A COMPREHENSIVE GUIDE TO THE PREVENTATIVE CARE AND MUSEUM STORAGE OF CHINESE, JAPANESE AND KOREAN HANGING SCROLLS

By

SARAH JEAN SMITH

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To my mother
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Abstract of Project in Lieu of Thesis Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Master of Arts

A COMPREHENSIVE GUIDE TO THE PREVENTATIVE CARE AND MUSEUM STORAGE OF CHINESE, JAPANESE AND KOREAN HANGING SCROLLS

By

Sarah Jean Smith

December 2011

Chair: Glenn Willumson
Major: Museology

The Samuel P. Harn Museum of Art at the University of Florida has a diverse collection of Asian scrolls. During the fall semester of 2010, I re-housed 60 hanging and hand scrolls for storage in the Harn Museum’s art storage facilities. Conducting research on best practices and standards for museum storage of Asian scrolls was necessary to complete the project, and it became evident that there are only a small amount of resources available on the topic of museum storage for Asian scrolls. To compliment the hands-on component of my thesis project, I created an informative guidebook meant to assist museum staff handling hanging scrolls. The guidebook suggests safe housing techniques and summarizes the traditional materials used in hanging scrolls for a better understanding of the objects’ construction and inherent weaknesses.

The mediums and techniques used in the construction of Asian art works on paper are often unique and require special consideration when it comes to museum storage; this is especially true regarding hanging scrolls from China, Japan and Korea. While appearing to be simple objects, scrolls are actually complex structures that are
extremely fragile and susceptible to damage through handling, display and fluctuating environmental conditions. Appropriate housing methods and storage of Asian hanging scrolls in museum environments are critical tools for long term preservation.

The guidebook was written with the intent of creating a comprehensive guide to the preventative care and museum storage of Chinese, Japanese and Korean hanging scrolls. To promote the safekeeping of Asian hanging scrolls in Western museum storage facilities the discussions are focused on striking a balance between access and preservation. The guidebook is organized into chapters, beginning with an introduction to hanging scrolls, geographic styles and mounting formats, and common materials. The possible types of deterioration, the effects of incorrect environmental conditions, poor handling and specific types of damage that result from these conditions are discussed along with the inherent weaknesses of particular materials and elements. A section on storage and hanging scroll components, such as wooden storage boxes and silk wrappers is provided followed by step-by-step instructions on how to tie a hanging scroll. The guidebook ends with a list of important sources on the conservation and construction of Asian scrolls and museum storage.
CHAPTER 1
INTRODUCTION

The Samuel P. Harn Museum of Art at the University of Florida has a diverse collection of Asian scrolls. During the fall semester of 2010 I re-housed 60 hanging and hand scrolls for storage in the Harn Museum’s art storage facilities. Conducting research on best practices and standards for museum storage of Asian scrolls was necessary to complete the project, and it became evident that there are only a small number of resources available on the topic of museum storage for Asian scrolls. To compliment the hands-on component of my thesis project, I created an informative guide meant to assist museum staff handling hanging scrolls. For a better understanding of the objects’ construction and inherent weaknesses this guidebook suggests safe housing techniques and summarizes the traditional materials used in hanging scrolls.

This manual was written with the intent of creating a comprehensive guide to the preventative care and museum storage of Chinese, Japanese and Korean hanging scrolls. “Asian art” is a term that covers a wide geographic range and a broad spectrum of materials and object types. Because the vast range of objects that could be included in this guide is so large, certain object types and geographic areas have been omitted. The focus of this guide is on hanging scrolls from China, Japan, and Korea. The works on paper in hanging format from Southeast Asia including Thailand, Cambodia, India and others areas have been excluded. Because so much material is out of the scope of this project the potential exists for this research to be expanded at a later date.

This guidebook is organized into chapters, beginning with an introduction to hanging scrolls, geographic styles and mounting formats, and common materials. The
possible types of deterioration, the effects of incorrect environmental conditions, poor handling and specific types of damage that result from these conditions are discussed along with the inherent weaknesses of particular materials and elements. A section on storage and hanging scroll components, such as wooden storage boxes and silk wrappers is provided followed by step-by-step instructions on how to tie a hanging scroll. The guidebook ends with list of important sources on the conservation and construction of Asian scrolls and museum storage.

All art objects are not created equal. Some of the materials and techniques used in Asian scrolls are unique and require special consideration in handling and storage. What can appear to be simple objects are actually complex structures that are extremely fragile and susceptible to damage through regular use and fluctuating environmental conditions. Although it may not usually be visible to the naked eye, these objects are in an ever-changing state. Complex interactions between materials and the environment take place daily on a minute scale. Once these changes become visible, it is usually too late to prevent damage. Organic substances will inevitably age over time but much can be done to slow the process. The delay of harmful aging is preferable to remounting and conservation. The three key elements in the preservation of these objects are proper storage, proper handling, and maintaining optimal environmental conditions. These elements along with an understanding of the physical properties inherent in each object form the basis for proper care for fragile objects, such as Asian scrolls.

The preservation of objects is essentially the goal of all registrars and collections managers. It is the motivating factor behind almost everything we do. The field of
collections management is made up of a network of colleagues that share knowledge to promote the best practices for the care of objects. The sharing of information is something that collections managers rely on to advance the field. Listserves facilitate information sharing and workshops and conferences are a major source of information that is otherwise too specific and difficult to find. I created this guidebook because I wanted to share the knowledge I gained through my hands-on housing project and its related research in a format that can be circulated and used by individuals working with hanging scrolls.

Often one person in a museum can be responsible for unpacking, processing and housing Asian scrolls even if they don’t have a background in Asian art. This guidebook is meant to assist people with any type of background handling and caring for these especially fragile and complex objects, in any size or type of museum. Each hanging scroll has special characteristics that help determine what method should be used when housing it in storage. In museums without a conservator on staff, staff members in collections management departments create their own systems for the storage of Asian scrolls. Every museum has unique collections, different storage facilities and varying levels of funding to apply towards the preservation of their collections. A selection of storage methods for hanging scrolls that varies from very simple to elaborate are provided in this guide.

The storage approaches discussed in this guidebook aim to strike a balance between access and preservation. Printing information about an object on the outside of storage containers, racks and aisles is a simple step that can alleviate unnecessary handling while providing visitors with information about many objects in a museum’s
A museum storage space is not a static room in which objects rest. Scholars, curators and collections managers frequent these spaces to utilize the wealth of information available to them through these objects. Whether a registrar is promoting collections care or a Korean scholar is researching a particular scroll, the organization and accessibility of objects within a museum storage space may facilitate or hinder these endeavors. Appropriate housing and labeling methods for Asian scrolls in museum environments is a useful tool for long term preservation.

When I started this project I knew that I wanted to focus on the materials, construction techniques and museum storage methods for Asian art objects. As someone who works closely with Asian art and who is responsible for condition reporting a large collection of Asian art, I have been fascinated with these objects. I desired to gain a better understanding of what they are made of and how they are made. I felt that, if I understood these objects better, I would be able to better care for them. It is for these reasons, combined with the need to re-house the scroll collection at the Harn Museum, that I began researching Asian art.

Reflecting on this project, I would have done several things differently. The biggest thing is that I would have narrowed the project down to specifically hanging scrolls from the beginning. When I initially began this project I naively thought I could cover all of the materials and types of objects from Asia, including lacquerware, jades, textiles and several other types of objects. After a few months of research I realized how all encompassing such a project would be because of the vast range and complexity of art objects from Asia. After consulting with my committee, it was agreed upon that I could narrow the scope of my project down to works on paper from Asia, such as folding
screens, albums, books, fans and woodblock prints. Although works on paper seemed to be a manageable subject at first, it quickly became evident that in order to cover each type of object sufficiently in detail I would need to write at least 50 pages on each type of object. My initial research on works on paper was rapidly growing in size and I realized that providing a quality overview of the materials, formats, types of deterioration, and storage methods for each work on paper format would have resulted in an over 200 page guidebook. Again I met with my committee and it was decided that I could proceed with the project, focusing on hanging scrolls.

Once my project was narrowed down specifically to hanging scrolls I continued my research in a more focused manner but still experienced many challenges along the way. Many publications and resources address conservation, preservation and the care and handling of artifacts, but many are too general in the discussion of the arts from Asia. Alternatively, many resources on scrolls can be too technical. Numerous publications provide in-depth discussions on the materials and construction of scrolls but quickly become too technical, using scientific jargon and providing detailed data on experiments such as calculating pigment particle sizes for 15th century Chinese scrolls. Although these resources are incredibly informative, they often provide only one or two sentences that are useful in understanding scrolls from a collections care perspective. Many technical resources only address condition issues, handling and housing as a side note. Another issue that made researching scrolls so challenging is that information on the preservation of Asian scrolls is often buried within articles of broader subjects and can be difficult to locate. Bibliographies often lead to obscure resources that are difficult to access. In order to access many of the sources listed in the
bibliography, I relied heavily on interlibrary loan, which is an excellent service but can also be very time consuming.

