East vs. West: Best Way To Bind Books

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June 2010
Acknowledgements
There are many people that graciously devoted their time to help this research. I would like to thank my advisor Professor Brian Lawler for his support and guidance. In addition, I would like to thank Dr. Harvey Levenson and Nancy Collins for their guidance and encouragements. I would also like to thank Dr. Xiaoying Rong and Instructor Greg Curtzwiler for their time devoted to my laboratory research. I also thank Vince Uhler for his help making test samples.

For all the valuable knowledge, I thank Kathy Travis, Catherine Trujillo, and Sher Zabaszkiewicz. Interviewing them have made provided me many answers to my research. A special thank you to Sher Zabaszkiewicz. She has devoted much of her time to show me her knowledge in book binding rather than just telling me.

Thank you all once again for making my research possible.
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Chapter One - Introduction

Books stand for knowledge and information from the past to the present and future. Over the centuries, people have stored valuable knowledge in books. Today, people flock to libraries and bookstores for that same kind of knowledge. Because books have to be made to last through time, it is important to make each book as durable as possible. One of the most important factors about book durability is binding. A good binding will keep all the pages together in order so books are comprehensible. It also keeps the pages and the text from damaging as quickly. Over centuries, many different individuals have attempted bookbinding. Which binding methods are the most durable, and what region of world did it originate from? Both the materials used to bind books and the style of bookbinding varies from continent to continent. How a book is bound is a good indication of when and where it is made. Some types of bookbinding endure the test of time while others are now only displayed in historical museums.

Stitch binding is one common method still used today that was invented by the Chinese thousands of years ago. As long as the sewing is done properly, the book can last a few lifetimes. Perhaps this is the reason why stitch binding is still a well-practiced binding method; however, there may be another way to make the books last longer.
Another popular binding method is perfect binding, which is applying glue to bind the pages of a book together with the cover. Perfect binding is one of the modern ways of binding books. Because of its fast production rate, perfect binding is often used for massively produced paperback books. Although the books are bound at a faster rate, the glue does not keep the pages in place for very long. After a few years, the pages will start to detach from the covers. Needless to say, perfect binding is not the most durable type of binding.

Research will show that case binding is the most durable way to bind books. Case binding is a kind of stitch binding; however, it uses different types of stitches than the original stitch binding. Case binding also includes a hard cover that cases in the pages of the book. Since it is an improved way of binding books, this method owes much of its success to its origins. This research will also explore the origins of the successful binding methods.

To find the best method of bookbinding this study must explore different types of bookbinding methods that passed through time. To provide organization, this research will categorize the methods of bookbinding by two main regions, East and West. These two regions are significant to bookbinding because of their long history of developing different binding methods. Both regions also have very different approaches to how they bind books. There are, however, some overlapping characteristics in bookbinding methods between both regions.
It is important to find the most durable way to bind books so the knowledge contained can be treasured for as long as possible. Throughout this study the purpose is to find the best bookbinding method, document their origin, and note how it is executed. In this way generations to come will have access the knowledge that is valued today.
Chapter Two – Literature Review

There are dozens of methods used throughout the history of bookbinding. Some methods still exist, and some vanished. Long before the United States of America was established during the Tang Dynasty, the Chinese people were printing and binding books. The traditional Chinese way of binding books include butterfly, stitched, whirlwind, concertina, and wrapped-back binding. “A butterfly bound book was made by folding sheets of paper in half, forming four sides each. Paste would then be applied to the folded edge of the paper, and the folded sheets would be stacked together so that the folded edges met to form the spine of the book,” noted Colin Chinnery, a bookbinding expert. “The popularity of this form of book in the Song dynasty (AD 960-1279) marked the end of the scroll and the beginning of the folded leaf book” (Chinnery). A scroll is referred to as a roll of papers, which was replaced by sheets, paper that fold at the center of each spread. A spread is two pages that are next to one another when the book is laid flat.

