and USB flash drives and cards) hold information that may need to be kept for a lifetime. However, in order to retrieve and read this information time and time again, the owners must ensure proper storage and handling of the media and they must transfer the content to new formats, as required. The following resources provide information related to the deterioration, storage, handling and longevity of electronic media. Advice on how to transfer analogue audio and video recordings to digital formats is also provided to ensure equipment obsolescence does not lead to loss of content. "This section presents key aspects of managing the care of audio, video and data recording media materials in heritage collections based on the principles of preventive conservation and risk management. Helpful list of abbreviations and symbols."]

Electronic Media. AIC Conservation Wiki.

Magnetic Storage Media // How They Store Data And Examples: HDD, Portable HDD and Magnetic Tape 🎥

['This video explains what is secondary storage, the different types of secondary storage, how magnetic storage media works to store data and some examples (Hard Disk Drive, Portable Hard Disk Drive and Magnetic Tape) of magnetic storage media, their uses, advantages and disadvantages."]

Audio Concepts 107: Analog Tape Recording - 3. Physics of Tape. macProVideoDotCom. 🎥

["For most of the heyday of analog recording, magnetic tape prevailed. Eventually, this recording medium was largely replaced by digital recording technologies, but more recently, analog tape has been growing back in popularity in both home and professional studios. Tape really has that warm sound that digital recordings lack and well tape is cool! This course covers everything you need to know about the history and know-how of analog tape.

Joe starts with a history of analog tape, from early monophonic recorders to the multitrack machines that were used to record countless classic records in the60s, 70s and the following decades. Theres a whole section on the physics of tape where you learn about tape heads, tape mechanics, tape formats, brands, and Dolby & dbx noise reduction. After discussing the basics of tape maintenance, Joe dives into how to work with tape, explaining recording and editing techniques specific to tape, including tape-based effects. The course also covers tape emulation plugins, how to incorporate magnetic tape with your DAW setup, and more."]

Audiovisual Formats: A Guide to Identification. California Audiovisual Preservation Project (CAVPP)'s, 2013.

["guide to identification of Audiovisual Formats with images"]

Care, Handling, and Storage of Audio Visual Materials. Library of Congress.

["Taking care when handling any collection item is one of the more effective, cost-efficient, and easily achieved preservation measures."]

Survey Instrument for Audio & Moving Image Collections. Columbia University. 2008.

["In 2005, the Andrew W. Mellon Foundation generously provided support to the Columbia University Libraries to develop and test a survey instrument to inventory and assess the physical condition and intellectual control of audio and moving image materials. The survey instrument and instruction manual are available here for free download. Database was created in the 2007 version of MS Access"]

Film Formats. Museum of Obsolete Media.

["Film Media Timeline. Still Photography. Motion-Picture Photography. Media Preservation. Media Identification Tools. Media Stability Ratings. Obsolescence Ratings"]

Video Formats. Museum of Obsolete Media.

["Video Media Timeline. Video Tape. Video Discs. Other Video Media. Media Identification Tools. Media Stability Ratings. Obsolescence Ratings"]

Lost Formats. Lost Formats Preservation Society.

["The society was founded in 2000 with the design of Emigre issue 57. Its sole purpose is to save formats from obscurity. This overview of Lost Formats is not presented in any particular order and not in any way complete."]

Longevity of Recordable CDs, DVDs and Blu-rays. Canadian Conservation Institute. CCI Notes N19/1. 2020.
Error Analysis and File Recovery Software for Digital Storage Media. Canadian Conservation Institute. CCI Notes N19/2. 2019.
Disaster Recovery of Modern Information Carriers: Compact Discs, Magnetic Tapes and Magnetic Disks. Canadian Conservation Institute. CCI Technical Bulletins TB25. 2002.
Remedies for Deteriorated or Damaged Modern Information Carriers. Canadian Conservation Institute. CCI Technical Bulletins TB27. 2005.
The Digitization of Audio Tapes. Canadian Conservation Institute. CCI Technical Bulletins TB30. 2020.
The Digitization of VHS Video Tapes. Canadian Conservation Institute. CCI Technical Bulletins TB31. 2020.
Other CCI resources on this topic
Video – Labeling CDs 🎥
Video – Identifying Acetate Base Audio Reels 🎥
Video – Identifying Audio Reels with Binder Hydrolysis 🎥
CD formats and their longevity – FAQ
Computer hard disks and diskettes – FAQ
Electronic media collections care for small museums and archives
Preservation of Electronic Records: New Knowledge and Decision-making (2003)
Video, audio recordings and 8mm films – FAQ

Digital Materials: Creation, Care, and Storage

Digital Preservation Coalition. "Digital Preservation Handbook". https://www.dpconline.org/handbook

Downing, Maggie, Heather Hendry, Andrew Pinkham, and Lee Price. "Digitization 201." Series of webinars from the Conservation Center for Art and Historic Artifacts, Philadelphia, December 2020.
https://www.youtube.com/playlist?list=PLUwal4tAEZjTgX0AFUTIeK_BNAlm57Doj

Library of Congress. "Sustainability of Digital Formats." http://www.digitalpreservation.gov/formats

Weddle, Bonita. "Digital Preservation for Small Repositories." Webinar for Documentary Heritage and Preservation Services for New York, March 2018. https://youtu.be/uVb4IXQgTeI 🎥

Collection Types

Outdoor Sculpture and Public Art

This collection of resources focuses on public art, materials and techniques, ethics, and conservation techniques. Each entry includes a citation, abstract, and conclusion when available, and any notes for use.

Art for the Millions: Essays from the 1930's by artists and administrators of the WPA Federal Art Project. Ed. Francis V. O'Connor. New York Graphic Society LTD; Connecticut. In particular, the sculpture section, pages 83-107.

Arzac, Sergio, Nancy Volkman, Charles A. Birnbaum, and Christine Capella Peters. 1998. "The Secretary of the Interior's Standards for the Treatment of Historic Properties." *APT Bulletin* 29 (1): 54. https://doi.org/10.2307/1504550.

Back, Margaret (2019). Managing Community Murals in an Urban Preservation Framework (Masters thesis). University of Pennsylvania, Philadelphia, PA.

> *Since their arrival in the 1960s, community murals have grown from grass roots efforts to beautify neighborhoods and assert community identity into artistically innovative expressions of injustices of the communities they serve. As murals increasingly appear in cities across the country, almost no guidelines exist for their management and care nor their relationship with existing cultural resource management practices. This thesis examines how community mural programs interact with other public and private entities to achieve preservation-oriented management practices. It explores the current policies and practices of three east coast community organizations, The Baltimore Mural Program, Mural Arts Philadelphia, and the Mayor's Mural Crew of Boston. This paper considers how these programs manage and access information, how they determine lifespan, how they make decisions about maintaining and removing murals, and how stakeholders participate in their process and decisions. By analyzing current practices, this paper outlines the need for best practices in mural management using values-based collections criteria. Beyond maintenance and care practices, this paper argues that preservation offers the opportunity to evaluate murals as contemporary contributions to the urban landscape.*
>
> *Community murals are proliferating in cities across the country yet almost no guidelines exist for their management and care nor their relationship with existing cultural resource management practices and policies in their host cities. Since their arrival in the 1960s neighborhoods of Chicago, Los Angeles, and Baltimore, community murals have grown from grass roots efforts to beautify neighborhoods and assert community identity into artistically innovative expressions of injustices of the under-represented communities they serve. With their position in public spaces these persuasive, and at times controversial, works are direct and often powerful. Underpinned by social programs, processes of community engagement, and physical manifestations of more complex community goals, community murals and mural programs have changed the face of cities. Because murals are increasingly regarded as contemporary reflections of cities and communities warrants serious consideration of their future. As murals increase in number and fall into disrepair, the need for systems of management and policies to respond to this unique cultural resource is apparent.*
>
> *This paper examines how community mural programs interact with other public and private entities to achieve preservation-oriented management practices. It explores the current policies and practices for managing community murals by addressing how these programs manage and access information, how they determine life span, how they make decisions about maintaining and removing murals, and how stake-holders participate in their process and decisions. Further, it considers the ways in which municipal partnerships interact and impact these programs and their objectives.*

In order to gain insight into these questions the author will examine the current policies and management practices of three distinctly different community mural programs: the Baltimore Mural Program, the City of Philadelphia Mural Arts Program, and the Boston Mayor's Mural Crew (Figure 1). Chosen for residing in complex large historic cities on the East Coast of the United States, the programs share in common missions to affect social change through art, despite their significant differences in scale and organization. In addition to examining the management practices of these organizations such as inventory, systems of management, deaccessioning and collection size, this paper will examine the different private and public stakeholders involved over the life of a mural. It will also specifically address issues of longevity, which are particularly important in this class of cultural resource. Documentation will be highlighted as a method for integrating preservation practices into community mural management. It will also examine the relationship with the historic resources of the host cities, the policies that protect them and their governing bodies. Stewardship of community murals invites both modification of existing practices and innovation. Factors common to conventional public art, such as permanence, and meeting accepted tenets of art, are replaced with intensely direct, personal expressions of underserved populations and their advocates. Although a relatively young phenomenon in cities, community murals are already a form of art that has colored urban centers and left a mark on recent history. Unlike conventional public art, they are rarely governed at the level of other forms of public art. Their existence in cities can be controversial and assumed temporary. As murals assert their message, vanish, and regenerate outside of many forms of control, it can be difficult to keep pace with these unique resources of urban history.

As these murals come of age in ever-changing urban landscapes and stewards encounter questions of changing communities, resource allocation, and relevance, they look to others for models. One particularly relevant policy framework can be found in the multi-disciplinary field of historic preservation, which addresses urban change as one of its principal objectives. Through proactive considerations and a commitment to the nuance of urban identity, preservation aspires to support and protect a city's history, character, and form.

Preservation embraces changing identities by encouraging thoughtful growth within cities, growth which acknowledges the built landscapes and communities that change over time. In consideration of community art, preservation encompasses more than physical conservation and maintenance practices. Rather it engages in a process, inviting issues of history, representation, and change to remain prominent in decision-making. Like the stewards and organizers of community murals programs, preservationists would be concerned that murals remain relevant to their communities. Beyond maintenance and care practices, preservation offers the opportunity to evaluate murals as contemporary contributions to the urban landscape.

(Baca, Judith. "Public participation in conservation 1: *The Great Wall of Los Angeles.").* Yngvason Hafthor and Cambridge Arts Council (Cambridge Mass). 2002. *Conservation and Maintenance of Contemporary Public Art*. London Cambridge Mass. New York: Archetype Publications ; in association with Cambridge Arts Council ; Distributed in the USA by Americans for the Arts.

Theoretical questions of permanence and public participation are addressed along with specific concerns, such as funding and legal responsibilities.

To conserve a living mural, the process that created it must be respected. As a site of public memory and history, the education of a new generation of youth and community members should take place to insure its continued respect, protection and survival in the neighborhood. The most critical element in the maintenance and preservation of a mural is its relationship to its community.

Under current policies of the City of Los Angeles, conservation contracts can be awarded to an individual without the express involvement of the artist who established the relationships with the community (or the community-based organizations) or sponsoring organization. They can be excluded from conserva- tion of

their own murals. This ignores the reason for creating community murals in Los Angeles in the first place. The impetus for the creation of community murals in this city is to recognize and support community artists who can make their communities visible in a country that had historically denied their existence. The majority of LA's murals are community murals created by artists representing culturally disenfranchised and politically underrepresented ethnic communities. To turn over these murals to highly specialized, highly paid, but culturally distant specialists is an ironic and demoralizing outcome. The privileged once again benefit from hard-won ethnic creative productivity, and the community artists and their communities are once again excluded.

After the artist is gone, the legacy of the Great Wall and other community murals falls to the children of the Great Wall. As artists, professionals, and citizens of our city they are key people to provide counsel for the conservation of this work. We must keep in mind that we are tending to living monuments which partake and are part of a community's thriving and ever-evolving identity. We are not dealing with portfolio objects without context. Conserving LA's murals is as important as preserving Michelangelo's Sistine Chapel ceiling or a priceless Ming Dynasty vase. Unlike those objects, murals are still very much embedded in the lives, hearts, and minds of the communities who recently created them. The city makes a grave mistake to grant exclusive concession to external conservators for a community's living art. It is even more outrageous to dismiss the living artist whose vision, hand and talent brought these murals forth for those communities.

Bae, Sang Weon. "Balancing Past and Present: Reevaluating Community Murals and Existing Practices."

Beale, A. and R. Smith. 1986. An evaluation of the effectiveness of various plastic and wax coatings in protecting outdoor bronze sculpture exposed to acid deposition. In Conservation of metal statuary and architectural decoration in open-air exposure. Paris: ICCROM.

A report on the investigation of plastic and wax coatings used to protect outdoor bronze sculpture in the US. One set of coated bronze samples were exposed to simulated acid rain for 16 weeks; another set were installed at a roof site. After exposure the samples were examined by microscopy and analyzed using FTIR. Coatings tested included Incralac, Sedonalacq, Benzotriazole, Butcher's bowling alley past wax, NPS wax mixture, and Tatti wax mixture. All coatings tested proved effective in protecting bronze exposed to acid deposition; all coatings tested were reversible after 27 weeks of exposure. At the end of the Preliminary Conclusions section is this note: "… the ultimate choice of material may rely on such factors as aesthetics, reversibility, and/or ease of application" (117)

Arthur Beale, "A Low Cost Reversible Alternative for Compensating Damaged Patinas of Outdoor Bronze Sculpture," Objects Specialty Group Abstracts, AIC 15 15th Annual Meeting, 20-24 May 1987, Vancouver, British Columbia, Canada, 209

Bierwagen, Shedlosky, Webster, Huovinen. "Developing and testing a new generation of protective coatings for outdoor bronze sculpture." In Progress for Organic Coatings 48 (2003): 289-296.