Another major component of my research was the multiple trips I made to major museums with prominent Asian art collections. The Harn Museum provided me with the opportunity to make four research trips, beginning with a visit to the Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, Washington D.C. This trip allowed me to see firsthand optimal storage methods for Asian art. Not only on this trip did I see a vast number of hanging scrolls beautifully stored, but I was able to discuss storage techniques with numerous professionals. In the following months I made trips to the Minneapolis Institute of Arts, the Philadelphia Museum of Art and the Seattle Asian Art Museum. At these museums I was able to tour the collection storage facilities, discuss collection storage techniques and enhance my knowledge of collections care.

In addition to the research trips I was able to attend two conferences that focused on museum storage techniques. The first conference, *A Space Odyssey: Storage Strategies for Cultural Collections*, was held in St. Paul, Minnesota. This conference did not specifically address the storage needs for Asian art but rather focused on general storage issues. The second conference, *East Asian Art: Historical Context and Modern Preservation of Paper-Based Works* was held in Philadelphia, Pennsylvania. This conference was very informative because the panel of speakers consisted of authorities in Asian art conservation. I was able to speak with Andrew Hare, an authority on traditional and modern storage of Asian art and the Supervisory Conservator of East Asian Painting at the Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, Washington D.C. Since the conference I have contacted Andrew Hare.
numerous times regarding specific storage questions. His guidance has proved to be invaluable.

Overall I feel that my independent research combined with the research trips and conferences allowed me to create a guidebook that covers the characteristics of Asian scrolls that condition their care in sufficient detail. Housing the 60 scrolls for the Harn Museum allowed me to implement my research and gain experience handling and preserving the objects that I have come to know so much about.

This guidebook draws together numerous bits of information on the construction, materiality and inherent weaknesses of Asian scrolls in an effort to provide a comprehensive reference of optimal care and storage methods. It is important to note that this guidebook is not meant to act as a guide to conservation nor is it meant to suggest the need for any conservation treatments. Rather it is intended to provide information regarding the preventative care of Chinese, Japanese and Korean hanging scrolls and proper storage for them. Each object is unique and the ideas expressed in this guidebook may not be suitable for your particular object. If in doubt regarding the appropriate method for the storage of an object, consult a conservator or the field of experts, such as collections managers and registrars experienced in working with Asian materials.
CHAPTER 2
CONCLUSION

Deciding upon a storage method for a particular object requires much thought and consideration. Storage space, existing storage furniture and available housing supplies will establish the parameters for storage options. The size and shape of an object further influences storage decisions. The overall condition of an object will affect decisions related to storage methods. Finally, the desired level of access to an object will have a bearing on how all of these factors will come together, resulting in a storage solution.

When the object being stored is a hanging scroll, storage solutions can be enhanced when additional factors such as construction, materials, types of deterioration and inherent weakness are considered. Comprehending the fragile nature of the organic materials that make up hanging scrolls and the delicate mounting structures will provide insight regarding appropriate storage methods. Hanging scroll components such as wooden storage boxes and textile wrappers are composed of different materials and present different storage challenges and they also require serious consideration when it comes to storage.

The storage solutions presented in this guidebook attempt to provide a range of options that can be used as a starting point to contemplate storage methods and can be adapted to suit the needs of a particular scroll. The information provided in this guidebook about formats, materials, condition issues and environmental concerns should be reflected upon and taken into consideration not only when storing scrolls but also when handling and displaying them.
The concept of understanding the materiality of a hanging scroll to influence storage, handling and display decisions can be applied to any type of object. In the broadest sense, understanding how objects are constructed, what they are made of and how they react to environmental concerns will affect the care provided to objects. More specifically, realizing the construction techniques, materials and susceptibility to deterioration will directly influence how objects are handled, stored and displayed. The lengthy discussion on hanging scrolls provided in the guidebook focuses on just one type of art object. There exists a vast world of art objects that can benefit from a deeper understanding of their materiality.
APPENDIX

A COMPREHENSIVE GUIDE TO THE PREVENTATIVE CARE AND MUSEUM STORAGE OF CHINESE, JAPANESE AND KOREAN HANGING SCROLLS
HANGING SCROLLS

Introduction

Hanging scrolls are one of the most distinctive forms of Asian art. The compact rolled format opens to reveal a world of calligraphy or imagery often framed by an ornamental silk border. Hanging scrolls appear deceivingly simple in construction but in reality are complex objects that require an understanding of their composition and inherent weaknesses in order to appropriately care and handle.

Definition

A scroll can be defined as an object constructed from multiple layers of paper or silk, upon which images or calligraphy are directly applied. The layers are fixed with diluted paste and attached to a mounting structure that allows the scroll to be rolled up when not in use. Andrew Hare, the Supervisory Conservator of East Asian Painting at the Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, Washington D.C., provides a detailed definition of a scroll in his article, Guidelines for the Care of East Asian Paintings: Display, Storage and Handling.

Scrolls are laminate structures made from heterogeneous materials. Simply described, an Asian painting or calligraphy is a thin layer of pigments adhered with animal glue to a flexible support of paper or silk. Typically, silk fabrics chosen to surround the central ‘image’ create a protective and decorative border. These elements are lined with several layers of paper and wheat starch adhesive and are combined to create an overall supporting structure. This integral mounting structure allows a painting to be ‘opened’ for display and ‘closed’ for storage.¹

This definition exemplifies some of the most characteristic features of hanging scrolls, their unique format, mounting structure and materials. Not mentioned in this definition is the tradition of remounting and restoration. Remounting is defined as “the process of

¹ Andrew Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” The Paper Conservator 30 (2006): 73.
detaching, repairing, and reattaching a surface to its support; in the case of a hanging scroll, a painting made of paper or silk is detached from silk borders, and its paper backing is repaired and reattached to new silk borders and fresh paper backing. Restoration is closely related to conservation and involves filling in missing or damaged areas on works of art by painting or retouching. China, Japan and Korea have longstanding, rich traditions of mounting and remounting. A hanging scroll can be remounted numerous times throughout its lifetime in order to preserve the scroll. The extremely detailed and historically rooted craft of mounting and remounting can be considered an art itself.

Hanging scrolls’ susceptibility to damage and deterioration due to their composition of organic materials and mounting format leads to the need for periodic remounting, however steps should be taken to prevent damage and slow down the inherent vices that are detrimental to the scroll nonetheless. A solid understanding of hanging scrolls (how they are made and what they are made of) combined with recognition of the subtle deterioration that happens on a daily basis, will undoubtedly result in better care. These interrelated issues - format, mounting structure, materials, damage, and deterioration - combined with preventative care and storage are the focus of discussion in the following sections.

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Formats

Hanging scrolls from China, Japan and Korea are similar in appearance but have subtle differences in proportion, decorative elements and size. Many of these subtle differences derive from the various architectural structures in each country where hanging scrolls are displayed. The eye level for viewers in a building in each geographic area, dictates the length and proportion of the scroll.\(^4\) For example, in Korea buildings have lower ceilings, and little space between pillars to hang scrolls so the top and bottom mounting silk is shorter.\(^5\) The overall size of a scroll also has an effect on elements that relate to its hanging such as hanging cords (cords attached to the top of the scroll by which it is hung) and eyelets (metal fasteners inserted into the upper wooden stave, which hanging cords are attached to). The width of the mounting dictates how many wall hooks will be required for hanging. If a scroll is over three feet wide, four eyelets are usually inserted into the upper stave (wooden rod at the top of the scroll to which eyelets are attached and where the paper and silk mounting structure is attached); three hooks would be required to support the hanging cord.\(^6\)

Some variations in scroll elements can be purely decorative while others have developed throughout centuries of artistic tradition. Scrolls can have knobs (handles at the bottom of the scroll attached to the roller rod) that are made of plain wood other knobs may be highly ornamented and made from ivory, jade, precious gemstones, lacquer, metal, and porcelain. Hanging cords vary in length, material and can be embellished with tassels. Decorative mounting elements can vary in pattern, color and

\(^5\) Ibid.
\(^6\) Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 75.
texture. In addition to the various elements on the scrolls themselves, hanging scrolls can come with a variety of components such as nested wooden storage boxes, silk wrappers and bags, and paper sashes. The elaborate packaging and presentation of hanging scrolls combined with the complex mounting structure and luxurious materials used, reinforces the precious nature of these paintings within Chinese, Japanese and Korean culture.