Fig. 1 - This illustration shows how each page is layout next to each other in butterfly binding (Chinnery).
Butterfly binding is seen today for certain limited edition books, but it is unpopular for mass production. Butterfly binding poses a problem “that every other spread was blank” (Zatsuroku). When mass-producing books, one important consideration is to cut down on the cost and fully use the paper. However, the benefits of this method are “that any text spread would open flat and not close, and that since the paper was so thin, there was no bleed-through of ink” (Zatsuroku). Ink bleeding is known as ink soaking through the page and is visible on the back of that page. Nevertheless, butterfly bound books results in too many blank pages and therefore are not used today.

Stitch binding, on the other hand, is still a popular practice in modern society. By stitching every page in the book together by the center of the spreads, the book has great durability.

Fig. 2 - Stitch Binding can come in many forms. This illustration shows a basic way of stitch binding a book (Chinnery).
Stitch Binding became the predominant Chinese book format late in the Ming dynasty (AD 1368-1644), and represents the last phase in the history of traditional Chinese bookbinding. The vast majority of books handed down to us from China's imperial past are in this format (Chinnery).

Thread binding is another name for Stitch binding. The method can clearly withstand the test of time since books that have been stitched from ancient times are still well kept now. Today, stitch binding is still a well-practiced method although it varies in the style of stitch binding.

There are many ways of stitching a book together. One type of stitch binding is Stab stitching. Stab stitching punctures the book on the inside margin leaving the book unable to lay flat. It differs from the original stitch bind because the stitches in stitch binding are placed on the spine of the book. “The Stab Stitch, or edge stitch binding, is a traditional Japanese binding that can be used to make lovely albums and journals” (Hollis).

Fig. 3 - The process of edge stitch binding or stab binding is illustrated in this diagram (Chinnery).

This was a very new method of putting a book together for the Chinese. There seems to be no form of book that
either led up to that technique or developed from it afterwards. The pages are folded and brought together into gatherings. The unstitched gatherings were then piled together. A cover was placed around the back of the book, and then three holes were pierced through the book near the spine. Two strings were used to pass through the three holes and bind the book at the spine (Chinnery).

In today’s market, stab bound books are not popular based on personal observations. The pages do not lay flat and is difficult to handle with care because of it. Each page gets bent near the spine and the fibers of the paper are damaged over time.

Whirlwind binding is also an unpopular binding method today. In brief, whirlwind binding is “to store the document, [where] it would be rolled up like a scroll, whereby the bottom page... is longer than all the other pages [and] wraps around the outside of the document, forming a kind of wrapper, so that externally it is indistinguishable from a standard scroll” (Chinnery).

![Diagram of whirlwind binding](image)

**Fig. 4 - Whirlwind binding resembles a scroll, which was replaced by books with folded pages (Chinnery).**

Whirlwind binding is very hard to find now, which indicates that this method may not have been popular to begin with or that
It did not keep the books safe over the centuries. Either way, whirlwind binding is virtually nonexistence in today’s bounded book.

Certain journals or limited edition books uses the binding method called concertina. In the past, “the concertina format was being widely used by Buddhists around China” (Chinnery). Traditional Chinese concertina made by the Monks had “[folios] long and thin, on which the text was written vertically so that each column would hold many characters, but each folio could only have a few columns each” (Chinnery). Its accordion-like appearance allows the reader to flip through each page easily. Since the concertina bookbinding method requires “no string passing through the middle of the document, much less damage was caused to the paper and so the book would last longer” (Chinnery). Folios are the page numbers that are positioned on every page of the book.

Fig. 5 – The image is a concertina book opening horizontally (Chinnery).
However, concertina runs into the same problem as the butterfly binding method, which is “owing to the way each leaf of the book was folded, every second page of a printed book would be blank” (Chinnery). Even though Figure 4 appears to have all the pages filled, the backside of the paper is blank. Wasting so many double-paged spreads can be very costly for mass produced books. This problem makes concertina binding less popular than some of the more efficient ways of binding such as stitch binding.

Wrapped-back bookbinding “[solves] this problem by simply folding the pages the opposite way round. Each sheet of paper was still only printed on one side but, after being folded, the wood block print would appear on the outside rather than the inside of the folio” (Chinnery).

Fig. 6 - The illustration shows the orientation of Wrapped-back Bookbinding (Chinnery).

