

AN ARTISTIC AND INTELLECTUAL HISTORY

History of Diagnostics, Observability, and Debugging in Arts

Artistic evidence and the examination of change

— *Seven parts and 35 chapters* —

Concept by Dmitry Vostokov, DumpAnalysis.org

Developed with AI assistance (GPT-6 Astra Max and Fable 5.1 Extra) and checked against the sources listed in this article.

Version 3 | October 2026

Historical synthesis with 80 references, chronology, glossary, and evidence taxonomy

Abstract

Arts leave evidence of their making, performance, transmission, and repair. A painting can preserve an abandoned composition below its visible surface. A musical manuscript can contain several stages of revision. A rehearsal recording can show a missed cue, while the prompt book shows what was supposed to happen. A digital installation can retain all its files and still fail to behave as a work. In this history, we examine how such conditions became available for analysis and how practitioners distinguished an intended feature from a defect requiring correction.

We follow selected developments in painting, drawing, printmaking, sculpture, architecture, decorative arts, literary composition, music, theater, dance, photography, film, and electronic and digital art. Workshop knowledge and practices of criticism are followed by connoisseurship, conservation laboratories, technical imaging, recording, performance documentation, and the preservation of executable works. These histories overlap. A new instrument adds a viewpoint; it does not make earlier forms of knowledge unnecessary.

Our main distinction is between the work, a particular material object or realization, the evidence captured from it, and the explanation built from that evidence. Their conditions need separate examination. A sound file can be intact but transferred at the wrong speed. A sculpture can be stable while its attribution remains uncertain. A restaged performance can differ from a recording and still preserve relationships that matter to the work. Conversely, a visually convincing reconstruction can conceal how much was supplied by the restorer.

Seven parts and 35 chapters are followed by a selected chronology, glossary, and evidence taxonomy. We connect the historical cases with our pattern-oriented software diagnostics through recurring analysis operations. The connections become literal where software participates in artistic production or presentation. Elsewhere they remain comparisons whose usefulness depends on retaining the material, cultural, and interpretive differences.

How to read this history

Let us first specify what we mean by diagnostics in arts. We mean the investigation of a condition, discrepancy, or failure and the examination of its possible explanations. The object of diagnosis may be a support, pigment, instrument, performance arrangement, recording, catalog entry, or software dependency. An aesthetic judgment is a different kind of claim. We can establish that a projector has lost synchronization without establishing that the installation is artistically successful.

Observability concerns the arrangements through which relevant states, changes, and relationships can be inspected. We use the word comparatively for workshop proofs, annotated scores, condition reports, and archival records. This usage does not assert the mathematical observability of an artistic practice. A photograph can make one aspect of a work visible while leaving its material construction, sound, interaction, or cultural setting unavailable. More records do not necessarily settle an interpretation.

Debugging is literal when we locate and correct defects in software used to create, exhibit, or preserve art. Applied to a printing error, rehearsal discrepancy, or misleading restoration, it is a present-day comparison.

Earlier practitioners usually spoke in their own vocabularies of correction, criticism, repair, tuning, restoration, and rehearsal. We do not give those practices a retrospective software identity or propose that they descend from one uninterrupted diagnostic tradition.

The historical sequence is organized within seven thematic parts. Part I concerns craft, transmission, and correction. Part II follows the examination of objects and the development of technical evidence. Part III considers conservation and the consequences of intervention. Part IV concerns music and recorded sound. Part V examines performed and moving-image works. Part VI follows variable media and software. Part VII compares investigations and develops a worked example.

The arts considered here have different institutions and boundaries. Architecture is included where material investigation bears on artistic and historical form. Literary arts enter through composition, revision, and performed texts. Crafts and living traditions contribute forms of knowledge that cannot be reduced to museum classification. The cases are selective, with examples from several regions; they do not constitute an exhaustive world history of artistic practice.

Numbered references identify sources for historical and technical claims. Dates of original works, later editions, restorations, and digital publication are distinguished where relevant. Hypothetical examples are explicitly identified. Our comparisons with analysis patterns are proposed readings of the evidence, not claims that earlier artists or conservators used our terminology. Technical descriptions explain the history of investigation; they are not treatment recipes for individual objects.

Contents

Seven parts and 35 chapters

SECTION	PAGE
Abstract	2
How to read this history	2
PART I · CRAFT TRANSMISSION AND CORRECTION	6
1. Vocabulary and historical scope	6
2. Workshop recipes and the observation of materials	7
3. Drawings proofs and visible revisions	8
4. Embodied knowledge and living transmission	8
5. Literary composition and the criticism of form	9
PART II · OBJECTS INSTRUMENTS AND TECHNICAL EVIDENCE	11
6. Connoisseurship attribution and provenance	11
7. Restoration and the meaning of an earlier state	12
8. The formation of conservation laboratories	12
9. Imaging beyond the visible surface	13
10. Sampling spectroscopy and the location of evidence	14
PART III · CONSERVATION CHANGE AND INTERVENTION	16
11. Paintings as records of making and aging	16
12. Sculpture architecture and structural relationships	17
13. Paper textiles and photographic objects	17
14. Preventive conservation and environmental records	18
15. Treatment records cultural authority and visible repair	19
PART IV · MUSIC NOTATION REHEARSAL AND SOUND	21
16. Musical manuscripts and the reconstruction of decisions	21
17. Rehearsal tuning and the condition of instruments	22
18. Recorded sound and the diagnosis of a transfer	22
19. Electronic music and executable processes	23
20. Silence noise and the limits of correction	24
PART V · PERFORMANCE AND MOVING IMAGES	26
21. Theater prompt books and coordinated activity	26

SECTION	PAGE
22. Dance notation and the preservation of movement	27
23. Film materials versions and archival reconstruction	27
24. Digital restoration and the boundaries of a correction	28
25. Performance documentation and future enactments	29
PART VI · VARIABLE MEDIA SOFTWARE AND MACHINE ANALYSIS	31
26. The variable media approach	31
27. Electronic installations and distributed failure	32
28. Web art games and changing dependencies	32
29. Migration emulation and preservation metadata	33
30. Machine analysis generative art and attribution	34
PART VII · COMPARATIVE DIAGNOSIS AND DIAGNOSTIC MEMORY	36
31. Repairs that change the object of investigation	36
32. Representations and the conditions of observability	37
33. Connections to pattern oriented software diagnostics	37
34. A worked investigation of a silent installation	39
35. Designing for future diagnosis	41
CONCLUSION	42
APPENDIX A SELECTED CHRONOLOGY	43
APPENDIX B GLOSSARY	45
APPENDIX C EVIDENCE TAXONOMY AND BLIND SPOTS	48
REFERENCES	50

PART I**Craft transmission and correction****1. Vocabulary and historical scope**

Let us consider a dark passage in a painting. It may have been dark when the artist completed the work. A coating may have yellowed, a pigment may have changed, or a photograph may have reproduced the passage incorrectly. We see one apparent condition and several possible locations for its explanation. Before choosing an intervention, we need to identify which object we are examining and which comparison makes its condition problematic.

There are historical vocabularies for evaluating artistic mistakes. In the *Poetics*, Aristotle distinguishes problems belonging to poetic art from errors concerning other kinds of knowledge. His discussion also allows that an apparent impossibility can serve a poetic purpose. We need not accept his prescriptions as universal to recognize the methodological point: a criticism depends on the kind of achievement being assessed. [1]

Material conservation introduces another distinction. A damaged support can threaten a work even when the damage has become familiar to viewers. A later addition may obscure an earlier state while having historical value of its own. The question of what to preserve therefore concerns more than the detection of a physical difference. It includes the significance of that difference and the consequences of removing it.

We use diagnostic artifact for a preserved item through which an investigation can proceed. Examples include a paint cross-section, a rehearsal note, an audio transfer log, a photograph of an installation, and a record of a software change. The artifact may be a part of the work, a representation of it, or documentation of an earlier examination. These relationships should accompany the artifact when it enters a collection.

A defect also needs a reference condition. A printing fault can be identified against an approved proof. A failed trigger can be assessed against installation instructions. An unconventional perspective cannot be declared defective merely because it differs from a particular geometric construction. Where the intended condition remains uncertain, the investigation can establish a difference without resolving whether it requires correction.

The history in this book concerns the development of ways to preserve these distinctions. We follow the movement from practical comparison to recorded examination, from visible particulars to instrumentally acquired evidence, and from isolated objects to works distributed across people and technical systems. None of these movements removes the need for judgment. They change what can be inspected and what another investigator can check.

2. Workshop recipes and the observation of materials

Historical workshop texts preserve instructions whose details can help us interpret surviving objects. The medieval treatise associated with Theophilus, known in English as *On Divers Arts*, concerns painting, glassmaking, and metalwork. Cennino Cennini's *Il libro dell'arte*, generally situated around the turn of the fifteenth century, records practical knowledge about artistic materials and procedures. These texts provide evidence of articulated craft knowledge, although neither represents every workshop of its period. [2, 3]

A recipe records a proposed sequence. It does not by itself establish that the sequence was followed for a particular object. The distinction matters when a historian uses a text to explain a painting. Similar materials can be combined in different proportions, processed differently, or applied to different supports. A named material may also have changed meaning across places, languages, and periods. Identifying the word is only part of identifying the practice.

Consider a hypothetical workshop instruction to prepare a smooth ground before painting. An uneven surface in a surviving panel could indicate an incomplete preparation, an intentional texture, later damage, or a treatment that altered the surface. The instruction supplies one expectation. Examination of the object must still establish which stage produced the feature. Reading a recipe as if it were an execution record would remove this necessary step.

Workshop learning also includes judgments that are difficult to reduce to words. A practitioner assesses consistency, resistance, drying, adhesion, and the response of a tool. Written instructions can prompt such judgments without fully specifying them. This is why practical reconstruction can help a researcher identify questions that a textual reading missed. It can expose how much a procedure depends on a material's preparation or on the operator's acquired skill.

Experimental reconstruction remains a new event. The experiment uses available materials, equipment, and interpretations of historical language. A successful reconstruction demonstrates one workable route under those conditions. It does not prove that the historical maker used the same route. Conversely, failure may reveal an incomplete interpretation of the recipe rather than an impossible historical technique.

From our perspective, workshop texts are an early form of diagnostic memory. They preserve useful sequences and sometimes warn against undesirable results. Surviving objects preserve a different kind of memory through their material relationships. The strongest investigation brings these forms of evidence together while keeping their origins visible. The instruction, the experiment, and the historical object can then correct one another without being treated as interchangeable witnesses.

3. Drawings proofs and visible revisions

Preparatory drawings and proofs allow the development of a work to be examined through intermediate states. A changed contour may record an artist's decision. A trial impression may expose how a printing matrix behaves on paper. Such artifacts make comparison possible before a final presentation and, if preserved, long after the workshop has dispersed. They provide a history of operations that the completed object may conceal.

Alberti's *De Pictura* of 1435 described a system of linear perspective. A geometric construction made certain spatial relationships open to checking within that representational convention. The construction was an instrument for making and assessing a particular kind of image. It did not establish a universal test of pictorial correctness across artistic traditions or across works that deliberately reorganize space. [4]

Printmaking supplies an especially clear distinction between a work and its successive material states. Getty's cataloging guidance distinguishes states of a work produced in multiples and notes the role of proofs in testing a plate. A change to a matrix can create a new state; differences in inking alone do not create a new state. The classification therefore requires examination of how the difference arose. [5]

Modern recording can recover additional evidence of preparation. Factum Foundation's documentation of the Raphael Cartoons combines color, infrared, and surface information. These records offer different views of the same objects rather than one image that contains every relevant property. Comparing them can help locate marks or surface features in relation to the visible design. The registration and processing of the records also become part of the evidence. [6]

Suppose two impressions show a line in different positions. We should first ask whether we have two states, a distorted reproduction, or different cropping of one image. Only after identifying the source of the difference can we interpret it as a revision. A sequence assembled from incorrect identifiers can create an artistic development that never occurred.

These practices make correction observable because they preserve a before and an after. Their limitation is selective survival. The surviving proof may be the one a collector valued, while several unsuccessful trials disappeared. We can reconstruct documented transitions, but the gaps between them remain gaps. The final work does not tell us how many abandoned paths preceded it, and a preserved revision does not automatically identify the maker's reason for changing direction.

4. Embodied knowledge and living transmission

Some arts preserve continuity through people who know how to make, perform, recognize, and teach. Their evidence includes movement, listening, correction in rehearsal, and participation in a setting. A written description can document parts of this knowledge, but it does not replace the competence

required to enact it. The history of diagnostics in arts therefore includes the trained observer as well as the surviving object.

UNESCO's accounts of Nôgaku and Indonesian wayang describe traditions that combine several expressive resources. Nôgaku includes performance involving masks, costume, movement, and speech or song. Wayang joins puppetry with narrative and musical practices. These combinations matter to analysis because a change in one element can alter the relationships through which the performance works. A collection of individual props does not preserve the performance by itself. [7, 8]

The Gbofe tradition associated with Afounkaha and the Tagbana community in Côte d'Ivoire gives another example. UNESCO's account connects horn music with singing and dance. A recording of horn sounds captures evidence of one part of this activity. It cannot independently specify the occasion, the relationships among participants, or the knowledge through which the performance is interpreted and continued. [9]

Gamelan likewise names both an Indonesian musical ensemble and its instruments in UNESCO's description. The relationship between instruments and performers cautions us against treating a single extracted sound as a complete unit of the practice. A diagnostic comparison needs to establish which ensemble, performance, and purpose supplied the reference. Different traditions and local arrangements can sustain different expectations. [10]

Imagine a hypothetical recording whose timing differs from a notation prepared by an outside observer. The discrepancy could reflect a notational simplification, a particular performance choice, a recording problem, or a genuine departure from the performers' expectations. Consulting experienced practitioners is part of identifying the problem. Automatically correcting the recording to fit the notation would give the observer's representation an authority it has not earned.

