Bibliology 101

[Slide 1]

Can you think of a superb technology that has existed almost without change for a couple of thousand years and can be found instantly in the home of every person in this room? Would it help if I mentioned that this familiar technology is currently under threat and could very well be displaced by a revolutionary new technology now sweeping the planet?

Can you guess what I am thinking of? The answer of course is BOOKS! *[Slide 2]* Real, hard-backed, printed books! Honest-to-god, paper, ink, & binder-board books. The familiar kind that you find in old-fashioned bookshops and libraries and houses. The kind that have been read and savored and treasured by educated people since the days of the Roman Empire!

And not, it goes without saying, the digital kind that you download on your Kindle or your iPad!

As a confirmed bibliophile, I would like to present tonight an affectionate history of books. I would like to follow the development of books from the earliest attempts to preserve the written word up to contemporary times and offer a few reflections on what will be coming in the years ahead. I will be showing slides to illustrate the essay and I brought a few three-dimensional books with me tonight as examples.

Spoiler alert: I do not believe the digital revolution will eliminate printed books entirely, but I do fear that they will become increasingly less common.

This essay is entitled "Bibliology 101". Bibliology has two common definitions: one referring to the study of the Bible and the other referring to the study of books as objects. Tonight I am using the term in the second sense.

So tonight I will be talking about the history of books as objects, not the content or the subject of books, not the author or the title, but the design and the technology of books – a remarkable, non-digital, all-natural, organic, hand-crafted, artisanal technology that has served humanity superbly for so many centuries but today seems to be going the way of the mechanical typewriter. Manufactured these days by soulless machinery, displaced by the computer, relegated to the seldom-browsed shelves of modern libraries that devote as much space to computer terminals and displays of DVD's as they do to old-fashioned books.

For those of us who are bibliophiles, who love to admire, fondle, smell, collect, and occasionally even read real books, especially old leather-bound books, it is distressing to think that our grandchildren may never experience that visceral joy! I suspect there are many here tonight who share these feelings!

To put you in the mood for a history of books, let's start by going back in time. Imagine for a minute that you are an educated citizen of Rome *[Slide 3]*, the largest city in the world, in the year 100 AD. You stroll one night from your townhouse to the personal library of a wealthy noble friend. As you gaze enviously upon his collection of books, what would you see? What would his books have looked like? How were they made? How would they differ from books today? And by the way,

is it possible that any of these ancient books have survived the centuries? Can we actually see some of them today?

As you are pondering these questions, let us review the evolution of books prior to Roman times.

We know that cave paintings *[Slide 4]* have been found dating back some tens of thousands of years, often depicting extinct animals such as bison and woolly mammoths. Humans spent many centuries painting and scratching those images on various surfaces. And if you can believe the B.C. comic strip *[Slide 5]*, Wi-Fi passwords were in use back then too.

Actually, true language-based writing does not seem to have emerged until around 3000BC, with the invention of cuneiform script *[Slide 6]* in Sumeria (present-day south-eastern Iraq).

The invention of writing in the sense of a system that permits all thoughts expressible through spoken language to be inscribed on a two-dimensional surface also occurred separately on at least two other occasions in human history. In China writing was developed during the Shang Dynasty some time prior to 1200BC, and in what is now Mexico a complete system of writing was developed by the ancient Mayans no later than about 300BC.

Back to ancient Sumeria. Not all cuneiform writing was inscribed on clay tablets, of course. If you had visited ancient Sumeria it is quite likely that you would have found the familiar wedge-shaped cuneiform markings in everyday use on materials other than clay tablets, perhaps painted onto leather or cloth or scratched onto wooden panels.

We can find hints as to the nature of the earliest books from the etymology of words relating to books. *Biblos* and *liber*, for example, are Greek and Latin words that both trace their meaning back to "inner bark of a tree". The word *book* itself *[Slide 7]* comes from the Old English word "*bōc*", which is derived from *bokiz*, the Proto-Germanic root word for "beech". It seems reasonable, then, to conclude that the very earliest books were written on wood in some form.

