2000

Conservators' Approaches to Viewing Textiles

Harold F. Mailand

Indiana University

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Abstract

Though conservation is often thought synonymous with preservation treatments, this discipline also includes numerous approaches to examination and investigation that can offer a more complete understanding of a textile. In addition to prolonging the life of an object, a conservator works to determine the piece's construction, materials, condition, and authenticity. These approaches can range from "low tech" means such as the use of the unaided eye to sophisticated scientific instrumentation.

Systematic visual examination procedures can provide a framework for solid data that can be used for comparative analysis. Scientific examination can supply information about the materials used in the textile's fabrication, various stages of construction, later alterations, and its' present condition. In a museum this evidence is an invaluable guide to the curator in charting the history of a piece, to a collector or dealer in supporting the object's "story line", and to the conservator in treating it.

To gain these viewpoints a conservator may put a particular object through a series of low and high magnification examinations, chemical tests, and photographic procedures. This paper will present approaches which have been explored during the course of treating textiles.

Selected case studies will be presented that describe the methodology used along with the subsequent understanding gained from these investigations.

Introduction

When you think of a conservator, you may imagine someone wearing a lab coat and/or someone being referred to as a "pseudo-scientist or as a "pedantic, nay-sayer". I want to assure you that I now only wear a lab coat to take off the chill during the summer months in my climate-controlled lab. I am not a scientist, so if I can understand and find value in the following, you may also find this paper of interest to you. What I would like to do is share with you some procedures that my colleagues and I have used ourselves, or have collaborated with specialists in other fields to gain a deeper understanding of the complex arena of textiles.

In the late 1970's and the first half of the 1980's, this textile conservator was part of a dynamic conservation team with specialists in painting, sculpture, and paper at the Indianapolis Museum of Art (IMA). It was by then a matter of procedure for objects entering the museum as purchase considerations and gifts for the permanent collection, or loans for temporary exhibitions to go through an examination process to determine their materials, techniques and conditions. This information was then presented to the curatorial board which they in turn could consider the findings and get a better idea if the object being considered was authentic, and the materials and procedures to stabilize the object before it could enter the permanent collection or to be placed on exhibition. For this procedure, the data from each object was recorded on specially designed worksheets. Along with black and white photographs or color slides this documentation was kept in a permanent file for future research. This form of detailed analysis generally does not appear on a standard accession card file, a computer data entry set-up, exhibition label, or catalog. An exception to this was the seminal work published by the Indianapolis Museum of Art which celebrated its centennial anniversary in 1983 with an exhibition of its textile and costume masterpieces. The catalog, collated by the late Peggy Gilfoy, brought together the curatorial expertise of her colleagues, as well as data and research from other sources. This proved to be a unique venture between museum curators and conservators, and analytical scientists in the academic, industrial, and the research and development community. It provided a valuable reference for future research as well as comparisons of similar textiles and costumes. Following are brief reviews of the procedures used for this publication and subsequent analytical work by others in the field of textile conservation.

Examination and Photo-Documentation of Textiles using Visible and Invisible Radiation

Visible light: Most conservation work and examination procedures are done under normal light conditions, in other words: daylight, incandescent or fluorescent light with the unaided eye. Ambient or directed light sources are generally the first means of looking at, and documenting an object to assess overall condition and construction. Transmitted light, or light that is projected behind the object, is helpful in observing specific condition problems, such as abrasion, slits, and loss. Raking light, which is light cast across the object, can detect surface anomalies such as old crease lines, impressions from missing embellishments, or perforations from previous stitching.

Structural Analysis: To analyze a textile's weave structure, embroidery stitches, and the twist and ply of individual yarns the unaided eye is possible, but more information is discernible through a simple mono or stereo-microscope with a 10 x to 20 x magnification and directed light.

Thread Count: To determine an accurate thread, mesh, or knot count of a textile a monocular instrument with an interchangeable 7X or 14 X lens and touch control counter is used.