Surprises are rarely positive in museum storage environments. An understanding of what can be expected when unrolling a scroll is essential in ensuring that hanging scrolls are properly handled. A familiarity with mounting structures and the basic formats of hanging scrolls aids in the comprehension of scrolls as composite objects. Several components are joined together to construct hanging scrolls. Slight variations in mounting structures and elements, such as the presence of tassels can have influence how scrolls are stored and handled. An awareness of these format variations and elements can help prevent any unnecessary surprises in storage environments.

**Chinese Format**

Chinese mounting and conservation techniques are based on a traditional craft believed to have developed 2,000 years ago. Aesthetic and structural objectives were already summarized in the Tang dynasty (618-907 A.D.) and remained almost unchanged up to the present date. The diagrams below illustrate Chinese hanging scroll elements and terminology (figure 1-1), and the four basic styles of hanging scrolls (figure 1-2). Compared to Japanese and Korean styles, the top and bottom mounting

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8 Ibid.
support are longer in Chinese scrolls and are often much thinner. Chinese scrolls may have two short tying cords made of ribbon rather than one long tying cord as found on Japanese and Korean scrolls, but this is not always the case.

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Figure 1-1. This diagram shows terminology for elements on Chinese hanging scrolls.
Mounters and conservators are relatively free to make choices between mounting materials and style as long as the colors and designs harmonize with the painting.\textsuperscript{10}

**Japanese Format**

Hanging scroll mounting techniques were first introduced into Japan from China in the 6th century and techniques developed until the 16th century.\textsuperscript{11} At this time the three basic styles of hanging scrolls used today in Japan were established. The three basic


styles of Japanese hanging scrolls, *shin* (figure 1-4), *gyō* (figure 1-5), *sō* (figure 1-6), all have their own subtypes. The differences between them are mounting elements and subjects usually depicted but can also relate to art historical traditions.\(^\text{12}\) Japanese mounting generally uses a wider range of silks, brocades and damasks than Chinese scrolls and the proportions of Japanese mountings tend to be smaller than Chinese.\(^\text{13}\)

\(^{12}\) Ibid.

Figure 1-3. This diagram shows terminology for elements on Japanese hanging scrolls.
Figure 1-4. The shin style is usually used to mount religious painting such as the Mandala representation of Buddha.

Figure 1-5. This diagram shows the gyō style of mounting. The gyō style is the most common mounting style and is used for a wide range of subjects such as: Imperial autographs, warriors, colored paintings of nature, Taoist figures, Japanese poetry and calligraphy.
Figure 1-6. This diagram shows the sō style of mounting which can be wide or narrow. This is the most informal style of mounting usually applied on scrolls to be used in ceremonial tea rooms.

**Korean Format**

Korean mounting styles have been influenced heavily by wars and the Japanese occupation (1910-1945) so the “traditional” Korean mounting style is taken from ancestral portraits’ and Buddhist paintings that survived during the Choson period (1392-1910). Many Korean scrolls resemble Japanese-style mounting because of the large number of Japanese mounters working in Korea during the Japanese occupation. Even the Korean word for mounting, janghwang, was replaced by the Japanese word hyōgu. Because the traditional Korean mounting style is so illusive, no diagram of standardized elements and proportions is provided in this guidebook.

Chi-sun Park, Head Conservator of East Asian Paintings at Jung-Jae Conservation Center in Seoul summarizes the characteristics of traditional Korean scroll

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15 Ibid.
mounting in her article titled, *Traditional Korean Mounting (janghwang)*, the following is
a brief summary of these characteristics.\(^{16}\)

- Traditional Korean scrolls have a triangular hanging stave at the top, and a thick
  wooden roller at the bottom with wood or jade knobs.
- The shape and thickness of the staves is different from Japan and China. Korean
  staves are more triangular in cross section.
- The metal hanging rings are also relatively larger and incorporate floral motifs.
- Hanging cords are round and finished with knotted tassels at both ends.

\(^{16}\) Ibid., 119.
MATERIALS OF A HANGING SCROLL

Introduction

Paper, silk, pigments and ink, and binding agents are the most common materials used to construct hanging scrolls. Each is discussed in greater detail in the following sections. The combination of these materials and mounting elements such as hanging cords and knobs results in the finished product of hanging scrolls. Different types of paper are used for various layers of a scroll depending on the type and size of the scroll. Silk can vary greatly in appearance and function as does the use of pigments and inks. Dyeing paper and producing images is achieved by manipulating pigments in inks using an assortment of techniques. Binding agents also vary greatly in function by acting as an adhesive for the layers in the mounting support and as the adhesive for the pigments to adhere to each other and to attach to the support.

Understanding the main materials that make up hanging scrolls - paper, silk, pigments, inks, binding agents - should influence decisions made with regards to handling and storage. For instance, understanding that the pigment layer of a painting is only bound to the paper or silk support by a small amount of organic adhesive should influence the decision to insert a paper sash under the tying cord and around the scroll to prevent tying the scroll too tight, which can result in abrasion of the pigment layer. Another instance of how knowledge of hanging scroll materials, specifically their fragile nature, can influence storage is that once deterioration of materials is identified, cautionary wording should be placed on all storage containers to prevent damage and handling.
Paper

Paper is a medium and a structural support in hanging scrolls. Many substances have been used to create paper throughout time. Paper has been made from: bamboo, mulberry, hemp, corn and rice stalks, cotton, flax, silk, cocoons, reeds, moss, a kind of water fungus, and a variety and combination of other materials.¹ It can vary in color, size, thickness and tensile strength. Handmade paper usually made of paper mulberry, hemp or bamboo is commonly used in scrolls. Additives such as white clay, and gofun, discussed later, can be added during the paper making process to provide opacity.² Metal foils and powders can be added to paper as a decorative element.

Common Paper Names

Japanese traditional handmade paper made with bark fibers and hemp is called washi. Varieties of washi are:

- **Mitsumata** - fine-grained soft paper
- **Gampi** - fine, strong paper having a smooth lustrous surface³
- **Kōzo** - paper mulberry, long fibers, very durable, light weight, good wet strength, most often used in scroll mounting as backing paper ⁴

Chinese traditional handmade paper is called tōshi. A very common type of Chinese handmade paper is called xuan. Xuan paper is characterized by its smooth

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absorbent surface and is made of bamboo, mulberry, and rice straw and generally has shorter paper fibers.\textsuperscript{5} Korean traditional handmade paper is called \textit{hanji}, literally meaning Korean paper. \textit{Dak} is a common type of handmade paper made from paper mulberry.

\textbf{Silk}

Silk can be used for painting and mounting in hanging scrolls and is both practical and decorative.\textsuperscript{6} Any fabric can be used as a mounting material but silk is the most common.\textsuperscript{7} Produced from the cocoon of the silk worm, silk can be manipulated to create a variety of effects. In the past both fine and coarse-textured silks were used for paintings, and weaves varied from single threaded to double-threaded, from loosely woven to closely woven.\textsuperscript{8} The appearance and color of silk can vary through processes of dyeing, stenciling, embroidering, printing and painting. There are also elaborate silks such as gold brocade in which gold threads are woven into silk and open-weave silk gauze embroidered with fine gilded paper strips.\textsuperscript{9}


\textsuperscript{6} Sarah Burdett and Sydney Thomson, “Japanese Hanging Scroll: A Deconstruction” in \textit{Works of Art on Paper- Books Documents and Photographs: Techniques and Conservation, Contributions to the Baltimore Congress, 2-6 September 2002}, ed Vincent Daniels et al. (London: International Institute for Conservation, 2002), 33. As discussed by Sarah Burdett and Sydney Thompson silk components can have a practical as well as decorative function. A thin silk can be used on the upper section of the backside of the scroll which provides protection from dirt and handling when the scroll is rolled. Also the same silk can be used at the bottom corners of the reverse side to help strengthen the scroll at a point of weakness.


\textsuperscript{9} Sarah Burdett and Sydney Thomson, “Japanese Hanging Scroll: A Deconstruction,” 32.
Binding Agents

Binding agents are used to attach layers of the scroll together and also to bind pigments to each other and to the support.¹⁰ There are many different types of binding agents used for different purposes in varying degrees on different areas of scrolls. The most common type of binding agents are starch pastes, which have been used for hundreds of years, and are either made from flour, a mixture of gluten and starch, or from pure starch.¹¹ Most pastes used in the construction and mounting of scrolls are characterized by their reversibility with the application of water.¹²

Common Binding Agents

- Wheat starch paste - flexible, reversible paste with good aging properties, made from wheat starch powder that is cooked with water and used to join the different layers of lining paper in the process of mounting and remounting.

