

PAPER, PRINTING AND THE PRINTING PRESS

A Horizontally Integrative Macrohistory Analysis

Shelton A. Gunaratne

Abstract / The Chinese used paper for two or three centuries before CE 105, when Cai Lun, director of imperial arsenals under Emperor He of the later Han dynasty (25–220), officially reported the ‘invention’ of paper. The Chinese began the first printed newspaper, *Jing Bao* (originally *Di Bao*), in 713 under the Tang dynasty (618–907); and it continued until the collapse of the Manchu dynasty in 1911. In 868, Wang Jie printed the famous *Diamond Sutra* (Kumarajiva’s *Vajracchedika Prajna Paramita*), the earliest printed book in existence. Xylography (block printing) was known in China for at least four centuries before 932, when Prime Minister Feng Dao supposedly ‘invented’ it by directing the printing of the 11 Confucian classics filling 130 volumes – a task that took 20 years. Alchemist Bi Sheng experimented with movable type for eight years from 1041, four centuries before Gutenberg. In 1313, Wang Zheng traced the development of movable type in his *Nong shu*, a treatise on agriculture. Chinese also made typography a fine art and produced numerous books. Printing from movable type reached its highest development in Korea from 1403 onwards. If the invention of printing ushered in the second communication revolution, then the celebration of Gutenberg as the inventor of printing represents a distortion of human history by those trying to document a so-called European ‘exceptionalism’ of the 15th century. The horizontally integrative macrohistory approach should set the record straight.

Keywords / Eurocentrism / horizontally integrative macrohistory / paper and printing / second communication revolution / world system theory

Introduction

Scholars refer to three communication revolutions in human history. The emergence of writing was the first. The invention of printing was the second. The convergence of telecommunication, computers and digitization is widely hailed as the third (Gunaratne, 2001a; Stevenson, 1994). A revolution effects a change in the societal power structure. Thus writing undermined the power monopoly of the elders, who preserved in oral form the accumulated knowledge of preliterate people. Likewise, printing ended the information monopoly of the church, the clergy and the mandarins, depending on the social context. The invention of digitization may change the societal power structure in ways yet to be seen.

The evolution of writing began in the Middle East. The pictures that the Old Stone Age people painted in their caves eventually transformed into conventionalized pictographs. The Sumerians of Mesopotamia (now Iraq) and the ancient Egyptians each developed ideographic scripts more than 3000 years before the Christian

era. The Sumerians passed on their script, called *cuneiform* (Latin for 'wedge-shaped'), to Akkadians, Babylonians, Assyrians, and to other neighboring peoples. The Egyptians used *hieroglyphics* (Greek for 'sacred carvings'), a form that Minoans and Hittites, as well as Maya and Aztec Indians, also used. The evolution of writing took place in four stages: first, picture writing, which expressed ideas directly; second, word-based writing systems; third, sound-based syllabic writing systems; and fourth, the invention of the alphabet. The origins of Chinese characters can be traced to primitive cuneiform and hieroglyphic scripts developed during the Shang dynasty (1700?–1100? BCE), although some argue that the Chinese system of writing developed separately. Despite the massive evidence available about the non-western origins of writing, the Eurocentric interpretation of history attempts to bestow the ultimate credit on the West. For instance, the *Encyclopedia Britannica* says the invention of the alphabet is a major achievement of western culture – an invention of enormous importance for Greek and for all Indo-European languages.¹

The evolution of printing began in ancient China even though the Eurocentric interpretation of history attempts to trace it to European 'exceptionalism' that supposedly emerged in the 15th century. *Encyclopedia Britannica* traces the invention of printing to the dawn of the age of the great discoveries. It says this invention was 'in part a response and in part a stimulus to the movement that, by transforming the economic, social, and ideological relations of civilization, would usher in the modern world' (*The New Encyclopedia Britannica*, 1998: 71). Economically, it says, the Italian republics had attained a high level of production and exchange while the Hanseatic League and the Flemish cities had experienced a commercial upsurge. Socially, the decline of the landed aristocracy and the rise of the urban mercantile bourgeoisie had come about. Ideologically, the aspirations of this bourgeoisie for a political role that would allow it to fulfill its economic ambitions had emerged.

This interpretation exemplifies the vertical separation of history to promote Eurocentrism. The 'great discoveries' concept ignores the explorations of non-Europeans, including the celebrated seven voyages of Zheng He [Cheng Ho] from 1405 to 1433 with 300-ship fleets carrying 27,000 men to India, Arabia and even to East Africa during the Ming dynasty (1368–1644). Temple (1986) asserts that the Chinese were the greatest sailors in history.

