

# Tracing writing technologies through time: A historical reflection of writing systems, writing surfaces and writing implements

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**Abstract.** Instructional technologies, just like any other technology have been evolving over time, and have existed over centuries. This paper develops a historical framework for the evolution of writing systems, surfaces and instruments up to the time their most modern prototypes were developed. The study was a documentary analysis of virtual documents stored electronically for access through the internet, text books, archival repositories and encyclopedia, providing insights into the past of writing technologies, and how these technologies have been changing over time. The study has demonstrated that the systems and instruments that we have today arose not by chance, but by careful thought and intelligent intention to manipulate resources found in nature. The study will provide an understanding of the progression of the most basic instructional technologies over the time of human civilization.

**Keywords:** Hieroglyphics, cuneiform, stone tablets, slates, papyrus, pencils, pens, civilization.

## INTRODUCTION

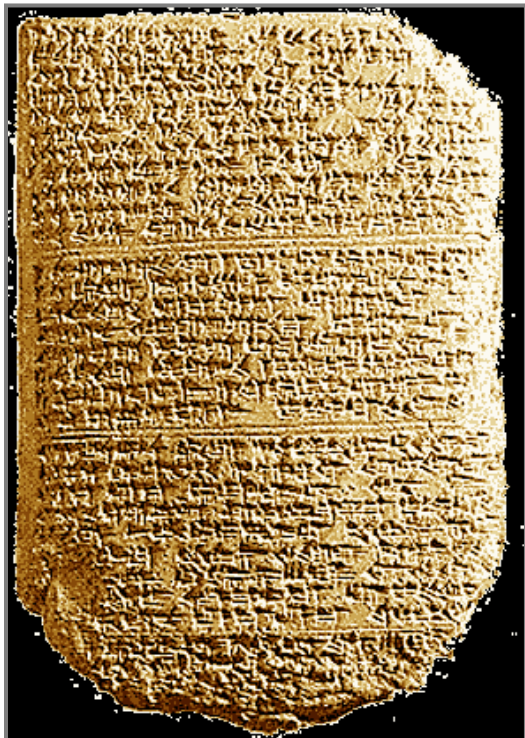
When elaborate writing systems began to develop around 4,500BC, the beginning of preservation of knowledge with concrete rather than oral records was just beginning. Oral records could not extend beyond several generations, but where they could; the risk of loss of accuracy was higher than could be imagined. The heavy demand on human memory demanded the invention of a method of preserving events revolving around their daily endeavors (Sifuna and Otiende, 2009:15). So whether by chance or by intention, the beginning of writing attempts, through drawings, signs or words was a deliberate attempt to preserve human thoughts and feelings. By extension written records provide to the present generation, a clear record of the history of human civilization.

## DEVELOPEMENT OF WRITING SYSTEMS

The *Homo sapiens* was an innovating being, dedicated to

using his fast accumulating intelligence to further his goals. And in his cave-like abode, he developed the first ever invention - the hunting club. The hunting club that included a sharpened stone, attached to a wooded handle, would be used as a hunting device and an instrument for skinning his wild catch. It is this device, which would later double as a tool for impressing pictures onto the walls of rocks of his cave dwellings (Timothy, 2008:5; Kevin 2000:14). Archeology has demonstrated that impressions of the rocks represented "events in daily life, such as planting of crops, business and hunting victories" (<http://inventors.about.com/library>).

With the progress of time, drawings evolved into easier-to-draw symbols representing words and sentences. By the 7<sup>th</sup> millennia, moist clay tablets had started to replace rocks as the chief writing surfaces, and a more elaborate system of recording using pictographs had started to evolve. The symbols were used to record business transactions amongst merchants.



**Figure 1.** Cuneiform clay tablets excavated from an ancient city ruins at Tell El Amarna, Egypt Dated 1380 BC. Source: 'Our Bible & the Ancient Manuscripts' by Sir Frederick Kenyon (1895 - 4th Ed. 1939) Pg 5 and Plate II. In <http://www.katapi.org.uk/Bible/MSS/ElAmarnaT.htm>.

The proto-writing symbols became more evident, and continued to increase in complexity through to 6,000 BC. By 4,000 BC, human had begun attempts to make impressions on moist clay tablets using reed and crude bone tools. These impressions were credited as the first form of writing called cuneiform. Cuneiform consisting of hundreds of wedge shaped marks on wet clay tablets. The tablets were then hardened in ovens, making them unchangeable. A class of people called scribes emerged. The scribes did most of the writing, and were tasked with keeping records, recording of historical events and wrote societal myths (Timothy, 2008:15; Joshua, 2011). In more advanced civilizations, bronze writing tools were used for the same purpose. These attempts started to make an impression that great strides in the development of writing, writing surfaces and writing tools was well in progress, events that would shape human civilization over thousands of years to come.