- Aged wheat starch paste, funu-nori - soft and reversible aged paste, used in a very diluted form. It is made from wheat starch powder that is cooked with water then aged for up to ten years and used to paste the second and consecutive layers of backing paper. It is characterized by good stability, reversibility and absence of color and flexibility.¹³

- Seaweed paste, funori - is a product from seaweed found mostly in Japan that has been used as an adhesive and a consolidant for centuries.¹⁴ Uses for seaweed paste include sizing paper, consolidating flaking and powdering paint, repairing

¹⁰ Kenzo Toshi and Hiromitsu Washizuka, Characteristics of Japanese Art that Condition its Care (Japan: Japanese Association of Museums, 1987), 95.


¹² Kōjirō Ikegami and Barbara B. Stephan. Japanese Bookbinding: Instructions from a Master Craftsman, 22.


applied leaves (gold and silver) and mica, backing paintings when mixed with animal glue.\(^{15}\)

- Rice flour paste - similar to wheat starch paste and can be used interchangeably, commonly used for joining parts of a scroll.\(^{16}\)

- Animal hide glue, nikawa - glue derived from animal hides, mostly used as a binder for pigments.\(^{17}\)

- Animal hide glue sized with alum, dosa - a sizing of diluted animal glue and alum.\(^{18}\)

When discussing binding agents it is important to mention alum, which is a sizing ingredient that hardens glue. Sizing is a surface coating applied to paper or silk making them stronger, less absorbent and more resistant to abrasion.\(^{19}\) Different types of paper and silk are combined to create scrolls and both are absorbent materials. In order to control the flow of ink and paint on the surface and the degree of penetration of paint into the support, paper and silk is usually sized with a solution of animal glue and alum, dosa, producing a smoother, slightly water-resistant surface.\(^{20}\) Alum reduces the dimensional change of the support while the painting is being executed and when the finished painting is exposed to varying humidity.\(^{21}\) It makes glue partially insoluble so it protects the painting from water action during mounting.\(^{22}\)


\(^{17}\) Oka. “Advantages and Disadvantages of the Hanging Scroll Format from a Conservation Viewpoint,” 169. Nikawa is a solid form of protein extracted from the skin of rabbits, cattle or deer.


\(^{19}\) Kōjirō Ikegami and Barbara B. Stephan. *Japanese Bookbinding: Instructions from a Master Craftsman*, 121.


\(^{21}\) Pasnak, Ekaterina, Season Tse, and Alison Murray. “An Investigation in the Gelatin Sizing of Far Eastern Paintings on Silk.” In *Scientific Research on the Pictorial Arts of Asia: Proceedings of the Second*
Pigments and Ink

Pigments and inks are applied onto the paper and silk surfaces with diluted amounts of binding agents and water to create the intricate designs on scrolls. Most pigments and inks used on hanging scrolls are of mineral and vegetable origin. Mineral powder pigments were made by crushing colored stones such as malachite. Ground mineral pigments could be mixed with a small amount of nikawa to create a paintable mixture. Many colored pigments and inks came in dried cake and stick form. Binding agents were mixed with the pigments and pressed into molds and dried. These sticks were ground with water to produce a solution that was used for painting. Later, animal and vegetable dyes and synthetic colors were introduced. Some colored dyes were mixed with fine ground gofun then mixed to a thick paste with nikawa and then shaped into sticks and dried to form gouache watercolor. Metal paints and foils have also been used in paintings.

Japanese, Chinese and Korean pigments and inks are generally very similar with a few exceptions. An especially interesting and regionally specific pigment in Asian paintings relates to the color white. Shell white, gofun, is a special pigment specific to Japanese painting, consisting of calcium carbonate. Shell white is made by

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22 Ibid.

23 Kenzo Toshi and Hiromitsu Washizuka, Characteristics of Japanese Art that Condition its Care, 52.


25 Ibid.

26 Kenzo Toshi and Hiromitsu Washizuka, Characteristics of Japanese Art that Condition its Care, 52.
weathering oyster and clam shells and crushing them. Lead and clay whites were used in China. They were introduced to Japan, but by the late sixteenth early seventeenth century gofun replaced lead white almost entirely. Unlike lead white, Gofun does not discolor and is not toxic. Gofun can be mixed with other colorants and dyes to produce varying tints and shades. It is important to note that many pigments and dyes are commonly used throughout East Asian paintings, such as malachite and cinnabar, but as many as 600 different pigments exist and can be used in combination with each other and in varying concentrations. This makes identification of specific pigments or dyes extremely challenging, and this task should be carried out by a professional conservator.

**Common Pigments and Dyes– Mineral and Plant**

- **Reds**- Cinnabar, red standard, vermillion, red ochre, red lead, safflower, madder, lac (purple-red), cochineal dye
- **Yellows**- Mineral yellow, reaglar, orpiment, yellow ochre, gamboge
- **Blues**- Azurite, flat blue, layered blue, light blue, granulated blue, indigo, Prussian blue, dayflower, ultramarine
- **Greens**- Malachite, peacock green, verdigris, granulated green
- **Whites**- White chalk, white clay, lead white, shell white (gofun)
- **Black**- Black paste, ink (made from soot or lamp-black pigment)

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28 Ibid.

Mica and Metal Paints

- Leaf and foils- metal, gold and silver
- Metal powder paints- pulverized gold and silver powder
- Mica- ground mica, can give a similar appearance to silver leaf ³⁰
- Silver could be imitated on Japanese prints and paintings by tin³¹


³¹ Ibid.
TYPES OF DETERIORATION AND INHERENT WEAKNESSES

Introduction

As discussed by Andrew Hare, “East Asian paintings are subject to three types of interrelated deterioration: chemical and biological degradation dependent on the environment, and physical damage caused by use, neglect and sometimes, unfortunate restorations.”¹ These types of deterioration all manifest themselves in the form of creases, cracks, tears, flaking, delamination and general wear. The methods used to mount hanging scrolls may also affect their condition. Many of the defects listed below can be in response to previous mounting and restoration techniques of the past.

Creases, cracks, tears, flaking and delamination are interrelated types of damage. Creases lead to cracks; cracks lead to tears; creases, cracks and tears can lead to flaking. Distortion and delamination can either cause these issues or can develop in response to them. All of these issues can be caused by poor handling, inadequate storage methods, poor quality materials, poor restorations, and environmental concerns. Examples of each of these condition issues are provided in each section with a brief discussion on the possible causes of the condition issues. Because these types of damage are interrelated the exact causes of these issues cannot be known. Several of the images of scrolls used to discuss condition issues in the following sections are in the Harn Museum’s collection, and conservation has been recommended by specialists. The condition of the scrolls is not a reflection of the care provided by the Harn Museum.

¹ Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 73.
Creases and Cracks

Creases and cracks are usually present in older hanging scrolls and can be a result of a variety of interrelated issues including construction, wear, and materials. Creases and cracks caused by repetitive compression, curling, and too much adhesive are likely to lead to abrasion and serious ridges. As stated earlier Japanese kōzo paper has long fibers with good tensile strength. Chinese paper has shorter fibers that can lead to easier creasing and breakage of the fibers. Once an area has fiber breakage and starts creasing, then all bending forces are concentrated in these areas which will result in more severe creasing and cracks.²

When a scroll is unrolled the backside of the scroll is compressed and the inside layer is stretched.³ Reverse compression also happens, so therefore when a scroll is rolled, the front side, including the pigment layer, is compressed, and the backside is stretched.⁴ This compression combined with the repetitive action of rolling and unrolling can cause the surface to break and weaken, developing cracks, creases and severe ridges.⁵

When a scroll is kept rolled for a long time both the inside and outer layer tend to stay somewhat fixed in a curled position. When a scroll is stored for a long time the rolled shape becomes the natural shape of the scroll.⁶ The degree of curling depends

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³ Ibid.
on the thickness of the sheet, its elasticity and its rigidity. When the scroll becomes brittle, the external bending force required to unroll the scroll breaks the sheet. Brittle and deformed scrolls are more likely to have breaks parallel to the roller. Breaks in the scroll tend to occur where the curvature of the scroll is at its largest. Hence, the lower parts of the scroll receive the most breaks.

Stiffness of a scroll from the adhesives used for mounting is another cause of the fibers losing flexibility and breaking, resulting in creases and cracks. Also the joins of different elements may be too hard, causing cracking of the seams when a hanging scroll is rolled. Excess wheat starch paste can make scrolls stiff. When layers are especially thick, the inside and outside layers have differences in the curve when rolled, which causes separation and de-lamination of the support layers.

Restorations and handling in general can cause visible damage. Creases occur from the edges of reinforcement strips added in previous restorations. Vertical creases in the middle and upper parts of a hanging scroll can be caused by tying the scroll too tightly or by simply gripping the scroll too tightly.