It is evident that the East binding process has a much longer history than the West ways of binding. To study the
American binding methods, it is best to look at their origins in Europe. The birth of bookbinding in Europe is through the influences of “English Monks” (Lerner).

Two major inventions produced books in large quantities. First, the Chinese invented paper around 200 BC. In the late 1400s, the first paper mill was established in England. Second, Johann Gutenberg invented movable type in 1456 (Lerner).

Both paper and movable type lead to the need for durable bookbinding. Europeans started to take an interest in book binding soon after the invention of duplicating movable type.

The 16th century bibliophile Jean Grolier, of Lyons, was first to develop a special style of designs individual to himself. Although Jean Grolier is regarded correctly as a French bibliophile, the bindings executed for him were essentially Italian in their principles of design (Weitz).

Jean Grolier was famous for his stamp binding, which is “Gold tooling, a decorative technique where a design is pressed into gold leaf that has been laid over the cover of a book, arrived in England in the early 16th century. The technique had been invented in the Arab world at least as early as the 13th century and was imported to Europe via the Italian trading ports in the mid 15th century” (English).

Stamp binding only refers to the way the book bind is decorated. The method of binding used with stamp binding is case
binding. In other words, stamp binding is case binding with decorative designs. The Europeans used the method of case binding which is putting hard covers over stitched pages.

Case or edition binding, the most common type of binding for hardcover books, involves sewing the individual signatures together, flattening the spine, applying end sheets and a strip of cloth to the spine. The hard covers are then attached. The spine of a case bound hard cover book is typically rounded and there are hinges (grooves) along the edges of the cover near the spine. Case bound books often also have dust covers or jackets (Bear).

Case binding has taken the Chinese way of stitch binding to a new level by placing protective hard covers around the pages. The case bound books are beautifully hand crafted, which is the reason this type of binding is still used for books today.

Some binding methods have evolved, however, because of the massive amounts of books being produced, the book publishing industry had to find ways to bind the books faster; thus, it began the modern age of bookbinding.

Perfect bound books are easy and fast to produce. This technique uses glue to bind the pages together. However, in the past, the life of perfect bound books is much shorter than traditional sewn books. This is due to pages falling out of the glue’s grip. Traditionally, perfect binding has used “ethylene vinyl acetate (EVA) hot melt and polyvinyl acetate (PVA) cold
emulsion adhesives” as their glue to bind books (O’Brien). Typically after a few years the pages start to detach from the book. However, there has been a recent improvement on perfect binding glue that gives binders more hope. Adding polyurethane reactive (PUR) into the original glue mixture improves its durability and flexibility. "Previously, stitching was the only way to guarantee signatures wouldn’t fall apart," explains Mike Roswell of Roswell’s Bindery (O’Brien). "With PUR… the paper will fail before the glue does." The down side to using PUR is that it takes longer to dry and is more expensive than the glue traditionally used.

“PUR adhesive [costs] about $5 per lb. [which] is more expensive than $1.50-per-lb. traditional hot melts. PUR [also] isn’t the fastest binding option PUR- equipped binder has a top output of 7,000 to 8,000 books per hour vs. a conventionally equipped binder that can churn out 16,000 to 18,000 books per hour. Also, most PUR adhesives currently require a 24-hour curing period” (O’Brien).

Curing is referred to the glue hardening completely so it reaches full strength potential. Since PUR is a relatively new product that has been introduced to perfect binding, only time will tell if it truly lives up to expectations.

Case bound books are considered more durable than perfect bound books. It may take longer and much more effort to stitch
binds a book and cases it in, but it is well worth it. A case bound book will last many lifetimes.
Chapter Three – Research Methods and Procedures

To find the most durable book binding method, I will research the topic using a combination of the following research methods: Elite and Specialized Interviews, Scientific Method, and Content Analysis. Each research method will broaden the understanding of book binding to determine the best binding technique.