These examples also change what loss means. An archive may preserve recordings while the opportunities to learn a practice diminish. Conversely, a living practice may continue through variation even where older recordings are scarce. Preservation has to consider the conditions of transmission and the community's account of continuity. Diagnostic work can assist by documenting changes and constraints, but it cannot assign cultural meaning from a signal difference alone.

5. Literary composition and the criticism of form

Literary works enter this history through the examination of composition, revision, and transmission. A crossed-out phrase, a corrected proof, or a changed scene order can preserve a decision in the making of a work. Later editors face a different task: they must decide how surviving witnesses relate to one another and what kind of reading text to provide. The objects can look similar while the authority to alter them is different.

Aristotle's *Poetics* already treats difficulties in a work as questions that require interpretation of purpose and form. Its categories belong to an ancient account of poetic art. We can use the discussion to

recognize an early effort to distinguish kinds of criticism without assuming that later literary practices share its standards. A contradiction within a represented world and a departure from ordinary factual description need not have the same artistic effect. [1]

Hamlet provides a documented example of the problems created by multiple textual witnesses. Barbara Mowat and Paul Werstine describe three early printed versions: the first quarto of 1603, the second quarto of 1604–1605, and the First Folio text of 1623. Their differences make the construction of a modern reading text an editorial activity. Combining readings can yield a usable edition without reproducing any single surviving early witness. [11]

We therefore need to distinguish correction from conflation. A printer's evident misreading can be an appropriate object of emendation. A scene present in one version and absent in another may raise a larger question about performance, revision, or transmission. The editor's apparatus allows readers to inspect such decisions. When the apparatus disappears from a derivative text, the resulting smoothness can hide the uncertainty on which the text was built.

For a contemporary author, revision can also change the specification. A passage removed during composition is not necessarily a defect that has been fixed. The writer may have changed the work's emphasis or abandoned a valid alternative. A history based only on the final text cannot reliably reconstruct those decisions. Drafts provide observations, but their order and relation to publication still require evidence.

The connection with debugging is consequently local. We can locate a corrupted character, a missing line introduced in typesetting, or a broken cross-reference. We can also examine why a narrative does not produce its intended effect, but the remedy may transform the intention itself. Literary creation makes this boundary particularly visible. Revision can discover the work being made, whereas restoration and scholarly editing ordinarily have to state which earlier condition they seek to represent.

PART II**Objects instruments and technical evidence****6. Connoisseurship attribution and provenance**

Attribution asks who made a work, or how it relates to a workshop, collaborator, copy, or later imitation. It has often depended on close comparison of visible particulars. Giovanni Morelli's nineteenth-century method emphasized recurrent details associated with a maker's habits. Jan M. van Daal's discussion in a Getty publication notes the prominence of hands and ears while cautioning against equating their anatomical diagrams with the method as a whole. Such features supplied a way to challenge an attribution through comparative observation. [12]

The diagnostic difficulty is the choice of comparison set. An accepted group of works may contain earlier misattributions. An artist may change technique, employ assistants, or imitate another artist. A repeated feature may reflect a shared model rather than one hand. Recognition becomes more reliable when the investigator can state which similarities matter, how the comparison material was selected, and what alternative relationships could explain the match.

Provenance adds a different history. Inventories, sales catalogs, correspondence, labels, and dealer records can help trace an object's movement and changing description. The Getty Provenance Index makes records of historic ownership transfers available for investigation. A documented transfer is evidence about a transaction or a recorded claim. It does not by itself establish that an attribution repeated in that transaction was correct. [13]

Scientific evidence can overturn a persuasive attribution, but the particular inference must be preserved. The National Gallery's record for *The Virgin and Child with an Angel*, associated with Fausto Muzzi and Giuseppe Guizzardi after Francesco Francia, describes its identification as a deliberate fake through scientific examination. The case belongs to the history of examining the object together with the claims made about it. [14]

Consider a hypothetical signature found below a later varnish. That position establishes a relative relationship between the inscription and the coating. It does not establish that the inscription was made by the named artist. A forger can sign before applying varnish. Likewise, an old support can carry a later image. The relevant question is which part of the proposed history the observation actually constrains.

Attribution is strongest when different kinds of evidence can disagree without being suppressed. A stylistic judgment, material analysis, and documented ownership sequence may support different levels of confidence. Recording the disagreement preserves a useful investigation. Replacing all qualifications with a confident name makes the catalog simpler while making the reasoning harder to inspect. A corrected attribution should therefore carry the history of the correction, including what remains unresolved.

7. Restoration and the meaning of an earlier state

Restoration has repeatedly raised the question of which past a present intervention should represent. An object may contain several periods of making and use. A building may have acquired additions that are now historically significant. Returning it to a selected earlier appearance requires a judgment about what belongs to the work and what may be removed. Material competence alone cannot make that selection.

The Society for the Protection of Ancient Buildings issued its manifesto in 1877 through William Morris, Philip Webb, and other founders. It opposed forms of restoration that replaced historical fabric with an idealized renewal and argued for protection. The document records a specific nineteenth-century position in debates about old buildings. It gives us a clear example of a proposed improvement being diagnosed as a potential loss of evidence. [15]

Twentieth-century conservation developed additional conceptual frameworks. Cesare Brandi's *Teoria del restauro* appeared in 1963 and considered restoration through the recognition of a work's aesthetic and historical dimensions. Its later application to contemporary art exposes difficult questions about materials, change, and the identity of a work. The theory belongs to a particular intellectual history; it is not a universal formula that resolves every intervention. [16]

The Venice Charter was formulated in 1964 and adopted by ICOMOS in 1965. It addressed monuments and sites, including the need to respect historical evidence and to avoid conjectural restoration. Its principles should be read within that scope. Applying them to a painting, a performance, or software requires an argument about what is comparable, not merely a transfer of vocabulary. [17]

A hypothetical sculpture assembled from ancient fragments and a nineteenth-century completion illustrates the choice. Removing the completion might reveal the surviving ancient material more clearly. It would also alter an object that has had its own later history. A technical examination can distinguish joins and materials, while records can establish when the assembly occurred. The decision about presentation must still state which history it intends to show.

These debates make an important diagnostic operation explicit: defining the target before making the correction. The oldest recoverable state is not automatically the preferred state, and the most complete-looking object is not automatically the most faithful one. A defensible intervention identifies its evidence, its intended result, and the losses it may introduce. Later readers need this record because the intervention itself becomes part of the object's history.

8. The formation of conservation laboratories

The growth of museum laboratories made the material examination of art a sustained institutional activity. The Rathgen-Forschungslabor in Berlin traces its foundation to the chemical laboratory of the Royal Museums in 1888. Friedrich Rathgen's association with the laboratory connects chemical analysis

with the practical care of collections. The importance of this development lies in regular investigation and accumulated experience, not in a claim that earlier makers lacked empirical knowledge. [18]

At Harvard, Edward Waldo Forbes supported the combination of art study and scientific examination. Harvard's preservation history records the founding of the Department of Technical Studies at the Fogg Art Museum in 1928, later the Straus Center for Conservation and Technical Studies. Collections of reference materials and records of examination helped connect observations from individual works with broader knowledge of artistic materials. A laboratory could retain comparative evidence that outlasted a particular treatment. [19]

The National Gallery's Technical Bulletin provides another form of continuity. Its first volume appeared in 1977 and included Garry Thomson, John Mills, and Joyce Plesters's history of the Gallery's Scientific Department. Publication made selected methods, observations, and interpretations available beyond the laboratory. It also allowed later readers to compare current conclusions with earlier technical descriptions. [20]

An institutional laboratory changes the scale of diagnosis. A conservator can investigate a local condition while a scientist compares it with known material behavior. An art historian can ask whether the finding fits a documented technique or period. These contributions remain distinguishable. The presence of several disciplines is useful when their questions and limits are recorded, rather than when one vocabulary simply overrides the others.

Reference collections introduce their own conditions of reliability. A labeled pigment sample can support identification only to the extent that its own origin and preparation are known. A result obtained from an aged material may differ from one obtained from a fresh sample. Laboratory instruments also require calibration and documented settings. The evidence supporting the examination can itself become an object of examination.

The laboratory thus adds more than a set of machines. It adds a durable arrangement of people, reference materials, procedures, and records. Its diagnostic memory includes unsuccessful methods and revised identifications as well as successful treatments. When that memory is preserved, an apparent new anomaly can be compared with earlier investigations. When it is lost, another laboratory may repeat an intervention without knowing what the object has already experienced.

9. Imaging beyond the visible surface

Technical imaging separates several meanings of seeing. A visible-light photograph records appearance under a particular illumination. Radiography records differences in the transmission of X-rays. Infrared imaging can reveal features that visible paint conceals when the materials and wavelengths permit it. Each method responds to physical properties. Its image is a representation produced under conditions that determine what can and cannot appear. [21, 24]

In 1968, J. R. J. van Asperen de Boer published a method of infrared reflectography for examining paintings. The article described improved detection of underdrawing compared with infrared photography. This was a specific technical development with consequences for studying artistic preparation. It did not make every underdrawing visible, and a blank-looking result should not be interpreted as proof that no preparatory drawing exists. [22]

An image can also combine evidence from several depths. A radiograph of a painting may include contributions from paint, support, joins, and later interventions. A feature in the image therefore needs a material explanation. Its apparent shape is not enough to assign it to one stage of making. Complementary methods help establish which physical relationships could have produced the observed signal.

Comparison requires spatial registration. The National Gallery has discussed superimposing infrared and color images to clarify how a reflectogram relates to the painted surface. Alignment makes corresponding features easier to inspect, but processing can also create misleading boundaries if images are distorted or incompletely matched. The original records and the transformation used to align them should remain available. [23]

Consider a hypothetical image that reveals an earlier hand beneath a painted sleeve. The observation supports the existence of an underlying feature at that location. Calling it a rejected gesture may be plausible, but a fuller interpretation needs evidence about sequence, materials, and the rest of the composition. It could belong to another version, an earlier painting on the support, or an intervention whose purpose is not yet known.

Imaging expands observability while preserving the need for inference. It gives us a new artifact to analyze and new ways to test explanations. It can also make uncertainty look deceptively concrete because a reconstructed image resembles direct vision. A useful report distinguishes the measured response, the processed image, and the historical interpretation. The reader can then inspect which part of the argument depends on the instrument and which depends on contextual knowledge.

10. Sampling spectroscopy and the location of evidence

Material analysis can identify properties that an image alone cannot resolve. Microscopic examination of a cross-section can expose a local sequence of layers. Spectroscopic and chromatographic methods can help characterize pigments, binding media, or other components. A National Gallery study of Titian paintings, for example, describes the coordinated use of radiography, infrared examination, paint samples, and chemical analysis. The methods answer related but different questions. [24]

The word local is essential. A sample comes from a position selected under practical and ethical constraints. Its results do not automatically describe the entire work. A fragment from an edge may include a later repair or a material used only in that region. Recording the sampling location and the relationship to visible features is therefore part of recording the result, not an optional addition.

An elemental result and a compound identification also have different scopes. Detecting an element can narrow a set of possible materials without uniquely identifying a pigment or explaining its role. A layer sequence can constrain relative order while leaving absolute dates uncertain. The investigator must connect the analytical result with preparation, use, aging, and intervention histories before drawing a larger conclusion.

Modern paints have created further questions because different formulations can respond differently to treatment. The Modern Paints Uncovered symposium, held at Tate Modern in 2006, brought together research on contemporary painted surfaces. Such work makes the history of diagnosis extend into the industrial manufacture of artists' materials. A familiar color name does not guarantee the same binder, additives, or behavior across products and periods. [25]

Cleaning research also examines what a treatment leaves behind. Getty's study *Solvent Gels for the Cleaning of Works of Art* addresses the residue question. This shifts attention from immediate visual success to consequences that may be less visible. The treatment is an intervention with its own materials and processes, and those processes can create future diagnostic problems. [26]

A hypothetical test that removes a discolored coating without an obvious color change can therefore be only one part of an assessment. It may leave questions about surface alteration, residues, or longer-term response. The result should be reported at the scale actually tested. Material investigation becomes more useful when it narrows a claim precisely than when it converts a small sample into an unsupported account of the whole object.

PART III

Conservation change and intervention

11. Paintings as records of making and aging

A painting presents the accumulated result of making, aging, handling, and intervention. These processes can affect the same passage. A preparatory change may become easier to see as materials age, while an old restoration may become more conspicuous for different reasons. Technical examination has to reconstruct these relationships before an observed difference can be assigned to the artist or to a later event.

The Mauritshuis examined Vermeer's *Girl with a Pearl Earring* in the 2018 *Girl in the Spotlight* project. Findings announced in 2020 included evidence of eyelashes and a green curtain behind the figure. The distinction between what the unaided eye sees now and what technical examination detects matters here. The project expanded knowledge of the painting without identifying the sitter or recovering every detail of its earlier appearance. [27, 28]

The Rijksmuseum launched Operation Night Watch in 2019 to investigate Rembrandt's painting and inform treatment. Its public research setting also made parts of the examination process visible to museum visitors. The project illustrates the coordination of several records around one object: the condition of the painting, its material construction, and its documented history have to be examined together. Public visibility and scientific interpretability nevertheless remain different achievements. [29]

These projects expose a common ambiguity in the word original. It can mean the artist's completed state, a particular earlier material arrangement, or an appearance reconstructed under assumed lighting. The available evidence may support different aspects with different confidence. A chemical identification can be secure even when a proposed reconstruction of color remains uncertain. A documented removal can establish that the object changed without preserving a full visual record of the lost state.