[*Outdoor bronze sculpture is vulnerable to acid rain-induced corrosion and the present protection schemes utilized by conservators do not provide adequate protection under many circumstances. To replace the current most common clear bronze protection systems, wax or Incralac® with a top coat of wax, work is underway to develop different options for conservators that include new longer-lasting, more durable systems having improved corrosion protection. The use of improved matrix binders based on fluorocarbon polymers, the use of nano-sized TiO2 for UV absorption, and the extended use of UVAs and HALS are under examination in a search for improved UV resistance and longer lived corrosion protection in clear bronze coatings. Advanced spectroscopic and electrochemical methods are being used to characterize new coatings candidates with respect to UV resistance and corrosion resistance.© 2003 Elsevier B.V. All rights reserved.]*

Binnie, Nancy, Lyndsie Selwyn, Carl Schlichting, and Deborah Rennie-Bisaillion. “Corrosion Protection of outdoor iron artifacts using commercial rust converters.” Journal of the International Institute for Conservation 20. (1995): 26-40.

Nine commercial rust converters and tannic acid were evaluated for their ability to form stable coatings on corroded iron artifacts stored or displayed outdoors. The rust converters were analyzed for significant chemical components using scanning electron microscopy/x-ray spectrometry (SEM/ XES), x-ray diffraction (XRD), and Fourier transform infrared spectrometry (FTIR), and in general contained tannic acid and a polymeric consolidant. They were applied to pre-rusted 10 cm x 30 cm mild steel plates, and were tested without application of a top coat of paint. Two test methods were used:i) a 30 day saline spray test (accelerated ageing), and (ii) up to 5 years of outdoor exposure in the prairie, central, and maritime regions of Canada (natural ageing). The most rapid and severe degradation took place in the maritime climate, and the least severe in that of the prairies. After combining the results from the saline spray test and outdoor weathering, the rust converters with best overall durability (and which are still available) are Conquest Polymeric Rust Converter and Rust-Oleum Rust Converter 7830. These coatings will protect the iron surface from re-developing rust for several years in most outdoor environments. Other products included in this study may offer excellent protection in some environments. -- Canadian Conservation Institute.

Brown, Edmund G. “How to Nominate a Property as a California Historical Landmark or California Point of Historical Interest.”

Church, Jason & Muto, Anna & Striegel, Mary. 2013. “Comparative Study of Rust Converters for Historic Outdoor Metalwork.”

[The degradation and subsequent treatment of iron is an important consideration for conservators. Rust is of particular concern as it weakens the underlaying layers of metal, and unlike the protective patina that other metals develop, iron oxide causes weakening and further corrosion. This paper aims to provide the reader with the knowledge required to make an informed decision when selecting a rust converter. All the chemicals trialed are commercially available in small quantities, with the exception of the 'CCI recipe'. The 'CCI Recipe' was added to the study after a survey of chemicals used was sent out to metals conservators and the results were found that a majority of the conservators polled used this recipe as opposed to a commercially available product. This study did not want to invent a new treatment, but simply evaluate those readily available to find the chemical class that performed best over time. Project Aims: The main goal of this study is to provide the user, either home owner or museum conservator, with the knowledge needed to make an informed decision when selecting a rust converter. With the exception of the 'CCI Recipe', all of the chemicals in this study are commercially available in quantities small enough for the average home preservation practitioner to obtain. The 'CCI Recipe' was added to the study after a survey of chemicals used was sent out to metals conservators and the results showed that the majority of the conservators polled used this recipe as opposed to a commercially available product. This study did not intend to invent a new treatment but simply to evaluate those readily used in order to find the chemical class that performed best over time.

After each of the tests were performed and the 1032 hours of accelerated weathering completed, many questions were answered and many were raised. Overall, the Rustoleum® Rust Reformer® performed the best, with no active corrosion evident and a nice even surface finish intact. The main active ingredient in the Rust Reformer® is tannic acid. However, the additive acrylic vinylidene chloride copolymer may have been just as important in sealing the metal’s surface. The combination of the two outlasted all other converters in this study. This product is readily available online and in most large hardware stores.
This study gives the end user information to make a more educated choice when looking to treat their historic ironwork. Whether the end user is the owner of a historic home or a technician at a museum, this research will help them in future treatments.

Future work on this study includes natural weathering of samples under the same testing regime and further testing of rust converters while exposed to a salt environment.]

Considine, B., J. Wolfe, K. Posner, and M. Bouchard, eds. 2010. Conserving outdoor sculpture: the Stark collection at the Getty Center. Los Angeles: Getty Conservation Institute.

This book provides an overview of the study, treatment, and installation of the Stark collection of Modernist outdoor sculpture at the Getty Center. A helpful list of the 28 sculptures is provided early in the book, along with a summary of analysis, treatment methods and materials, and maintenance plans for each sculptures. Chapters discuss project organization, installation design, scientific analysis, artist interviews, treatment, and maintenance. Separate chapters on the treatment of painted sculptures, bronze sculptures, and on mountmaking are also included.

Cooper, Madeline. 2022. Mapping and the future of caring for the past: Using GIS as a tool to understand the risk of emergencies to cultural heritage collections. Parks Stewardship Forum 38(3): 389–398.

[Natural and human-caused disasters have always been a risk to museums, libraries, archives, and all types of cultural heritage collections. The increase in frequency and intensity of extreme weather events brought about by climate change indicate that risk assessment and emergency preparedness and response will become even more important in caring for these collections in the future. Since the beginning of the 20th century, the art conservation and heritage preservation communities in the United States have worked to develop tools and networks for organizations preparing for and responding to collections emergencies. Some of these initiatives, including an interactive map called Active Weather Risks for Museums, Libraries, and Archives, have included the integration of Geographic Information Systems (GIS) in mapping cultural heritage assets and identifying location-specific risks. Continued research into the applications for GIS in responsive risk assessment and emergency planning, and the utilization of publicly available hazard data from emergency management organi- zations and climate scientists, will help prevent catastrophic damage to our nation's collections.

The changing climate indicates that emergency preparedness and response will almost certainly need to become a bigger priority for museums, libraries, archives, public art, and other cultural heritage collections in the future. There is a history in the United States of conservators and other preservation professionals reacting to natural and human-caused disasters to create new tools and networks. We have drawn on the lessons of disasters in the past and will continue to do so as we work towards the preservation of cultural heritage into the future. There is so much work being done by emergency management agencies and climate scientists that has the potential to aid cultural heritage organizations in producing better risk assessments and emergency plans. GIS is an effective way for cultural heritage institutions to visualize and utilize this location-specific information. More research into the utilization of GIS will serve those dedicated to the prevention of catastrophic damage to our nation's collections.]

Drescher, Timothy W. 2003. "Priorities in Conserving Community Murals."
originally presented at "Mural Painting and Conservation in the Americas," a two-day symposium sponsored by the Getty Research Institute and the Getty Conservation Institute, May 16–17, 2003, at the Getty Center in Los Angeles.

[Traditional conservators confront a challenging set of issues that must be resolved prior to the restoration of any community mural. This essay offers a tentative attempt to systematize the issues that such a conservation project might face. It articulates the necessary decisions as they have been discussed over the past decade or so.

In some cases, the special nature of community murals creates conflicts with conservators' normal practices, so it is useful to begin by briefly considering the differences between community murals and other forms of painting. To do that, it is necessary to better understand the nature of community murals. (I will use the word conservation generically to include restoration, maintenance, repainting, and preservation, because the important questions are not about literal preservation so much as about the processes controlling it.) The crucial point has nothing to do with the technical aspects of materials, surfaces, and exposure; nor is it a

matter of incorporating the visual field, especially architecture, into the design; nor is it a matter of size, but of the "social field." I have seen community "dance murals," heard "word murals," and witnessed artists holding up postcard-sized paintings that they called murals. What is going on here? It is this: community murals are primarily social. They exist at the interface of the social and the artistic, but insofar as conservation is concerned, the key fact is to recognize that they are part of an ongoing social process. We use the word community for this social field in which community murals exist. It refers to the daily audience of the mural as well as to its producers and to the painting itself. This combination, whose interests generated the mural (otherwise it is not a community mural), is the most important aspect of any conservation project. However, the fact is that over time people in communities, including artists, change their attitudes, their likes and dislikes. Their murals reflect this variability, this dynamism. This changeability presents unique problems for conservators.

So for community mural conservation, the most important factors are the determinant social contexts surrounding each mural, the complex social field of which the mural is a dynamic acrylic symbol. Many murals preserve marginalized or devalued histories specific to particular locations that have become recognized as significant to the broader society. It is unclear to me whether or not civic and government agencies, other institutional bureaucracies, or, indeed, the conservation community itself fully understand and share this priority. This situation is one reason that collaboration is essential in the conservation of community murals.

For conservators, conservation of murals requires a different approach than usual. The traditional conservator's job has been to conserve a static object, but community murals are not static—or they are, but only in a very limited sense. This observation does not mean that conservators have no role in the restoration of community works. Conservators bring vast technical knowledge to any project, expertise that is invaluable to any successful conservation. The fact is, many muralists and communities would like a conservator to do the work with no changes in imagery. If there are no problems, fine. Obviously, collaboration among "the community" and its artists and conservators (and others) is the optimum basis of successful community mural preservation. But problems can arise. Differences between accepted conservators' practices and a community muralist can be determined and then resolved only in conjunction with the community, as described below. The roles of the several participants in a proposed conservation project must be reconceived in light of a community mural's distinctive characteristics—that is, considered not merely as an art object but, most importantly, as part of a social process. The conservation of a painted surface must conserve the social, creative process of the original work as well as the painting itself. I will use a new word for this: sociocreative. With community murals, the goal of conservation is to preserve the entire sociocreative project.

We can further clarify the issues regarding conservation of community murals in their sociocreative entirety by asking a series of questions and offering tentative answers:
1. Which murals should be saved?
2. How should it be determined which should be saved (or, who should make this determination)?
3. Who should determine what changes are allowed? Can general criteria be developed here, or is each case sui generis?
4. Who should pay? Who can pay?]

Feist, William C, David Hon, and Roger Rowell, Ed. "Chemistry of weathering and protection." In The chemistry of solid wood: Advances in chemistry series 207. Washington: American Chemical Society: Books and Journals Division, 1984. Pg. 401-451.

[Wood undergoes photodegradation and photooxidation in the natural weathering process. UV attack of lignin. Only 200 microns are penetrated by light. Hydroperoxides produce chromophoric groups. Influence of outdoor weathering on performance]

Finkelpearl, Tom. (2001). "Dialogues in Public Art." Cambridge: MIT Press.

Fleming, Ronald Lee. “The Art of Placemaking: Interpreting Community Through Public Art and Urban Design.”

Garfinkle, Ann. 2003. “The Legal and Ethical Consideration of Mural Conservation: Issues and Debates.” originally presented at “Mural Painting and Conservation in the Americas,” a two-day symposium sponsored by the Getty Research Institute and the Getty Conservation Institute, May 16–17, 2003, at the Getty Center in Los Angeles.

[Although California protected the works of California visual artists with the California Art Preservation Act (CAPA) of 1979, approximately eleven years before the United States Congress voted to protect the works of visual artists throughout the United States, I think your understanding of the law would be clearer if I started this discussion with the federal law, the Visual Artists Rights Act, known by the acronym of VARA. Then I will discuss California law and the California Art Preservation Act. The reason to discuss the federal law first is because the supremacy clause of the U.S. Constitution gives federal law preemption over state law. Please note that neither law mandates conservation. The second part of my discussion will concern itself with the application of VARA and CAPA to the conservator and to the building owner wanting to either commission a mural, conserve a mural, or destroy a mural.

In December 1990, after more than ten years of debate, Congress passed the Visual Artists Rights Act, representing one of the most significant changes in American copyright law in its two-hundred-year history. This law granted new rights for American artists called “moral rights”: first, the “right of attribution,” which grants artists the right to be identified with their works, and second, the “right of integrity,” which grants artists the right to protect their works from modification or destruction. The passage of VARA imposes a legal liability for those who destroy, alter, or mutilate a mural and requires conservators to preserve the artistic intent of the artist.

A copyright is a proprietary interest that vests in a creator from the moment an idea is fixed in a tangible medium of expression. In the United States, copyright law is derived from the clause in the Constitution that delegates to Congress the authority “to promote the useful arts and sciences.” It is by this authority that Congress has statutorily granted proprietary rights in the expression of original ideas.

As is suggested by the AIC code of ethics, a conservator should recognize his or her limitations and use good judgment. Conservators should not commit to the restoration of a work of art unless they have the required skills and knowledge. Given the remedies now available to artists under VARA and CAPA, conservators should not be pressured by deadlines that cannot be met without sacrificing professional standards. Conservators must test thoroughly. Why is VARA scarier than a suit for damages for breach of contract, or even scarier than a CAPA suit? Because statutory damages under VARA for intentional destruction or mutilation are $150,000. List of Suggestions for artists, separate suggestions for wall/land owners.]

Gowing, E., and R. Pender. 2007. *All Manner of Murals: The History, Techniques and Conservation of Secular Wall Paintings: Proceedings*. Archetype. (Ernestine McKay. Contemporary Mural Painting: trends and traditions.”)

[To appreciate the full breadth of modern wall painting, we should begin by considering the driving forces behind trends in contemporary painting, and how these changes are likely to affect the most ancient of art techniques - mural painting. We begin to understand the reality behind the publicity by looking at the motivation and ambitions of those who com- mission and create this kind of work.

as a crucial component of sophisticated construction plans. In the early 1900s, the Prairie School architects, a group of US designers, were the first to make extensive use of what became known as architectural painting. These commissions are primarily functional, intended to visually integrate an external wall or structure with a particular location or environment. More recently, architectural paintings have been commissioned to help reduce the ugliness of aesthetic flaws or temporary obstructions in modern urban landscapes.