The Chinese sailed around the Cape of Good Hope in the opposite direction to that taken by the Europeans and at an earlier time. They were also first to discover Australia, landing at the site now called Port Darwin. Chinese trade with the Philippines and Indonesia was common; and trade with the eastern coast of Africa was so extensive that pieces of broken Chinese porcelain are to be found scattered all up and down the beaches of Tanzania and Mozambique, dating back for centuries. The Chinese also made voyages to the American continents, though it is questionable whether they were return voyages. . . . For nearly two millennia, they had ships and sailing techniques so far in advance of the rest of the world that comparisons are embarrassing. When the West finally did catch up with them, it was only by adapting their inventions in one way or another. (Temple, 1986: 186)

Moreover, the alleged economic transformation in Europe downplays the fact that 'the Asian economy and intra-Asian trade continued on vastly greater scales than European trade and its incursions in Asia until the nineteenth century' (Frank,

1998: 184). For lack of holism, the attempt to connect the invention of printing with European civilization (or exceptionalism) crashes into the realm of myth.

Similarly, Bombay-born English poet Rudyard Kipling ignored the historical evolution of the world system when he wrote in the *Ballad of East and West*.

*Oh, East is East, West is West, and never the twain shall meet,
Till Earth and Sky stand presently at God's great Judgment Seat.*

Kipling, a defender of British imperialism, found common grounds with Marx, Weber and their myriad followers in the social sciences. They laid the groundwork for a Eurocentric social theory² based on European 'exceptionalism' dating back to the voyages of Columbus (in 1492) and Vasco da Gama (in 1498). Instead of analyzing world history holistically and horizontally, they chose to do so partially and vertically. Vertical separation enabled the Eurocentric historians to trace the invention of printing to Gutenberg, c. 1450, as another manifestation of European exceptionalism.

Because the invention of printing is considered the second communication revolution, this article uses the world system framework to examine the historical truth about the origin of printing. More than 130 titles in the Library of Congress database bear Gutenberg's name, as a perpetual reminder of the Eurocentric celebration of a man who helped transform the societal power structure. However, should not the world separate the truth from the myth and celebrate the real inventors of printing, whose names may sound so alien to the West?

World System Perspective

Frank (1998) explains that the world system theory facilitates a holistic understanding of historical processes because the whole (the world system) is more than the sum of its parts (nation-states or regions). This framework is also consistent with the principle of part-whole interdetermination, a vital aspect of Chinese philosophy (Cheng, 1987: 26), as well as with the notion of interconnectedness of things in Indian philosophy (Dissanayake, 1987: 155). Unlike Wallerstein (1974), who traces the world system to the alleged European 'exceptionalism' that supposedly emerged in the 15th century, Frank traces the world system to at least 5000 years back³ (Frank and Gills, 1993). Frank's humanocentric notion of the world system facilitates a much more accurate interpretation of world developments using what historian Fletcher (1985) termed the horizontally integrative macrohistory approach.

A humanocentric approach to the study of communication history must replace the vertical separation approach demarcated as western vs eastern, or occidental vs oriental, or European vs Afro-Asian. Separatist history – European, Asian or whatever – that ignores the horizontal connections to the world system over all stages of historical progression fails to document the truth about human achievements. The alleged European 'exceptionalism' disregards historical continuity and implicitly denigrates non-European achievements.

Frank (1998) questions the notion of European exceptionalism on six related grounds. First, he documents that the derogatory implications of the thesis of

Orientalism, in contrast to that of European exceptionalism, empirically and descriptively misrepresent how Asian economies and societies have performed. Second, he demonstrates the failure of historical evidence from Europe itself or from elsewhere to show the alleged European exceptionalism. Third, he shows that the comparative method of Marx and other Eurocentric scholars suffers from inadequate holism and misplaced concreteness. Fourth, he says the assumption that local, national, or regional developments determine the institutional basis and mechanisms of production and accumulation, exchange and distribution, and their functional operation fails to consider that such developments may well be responses to participation in a single world system. Fifth, he argues that even the best comparative studies violate the canon of holism if they fail to analyze the impact of the global whole and the world economy/system. Sixth, he points out that the factors chosen for the comparison without reference to the world system vitiate the comparative studies of 'western' and 'oriental' societies.

Frank's (1998) analysis of worldwide economic relations in productivity, technology and their enabling and supporting economic and financial institutions, which developed on a global scale, shows that during the early modern period from approximately 1400 to 1800 Asian productivity was superior to that of Europe. During this period, the population grew faster in Asia, particularly in China and India, than in Europe possibly because production also grew faster to support the population growth. By 1750, according to the estimates of Paul Bairoch, about 80 percent of the world gross product of \$155 billion (measured in 1960 US dollars) was in Asia, which shared 66 percent of the world population. This leads to the conclusion that on average the productivity of Asians and their quality of life were significantly higher than those of Europeans. In terms of productivity and competitiveness, 'Europeans were able to sell very few manufactures to the East', and 'Europe was not a major industrial center in terms of exports to the rest of the world economy' (Frank, 1998: 177). Yet, Eurocentric history expounds that Europeans created and dominated world trade. Frank says that for three centuries after 1500, the Europeans remained a small player who had to adapt to 'the world economic rules of the game in Asia' (Frank, 1998: 185).