For a hypothetical landscape whose sky now appears unusually flat, we might compare earlier photographs, inspect the surface, and examine selected regions with complementary methods. If the photographs were made with different lighting and processing, their difference cannot be assigned directly to aging. If examination identifies later overpaint, that finding changes the investigation but does not automatically authorize its removal. The earlier state may itself be incomplete or unstable.

The practical value of a historical examination is therefore a more discriminating account of change. It can distinguish what belongs to construction, what belongs to deterioration, and what remains ambiguous. The result need not be a complete return to an imagined first appearance. Sometimes the most useful outcome is a record that makes future treatment more cautious and future interpretation more precise.

12. Sculpture architecture and structural relationships

Sculpture and architecture require attention to the relationships that keep a form physically present. A surface may appear coherent while joints, supports, or internal components have changed. Conversely, visible seams can belong to the original method of making. The diagnostic question concerns both the appearance of the work and the structure through which that appearance is sustained.

Getty's Guidelines for the Technical Examination of Bronze Sculpture organize the study of fabrication and later histories through shared terminology and methods. Their introduction distinguishes traces of production from traces of use, repair, display, and examination. It also emphasizes the participation of makers, historians, conservators, and scientists. A bronze object can retain evidence of several people's operations rather than a single authorial gesture. [30]

This distinction affects how a feature is interpreted. A patch may be associated with manufacture or with later repair. A surface deposit may have a history of deliberate application, environmental change, or use. An apparent match between two casts can raise questions about models, molds, and subsequent reproduction. Dating one material or recognizing one feature does not independently settle all these relationships.

Panel paintings occupy a related structural domain. The symposium documented in *The Structural Conservation of Panel Paintings* brought attention to supports and their treatment. A painted image and its wooden support are distinguishable for analysis but interact materially. An intervention intended to control one aspect of the support can affect the paint layers attached to it. Examining the visible image alone therefore leaves part of the work's condition outside view. [31]

For buildings, records of alterations and repairs can be as important as current measurements. The Venice Charter's attention to monuments and sites places physical work within a history that includes later contributions. Consider a hypothetical crack beside a replaced architectural element. Its position is a reason to examine the relationship, not proof that the replacement caused it. Earlier photographs, repair records, and observation of change are needed to distinguish an old stable feature from an active process. [17]

Structural diagnosis also changes the relevant time scale. An object can remain upright during a short inspection while continuing to deteriorate slowly. A performance structure can behave differently under load than when empty. The observed condition must be related to the conditions under which it was observed. This is a recurring reason to preserve measurements together with their location, date, and operational context.

13. Paper textiles and photographic objects

Works on paper and textiles remind us that a support can be part of the artistic surface rather than a neutral carrier. Fibers, folds, stitches, mounts, and backing materials can affect both appearance and

survival. Getty's Historical Perspectives in the Conservation of Works of Art on Paper assembles texts documenting changing approaches to their care. The history includes changing judgments about what should be removed, retained, or made less visible. [32]

East Asian painting conservation gives mounting a particularly clear place in this account. The Metropolitan Museum of Art describes responsibilities that include the treatment, mounting, and preservation of Chinese, Japanese, Korean, and Himalayan paintings. Examining such a work requires attention to its physical format and to how it is handled and displayed. Replacing a mount is a substantial event in the object's history, even where its purpose is continued preservation. [33]

Textiles introduce another set of relationships among material, use, and display. The Canadian Conservation Institute identifies environmental vulnerabilities in its guidance on textiles. A costume can also preserve evidence of alteration, wear, and performance. Flattening its history into a single ideal appearance could erase information about how it was fitted or used. The significance of a repair depends on the question being asked of the object. [34]

Photographs complicate the boundary between an image and an object. A negative, a particular print, and a later digital reproduction may share an image while having different material histories. Library of Congress guidance distinguishes the preservation needs of photographic prints and film materials. Identifying the process and support is therefore part of establishing which forms of deterioration and care are relevant. [35]

Suppose a hypothetical exhibition uses a digital image to represent a faded photograph. A color adjustment can make the reproduction easier to read without changing the physical print. That adjustment creates a new representation. If it is presented as a faithful record of current condition, it becomes misleading. If it is identified as an interpretive reconstruction, its usefulness can be assessed against the evidence used to make it.

Across these media, diagnosis depends on preserving the relation between surface, support, and history of use. A stain may be a treatment problem, evidence of storage, or a mark whose significance requires further study. The category cannot be assigned from appearance alone. Good documentation records what is present before deciding which part of it should be reduced or removed.

14. Preventive conservation and environmental records

Preventive conservation shifts attention from a damaged object to the conditions under which collections change. Instead of waiting for a visible failure, practitioners examine exposure, handling, storage, and other sources of risk. The historical literature assembled by Getty shows that preventive concerns have a long history, even though their modern organization and instrumentation developed in particular institutions. The approach complements treatment of individual objects. [36]

The Canadian Conservation Institute identifies ten agents of deterioration: physical forces; thieves and vandals; fire; water; pests; pollutants; light, ultraviolet and infrared; incorrect temperature; incorrect

relative humidity; and dissociation. The category of dissociation directs attention to the loss of connections between an object and its identifying information. An object can remain physically present while becoming much less useful because its documentation has been separated from it. [37]

Environmental records add a temporal dimension. A current reading describes the sensor's present surroundings. A sequence of readings can reveal cycles or excursions that a single inspection misses. The interpretive step is to connect the record with the object's actual exposure. Sensor placement, calibration, collection intervals, and changes in display arrangements can all affect that connection.

Light illustrates why observation and preservation can conflict. CCI's account distinguishes visible light from ultraviolet and infrared radiation and explains their different roles in deterioration. Making a work available for viewing also exposes it to an environment. A decision about display duration or illumination therefore involves the materials, the purpose of access, and the acceptable risk of change. One universal number cannot express all these relationships. [38]

Consider a hypothetical fading problem in a display case. A room-level monitor shows no unusual event. This does not eliminate exposure as a possible explanation because the monitor may not represent conditions at the object. A change in case lighting, a reflection, or the object's previous exposure may remain relevant. The diagnostic record should follow the object through its locations rather than begin only when the damage was noticed.

Preventive work also needs evidence that proposed remedies affect the relevant condition. A new case can improve one environmental property while changing another. A shorter display can reduce exposure while restricting access. The point of monitoring is to support a reasoned decision and to make its consequences inspectable. A large archive of readings without object locations or intervention dates may be less useful than a smaller, well-contextualized record.

15. Treatment records cultural authority and visible repair

A conservation treatment changes the evidence available to the next investigator. The American Institute for Conservation's guidelines call for records of examination, plans, procedures, materials, and alterations. They also treat the preservation of documentation as part of professional responsibility. These requirements make the intervention itself available for later analysis, including analysis of consequences that were not apparent at the time. [39]

The Nara Document on Authenticity of 1994 emphasizes cultural context in judgments about heritage. For our purposes, it cautions against assuming that every tradition locates authenticity in the same material properties. A decision that preserves old fabric may have a different meaning from one that sustains an authorized practice of renewal. The specific community and object must supply the context for the comparison. [40]

Kintsugi provides a material example of repair made visible. Smithsonian accounts describe the use of lacquer and powdered gold in the repair of ceramics. The repaired junction can participate in the

object's appearance rather than being concealed. This does not establish that every visible repair is desirable or that kintsugi supplies a universal conservation method. It shows that restoration to an uninterrupted surface is only one possible aim. [41]

Authority also concerns access to knowledge. Local Contexts' Traditional Knowledge Labels communicate community-specific protocols and responsibilities for using cultural materials. The availability of a digital record does not by itself determine who should reuse it or how. In a diagnostic investigation, these conditions affect what can be recorded, circulated, and interpreted publicly. They should be attached to the evidence rather than discovered only after publication. [42]

The 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage places safeguarding in relation to living practices and their bearers. Its relevance here is the distinction between preserving a record and sustaining the conditions of continuation. A recording can assist transmission, but it cannot independently decide what a community should teach, alter, or keep restricted. [43]

The resulting diagnostic question is more precise than whether an intervention is technically possible. We need to know its purpose, its authority, the evidence supporting it, and the changes it introduces. Some changes can be reduced or reversed later; others cannot. Documentation does not cancel an irreversible loss, but it prevents the treatment from becoming an unexplained gap in the object's history.

PART IV

Music notation rehearsal and sound

16. Musical manuscripts and the reconstruction of decisions

A musical work can survive through sketches, scores, instrumental parts, editions, and performances. These artifacts preserve different stages and uses. A sketch may explore alternatives. A performing part may include practical annotations. A printed score may incorporate corrections made at another time. Their disagreement is therefore a starting point for investigation rather than automatic evidence that one witness is defective.

The Beethoven-Haus digital archive organizes surviving sketches and provides access to sketchbook materials. Such organization helps scholars examine relationships among pages and compositional activity. A manuscript's physical arrangement and the chronology of the ideas it contains need not coincide straightforwardly. Loose leaves, later binding, and reuse make the order of a source a question to investigate. [44]

Bach digital provides a complementary example of source-based musical research through records of works and musical witnesses. A work entry, a manuscript, and a digital image have distinct identities. The catalog connects them so that a claim about a reading can be traced to a particular source. The quality of the connection matters when several copies transmit related but nonidentical versions. [45]

Consider a hypothetical discrepancy between a full score and an instrumental part. The part may preserve a correction made during rehearsal, a copyist's error, or a change intended for one occasion. Counting how many later editions repeat either reading will not establish its origin if those editions depend on one source. We need the transmission relationship as well as the visible note.

Editorial apparatus makes this relationship inspectable. An edition can distinguish the chosen reading from alternatives and explain the evidence for intervention. A performer may reasonably choose an edition optimized for use, while a researcher needs access to the decisions behind it. The two purposes can coexist if the simplified presentation does not erase its dependence on a more complex source history.

The diagnostic operation is the separation of observed difference from proposed correction. A wrong pitch introduced by copying is one problem. An authorized revision is another. An unresolved difference among sources is a third. Preserving these categories allows future evidence to change an editorial judgment without pretending that the earlier edition was merely careless. The history of musical editing becomes a history of increasingly inspectable decisions, alongside continuing uncertainty about particular works.

17. Rehearsal tuning and the condition of instruments

Rehearsal provides a setting in which a performance can be repeated selectively and compared with an intended result. Musicians can isolate a passage, alter a condition, and listen again. The relevant evidence includes what performers hear and feel, the score or other shared guide, and the interactions among players. A recording adds another viewpoint, but it is not identical to the sound and balance perceived in the room.

An instrument is also a material object with a history. The Metropolitan Museum of Art describes the need to balance conservation with interpretation, teaching, and performance in its musical instrument collection. Playing an instrument can reveal properties that silent display leaves inaccessible, while use may place demands on historical materials. Preserving an instrument and preserving opportunities to hear it can require different decisions. [46]

Tuning illustrates the importance of an appropriate reference. A measured pitch can be compared with a target, but the target comes from a performance practice and its context. An ensemble's internal relationships may matter more than conformity with an external reference chosen for another purpose. A diagnostic description should identify the intended tuning arrangement before labeling a difference as a fault.

In a hypothetical rehearsal, a sustained sound appears to drift. Possible explanations include the instrument, the player, temperature change, interaction with another part, or a misleading recording. Repeating the passage with one condition altered can help distinguish them. However, the conditions of the repetition must be preserved. Moving the microphone and changing the instrument at the same time would make the result difficult to interpret.

The human component is not a defective module to be replaced in an explanatory diagram. Breath, attention, familiarity, and communication can affect the result, but they belong to an embodied collaborative activity. A useful correction may be a clearer cue or a changed rehearsal arrangement. More measurement is helpful only when it addresses the relationship that produced the discrepancy.

Historical performance adds another layer. An instrument's present state may reflect later alterations, and a surviving score may assume practices it does not spell out. A modern reconstruction can test a plausible relationship among materials and performance choices. It remains a reconstruction with declared assumptions. The diagnostic value lies in making those assumptions examinable and in distinguishing what the experiment demonstrates from what it merely makes imaginable.

18. Recorded sound and the diagnosis of a transfer

Sound recording created durable evidence of particular sonic events while introducing a chain of technical transformations. The Library of Congress account of Berliner's gramophone places disc recording in relation to Edison's 1877 phonograph and later recording developments. Recorded sound

could be replayed and compared, but the replay depended on the medium and the apparatus used to read it. The historical performance and the reproduced signal were never the same object. [47]

A recording can contain features introduced during capture, storage, playback, or digitization. An audible click may belong to a damaged carrier. A changed pitch may result from playback speed. A balance that seems unusual may reflect microphone placement or recording limitations. Identifying where the feature entered the chain is necessary before deciding whether it should be removed.

IASA's Guidelines on the Production and Preservation of Digital Audio Objects, in their second edition of 2009, organize the preservation of sound through documented technical processes. A preservation transfer and a processed listening copy can serve different purposes. Keeping their identities and processing histories separate allows later users to revisit a treatment without mistaking its result for the untouched source. [48]

Optical recovery offers an instructive change of viewpoint. The Library of Congress's account of the IRENE project describes a prototype optical scanner installed there in 2006. Surface measurements can support sound recovery without conventional stylus playback in the same way. The recovered audio is still produced through interpretation of measured geometry, so the acquisition and reconstruction procedures remain part of its provenance. [49]

Suppose a hypothetical digitized solo sounds unusually fast. The artistic interpretation is one possibility, but we should also inspect transfer speed, file metadata, and the history of subsequent processing. A second transfer from the same carrier can help if its conditions are independently established. Agreement between two copies derived from one erroneous transfer adds no independent confirmation.