My research will begin with Elite and Specialized Interviews. “Elite and Specialized interviewing... [is when] each interviewee is treated as a special and important individual, and individuals in important or ‘exposed’ positions are given special treatment by the interviewer” (Levenson). I plan to interview Kathy Travis, a skilled bookbinder in San Luis Obispo. She is the owner of Butterfly Binding, operating out of her studio. After setting up a time to speak with her about book binding through email we will meet and discuss the pros and cons of different book methods.

I plan to discuss with Ms. Travis my research into finding the most durable book binding process to start the interview in the right direction. My ideas will be improved by asking her opinion of the research. During the interview I will ask “general questions” and “avoid leading questions,” speaking only to guide the conversation (Levenson). The general questions I will start off with is, can you tell me about your experiences with bookbinding? After the interview, I will thank her for her
time and show my appreciation for her knowledge on the subject. By writing down everything I could remember from the interview directly after I leave the studio, the interview will be fresh in my mind and my notes will retain the majority of what was said.

My second interview will be with a book specialist, Catherine Trujillo. Trujillo works in the Special Collections department in the Robert E. Kennedy Library at Cal Poly San Luis Obispo. She has seen some of the most unique types of binding that have been made in the past century. I plan to set up an interview with her in the library regarding her experiences in which book binding method holds up the best for books over time. This way, she could also show me examples of different types of binding from the Special Collections. I also plan to ask questions such as what makes a bind more durable and how have Eastern or Western methods influenced bookbinding differently. This information could lead to reasons behind why certain bookbinding techniques last longer than others.

Following the two interviews, I will write down what both ladies have said about bookbinding methods. I will note their successes and failures with different types of bookbinding methods and quantify the information.

Besides conducting the two interviews and listening to the opinions of two book design professionals on Eastern and Western binding methods I plan to conduct my own tests in the California Polytechnic State University of San Luis Obispo’s Graphic Communication department’s bindery lab. By taking what others
said were the top binding methods for book durability, I will test those methods using the same paper for all methods. Using the same material decreases the uncontrolled variables in the experiment, improving accuracy, which along with the Scientific Method will help determine the most durable bookbinding process.

“The Scientific Method [is] considered a rigorous procedure for the study of scientific hypotheses, theories, and explanations” (Levenson). The Scientific Method involves five steps: Identifying and defining the problem, formulating a hypothesis, collecting, organizing and analyzing data, formulating conclusions, and repeating, verifying, and modifying the research (Levenson). I have identified the problem to be solved as which type of book binding method last the longest, and what are its influences? My hypothesis is that the case binding method is the most durable, which was influenced by both the western and eastern societies. The next step is to begin my experiment and collect data.

First I plan to ask the University Graphics System, a student run print shop, for sample materials I could test with. Certain types of bookbinding, such as case binding, are done by hand, in which case I will hand bind one sample book per method. After collecting the sample book for case bound, perfect bound, stab bound, and other types of binding, I will test the book’s tear resistance. I will use the ink and substrate lab at the Cal Poly Graphic Communication department.
Once I am in the lab, I will test the tensile strength of each method of bookbinding and document every step of my experimentation. I will also note the results of each test within the experiment. Afterwards, I will compare my notes and make a conclusion about which bookbinding technique is the most permanent. After determining the most durable method of bookbinding I will conduct the experiment several times to make sure it is repeatable.

Lastly, I will use Content Analysis. “...Content analysis is often used in combination with other research methods in developing results and drawing conclusions” (Levenson). I will apply content analysis to process and evaluate the information I collected from the interviews. Applying manifest content analysis by analyzing the specialized industry’s manifest language would help decipher some of the dialog during the two interviews and improve the research. Also, in quantifying content analysis the result of the analysis is usually expressed numerically, which would help make the experiments draw an easier to understand, more concise conclusion.

Knowing these research methods gives me a much clearer direction on how I would find the most durable book binding method. After defining what that is, finding the history and origins of the binding will be the last step to the experiment. It will also help gain better understanding of the bookbinding method.
Chapter 4 - Results

Samples were gathered to be tested before conducting tensile strength testing on different types of bindings. Since the most commonly used bindings today are perfect bind and stitched bind, three samples each of perfect bound, case bound and saddle stitched books were created. Case binding and saddle stitch binding are both methods of stitch binding, but they behave differently and have different tensile strengths. To decrease the uncontrolled variables in the experiment, all samples were made with 70-pound Sundance Felt Warm White paper from Kelly Paper. The book industry standard paper is between 70 to 80 pound text stock.