Fiber Identification: Individual elements of construction are identified through micro-sampling. Fragments of each different fiber component (warp, weft, and/or surface embellishment) measuring approximately 1/8" are placed on a glass slide, separated and observed with transmitted or reflected light using a microscope capable of higher magnification. The individual characteristics of the fiber are then compared to standard (i.e., known) fiber specimens.

Photo-Documentation: Along with written records, photographic procedures are indispensable aids in documenting the physical components and condition of a textile. Photographic instrumentation can document what the eye can see under normal light, and with appropriate filtration can record non-visible radiation. Most conservators use 35 mm color slides, or work with professional photographers to obtain 4 x 5 in color transparencies or black and white prints. By employing photomicography a more detailed and permanent record of a particular construction or condition can be provided. By using a camera and various kinds of microscopes it is possible to enlarge an area from 10X magnification with an ordinary microscope, to 5,000 X magnification, and greater when necessary, with a scanning electron microscope. This form of examination requires the removal and mounting of a small sample, but provides a wealth of detailed information. The photographic documentation generated precludes the necessity of re-examining the piece, and therefore spares the piece from unnecessary handling in the future.

Ultra-Violet Fluorescence: The degree to which textiles absorb ultraviolet, as well as the amount of visible fluorescence they produce, is of interest to the conservator. By viewing a textile under ultraviolet light a conservator can discern irregularities on the surface, such as dyes, fabric finishes, repairs, previous treatments such as, bleaching, adhesives, or cleaning with optical whiteners or brighteners. A common "black light" fluorescent tube can detect such anomalies, and a camera which is fitted with a filter that absorbs other wavelengths can record visible fluorescence.

X-Radiography: X-rays are capable of penetrating substances that appear opaque to the unaided eye. Exposing film to x-rays as they pass through an object produces an x-radiograph. The different densities of the different materials, and their ability to absorb, or transmit the x-rays produces an image on the film. This method has proved useful in examining multi-layered textiles without physically separating and removing original material for analysis, and thus disrupt the historical integrity of the piece.

Examination of Textiles with Chemical Dye Tests

Thin Layer Chromatography (TLC): Mary Ballard, at the Smithsonian Center for Materials Research and Education, Washington DC, has been instrumental in introducing many conservators to the natural dye analysis work of the German scientist, Dr. Helmut Schweppe. His testing procedures are carried out with simple equipment to extract natural dyestuffs from old samples. Thin layer chromatography can be carried out with minute samples, and identification is made with known comparative materials.

Schweppe Aniline Dye Test: Polly Willman has described an approach to determine the presence of aniline dyes found in the First Ladies collection, Smithsonian Institution, Washington, DC. The purple dye in the supplemental wefts of the flowers in the gown worn by Mary Todd Lincoln 1861-62 was tested using the Schweppe Aniline dye test method. A small thread sample was placed into a "watch glass"; sequential solutions of sulfuric acid, and water were added, and the color changes were noted. The dye in the supplemental wefts tested to be Perkin's Purple (mauvine). Not only did this test confirm that it was an example of the first synthetic dye patented in 1856 by Perkins, but also how rapid the industry adapted to this new dye technology, and that Mrs. Lincoln was indeed at the forefront of fashion.

Specialized Methods of Examining Textiles
In 1982-83, as we were preparing textiles for the IMA Centennial Exhibition, we noticed that metallic threads were used by many cultures over the centuries, and realized that we knew very little about this technology other than to say they looked like gold or silver. So one day Dr. Leon Stodulski, Associate Professor of Analytical Chemistry at Indiana University Purdue University Indianapolis (IUPUI) was in the IMA Conservation Laboratory, and I approached him with the question of how can we learn more about precious metal in textile and costumes. His eyes lit up and then he went over my head with what could be done with the right instrumentation. We did not have it, he did not have all of it, but local industry did, and was happy to help us with our study.

Atomic Emission Spectrographic Analysis: This analysis was performed at IUPUI through micro-sampling. A 3 mm length of the sample was removed and placed in a graphite electrode, packed with pure graphite, and subjected to Atomic Emission Spectrographic analysis. The metallic elements present were determined spectrographically and estimates of the relative amounts of gold, silver, copper, and other elements in each strip were obtained by comparing spectral line intensities with a series of known standards. Each element could therefore be identified as a major, minor, or trace amount.