But those early writings on perishable materials have long since disappeared. The earliest examples of books that we can look at today contain information considered important enough to have been impressed into clay tablets or carved into stones. Because of the durability of these materials, hundreds of thousands of examples of books made of these materials have survived, and many of the inscriptions have been translated.

So, if you had visited an ancient Sumerian library, two or three thousand years before Rome became the center of Western Civilization, many of the books that you would have seen would have been in the form of clay tablets *[Slide 8]*. There may well have been wax tablets or papyrus and leather scrolls also, but no examples survive. The ruins of one ancient Sumerian library were actually discovered in 1849 near Nineveh, in Syria. These ruins, the so-called Royal Library of Ashurbanipal, included more than 20,000 clay tablets with texts of all kinds dating from the 7th century BC. Sadly, many of the tablets were in fragments that were jumbled together by the clumsy archeologists and are incapable of being understood today.

As many as 2,000,000 cuneiform writings have been recovered and can be found today in museums around the world, but less than 10% have been read. Only a small number of scholars today are able to interpret the script. We can only imagine what secrets are yet to be revealed!

Cuneiform script continued to evolve and become simpler through the centuries. It remained in use for more than 3000 years, until it was generally replaced by alphabetic writing. The use of clay tablets also endured for many centuries. As a form of book technology, tablets offered advantages: they were cheap to produce and very durable. On the other hand, they were heavy, hard to transport, and inconvenient to store. Moreover, only limited amounts of information could be pressed onto a single tablet. Imagine the amount of clay needed to make tablets containing the full text of Homer's *Odyssey*!

As societies became more complex and writing became more common, clay tablets outlived their usefulness; another form of book technology was needed. Papyrus became the material of choice and the scroll became the dominant book design.

Papyrus had been manufactured in Egypt *[Slide 9]* and South Sudan as early as the fourth millennium BC, around the same time that cuneiform writing emerged. We can infer that papyrus books, most likely in the form of scrolls, therefore must have been in use in ancient Egypt perhaps as early as the First Dynasty, approximately 3100BC, but we have no direct evidence. The earliest surviving fragments date to approximately 2500 BC.

Papyrus is not easy to make. You begin by removing the outer rind from the stem of the papyrus plant, cutting the sticky, fibrous inner pith into thin strips about 16 inches long, placing the strips side by side on a hard surface with their edges slightly overlapping, and laying another layer of strips on top at right angles. Before they dry, the two layers are hammered together, forming the layers into a single sheet. The sheet is then dried under pressure. After drying, the sheet is polished with a stone or seashell or piece of rounded wood.

Single sheets of papyrus can be glued together end-to-end and rolled up to form scrolls. *[Slide 10]* Papyrus scrolls became the dominant form of book technology in the first millennium BC. They offered many advantages over clay tablets: they were lightweight, convenient to store and transport and much more information could be placed on a scroll than on a single tablet.

But this technology also had drawbacks. Papyrus plants grow only in certain parts of the world, papyrus is expensive, and although it is reasonably durable in an exceptionally dry climate like Egypt, it deteriorates rapidly in a temperate or humid climate. For that reason, very few papyrus scrolls have survived from ancient times.

The largest surviving assortment of papyrus scrolls consists of more than 1800 specimens from the private library of a wealthy Roman nobleman that were buried by the eruption of Mount Vesuvius in 79AD. These are the famous Herculaneum papyri *[Slide 11]*. It is ironic that they survived only because the volcanic heat baked them into brittle, black, carbonized lumps that are just now capable of being read with the aid of MRI machines and computers.

Parchment – or vellum – became an alternative to papyrus in early Roman times. Parchment in the strict sense refers to the skin of a sheep or goat *[Slide 12]*, while vellum refers to the skin of a calf, although the terms are often used interchangeably and can include the skins of horses and other mammals. Parchment is an excellent writing material but so expensive that only the wealthiest can afford it. It is made by stretching, scraping, and washing the animal skin with lime to create an attractive, translucent surface. The very highest quality is made from the skin of unborn or stillborn animals. Needless to say, you'll have a hard time finding parchment of that quality at your neighborhood Wal-Mart!