Frank (1998: 186) rejects the view that Europe rose to 'dominance' in 1500. He says that having found silver in the Americas, the Europeans took the silver to the East to purchase the merchandise that they could not themselves competitively produce. The ultimate depository of silver was China, the center of world trade. Moreover, Frank says, the study of the history and role of the 'scientific and technological revolution seems to be much more ideologically driven than the technology and science that allegedly support it' (Frank, 1998: 186). He asserts that when science and technology are examined as economic and social activities worldwide, the Eurocentric claim of a scientific revolution prior to very modern times receives less historical support. He asks, 'After importing the compass, gunpowder, printing, and so on from China, was technology then developed indigenously in Europe but no longer in China and elsewhere in Asia' (Frank, 1998: 186)?⁴ Europe's 'takeoff' after 1800 was not based on exceptional European scientific, technological and institutional 'preparation' or the 'Renaissance', he asserts, but on the prior and contemporaneous development of the totality of the world system (Frank, 1998: 224).

In his three volumes on the world system, Wallerstein (1974, 1980, 1989) is inexplicably silent on the invention of printing. He makes two references to 'printers' in the footnotes of his second volume: one to extol Holland's primacy as a book-printing center c. 1699 (Wallerstein, 1980: 44); and the other to highlight the Dutch achievements in many branches of technology simultaneously, including printing (Wallerstein, 1980: 66). In his first volume (Wallerstein, 1974), he expresses skepticism about 'Chinese technological competence and superiority over the West until the latter's sudden surge forward', as historian Joseph Needham has claimed, because 'then it is even more striking that Chinese and Portuguese overseas explorations began virtually simultaneously, but that after a mere 28 years the Chinese pulled back into a continental shell and ceased all further attempts' (Wallerstein, 1974: 54). Wallerstein was referring to the great voyages of Zheng He (see Levathes, 1994) with whose death in 1434 the Chinese voyages ceased. In 1479, when Wang Jin wanted to lead a military expedition to Annam (now central Vietnam), the official bureaucracy of Confucian mandarins had refused him access to Zheng's papers on Annam. After discussing the explanations of various scholars on why the Chinese expeditions ceased, Wallerstein argues that China's prebendal land-controlling mandarins, who believed the Chinese empire to be the whole and the only economy, considered Zheng He's expeditions 'as a drain on the treasury' (Wallerstein, 1974: 60). Thus, despite China's equal status with Europe in technology, including naval engineering, in the 15th century, Europe expanded to become a 'world system' while China declined as a 'world empire'. This distinction became the cornerstone of Wallerstein's Eurocentric world system theory.

Frank (1998), on the other hand, analyzes the rise of the West from a humanocentric perspective and maintains that China remained the central world economy until late 18th century. Because Frank, drawing from the voluminous research of Joseph Needham, has already documented the heretofore underestimated Asian contribution to science and technology – in mathematics, astronomy, medicine, engineering and various other fields – this article concentrates on recognizing and celebrating the real contributors responsible for setting off the second communication revolution associated with the invention of printing.

Beginning of Printing

This article relies heavily on Carter (1955), Laufer (1973), Temple (1986) and Tsien (1985) to trace the history of printing.⁵ Perhaps the most authoritative is Tsien's book, which constitutes a separate volume in Needham's monumental series on *Science and Civilization in China*.

Carter recognized the revolutionary impact of paper and printing, which 'paved the way for the religious reformation and made possible popular education' (see Carter, 1955: ix) from the Eurocentric perspective. Frank (1998), on the other hand, saw the importance of printing for the transmission of knowledge from the oriental perspective:

It is . . . significant that woodblock printing was invented and used in China up to half a millennium earlier than elsewhere. Color printing began in China in 1340, and five-color

printing was in use there in the 1580s and widespread (certainly far more than in the West) in both China and Japan in the seventeenth and eighteenth centuries. Movable metal type came from Korea and was soon introduced elsewhere, though not into the Islamic world for a long time. In China . . . economically and socially speaking, printing, publishing, and literacy expanded enormously and surely had much more widespread effects than in Europe – including even the counterfeiting of paper money until the Ming withdrew it from circulation. (Frank, 1998: 200)

In ancient and medieval times, inventions, works of literature and languages followed the path of the 6400-kilometer caravan track called the Silk Road, a major trade and travel route between Asia, the Middle East and Europe. Conquering armies, Buddhist missionaries traveling from India to China and Muslim clerics from Southwest Asia (Middle East) also used the same route. In 1271, when the Polos – Marco, his father Niccolo and uncle Maffeo – set out from Venice to China via the southern Wakhan route of the Silk Road, this path of Eurasian cultural exchange was already in use for more than 1500 years. The road crossed a wide range of climates and cultures, from the lush, temperate region of eastern China to the deserts and mountains of Muslim Central Asia. Originating in Xian, the Silk Road followed the Great Wall of China to the northwest, bypassed the Takla Makan Desert, climbed the Pamir Mountains, crossed Afghanistan, and went on to the Levant. Entrepreneurs shipped the merchandise from the Levant across the Mediterranean Sea.