The greatest contemporary murals are those that truly reflect the times in which we live. They draw on modern subject themes to illustrate the spirit and energy of communities across the world. Compelling paintings are created by a fortunate fusion of highly creative artists and visionary patrons. Patronage since the 1970s: recent trends This transformation combines with the influence of local cultures and fashions to create shifts in style that evolve into tomorrow's traditions. When looking at contemporary wall painting, it helps to make a clear distinction between the different styles of murals that have emerged in recent years. For

simplicity, I have defined these in three principal categories, each characterized by their own individual patronage:
1 Public murals: these paintings are often external and are funded largely by the public sector. Commissions are usually characterized by a strong local community focus - sometimes mainstream, sometimes more cutting edge, depending on the socio-political and cultural context. 2 Private murals: private individuals and corporate institutions traditionally sponsor murals for interior locations, usually found within stylish domestic, retail, leisure and entertainment environments, or as a key element in major interior design projects. A range of pigments and techniques is available today to decorate internal walls. Fresco painting remains the most enduring and high quality technique in use, and is applied both for commissions of new work and the restoration of histori- cal murals within large-scale conservation projects. 3 Architectural murals: property developers or architectural designers generally commission these paintings
Patrons will occasionally sponsor work across a range of sites. Murals tend to be planned and executed by specialist artists with unique rationales and personal styles, however, which they apply to the needs of specific locations and architectural settings. As a result, we see distinct traditions emerging between public sector and privately commissioned murals. Significant historic, civic and personal milestones inspire a modern gen- eration of mural artists and patrons to make creative public statements through bold and dramatic mural designs.
It is fascinating to observe how similar trends arise in different areas of the world. As patrons increasingly operate on a global scale, the resulting trends in each category have also become global. Public murals, in particular, are influenced by themes that resonate with large social groups across the world's urban communities. Common interests include environmental protection, healthcare, cultural heritage, education, crime pre- vention, sports victories, pride in local landscapes and history. Muralists are finding inspiration from these shared concerns and social issues. Internet communications raise awareness and build support for artistic concepts and visions worldwide in much shorter timescales than ever before.
When we look back at how far the art of mural painting developed during the 20th century, we can only dream of what is possible in this century. The powerful combination of radical social upheaval and new media will bring with it exceptional possibilities in terms of large-scale mural art.]

Groysman, Alec. 2010. Corrosion for Everybody. Springer Science+Business Media.
[This volume explains this important topic in a lucid, interesting, and popular form to everybody: to students and young engineers who are only beginning their studies, to scientists and engineers who have dealt with corrosion for many years, and to non-specialists involved in corrosion problems.
The book uses a fresh writing style, with some new explanations relating to thermodynamics of oxidation of iron and mild steels in water, reversible and irreversible potential, solubility of oxygen in water and aqueous solutions of electrolytes, corrosion of metals in fuels, corrosion of storage tanks for fuels and their corrosion control, corrosion monitoring in practice, humanitarian aspects of corrosion science and technology (history of the evolution of knowledge about corrosion, relationships between corrosion and philosophy, corrosion and art). Many practical examples of various corrosion phenomena are given.]

Hart, Joseph. Things Fall Apart: Art conservator Robert Lodge discusses his work on public sculpture. Public Art Review, 49, Fall/Winter 2013.

Heller, R. 1983. The coating of metal objects at Winterthur. The American Institute for Conservation of Historic and Artistic Works: preprints of papers presented at the eleventh annual meeting, Baltimore, Maryland 25 – 29 May 1983.
[This article discusses the factors that influenced the introduction of a metal coating program at Winterthur Museum, including the need to display silver objects in uncontrolled environments without needing to constantly polish them. A B-72 coating was initially considered, but deemed impractical due to its tendency to run. Agateen Nitrocellulose Lacquer was selected because of its easy application, quick drying time, and colorless quality. Agateen was found to last up to ten years with objects that were housed at Winterthur, and an independent study was cited which claimed a 28 year span before yellowing occurred.]

Heuman, Jackie. “Removing corrosion on a painted outdoor bronze sculpture with mild chelating agents.” The Conservator 16. (1992): 12-17.

This paper discusses the examination and analysis of the alloy, patination and encrustation found on the surface of the sculpture. The use of mild chelating agents for removing corrosion products that lie over a non-chemically applied patina are investigated.

Hornbeck, Stephanie E. 2009. “A Conservation Conundrum: Ephemeral Art at the National Museum of African Art.” *African Arts* 42 (3): 52–61. https://doi.org/10.1162/afar.2009.42.3.52.

[Ephemeral materials, because they are often unpredictable, present challenges to conservators entrusted with their preservation. This apt quotation from conservation scientists David Grattan and R. Scott Williams of the Canadian Conservation Institute describes the conservator’s dilemma:
“Works of art, therefore, have two kinds of life: that of the concept? the meaning?and that of the materials. As an object ages it changes; ultimately, the disintegration of the materials brings obliteration. But in modern art, ideas are often transient and materials ephemeral. So, what then is the question being asked of the conservator? Is it to preserve the material at all costs? To convey the artists intent? Or is it simply to define the nature of the materials and understand the degradation? (Grattan and Williams 1999:73).”

Working with art created by living artists, as we navigate between the sometimes-competing demands of preservation of the physical art work and respect of artistic intent, requires collaboration among the artist, their studio assistants, curators, conservators, and conservation scientists. At the National Museum of African Art, we have come to apply our experience with preserving ethnographic materials to contemporary works in the collection, and vice versa. The technical study of new materials and advances in the conservation profession will continue to inform our approach to the treatment and exhibition of ephemeral art. Conservation professional codes of ethics will continue to be modified as needed to accommodate the special considerations particular to art created by living artists. To understand the arc of a work of art's lifespan, the conservator must first understand the original materials and techniques of fabrication. Consequently, we rely upon descriptions of materials and media and documentation of artistic intent, including installation details. These critical resources will guide us as unknown, future scenarios unfold. Indeed, our experiences demonstrate that the dialogues surrounding the conservation of ephemeral art are dynamic and continually evolving.]

Keck, Sheldon. Training for Engineers in Conservation In recent advances in Conservation. 1963. Ed. Gary Thomson. (IIC Rome 1981).

[The requirements of the conservator or restorer are enumerated. One such requirement is that the conservator should be an engineer with aesthetic sensibility who knows the material and structures present in art and the causes of their deterioration. The need for proper education and training facilities and for international cooperation among institutions is stressed. It is suggested that the IIC and the Rome Center might help to bring this about.]

Kerschner, Richard L. 2016. “The Rescue and Conservation of the Lost Shul Mural” 23.

Kim, Youngja Lee. “Problems in Cor-Ten steel sculpture.” In Preprints of papers presented at the seventh annual meeting: Toronto, Canada, 30 May-1 June 1979. American Institute for Conservation of Historic Artistic Works, Washington DC. (1979): 59-65.

[The corrosion in an outdoor sculpture in Cor-Ten steel by the American sculpture Louise Nevelson is analyzed and a corrective procedure offered. Analysis of corrosion used in applications of Auger electron spectroscopy, x-ray fluorescence spectrometry, scanning electron microscopy, and optical microscopy. Treatment consisted of removing corrosion using glass-bead peening, and priming interior and faying surfaces with coal tar epoxy. There is a discussion of proper construction techniques using Cor-Ten steel.]

Kyi, Caroline, Nicole Tse, and Sandra Khazam. 2016. “The Potential Role of Citizen Conservation in Re-Shaping Approaches to Murals in an Urban Context.” *Studies in Conservation* 61 (sup2): 98–103. https://doi.org/10.1080/00393630.2016.1193690.

[Public visual spaces, populated by a blend of community murals, unauthorised street art, and historic painted mercantile signs, are often the mark of an urban environment that is both progressive and eclectic. Changes in the aesthetic and cultural value of these urban mural forms have led to an increase in the appreciation and, in some instances, promotion of their artistic merit and cultural significance as examples of public art. However, examining the significance of these works, with a view to implementing a conservation approach is problematic. This is due to a number of practical and theoretical considerations that are primarily a result of the ephemeral existence of urban murals outside conventional exhibition spaces, and issues associated with their often fragmented ownership and uncertain authorship.

Consequently, larger thinking on the interpretation, conservation assessment, and advocacy for the conservation of urban murals are required. Key to defining and implementing such strategies is contextualising the public visual spaces that these murals occupy and, as part of this, the local and wider communities' perception of these murals as culturally significant objects as well as fostering awareness and understanding of appropriate measures aimed at their conservation. This paper examines the role of citizen science, or crowd-sourcing, of local community members in establishing a conservation dialogue and generating conservation- relevant data on urban murals. It looks specifically at a project involving a collection of in situ historic painted mercantile signs — also known as ghost signs — in the City of Port Phillip, Melbourne, Australia. The project fostered the establishment of an informed and open dialogue between conservation specialists and participants from the local community on the significance of local ghost signs whilst transferring knowledge on conservation processes and assessment methods. Working directly with community members, a programme was designed in which conservation and community knowledge of these urban art forms, could be collected and exchanged across digital platforms. This enabled researchers to examine how citizen science can be utilised as a research tool as well as a means to advocate for the conservation of collections of urban murals. It created the opportunity to consider the role of non-specialists and shared authorities in the collection and collation of conservation- relevant data and how information generated from what we call citizen conservation projects, can inform the way in which conservators evaluate and prioritize the conservation of urban cultural heritage. The data gathered and interpreted proved to be the most effective means of 'conserving' these often ephemeral forms of cultural material.]

Lins, Andrew. A Cleaning of Weather Bronze Monuments: A review and comparison of current corrosion removal techniques. The conservation of bronze sculpture in the outdoor environment: a dialogue among conservators, curators, environmental scientists, and corrosion engineers. Terry Drayman-Weisser Ed. Houston: National Association of Corrosion Engineers, 1992. Pg. 209-223, Annotated Bibliography 187-208.

[A survey of current literature and practice is given, followed by comparative tests of seven cleaning procedures (four using abrasives delivered by compressed air). These are contrasted with corrosion product removal using ultra-high pressure water blasting. The results of the tests are discussed on the basis of optical microscopy, metallography, XRF and XRD analyses, and electron beam microprobe analysis.]

McNally, Rika Smith and Lillian Hsu. 2012. “Conservation of Contemporary Public Art (Article).” Getty Institute for Conservation Fall 2012 Newsletter.

[The materials of the public artist long ago moved beyond bronze, marble, and stained glass. Contemporary artists do not hesitate to dip into the pockets of the material, cultural, or technological worlds to retrieve something that sparks their imagination or serves a desired effect. Public art collections reflect the growth of electronic art and socially integrated design that continues to expand the artist's palette and the artist's role in the public sphere. We encourage our public artists to experiment, even as it complicates the challenge of ensuring that public art endures. In this early part of the twenty-first century, endurance is a word indefinitely defined.

The urban realm is a complex environment full of unpredictable activities that exert their forces on even the simplest of objects. A city is a lively, active world with an intense level of usage. Weather, ultraviolet light, little security, and pollution are also part of the public art collection's reality. Confronting these elements is the public artist, who has an aesthetic vision that must be realized in an environment that is simultaneously physical, social, and political. Public art has always been about collaboration, but in addition to the artist-and-patron relationship, contemporary public art includes collaboration with the general public, arts administrators, architects, engineers, city planners, landscape designers, fabricators, and art conservators. Assisting both the artist, who must choose materials that will satisfy a concept within a budget, and the arts agency, which must maintain an art collection for the continued benefit of the public, is the art conservator, who serves as a materials guide, combining scientific concepts with the physical care of art.

The conservation and maintenance of public art exist where the desire for control and the desire for freedom intersect, mirroring the tension throughout our culture between the urge to preserve memory and history and the value we place on freedom of expression and living in the moment. Our public spaces are shaped by intricate planning that entails a purposeful arrangement of physical elements and an attempt to balance guarantees of endurance with inspirational vision.

Caring for public art in these intricate circumstances is complicated. We are in constant motion, juggling contradiction, high expectations, ignorance, and a disparate set of goals. One practices the maintenance of public art in the midst of the messy, tangled world of urban life. The serendipity and disorder of activity, the unknowns of accelerating technology, the power of climate, and the reliable march of decay sometimes make us seem like fools. Who are we to think we can predict the outcome?

THE CAC PROGRAM
The Cambridge Arts Council (CAC) in Cambridge, Massachusetts, has been contending with these challenges since 1979, when the Cambridge Public Art Ordinance was created, and the CAC began commissioning public art for capital improvement projects. In 1996 our Conservation and Maintenance Program was initiated, and it continues to this day, providing professional care to our collection of over one hundred works of art, many with multiple parts. They are integrated into the built landscape and sited throughout the neighborhoods of Cambridge. At the CAC, the conservator acts as informer and planner, advocate and facilitator, and budget estimator, in addition to coordinating routine maintenance and treatment. The CAC's conservation work is truly interdisciplinary, based on numerous communications and conversations between many departments as we plan and care for the public collection.

The CAC conservation program is built on three basic components: assessment, maintenance, and treatment. Each of these endeavors is governed by the conservation profession's best practices in documentation, including writing and photography, design drawings, and video. Constant record keeping of materials facts and care directions, as well as of conversations and artist interviews, is critical.

We approach the conservation needs of the public art collection, as well as of individual artworks, in the same way we approach the needs of artworks in a museum—with care, discussion, and planning. The care of contemporary public art requires equal vigilance in assessment, preventive measures, conservative procedures, and detailed documentation. At the same time, the conservation of public art may be different from museum conservation in the need to be nimble: hail and strong winds may require immediate action, and a truck plowing through bollards and hitting a fountain certainly does.