Despite their limited durability and the need to re-write new copies every so often as the old ones fell apart, scrolls continued to be the dominant book technology until late Roman times. Your wealthy Roman nobleman friend in the year 100 AD with the private library *[Slide 13]* that you envied so much would have had piles of parchment or papyrus scrolls stacked on his shelves. Books for him would have meant scrolls and only scrolls.

But then something happened. The world changed again and books took on a new form. Which brings me to a pivotal moment in the history of books – the invention of the codex! But perhaps you aren't familiar with the term "codex"?

Codex *[Slide 14]* is derived from the Latin word *caudex,* meaning "the trunk of a tree", possibly referring to the inherent design which contains many leaves attached to a spine. It describes the same form of book we are all familiar with today: flexible pages with writing on both sides, bound along one edge, and usually protected in covers made of rigid material. The plural of *codex* is *codices*.

Scrolls, despite their many advantages when compared to clay tablets, suffer in comparison to codices. *[Slide 15]* Scrolls are written on only one side of the papyrus or other material; codices can be written on both sides. Scrolls are cumbersome and require two hands to read; codices can be held in one hand leaving the other free to hold a pen (or a cup of coffee). The reader of a scroll cannot easily flip back and forth between sections of the book as he can by flipping the pages of a codex. Thus the codex is much more economical, efficient and convenient than the scroll. It is no wonder that the codex supplanted the scroll; what is surprising is how long that process took and how it happened.

In Roman times, paper was unknown and papyrus and parchment were expensive. For everyday purposes writing usually involved the use of wax tablets *[Slide 16]*, rectangular wooden frames covered with soft wax that could be written on with the pointed end of a stylus and erased and reused by smoothing the wax with the rounded end of the stylus.

It was soon discovered that several lightweight wooden wax tablets could be stitched together along one edge with flexible cords, creating a codex of sorts that looks very much like a familiar book of today. There is at least one surviving mural on a wall at Pompeii *[Slide 17]* with an image of just such an early wax-tablet book.

The codex form quickly morphed from a short stack of wooden wax tablets to a thick sheaf of bound pages of papyrus or parchment. The modern book was born. Any well-made book of today is virtually indistinguishable in structure and materials from a book in codex form made 2,000 years ago. This timeless design *[Slide 18]* consists of a number of flexible pages, usually consisting of four or more individual

sheets folded over into "quires", which are stitched together onto sturdy cords. The resulting unit is encased in rigid boards made of wood or today what we know of as "binder's board" – a particularly dense & tough sort of cardboard. The boards are then covered with leather, cloth, or paper to protect the contents.

Evidence exists of early Roman codices written on papyrus or parchment in use for writings of temporary importance or for business or commercial use, but rarely for literature. It seems that for writings having enduring value, despite the obvious advantages of the codex design, only the scroll was considered an appropriate format for books. A Luddite mindset in Ancient Roman times!

And yet, sometime around the first century AD the use of the codex format for books began to spread. Coincidentally, the Christian religion also began to take root during this time. As Christianity moved from the status of a suppressed and persecuted cult to the mainstream and eventually became the endorsed religion of Rome under Emperor Constantine *[Slide 19]* in the 4th century, codices also became the dominant book format in the Western World.

Some scholars believe this is not entirely coincidental. Very early Christian believers practiced their religion in the shadows. For their purposes, books containing the gospel message needed to be cheap and easy to conceal. Scrolls were expensive and hard to manipulate. The small, codex format used for utilitarian books was far better. The spread of Christianity was thus facilitated by the exchange of small books in codex form. These books were scarce and highly valued by their owners. It is perhaps no surprise that the earliest surviving books in codex form so often contain biblical texts.

Thus as Christianity entered the mainstream, so did the use of the codex. Traditionally-minded Roman scholars resisted the change and continued to favor scrolls, but by the late 4th Century, scrolls had begun to disappear and the codex form of book was dominant. So if you were to visit one of the 28 public libraries that we know existed in Rome in the year 377, you would have seen dwindling numbers of scrolls and increasing numbers of codices.