The nature of the world system, described elsewhere in greater detail (Gunaradne, 2001b) – a core-periphery structure reshaping itself through competitive capital accumulation as manifested in alternating hegemony and rivalry over long and short economic cycles – leads us to surmise that the West was not unaware of the innovations of the East. Those who traversed the Silk Road or the oceanic routes would have been the natural communication link. It is hard to believe that the news about the invention of movable type in China, in the mid-11th century, and subsequently in Korea and Japan, did not reach the West until Gutenberg independently made the invention in the mid-15th century. Besides, Eurocentric scholarship belittles the contribution of eastern innovations to western enrichment, as when Carter asserts:

It is the glory of European genius, newly awakened, that it was able to seize these discoveries, dimly seen in East Asia and in some cases dimly understood in the land of their birth, and to make them the basis for a civilization of which their discoverers could never have dreamed. (Carter, 1955: x)

Temple (1986), however, attributes these and other European accomplishments to the genius of China. Paper and printing exemplify that genius. Applying the horizontally integrative macrohistory approach, we can examine the progress of paper and printing across the world over each historical period denoting the Chinese dynasties.

Han Dynasty (202 BCE–CE 220)

Before the invention of paper, the Chinese used bamboo pens with ink of soot or lampblack to write on slips of bamboo or wood or scrolls of silk. Meng Dian

invented the writing brush of hair early in the Qin period (221–206 BCE). Then came what Carter calls ‘the most certain and the most complete of China’s inventions’ (Carter, 1955: 3) – the invention of paper by Cai Lun⁶ in 105 as officially reported in the Han dynastic records. However, Tsien (1985: 2) says that recent discoveries of very ancient paper fragments in north and northwest China have pushed back the date of the invention of paper ‘at least to some two to three centuries’ before Cai Lun. Tree bark, hemp, old rags and fishnets went into the production of paper. Calligrapher Zuo Bo and the legendary Kong Dan made extensive improvements in paper manufacture.

Printing was most likely known in China by the end of the second century because the Chinese then had at their disposal the three elements necessary for printing: *paper*, the techniques for the manufacture of which they had known for several decades; *ink*, whose basic formula they had known for 25 centuries; and *surfaces* bearing texts carved in relief. Laufer (1973) says the turning point in the history of printing was the invention of paper. Block printing, exemplified in the use of seals (first mentioned c. 255 BCE, and subsequently associated with Qin dynasty’s Emperor Shi Huangdi, who built the Great Wall), came into general use during the Han period. Temple (1986: 110) points out that the Chinese ‘got the idea of seals from the Middle East, where the Babylonians and Sumerians used them in profusion’. The use of seals in western culture ceased after the fall of the western Roman empire but revived in the latter half of the eighth century (Tsien, 1985). Bronze casting, a forerunner of movable type, was used in China as early as 600 years before the Christian era. Chinese also conceived stone rubbing as a method of mass-producing religious texts. Seven Confucian classics, exceeding 200,000 characters, were engraved on some 46 stone tablets between 175 and 183, and the practice of making ink rubbings from these engravings followed. Inscribing on stone was also prevalent in the West, where, however, it was used more as an artistic material than for writing (Tsien, 1985).

Six Dynasties (220–589)

With the fall of the Han empire, China experienced 400 years of anarchy comparable to the Dark Ages in Europe. However, Buddhism flourished during these depressing years, making this period ‘an age of faith’ (Carter, 1955: 27). Religious literature and art flourished because of Buddhism. Paper manufacture expanded rapidly displacing bamboo, wood and silk as writing material. The use of paper became general throughout eastern Turkestan (a large indefinite region – covering some 1.6 million square miles – extending eastward from the Caspian Sea through Central Asia into China’s Xinjiang). As for block printing, the fifth century marked the earliest use of inked seals.

Sui Dynasty (589–618) and Tang Dynasty (618–906)

The use of paper spread to Samarkand in 650, to Mecca in 706 and to Egypt c. 800. The manufacture of paper began in Samarkand in 751, in Baghdad in 793 and in Egypt c. 900. Papermaking appears to have followed the Silk Road.

Chinese captives taken prisoner at the Battle of Talas, near Samarkand, in 751 reportedly gave the secret to the Arabs.