In addition to the three basic components of assessment, maintenance, and treatment, a fourth and critical part of contemporary public art conservation is prefabrication conservation reviews. We have devoted the most time to this practice in the last few years. A prefabrication review provides information on the artist's intent, material choices, technology updates and replacement, fabrication techniques, and installation

methods. It also establishes a clearly written long-term maintenance plan, including the artist's and the commissioning agent's discussion of expected longevity. The reviews are not an attempt to judge the physical acceptability of a proposed artwork but, rather, are a way to inform all involved in the process and to discuss materials or methods improvement and future ongoing maintenance. The reviews can also be used to clarify the definitions of permanent versus temporary (isn't most urban planning actually transitory?) and prepare maintenance budgets. We talk to the artists about their work—from their initial response to the project to their fully developed structural vision—as well as about installation challenges; their thoughts about surface color, texture, and sheen; and their hopes for how the public will encounter, question, and appreciate their art.

THE HUMAN FACTOR
In a recent gathering of heads of various departments meeting to review our conservation and maintenance budget, the conversation turned to one of our public artworks, a bus shelter designed by Taylor Davis. Davis's sculptural shelter is constructed of fifteen narrow eight-foot-tall panels of rose-colored glass held in measured rhythm by aluminum framing within a unique four-sided structure. A long wooden bench is set half inside and half outside the shelter.

During the work's planning process, maintenance concerns were mostly about graffiti, which everyone expected. Since the rose color was achieved by laminating a rose-tinted film between two pieces of clear glass, the surface of the panels would be relatively easy to clean. The piece, which was installed in 2006, was majestic and luminescent. Yet barely six months had passed before eight of the fifteen panels were smashed, and the cycle of breakage and replacement continued. Each panel costs approximately $800 to replace. Although common wisdom says rapid repair discourages further vandalism, these custom glass panels could not be replaced quickly. With the Conservation and Maintenance Program's annual conservation and routine maintenance budget of approximately $30,000 for a growing collection of over one hundred works of art, the shelter was becoming unsustainable within our means. Possible solutions under discussion with the artist include moving the artwork to a different neighborhood, replacing the custom rose-colored panes with standard colored glass, or removing the artwork and extending the concept of rose-colored glass to other commercially made city bus shelters when their glass panels need replacing.

Everyone around the table knew of the repeated damage. Then someone said, "Public art doesn't last in North Cambridge." Another artwork a half mile away was mentioned—Randal Thurston's Yerxa Road Underpass, also completed in 2006. Using silhouetted motifs of butterflies, birds, and trees, Thurston's artwork adorns two 150-foot north and south ramp walls, two portals, and a 50-foot tunnel lined with ceramic tiles, into which the artist designed sandblasted and painted images of butterflies. The ceramic tunnel walls are repeatedly tagged with graffiti. Tagging includes references to rival gangs, as well as students' attempts at humor and "coolness." Admittedly, it is a long pedestrian tunnel under railroad tracks that cannot be seen from any surrounding house, but it is also a well-loved and well-lit work of public art that enhances a busy thoroughfare for people on foot and on bicycle, linking two dense residential areas.

The comment in the meeting that day was about a set of individuals and their particular culture, demonstrated in a particular public space in a particular neighborhood. The repeated actions of a few were powerful enough to cause an attribution of character to a whole neighborhood. Was this a site condition like winter heaving, acid rain, or truck exhaust? We would have to say yes—particular, repeated human behavior is a site condition.

In another neighborhood several years ago, the residents expressed a complete reversal of opinion about an artist's proposal, which had gone through the standard public approval process. Residents were prepared to hold up construction of their new street unless we rescinded the public art. In an unprecedented move, we had to withdraw the project. Weeks later we encountered one of the residents in a local shop, and with an apologetic smile, he expressed his regrets that the artwork had not worked out but then offered the explanation "We're just philistines." Human behavior, sometimes rooted in attitudes and beliefs about art and

public space, can be the most elusive site condition to address, but it remains an ever-present variable in our conservation efforts.

SUCCESSES AND CHALLENGES

We have had many successes planning and caring for our public art collection through an effective routine maintenance program that benefits from our close relationship with the Department of Public Works and other city departments. By using high-performance paint systems, we have prevented the fading of paint on outdoor painted steel and have been assured of reduced galvanic corrosion with the use of better-matching alloys. Our protective coatings on bronze and murals make graffiti removal easier. Our city manager recognizes and approves of what we do. We are a small line item in the city's budget, but our budget is consistent. Our public artists are appreciative of the information and assistance we can provide, and they ask for help and support early on.

We have also experienced failures and continue to meet many challenges. On occasion, contractors or fabricators have substituted materials to the detriment of quality, and installations have not gone as well as planned. Persistent graffiti has tested our ability to keep up with removal. Only eight years ago, the web page for our Conservation and Maintenance Program stated that vandalism to public art was a rarity in Cambridge. Sadly, we had to remove that assertion from the website. When a local hardware store has a sale on spray paint, we know there will be an increase in tagging with these ready supplies, and we ask store owners to remove buckets of spray cans and sale signs from the sidewalks. We have followed specific taggers, photographing their work and locations, and have sometimes visited schools and youth centers to identify residents with a reputation for tagging. As we grapple with the chemical as well as social issues of graffiti, another layer of dialogue must continue among all who care about public spaces—a conversation that expression, an opportunity for public commentary, the taggers' demands to be noticed, and the belief in civic responsibility and a shared respect for public and private space.

Electronic art is a fast-growing component of our collection and of artist proposals. Video, lighting, sound, cell phone apps, and the needs of changing software require a different kind of care than washing and applying protective coatings. These newer media present a new set of challenges—they are a flourishing addition to the public artist's resources but one that requires management on a case-by-case basis. Constantly evolving technologies require the skills and knowledge base of specialized technicians and new-media archivists, and we realize we need added funds for electronic art preservation consulting.

Percent-for-art programs and public-private commissions often offer barely enough money for design, fabrication, and installation, and it is very rare for an artwork to come with maintenance funding or even with a written understanding of how long the object is meant to last or how to care for it. The biggest obstacles we see for the conservation of public art are the lack of communication between professional disciplines and a serious lack of funding. Engineers, landscape designers, city officials, and the public need to understand what good conservation practice is, and it is important that they understand that maintenance is a routine and necessary part of a public art collection. Our conservation technicians carry out maintenance and are often thanked by residents and passersby, but many think they are volunteers and do not appreciate the training and oversight we provide. With every public art project, we talk with artists about choices that can prevent or slow deterioration, such as best materials, fabrication processes, and installation methods. Artists need freedom to experiment with ideas and to use materials expressively. We make decisions based on laws of safety and access, predictability of materials, the known habits of the public, and the budget, but once the fences come down and the contractor leaves, the space returns to the people, and life happens.

Furthering the complexity of conservation is the increasing erasure in many projects of any observable difference between the social and physical attributes of an artwork and those of its site. In many cases, an artist's work becomes indistinguishable from the work of other disciplines, except for the ideas the artist brings to the project. When an artist chooses the pavers to go down an alley or plans the colors to accent a

bridge or garage railing, the preservation of those aesthetic selections is within our jurisdiction but requires the services of our Department of Public Works or of a commercial cleaning crew, and we are often not even present when preservation action is taken. When artists propose long-term social programming as public art—such as directing a school to implement student projects for the yearly collection of rainwater, calling for the harvesting of crops by residents, or creating other community activities based on an artist's instructions—the character of our efforts to maintain the artists' intent is very different from simply scheduling washing and waxing.

PUBLIC ART, PUBLIC SPACES
A vibrant urban environment holds myriad hazards for public art. A wealth of activity, a density of needs, and the limitations of resources all demand our attention. The process of bringing an integrated and site-responsive work of art to realization and endurance has no clear road map.

What can we do to advance the conservation of public art? The conservation field needs to recognize and support the growing number of conservators who specialize in public art. Such support could be manifested in a number of ways, including establishing electronic networks specifically for those working with public art, hosting conferences (or sessions within established conferences) that focus on public art conservation, and encouraging training and publication in the care of public art. Because increased communication between public art conservators and allied professions is critical to the field's advancement, we should continue to advocate for the exchange of knowledge and experience within the discipline, as well as with other related fields, such as museum studies, curatorial practice, urban planning, architecture, engineering, and material science.

Cultivating close ties to prominent public artists is another important way to build an appreciation of conservation, so that they can speak for the critical role that conservation plays in planning and preserving public art. Interdisciplinary conferences, exhibits that focus on the relationship between artists' materials and conservation, and public dialogues further engage a variety of audiences through multiple formats. As conservators, we must continually define and redefine the terms and intentions of our practice and ask questions. What is permanence? When does change trump preservation? To what extent do we allow experimentation? Not only do we need to do this for our field, we need to do it for our audiences.

Our public spaces are critical to a civic life that honors and celebrates our humanity and history and responds to cultural and political change. Residents and visitors—diverse in culture, age, and interests—seek the freedom to move about and use public space spontaneously and for a wide range of purposes. While the ways in which the weather and the public might interact with works of art are never entirely known or predictable, conservation is an essential component of ensuring that public art continues to enrich our environment, prompts us to ask questions, and feeds our imaginations.

Since 1998, Rika Smith McNally has been involved in the care of the public art collection of the Cambridge Art Council in Cambridge, Massachusetts; in 2010 she became a permanent staff member as conservator of public art. Since 2006 Lillian Hsu has been the director of public art for the Cambridge Arts Council, where she manages the city's Percent-for-Art Program. She is also a sculptor and installation artist.

Mitchel, W.J.T. “Art and the Public Sphere.” University of Chicago Press: Chicago and London

Moffett, Dana L. “Wax Coatings on Ethnographic Metal Objects: Justifications for Allowing a Tradition to Wane.” JAIC 1996, Volume 35, Number 1, Article 1 (1-7).

[Case Study of 19th century Benin copper alloy head. Had been cleaned in 1984 and given two coats of Incralac and a layer of Renaissance wax (microcrystalline-polyethylene blend). 1991 the wax coating had developed a white haze. Toluene swab test removed wax and Incralac, but when the head was left in a toluene bath, the

treatment left a brittle, translucent white residue tenaciously adhered to the surface, insoluble in toluene at room temp. FTIR analysis showed that the white material closely matched with polyethylene wax (in the Renaissance coating) After testing a number of solvents, it was found that only heated xylene (82°C) would successfully remove the white flakes. Object was left uncoated.]

Montagna, Dennis R. Conserving Outdoor Bronze Sculpture. Preservation Tech Notes. National Park Service. Wash DC 1989.

[The 1987 treatment of the Thaddeus Kosciuszko Monument in Lafayette Park, Washington, DC, is described in detail including equipment, materials, and application procedures. A carefully supervised team of National Park Service employees washed the bronze statuary with nonionic detergent in 250°F water under controlled pressure, removed loose corrosion with airbrasive equipment using pulverized walnut shell, applied Benzotriazole as a corrosion inhibitor, and followed with a coating of mixed waxes. Costs are given along with estimated future maintenance costs. – AATA]

Munro, Michael. 2015. "Preservation Without Policy: Maintaining Manhattan's Community Murals." Masters Thesis.

[The contemporary community mural movement has played a critical role in allowing residents of cities to reflect upon particular historic, cultural or political climates publicly, and can be traced back to the 1967 mural Wall of Respect, painted along a Southside Chicago building to advocate for the grassroots civil rights movement. As noted by Chilean poet Pablo Neruda, "murals are the people's blackboards", through which they are able to beautify, educate, celebrate, protest and motivate their communities to action. However, despite the powerful role the murals have played in communities, many are deteriorating or face demolition for a variety of reasons, from a deteriorating wall on which they are painted, lack of basic maintenance, shifting demographics within the community that render the mural irrelevant, and evolving aesthetic tastes. With the loss of community murals, neighborhoods are at risk of losing not only their public art, but also the often-contentious history that caused their creation. This thesis aims to address the preservation of community murals in Harlem and East Harlem in New York City. Through a study of the changing demographics of the study area and the role that community murals have played, documentation of the existing community murals, and the role that they have played in giving minority communities a public voice, this thesis will take a critical approach to the policy void that exists in New York City and how non-profit public art programs have advocated and can advocate for our city's murals continued existence.]

(Nichols, Susan. "Creative Approaches to Preservation Funding*").* Yngvason Hafthor and Cambridge Arts Council (Cambridge Mass). 2002. *Conservation and Maintenance of Contemporary Public Art*. London Cambridge Mass. New York: Archetype Publications ; in association with Cambridge Arts Council ; Distributed in the USA by Americans for the Arts.

In conclusion, I would like to quote Gloucester Mayor, Bruce H. Tobey. "We can't let tight local budgets be an excuse for neglecting community art treasures. By mixing and matching private funding, citizen talents, volunteer sweat equity and public resources, we can guarantee that preservation of public outdoor sculpture remains a top priority." To that I'll add, "The only limit to fundraising possibilities is your imagination."

With typical ingenuity, US communities have addressed fundraising needs for assessment, conservation treatment and maintenance in a dizzying array of ways. In my tenure as the Director of Save Outdoor Sculpture! (SOS!) I have found that five main motivation factors have led to successful fundraising strategies: stipulation, service, self-interest, sentiment and straightforward savvy."

By stipulation, I mean the mission or legal obligation of the owner to care for the preservation of the artwork. Many approaches have been developed to support this obligation. In Colorado, for instance, 28 percent of the taxes collect- ed from gambling go directly to the state's historical fund; 80 percent of that fund supports historic preservation projects throughout the state. Another source of funds is the US highway bill, which earmarks nearly $4 billion for "Transporta- tion Enhancement Activities" through September 2003. Public art is specifically listed as a transit

enhancement activity. The District of Columbia used this source to replicate four lions that guard a bridge and Texas received $250,000 to conserve 10 sculptures.