Recorded sound makes repeated listening possible, yet repetition alone does not correct a misunderstanding of the source. The investigation needs a record of the transformations between carrier and listening experience. Its useful endpoint may be a corrected transfer, an annotated uncertainty about speed, or several versions serving distinct purposes. Preserving this distinction protects both the audible work and the history of its reproduction.

19. Electronic music and executable processes

Electronic and computer music make technical systems part of the production of sound. Max Mathews, working at Bell Laboratories, demonstrated his MUSIC synthesis program in 1957, as documented by the Computer History Museum. A musical result could now depend on instructions executed by a digital computer. Diagnosis could concern both the compositional choices and the program or environment through which those choices became sound. [50]

Collaborations between artists and engineers broadened these relationships. Experiments in Art and Technology was founded in 1966, and the history of its performances and projects connects artistic activity with circuits, communication systems, and technical labor. Getty's account preserves that

collaborative setting. It reminds us that a technical realization often depends on people whose decisions are not fully represented in a finished recording. [51]

David Tudor's *Rainforest IV*, dating from 1973, provides a documented example of an electroacoustic environment developed through resonant objects and electronic activity. Its identity cannot be captured adequately by a list of sound files. The arrangement through which sounds are generated and experienced matters. A record of one realization provides evidence of that realization while leaving further questions about allowable variation. [52]

In a hypothetical electronic score, a change to a control mapping makes a gesture produce a different sound. The software may execute successfully while the mapping is wrong for the intended realization. Conversely, a deliberate change to the mapping may create a new version. An absence of error messages is therefore insufficient evidence of artistic continuity. The relevant comparison includes control behavior and the resulting experience.

Reproduction also depends on technical context. A patch or program may call upon libraries, devices, timing assumptions, or external data. Retaining the code can leave these dependencies unspecified. A recorded output preserves one result, but it cannot reveal every possible response to input. The choice of preservation evidence should follow whether the work is fixed, generative, interactive, or some combination.

Here the connection with software diagnostics becomes direct. Logs, version records, configuration snapshots, and controlled tests can help explain failures of a musical system. They are most useful when interpreted with knowledge of the work. Fixing a technical anomaly that the artist deliberately incorporated could make the system more conventional while making the realization less faithful.

20. Silence noise and the limits of correction

The history of music also includes works that change what a listener should attend to. John Cage's *4'33"* was first performed by David Tudor in 1952; the Museum of Modern Art's proportional-notation score is dated 1952/1953. The work makes it impossible to diagnose the absence of conventional instrumental sound without first identifying the score and the performance situation. An apparent lack of output may be central to the activity. [53]

This example does not imply that every silence is intentional. A failed loudspeaker and a specified silent interval can sound similar from one listening position. Their explanations differ. The investigator needs evidence of the intended sequence and of the system that was supposed to produce it. The same observation can be an expected state in one work and a failure in another.

Noise presents a related difficulty in restoration. Removing an audible feature may improve intelligibility while altering timbre or eliminating a historically significant sound. IASA's preservation framework helps distinguish the documented transfer from later processing for access. Keeping an earlier representation

available makes it possible to reassess whether a supposed improvement removed something relevant. [48]

We can make the issue concrete with a hypothetical archival recording that includes a low mechanical sound. It might come from the recording apparatus, the venue, or equipment intentionally used in the performance. A spectral display can help characterize the sound. It cannot by itself identify its artistic status. Production records and comparison with other performances may be needed before processing is justified.

Interpretation also involves alternatives that cannot be ranked as simple corrections. Two performances can differ in phrasing while remaining defensible readings. A quantitative comparison may make their timing differences precise without selecting a winner. The measurement answers a descriptive question. Converting it into a verdict requires an additional account of musical purpose.

Arts therefore expose a limit of automatic correction. A tool can detect deviations from a chosen reference, but the reference may be incomplete, inappropriate, or deliberately challenged by the work. Diagnostic competence includes recognizing this situation. Sometimes the correct technical action is to restore a missing signal. Sometimes the useful action is to preserve the signal and correct the description of what the listener is hearing.

PART V

Performance and moving images

21. Theater prompt books and coordinated activity

A theatrical performance coordinates activities that no single participant observes completely. Speech, movement, scenery, lighting, sound, and audience response unfold through overlapping sequences. A missed transition may be noticed on stage before its origin is understood. Diagnosing it requires evidence about the relationships among those sequences, including the instructions through which participants coordinate their work.

Prompt books preserve part of this arrangement. Beverley Hart's study of the V&A collection examines their value as records of theatrical activity. An annotated script can contain cuts, cues, and information about staging that a published play does not provide. It is therefore evidence of a particular production process rather than simply a more detailed copy of the literary text. [54]

The difference between instruction and occurrence remains important. A cue written beside a line records an intended relationship. It does not prove that the cue was executed at that point in every performance. An added annotation may document a change after rehearsal, while an uncanceled instruction may no longer have been used. The prompt book's own history needs to be reconstructed before it becomes a reliable account of the stage.

Consider a hypothetical scene in which a door opens before the lighting change. The symptom could arise from an early cue, a delayed response, an altered line reading, or a technical fault. A recording shows the visible sequence. A cue log may record the operator's action. The annotated script identifies the intended relationship. Comparing these artifacts allows us to locate a discrepancy more precisely than blaming the first conspicuous component.

Clock time can help only when the records refer to comparable time bases. A camera, sound recorder, and control system may start at different moments. Even synchronized records preserve different events: a button press, a command being sent, and an effect becoming visible are not identical. The sequence needs these distinctions if it is to support an explanation of delay.

Theater thus provides a useful historical comparison for concurrent activity. A production maintains continuity through shared knowledge, rehearsal, and records that coordinate specialized roles. Its diagnostic artifacts preserve only selected aspects. The reconstruction should retain who could see or hear what at each point, because an apparently obvious failure to a spectator may have been unavailable to the person expected to correct it.

22. Dance notation and the preservation of movement

Dance raises a particular problem of evidence: the work occurs through moving bodies, while most records isolate a viewpoint or translate movement into another form. A photograph selects an instant. A video retains temporal sequence from a camera position. A notation identifies movement through a symbolic system. Each can help another person study the work, but each requires interpretive competence.

Labanotation became the focus of the Dance Notation Bureau, founded in 1940. Mei-Chen Lu's account describes the Bureau's work in standardization, recording, teaching, and staging. The history makes preservation an organized analytical practice. A score can be used to communicate movement to dancers who did not participate in its earlier realization, provided they can read and interpret its conventions. [55]

Benesh Movement Notation offers another approach. The Royal Academy of Dance dates its first publication to 1956 and identifies Rudolf and Joan Benesh as its devisers. The notation supports the recording and restaging of dance. Its existence alongside other systems shows that movement can be represented through different analytical choices rather than one inevitable transcription. [56]

The Merce Cunningham Trust's Dance Capsules provide a later model of assembling resources around choreographic works. Such a collection can connect evidence that would otherwise remain dispersed. Its diagnostic usefulness depends on identifying the date, purpose, and relationship of the materials. Two records in one capsule may document different realizations rather than duplicate observations of one event. [57]

In a hypothetical reconstruction, a dancer arrives at a position later than a video seems to indicate. The video may show another version, a different tempo, or a perspective that obscures the start of the movement. A notation may record the intended duration but leave a quality of transition to interpretation. The investigation should compare these possibilities before treating the performer as the source of the discrepancy.

Embodied knowledge remains part of the reconstruction. A former performer may explain a transition that is difficult to infer from records, while records may reveal a difference in remembered detail. Neither source needs to be accepted without examination. Their disagreement can help identify which properties are stable across realizations and which belong to a particular event. Preserving dance therefore includes preserving the competence to ask and answer such questions.

23. Film materials versions and archival reconstruction

Film preservation joins the care of a physical carrier with the reconstruction of an ordered moving image. A surviving print can differ from another in length, titles, color, or editing. It can also carry

damage acquired during projection and storage. Before restoring an image, an archive needs to establish which version the source represents and how it relates to other materials.

The National Film Preservation Foundation's 2004 Film Preservation Guide describes basic work for archives, libraries, and museums. Its emphasis on identification, inspection, storage, and copying makes clear that preservation begins before digital image processing. Film materials have different properties and deterioration histories. A source that is difficult to reproduce can still contain evidence absent from a cleaner-looking copy. [58]

The British Film Institute's account of beginning a Hitchcock restoration describes the search for surviving elements and the investigation of presentation conditions. Silent-film speed is among the questions that require historical judgment. A digital file can reproduce a sequence consistently at a chosen rate while that rate remains inappropriate for the material. Technical regularity alone does not establish historical fidelity. [59]

Metropolis demonstrates the effect of newly available evidence. The Murnau Foundation's Metropolis 27/10 project relates the reconstruction to a copy found in Buenos Aires in 2008. The discovery allowed an earlier reconstruction to be reconsidered and informed the restoration presented in 2010. The case shows why the best available version at one time can remain provisional without being arbitrary. [60]

For a hypothetical missing scene, a still photograph, censorship description, script, and later print supply different constraints. A still can show a setup without preserving movement. A script may describe an intention that was changed during production. A surviving print can preserve the scene while introducing another language or edit. Combining them requires an explicit account of which source supports each reconstructed element.

An archival reconstruction is consequently a documented argument embodied in a new presentation. It should preserve the distinction between recovered material and supplied transitions or explanatory titles. Keeping the earlier source elements and the restoration record allows future evidence to improve the reconstruction. A seamless viewing experience can be valuable, but it should not become the only surviving evidence of how the film was assembled.

24. Digital restoration and the boundaries of a correction

Digital film restoration increases the precision with which individual images can be altered. Eye Filmmuseum contrasts digital work with photochemical methods, including wet-gate techniques and the Desmet method for reproducing tinting effects. The history is a change in available operations rather than a replacement of judgment by an algorithm. Selecting what counts as damage remains an interpretive task. [61]

FIAF's Digital Statement Part III examines image restoration, manipulation, treatment, and ethics. It distinguishes the remediation of deterioration from changes that erase a film's character. The same software operation can serve either purpose depending on where and why it is applied. Removing a

scratch and removing a small intended object may involve similar pixel transformations while having very different historical meanings. [62]

Automated detection works through assumptions about what ordinarily belongs in an image or sequence. Grain, flicker, rapid movement, and deliberate optical effects can challenge those assumptions. A processed image may appear cleaner while carrying less evidence of the source. Evaluation therefore needs a comparison with the unprocessed capture and knowledge of the film's production and presentation.

Sound and image must also remain related. A correction to frame timing can alter synchronization, and an audio process can change the perceived rhythm of a scene. The work should be examined as a temporal sequence as well as a collection of frames. Local visual success is insufficient if an intervention creates a new discrepancy across channels.

The FIAF Code of Ethics has its own version history: the federation provides the earlier 1998–2025 text alongside the version approved in May 2025. This is a useful reminder that professional guidance is itself a dated artifact. A report should identify which guidance informed a project instead of citing a changing webpage as though its content had always been the same. [63]

In a hypothetical restoration of a damaged frame, a generated replacement can make motion look continuous. Its plausibility does not establish that it reproduces the lost image. It may be suitable for a clearly described derivative presentation, while an archival account needs to identify the addition. The distinction protects the historical question from being answered by the software's ability to produce an attractive completion.

25. Performance documentation and future enactments

Performance art extends preservation beyond retaining objects used in an event. A work may depend on instructions, participation, duration, location, and relationships among people. Documentation can preserve evidence of these conditions, but a record of one event and a basis for another enactment are different artifacts. A video may be valuable for both purposes while being sufficient for neither on its own.

Tate's Documentation and Conservation of Performance project examines questions of authenticity, activation, and conservation. Its performance specification provides a way to record requirements for future realizations. Such work gives institutional form to a problem that cannot be solved by placing props in storage. A collection needs an account of what must happen, which differences are allowed, and how those judgments were established. [64, 65]

The documentation process can reveal that the apparent object of preservation was too narrow. A particular chair may be replaceable, while its placement in relation to participants is essential. A written phrase may be fixed, while timing remains responsive to the situation. These are hypothetical examples,

but they show why an inventory of objects cannot independently define the identity of an event-based work.

Interviews add evidence without providing an unlimited solution. An artist may revise an account, describe an ideal rather than a past realization, or leave a question open. Earlier collaborators can preserve knowledge that was never written down. Recording the date and context of a statement allows future users to distinguish a recollection, a new authorization, and an interpretation offered for a particular exhibition.

Documentation can also affect future practice. Once a video becomes the familiar reference, later performers may imitate features that were incidental to the recorded occasion. A conservation record should therefore indicate which properties are treated as constitutive and which are examples. Otherwise, the survival of one recording can turn accidental details into apparent rules.

Diagnostic work in this setting concerns the relationship between a realization and an articulated understanding of the work. A discrepancy can lead to a technical correction, a revised specification, or recognition of acceptable variation. The result should remain attached to the relevant enactment. A later performance can then be compared with an inspectable history of decisions rather than with an undocumented memory of how the work ought to be.

PART VI

Variable media software and machine analysis

26. The variable media approach

Twentieth-century artistic practices made the identity of a work increasingly difficult to attach to one enduring object. A work could consist of instructions, replaceable components, a repeatable event, or an arrangement whose original equipment would become obsolete. Conservation had to investigate what could change while the work continued to be presented meaningfully.