Several developments occurred in block printing: Daoist wood seals, used for making charms, appeared in the sixth century. Buddhist monasteries experimented with various forms of duplication – seals, rubbing, Buddha stamps, stencils and textile prints – in the seventh century. Buddhism received a new impetus when Xuan-zhuang (602–64), the greatest of all the apostles of Chinese Buddhism, returned from India. Buddhists used stencils to reproduce large quantities of Buddha images. The technique of composite inked squeezes foreshadowed photography. In 868, Wang Jie produced the first complete printed book, *Diamond Sutra* (the Chinese version of Kumarajiva's *Vajracchedika Prajna Paramita*) to give blessings to his parents. The manuscript chamber at Dunhuang contained this Buddhist religious work together with a copy of it in the form of lithograph rubbing. However, the oldest known printed work was a Buddhist charm scroll printed in China between 704 and 751 but preserved in a Korean temple. The same Buddhist sutra of the Korean scroll was printed in Japan about 764–70 by order of Empress Shotoku and distributed to Japan's 10 major temples. Korea was the first country to which printing spread from China, c. 700. The Buddhists took the new technology to Japan. By 835, non-religious work too appeared in print with Sichuan and the lower Yangzi valley turning into centers of printing. Between 847 and 851, alchemist Liu Hong printed several thousand copies of his biography. Moreover, personal printed calendars became popular. The Chinese also conceived the idea of the printed newspaper, *Jing Bao*⁷ in 713 under the Tang dynasty. Originally started as *Di Bao* in 618, it continued until the collapse of the Manchu dynasty in 1911 (Bishop, 1989; Chang, 1989; Laufer, 1973).

Five Dynasties (907–60) and Song Dynasty (960–1279)

The use of paper spread to Spain c. 950, to Constantinople c. 1100, to Sicily in 1109, to Italy in 1154 and to Germany in 1228. The manufacture of paper began in Morocco c. 1100, in Spain in 1150 and in Italy in 1276.

The printing of the 11 Confucian classics – filling 130 volumes – by Prime Minister Feng Dao, between 932 and 953, ushered in the era of large-scale block printing (technically called xylography, the art of printing from wood carving). These were 'the world's first official printed publications' (Temple, 1986: 112). The 10th century also saw the printing of collections of works by individual poets like He Ning, as well as historical criticism and encyclopedic works. Monk Xuan Zun printed his own commentary upon the classic of Daoist sage Lao Zi. Dunhuang findings indicate that charms and votive offerings continued to be printed in the second half of the 10th century. Block printing also produced playing cards (first mentioned in 969), paper money in Sichuan (late 10th century) and the great dynastic histories (994–1063). The printing of 130,000 pages of the *Tripitaka*, the Buddhist Canon, took place from 971 to 983 while Buddhist *sutras* were also printed in Zhejiang (956–75). (At least six different editions of the *Tripitaka* were printed during the three centuries of the Song.) Thus the Song dynasty marked the high tide of Chinese printing. In Korea,

woodblock printing had a huge impact during the Koryo dynasty (918–1392) because books had become commonplace, for Xü Jing, a Chinese member of a mission to Koryo in 1123, had observed in his travelogue that Koreans considered it shameful not to be able to read. Japan began printing Buddhist books in the 11th century, while Buddhist books printed in Chinese and Tangut were found in Kharakhoto, Mongolia, in 1016. Turfan in Turkestan became a great Buddhist printing center in the 13th century or earlier, while Egypt also practiced block printing through the same period. In China, the reckless issue of paper money c. 1100 caused inflation. Paper money printed in 1107 came out in three colors to prevent counterfeiting. This makes the Chinese the inventors of multi-color printing as well.

Bi Sheng, an alchemist, invented movable type between 1041 and 1049 when he experimented with type made of earthenware set in an iron form. Scientist Shen Gua recorded this invention in his *Dream Pool Essays* of 1086. Improvements occurred with both type and form made of earthenware, and subsequently with type made of tin, perforated and held in place by a wire. However, because of the difficulty of getting a satisfactory ink, movable type was not widely used in China. Koreans used metal type in 1234 to print *Kogum Sangjong Yemun*, a ritual code.

Yuan Dynasty (1279–1368)

The use of paper spread to England in 1309, and to Holland in 1346. Notable events relating to block printing included: letters with large Chinese seal impressions sent from Persia to the king of France in 1289 and 1305; the issue of printed money (in Chinese and Arabic) at Tabriz, Persia, in 1294; the description of paper money by Marco Polo in 1298; and Persian scholar-official Rashid-eddin's accurate description (in Arabic and Persian) of Chinese block printing c. 1303. Developments in typography included: the spread of wooden type to Turkestan, and the use of Uighur fonts c. 1300; and the printing, in 1313, of Wang Zheng's classic, the *Nong shu* (Treatise on Agriculture), in which he describes the development and perfection of wooden type, as well as its storage and handling arrangements. (The treatise itself, however, was printed with bronze type.)

Ming Dynasty (1368–1644)

The manufacture of paper began in Germany in 1391, in England in 1494 and in Mexico in 1575. Printing during the Ming period 'was distinguished by the extended scope of its subject-matter and by its technical innovations and artistic refinement' (Tsien, 1985: 172). With the arrival of Jesuit missionaries at the end of the 16th century, Chinese literati came into contact with western knowledge.