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7 Kenzo Toshi and Hiromitsu Washizuka, *Characteristics of Japanese Art that Condition its Care*, 105
8 Kenzo Toshi and Hiromitsu Washizuka, *Characteristics of Japanese Art that Condition its Care*, 115.
10 Lin, “Preservation and Conservation of Traditional Antique Chinese Painting and Calligraphy Seen Through Observation and Examination of Works of Art,” 95.
Figure 3-1. This image shows a severe, large horizontal crack running the width of the scroll. This crack is fairly straight and could be the result of being fixed in a rolled position for a long time and then unrolled or from stiff adhesives causing breakage. Detail of *Monkeys in a Mountain Landscape* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink and color on paper, Gift of General James A. Van Fleet, 1988.1.23, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.
Figure 3-2. This image shows two moderate horizontal cracks. These cracks do not run the entire width of the scroll and could be a result of poor handling or their proximity to the bottom of the scroll where the curvature is the greatest. Smaller irregular shaped creases are scattered throughout the image which could be related to the larger cracks or poor handling. Detail of *Soldiers in the Mountains* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink, color and gold on paper, Gift of General James A. Van Fleet, 1988.1.24, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.
Figure 3-3. This image shows numerous cracks and creases ranging in size and degree. Detail of *Soldiers in the Mountains* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink, color and gold on paper, Gift of General James A. Van Fleet, 1988.1.24, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.
Figure 3-4. This image shows how numerous cracks and creases can be concentrated in one area.

**Tears**

Hanging scrolls can vary greatly in length and width. Because of the weight of some scrolls, areas near the top stave and bottom roller are common areas for tears. If the roller is too heavy or has been hanging for too long, tears may appear along the top stave (figure 3-5).\(^{12}\) If a tear develops at the bottom roller, the continued stress can cause the tear to worsen and eventually the bottom roller could come almost completely disconnected (figure 3-7).

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Figure 3-5. This image shows a severe tear located at the top of the hanging scroll directly underneath the upper stave. This scroll may have been hung for too long or because of becoming brittle over time the paper and silk layers have simply broken due to the applied force when being opened and closed.
Figure 3-6. This image shows a small tear on the backside of a scroll under the stave. This tear could have developed due to numerous reasons including: being hung for too long, the wooden stave warping, or embrittlement of the paper and silk layers.
Figure 3-7. This image shows a roller rod that has come almost completely disconnected from the mounting structure. This condition could have developed from a small tear near the rolling rod that eventually worsened. The tear may have developed in response to the weight of the roller rod or because of improper mounting techniques. The cause of this condition issue was never recorded, making it challenging to know exactly how the roller rod became partially disconnected, but it is possible that an initial tear was the cause.

**Flaking and Losses**

Flaking and losses on scrolls mainly affects the pigment layers. The pigment layers on Asian paintings are fragile due to the delicate nature of their construction and responsiveness to fluctuating temperature and humidity. The pigment layer on an Asian painting is very porous, with pigment grains imperfectly covered by and mixed with a glue medium, leaving many minute air spaces in the layer making it susceptible to deterioration.  

Some pigments such as shell white, *gofun*, are susceptible to flaking because of adhesive deterioration. As discussed by East Asian paper conservator Sandra Grantham, in “Some Painting Techniques and Materials used in Japan and the Far East,” shell white was known to become whiter with age, and this was because the binder deteriorated, leaving more pigment particles exposed to reflect light from the matte surface but at the same time, it became fragile and prone to powdering or flaking.  

General deterioration of binding agents causes the adhesive power to loosen and paint to flake off or become chalky.

In addition to adhesive deterioration, pigment or paint layers with animal binding mediums can often become stiff and less flexible. Then when the scroll is rolled the

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paint layers do not curve as easily as the silk or paper support, resulting in flaking and losses.\textsuperscript{15} Additionally, surface coatings applied during conservation and mounting such as heavy sizing and consolidation of flaking paint with animal gelatin on the surface of the paint can cause the surface to shrink and flake off.\textsuperscript{16}

Many types of deterioration such as creasing and cracks are interrelated, and should be considered when looking for causes of flaking and losses in hanging scrolls. The same compression and tension that can cause creases and cracks also causes related flaking of various degrees.\textsuperscript{17} When the scroll is rolled, the pigment layers may be abraded when their surface comes in contact with the backside of the scroll. This happens on the areas that are higher than the rest of the front surface, such as those areas with cracks and creases or where the scroll parts are joined.\textsuperscript{18}

\begin{thebibliography}{9}
\bibitem{15} Nishio, “Maintenance of East Asian Paintings (examination),” n.p.
\bibitem{16} Ibid.
\bibitem{17} Lin, “Preservation and Conservation of Traditional Antique Chinese Painting and Calligraphy Seen Through Observation and Examination of Works of Art,” 96.
\bibitem{18} Nishio, “Maintenance of East Asian Paintings (examination),” n.p.
\end{thebibliography}
Figure 3-8. This image shows a small loss on the pigment layer of a hanging scroll. The loss is located along a horizontal crack. The loss is fairly rectangular in shape and may have developed in response to the crack. If the crack was continued through the loss it would run through the center. Small pieces above and below the crack may have flaked off due to the repeated action of opening and closing or because of stiff adhesives. Detail of *Soldiers in the Mountains* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink, color and gold on paper, Gift of General James A. Van Fleet, 1988.1.24, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.
Figure 3-9. The losses seen in this image are irregularly shaped and vary in size and degree. Although there are mild cracks and creases throughout the scroll, the losses are not located directly on them. These losses may have been a result of abrasion or deterioration of the binding agents or pigments. Detail of *Monkeys in a Mountain Landscape* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink and color on paper, Gift of General James A. Van Fleet, 1988.1.23, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.
Figure 3-10. This image shows small, irregular shaped losses near not only cracks and creases but also a large area of discoloration. These combined issues could indicate that this area has received conservation treatment in the past. Previous restoration techniques may be responsible for the discoloration, embrittlement and related cracking and flaking of the painting. Detail of *Monkeys in a Mountain Landscape* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink and color on paper, Gift of General James A. Van Fleet, 1988.1.23, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.

**Distortion**

In addition to physical distortion, such as curling caused by long-term storage in a rolled position, gravitational pulls and stresses during hanging can cause undulations and distortion in scrolls. The built in tension of the paper, silk and binding layers, added to a scroll that has taken on a fixed shape from being rolled may, cause it to appear slightly concave or convex when unrolled and displayed.\(^{19}\) How a hanging scroll is assembled and constructed can have an impact on the level of distortion a scroll

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\(^{19}\) Toishi, “The Scroll Painting,” 20.
experiences throughout its lifetime. The improper placement of hanging cords and hanging fasteners can cause flexing to the upper wooden stave which can affect the tension running throughout the entire scroll.\textsuperscript{20} Also, if the weight of the lower rod is too heavy, stretching and stress can take place.\textsuperscript{21} If scrolls have been seriously affected by extended periods of hanging, when rerolled the parts of the scroll will be in uneven contact with each other and can possibly cause more damage. In general all forms of distortion including warping, undulations, flexing and stresses can lead to cracks, tears and flaking.\textsuperscript{22}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{scroll_side_view.png}
\caption{This image shows a scroll viewed from the side when lying open on a table. The wavy undulations seen here may be related to any of the factors discussed above.}
\end{figure}

\begin{flushright}
\textsuperscript{20} Lin, “Preservation and Conservation of Traditional Antique Chinese Painting and Calligraphy Seen Through Observation and Examination of Works of Art,” 96.
\textsuperscript{21} Ibid.
\textsuperscript{22} Ibid.
\end{flushright}
Figure 3-12. This image shows a large wavy undulation where the painting is attached to the lower mounting structure. This distortion may be caused by the built-in tension of the layers and how the scroll was assembled.

**Stains and Discoloration**

Stains and discoloration can affect the painting and the mounting structure. Some of the organic components that make up paper, pigments and binders are susceptible to discoloration and deterioration over time. Combining these components causes complex interactions to take place that produce visible deterioration within the scroll. Backing paper and primary support layers can discolor from contact with malachite and azurite pigments, especially when the paper or silk support is acidic.\(^{23}\) The yellow pigment gamboge is more likely to discolor in slightly alkaline conditions.\(^{24}\) The presence of alum in paintings can manifest itself through discoloration and

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\(^{23}\) Nishio, “Maintenance of East Asian Paintings (Examination),” n.p.

embrittlement of the support layer.\textsuperscript{25} If too much alum is used, the pigment layer may exfoliate or white streaks or salt efflorescence may occur and colors can lose their brilliance.\textsuperscript{26} More recently it has been accepted that alum promotes acidity, and its use is in decline.\textsuperscript{27} Poor restorations can also result in areas of discoloration.

Figure 3-13. This image shows a large circular area of discoloration, possibly the result of a poor restoration. Detail of *Monkeys in a Mountain Landscape* by Shin Yoon-bok, Choson Dynasty (1392-1910), late 18th Century, Ink and color on paper, Gift of General James A. Van Fleet, 1988.1.23, Samuel P. Harn Museum of Art. Photo credit Randy Batista Photography.