Permanence Through Change: The Variable Media Approach, published in 2003 by the Guggenheim Museum and the Daniel Langlois Foundation, organized discussion around these problems. The approach considers behavior and preservation strategies such as storage, migration, emulation, and reinterpretation. Its importance for this history is the explicit description of choices that become necessary when retaining original material alone cannot sustain access to a work. [66]

Pip Laurenson's 2006 discussion of authenticity, change, and loss in time-based media installations further examined how conservation can understand a work across realizations. A replacement component cannot be assessed solely by comparing its model number with an old inventory. The relationship between the component and the work's defining properties matters. Establishing that relationship is part of the investigation. [67]

Duchamp's *Fountain* supplies an earlier example of the difficulty of equating a work with one surviving material object. The Philadelphia Museum of Art identifies its 1950 example as a replica of the 1917 original. The dates and relationship need to remain explicit. Describing the later object as if it were the original urinal would collapse a history of replicas and authorization into a false material continuity. [68]

For a hypothetical installation using a commercially manufactured lamp, a replacement might preserve illumination while changing shape, timing, or the visible character of the equipment. Different works can assign significance to different properties. A conservation decision therefore needs evidence of what matters in this particular case. General enthusiasm for technological modernization cannot supply that evidence.

Variable media approaches turn replacement into an examinable operation. They ask for records of significant properties, allowable variation, and the basis of authorization. This does not eliminate future disagreement. It gives disagreement a more precise object: a particular proposed change can be evaluated against an articulated account of the work and its previous realizations.

27. Electronic installations and distributed failure

An electronic installation can fail across a chain of interacting components. A sensor detects activity, a controller interprets it, a program selects a response, and displays or loudspeakers present the result. The visitor encounters the whole arrangement. A fault in one component can therefore appear as a failure somewhere else, particularly when the system records only selected transitions.

The history of artist-engineer collaboration, including Experiments in Art and Technology and Tudor's electronic practice, makes this interdependence visible. The artistic result was developed through technical relationships and the skills of participants. Later preservation needs to recover enough of those relationships to distinguish a failed component from a deliberately unstable or responsive behavior. [51, 52]

Matters in Media Art separates documentation of media elements, equipment, and the overall installation. This division is useful because a correct file and a functioning device do not guarantee a correct installation. The physical arrangement, signal routing, and conditions of presentation can change what a visitor perceives. The documented whole supplies the context in which individual components are assessed. [69]

Consider a hypothetical sound installation that remains silent when approached. The sensor may not detect the visitor, the controller may apply the wrong threshold, or the audio path may be muted. A status indicator that confirms the program is running eliminates none of these possibilities by itself. Observations should be placed at relevant boundaries so that the disappearance of the expected activity can be localized.

Testing also has to preserve the artistic behavior being examined. Temporarily forcing a sensor value can help verify the downstream response. Leaving that forced value in place would change the interaction. Likewise, replacing a variable delay with a fixed one may simplify testing while removing a property of the work. Diagnostic modifications need an identity and a clear relationship to the exhibited configuration.

The installation record should therefore contain more than a successful opening-day photograph. It should connect the configuration, the installed arrangement, the test results, and the people able to interpret them. A failure after transport or reinstallation can then be compared with a known earlier condition. Without those connections, the collection may preserve every named component while losing the means to explain how the work operated.

28. Web art games and changing dependencies

Software-based art depends on an execution environment that may change independently of the work's files. Browsers, operating systems, hardware, fonts, network services, and input devices can affect a

realization. The preservation problem is therefore more extensive than retaining a copy of source code. A digital object can remain readable as bytes while becoming unavailable as an experience.

Douglas Davis's *The World's First Collaborative Sentence* began in 1994. The Whitney Museum's restoration account, presented in 2013, distinguishes a live version from a historic version. The live version supports continued contribution, while the historic version retains a different relationship to the earlier code and accumulated material. The project openly describes changes and unresolved issues, including character encoding. This preserves alternatives rather than hiding them behind one undifferentiated claim of restoration. [70]

The Museum of Modern Art's 2012 acquisition of an initial group of video games likewise placed behavior and interaction within a collecting institution. Its later account discusses the acquisition as part of interactive design. A game's visual appearance is one property among others; input response, timing, and the relationships through which a player acts also matter to its presentation. [71]

For a hypothetical web artwork, a missing external resource can make the page appear blank even though the local program is intact. A later browser may reject an old component or interpret layout differently. Replacing the missing resource with a contemporary service can restore activity while introducing different content or behavior. The repair should state which continuity it preserves and which dependency it changes.

Networked works also retain traces of other participants. Capturing a web session preserves selected requests and responses, not every possible future interaction with a remote service. An archive can provide valuable access while remaining incomplete with respect to the live system. That limitation should be described at the level of functionality rather than hidden in a general statement that the site was saved.

Literal debugging becomes a conservation operation when it is directed toward restoring a documented behavior. The investigator needs both software evidence and an account of the work. A technically successful rewrite can still be a poor conservation outcome if it changes the interaction that gave the work its identity. Preserving the earlier files and documenting the repair allows later users to inspect that judgment.

29. Migration emulation and preservation metadata

Migration and emulation preserve different relationships to a digital work. Migration changes a representation or implementation so that it can function in another environment. Emulation supplies an environment intended to reproduce relevant behavior of an earlier system. The variable media literature treats these as distinct strategies because they preserve and alter different properties. Neither strategy guarantees fidelity without evaluation. [66]

An emulated work may run while differing in timing, display, input, or sound. A migrated work may reproduce a familiar appearance while changing its internal organization. These differences can be

acceptable, consequential, or unresolved depending on the work. The investigation should identify the properties being compared and the evidence used as a reference rather than rely on the strategy's name as an assurance of authenticity.

PREMIS Data Dictionary version 3.0, released in 2015, organizes preservation metadata around objects, events, agents, and rights. This supplies a way to connect a digital object with the actions performed on it and the circumstances of those actions. Such records help distinguish an acquired file, a normalized copy, an emulated realization, and a later access version. [72]

A checksum answers a restricted question about a sequence of bytes. Matching a recorded checksum can support a claim that those bytes have not changed since the reference was established. It cannot establish that the correct file was acquired, that the reference copy was complete, or that the current software interprets the bytes appropriately. Bit-level integrity and behavioral continuity therefore need separate checks.

In a hypothetical migration of an interactive work, the main screen passes visual comparison but a rarely used branch fails. The problem is incomplete observation of the work's possible behavior. A preservation test should follow representative interactions, including significant alternatives and transitions. Its limits should be recorded so that passing the test does not become a claim that every possible execution has been verified.

Preservation metadata makes these limits durable. It allows a future investigator to ask what was tested, with which configuration, against which reference, and under whose authority. The accumulated record becomes diagnostic memory for the work. Its value is highest when it includes decisions and uncertainties, because those are precisely the details that a later successful-looking run cannot recover from the files alone.

30. Machine analysis generative art and attribution

Computational art has a history that precedes current generative models. Harold Cohen developed AARON over decades; the Whitney's 2024 exhibition traced its development from the late 1960s and early 1970s onward. The program provides a case in which the rules and implementation of an art-making process are themselves part of the artistic history. Its development should not be collapsed into the different methods of later machine learning. [73]

Computational methods have also been proposed for analyzing authorship. In 2004, Siwei Lyu, Daniel Rockmore, and Hany Farid published a digital technique for art authentication using statistical image analysis. The work investigated how computational features could contribute to comparative assessment. Such a method supplies evidence under its study conditions, not an unrestricted certificate of authorship for any image submitted to it. [74]

An attribution model can learn features of reproduction as well as features of an artist's work. Differences in scanning, color processing, cropping, and source collections may correlate with the labels

used for training. A strong result within one dataset can therefore fail on material acquired differently. Evaluation needs independent works and acquisition conditions relevant to the intended use, together with a documented account of uncertainty.

Generative completion introduces another problem. A model can supply a plausible missing face, frame, sound, or passage without recovering the historical content that was lost. Plausibility is evidence of compatibility with a model's learned regularities. It is not independent evidence that the supplied material existed in the work. A generated reconstruction should remain identifiable as a proposal.

Provenance technology answers a related but narrower question. The C2PA version 2.2 explainer distinguishes verification of associated provenance information from a judgment that the content is true. A valid record of an editing operation can help establish a file's processing history. It does not settle artistic attribution or establish that a depicted event occurred. [75]

Finally, an apparent technical error may be deliberately used as artistic material. Rosa Menkman's *The Glitch Moment(um)*, published in 2011, examines glitches and their artistic interpretation. Automatic correction therefore needs the same contextual discipline as earlier restoration. We should first establish what the feature is doing in the work. The capacity to remove an anomaly does not establish that removal is the appropriate action. [76]

PART VII

Comparative diagnosis and diagnostic memory

31. Repairs that change the object of investigation

A repair can succeed according to one criterion while changing something else that matters. A cleaned image can become more legible while losing a historically significant surface. A faster digital system can respond reliably while changing an interaction's rhythm. The history of arts repeatedly requires us to ask whether the chosen test evaluates the property that the intervention was intended to preserve.

Harvard Art Museums' presentation of Rothko's Harvard Murals provides a documented example of an intervention directed at appearance through projected light. The project used a camera-projector approach to compensate for altered color without applying the corresponding color to the painted surface. Its logic makes the relationship between the material painting and the presented appearance explicit. The projection is an intervention in viewing conditions, not a chemical reversal of the painting's history. [77]

The example suggests a useful distinction among material treatment, presentation adjustment, and interpretive reconstruction. They can serve related purposes but produce different artifacts. A digital reconstruction of a damaged design may help visitors understand a hypothesis. A structural treatment may stabilize surviving material. Presenting both under the single word restoration can obscure which claims the evidence supports.

The distinction also applies to corrections of information. Replacing a wrong attribution in a catalog changes an institutional claim, while removing a false signature changes the object. Either may be justified in particular circumstances, but they are not the same remedy. Preserving the reason for a catalog correction is valuable even when no physical intervention occurs.

Consider a hypothetical film in which automated cleanup removes a recurring bright mark. The mark is later recognized as part of a deliberately exposed optical effect. The operation was technically successful: the selected feature disappeared. The diagnostic error occurred earlier, when the feature was classified as damage. A processing log can reveal what happened, while access to the source capture allows the correction to be reconsidered.

Across these cases, the investigation should include the proposed remedy as an object of analysis. We need to ask what it changes, how the effect will be assessed, and what evidence will remain afterward. A successful intervention should leave a clearer account of the work's condition and of the decision made about it. A remedy that erases its own history creates a new problem for the next investigator.

32. Representations and the conditions of observability

Arts are often studied through representations that travel more easily than the works. Photographs, scans, recordings, transcripts, and models make comparison possible across collections and time. Their convenience can conceal the acquisition process. A file displayed on a screen can appear to be the object itself, especially when the conditions of capture are absent from the record.

The Federal Agencies Digital Guidelines Initiative's third-edition technical guidelines of 2023 provide a documented framework for digitizing cultural heritage materials. The guidelines treat image quality through controlled acquisition and evaluation. Their relevance to this history is the recognition that a surrogate should be assessed as an instrument of access with measurable properties, rather than assumed faithful because it is digital. [78]

The appropriate properties depend on the question. A photograph suitable for identifying a composition may not preserve the detail needed to examine a surface mark. A recording useful for following a performance may not support a precise measurement of local sound levels. A successful acquisition for one purpose can be insufficient for another without being carelessly made.

Processing introduces additional boundaries. Color correction, compression, geometric adjustment, and transcription can each improve usability while changing the evidence. A derived image should retain its relationship to the source and to the operations that produced it. When two researchers compare different derivatives without knowing their histories, apparent disagreement about the artwork may be disagreement between processing choices.

Missing evidence requires equally careful treatment. An unrecorded cue may have occurred outside the camera's view. A pigment may be undetected because the method was unsuitable or the signal was below its useful sensitivity. A search may miss an object because its catalog terminology differs from the query. Absence becomes diagnostic only in relation to a specified opportunity for observation.

We can therefore think of observability as a relationship among a question, an acquisition arrangement, and an interpretation. It is not a property bestowed on a collection by accumulating files. The records must make the relevant distinctions possible. Their limits should travel with them, so that another investigator can identify which conclusions are supported and which would require a different view of the work.

33. Connections to pattern oriented software diagnostics

Our pattern-oriented software diagnostics begins with artifacts and recurring relationships that help organize their analysis. Theoretical Software Diagnostics examines the conceptual foundations of this activity. The fifth edition of our trace analysis reference extends its stated scope to traces, logs, text, narrative, and data. Arts offer another field in which these analytical relationships can be considered, provided we specify where the comparison holds. [79, 80]

Message Context directs attention to related evidence around a selected observation. For an artwork, the relevant context might include a neighboring layer, a preparatory study, a rehearsal annotation, or a record of treatment. The analogy concerns the need to interpret a feature through relationships. It does not suggest that the physical neighbors of a mark supply all its cultural meaning.

Adjoint Thread of Activity provides a way to follow selected activity across records that were not originally arranged as one sequence. In software, a selection can follow a component or another attribute across computational threads. In an arts investigation, we might follow one object through inventories, photographs, loans, and interventions. The selection rule must be preserved because it determines which records become visible together. [80]

Inter-Correlation helps compare distinct traces or records. A cue log and a performance recording can constrain the same event from different viewpoints. Their agreement becomes useful only after identifying the event and aligning the relevant times. A similarity in timestamp or label does not establish that two records concern the same realization.