Block printing – image prints and playing cards – began in Europe at the end of the 14th century, although the earliest European block prints had the dates of 1418 and 1423. The earliest European block books appeared between 1440 and 1450. In Korea, the Yi dynasty (1392–1910), which followed the

Koryo dynasty, created the *Han-gul* alphabetic script as the national form of writing, and promoted the wide application of metal type for printing. Korea set up a metal type foundry in 1390. In 1403, King Htai Tjong ordered the first set of 100,000 pieces of type to be cast in bronze. Nine other fonts followed from then to 1516; two of them were made in 1420 and 1434. In Japan, from the 13th to the 16th centuries, the major efforts in printing were carried out in parallel groups of Zen temples in Kyoto and Kamakura, known as the Gozanji. In the 14th century, the Japanese script *kana* was used for the first time in printed books. The presses of the Buddhist temples dominated Japanese printing until the end of the 16th century, whereafter a brief flourishing of movable-type printing took place until 1650. Meanwhile, rapid advances in typography throughout Europe followed Gutenberg's 'invention' of movable type c. 1450; and printing reached Mexico in 1539.

Figure 1 traces the highlights of the historical evolution of writing, paper, and printing in the backdrop of world system cycles up to end of the medieval period.

Discussion and Conclusion

The horizontally integrative macrohistory approach based on Frank's version of the world system theory clearly shows that the Far East, not Europe, was the main instigator of the second communication revolution. Paper and printing, including typography, had their undisputed origins in China. Bi Sheng invented movable type four centuries before Gutenberg. Early in the 20th century, Hessels (1912) asserted that Gutenberg was not the inventor of printing. Dutch printer Laurens Janszoon Coster also had a claim on the first use of movable metal type in the 1430s. Temple (1986: 9) is unequivocal: 'Johann Gutenberg did *not* invent movable type. It was invented in China'. More recently, the research of two Princeton scholars revealed 'the metal mold method of printing attributed to Gutenberg was probably invented by someone else about 20 years before Gutenberg printed his Bible' (Smith, 2001: B9). Gutenberg, however, retains credit as the inventor of the printing press, which helped mass produce the Bible and other materials.

Although Carter was unaware of the world system theory, he recognized its framework when he wrote:

Of all the world's great inventions that of printing is the most cosmopolitan and international. China invented paper and first experimented with block printing and movable type. Japan produced the earliest block prints that are extant. Korea . . . first printed with type of metal, cast from mold. India furnished the language and the religion of the earliest block prints. People of Turkish race were among the most important agents in carrying block printing across Asia. . . . Persia and Egypt are the two lands of the Near East where block printing is known to have been done before it began in Europe. The Arabs were the agents who prepared the way by carrying the making of paper from China to Europe. Paper making actually entered Europe through Spain. . . . As for block printing and its advent in Europe, Russia's claim to have been the channel rests on the oldest authority, though Italy's claim is equally strong. . . . Holland and France, as well as Germany, claim first to have experimented with typography. Germany perfected the invention, and from Germany it spread to all the world. (Carter, 1955: 243)

FIGURE 1

Highlights of the First Two Communication Revolutions against the Backdrop of World System Cycles up to 1450

Bronze Age 3000–1000 BCE

A and B Phases: 3000–2000 BCE

- Creation of first world system imperium under Sargon of Akkad
- ‘Dark Ages’: Gutian invaders rule Mesopotamia; collapse of central state power in Old Kingdom (Egypt); Amorites displace Sumerians

Writing: cuneiform in Mesopotamia; hieroglyphics in Egypt

B Phase: 1700–1500/1400 BCE
(Disintegration of
hegemonies and economic
disruptions)

- Hittites and Kassites conquer Anatolia and Mesopotamia
- Hurrians and Hyksos overrun Levant and Egypt
- Aryans inundate the Indus at decline of Harappan civilization; beginnings of Vedic Hinduism
- Shang aristocracy established in north China

Writing: Phoenicians develop rudiments of an alphabetic language

A Phase: 1400–1200 BCE
(Economic recovery)

- Hittite empire
- Empire of New Kingdom Egypt

Ink: By 1200, Chinese mix lampblack and glues or gums to make ink for brush writing and for printing from wooden blocks

B Phase: 1200–1000 BCE

- Collapse of Hittite empire and Kassite dynasty in Babylonia
- Libyan mercenaries and Nubians seize power in Egypt
- Dorians, Aramaeans and Phoenicians overrun Mycenaeans in Greece and Levant
- Barbarian Zhou oust Shang
- Appearance of Brahminic Hinduism

Iron Age and Classical Period 1000 BCE–CE 500

A Phase: 1000–800 BCE

- Assyrian empire in northern Mesopotamia
- Phoenician influence over Mycenaeans
- Hinduism influenced by Upanishad philosophy