\textsuperscript{25} Ekaterina Pasnak, Season Tse, and Alison Murray. “An Investigation in the Gelatin Sizing of Far Eastern Paintings on Silk,” 82.

\textsuperscript{26} Ibid.

\textsuperscript{27} Sarah Burdett and Sydney Thomson, “Japanese Hanging Scroll: A Deconstruction,” 34.
Inherent Weakness

The two factors that contribute to a hanging scroll’s overall level of inherent weakness are the materials used and the methods of construction. The organic components of a hanging scroll discussed above, such as paper, silk and binding agents, are inherently weak due to their very nature, but the other non-organic components of a hanging scroll contribute to the overall level of weakness built into a scroll. Like any type of object, scrolls can have elements break, become loose or weaken over time and become detrimental to the object as a whole. Anything attached to the paper and silk elements such as hanging strings, metal fasteners, knobs and wooden rods can become loose or unattached and can potentially cause more damage to the scroll.

The metal loops inserted into the top rod that hold the hanging string must be securely attached so that they can support the weight of the hanging scroll. In addition, hanging strings can also become weak and must be strong enough to support the scroll (figure 3-15). If the metal loops or hanging strings are unable to support the

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29 Ibid.
scroll, the result can be a disastrous fall while on display. Knobs can also break or become loose, which can cause unnecessary damage while rolling and unrolling (figure 3-16).\textsuperscript{30} The wooden rods at the top and bottom of the scroll have a great effect on the overall structure and stability of a scroll. The wooden rods can warp if the wood is not correctly aged, and the grain of the wood must also be straight.\textsuperscript{31} Also, if the diameter of the roller is small, damage can be caused by rolling the scroll around such as small diameter.

In all of the above elements, full breakage or separation is not always the case. These elements can become partially separated or loose, which can result in general distortion and stress being applied throughout the scroll structure. A slight distortion in any of the elements mentioned above can have a major impact on the hanging scroll.

Figure 3-15. This image shows hanging strings that have become weak and torn apart.

\textsuperscript{30} Ibid.

\textsuperscript{31} Ibid.
Figure 3-16. This image shows a hanging scroll with a broken and detached knob.
ENVIROMENTAL CONCERNS

Maintaining a stable environment is absolutely necessary for the preservation of scrolls. Extreme fluctuations in temperature, humidity and light levels will have disastrous effects on hanging scrolls. The organic and absorbent materials that make up these fragile objects can easily be damaged through extended periods of display and exposure to unstable environments. Environmental monitoring and regulating periods of display is crucial for the care of hanging scrolls.

Light

Works on paper are highly sensitive to light energy in any spectrum, and this holds true for hanging scrolls. Light provides the energy to fuel destructive chemical reactions within paper that contribute to the deterioration of the objects.¹ More specifically, light energy is absorbed by the chemical bonds in organic molecules within an object, thus initiating the sequence of chemical reactions that result in degradation. All deleterious effects created by light are cumulative and irreversible. The three different types of light, ultraviolet, infrared, and visible, have varying effects on works on paper.

Ultraviolet light is the shortest most energetic form of radiation and thus is potentially the most dangerous. Ultraviolet radiation causes significant alteration to organic materials and must be eliminated entirely. The changes in paper caused by ultraviolet radiation often show up as physical damage such as chalking, crazing, cracking. Infrared light causes damage because the absorbed energy heats up the surface of an object speeding up the damaging chemical processes. Infrared radiation

also heats the air resulting in instability in relative humidity. Visible light can be understood in terms of *illuminance*, the amount of light falling on a unit area, measured in footcandles or lux.

The amount of change that occurs within an object is dependent on the nature of the object and the quantity and intensity of light falling on it. Because hanging scrolls are mostly made up of organic materials they are particularly light sensitive. Light degrades the paper support on which the image is executed, gradually breaking down the structure and strength of cellulose in the paper. Long term exposure leads to embrittlement of silk and paper, causing stiffening of the laminate mounting structures. Light can cause paper and silk to fade, yellow, or darken. Fading is related directly to the amount of light received (time multiplied by intensity), but it is also influenced by wavelengths and other factors such as the humidity level and the nature of the substrate. Different pigments and dyes used in paintings and mountings make them susceptible to rapid or uneven fading. Even binding agents such as seaweed paste is

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6 Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 74.


8 Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 74.
shown to bleach more under extreme light conditions, becoming slightly more brittle yet still flexible.\(^9\)

**Humidity**

Relative humidity can be defined as the proportion of the amount of water vapor in a given quantity of air compared to the maximum amount of water vapor that the air could hold at that same temperature, expressed as a percentage.\(^10\) Fluctuations in relative humidity will cause dimensional changes in an object. Hydroscopic materials, such as those that compose scrolls are extremely sensitive to fluctuations in relative humidity. Dryness and high humidity can affect scrolls in similar ways such as causing cockling, distortion, and delamination.

All layers of a hanging scroll are affected by humidity. Extreme highs and lows in humidity levels will cause rapid stress in paper and silk that can result in strength loss and embrittlement. Brittle paper and silk are more susceptible to mechanical damage such as breakage. The pigment layers of a painting expand at different rates from the paper or silk support in high humidity.\(^11\) Binding agents such as *nikawa* are vulnerable to microbiological attacks in high humidity and brittleness in low humidity.\(^12\) Additionally, moisture swells hardened wheat starch paste, and temporarily loosens the adhesive power.\(^13\) As discussed by Yoshiyuki Nishio, the front support layer and reverse backing layer suffer from the disproportion in expansion and shrinking when exposed to

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fluctuating humidity. The surface shrinks when dry, cracking the surface of the silk or paper support and causing it to lift up or separate from the backing paper layer.

Mold and fungi grow as a result of poor environmental conditions, especially high humidity. As discussed by Andrew Hare, moisture absorbed by the mounting will further encourage foxing, mold growth, staining and delamination of the mounting structure. High humidity caused by weak and poor air circulation can result in damage, visible on the front and back of a hanging scroll as brown spots referred to as foxing (figure 4-1). As discussed by Xie Yulin and Chen Yuansheng, “Foxing on Backs of Chinese Paintings,” “foxing is a complex process and results from a series of reactions caused by moisture, air pollutants and fungal growth.” Foxing usually appears after long periods of time, and paper affected by foxing becomes weaker and friable.

\[\text{fluctuating humidity.}^{\text{14}}\text{ The surface shrinks when dry, cracking the surface of the silk or paper support and causing it to lift up or separate from the backing paper layer.}^{\text{15}}\]

\[\text{Mold and fungi grow as a result of poor environmental conditions, especially high humidity. As discussed by Andrew Hare, moisture absorbed by the mounting will further encourage foxing, mold growth, staining and delamination of the mounting structure.}^{\text{16}}\]

\[\text{High humidity caused by weak and poor air circulation can result in damage, visible on the front and back of a hanging scroll as brown spots referred to as foxing (figure 4-1). As discussed by Xie Yulin and Chen Yuansheng, “Foxing on Backs of Chinese Paintings,” “foxing is a complex process and results from a series of reactions caused by moisture, air pollutants and fungal growth.”}^{\text{17}}\]

\[\text{Foxing usually appears after long periods of time, and paper affected by foxing becomes weaker and friable.}^{\text{18}}\]

\[\text{14 Ibid.}^{\text{14}}\]

\[\text{15 Ibid.}^{\text{15}}\]

\[\text{16 Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 74.}^{\text{16}}\]


\[\text{18 Xie Yulin and Chen Yuansheng, “Foxing on Backs of Chinese Paintings,” 92.}^{\text{18}}\]
Figure 4-1. A) This image shows in full length a painting affected by foxing. B) This is detail that shows the numerous spots of foxing scattered throughout the scroll. *Scholar in a Garden* by Chang Sung-op, Choson Dynasty (1392-1910),
STORAGE

There are numerous ways to approach the storage of scrolls, ranging from a basic level of protection to a multilayered storage solution. Several factors should be considered when deciding upon a storage method for a scroll. The size, shape, materials and the overall condition of the scroll should be taken into consideration. The decision should also be influenced by the existing storage furniture, the availability of storage space and housing supplies. In addition, the desired level of access to the scrolls should be considered and appropriate labeling techniques should be utilized. Labeling the outside of storage containers is a small step that can greatly reduce unnecessary handling and facilitate organization. Fragile objects in particular should have cautionary wording placed on labels. Labeling is an essential step in the proper storage of scrolls.

Scroll Storage Methods

Below is a summary of methods that can be used when storing hanging scrolls in museum collections. A variety of these approaches and materials can be used interchangeably. Common preservation materials are mentioned such as Ethafoam®, Tyvek®, Filmoplast® and Volara®, which are all brand names.¹ Other preservation materials can be used.