The case bound book was hand stitched, while Vince Uhler (University Graphic Systems’ technician) assisted with perfect binding book samples. With many years of experience in perfect binding, Uhler ran the Muller-Martini Amigo Perfect Binder with 37-081 hot melts from Sovereign Specialty Chemicals, Inc., an industry standard hot melt. He also saddle stitched samples on the saddle-stitching machine Xsheen TD202. All samples are 48 pages and 4.5”x7”. The Polar Mohr polar cutter was used to modify the samples as the tensile strength tester can only use samples about one inch wide.
Fig. 7 - Samples from left to right: saddle stitch binding, perfect binding and case binding.

After samples were created they were ready for tensile testing. Since the Graphic Communication Department does not have an industry standard paper tensile strength tester, the best machine to use is located in the Materials Engineering Laboratory at Cal Poly. I contacted Greg Curtzwiler, the laboratory technician, and he agreed to assist me in using the tensile strength machine. Curtzwiler used the Testometric M350-5KN, which is a universal materials testing machine. The M350-5KN uses a “comprehensive winTest™ Analysis software covering tensile, compression, peel, shear, tear, cyclic, creep and multi stage testing” (Materials). The software measured the strength of each type of bookbinding and converted the information into text files.

More specifically on the tensile strength test, there are two clamps on opposite sides of the machine. One signature in the sample was secured with one clamp while the rest of the pages were clamped in the opposite. As the machine began to pull apart
the book samples, the software recorded the force the binding can take over time.

*Fig. 8 – Tensile Strength Testing:* The page signature is being pulled apart to measure the tensile strength of the bookbinding sample.

The steps were repeated for each sample and then saved the text files on a flash drive.
After completing tensile strength tests, the text files were uploaded into an excel spreadsheet. This data was used to make line charts by setting the y-axis as force and the x-axis as time. To make the graphs more clear they were edited using Creative Suite 4 Illustrator.

For a book to last over time, the binding must withstand both the force that is exerted on the pages inside and deterioration over time. Since these samples are brand new, I cannot test for the deterioration that happens to the books over time. The tensile strength test is only showing how much force different types of bookbinding can withstand.

Based on that line chart, case bind can withstand the most amount of force, while perfect bind has the least amount of force resistance. When perfect bind is brand new, however, the
flexibility of the glue does cause the pages to stay attached to the book longer. This is evident in Figure 9. According to the experts such as Kathy Travis, however, the glue does lose its flexibility over time.

When I interviewed Kathy Travis, a book binding specialist, she said without hesitation, “Case bound books are almost always more durable than any other kind of books.” She is referring to the books with sewn signatures that are glued inside hard covers. She also mentioned some key factors to make the books last longer. “You must use materials that are archival, which means they’re acid free,” said Travis, “and use materials with no additives, such as 100% cotton thread. Additives cause the materials to break more easily.” This is important to my research because I must take into consideration when looking at different samples of bookbinding. Some factors could affect the durability so I must make sure factors such as poor quality paper do not take place in the samples I observe for this research.

Taking this into consideration, I made sure the samples all match industry standards. She believes the most durable binding is case binding, which originates from Europe. She seems to have the same opinion as the experts I have previously researched.

Catherine Trujillo, who works in Special Collections in the Robert E. Kennedy Library, also reassured me that sewn books are very durable over time. She showed me some of the oldest books in Special Collections such as Shakespeare’s Songs bound by Craig
Jensen in 1853. *Shakespeare’s Songs* is case bound, which means the signatures inside are sewn together.

Like Travis, Trujillo mentions how different factors would affect the binding durability. “During the 1960s, paper companies started mixing additives to paper with the impression that they would help better the paper. It turns out the books break apart more easily than before. So, they stopped producing paper that way,” says Trujillo.