Discontinuity and No Activity direct attention to gaps, but their conditions of use matter. A silent passage can be intended. An absent record can reflect acquisition or cataloging. The diagnostic question is what evidence would normally be generated and whether that process was operating. False Positive Error supplies a related warning: an error message present in both successful and unsuccessful runs may not explain the reported failure. Its relationship to the symptom still needs examination. [80]

These are analytical transfers rather than claims of historical influence on earlier arts practices. The following comparisons identify useful operations and boundaries. They are most direct in electronic and software-based works, where an artistic realization actually produces technical traces. In other arts, the patterns help formulate questions while the materials, sources, and knowledgeable practitioners supply the evidence needed to answer them.

Pattern or concept	Application in an arts investigation	Boundary to retain
Message Context	Read a feature with related passages, layers, cues, or records.	Relevant context may extend far beyond spatial or temporal neighbors.
Adjoint Thread of Activity	Follow one object, component, role, or motif across dispersed records.	The selected attribute and identity rule shape the resulting sequence.
Message Invariant	Compare recurring cue or log forms while inspecting changed parameters.	A stable form does not establish a stable meaning or implementation.
Inter-Correlation	Relate logs, recordings, and observations of an installation or performance.	Match the realization and time basis before interpreting agreement.
Discontinuity	Investigate a gap in an expected sequence of activity.	A gap can arise from intentional timing or incomplete acquisition.
No Activity	Check a missing activity where the recording arrangement should detect it.	Absence is informative only after coverage has been established.
False Positive Error	Compare an error message in successful and failing realizations.	Presence in both weakens a simple causal explanation but does not prove irrelevance.
Activity Overlap	Inspect coinciding cues, processes, or participant actions.	Overlap may be intended; temporal coincidence alone does not establish conflict.

34. A worked investigation of a silent installation

Let us consider a constructed example. An interactive installation responds to a visitor's movement with light and sound. Its approved installation record permits variable delays and deliberate intervals of silence. After transport to another venue, the light responds but the sound is never heard. The installer reports that the program is running and its log contains playback messages. All facts and results in this example are hypothetical.

We first establish the problem's boundary. The complaint concerns persistent silence after reinstallation, not every interval without sound. Earlier documentation identifies the intended loudspeaker arrangement and includes a verified realization. We preserve the current configuration, the application log, and the audio routing state before changing them. The comparison now has an identifiable earlier condition and a record of the failing one.

The first observations narrow the location of the failure. Sensor events and corresponding light responses show that some input and response activity continues. A playback-started message establishes that the application reached its playback operation. It does not establish that sound reached the intended loudspeakers. We therefore inspect the next boundary instead of assuming that the artistic delay or the sensor explains the silence.

In the constructed investigation, the operating system routes the application's audio to a different output from the one connected to the installation. A device identifier retained from the earlier configuration no longer denotes the intended route. A controlled test through the intended path produces sound. The evidence supports a configuration problem in the presentation chain; it does not support an alteration to the artistic timing.

Observation or check	Result in the constructed example	Inference and limit
Installation instructions	Variable delays and some silence are intended.	Persistent silence is the complaint; silence alone is not a defect.
Sensor and light response	Inputs produce the expected visual response.	Some activity continues; this does not validate the audio path.
Application log	Playback operations are recorded.	The program reached the operation; acoustic output is unconfirmed.
Audio routing state	The selected output differs from the connected installation output.	A configuration mismatch is identified.
Controlled path test	The intended route produces sound.	The path can function under the test conditions.
Corrected mapping and restart	The route persists and expected interaction produces sound.	The reported failure is resolved in the tested configuration.
Artistic behavior check	Authorized delays and silent intervals remain.	The repair preserves those documented properties of the realization.

We correct the output mapping and record the change. The verification follows a complete interaction sequence through input, application response, routing, and audible output. It also includes a restart because a temporary selection may not persist. The intended silent intervals remain present, and they are checked against the work's instructions. Eliminating them would conceal a misunderstanding of the work rather than improve the repair.

The final record separates the fault, the remedy, and the remaining limits. It identifies the configuration mismatch and the observations supporting it. It records the corrected route, the tests completed, and the realization used as a reference. It does not claim that every future device or venue has been validated. The additional documentation makes another reinstallation easier to assess because it explains which boundary failed and how the corrected behavior was established.

35. Designing for future diagnosis

The histories examined here suggest that future diagnosis begins during making, acquisition, and presentation. Intermediate states, material choices, installation instructions, and authorized variations can be recorded while their meaning is still accessible. Waiting until a failure occurs often leaves an investigator trying to reconstruct decisions that no remaining artifact fully explains.

For a material work, a useful record can connect images of condition with locations, dates, and the history of examination. For a performance, it can distinguish an instruction from an observed realization. For software-based art, it can relate files to execution environments and significant behaviors. The point is to preserve relationships that later examination cannot easily recover, rather than collect every available measurement indiscriminately.

The history also shows why documentation needs maintenance. Names change, files move, formats become difficult to read, and people leave institutions. A record that once made an object identifiable can become ambiguous after it is separated from its context. Periodic checks should therefore include whether evidence can still be found and interpreted, not merely whether a storage system reports that its files remain present.

Access can be designed with different purposes in mind. A visitor may need a clear presentation, while a researcher needs source records and a practitioner needs operational instructions. These views can share an underlying history without displaying every detail to every audience. The connection among them should remain explicit so that a simplified presentation does not become the only surviving account.

We should also preserve the possibility of correction. An attribution, a restoration choice, or an emulation can be well justified by current evidence and still be revised later. Recording alternatives and reasons allows the revision to proceed without manufacturing certainty about the past. Diagnostic memory includes the history of what was believed and why it was reasonable at the time.

The result is a practical relationship between artistic continuity and inspectable change. We cannot preserve every state or reproduce every experience. We can preserve enough evidence to distinguish the work's transformations from the failures of its supports and representations. Where the distinction remains unresolved, the record should carry that unresolved question forward. A future investigation can then begin with a known limit instead of an unexplained absence.

Conclusion

The history of diagnostics, observability, and debugging in arts concerns the ways practitioners made artistic processes and conditions available for examination. Workshop instructions preserved procedures. Drawings and proofs retained intermediate states. Laboratories and imaging revealed material relationships. Scores, prompt books, notation, and recordings preserved selected aspects of performance. Software-based works made execution environments and dependencies part of the artistic artifact.

The recurring problem is the location of a discrepancy. It can belong to making, aging, transmission, acquisition, processing, presentation, or interpretation. Different locations require different remedies. A correction to a catalog does not repair a support. A restored signal does not establish an attribution. A technically functional installation may still depart from the work's documented behavior.

Arts also make the reference condition a subject of inquiry. Change can be damage, revision, adaptation, or an intended property. The appropriate diagnosis therefore combines observations with knowledge of the work and the authority under which a correction is proposed. It preserves the distinction between what was measured, what was inferred, and what was chosen.

Our connection to pattern-oriented diagnostics follows this discipline. Patterns help us notice relationships, compare artifacts, and formulate investigations. Their value depends on the evidence carried through those operations. The most useful correction leaves both the work and the reasoning about its treatment available to the next reader, listener, performer, or investigator.

Appendix A Selected chronology

The dates below identify selected works, publications, institutions, and examinations discussed in the chapters. They do not establish single origins for practices that developed in several places. A date of inscription on a heritage list is a recognition event, not the beginning of the tradition. Original works and later conservation or publication events are distinguished.

Period or date	Development	Diagnostic significance
Fourth century BCE	Aristotle's Poetics distinguishes kinds of artistic error.	Criticism depends on what a work and its art are attempting. [1]
Twelfth century	The treatise associated with Theophilus records artistic techniques.	Written procedures preserve evidence of craft knowledge. [2]
Around 1400	Cennini's Il libro dell'arte records workshop practice.	Materials and sequences can be examined alongside surviving objects. [3]
1435	Alberti's De Pictura describes linear perspective.	A representational convention supplies explicit relationships for checking. [4]
1603–1623	Early printed versions of Hamlet differ.	Multiple witnesses require declared editorial choices. [11]
Nineteenth century	Morelli develops comparative attribution through details.	Recurring particulars become evidence for a maker or workshop relationship. [12]
1877	Edison's phonograph enters the history of sound recording.	Sound can be replayed through a technical chain. [47]
1877	The SPAB Manifesto opposes destructive restoration.	A proposed improvement can be a loss of historical evidence. [15]
1888	The Berlin museum chemical laboratory is established.	Material investigation gains institutional continuity. [18]
1917 and 1950	Duchamp's Fountain and a later replica have distinct material histories.	The work and a particular object cannot simply be equated. [68]
1928	Harvard's Fogg Art Museum establishes the Department of Technical Studies.	Art study, examination, and comparative materials are joined. [19]
1940	The Dance Notation Bureau is founded.	Notation becomes a sustained system of recording, teaching, and restaging. [55]
1952	Cage's 4'33" is first performed.	An apparent absence of conventional output requires contextual interpretation. [53]
1956	Benesh Movement Notation is first published.	Movement can be recorded for future analysis and enactment. [56]
1957	Mathews demonstrates MUSIC, developed at Bell Laboratories.	Executable instructions enter the production of musical sound. [50]
1963	Brandi's Teoria del restauro is published.	Restoration is examined through historical and aesthetic relationships. [16]
1964–1965	The Venice Charter is formulated and then adopted by ICOMOS.	Conservation of monuments is related to inspectable historical evidence. [17]
1966	Experiments in Art and Technology is founded.	Artist-engineer collaboration makes technical dependencies part of realization. [51]

Period or date	Development	Diagnostic significance
1968	Van Asperen de Boer publishes his infrared reflectography method.	Some underdrawings become more accessible to examination. [22]
Late 1960s onward	Cohen develops the process later named AARON.	An art-making program accumulates its own history of revision. [73]
1973	Tudor's Rainforest IV develops an electroacoustic environment.	Arrangement and behavior matter alongside recorded output. [52]
1977	The National Gallery Technical Bulletin begins publication.	Technical investigations enter a shared published record. [20]
1994	The Nara Document on Authenticity is formulated.	Cultural context is made explicit in judgments of authenticity. [40]
1994 and 2013	Davis's Collaborative Sentence is launched and later presented in restored forms.	Continued participation and historical presentation receive distinct versions. [70]
2003	The Variable Media Approach volume and UNESCO's intangible heritage convention appear.	Different frameworks address continuity beyond one fixed object. [66, 43]
2004	Lyu, Rockmore, and Farid publish statistical art-authentication research.	Computed image features are investigated as comparative evidence. [74]
2006	Laurenson examines authenticity in time-based media; IRENE reaches the Library of Congress.	Work identity and acquisition technology extend the scope of preservation. [67, 49]
2008–2010	Newly found Metropolis material informs a revised restoration.	An earlier reconstruction changes when additional witnesses become available. [60]
2009	IASA-TC 04 second edition is published.	Documented audio acquisition and preservation receive coordinated guidance. [48]
2011	Menkman publishes The Glitch Moment(um).	Technical anomalies are examined as artistic material. [76]
2012	MoMA acquires its initial group of video games.	Interaction and behavior enter an expanded collecting practice. [71]
2014–2015	Harvard presents Rothko's murals with projection-based color compensation.	A viewing intervention is distinguished from material reversal. [77]
2015	PREMIS Data Dictionary version 3.0 is released.	Objects, events, agents, and rights connect digital preservation records. [72]
2018 and 2020	Girl in the Spotlight examination and findings.	Multiple methods revise knowledge of Vermeer's materials and appearance. [27, 28]
2019	Operation Night Watch begins.	Coordinated examination supports the study and treatment of a major painting. [29]
2023	FADGI publishes the third edition of its still-image technical guidelines.	Digital surrogates are evaluated through controlled acquisition. [78]
2025	FIAF approves a revised Code of Ethics.	Professional guidance retains a visible history of revision. [63]

Appendix B Glossary

The definitions describe the usage of this book. Where a term belongs to a specialist practice, its application still depends on the medium and the question being investigated.

Acquisition. The process by which an observation, image, recording, sample, or file is obtained; its conditions affect later interpretation.

Adjoint Thread of Activity. In our pattern language, an activity selected through an attribute across a trace; used comparatively here to follow related records across different sources.

Artifact. A material or digital item available for examination. It can be a work, a part, a record, or a derived representation.

Attribution. A claim connecting a work with a maker, workshop, collaborator, or production history.

Authenticity. A judgment about a work or realization in relation to its history, identity, and cultural context; it is not one universal measurable property.

Bit-level integrity. Continuity of a specified sequence of bytes relative to a recorded reference.

Blind spot. A relevant property or relationship that the available acquisition or evidence does not disclose.

Calibration. Establishing or checking the relationship between an instrument's response and a reference.

Checksum. A computed value used to help detect changes in digital data. Its agreement does not establish artistic or historical authenticity.

Condition report. A dated account of observed state, ideally linked to the object and the circumstances of examination.

Connoisseurship. Informed comparative judgment about works, including style, quality, and attribution.

Conservation. Care and investigation directed toward sustaining significant properties of cultural material or practice, within the relevant professional and cultural context.

Cross-section. A prepared sample exposing material relationships across layers at a particular location.

Debugging. The identification and correction of a specified software defect; used comparatively for other correction practices only with an explicit boundary.

Derivative. A representation made from an earlier source through copying, processing, transcription, migration, or another transformation.

Diagnostic artifact. An artifact preserved or used to support the investigation of a condition or explanation.

Diagnostic memory. Retained evidence of examinations, decisions, interventions, and their consequences.