¹ Ethafoam® is the brand name of the Dow Chemical Company for polyethylene microfoam which is inert. Tyvek® is the brand name of Dupont for a barrier product made from high density polyethylene fibers. Filmoplast® is the brand name of Neschen for acid and solvent-free tapes. Volara® is the brand name of Sekisui Voltek for fine-celled, irradiation crosslinked foam.


Wrapping and Cushioning

Simply lining shelves or drawers with a soft cushiony material such as Volara and placing scrolls on them is an option. Ideally scrolls should be wrapped in a protective material such as unbleached cotton muslin, Tyvek or even acid-free tissue or paper. As discussed by Andrew Hare, “when making a wrapping cloth, sizing the square of the cloth diagonally up the scroll will require less material and allow for easier handling and compact storage.”\(^2\) Cotton muslin can be substituted for acid-free paper or Tyvek.\(^3\) Wrapping the scrolls protects them from soil and dust, and the wrapping material can easily be replaced if needed. Identifying numbers can be easily attached to the wrappers (figure 5-1). Along the same lines of providing protection to scrolls by wrapping them, custom bags can be made of Tyvek or muslin. The bag is cut and sewn to the shape of the object and is then tied with a cord with the label attached to it.\(^4\)

Whether the storage method uses wrappers or bags, or places scrolls on shelves or in drawers, identifying information for the scrolls should be placed near the storage location to reduce handling. Providing a simple printout from the database or even a handwritten list with identifying numbers will minimize handling when looking for a specific object (figure 5-2). Although this storage method provides a level of protection and accessibility, the scroll is not fully supported and weight is not distributed evenly. This storage method can be enhanced by incorporating foam blocks to support the knobs and distribute weight more evenly throughout the scroll.

\(^2\) Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 80.

\(^3\) Ibid.

Figure 5-1. This image shows a scroll that has been wrapped in unbleached cotton muslin with the accession number written on the outside of the wrapper.

Figure 5-2. This image shows a sheet with identifying information placed in a drawer with scrolls to minimize handling.
Figure 5-3. This image shows a scroll that is stored using minimal preservation techniques. This scroll has been wrapped in tissue and acid-free paper and tied closed with twill tape and is simply placed on open shelving.

**Acid-Free Archival Boxes**

Placing scrolls in acid-free archival boxes protects scrolls from soil, dust, and light and allows for easy handling. The use of rigid boxes also allows for boxes to be stacked. Boxes can be purchased in a variety of sizes and types and can have clamshell lids, overlapping lids and drop down sides. Boxes can be purchased pre-scored and cut for easy assembling. Pre-scored and cut boxes have the advantage that they can be assembled without the use of any adhesives. Boxes can also be purchased assembled with metal edges for structural reinforcement (figure 5-4). Some prefabricated boxes have slots to support the knobs of hanging scrolls so that the whole scroll “floats” within the box. Custom boxes can also be made in-house using archival materials. The Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian
Institution, in Washington D.C., provides an excellent PDF on their website that adapts useful features of traditional wooden scroll boxes to make storage boxes out of acid-free corrugated board blanks.¹

The interior of any box can be enhanced by using archival materials to support the scroll. A simple U-shaped sheet of Volara placed inside the box can cradle a scroll. Scrolls that are wrapped in a protective material can be placed in boxes along with a cord that helps lift the scroll in and out (figure 5-5). Ethafoam blocks can be cut to shape to act as cradles for the knobs, mimicking the cradles found in traditional wooden storage boxes.

Figure 5-4. These images show prefabricated, metal-edge acid-free boxes.

¹ http://www.asia.si.edu/research/dcsr/eapcs.asp
Figure 5-5. A) A scroll wrapped in unbleached cotton muslin and stored in archival box with a cord to help lift the scroll in and out. B) Scroll being picked up by cord.

Figure 5-6. This image shows a collection of hanging scrolls housed in standard-sized archival boxes stored on open shelving, allowing them to be safely stacked.
Steps to Enhance the Interior of a Scroll box

One method to enhance the interior of a scroll box utilizes Ethafoam, Tyvek, Filmoplast and tissue. The images below show the interior support for a premade scroll box created in-house (figure 5-7 and 5-8). When housing scrolls it is important to choose or create a box that can comfortably accommodate the length and diameter of the scroll.

Figure 5-7.

Figure 5-8.
1. Line the bottom of an archival box with tissue.

2. Cut two Ethafoam blocks to fit snugly into each end of the scroll box.

3. Cut channels slightly larger than the size of the hanging scroll knobs in the sides of the Ethafoam blocks. Cut the channel for the scroll bar slightly off center to accommodate the semi cylindrical bar at the top and to make the scroll lay in the center in the box.

4. Cover the Ethafoam blocks with Tyvek and use Filmoplast tape to secure the Tyvek in place.

5. Wedge the wrapped Ethafoam blocks into the corners of the box.

6. Wrap scroll in a tissue or paper.
7. Gently place scroll inside box with knobs resting securely on wrapped Ethafoam blocks.

8. Place identifying label with image on outside of the box at both ends and on sides.

Original Wooden Boxes

Utilizing the existing wooden storage boxes that accompany a scroll is of course an option for storage. It is general museum practice to avoid using any wood product in storage because of harmful off-gassing. The benefits and drawbacks of using these boxes should be considered before adopting this method for storage. If the original box is in good, stable condition, the scroll can simply be stored in it and placed on a shelf or in a cabinet. This method of storage can be taken one step further by placing the wood storage boxes in archival boxes (figure 5-9 and 5-10). Placing a box inside a box may seem redundant but it has advantages. Placing wood storage boxes inside standard sized archival boxes can allow for identifying labels to be placed on the outside of containers without causing any damage to the scroll box. Another benefit of using standard size boxes is that they can be safely stacked. Because the original wooden
scroll boxes in a collection will likely not all be the same size, tissue or foam blocks can be used to fill up extra space and secure the box inside the archival box.

Figure 5-9
Cushioning and boxing scrolls are great preservation steps because of the support and protection provided. The Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, in Washington D.C., promotes optimal storage by utilizing a multi-layered housing system. Discussed in great detail by Andrew Hare in “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling”, the Freer Sackler Galleries use passive micro-climates to augment modern climate control.

- **Layer 1**: Wrap each object in unbleached cotton muslin as an initial protective layer.
- **Layer 2**: The wrapped scrolls can be placed as is in drawers or placed in boxes.
- **Layer 3**: Scroll is then placed in closed storage boxes to create an initial microclimate. The labeled boxes are then placed within cases, drawers or on shelves.
- **Layer 4**: Cases are in a closed climate controlled storage room.

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2 Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 73.
The Freer and Sackler Galleries storage facilities have adopted this system to suit the needs of particular scrolls. Some scrolls are stored in their original wooden boxes on shelves, while others are simply wrapped in an initial protective layer and placed in drawers. Scrolls are always stored in multiple layers of protection and they always have identifying information readily available to reduce handling.

Figure 5-11. This image shows scrolls wrapped in an initial protective layer and placed inside a large drawer in the Freer and Sackler Galleries’ art storage facility in Washington D.C.
Figure 5-12. This image shows scrolls wrapped in an initial protective layer and placed inside an archival box and placed within a large drawer at the Freer and Sackler Galleries’ art storage facility in Washington D.C.

**Scroll Storage Tips**

No matter what method is used to store scrolls, utilizing a protective paper sash when the scroll is rolled up will benefit the scroll. Without the sash, the outer layer of covering silk can easily be damaged by mishandling or by securing the tying cord too
tightly at the middle of the scroll (figure 5-13). As discussed by Andrew Hare, “repeated handling in this area weakens the outer layer of the scroll causing successive layers of the mounting inside to crease.” Utilizing a protective paper sash in the center of the scroll that goes under the hanging cords, tucks under the upper scroll bar and wraps around the scroll will help prevent damage (figure 5-14). Mulberry paper is recommended but acid-free paper can also be used.

Figure 5-13. This image shows the outer layer of silk that has been worn and frayed from repeated handling and tying of the scroll without a paper sash.

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3 Ibid., 80.
4 Ibid.
Figure 5-14. This image shows a paper sash wrapped around a hanging scroll.

Paper sashes are a safe and inexpensive addition to storage in any situation. Another addition that can be considered but can also be very costly is the use of a futomaki. A *futomaki* is a wood roller that increases the diameter of a scroll, reducing the stress caused when rolling and unrolling.\(^5\) As discussed earlier, when a scroll has a particularly small diameter roller rod, creases and cracks are more likely to occur because the scroll is rolled around such a small diameter. Lateral cracking of the scroll is connected intimately with the curvature on rolling, so it is useful to make the curvature less.\(^6\) In order to prevent further creases and cracking the use of a futomaki can be incorporated into storage.