Among the oldest surviving books in codex form *[Slide 20]* are thirteen leather-bound papyrus codices discovered in 1945 buried inside a sealed jar near the town of *Nag Hammadi* in Upper Egypt. These books date to the first half of the 4th century. They are written in the Coptic language and contain Gnostic religious texts.

A few other famous early codices have survived from Roman times. The best-known is the remarkable *Codex Sinaiticus [Slide 21]*, a Greek Bible beautifully written on parchment around 350AD. It originally contained the complete texts of both the Old and New Testaments. Most of the pages of this historic treasure are in the British Museum Library, with smaller portions in three other libraries around the world.

The oldest surviving European book is the St. Cuthbert Gospel *[Slide 22]*, which was buried in the tomb of St. Cuthbert, an early English Christian leader, on the island of Lindisfarne off Northumberland, around 698 AD. Written on parchment with an embossed-leather binding over wooden boards, it looks astonishingly fresh and modern. A tribute to the quality and durability of traditional book-making technology!

The St. Cuthbert Gospel is one example of the thousands of manuscript books painstakingly written and rewritten by Irish monks *[Slide 23]* in the centuries following the Fall of Rome. Without the incredible dedication of these monks, much of the accumulated wisdom of the ancient world would have been lost during the Dark Ages.

The oldest surviving Mayan book is the Dresden Codex *[Slide 24]*, written on fig-bark paper in the 11th or 12th century AD. It is one of only fifteen or so Mesoamerican books that survived the European conquest. Tragically, many thousands of Mayan books were deliberately destroyed by the Spaniards on religious or cultural grounds.

For more than 1000 years after the invention of the codex in Ancient Rome, all books were precious and rare, due to the expense of the materials and the laborious effort required in writing the manuscript. Only scholars and aristocrats could afford to own books. During the late Middle Ages, books in Europe were so precious that some libraries resorted to the practice of chaining the books to the shelves *[Slide 25]* to prevent theft. Several of these libraries have preserved the shelving and chains intact for more than 500 years and can be viewed on your next trip to Europe.

But that all changed when the technologies of papermaking and printing converged in the 15th century.

Papermaking was actually invented in China *[Slide 26]* as long ago as the Han Dynasty, around the first century BC. But it took more than 1,000 years to arrive in the west, reaching Moorish Spain around the 10th Century AD and Northern Europe around the year 1400. Once a

dependable supply became established, however, paper replaced parchment for all but the most expensive books. Paper made the traditional way with natural materials is not only relatively inexpensive, but it is also quite durable. Good quality paper can last indefinitely if kept clean and dry. So a plentiful supply of affordable writing material in the form of paper provided the first step toward the proliferation of books.

The second step, of course, was the appearance of the printing press with movable metal type *[Slide 27]*, invented by Johannes Gutenberg in Strasbourg, Germany around 1440. Gutenberg's printing system marked a quantum leap forward in technology and that knowledge quickly spread across the continent.

Other forms of printing had been in existence prior to Gutenberg. In China, for example, books on paper had been printed with woodblocks, where a complete page of text was carved onto a single block of wood, since the Tang Dynasty at least 800 years before Gutenberg. The oldest surviving example dates to 868AD. And printing from movable type also was in use in China some 400 years before Gutenberg, although that technology did not really catch on due to the complex nature of Chinese character writing.

But after Gutenberg's successful and spectacularly beautiful Bible *[Slide 28]* came off the press in 1455, the printing industry in Europe exploded. According to some estimates by the year 1500 more than 1,000 printing presses were in operation across the continent and more than 8,000,000 books had been printed. These books, printed during the infancy or incubation period of the art of printing, are known today as *incunables* and are very collectible.

Because books could be printed on low-cost paper and no longer required hundreds of hours of work by skilled scribes to produce they became much more affordable. No longer was ownership limited to scholars and aristocrats; books became available to the masses and the spread of literacy and learning began to accelerate.