Owners of artworks may not always want to fulfill their obligation, but that does not release them from their responsibility. In 1990, when vandals damaged four Civil War statues in a Dayton cemetery, a fundraising committee member uncovered an obscure law that required any county having jurisdiction of a veterans' cemetery - or a cemetery containing a veterans' memorial - to "care for and properly preserve... such monuments or memorials" and pay associated expenses. When the county commissioners refused to comply, the committee took the matter to the state attorney general, who upheld the law. While the Ohio law is unusually broad, it points out the importance of careful legal research when seeking funds.

Another motivation for preserving public art is service. Many people, young and old, have helped preserve many sculptures out of sense of altruism. Community service may be a factor in most of the four other categories of motivation, but often it is the driving force. A resident of Charlottesville, Virginia, was moved to action after she attended an SOS! talk about her town's sculptures and their condition. With help from friends and proceeds from the sale of her personal library, she raised $1,000 to hire a conservator for the assessment of three historic statues. Subsequently, she and her postman, a member of Sons of Confederate Veterans, raised $65,000 to provide conservation for all three artworks.
Since 1996, 40 city-owned sculptures have been preserved thanks to Cleve- land's Adopt-a-Sculpture program. Each summer, adults and older youth work with conservators on maintenance. Everyone is trained on how to inspect, wash and document. Their work is monitored very closely. In addition, the Cleveland Museum of Art has committed to 25 years of maintenance of seven city-owned sculptures near the museum.

In 1995, 145 fifth-graders set out to raise $2,500 toward a maintenance endowment for the Sam Houston Memorial (1925) by Enrico Cerrachio. They tried traditional "kid methods," such as bake sales and newspaper subscriptions. They earned $1,300. Then they each wrote to the CEO of Exxon, headquartered in Houston, proposing an outright gift. Exxon executives offered to match $3 for each $1 raised over the next 10 years, up to $25,000. Five fifth-grade classes have pursued the challenge. As of this past summer, the kids' fundraising and accompanying corporate matches raised a total of $19,000 for the maintenance endowment.

Like "service," self-interest is present in each of the five categories and it played a likely role in Exxon's support. Adopt-a-monument programs provide good examples where self-interest is a prime motivation. The motivation to benefit my neighborhood or to enhance public opinion of our law firm or my con- servation firm is a strong reason behind the decision to adopt public artworks. The concept was initiated in 1987 with New York City's Adopt-a-Monument program, which asks sponsors with some link to the sculpture to support its care. In New York, a French liquor company paid for conservation of Joan of Arc and Cuban-Americans paid for conservation of Jose Marti. New York City and Milwaukee chapters of the St. Andrews Society covered conservation costs for two statues of Robert Burns. Adopt-a-sculpture programs are proven vehicles to secure private money for preservation in communities around the country. In St. Joseph, Michigan, the Upton Foundation adopted a sculpture in the Upton Arboretum depicting members of the Upton Family. In the same town, a church adopted a contemporary statue of St. Francis.
Sentiment is another strong motivating factor that has often been used successfully to tap alums, relatives or foundations for preservation funds. In Gloucester, Massachusetts, for instance, a private foundation tied to one of the men honored by a WWI memorial contributed $15,000 for conservation of the memorial. Scholarship and equipment brought in $23,000 of in-kind services.

The fifth motivation factor is straightforward savvy. Choosing, for instance, when and how to approach and involve the media, yields more results than "merely" money. A popular radio personality asked his listeners to drop off their extra pennies on Abraham Lincoln's birthday and dollars on George Washington's birthday to pay for the conservation of George Bannerman Dealey (1948) by Felix De Weldon at Dealey Plaza, Dallas. The result was more than $11,000.

This was doubled in an eleventh-hour surprise match by a corporation Dealey's own newspaper - motivated by self-interest, sentiment and savvy.
Other savvy approaches include incentives used at the commissioning stage. In Mobile, Alabama, individuals and businesses donating at least $2,500 to the cost of creating a sculpture for the airport received a year of free parking at the airport. Other donor premiums include the chance to visit the foundry, quarry or conservator's studio. Souvenir sales also have their place. In Des Moines, sales
of a limited-edition Hank Ketcham print contributed funds toward preservation of Soldiers and Sailors Monument. Ketcham was the grand-nephew of the monument's designer. Sales of commemorative bricks may be pedestrian, but they can be profitable. In Savannah, brick sales brought in $44,000-half the needed conservation costs. Also in Savannah, a bookstore pledged 10 percent of sales of Polish-interest titles toward conservation costs of the Pulaski Monument. Those proceeds plus contributions from Polish societies, clubs and fraternal organizations raised more than $10,000. A percentage of the sale of art books or art supplies could be applied to conservation and maintenance costs of contemporary public art.
In 1985, New York City was faced with a conservation treatment bill of $3.5 million for conservation of the General William Tecumseh Sherman sculpture by Augustus Saint-Gaudens. It is located at the highly visible Grand Army Plaza, just in front of the Plaza Hotel. While the project happened 15 years ago, the lessons are timeless. A door-to-door campaign solicited a voluntary "window tax" surcharge of all residents who overlooked the plaza. Apportioned by floor space, owners were asked to give 50 cents per square foot, tenants at 30 cents per square foot. Over $3.3 million was raised. Ambitious but, at its core, simple and
savvy.

Whatever the motivation, the common ingredients in all of these strategies are: clearly articulated benefits to the community, a fundraising plan, a mix of public and private funds, public visibility and political backing.

Norbutus, Amanda J. 2012. New Approaches for the Preservation of Outdoor Public Murals: The Assessment of Protective Coatings for Mural Paintings and Painted Architectural Surfaces. (A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Preservation Studies)

> *[This doctoral research focused on the history, methods, and materials of public murals and their preservation. Over 350 public art programs exist in the United States, many of which have outdoor murals in their collections. The contemporary public mural movement began in 1969 and by 2012 there are thousands of murals located throughout the United States. Major mural programs are hosted in Los Angeles, New York, Philadelphia, and San Francisco, with emerging programs being developed in other cities. Mural programs, projects, materials, and preservation efforts between 2008-2011 were surveyed. Constant outdoor exposure (e.g. solar radiation, extreme temperatures and humidity, freeze/thaw cycling) of the unprotected acrylic mural paintings has resulted in fading, chalking, hazing, flaking, spalling, or yellowing of the mural paint system.*
>
> *The current trends in conservation of outdoor public murals were also investigated. Treatment options included complete overpainting for image renewal, resaturation of images using varnishes and selective inpainting or toning, and resaturation of images using varnish only. The treatment selected by mural caretakers was based on a variety of factors, which often included: cost, accessibility, expected longevity after treatment, and sufficient photodocumentation of the original mural image.*
> *The use of ultraviolet (UV) light stabilizing coatings was investigated for potential end-use on outdoor public murals. Ultraviolet absorbers (UVAs) and hindered amine light stabilizers (HALS) can work synergistically to prevent photodegradation. UVAs preferentially absorb UV, reducing potential radical production. HALS quench radicals and prevent photo-oxidation from advancing. UVAs Tinuvin 99, Tinuvin 400, and Tinuvin 477 and HALS Tinuvin 123 (BASF) were added (1-5% weight solids each) to waterborne Avalure AC 315 acrylic copolymer. The coating formulations were naturally (12 months) and artificially aged (1500 hours) and analyzed for the formation of degradation products using GC-MS, FTIR. The UV-protection range was*

measured using UV-Vis spectroscopy. The usefulness of UVLS-treatments on acrylic mural paints (Golden Artist Colors Heavy Bodied Acrylics) was assessed visually and using colorimetry.

Recommended concentration of UVLS for end-use in outdoor mural coatings are: at least 3% HALS and 3% UVA. Combinations of Tinuvin 123 and 477 performed best in both artificial and natural aging trials. Use of UV-protective coatings in addition to wall preparation, better materials, community education, maintenance programs, can extend the life of these important examples of our distinctive and irreplaceable social, artistic, and political heritage from the past half century.]

National Park Service. 1999. "National Register Bulletin: How to Prepare National Historic Landmark Nominations" (1999 Edition; Reformatted for Web 2018).

[This bulletin has been prepared in response to the growing interest and appreciation of National Historic Landmarks. It contains instructions for completing the National Historic Landmarks nomination form. This form is used to document historic properties for potential designation as National Historic Landmarks.

One nomination form is completed for each property nominated for designation. This property may be a single resource, such as a historic house or bridge, or it may be a historic district containing multiple buildings, structures, sites, and objects. Information on the nomination form identifies, locates, and describes the historic property in order to determine its integrity; explains how the property meets one or more of the NHL criteria; and makes the case for the national significance of the property.

A brief history of the NHL program; NHL theme studies and their use; NHL designation procedures; preparing NHL boundary studies' NHL documentation improvement studies, and studies to withdraw NHL designation; and using NHL documentation are also discussed in this document.]

O'Grady, Caitlin R, and Heather Hurst. 2011. "Lost Walls/Murals Rebuilt: Interdisciplinary Approaches to the Conservation of Pre-Classic Maya Wall Paintings from San Bartolo, Guatemala." ICOM Committee for Conservation Janet Bridgland and Catherine Antomarchi. 2011. Icom-Cc : 16th Triennial Conference Lisbon 19-23 September 2011. Paris: ICOM CC.

[In order to study the ancient activity of Maya mural painting at San Bartolo, Guatemala, pigments and plasters are analyzed within the context of surface condition and stylistic evaluation of artistic hands. Using portable X-ray fluorescence (pXRF), a non-invasive sampling technique, the range and varia- tion of materials used throughout the mural painting program is characterized. The study results provide data regarding the individual artists who collaborated on this mural paint- ing ca. 100 BC and informs future conserva- tion assessment by facilitating reconstruction and integration of additional broken mural fragments through chemical and stylistic identification of artistic hands.

Compositional variation with little visual differentiation is present within some hues and background plaster substrates and is localized in spatial clusters. Considering these data in conjunction with stylistic evaluation, multiple lines of evidence point toward a group of ancient Maya artists collaborating to paint a single artwork. They probably adjusted their recipes, while working closely to create a unified mural. This characterization of production methods suggests shared artistic training that is best described as a school of mural painting. The origin and extent of this tradition, previously identified only for the Classic period 600 years later, can be studied through future comparison with other Preclassic mural paintings from local and regional sites. Finally, this study benefits the corpus of broken San Bartolo mural fragments that await reassembly. Materials analysis collected from the in situ murals provides data necessary to develop treatment methods for thousands of broken fragments through identification of distinct manufacturing traditions.]

Park, Sharon C. 2007. "Maintaining the Exteriors of Small and Medium Size Historic Buildings." National Park Service.

This resource provides rationale for regular maintenance, as well as practical guidance in caring for historic buildings. Preservation is defined as "the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction."

Maintenance helps preserve the integrity of historic structures. If existing materials are regularly maintained and deterioration is significantly reduced or prevented, the integrity of materials and workmanship of the building is protected. Proper maintenance is the most cost effective method of extending the life of a building. As soon as a building is constructed, restored, or rehabilitated, physical care is needed to slow the natural process of deterioration. An older building has already experienced years of normal weathering and may have suffered from neglect or inappropriate work as well. Decay is inevitable but deterioration can accelerate when the building envelope is not maintained on a regular basis. Surfaces and parts that were seamlessly joined when the building was constructed may gradually become loose or disconnected; materials that were once sound begin to show signs of weathering. If maintenance is deferred, a typical response is to rush in to fix what has been ignored, creating additional problems. Work done on a crisis level can favor inappropriate treatments that alter or damage historic material.
There are rewards for undertaking certain repetitive tasks consistently according to a set schedule. Routine and preventive care of building materials is the most effective way of slowing the natural process of deterioration. The survival of historic buildings in good condition is primarily due to regular upkeep and the preservation of historic materials.

Well-maintained properties tend to suffer less damage from storms, high winds, and even small earthquakes. Keeping the roof sound, armatures and attachments such as shutters tightened and secured, and having joints and connections functioning well, strengthens the ability of older buildings to withstand natural occurrences.

Over time, the cost of maintenance is substantially less than the replacement of deteriorated historic features and involves considerably less disruption. Stopping decay before it is widespread helps keep the scale and complexity of work manageable for the owner. This Preservation Brief is designed for those responsible for the care of small and medium size historic buildings, including owners, property administrators, in-house maintenance staff, volunteers, architects, and maintenance contractors. The Brief discusses the benefits of regular inspections, monitoring, and seasonal maintenance work; provides general guidance on maintenance treatments for historic building exteriors; and emphasizes the importance of keeping a written record of completed work.

Maintenance is the most important preservation treatment for extending the life of a historic property. It is also the most cost effective. Understanding the construction techniques of the original builders and the performance qualities of older building materials, using traditional maintenance and repair methods, and selecting in-kind materials where replacements are needed will help preserve the building and its historic character. Maintenance can be managed in small distinct components, coordinated with other work, and scheduled over many years to ensure that materials are properly cared for and their life span maximized. A written maintenance plan is the most effective way to organize, schedule, and guide the work necessary to properly care for a historic building. The maintenance plan should include a description of the materials and methods required for each task, as well as a schedule for work required for maintenance of different building materials and components.

(Philips, Patricia. 2001. Temporality and Preservation: A Panel Discussion) (Patricia Phillips, Nickolas Pappas, Ellen Driscoll, and Craigen Bowen. Moderated and edited by Ann Wilson Lloyd). Yngvason Hafthor and Cambridge Arts Council (Cambridge Mass). 2002. *Conservation and Maintenance of Contemporary Public Art*.