By 1,500 BC, different civilizations, independent of each other though, began to develop more elaborate writing systems. Egyptians developed a writing system that used pictures, popularly known as hieroglyphics. Hieroglyphics was practiced by noble professionals called "scribes" who carefully made impressions on papyrus scrolls using thin brushes made from the sea rush plant

(*Juncus martimus*). The reed pen required dipping in ink or paint. Scholars believe that the development of Egyptian hieroglyphs was invented under the influence of the Sumerian Script. By extension, it follows the Sumerian script was a pioneer of the hieroglyphics. The Sumerian script was known as Cuneiform (Bright and Daniels, 1996).

Technically, cuneiform means "wedge shaped" because most of the marks that defined this system of writing were wedge shaped. It is believed that the writing was most probably invented in Uruk in southern Mesopotamia (modern day Iraq) around 4,000 BC, and existed mainly in form of pictographs. In the early stages of its development, cuneiform writing (Figure 1) was logographic in nature, where a sign represented a thing or an action. By 1,000BC the system had mutated from pictographs to more elaborate and smaller alphabetic signs

(<http://etcsl.orinst.ox.ac.uk/edition2/cuneiformwriting.php>).

By 1300BC, the Romans had developed their own form of writing called historiography. Historiography was used to preserve "a wide array of information, including religious documentaries, names of consuls, deaths of priests, and various disasters throughout history". Their chief writing surface were sheets of wax spread on a wooden platform, and a metallic pen popularly known as "stylus". Other writing forms of the antiquity included the Chinese logographs (which was based on pictures so that the word for "cow" was clearly the picture of a cow's head; "to go" was written with the picture of a foot), the Maya scripts (Mayan glyphs) of the Mesoamerican civilization and Ethiopia's Geeze used in ancient Ethiopia (present day Eritria and the Northern Ethiopia of the Horn of Africa). Ethiopian Geeze started to develop around 7<sup>th</sup> and 6<sup>th</sup> Century BC, and is still in use for liturgy in Ethiopian Orthodox Church today.

## DEVELOPMENT OF WRITING SURFACES

Prior to the invention of paper, ancient people employed many substances for recording their thoughts. These surfaces include rocks surfaces, clay tablets, metal plates, papyrus, parchments, vellum, barks and vellum or any other durable material (Benton, 1969:280). The trend in the evolution of writing material was evolving independently in various civilizations before converging to the most ubiquitous writing surface: paper.

In Mesopotamia, clay was readily available and so the Sumerians only needed to scribe details on it, then process the clay into hard tablets by baking them on the sun. Since they were not portable, clay tablets could only be used for preserving, but not transferring information. Clay tablets would remain the chief medium for writing throughout the Bronze and Iron ages.

Around 3000 BC, Egyptian civilization presented to the modern world a more portable material for writing. The



**Figure 2.** *Cyperus payrus*: Source: <http://www.google.co.ke.search?q=cyperus>.

material was called Papyrus. Obtained from the papyrus plant (*Cyperus payrus*, Figure 2) a sedge growing along the Nile delta of Egypt, the material was superior not only for its portability but because “it was flexible, smooth and able to retain ink without smudge” (www.historyworld.net). The Egyptians, using a superior ancient technology used adhesives to join several rectangles from papyrus and rolled them to make up scrolls (Figure 3). The papyrus scrolls remained important writing surface during the Egyptian, Greek, and Roman civilization.

Far to the East, in Oriental China, the Bamboo tree (*Bambusa* spp.), was the most available and most convenient writing material. Around 1500BC, the Chinese processed the bamboo into stripes. Vertical logographical impressions were made on each of the vertical stripes, the stripes were joined with thread to form a Bamboo book (www.historyworld.net) (Figure 4).

In India, palm tree leaves, and the bark of the birch trees were important recording surfaces. All along, the Pergamum region of modern day Turkey had started processing animal skin into a reputable writing surface. By 150BC, leather processing technologies had started treating leather and converting it into a thin flexible material whose two surfaces could be used for writing. This material was called “parchment” and remained an important writing surface in medieval Europe.