Writing: Greeks adopt Semitic (Phoenician?) alphabet of 22 letters

- B Phase: 800–550 BCE
- Decline of Assyrians. Rivalry among Babylonians, Medes and Persians
 - Economic decline of Phoenician cities
 - Iron technology spreads in north India
 - Zhou hegemony gives way to independent states
- A Phase: 550–450 BCE
- Zoroastrianism, Hebrew prophets (Ezekiel and Isaiah). Rise of Achaemenid Persian empire in West Asia
 - Pythagoreanism, Ionian philosophy. Expansion of Greek cities
 - Hindu reformism: Buddhism, Jainism
 - Confucianism, Daoism
- B Phase: 450–350 BCE
- Hellenic conquest of Persia; Hellenistic Judaism
 - Decline of Greek cities. Macedonian hegemony of Greece. Celts invade Italy and set up Galatia kingdom in Asia Minor
 - Breakaway of the Indus from Persian empire
- A Phase: 350–250/200 BCE
- Alexander the Great reconquers Persia
 - Hellenistic economic expansion
 - Maurya hegemony in northern India and Central Asia
 - Qin dynasty hegemony
- Block printing:** (In China), first mention of the use of seals (255 BCE)
- B Phase: 250/200–100/50 BCE
- Economic decline of Egypt. Decline of free peasantry in Greece and Italy
 - Decline of Maurya empire
 - Power struggle among Chinese, Xiongnu and Yuezhi
- Paper:** Chinese invent paper made of matted rag fibers (2nd century BCE)
- A Phase: 100/50 BCE–CE 150/200
- Unbroken belt of interlinking competing hegemonies – Roman (Mediterranean Basin), Parthian (Mesopotamia and Persia), Kushan (Central Asia) and Han (China) empires – characterized by constant rivalries
 - Rome enjoys peace and economic prosperity; Parthians build empire; Kushan unify Central Asia; Chinese build Great Wall and take control of Silk Road; Indians expand into Southeast Asia
 - Rabbinic Judaism; Christianity

Block printing: (In China), general use of seals. Impressions on clay without ink; (c. 100 BCE) earliest use of ink from lampblack; and (CE 175–83) standard text of the classics cut in stone

Paper: Invention of paper officially announced to the emperor by Cai Lun

B Phase: 150/200–500

- Pan-Eurasian world system crisis disintegrates Roman, Han, Parthian and Kushan hegemonistic structures simultaneously. Western Europe declines into the 'Dark Ages', and economic retrogression and political division within China
- Ascendancy and decline of the Sassanid (Persia) and Gupta (India) empires

Block printing: (In China), earliest use of inked seals (5th century)

Medieval and Early Modern Periods 500–1500

A Phase: 500–750/800

- Interlinking and synchronization of Afro-Eurasia (except Western Europe and parts of Africa) via Central Asia
- Overextension of the Byzantium (eastern Roman) and the Sassanid empires; reunification of China under Sui dynasty; and expansion into Central Asia under Tang dynasty; Sri Harsha hegemony in northern India
- Founding of Islam. New Arab/Muslim caliphate (the Orthodox Caliphate in Medina, the Omayyad Caliphate in Damascus that subjugated North Africa and Spain, and the Abbasid Caliphate in Baghdad that conquered Sassanid possessions) unifies Mesopotamia, Egypt and Central Asia

Paper: Chinese taken prisoner at Battle of Talas, near Samarkand, reveal secret of papermaking to Arabs (751), who spread the technique in areas under their domination – from Baghdad to Madrid – until 13th century

Block printing: (In Japan), oldest known printed works in Sanskrit and Chinese characters – Buddhist incantations ordered by Empress Shotoku (764–70)

B Phase: 750/800–1000/1050

- Major watersheds in every Eurasian empire: Carolingian, Abbasid, Uighur, Turkic and anti-Tang rebellions
- Reversal of Tang Chinese expansion in Asia at Battle of Talas (751)

- Decline of Baghdad and Basra, and of the centrality of the Gulf route to the Orient

Block printing: (In China), the first known book, the *Diamond Sutra* printed by order of Wang Jie found in Dunhuang (868); a collection of Chinese classics in 130 volumes, at the initiative of Feng Dao, a Chinese minister (932–53); about 50 printed charms and votive offerings found in Dunhuang (947–83); earliest mention of playing cards (969); printing of the *Tripitaka*, the Buddhist Canon, in 130,000 pages in Zhejiang (956–75); first printing of paper money (late 10th century); printing of the great dynastic histories (994–1063)

A Phase: 1000/1050–1250/1300

- Consolidation of Song China
- Expansion of Europe (the Crusades, the colonization)
- Rise of Cairo under the Mamluks; Venice–Cairo ‘marriage of convenience’ to monopolize Asian–Mediterranean trade