London Cambridge Mass. New York: Archetype Publications ; in association with Cambridge Arts Council ; Distributed in the USA by Americans for the Arts.

"Most works of art in the past have been oriented toward permanence. Today's art, however, is deeply involved in change. Nature constantly rearranges the work; it participates in the life process through the force of seasons. Thus the sculpture contains a fourth dimension: time. Which isn't surprising when you consider it, since time and space are generally assumed to be the common, inevitable properties of physical things." (Beverly Pepper, Art Journal, Spring 1978)

-

Much has changed since Beverly Pepper wrote these words, but the nature of time continues to inspire and aggrieve artists. They cannot ignore its significance or its effects. Time in contemporary art has become a "sculptural" element equal in importance to space, and when the space is public, a host of new complexities appear. What counts as permanence in ever-changing public spaces? How long should a place-specific artwork be maintained if everything changes around it? Are museum standards of preservation applicable to public art, or does public art somehow have less lasting value because of its place?

A panel consisting of an artist, an art critic, a professional philosopher and a conservator was asked to contemplate some of the larger questions of temporal- its and change that affect public art. Being original thinkers, the panelists expanded upon the subject, bringing in new and unexpected questions that were then further explored in an open dialogue with the conference attendees.

Pounds, Jon. 2003. "The Gift of Absence: Mural Restoration in a Policy Void." Getty Conservation Institute.

Beyond the difficulty of just painting well on a large wall, there are political, social, environmental, and fiscal obstacles to creating and maintaining murals. Those obstacles have been embraced—even loved—by muralists, and they are seen to be an important part of the process of creating an excellent mural. I would like to speak about some specific situations arising in Chicago, because it is what I know best, and because I think our experiences may illuminate the opportunities and need in other places.

Restoration versus Conservation versus Repainting

It is fair to say that the early murals were done with a hearty dose of testosterone; the founding fathers believed that the best way for a mural to last was to make it with the strongest, hardest oil-based paint available. Within a few years, the muralists were infected by a more female notion: that permeability is preferred over a powerful sealing of the wall. Murals have since been painted with acrylic.

The process of renewing murals painted with oil paint is not a conservation project focused on saving everything available of the original mural; both conservation and restoration involve encapsulation of old material and reduced breathability for the wall.

The current Chicago Public Art Group restoration sequence is the following: • research archives, print photos as reference materials; • photograph existing mural condition for archives; • clean the wall using a power washer with a very mild detergent to remove grime and loose paint; • seal the wall by spraying with acrylic varnish; • redraw missing elements; • repaint the mural using the techniques researched in archive; • reseal the mural with acrylic varnish; • rephotograph the mural and provide written notes for the archive. Yes, we know there is a need to develop a structure with responsibility for inventory and assessment. We also need a greater commitment to bringing younger artists into the process with the elders to learn from them the technical tricks, the organizing techniques, and the decision-making process that informed the original work. Preservation requires more than recapturing the original look of the mural. The meaning of the work must be reexamined, perhaps revised or reinvented, and reasserted as a historic record and as a contemporary reaffirmation of meaning.

Prytulak, G. "Rust and the working surfaces of industrial artefacts." In *Industrial collections: care and conservation.* London: The Council of Museum in Wales, 1999. Pg. 59-64

> *Most industrial artefacts designed for outdoor use have working surface of the polished bare steel. These working surfaces begin to rust when the machines are left idle. Museums face a number of problems when they acquire these artefacts. A polished steel surface is unstable in most conditions, so it requires constant care, whereas a rusted surface, if left outdoors, must be cleaned regularly or painted over to prevent serious corrosion pitting. If a museum brings the machine indoors for display or restoration, it is obligated to tolerate the rusted surfaces, because a working polish cannot be artificially recreated. This document will address how museum professionals can develop a more appreciative eye for both polished working surfaces and historically appropriate rust; recognising the rarity and interpretative value of the former and judging when it is 'industrially correct' to leave the latter intact.*

Pullen, Derek and Jackie Heuman. (2007). "Modern and Contemporary Outdoor Sculpture Conservation: Challenges and Advances." – Available online here:
http://www.getty.edu/conservation/publications resources/newsletters/22 2/feature.html

Purkait, Pulak, and Bhabatosh Chanda. 2012. "Digital Restoration of Damaged Mural Images." In *Proceedings of the Eighth Indian Conference on Computer Vision, Graphics and Image Processing - ICVGIP '12*, 1–8. Mumbai, India: ACM Press. https://doi.org/10.1145/2425333.2425382.

> *Patch-based techniques are proven to generate promising results and outperform many of the existing state-of-art techniques for most of the applications in digital image process- ing. In this work we develop a patch based coherent texture synthesis technique. A patch-based anisotropic diffusion technique combined with a novel high-frequency gen- erating technique that can enhance line/brush strokes is also proposed. Though these techniques can be applied to many different image processing applications, here we have limited ourselves in the application to interactive digital mural painting recovery/restoration. Some empirical and practical evidence for its high quality texture synthesis and restora- tion for mural paintings are also presented. The experimen- tal results show the effectiveness of the proposed algorithm.*
>
> *In this work, we develop an algorithm for coherent texture synthesis and high-frequency enhancing diffusion scheme. Then using those as the building tools we develop a mural painting restoration technique which works in almost real time. Our experimental section suggests that we can achieve a close approximation of original realistic mural painting from the distorted ones. It would help artist to do the restoration process very quickly and amateur people can also restore efficiently as the user needs to select only some source and target windows where the texture is to be generated. Application of this idea of texture generation scheme and HF enhancing diffusion scheme may not be limited only to the paintings/mural restoration, and can be easily extended to other kinds of image restoration applications (e.g., image deblurring, de-noising, and super resolution). Hopefully, in future work we would address those problems in detail.*

Rainer, Leslie. 2003. "The Conservation of Outdoor Contemporary Murals." THe Getty Conservation Institute. GCI Newsletter.

> *From the beginning of the 20th century, murals have had a significant presence in the architecture of the Americas. In the second half of the th century, social change, political activism, and the rise of the Chicano mural movement generated new impetus for murals in the United States. Through redevelopment programs, percent-for-art initiatives, and youth training programs, such funding has led to an explosion of public art in cities and towns across America, and a vast number of exterior murals have been created.*
>
> *Today, as these murals age, many require conservation treatment if they are to survive.*
> *wall paintings, works of art integrated into a specific architectural space. Art historian Francis V. O'Connor has emphasized the importance of a mural's setting, writing that "a mural, unlike portable works of art, is an*

environmental artifact that was conceived in relation to its natural and/or architectural setting; the original site is an intimate part of its formal attributes."

The word mural is derived from the Latin word murus, meaning wall. Walls have long provided a direct support for aesthetic, political, and social ideas expressed with paint. Cave paintings could be considered the earliest murals, followed over time by wall paintings in tombs, temples, churches, civic buildings, and a variety of outdoor spaces. Modern murals grow out of this long tradition.

The issues that directly or indirectly affect the conservation of murals must be approached from all sides and at all levels. As some cities are recognizing, there must be an administrative responsibility for maintenance and long-term care, preferably from the conception of the project. This includes keeping a complete inventory of murals, with full documentation, including information on the materials used. Rae Atira-Soncea, Percent-for-Art conservation coordinator of the Wisconsin Arts Board, has stated that "maintaining reliable information is the first step in conservation." Artists can help by providing the appropriate funding agency with original artwork and images of the work upon completion. One way of managing this information is to create a database that can be updated over time that gives full information for every mural in a given city or region. In Los Angeles and Quebec, databases are being developed for the inventory and condition assessment of large collections of murals.

Relationships between artists and conservators should be cultivated and strengthened; arts administrators could encourage this relationship in a formal way, as the does. The collaboration between artists and conservators should start at the time of mural creation, well before the need for conservation arises. Conservators can advise on the best paints to use from a materials standpoint; perhaps they can take this one step further by helping industry to research and develop appropriate materials for use in the creation and conservation of murals. At the same time, it is necessary to train more conservators in mural conservation. Conservation programs could incorporate courses on murals and architectural surfaces into their curricula.

In caring for exterior murals, conservation is not only a scientific and technical endeavor. As Julie Boivin, cocurator for the public art of Montreal, has written, "conservation has become a fundamentally social and cultural activity in the fullest sense. The public art equation in which artist, client, public, and site are indis sociable must continually be questioned, evaluated, and perhaps modified. The conservation of contemporary public art might raise some of the most challenging issues and provide opportunities to observe how far we can take those ideas."

Shank, J. William, & Tim Drescher (2016) Breaking the rules: A new life for Rescue Public Murals, Studies in Conservation, 61:sup2, 203-207, DOI: 10.1080/00393630.2016.1188249

The understanding of the conservation needs of outdoor community murals has increased exponentially since Rescue Public Murals (RPM) was introduced at the IIC London Congress in 2008, and this paper serves as a synopsis of current trends in the creation of exterior murals, and philosophies in dealing with their preservation. With the recent closing of its umbrella organization Heritage Preservation in Washington DC, the RPM initiative is redefining its mission and its usefulness to the worlds of conservation and community murals. The standard ethics and principles of the conservation profession are insufficient, or inappropriate, to meet the needs of community murals. Respect for the artist's intent is not high on the list of concerns in the case of saving such works. If established conservation procedures are applied to such paintings, much can be lost in exchange for a decision to proceed in a traditional manner. Outdoor murals are made of relatively short-lived materials and they are part of a continuing community dynamic and thus are not 'completed' in the same manner as an easel painting when prepared for exhibition or sale. When a community mural no longer serves its function in the context of its community, informed decisions must be made about how — or whether — to proceed in order to prolong its life. Conservators can play an important part in this process.

Synopsis of trends

The key elements of transition in the world of community murals are the shift from brush to spray-can and the reduction of community political involvement; many fewer political images are being painted in this century (as part of a decline since the 1970s), as murals have become 'safe', and hence less controversial and more fundable. Today's imagery is relatively tame, designs are predictable, often egocentric (the basis of much graffiti-derived spray-can work) or 'feel good', which is also termed 'socially engaged'. The content has shifted (or, more accurately, one of the several strands present in the 1960s and early 1970s has been extended) but the vocabulary of revolution has been retained because of its power, cachet, and appeal especially to young people. This 'over labeling' is typical of marketing vocabulary, exaggerating for purposes of publicity. The content has mellowed, because those making funding and design decisions in foundations and government bureaucracies are older, or act as if they are. Murals are frequently produced by museum-oriented arts administration programs, not by political activists, as was the case in the early phases of the mural movement up to around 1980. But political activism has also changed in that time, so there is little pressure from those artists who have retained the earlier vocabulary. The dominant themes for twenty-first century murals in the United States have been ethnic or gender identity. Several preservation approaches are available for consideration. The use of photographic reproductions is gaining in popularity. Electronic print-outs have been embraced by some because they can be accurate (except for fading and inexact color reproduction), relatively inexpensive, easy (requiring almost no effort by the artist, certainly relative to brush-painting on site), do not involve logistic complications, and quick. But they eliminate community involvement, except perhaps for a celebratory dedication or re-dedication. Photographic reproductions are especially attractive in the preservation of murals in those projects where the planning and permissions have mainly been developed in collaboration with an organization rather than with a mural's audience. A drawback, however, is that digital or photographic reproduction removes a fundamental part of the mural-painting experience. Photographic replicas reduce a mural project to its final image, without the inefficient, time-consuming process of involving a community — the aspect of community murals that is most likely to be subversive, precisely because of its potential for being genuinely democratic. Accordingly, RPM respects the process and the image, not just the image.

Shank, Will, and Debbie Hess Norris. 2008. "Giving Contemporary Murals a Longer Life: The Challenges for Muralists and Conservators." *Studies in Conservation* 53 (sup1): 12–16. https://doi.org/10.1179/sic.2008.53.Supplement-1.12.

Rescue Public Murals (RPM) is the latest initiative undertaken by Heritage Preservation to address the urgent concerns of artists and communities about the preservation of public works of art. While resembling Save Outdoor Sculpture!, an award-winning programme that inventoried 32000 sculptures and resulted in $8 million in support, the efforts of RPM offer considerable differences from established conservation procedures. Vulnerable by nature, outdoor murals are susceptible to the ravages of weather and to interaction with the public at large. Outdoor paint media, protective coatings, and primary supports have a limited life span. Is it sufficient to document the existence of a public mural and allow the original to deteriorate? Is it ethical to allow an artist to repaint earlier work as the neighborhood changes? RPM is addressing the ethical and preservation challenges presented by these enormous works of art, and validating their importance as a significant artistic and social expression of the past half century.

Public murals enliven neighborhoods, inform citizens, and comment on events, aspirations, and challenges in communities. Unfortunately, the very qualities that make murals so distinctive also lead to their disintegration. It is up to us to learn how best to make their messages and their beauty accessible to the public and how to save them for the future.

Tarnowski, Amber. *Polysaccharide anti-graffiti coating as a preventive conservation coating on sandstone and marble.* Kingston, Ontario: Queen's University, 2003. In *Proceedings of the 10th International Congress on Deterioration and Conservation of Stone, Stockholm, June 27- July 2, 2004.* Pg. 383 - 390.

This research explored the suitability of the commercial polysaccharide antigraffiti coating 'PSS 20' as a preventive conservation measure for marble and three types of sandstone. Because of the various methods of

scientific study of materials currently practiced in architectural conservation, this research presented a methodology for evaluating sacrificial anti-graffiti coatings. Two methods of applying the coating, by brush and by professional spraying, were compared. The aesthetic and physical properties of the coating were tested and evaluated. StudentThesis

Thomas, Kenisha R. n.d. "THE OUTDOOR MURALS OF RICHARD HAAS: HISTORY, CHALLENGES AND STRATEGIES FOR PRESERVATION."