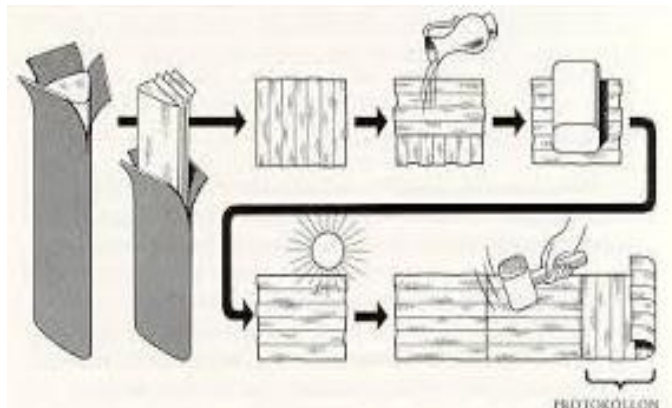
Around 105AD, Tsai Lun, a Chinese court official developed the idea of forming sheets of paper from hemp waste, old rags and fish nets, macerated fibers of bark of the Mulberry tree (*Broussonetia papyrifera*), Laurel (*Laurusnobilis*) and Chinese grass (*Miscanthus sinensis*) (Benton, 1969:280). The paper material was thinner and more flexible than papyrus of Egypt and the parchments of the Pergamum. The paper making technology became widespread in China and its environs. When the technology reached Japan, the Mulberry tree (*Broussonetia papyrifera*), Gampi (a plant from Japanese Mountain forest) rice straw and Mitsumata Bark were the raw material for paper manufacture (Benton, 1969).

In 751 AD, the soldiers of the Chinese Tang dynasty captured Arabs occupying Samarqand (an old prosperous city along the caravan route between China and the Mediterranean) in the present day Kyrgyzstan/Kazakh border. In a retaliation attack, the Arab Abbasid caliphate captured Chinese prisoners in what is referred to as the battle of Talas River (Szczepanski, 2013). In the battle, the caliphate captured Chinese captives who passed on the skill of paper making in Samarqand. Samarqand became an important paper making region because it had sufficient fax, hemp and plenty of clean water.

Samarqand lied along important caravan route linking China to the Arab cities of Bagdad, Damascus, Egypt and the Mediterranean. So the paper making technology diffused readily along the route and reached Egypt in the 10<sup>th</sup> Century, before spreading along the Mediterranean into Morocco in the 12<sup>th</sup> Century. From Morocco the technology spread into Valencia in Spain, from where it reached Sicily (Italy). In Europe, paper found widespread manufacture in the 14<sup>th</sup> and 15<sup>th</sup> century. From Europe paper making technology reached North America and the first paper mill was built at Roxboro German town, North Carolina in 1690 (Benton, 1969). Paper remains an important writing surface to this day.

## FROM HUNTING CLUB TO FOUNTAIN PENS

Pens are instruments for writing using ink or any other coloured fluid. Throughout human history, brushes, reeds, bones, bird feathers and other material has been used for making pens (Benton, 545). As aforementioned, the first writing object was the hunting club. Using the club, the cave man inscribed his thoughts and experiences on the hard rock surfaces. However as writing systems advanced, and as writing surfaces continued to take shape, a more elaborate tool for writing was necessary. The Greeks are credited with the earliest writing object that appeared like the modern pen. They “employed a writing stylus, made of metal, bone or ivory, to place marks upon wax-coated tablets”. Far in the orient, the Chinese, in the second millennium BC, had invented and found use of a fluid “designed for blackening the surfaces of raised stone-carved hieroglyphics”. This ink was originally made of carbon from pine wood soot mixed with the animal glue (Farquhar, 2014; Winter, 1974). This invention was credited to a Chinese philosopher, Tien-Lcheu (2697 B.C.), and by 1200 B.C the ink had found more common usage for inscription. Other cultures developed inks using the natural dyes and colors derived from berries, plants and naturally occurring minerals. Ink was a perfect fluid for use on papyrus, parchment and paper. Consequently the Romans “converted bamboo stems into a primitive form of fountain pen”, with a well cut nib and the ink carefully filled into the hollow bamboo reservoir. Skillful scribes



**Figure 3.** Processing papyrus plant into papyrus. Adopted from <http://www.puffin.creighton.edu>.



**Figure 4.** Bamboo Book. Adopted from [www.chinatoday.com](http://www.chinatoday.com).

would cautiously squeeze the reservoir to force ink into the nib, making a perfect impression on the parchments.

Bones and rocks could not write on the papyrus scrolls, so the Egyptians used a writing device referred to as “reed Pen”. The reed pens were made from thin reed bushes of the sea rush plant (*Juncus maritimus*) (<http://www.britannica.com/reed-pen>). In many south European areas, where reeds suitable for writing purposes were not indigenous, the feather became the main writing instrument.