Diagnostics. Investigation of an observed condition, discrepancy, or failure and its possible explanations.

Digital surrogate. A digital representation of a source object or record, acquired and processed under particular conditions.

Discontinuity. A gap in an expected sequence; its meaning depends on both the activity and its recording arrangement.

Dissociation. Loss of the connections that make an object or record identifiable, locatable, or interpretable.

Emulation. Reproduction of relevant behavior of an earlier technical environment so that retained software or media can be used.

Evidence. An artifact or observation considered in relation to a claim through an argument.

False Positive Error. In trace analysis, an error message that may not explain the reported failure, including one also observed in functioning behavior.

Glitch. An apparent technical disruption or artifact that can be unwanted, investigated, or incorporated deliberately into artistic practice.

Infrared reflectography. Imaging of a painting's infrared response that can reveal some underdrawings or other concealed features under suitable conditions.

Installation specification. A record of relationships, requirements, and permissible variations for realizing an installation.

Inter-Correlation. Comparison of relationships across different traces or records, with their identities and acquisition conditions established.

Interpretation. An account of significance or explanation constructed from evidence and context.

Material history. The sequence of making, use, aging, damage, examination, and intervention affecting an object.

Message Context. Related messages or observations needed to interpret a selected item within an investigation.

Message Invariant. The recurring portion of a message form considered separately from variable values.

Migration. Changing a digital representation or implementation to support use in another technical environment.

No Activity. The absence of expected recorded activity after establishing that the relevant activity was within the recording scope.

Observability. The conditions under which relevant states and relationships become inspectable; the comparative use here does not assert mathematical state reconstructibility.

Overpaint. Paint applied over an earlier painted surface, whose origin and purpose require investigation.

Patina. A surface condition or alteration whose material origin, deliberate application, age, and significance must be distinguished in context.

Pentimento. A visible or revealed change made during the development of a painting; identifying one requires evidence about sequence and authorship of the change.

Performance specification. A documented account of requirements and allowable variation for future enactments of a performance work.

Preservation. Activities supporting continued survival, access, and intelligibility of works and their evidence.

Preventive conservation. Reduction and management of risks through attention to environments, storage, handling, and associated conditions.

Prompt book. An annotated theatrical text preserving information about a production, including cues and staging decisions.

Proof. An impression or other preliminary representation used to inspect a work before or during its development.

Provenance. The documented history of an object, record, or result, including ownership or production and processing as appropriate.

Realization. A particular enactment, installation, or execution through which a work is presented.

Reconstruction. An evidence-based proposal or presentation of a state that is not directly available in full.

Reference condition. The identified state, instruction, or relationship against which a difference is assessed.

Registration. Alignment of records, often images, so that corresponding locations or features can be compared.

Restoration. An intervention intended to recover or clarify a selected condition or appearance; its target and evidential basis need to be stated.

Significant property. A characteristic judged important to the identity, meaning, or experience of a work in a specified context.

State. In printmaking, a stage associated with a changed matrix; more generally, a condition at a specified point that must not be confused with a complete work history.

Stratigraphy. The study of layer relationships and sequences; layers can constrain relative order without supplying complete dates or causes.

Technical art history. Study of artistic making and material history through the coordinated examination of objects, technical evidence, and contextual sources.

Time-based media. Art whose realization depends on duration and often on technical systems, including film, video, sound, and some installations.

Treatment record. Documentation of an intervention, including what was done, why, with which materials or procedures, and with what observed result.

Variable media. An approach to works whose continuation may involve changing materials or technologies while preserving specified significant properties.

Version. An identifiable form of a work, representation, program, or document with a particular relationship to earlier and later forms.

Witness. A surviving source that carries evidence of a work or event; several witnesses may depend on one earlier source.

Appendix C Evidence taxonomy and blind spots

Evidence becomes useful in relation to a claim. The classes below overlap because an object can preserve traces of making, use, and intervention at the same time. The blind spot identifies a limit to consider, not a reason to reject the evidence.

Evidence class	What it can support	Characteristic blind spot
Material object or fragment	Construction, condition, and relative material relationships.	Its present state includes aging and interventions.
Workshop text or recipe	Articulated procedures and expectations.	An instruction does not establish what was done to a particular object.
Preparatory drawing or proof	A surviving intermediate state or revision.	The record may omit most abandoned alternatives.
Technical image	Responses acquired by a specified physical method.	Contrast is method-dependent and can combine contributions from several depths.
Sample and analytical result	Material properties at a documented location.	The sample may not represent the whole object or every layer.
Condition and treatment record	Observed state and documented intervention.	Undocumented earlier work may remain invisible.
Provenance document	A recorded transaction, possession, or description.	A repeated attribution may be inherited rather than independently established.
Score or prompt book	Instructions, annotations, and their changes.	An instruction does not prove its execution.
Audio or video recording	A captured aspect of a particular event.	Position, apparatus, editing, and framing shape the record.
Practitioner testimony	Experience, interpretation, and explanations of practice.	Memory, occasion, and later changes in understanding need consideration.
Environmental sequence	Recorded conditions at a sensor over time.	The sensor may not represent the object's actual exposure.
Files and source code	Retained representations or executable instructions.	Dependencies and behavior may be incompletely preserved.
Runtime log	Events the instrumented system chose and managed to record.	A message about an operation may precede its successful external effect.
Installation specification	Required relationships and authorized variations.	Its date and authority may limit its scope.
Generated reconstruction	A proposed completion under a model's assumptions.	Plausibility does not establish the missing historical content.

C1 Questions to carry with an artifact

We should be able to identify the work or realization, the object or event examined, the place and date of acquisition, and the person or system responsible for the record. The reason for acquisition matters as well. A photograph made for publicity and one made for condition assessment may support different comparisons even when they depict the same object.

The record should identify transformations between the source and the representation in use. Cropping, normalization, retouching, transcription, color adjustment, resampling, migration, and emulation can affect an inference. Their importance depends on the question. A record of processing lets another investigator decide whether a derivative is adequate or whether the earlier source is needed.

We also need the reference condition against which a difference is judged. It may come from an approved proof, an artist's instructions, a documented earlier realization, or a carefully stated reconstruction. The authority, date, and scope of that reference should be explicit. An instruction for one exhibition should not silently become a permanent rule for every future presentation.

Finally, we should preserve known alternatives and the boundaries of verification. The record can state which explanation was supported, which possibilities were excluded, and which remained unresolved. Where a practical decision was necessary despite uncertainty, that decision and its reason should be retained. The next investigation then inherits an argument that can be examined rather than a conclusion detached from its evidence.

C2 Keeping levels of verification distinct

Passing one check does not establish every other property of the work. A clear image, an intact file, and a plausible account each answer different questions. Combining them is useful when their relationships are documented.

Level	A suitable check	What passing it does not establish
Object identity	Match identifiers, physical features, and provenance records.	That every associated attribution is correct.
Material condition	Examine relevant supports, surfaces, and relationships.	That a selected historical appearance should be restored.
Acquisition	Check the method, settings, calibration, and coverage.	That every relevant property was captured.
Representation	Compare the derivative with its source and processing record.	That the derivative suits every research question.
File integrity	Compare bytes with an established reference checksum.	That the reference was complete or the work still functions.
Execution	Run the software and inspect specified behaviors.	That every interaction or environment has been tested.
Realization	Compare significant properties with an authorized reference.	That all future variations are either permitted or prohibited.
Interpretation	Connect claims to independent evidence and alternatives.	That only one defensible account of the work exists.

References

Web resources were checked on October 2, 2026. Institutional pages without a publication date are identified by title and responsible organization. Historical dates in the text refer to the event or original work, not to the date of a later translation or webpage. The two author volumes at the end of the citation sequence provide the source for our diagnostic concepts and pattern names.

- [1] Aristotle. *Poetics*. Translated by S. H. Butcher. The Internet Classics Archive, Massachusetts Institute of Technology; especially Parts XXIV–XXV.
<https://classics.mit.edu/Aristotle/poetics.3.3.html>
- [2] Theophilus. *On Divers Arts: The Foremost Medieval Treatise on Painting, Glassmaking, and Metalwork*. Translated with introduction and notes by John G. Hawthorne and Cyril Stanley Smith. New York: Dover Publications, 1979. Unabridged republication of the University of Chicago Press edition of 1963.
<https://store.doverpublications.com/products/9780486237848>
- [3] Cennini, Cennino d’Andrea. *The Craftsman’s Handbook: The Italian Il Libro dell’Arte*. Translated by Daniel V. Thompson, Jr. New York: Dover Publications, 1960. Unabridged republication of the Yale University Press translation of 1933.
<https://store.doverpublications.com/products/9780486200545>
- [4] National Gallery, London. Linear perspective. Glossary entry discussing Alberti’s *De Pictura* (1435).
<https://www.nationalgallery.org.uk/paintings/glossary/linear-perspective>
- [5] Getty. State. Categories for the Description of Works of Art.
<https://www.getty.edu/publications/categories-description-works-art/categories/object-architecture-group/9/>
- [6] Factum Foundation. The Raphael Cartoons. Project documentation of color, surface, and infrared recording.
<https://factumfoundation.org/our-projects/digitisation/the-raphael-cartoons/>
- [7] UNESCO. Nôgaku theatre. Representative List of the Intangible Cultural Heritage of Humanity, inscription 2008; originally proclaimed 2001.
<https://ich.unesco.org/en/RL/nogaku-theatre-00012>
- [8] UNESCO. Wayang puppet theatre. Representative List of the Intangible Cultural Heritage of Humanity, inscription 2008; originally proclaimed 2003.
<https://ich.unesco.org/en/RL/wayang-puppet-theatre-00063>
- [9] UNESCO. Gbofe of Afounkaha, the music of the transverse trumps of the Tagbana community. Representative List, inscription 2008; originally proclaimed 2001.
<https://ich.unesco.org/en/RL/gbofe-of-afounkaha-the-music-of-the-transverse-trumps-of-the-tagbana-community-00005>
- [10] UNESCO. Gamelan. Representative List of the Intangible Cultural Heritage of Humanity, 2021.
<https://ich.unesco.org/en/RL/gamelan-01607>
- [11] Mowat, Barbara, and Paul Werstine. *An Introduction to This Text: Hamlet*. Folger Shakespeare Library Editions.
<https://www.folger.edu/explore/shakespeares-works/hamlet/an-introduction-to-this-text/>
- [12] van Daal, Jan M. “The Histories They Hold: On Making Mummy Portraits Matter.” In *Mummy Portraits of Roman Egypt, Volume 2: Emerging Research from the APPEAR Project*, edited by Marie Svoboda and Caroline R. Cartwright, chapter 1. Los Angeles: J. Paul Getty Museum, 2026.
<https://www.getty.edu/publications/mummy-portraits-2/01/>
- [13] Getty Research Institute. Getty Provenance Index. Resource and documentation portal.
<https://www.getty.edu/research-conservation/tools-databases/provenance/>

- [14] National Gallery, London. Fausto Muzzi and Giuseppe Guizzardi, after Francesco Francia, *The Virgin and Child with an Angel*, NG3927. Collection and provenance record.
<https://www.nationalgallery.org.uk/paintings/fausto-muzzi-and-giuseppe-guizzardi-after-francesco-francia-the-virgin-and-child-with-an-angel>
- [15] Society for the Protection of Ancient Buildings. *The SPAB Manifesto*. William Morris, Philip Webb, and other founder members, 1877.
<https://www.spab.org.uk/about-us/spab-manifesto>
- [16] Santabárbara Morera, Carlota. "Cesare Brandi and contemporary art: theory, aesthetic and restoration. A tempestuous dialectic." Translated by Valerie Magar. *Conversaciones...* no. 7 (June 2019), 249–266.
<https://revistas.inah.gob.mx/index.php/conversaciones/article/view/14829>
- [17] International Council on Monuments and Sites. *International Charter for the Conservation and Restoration of Monuments and Sites*. Venice, 1964; adopted by ICOMOS in 1965.
https://admin.icomos.org/wp-content/uploads/2025/03/Venice_Charter_EN.pdf
- [18] Staatliche Museen zu Berlin. Rathgen-Forschungslabor: Profile. Institutional history of the laboratory founded in 1888.
<https://www.smb.museum/en/museums-institutions/rathgen-forschungslabor/about-us/profile/>
- [19] Harvard Library Preservation Services. 1924–1930. Institutional chronology, entry for 1928 on the Fogg Art Museum's Department of Technical Studies.
<https://preservation.library.harvard.edu/1924-1930>
- [20] Thomson, Garry, John Mills, and Joyce Plesters. *The Scientific Department of the National Gallery*. National Gallery Technical Bulletin 1 (1977), 18–28.
<https://www.nationalgallery.org.uk/research/publications/technical-bulletin/the-scientific-department-of-the-national-gallery>
- [21] National Academy of Sciences. *Scientific Examination of Art: Modern Techniques in Conservation and Analysis*. Washington, DC: The National Academies Press, 2005. Especially Molly Faries, "Analytical Capabilities of Infrared Reflectography: An Art Historian's Perspective," 87–104. DOI: 10.17226/11413.
<https://doi.org/10.17226/11413>
<https://www.nationalacademies.org/read/11413/chapter/8>
- [22] van Asperen de Boer, J. R. J. *Infrared Reflectography: a Method for the Examination of Paintings*. *Applied Optics* 7, no. 9 (1968), 1711–1714. DOI: 10.1364/AO.7.001711.
<https://doi.org/10.1364/AO.7.001711>
- [23] Saunders, David, and John Cupitt. *Elucidating Reflectograms by Superimposing Infra-red and Colour Images*. National Gallery Technical Bulletin 16 (1995), 61–65.
<https://www.nationalgallery.org.uk/research/publications/technical-bulletin/elucidating-reflectograms-by-superimposing-infra-red-and-colour-images>
- [24] Dunkerton, Jill, and Marika Spring, with contributions from Rachel Billinge, Kamilla Kalinina, Rachel Morrison, Gabriella Macaro, David Pegg, and Ashok Roy. "Catalogue." *Titian's Painting Technique to c. 1540*. National Gallery Technical Bulletin 34 (2013), 32–105.
<https://www.nationalgallery.org.uk/research/publications/technical-bulletin/catalogue>
- [25] Learner, Thomas J. S., Patricia Smithen, Jay W. Krueger, and Michael R. Schilling, editors. *Modern Paints Uncovered: Proceedings from the Modern Paints Uncovered Symposium*, Tate Modern, London, May 16–19, 2006. Los Angeles: Getty Conservation Institute, 2007.
<https://www.getty.edu/publications-reports/item/244G3V>
- [26] Stulik, Dusan, David Miller, Herant Khanjian, Narayan Khandekar, Richard Wolbers, Janice Carlson, and W. Christian Petersen. *Solvent Gels for the Cleaning of Works of Art: The Residue Question*. Edited by Valerie Dorge. Los Angeles: Getty Conservation Institute, 2004.
<https://www.getty.edu/publications-reports/item/245BCS>