Besides case bound books, Catherine Trujillo also showed me another kind of binding that could perhaps be stronger than even case binding. The book "Seven," unpublished poems by Luis J. Rodriguez is bound with silk thread and steel wires. The wire is inserted at the end of each page and the silk thread strategically ties the steel wires together so they function as the book hinge. This contemporary type of binding has a similar appearance as the traditional stab binding, which is an eastern binding method. What makes this new type of binding different is that it actually lies flat when the book is opened, which means the pages do not need to bend when the users handle the book. Bending the pages weaken the fibers in the paper, and weakens the binding. I would later find out this type of binding is called The Daniel E. Kelm Wire Edge Binding.
Fig. 10 - The Daniel E. Kelm Wire Edge Binding

Binding with steel wires and silk threads also makes the binding very durable. "Silk thread is one of the most durable thread to bind a book," says Kathy Travis. Steel wires are also great for book binding because they are lightweight and very strong. This hinge could be stronger than even case binding. To learn furthermore about the binding, Catherine Trujillo referred me to the bookbinding artist who bound "Seven", unpublished poems by Luis J. Rodriguez, Sher Zabaszkiewicz. Zabaszkiewicz had graciously agreed to share with me the steps to create such a unique bind.

Zabaszkiewicz mentioned Daniel Kelm invented this original type of binding. However, he used tape to connect the wires together. Zabaszkiewicz modified the binding by using silk thread to
connect the wire. The silk is much stronger than tape and connects the wires more fluidly. “It’s something about this type of binding that doesn’t ware the thread of the paper. It’s stronger than case bind because of that reason and also because of the wires,” Sher Zabaszkiewiez remarks. Being one of the most influential people in the bookbinding world, Zabaszkiewiez has developed possibly the strongest bookbinding method know to mankind. The only downfall for this type of binding is that it is very time consuming. “I can bind three books of ‘Seven’ a day, and I’ve made 50 copies in my lifetime,” Zabaszkiewiez says. Though is not a problem for Zabaszkiewiez because her books are uniquely crafted and belongs to Special Collections around the nation. Also, in comparison to case binding, Daniel E Kelm’s Wire Edge Binding Method takes equally long. Because of her dedication, Daniel E. Kelm’s Wire Edge Binding Method is modified to become such a durable binding method.
Chapter 5 - Conclusion

The practice of bookbinding has been implemented for centuries. It is incredible that different ways of bookbinding are still invented to this day. Through my research, I have found case binding to be the most durable common method of binding. I have tested samples of case binding against perfect binding and saddle-stitch binding. The tensile strength tests have proven case binding to hold the most amount of pressure before detaching from itself. I have also asked for the opinions of three knowledgeable experts in bookbinding. Although they have all agreed that case binding is extremely durable, Daniel E. Kelm Wire Edge Binding seemed even stronger than case binding due to the steel wires and the way the hinge is made.

Research also shows that Sher Zabaszkiewiez’s modification of Daniel E. Kelm Wire Edge Binding is what is strongest of today’s bookbinding. This binding could allow "Seven", unpublished poems by Luis J. Rodriguez, to last centuries more. Her knowledge has helped amateur bookbinders like me improve our bookbinding skills.

To improve the way books are bound in order for the books to last longer, not only the binding is taken into account, but also the materials used are also very important. All three interviewees have indicated that materials are just as important as the binding method to keep the book durable.
Books are important because the longer they last, the better they helps preserve history. For example, the Chinese history and Egyptian history are the two oldest documented histories in the world. People have learned about their historical events through preserved books. This is why books are essential to document mankind’s knowledge and history.

Books not only contain valuable content, but the materials used and the way they are bound speaks a lot to the history of the book. In a way, the book tells a better story than if the content was just presented in a digital file. Hopefully, people like Cathy Travis and Sher Zabaszkiewiez can continue to make lasting books and encourage others to bind books as well. Their work have inspired me to study book binding and I hope to continue to explore the durability of different types of binding from binding experts and hands on experiments.


Travis, Cathy. Personal Interview. 5 April 2010.

Trujillo, Catherine. Personal Interview. 20 May 2010.


Sengokudaimyo. 5 Feb.


Zabaszkiewiez, Sher. Personal Interview. 29 May 2010.