The reed pen continued being used well into the Middle Ages (350 to 1456 AD) before being replaced by quill pens. Introduced in 700 AD, quill pens were made from the first five flight feathers of the left wing of moulting birds (usually, goose, swan bird, eagle, owl, turkey, hawk or chicken), depending on the availability of the feather. Feathers from the left wings were preferred because they curve outwards and away from the writer (Benton, vol 9, 129). The strongest quill was carefully selected from the feather wings, and required meticulous processing on hot sand to strengthen it, then sharpening with a very sharp special knife (pen knife) before being used as a writing implement. The hollow shaft of the feather acted as an

ink reservoir (<http://en.wikipedia.org/wiki/Quill>). Quill pens were preferred writing instruments in the West from the 6<sup>th</sup> century, well through into the 18<sup>th</sup> Century. The early one room school houses in the 1700 and 1800s used quill pens to teach students how to write (Judy and Jean, 2011). It is documented that quill pens were used in writing the American constitution in 1787. Today, quill pens are used occasionally by artists and calligraphers (Benton, 1969; 546) (Figure 5).

The use of quill pens declined in the 18<sup>th</sup> century after the invention and mass production of pens with maintenance free metallic nib, “which would carry their own supply of ink”. These pens were called fountain pens, which continue finding application to this day. After the discovery of the fountain pen, there have been numerous changes and improvements on the shape of the pen making them more ergonomic, economical and affordable.

### SLATE, CHALKBOARDS AND CHALK

Parallel to the advancing pens, parchment and paper, other



**Figure 5.** An artistic impression of a calligrapher using a quill pen and a photo of bamboo reed pen: Source: <http://www.google.co.ke/url?.wikipedia.org>.



**Figure 6.** Picture of slate stone fragments on the outskirts of a mine, Britain: Larger pieces of slate stones were used to make writing slates (left) as well as chalkboards. Source; <http://www.google.co.kearchive.html>.

writing tools and writing surfaces begun to emerge. The surface was called the slate. The slate, made from slate stone (a black metamorphic rock) were used in Indian schools as early as the 11<sup>th</sup> Century, and by the 14<sup>th</sup> century found quick application in the rapidly expanding school systems of Northern Europe. The slates were originally small (4 × 6 inches), required reinforcement with wooden frames, written on using a slate pencil or chalk. The slates would later mutate into a larger slates called the chalkboard, an important writing tool in the classrooms of 17<sup>th</sup> century through to the 20<sup>th</sup> century (Figure 6).

Chalkboards are credited to have revolutionized learning since the instructor was now able to present learning content to a group of learners thereby speeding up the pace at which classroom instruction was progressing ([www.wikipedia.org/wiki/slate](http://www.wikipedia.org/wiki/slate)). Many schools around the world still use the chalkboard. However, the

use of the chalkboard in colleges and universities is diminishing and being replaced by the white board. Besides being a surface for writing, the white board is used as surfaces for projecting images from a computer application by means of an LCD (liquid crystal display) projector. The newest entry into the category is the interactive white board (sometimes referred to as smart board). The smart board projects the computer's desktop onto its surface and allows interaction between it and the computer by means of blue tooth protocol (Clarey, 2010; Judy and Jean, 2011:6).

#### DISCOVERY AND EVOLUTION PENCILS

A pencil is a solid rod of graphite enclosed in a wood case typically for drawing and writing. The origin of the pencil can be traced to 1564, when a material called

graphite was discovered in Borrowdale Cumberland, in England. The material was observed as quite brittle but quite visible when used to make markings on the sheep of local farmers. Consequently, local people, to make markings using graphite had to tie threads to the graphite or push graphite into metallic holders to reinforce it. In 1683, J. Pettus glued the graphite into wood to provide what seemed a better reinforcement (Benton, 1969). The pencil as we know it today had just been born. Pencils were later patented then mass produced in Nuremberg Germany in 1662, before blooming into an important industry during the industrial revolution of the 19<sup>th</sup> century. Today, the graphite in pencil is enclosed with quality wood, usually Californian Incense Cedar (*Libocerdus decurrens*) from the east of USA, and Red Kenya Cedar (*Junipus virginiana*) from Kenya (Benton, 1969:548). In 1795, Nicholas Jacques Conté, a French painter, patented his discovery that the hardness of the pencil could be modified by mixing and heating known proportions of powdered graphite with varying amount of clay. By varying the ratio of graphite to clay, the hardness of the graphite rod could be modified (BBC, 2014).

Over time, the pencils then spread from Europe to America, to Asia to Africa and the rest of the world where they have found ready use by learners, cosmetologists, carpenters, artists and architectures (www.rocketcityspacepioneers.com).

## CONCLUSION

With time, writing systems, writing surfaces and instruments continue to change. The typewriter, the computer keyboard, touch surfaces, interactive boards and virtual pages have shifted reality writing instruments and surfaces into a virtual paperless world. This is not a cause for worry; provided human thoughts, feelings and opinions are recorded for posterity. To a teacher, digital writing tools and systems are ably expanding the frontiers of learning and demanding transformation not only of pedagogical thought but also the practice of the teaching enterprise.

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