The technology of books, however, remained unchanged for another 400 years. Printing and bookbinding remained a handcraft and the materials used in bookmaking remained virtually identical to those used in late Roman times. It was not until the mid-19th Century that we find another major change in book technology. The industrial revolution reached the papermaking and printing industries *[Slide 29]*. Books no longer needed to be handcrafted by skilled artisans. They could be manufactured in vast quantities. Large-scale paper mills and mechanical presses powered by steam drove down the cost of books once again, and books became very cheap to produce, especially if they were printed on machine-made wood-pulp paper rather than the traditional linen-rag paper.

Unfortunately many early manufactured books *[Slide 30]* contained a fundamental flaw that was not discovered until decades later. The high-acid content of the wood-pulp paper caused it to turn brown and brittle, eventually disintegrating into sawdust. We have all seen how cheaply-printed newspapers and comic books from the 1930's or 40's have turned brittle, for the same reason.

A large portion of the cheaply-made books printed between 1860 and 1930 are printed on high-acid wood-pulp paper and are in the process of self-destructing. This is irreversible. Unless those books can

be stabilized by de-acidization or photographed page-by-page, either of which is very expensive, they are doomed. Much information will be lost as a result.

Once it was known that high-acid paper had a short shelf life, book-makers reverted to natural materials or acid-free paper for books except those considered disposable. Most hardbacks printed today are made with acid-free paper.

There is no question that industrialization often had a negative effect on quality, as mechanized manufacturing replaced hand work in many industries, including bookmaking. Late in the 19th century, the Arts & Crafts movement started in England largely in reaction to the negative consequences of the industrial revolution. In England and later in the U.S. this led to the establishment of a number of small, hand-operated printing presses that were started in order to make very high-quality books the old-fashioned way. Some are still in business today. Books made at the famous Kelmscott Press *[Slide 31]*, the Doves Press, and the Ashendene Press, for example, were hand-printed on vellum or linen-rag paper and hand-bound using traditional materials. They are beautiful works of art and can cost in the many thousands of dollars.

If you are a bibliophile like me you may be feeling pangs of regret as you contemplate the possibility of printed books fading away. You would miss the sensory satisfaction of handling three-dimensional tomes: the heft of the solid volume, the visual artistry of a well-designed page, the tactile pleasure of handling crisp, high rag-content paper and the nostalgic, slightly musty scent of a real bookbinding (especially if the binding is vintage leather).

We know that we can still find honest, durable books printed on paper. But we also know that the digital revolution is driving costs down yet again. Purchasing a book printed on paper can cost much more than accessing the book on a Kindle. So what will books be like in the future? Shouldn't we expect to see books on paper become increasingly scarce?

I think the answer is a tentative yes; inexpensive and convenient digital books will slowly reduce the demand for printed books. But I doubt if printed books will disappear entirely. Books printed on paper using the ancient technology of codex design actually may be more durable and longer-lasting than virtual books existing only as a string of 1's and 0's.

Think of how digital technology has evolved during our lifetimes. When I was in college in the 1960's, I registered for classes with IBM punch-cards *[Slide 32]* fed manually into the massive university computer. Information was stored on magnetic tapes, followed by floppy discs a few years later. But now all those technologies are obsolete. Today hardly anyone can read punch cards or floppy discs. We have progressed to DVD's and cloud-based server farms. Who knows where technology will go in the decades ahead? What is the life expectancy of a plastic DVD? Is it longer than 1,000 years, like a well-made printed book? I think not. And even if your standard cloud-based server farm is triply-redundant with backed-up data centers buried beneath a mountain in Colorado, is it forever immune from earthquakes and terrorist attacks? I doubt it!

On the other hand there can be no doubt that *Moby Dick [Slide 33]* will endure forever. Well-printed copies of that book exist in dozens of

editions in thousands of locations throughout the world. It is impossible to imagine how that information could ever be lost to humanity. By contrast, a book written today in digital form may exist only on a small number of computer servers. I am afraid the risk of losing that information is actually greater than the risk of losing information in printed form, especially if we consider the unexpected disasters that are likely to occur over time-frames measured in centuries.

So, let us raise a glass to our reliable and durable old friend the codex! You have served us well for 2,000 years; may you continue to do so for many centuries to come!

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