Scanning Electron Microscopy (SEM): This process involves examining a cross section of the metallic thread that has been mounted in epoxy resin. The sample was then sectioned by cutting it perpendicular to its length using a diamond knife. This specimen was then placed in a vacuum chamber of the microscope and scanned with a narrow beam of high energy electrons. Using an x-ray energy analyzer, the scientists could determine the identity and estimate the relative amounts of the metallic elements present throughout the strip. Photographs were taken for study of the specimens at magnifications of up to 5,000 x.

Note: By taking a closer look via the above two methods we were able to categorize the different manufacturing techniques employed by the metallurgist. We also learned more about the composition of the metal strips wound around the core thread in terms of major, minor, and trace elements. This study suggests that there maybe identifiable technical and compositional patterns that can be used to help date and authenticate unknowns.

Energy-Dispersive X-Ray Fluorescence (XRF): This approach is used for the characterization of metal alloys, glass, ceramics, and pigments. This analytical technique is very quick and entirely non-destructive. Before Perkin's discovery of the artificial dye "mauvine" there were innovations in the 19th c. that led to the development of "mineral dyes". These colorants were based on inorganic paint pigments that were applied to a textile surface. Attempts to create fast and inexpensive dyes were patented and documented in the textile trade literature. Thus by determining the existence of mineral dyes on textile goods it could help to distinguish this technology as well as to date the object. XRF was applied by Joy Gardiner, and others at the Winterthur Museum which did indicate mineral dyes were used in early 19th c. American Quilts found in their collection.

Observations, Speculations, and Connections

Sometimes just by examining and treating textiles we can just be lucky in gaining insights. By working directly on tapestries over the past 25 years I have developed a working theory that there was a Renaissance in repairing tapestries in the last two decades of the 19th and the first decade of the 20th c. Reweaving gave work to skilled weavers whose market for new tapestry production was crashing. In turn this met the need of a new market, collecting historic tapestries for the new museums and mansions in the States. While preparing a pair of tapestries for cleaning we discovered rare documents attached to the top backs of the tapestries and behind the linen lining. Needlepoint on canvas labels stated that these tapestries were repaired in London in 1889 by G. Herpin & Co.. This not only added to the provenance of the tapestries, but also gave us a clear point in time when aniline dyes, and weighted silk yarns were available in the market place, and incorporated in the efforts to preserve these objects. Because of the characteristic fading and color change of early synthetic dyes, and the accelerated break down of weighted silk yarns we know when and where this work was introduced.

As Polly Willman was preparing the First Ladies Gowns for re-exhibition, she took a closer look at the gown worn by Mrs. McKinley, 1901. The silk satin ground was in poor condition with numerous vertical slits, especially where exposed to light. A standard burn test was conducted. The warp threads reacted normally by melting and forming a brittle bead. However, the weft was non-characteristic of silk in that it left a white ash. Under SEM the warp and weft were analyzed and showed the presence of tin in the weft. This shows that the silk was weighted in the yarn stage, not the fabric stage. This also explains why the degradation was isolated to the weft yarns, which created only vertical slits. This gives new insights into the weighted silk problems that haunts many of us today.

Along with my interest in the preservation of textiles, I am also interested in the preservation of rare livestock breeds. Yes, I grew up on a farm, and now I have a little farm where I have been involved in raising endangered breeds of farm animals. Where am I going with this? Well, during one of the American Livestock Breeds Conservancy (ALBC) annual meetings, I was enchanted to hear that work is being done to characterize certain breeds of sheep through genetic mapping. We have learned in the past decade that we humans have both common and unique characteristics that can be identified through our DNA. Likewise animal scientists are looking at micro-satellite places on the chromosomes that may characterize certain breeds within sheep. So what? Well we often just characterize most historic fibers as cellulose: cotton, linen, etc,; and protein: silk, wool, etc. which really, by itself, may not help in dating the object or give insight into its provenance.