- [27] Mauritshuis. The Girl in the Spotlight. Documentation of the 2018 technical examination of Girl with a Pearl Earring.
<https://www.mauritshuis.nl/en/what-s-on/exhibitions/exhibitions-from-the-past/the-girl-in-the-spotlight>
- [28] Mauritshuis. Closer to Vermeer and the Girl. Research findings announced April 28, 2020.
<https://www.mauritshuis.nl/en/press-releases/closer-to-vermeer-and-the-girl>
- [29] Rijksmuseum. Operation Night Watch to Start at the Rijksmuseum. Project announcement, 2019.
<https://www.rijksmuseum.nl/en/press/press-releases/operation-night-watch-to-start-at-the-rijksmuseum>
- [30] Bourgarit, David, Jane Bassett, Francesca G. Bewer, Arlen Heginbotham, Andrew Lacey, and Peta Motture, editors. Guidelines for the Technical Examination of Bronze Sculpture. Los Angeles: J. Paul Getty Museum, 2025. General Introduction.
<https://www.getty.edu/publications/bronze-guidelines/intro/>
- [31] Dardes, Kathleen, and Andrea Rothe, editors. The Structural Conservation of Panel Paintings: Proceedings of a Symposium at the J. Paul Getty Museum, April 24–28, 1995. Los Angeles: Getty Conservation Institute, 1998.
<https://www.getty.edu/publications-reports/item/245FC0>
- [32] Ellis, Margaret Holben, editor. Historical Perspectives in the Conservation of Works of Art on Paper. Readings in Conservation 7. Los Angeles: Getty Conservation Institute, 2014.
<https://www.getty.edu/publications-reports/item/242ZPH>
- [33] Metropolitan Museum of Art. East Asian Painting Conservation. Departmental account of conservation, mounting, and preservation.
<https://www.metmuseum.org/departments/east-asian-painting-conservation>
- [34] Canadian Conservation Institute. Textiles and the Environment. CCI Notes 13/1.
<https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/textiles-environment.html>
- [35] Library of Congress. Care, Handling and Storage of Photographs. Preservation guidance.
<https://www.loc.gov/preservation/care/photo.html>
- [36] Staniforth, Sarah, editor. Historical Perspectives on Preventive Conservation. Readings in Conservation 6. Los Angeles: Getty Conservation Institute, 2013.
<https://www.getty.edu/publications-reports/item/2435JZ>
- [37] Canadian Conservation Institute. Agents of Deterioration. Conservation resources.
<https://www.canada.ca/en/conservation-institute/services/agents-deterioration.html>
- [38] Michalski, Stefan. Agent of Deterioration: Light, Ultraviolet and Infrared. Canadian Conservation Institute.
<https://www.canada.ca/en/conservation-institute/services/agents-deterioration/light.html>
- [39] American Institute for Conservation. Code of Ethics and Guidelines for Practice. Revised August 1994, as displayed in October 2026. Especially guidelines 24–28: Documentation, Examination, Treatment Plan, Treatment, and Preservation of Documentation.
<https://www.culturalheritage.org/conservation-at-work/uphold-professional-standards/code>
- [40] ICCROM. The Nara Document on Authenticity (1994).
https://www.iccrom.org/sites/default/files/publications/2020-05/convern8_06_thenaradocu_ing.pdf
- [41] National Museum of Asian Art, Smithsonian Institution. Gold. Materials and Techniques.
<https://asia.si.edu/explore-art-culture/art-stories/materials-techniques/gold/>
- [42] Local Contexts. Traditional Knowledge Labels. Community protocols for access and use.
<https://localcontexts.org/labels/traditional-knowledge-labels/>
- [43] UNESCO. Convention for the Safeguarding of the Intangible Cultural Heritage. 2003.
<https://ich.unesco.org/en/convention>
- [44] Beethoven-Haus Bonn. Subdivision of Sketches by Beethoven in the Digital Archive. Cataloging and sketchbook resources.
<https://www.beethoven.de/en/g/skizzenausgabe>

- [45] Bach digital. Research portal for works, sources, and digitized musical manuscripts.
<https://www.bach-digital.de/>
- [46] Metropolitan Museum of Art. Musical Instruments. Collection history and conservation responsibilities.
<https://www.metmuseum.org/departments/musical-instruments>
- [47] Library of Congress. The Gramophone. Emile Berliner and the Birth of the Recording Industry.
<https://www.loc.gov/collections/emile-berliner/articles-and-essays/gramophone/>
- [48] Bradley, Kevin, editor. Guidelines on the Production and Preservation of Digital Audio Objects. IASA Technical Committee, IASA-TC 04, 2nd edition, 2009. Web edition.
<https://www.iasa-web.org/tc04/audio-preservation>
- [49] Haber, Carl. Capturing Recorded Sound through Imaging: The I.R.E.N.E. Project and Future Prospects. Lecture, Topics in Preservation Series, Library of Congress, June 18, 2007.
<https://www.loc.gov/preservation/outreach/tops/haber07/index.html>
- [50] Computer History Museum. Max Mathews Makes MUSIC. Revolution: The First 2000 Years of Computing.
<https://www.computerhistory.org/revolution/computer-graphics-music-and-art/15/222>
- [51] Getty. Getty Presents Sensing the Future: Experiments in Art and Technology. Exhibition announcement and institutional history, 2024.
<https://www.getty.edu/news/getty-presents-sensing-the-future-experiments-in-art-and-technology/>
- [52] Getty Research Institute. David Tudor—Rainforest IV. Documentation of the 1973 work and subsequent realization.
https://www.getty.edu/research/tools/guides_bibliographies/david_tudor/av/rainforest.html
- [53] Museum of Modern Art. John Cage, 4'33" (In Proportional Notation), 1952/1953. Collection entry.
<https://www.moma.org/collection/works/163616>
- [54] Hart, Beverley. Contradicting Prospero: The Prompt Book Collection in the V&A Department of Theatre & Performance. V&A Online Journal 6 (Summer 2014). Digitized issue containing the article.
https://research.vam.ac.uk/journals/research-journal/issue-6/_assets/downloads/pagedjs.pdf
- [55] Lu, Mei-Chen. "Resources and Riches: The Dance Notation Bureau." *Dance Chronicle* 32, no. 2 (2009), 291–301. DOI: 10.1080/01472520902966062. Author's postprint published by the Dance Notation Bureau, August 31, 2011.
<https://www.dancenotation.org/theory-bulletin-board/resources-and-riches-dance-notation-bureau/>
- [56] Royal Academy of Dance. Benesh International. Historical account of Benesh Movement Notation, first published in 1956.
<https://www.royalacademyofdance.org/benesh-international/>
- [57] Merce Cunningham Trust. Dance Capsules. Preservation and study resources.
<https://www.mercecunningham.org/the-work/dance-capsules/>
- [58] National Film Preservation Foundation. The Film Preservation Guide: The Basics for Archives, Libraries, and Museums. 2004.
<https://www.filmpreservation.org/preservation-basics/the-film-preservation-guide>
- [59] Dixon, Bryony. Restoring Hitchcock #1: How a Film Restoration Begins. British Film Institute, August 9, 2012.
<https://www.bfi.org.uk/features/restoring-hitchcock-1-how-film-restoration-begins>
- [60] Friedrich-Wilhelm-Murnau-Stiftung. Projekt: Metropolis 27/10. Reconstruction and restoration project.
<https://murnau-stiftung.de/stiftung/projekte/projekt-metropolis-2710>
- [61] Eye Filmmuseum. Digital Restoration. Film Files.
<https://www.eyefilm.nl/en/collection/collections/film/film-files/digitale-filmrestauratie>
- [62] Byrne, Robert, Caroline Fournier, Anne Gant, and Ulrich Ruedel. The Digital Statement Part III: Image Restoration, Manipulation, Treatment, and Ethics. FIAF Technical Commission, April 2021. Also published in *Journal of Film Preservation* 104 (2021), 25–37.
<https://www.fiafnet.org/pages/E-Resources/Digital-Statement-part-III.html>

- [63] International Federation of Film Archives. FIAF Code of Ethics. Version adopted by the General Assembly in Montreal on May 1, 2025; earlier 1998–2025 version linked from the same resource.
<https://www.fiafnet.org/pages/Community/fiaf-code-of-ethics-revised-2025-en.html>
- [64] Tate. Documentation and Conservation of Performance. Research project.
<https://www.tate.org.uk/about-us/projects/documentation-conservation-performance>
- [65] Tate. Documentation Tool: Performance Specification. Documentation and Conservation of Performance project.
<https://www.tate.org.uk/about-us/projects/documentation-conservation-performance/performance-specification>
- [66] Depocas, Alain, Jon Ippolito, and Caitlin Jones, editors. Permanence Through Change: The Variable Media Approach. New York: Solomon R. Guggenheim Museum; Montreal: Daniel Langlois Foundation for Art, Science, and Technology, 2003.
<https://www.variablemedia.net/pdf/Permanence.pdf>
- [67] Laurenson, Pip. Authenticity, Change and Loss in the Conservation of Time-Based Media Installations. Tate Papers 6, 2006.
<https://www.tate.org.uk/research/tate-papers/06/authenticity-change-and-loss-conservation-of-time-based-media-installations>
- [68] Philadelphia Museum of Art. Marcel Duchamp, Fountain, 1950 (replica of 1917 original). Collection entry.
<https://www.philamuseum.org/objects/92488>
- [69] Matters in Media Art. Documenting Media Art. Collaborative collection-care resource.
<https://mattersinmediaart.org/assessing-time-based-media-art.html>
- [70] Whitney Museum of American Art. Douglas Davis: The World’s First Collaborative Sentence. Launched 1994; restored versions presented in 2013. Includes the project’s conservation account.
<https://whitney.org/artport/douglas-davis>
- [71] Antonelli, Paola, and Paul Galloway. When Video Games Came to the Museum. Museum of Modern Art Magazine, November 3, 2022. Retrospective on the 2012 acquisitions.
<https://www.moma.org/magazine/articles/798>
- [72] PREMIS Editorial Committee. PREMIS Data Dictionary for Preservation Metadata, Version 3.0. 2015. Library of Congress.
<https://www.loc.gov/standards/premis/v3/index.html>
- [73] Whitney Museum of American Art. Harold Cohen: AARON. Exhibition, February 3–May 19, 2024.
<https://whitney.org/exhibitions/harold-cohen-aaron>
- [74] Lyu, Siwei, Daniel Rockmore, and Hany Farid. A Digital Technique for Art Authentication. Proceedings of the National Academy of Sciences 101, no. 49 (2004), 17006–17010. DOI: 10.1073/pnas.0406398101.
<https://doi.org/10.1073/pnas.0406398101>
- [75] Coalition for Content Provenance and Authenticity. C2PA and Content Credentials Explainer. Specification version 2.2.
<https://spec.c2pa.org/specifications/specifications/2.2/explainer/Explainer.html>
- [76] Menkman, Rosa. The Glitch Moment(um). Network Notebooks 4. Institute of Network Cultures, 2011.
https://networkcultures.org/_uploads/NN%234_RosaMenkman.pdf
- [77] Walsh, Colleen. A Light Touch for Rothko Murals. Harvard Gazette, May 20, 2014. Account of Harvard Art Museums’ projection-based conservation project.
<https://news.harvard.edu/gazette/story/2014/05/a-light-touch-for-rothko-murals/>
- [78] Federal Agencies Digital Guidelines Initiative. Technical Guidelines for Digitizing Cultural Heritage Materials. 3rd edition, May 2023.
https://www.digitizationguidelines.gov/guidelines/FADGITechnicalGuidelinesforDigitizingCulturalHeritageMaterials_ThirdEdition_05092023.pdf
- [79] Vostokov, Dmitry. Theoretical Software Diagnostics: Collected Articles. 4th edition. OpenTask, 2024.
<https://dumpanalysis.org/theoretical-software-diagnostics-book>
- [80] Vostokov, Dmitry. Trace, Log, Text, Narrative, Data: An Analysis Pattern Reference for Information Mining, Diagnostics, Anomaly Detection. 5th edition. OpenTask, 2023.
<https://dumpanalysis.org/trace-log-analysis-pattern-reference>