A futomaki looks like circular rod generally the width of the scroll that has been cut in half and hinged. Usually made out of seasoned paulownia wood, the *futomaki* has a groove cut on the inside that holds the roller at the bottom of the scroll (figure 5-15 and

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5-16). Rolling the scroll around a larger diameter minimizes stress and reduces creases and cracking. To be efficient, the futomaki should be about double the size of the diameter of the roller. A more inexpensive version of a futomaki can be made by cutting a circular channel the size of the roller rod into a circular foam rod (figure 5-17 and 5-18). The foam rod can be covered with a stretchy unbleached cotton fabric such as stockinette (figure 5-19).

Figure 5-15. This image is a side view of a scroll wrapped around a wooden futomaki. The dark wood is the hanging scroll knob.

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Figure 5-16. This image shows a scroll wrapped around a wooden futomaki.

Figure 5-17. This image is a side view of a scroll wrapped around a futomaki made out of foam and stockinette.
Figure 5-18. This image shows a scroll wrapped around a *futomaki* made out of foam and stockinette.

Figure 5-19. This image shows the circular channel cut into a foam road to make an inexpensive *futomaki*. The material covering the foam is cotton stockinette.
Another way to enhance the storage of scrolls is to utilize tags made out of soft materials. Avoid attaching anything that is too rigid or has sharp edges, such as thick cardstock tags, that may scratch or harm the scroll. Tags should be made out of softer materials such as Tyvek; identifying numbers can be written on these tags with archival quality pens. If scrolls are stored in containers such as boxes, identifying information including photographs can be placed on the outside.
WOODEN STORAGE BOXES AND TEXTILE WRAPPERS

Often scrolls will have their own custom made wooden storage boxes and textile wrappers. These components also have storage needs that must be considered. They can provide important historical information about the scrolls. Inscriptions, signatures and auction stickers are part of the scrolls' provenance and appropriate steps should be taken to care for these objects.

Wooden Boxes

Wooden scroll boxes can vary in shape, size and material and are excellent buffers against fluctuating atmospheric conditions. It is common for a scroll to have nested wooden boxes with an outer lacquer box or just a single wood box. Lids can slide open or be fully lifted off and removed. Boxes usually have ‘U’-shaped supports at both ends of the box to support the knobs (figure 6-1). Boxes can also be lined with padding and silk. Wooden boxes can also be made to hold several scrolls at once that are part of a series (figure 6-2). Usually wooden boxes are incredibly well-crafted and can be considered works of art themselves.

Boxes are often made of paulownia wood, which is a soft and lightweight wood but they can also be made of harder woods such as Japanese cedar, ebony and rosewood or other non-resinous woods. The pieces of the wood can be joined together using hardened bamboo nails and natural glue and butt joints (figure 6-3).[^1] Paulownia wood and other porous woods are highly responsive to changes in temperature and humidity which allows them to swell and create tight seals.[^2] As discussed by Simon Fleury in, “Don't Throw Away the Box,” when the lid of a well-made box is shut, it pushes air from

the interior of the box outwards, resulting in an airtight seal.\(^3\) The tight seal essentially creates a microclimate, acting as a buffer against atmospheric change.\(^4\) The outer lacquer box functions as a moisture barrier and the plain inner box acts as a humidity buffer.\(^5\) Paulownia wood also has other beneficial storage qualities such as being lightweight, absorbing impact, not being prone to cracking or deformation, and not easily burned.\(^6\) Many of the woods used in making boxes are aromatic timbers that possess worm-resistant qualities.\(^7\)

By the time scrolls make it into museum collections their original wooden boxes may no longer accompany the scrolls or the condition of the box can be detrimental to the scroll. Broken pieces of wood or ill-fitting lids can potentially cause damage to the scroll stored within. Hazardous boxes should always be kept but should be stored separately from the scroll.

The changing nature of the scrolls themselves can also determine whether the scrolls should still be stored in their original wooden boxes. A scroll can expand in diameter and no longer fit into its original box. In such a case; it should not be forced to do so.\(^8\) A sliding lid can catch the edge of a scroll that has expanded, thus causing

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\(^3\) Fleury, “Don’t Throw Away the Box,” 173.

\(^4\) Kenzo Toshi and Hiromitsu Washizuka, *Characteristics of Japanese Art that Condition its Care*, 2.


\(^6\) Fleury, “Don’t Throw Away the Box,” 173.


\(^8\) Hare, “Guidelines for the Care of East Asian Paintings: Display, Storage and Handling,” 79.
damage. If a scroll no longer fits comfortably within a box, then the scroll and the box should be stored separately.

Wooden boxes provide the benefit of microclimates and protection while at the same time having the negative effect of off-gassing. As an authority on the storage of Asian art, Andrew Hare recommends “limiting the addition of new wooden storage boxes, using acid-free materials for new housing, and removing or encapsulating potentially harmful materials.”⁹ This method strikes a balance between traditional and modern storage practices.

When storing wooden storage boxes with writing on the lids, with or without scrolls in them, it is recommended to wrap an acid-free sheet of paper around the lid to protect the writing from abrasion (figure 6-5 and figure 6-6). This is especially necessary for nested boxes that are constantly in contact with the surface of another box. The repeated action of removing the inner box overtime will wear away at the historical inscriptions and writings.

⁹ Ibid., 78.
Figure 6-1. This image shows the U-shaped supports inside a wooden scroll box.

Figure 6-2. This image shows a wooden scroll box made to hold a pair of scrolls.
Figure 6-3. This image shows the hardened bamboo nails used to construct a wooden scroll box.

Figure 6-4. This image shows the lid of a wooden scroll box with inscriptions written on the top.
Figure 6-5. This image shows an inner wooden box with acid-free paper wrapped around the lid to protect the writing on it. The inner wooden box is stored inside the larger, outer wooden box. The nested boxes are stored inside the labeled archival box.

Figure 6-6. This image shows the inner wooden box slid partially inside the larger outer wooden box. The inner wooden box has acid-free paper wrapped around the lid to protect the writing on top from abrasion.
Textile Wrappers, Bags and Sleeves

Just as scrolls often come in wooden boxes, they may also come with textile wrappers, bags and sleeves. These components are frequently made with elaborate silk, and like the wooden boxes they can have historical significance. Artists’ names and titles can be recorded on the inside of wrappers, bags and sleeves. Over time wrappers and sleeves can become tight and damage the scrolls being placed inside. If a scroll no longer fits comfortably within any of these components, the scroll and the bag should be stored separately. Like scrolls, these objects can also be damaged from repeated handling. Any of these components can be labeled and stored separately. A three-part numbering system is often used for accessioned items.

Explanation of the three-part numbering system

- The first number indicates the year the object was accessioned. Example: 2011.
- The second number indicates the sequence of transaction by which the object/s were formally taken into the collection. Example: 2011.6
- If there is more than one object in the transaction a third number is needed. The third number is assigned to each number in the group. Example: 2011.6.3

Components such as nested wooden storage boxes, textile wrappers, bags and sleeves can be assigned the three-part number and a letter can be added to the end of the number to distinguish the individual items.

For example the number for a hanging scroll with a textile wrapper and a silk bag would be:

- Scroll - 2011.6.3
- Textile wrapper – 2011.6.3a
- Silk bag – 2011.6.3b

HOW TO TIE A SCROLL

The steps outlined below demonstrate how to tie a hanging scroll that has one long tying cord, like most hanging scrolls from Japan and Korea. As mentioned earlier some hanging scrolls have two short tying cords which are tied into a simple bow. Clean, cotton gloves should be worn when handling hanging scrolls. Gloves should only be removed if they are restricting the handler from safely handling the scroll.

1. Insert acid-free paper under scroll bar

2. Wrap paper sash around entire scroll
3. Pull scroll tie slightly to the left

4. Wrap scroll tie around scroll while keeping it flat
5. Leave enough excess scroll tie to make a loop

6. Gently lift hanger

7. Tuck scroll tie under and make a flat loop
8. Pull to make loop and remaining scroll tie even in length

9. Tuck and secure loop under left side of hanger

*Scroll tie can be wrapped as many times as needed as long as the loop can be secured under the hanger
LIST OF REFERENCES


BIOGRAPHICAL SKETCH

Sarah Jean Smith was born on November 10, 1983 in Stuart, Florida. She graduated with a Bachelors of Arts degree in Art History from the University of Florida in 2007. As a graduate student in Museum Studies at the University of Florida, Sarah interned at the Samuel P. Harn Museum of Art in Gainesville, Florida and at the Resurrection Bay Historical Society in Seward, Alaska. She is currently employed at the Samuel P. Harn Museum of Art as an Asian Art Curatorial Assistant.