Around this time we were treating a tapestry that had a lot of abrasion and loss of the weft elements. However this loss revealed the warps which had an intriguing use of both natural "white" wool and pigmented "black" wool. This seemed uncharacteristic of most Northern European tapestries of the 17th c. which have uniform unpigmented wool warps. This discovery got me questioning again: What did these sheep look like? When and where were they raised? What if we could determine the breed of sheep by just a small sample of its wool or hair? For example, if the sample had characteristics of a Merino we could deduce that it was from one of the earliest attempts at European selective breeding practices during the 18th c.; if a particular sample proved to be from Navajo-Churro sheep we could say that the wool was from sheep raised in the Southwestern United States and not a commercial wool produced from sheep raised in the Eastern United States or from European imports, etc..

After listening to Elizabeth Barber's paper this spring on her research on wool mummy covering's from Urumchi, I was even more curious about what kind of genetic information could be extrapolated from wool. She has found that these mummified people were Caucasian, but lived and died in a desolate part of present-day Chinese Turkistan. She took a sample from local live sheep that she found at a nearby zoo for comparison with the mummy wrapping fibers. This got me going again! Were the sheep that produced the wool from these early people from China, or were they brought in from the West? Likewise, was the wool found in Coptic textiles from native sheep on the African continent, or was it imported from the North or Eastern Mediterranean areas. This raises new questions and new ways of tracking trade around the world. Documented samples of wool found in tapestries and other textiles could provide a set of known controls for comparisons. Hence, we would have another tool for dating and establishing the provenance of "unknown" or questionable attributions in many collections around the world. Again, it is all about comparisons to known controls, taking the time, interest, and making the connections.

Conclusion

Today I concentrate on my business which preserves textiles for museums and private clients. I do not conduct a lot of formal analysis, because my clients generally do not request it. Nevertheless, I still have questions as we continue to treat a wide range of textiles and costumes. I may not have a lot sophisticated equipment in my own lab, but I know I can get information from other sources if I am really haunted by something or that my client too, is curious.

Personnel in the conservation, scientific, educational, and business communities have much to offer in the line of equipment and expertise. Often these fields are unaware of the questions you and I may have. Likewise, we as historians, curators, educators, and conservators are not aware of their equipment and expertise nor how to apply it to our concerns. Often they can be lured into sharing. I was surprised with their willingness and interest to share in the past. So please think of Conservators as a viable link to gaining new insights. Conservators love problem solving, challenges, and to be engaged. Just ask us. We may not know all the answers, but we both will learn something by working together.

Acknowledgements

I would like to gratefully acknowledge Leon P. Stodulski, Ph.D., Senior Research Scientist, Conservation Division, The Detroit Institute of Arts for sharing his enthusiasm and knowledge in painless and humorous ways. I also want to thank my colleagues Mary Ballard, Senior Textiles Conservator, Smithsonian Center for Materials Research and

Education; Joy Gardiner, Associate Textile Conservator, Winterthur Museum; and Polly Willman, former Senior Conservator of Costumes at the National Museum of American History, Smithsonian Institution, and current owner of Preservation Services for Costumes & Textiles, Arlington, VA, for loaning slides and notes for the slide presentation and for this text. Thanks also go to Don Bixby and staff at the American Livestock Breeds Conservancy, Pittsboro, NC for their assistance in connecting preservation issues.

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Author

Harold F. Mailand holds a master's degree in Textile Design and Education from Indiana University. His training in textile conservation includes internships at The Textile Museum, Smithsonian Institution, Museum of Fine Arts in Boston, and The Costume Institute/Metropolitan Museum of Art with grants from National Endowment for the Arts, National Museum Act and others. Mr. Mailand was Associate Textile Conservator for the Indianapolis Museum of Art, and in 1986 he founded Textile Conservation Services, a textile conservation facility in Indianapolis, Indiana. He is a Fellow in American Institute for Conservation (AIC) His most recent publication is a 1999, co-authored, 92 page text entitled, Preserving Textiles: A guide for the Nonspecialist.