Weber, John Pitman. 2003. "Politics and Practice of Community Public Art." ("Mural Painting and Conservation in the Americas," a two-day symposium sponsored by the Getty Research Institute and the Getty Conservation Institute, May 16–17, 2003, at the Getty Center in Los Angeles.)

The community mural movement, which arose in the late 1960s, created varied and dramatic mural expressions along with a profoundly original practice, now a tradition, which has been emulated in many countries. The community murals also stimulated a thirty-year revival of mural forms and contributed importantly to the revival of interest in America's mural heritage. The community mural movement also excited interest abroad, including in Mexico, where U.S. muralists received early encouragement from both Siqueiros and Chávez Morado. Arnold Belkin, considered by some as Mexico's last important muralist, participated in the U.S. movement during the early 1970s in New York City. He later invited more than one U.S. muralist to speak at the National School of Painting and Sculpture La Esmeralda.

Obviously, the community murals were in no way an anonymous, spontaneous outpouring. Deeply influenced by a variety of contemporary aesthetic movements, the early community muralists also had organic and personal connections to older mural traditions, especially to Mexico. Nowhere was the influence of Mexican muralism stronger than in Chicago, the self-proclaimed starting point of the contemporary community mural movement. It was the classical compositional approaches of the Tres Grandes that we studied—the architectonics, not the stylistic mannerisms. My colleagues William Walker, Mitchell Caton, Calvin Jones, and others, working with limited resources, authored brilliant extensions and expansions of that tradition.

Today, all the early community murals of the late 1960s are gone. Almost all of the thousands of outdoor murals of the 1970s are also gone—demolished, erased, painted over, a few still visible as ghosts. Increasingly, 1980s murals are also threatened. As a Chicago-based muralist, an active participant in the movement from 1969 on, I am personally concerned, since large-scale outdoor mural painting virtually ceased in Chicago by the late nineties. Our once-large collection of outdoor murals is fading and disappearing. Community public art continues to thrive, with wonderful new work of mosaic and cement relief. I bear some of the responsibility for that change, having advocated it and having helped initiate the change to mosaic and cement more than twenty years ago. The choice of cement relief (as in examples of my own work, For the People of the Future [Chicago, 1980] and From One Generation to Another [Avenue C, 1984]) in part was made in order to make removal more costly, if not impossible without demolition. Mosaic has become the favorite medium for community public art in Chicago because it does not fade. Still, I mourn the losses.

The loss of the early murals has little to do with their real or perceived aesthetic quality but everything to do with the short life span of urban America, as neighborhoods change and property changes hands. A new owner commonly either has no identification with the mural or sees the wall as simply a rental space. Walker's great Peace and Salvation: The Wall of Understanding, 1970, the first masterpiece of the mural movement, after lasting almost twenty- five years, was destroyed to provide an advertising space (Figures 1 and 2). One of Richard Haas's heroic Chicago murals is likewise half covered with advertising. Our greatest losses are to greed.

In the recent, handsome book Philadelphia Murals, a former city official is quoted, "You have to shift your resources into preservation. If you think murals are art, you've got an imperative. Real art is preserved" (Jan

Golden, Robin Rice, and Monica Yang Kinney, Philadelphia Murals and the Stories They Tell [Philadelphia: Temple University Press, 2002], p. 93). If it were only so. The quote underlines the ambiguous status of public art and especially of outdoor public art. Last January I watched the 1999 Market Street mural being demolished. It was painted by David McShane with local youth and addressed their hopes for access to education. Its destruction perhaps tells a truer story about government intentions. Nonetheless, the public commitment of the Philadelphia Mural Arts Program to restore at least ten murals a year should encourage all lovers of mural art. Perhaps there is still time to save some of the painted walls.

Weisser, Terry Drayman, Dialogue/89 – The conservation of Bronze sculpture in the outdoor environment: National association of corrosion Engineers, 1992.

The symposium addressed vulnerability and deterioration of our most visible cultural heritage – our outdoor monuments and sculptures. This includes the problem of acid rain, specific processes or deterioration and the longer, effects of treatments and maintenance procedures.

Wharton, G. and V. Naudé, eds. 1993. Guide To The Maintenance Of Outdoor Sculpture. Washington, DC: The American Institute for Conservation of Historic and Artistic Works.

This book underlines some of the ethical and practical considerations that come into play with the maintenance of outdoor sculpture. Chapter 1 looks at the history of the practice and the role of conservators in continuing its legacy. Chapter 2 points to the joint efforts of art owners, artists, historians, technicians, in addition to conservators in the success of maintenance practice. Chapter 3 outlines survey steps based on conventional inventory or the NIC/NMAA's SOS survey guidelines, while Chapter 4 details some of the aimed-for goals of Long-Range maintenance plans. Chapter 5 goes into further detail regarding such a plan, looking at administrative, financial, and public outreach considerations. Chapter 6 discusses materials, various metals, stone, wood, etc., while Chapter 7 deals with contract considerations.

Willams, Donna and Rosa Lowinger. "Quiet collaboration: the special relationship between artists and their fabricators." *From marble to chocolate: the conservation of modern sculpture*; Tate Gallery Conference. London: Archetype Publications, 1995. Pg. 130-135.

In modern and contemporary sculpture, industrial metal finishes are frequently encountered. These materials are used by artists for their particular surface qualities: reflectance, optical effects, and mechanical non-hands-on finish. These objects may be composed of or contain elements of high polish brass, copper, and stainless steel surfaces; shot-peened or brushed, as well as anodized aluminum; hot- and cold-rolled steel, cast iron, Cor-Ten steel, and other nonpatinated metal surfaces. The treatment of such surfaces is often problematic. Isolated repairs are difficult to blend and, in many instances, the finish is impossible to replicate except by the means by which the piece was originally produced. Surfaces are similarly difficult to maintain due to the exactness of their finish. In many cases, treatment and maintenance of these metal pieces is further complicated by the lack of any surface coatings applied particularly for exterior environments, i.e., wax, lacquers, etc. Examples of conservation treatments for high polished brass, copper, and aluminum surfaces, brushed aluminum, and cold-rolled and cast steel surfaces by artists Susan Rankaitis, Donald Judd, and Ellsworth Kelly are discussed. Where feasible the artist or the fabricator was consulted.

Windon, Katrina. 2012. "The Right to Decay with Dignity: Documentation and the Negotiation between an Artist's Sanction and the Cultural Interest." *Art Documentation: Journal of the Art Libraries Society of North America* 31 (2): 142–57. https://doi.org/10.1086/668108.

Art, like anything else in the world, has always been impermanent, despite conservators' attempts to give it permanence. Increasingly, however, modern art is embracing a more immediate impermanence, and this ephemeral art presents unique challenges to conservators and curators. Ethical and legal guidelines mandate a respect for the artist's intention—the artist's sanction—regarding the disposition of the work, so preservation of that work for future audiences must rely upon a more indirect form of preservation: the creation of documentary surrogates. These surrogates may be created by the artists themselves, by collecting

institutions, or by third parties. They may be textual, audiovisual, or as materially three-dimensional as the original work itself. The documentation of ephemeral art must be tailored to the specific needs of the work, desires of the artist, constraints of the technology, and budgets of the holding institutions. The documentation process is one that should be begun at the point of acquisition, carefully planned, and carefully documented, so that future viewers may see, if not the work itself, a thorough record of it, and the sincere attempt to preserve the spirit of it.

It is customary to lament the loss of some indefinable element when not viewing something in its original, in person. "Immersion experiences . . . are primary," Schall states.89 They are more sensual, more evocative than recordings or replications. Hedstrom and Perricci claim that "the dual levels of surrogacy only capture a pale representation of an actual event or process."

Perhaps, perhaps not. Certainly, if artists involve themselves in the process of surrogate creation, there is something to be said for the idea that the resultant product is, in some way, an original, in the way that a literary translation is, despite being a derivative work, still a unique original. Surrogates may be less valued than original pieces due to mankind's privileging of the original and the art world's obsession with authenticity, a concern which itself often contributes to the depth of documentation on a work. However, Hedstrom and Perricci claim that in contemporary art, faithfulness to the original is more important than the concept of authenticity.

The documentation should never claim to be what it is not. "These efforts," Potts says, "need to recognise their paradoxical and contradictory status—that they can never actually reconstitute the work or make it fully present to us now," for they may be "possibly the more effective for testifying to their relative inadequacy, to their provisional and contingent nature." There is power in admitting favored-reproduction status, power in the quasi-permanence documentary surrogates may hope for, power in having survived. Done properly, and tailored to the specific needs of an exhibit rather than simply relying on standbys like traditional photography, documentation can capture, if not the aura itself, at least some facsimile thereof. Documentation is not only sometimes the only viable option, but it also opens new doors and allows new viewers and new interpretations in the present as well as in the future. For those who cannot geographically travel to a gallery space, digital documentation may provide an alternative—often an interactive, simulatory, possibly even emulatory—experience.

Library and Archival Collections

Books

Structurally, books are the most complex objects in this chapter.
A book's structure may be as humble as a stapled pamphlet or as luxurious as a gold-tooled, leather-bound book sewn on raised bands. Regardless, both ends of the spectrum may be highly prized as cultural artifacts and must continue to function as intended. Common materials found in books include paper, printer's ink, decorative papers, adhesives, leather, parchment, fabric, hemp cord, and thread.
This mixed collection of materials that we call the book must be able to flex and provide support throughout the structure for the volume to function (FIG. 2). Problems occur when one or more of the materials in a book become weak or rigid. Then the covers may fall off; the pages may loosen or detach; and the paper may tear. External forces, such as a book accidentally getting wet, may affect the different materials in different ways, leading to stains, straining, and breakage. Internal forces, such as acidic compounds in the paper and leather and corrosive media may also be at work.

Handwritten and Printed Documents

Manuscripts and documents are composed of paper or parchment leaves inscribed with printed and handwritten ink and may be adorned with seals, ribbons, and postal stamps. They are often creased, torn, and soiled from a postal journey or everyday wear-and-tear, or faded from display.
In addition, the acidic, iron-based ink that was in common use from the eighth century through the opening decades of the twentieth century often corrodes and weakens the paper around it.
Writing inks age more unpredictably than printing inks, because recipes for writing inks over time have been so variable, both before and after the commercial manufacture of inks began during the Industrial Revolution.
Modern writing inks are proprietary, so industry secrets make it challenging to understand their components and how they might age. Most printing inks found in books tend to be relatively stable, although high oil content can migrate into adjacent paper, creating a "halo" around the text or offset onto adjacent pages, particularly if books are stored in fluctuating environmental conditions. Printing inks used for ephemera, especially color inks, can be especially vulnerable to light and humidity damage.

Ephemera

The term ephemera usually refers to printed documents that were originally intended for short-term use, such as souvenirs or items of historical interest. These materials, because they were not produced with an eye toward longevity and durability, often suffer from inherent vice. By this we mean that the very nature of their materials leads to inevitable dete. rioration. Ephemera may include advertisements, cigar boxes, baseball and trade cards, broadsides, event programs, calendars, brochures, greeting cards, postcards, menus, paper dolls, and postage stamps.
If you are fortunate enough to have newspaper clippings that predate the 1850s in your collection, then they are likely in stable condition, since acidic wood pulp papers were not manufactured widely until the mid-nineteenth century. Most ephemera, however, including newspapers from the second half of the nineteenth century and later, are printed on inexpensive, wood-pulp paper. Such papers are a prime example of inherent vice and are best stored safely away from heat, light, and dust. Encapsulating fragile wood pulp papers between layers of polyester film allows them to be handled safely.

Scrapbooks

Scrapbooks may be homemade structures or commercially sold blank books with contents added by the creator or consumer. Sometimes these blank books are marketed specifically for scrapbook use and have flexible binding structures that are made to accommodate the additional bulk of the items added to them. Many historical scrapbooks, however, were made by repurposing a book that was not originally intended for this use. Scrapbooks are therefore often physically fragile and full of inherent vice. Their binding structures are compromised by their contents, which can cause physical strain to the bindings and may be chemically incompatible with adjacent materials. For example, highly acidic dried plant materials, such as pressed flowers, will cause oxidation of the cellulose on facing papers, leaving a "burn" pattern.

Scrapbooks present some of the most difficult challenges in the preservation world. They require special care and consideration every time they are opened. Covers must be supported to avoid stress on the binding (FIG. 3). Pages must be turned slowly, and support must be provided for loose or detached items. Fragile, detached items can be placed in labeled envelopes, with a note about their original location in the book. The use of a book box that is rigid and strong enough to support and protect the scrapbook is imperative for any preservation effort. Ideally, all scrapbooks should be maintained intact, since a significant part of their value lies in the arrangement of pages by their creator. When the structure or contents are too physically fragile or chemically vulnerable to maintain in their original state, a conservation professional can suggest alternatives.

Indigenous Collections

Indigenous collections. Canadian Conservation Institute..

> *[“Many materials have been used by Indigenous peoples to craft objects, from functional household items to intricate jewelry, carvings and statues. Objects that are sacred and culturally sensitive require special considerations. With proper care, these objects can be enjoyed for many years. The following resources provide information and advice on how to care for Indigenous collections.”]*

Canadian Conservation Institute (CCI) Notes

N6/1 Care of Ivory, Bone, Horn and Antler. Canadian Conservation Institute. CCI Notes (1988)
N6/2 Care of Basketry. Canadian Conservation Institute. CCI Notes (1988)
N6/3 Care of Canoes, Kayaks and Umiaks. Canadian Conservation Institute. CCI Notes (1989)
N6/4 Care of Objects Decorated with Glass Beads. Canadian Conservation Institute. CCI Notes (1994)
N6/5 Care of Quillwork. Canadian Conservation Institute. CCI Notes (1991)
N6/7 Totem Poles Displayed Indoors. Canadian Conservation Institute. CCI Notes (2008)
N6/8 Totem Poles Displayed Outside. Canadian Conservation Institute. CCI Notes (2008)
N6/9 Care of Inuit Carvings. Canadian Conservation Institute. CCI Notes (2016)
N8/4 Care of Rawhide and Semi-Tanned Leather. Canadian Conservation Institute. CCI Notes (1992)

Other CCI resources on this topic

Preserving Aboriginal Heritage: Technical and Traditional Approaches (2007)

External links

Storage Supports for Basket Collections National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 5/1, 1993)
Storage Mounts for Feathered Headdresses and Soft-Sided Hats and Caps National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 5/2, 1993)
Internal Supports for Buckskin Clothing Storage National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 5/3, 2011)
Byne's "Disease:" How To Recognize, Handle and Store Affected Shells and Related Collections National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 11/15, 2008)
A Guide to Guardians of Iwi Treasures (PDF format) (Te Papa National Services)
Bone, Antler, Ivory, and Teeth (PDF format) (Minnesota Historical Society)
Indigenous people and museums (National Museums of Australia)

Ivory, Bone, Antler and Horn (Pitt Rivers Museum)
National NAGPRA (Native American Graves Protection and Repatriation Act, U.S. Department of the Interior, National Park Service)
Quills, Horn, Hair, Feathers, Claws, and Baleen (PDF format) (Minnesota Historical Society)
Task Force Report on Museums and First Peoples (PDF format) (Canadian Museums Association and Assembly of First Nations, 1994)
The Care and Handling of Ivory Objects (Smithsonian Museum Conservation Institute)
The Care of Feathers (PDF format) (Bishop Museum)
Traditional Care (National Museum of Natural History, Smithsonian Institute)

Industrial Collections

Industrial Collections. Canadian Conservation Institute.

> *["Industrial collections include items such as machine tools, printing presses and other industrially produced objects. These resources provide information on how to properly care for and store these objects indoors and outdoors, how they work and the factors that can cause deterioration such as sunlight, heat and oxygen."]*

N15/2 Care of Machinery Artifacts Displayed or Stored Outside. Canadian Conservation Institute. CCI Notes (1993)
N15/4 Indoor Display of Industrial Collections. Canadian Conservation Institute. CCI Notes (1998)
N15/5 Lubrication for Industrial Collections. Canadian Conservation Institute. CCI Notes (2002)
N15/6 Trade Literature for Industrial Collections. Canadian Conservation Institute. CCI Notes (2002)
N15/7 Rubber Components in Industrial Collections. Canadian Conservation Institute. CCI Notes (2002)
N15/8 Outdoor Storage and Display: Basic Principles. Canadian Conservation Institute. CCI Notes (2010)
N15/9 Outdoor Storage and Display: Remedial Measures. Canadian Conservation Institute. CCI Notes (2010)
Technical Bulletins
TB16 Care and Preservation of Firearms (1995)
TB17 Threaded Fasteners in Metal Artifacts (1997)
Other CCI resources on this topic
Basic care – Clocks and watches
Basic care – Lamps and light fixtures
Basic care – Tools
Related CCI resources
Agents of deterioration
Basic requirements of preventive conservation
Handling heritage objects
External links
Preparing Historic Motorized Vehicles for Storage or Exhibit National Parks Service, Conserve O Gram. (PDF format) (Conserve O Gram 10/3, 1999)

Archeological Objects

Archaeological Conservation. AIC Conservation Wiki.
Archaeological collections. Canadian Conservation Institute.

> *["Archaeological artifacts are delicate objects that require proper care. These resources provide information and advice on how to care for archaeological collections."]*

N4/1 Identifying Archaeological Metal. Canadian Conservation Institute. CCI Notes (2007)
N4/2 Vacuum Freeze-drying Archaeological Artifacts. Canadian Conservation Institute. CCI Notes (2007)
N4/3 Conservation of Wet Faunal Remains: Bone, Antler and Ivory. Canadian Conservation Institute. CCI Notes (2007)
N4/4 Test for Chloride Ions in Iron Treatment Solutions Using Quantab Test Strips. Canadian Conservation Institute. CCI Notes (2016)
N4/5 How to Test for Chloride Ions in Iron Treatment Solutions Using Silver Nitrate. Canadian Conservation Institute. CCI Notes (2016)
First Aid for Wet-Site Objects National Parks Service, Conserve O Gram. (PDF format) (Conserve O Gram 6/1, 1993)
Desalinization: Passive Alkaline Soak National Parks Service, Conserve O Gram. (PDF format) (Conserve O Gram 6/2, 1993)
Testing for Chlorides with Silver Nitrate National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 6/3, 1993)
Soluble Salts and Deterioration of Archeological Materials National Parks Service, Conserve O Gram (PDF format) (Conserve O Gram 6/5, 1998)
Curatorial Care of Archeological Objects (PDF format) (National Park Service Museum)
Guidelines on the Care of Archaeological Artefacts (PDF format) (National Museum of Iceland)
The Care and Handling of Art Objects (PDF format) (The Metropolitan Museum of Art)

Historic House Museums and Furnished Historic Structures

Heritage Preservation and National Park Service. *Caring for Your Historic House*.
https://store.culturalheritage.org/site/index.php?app=ecom&ns=prodshow&ref=FAIC-35

Storage, Exhibition, and Transport

Housing

Brown, Karen E. K. "Using Spreadsheets for the Phase Boxing of Books." Archival Products News v. 11, no. 1 (Winter 2004). http://www.archival.com/newsletters/apnewsvol11no1.pdf

CCAHA. "Matting and Framing Specifications for Paper-Based Collections." http://download.aaslh.org/AASLH-Website-Resources/ccaha-matting-and-framing-specifications-for-objects-on-paper.original.pdf

Clarkson, Christopher and Sherelyn Ogden. "The Book Shoe: Description and Uses." NEDCC Technical Leaflet: Storage and Handling Section 4, Leaflet 7. http://www.nedcc.org/free-resources/preservation-leaflets/4.-storage-and-handling/4.7-the-book-shoe-description-and-uses

NEDCC. "Custom Protective Enclosures." NEDCC Technical Leaflet: Conservation Procedures Section 7, Leaflet 4. https://www.nedcc.org/free-resources/preservation-leaflets/7.-conservation-procedures/7.4-custom-protective-enclosures

NEDCC. "Storage Enclosures for Books and Artifacts on Paper" NEDCC Technical Leaflet: Storage and Handling Section 4, Leaflet 4. https://www.nedcc.org/free-resources/preservation-leaflets/4.-storage-and-handling/4.4-storage-enclosures-for-books-and-artifacts-on-paper

Storage

ICCROM/UNESCO/CCI: RE-ORG Storage Reorganization Method

- Who: RE-ORG is a storage reorganization tool developed by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and the Canadian Conservation Institute (CCI)
- What: Applied to over 100 museums worldwide, RE-ORG provides a step-by-step methodology for reorganizing small museum storage areas for better access and preservation, and with a focus on creative and safe improvements to existing storage

FAIC/SPNHC: STASHc Online Storage Resource

- Who: STASHc, which stands for Storage Techniques for Art, Science, and History collections, is an online tool supported by the Foundation for the American Institute for Conservation (FAIC) and the Society for the Preservation of Natural History Collections (SPNHC)
- What: The STASHc website provides information on safe storage solutions appropriate for heritage institutions of all types, sizes, and resource levels; articles are organized by storage configuration to stimulate the transfer and adaptation of methods used across collection types

Exhibition and Transit

International Mountmakers Forum

- Who: The International Mountmakers Forum (IMF) is a group of allied professionals dedicated to advancing the design, fabrication, and installation of safe and well-made supports for the display or storage of objects
- What: The IMF website provides a platform for fostering communication, promoting best practice, and disseminating information; key elements include an online discussion forum, resources on mountmaking materials and tools, and links to conferences and workshops with past presentation recordings accessible for viewing

Preparation, Art Handling, and Collections Care Information Network

• Who: The Preparation, Art Handling, and Collections Care Information Network (PACCIN) is a non-profit volunteer organization that seeks to elevate standards of art and artifact handling and

housing; areas of focus include packing, crating, shipping, installation, mountmaking, rigging, exhibition fabrication, and storage, as well as educational and employment opportunities
• What: The PACCIN network website includes sections on tools and equipment, materials, tips and solutions, and case studies; additionally, PACCIN organizes conferences and workshops with many presentations available for view online
Making Archival Boxes
Connecting to Collections Care: Resources for Making Archival Boxes and Enclosures
• Who: The Connecting to Collections (C2C) Care online community is committed to helping small and mid-sized cultural institutions care for their collections
• What: Archival boxes and enclosures serve an important role in protecting a heritage object and the creation of bespoke housings ensures a custom fit and can provide cost savings; this resource shares links on making archival boxes and four flap enclosures
o Note that this accompanied the C2C Care webinar on the Care of Books and Scrapbooks
o The full breadth of C2C Care resources can be explored using the Resource Search Tool

Housekeeping and Cleaning

Handling and Moving Collections

Handling

Gerald R. Ford Conservation Center. Object Handling Procedures. 2017. Harvard University Library. Careful Handling Guidelines and Procedures.

Moving Collections

CCAHA. “Guidelines for Re-housing: Renovation and Moving.” https://ccaha.org/resources/guidelines-re-housing-renovation-and-moving

President and Fellows of Harvard College. “Conservation Guidelines: Packing Bins to Transport Library Materials.” Preservation & Imaging Department, Harvard University Library.
https://projects.iq.harvard.edu/carefulhandling/conservation-guidelines-packing-bins-transport-library- books

Preservation Advisory Centre, British Library. “Moving Library and Archive Collections.” August 2013.
https://www.bl.uk/britishlibrary/~/media/bl/global/conservation/pdf-guides/moving-library-and-archive-collections-guide.pdf

Smithsonian Museum Conservation Institute. “Moving, Packing and Shipping Furniture”.
www.si.edu/mci/english/learn_more/taking_care/movefurn.html

Collections Environment and Monitoring

Security and Fire Protection

Emergency Preparedness Planning

Health and Safety

[2023 Mental Health Tips for Heritage Professionals]

Access to and Use of Collections

Chicago Historical Society. “Exhibit Conservation Guidelines for the Chicago Historical Society.” https://www.yumpu.com/en/document/read/30434658/exhibit-conservation-guidelines-for-the-chicago-historical-society

Connecticut Historical Society Museum & Library. “Handling Rare Materials.” https://chs.org/wp-content/uploads/2016/11/CHS-Handling-Rare-Materials.pdf

CCAHA. “Photocopying Guidelines.” 2018. https://ccaha.org/resources/photocopying-guidelines

Delaware Public Archives. “Guidelines.” https://archives.delaware.gov/visit-the-dpa/

Murray, Amanda. “Creating Physical Access: Setting Handling Guidelines.” Webinar for Documentary Heritage and Preservation Services for New York, September 2021. https://youtu.be/m3Q254pvu1w

Parks, Amelia. "Preservation in Exhibits." Webinar for Documentary Heritage and Preservation Services for New York, January 2018. https://youtu.be/cOl0Q7g8zBU

Alvis, Alexandra K. “No Love for White Gloves, or: the Cotton Menace”. Smithsonian Libraries and Archives Blog, 2019. https://blog.library.si.edu/blog/2019/11/21/no-love-for-white-gloves-or-the-cotton-menace/

ANSI/NISO. “Environmental Conditions for Exhibiting Library and Archival Materials.” NISO Press: Bethesda. 2001. https://groups.niso.org/apps/group_public/download.php/6482/Environmental%20Conditions%20for%20Exhibiting%20Library%20and%20Archival%20Materials.pdf

Harvard University Library. “Careful Handling Guidelines and Procedures.” https://projects.iq.harvard.edu/carefulhandling/guidelinesprocedures

Marcus, Gillian. "Security for Collections." Webinar for Documentary Heritage and Preservation Services for New York, March 2017. https://youtu.be/cNaPymveW68

NEDCC. Preservation Leaflet 4.1: Storage Methods and Handling Practices. https://www.nedcc.org/free-resources/preservation-leaflets/4.-storage-and-handling/4.1-storage-methods-and-handling-practices

Society of American Archivists Museum Archives Section. Standards & Best Practices Resources Guide, Reference and Access/Use Services Section
https://www2.archivists.org/groups/museum-archives-section/6-reference-and-accessuse-services

Preservation Supplies Vendors

- This list is a resource of select vendors and does not constitute endorsement
- All products should be assessed as to their appropriateness for long-term preservation by investigation of material descriptions and origins or consultation with a conservation professional
- The final listing represents an inclusive compilation of vendors relevant to the preservation sector developed by the Conservation Center for Art and Historic Artifacts (CCAHA)

Archival Products 1801 Thompson Avenue Des Moines, IA 50316-2751 (515) 262-3191, (800) 526-5640	Conservation Resources International 7350-A Lockport Place Lorton, VA 22079 (800) 634-6932	Gaylord Archival PO Box 4901 Syracuse, NY 13221-4901 (800) 448-6160
Hollinger Metal Edge 9401 Northeast Drive Fredericksburg, VA 22408 (800) 634-0491	Light Impressions 100 Carlson Road Rochester, NY 14610 (888) 222-2054	TALAS 330 Morgan Ave Brooklyn, NY 11211 (212) 219-0770
University Products, Inc. PO Box 101 Holyoke, MA 01041-0101 (800) 628-1912		

CCAHA Conscientious Consumption: An Inclusive Vendor List
Initiated by the Conservation Center for Art and Historic Artifacts (CCAHA) for its 'Diversity in Collections Care: Many Voices' colloquium, this evolving list includes preservation vendors that are BIPOC-, LGBTQ+-, and women-owned and/or operated and offer more sustainable products in an effort to raise awareness, access, and support