Typography: (In China), alchemist Bi Sheng invents movable type (four centuries before Gutenberg) made of an amalgam of clay and glue hardened by baking (c. 1041–8); use of tin to improve movable type

Typography: (In Korea), development of typography (c. 1200–50). *Kogum Sangjong Yemun*, a ritual code, printed with metal type in 1234

Paper: Paper penetrates Europe as a commodity through Italian ports and overland routes (from 12th century)

B Phase: 1250/1300–1450

- Construction and collapse of Mongol empire: rise of Manchus in northeast China. Mongols conquer Persia and Mesopotamia. Genghis Khan conquers Central Asia from Muslim Khwarizm empire. Tamerlane reconquers

Printing: (In China), magistrate Wang Zheng gets an artisan to carve more than 60,000 characters on movable wooden blocks prior to printing his *Nong shu*, a treatise on agriculture, which also traced the history of technology (c. 1313)

Printing: Uighur typefaces, carved on wooden cubes, found that date from the early 14th century

Printing: (In Korea), King Htai Tjong, in 1403, orders the first set of 100,000 pieces of type to be cast in bronze. Two other fonts made in 1420 and 1434, before Europe 'discovered' typography. Nine fonts completed by 1516

Printing: (In Europe), Gutenberg 'invents' typography (c. 1450) and prints the Mazarin Bible in 1456

Sources: Carter (1955), Frank and Gills (1993).

The spread of paper and printing demonstrates how the units of the world system are connected to each other. The premise of European exceptionalism resulted in bestowing on Gutenberg more credit than he deserved, thereby denigrating the real inventors in the Far East. The spread of paper and printing also shows the phenomena of capital accumulation and hegemony-rivalry at work. The ups and downs of long economic cycles placed Europe ahead of the Far East to take advantage of the latter's genius (Temple, 1986). In relation to the spread of paper and printing, China stood as the undisputed center flanked by Korea and Japan – the three countries forming a sort of center cluster. Central Asia and the Middle East constituted the semi-periphery cluster that became the transmission link between the center cluster and Europe, the periphery cluster that was going through the Dark Ages following the fall of the Roman empire. The semi-periphery was clearly reaping the benefits of capital accumulation in its role as the transmission link. The fortunes of the periphery cluster began to change with its newly found silver and gold in the Americas, that enabled it to compete with the center cluster more aggressively. Inexpensive labor, the result of a large population pool in relation to production, blunted China's incentive for technical innovation, whereas the reverse circumstances in Europe – expensive labor, the result of a smaller population in relation to production – provided incentives for technical innovation that resulted in the industrial revolution of the late 18th century (Frank, 1998). Over a 200- to 300-year-long economic cycle of capital accumulation, Europe succeeded in transforming the medieval world system structure.

A Eurocentric justification for attributing the 'invention' of printing to Gutenberg also includes a denigration of Islam: that Islam may have prevented the spread of typography into Europe. This view accepts that typography was assimilated by the Uighurs who lived on the borders of Mongolia and Turkestan, since a set of Uighur typefaces, carved on wooden cubes, has been found that date from the early 14th century. It also accepts that the nomadic Uighurs may have spread the knowledge of typography as far as Egypt, where 'it may have encountered an obstacle to its progress toward Europe, namely, that, even though the Islamic religion had accepted paper in order to record the word of Allah, it may have refused to permit the word of Allah to be reproduced by artificial means' (*The New Encyclopedia Britannica*, 1998: 72). This interpretation merely highlights the peripheral status of Europe, which so much depended on the Arabs.

Another Eurocentric view purportedly provides a material explanation of

why printing developed in 15th-century Europe, even though the principle on which printing is based had been known in the Orient long before: the fact that European writing was based on a limited alphabet compared to some 80,000 symbols in Chinese, which 'lends itself only poorly to the requirements of a typography' (*The New Encyclopedia Britannica*, 1998: 71). Tsien (1985: 220) agrees that the nature of written Chinese requiring several types for each character 'reduced the practicability of movable-type printing in China'. Chu (1988: 133), on the other hand, points out that the Chinese ideographic system is, perhaps, 'the most misunderstood aspect of Chinese communication'. He asserts that the ideographs are far richer in meaning than the Romanized system, and also save much space over the latter. Therefore, typesetting ideographic characters may not necessarily take a longer time than Romanized characters because of this advantage. Xylography may have won over typography in China primarily because of the additional richness that block printing could give to each ideograph. Unlike in the West, mass production was not the intent of the block printers of China.

Yet another Eurocentric view is that printing in China failed to produce the massive social changes to the extent that Gutenberg's 'invention' of printing did in Europe. Commenting on the impact of printing on intellectual life and society in the East and the West, Tsien says:

In both [East and West] printing promoted culture, widened the scope of subjects that interested scholars, helped shift the bias from religious to classical learning, . . . popularized education, spread literacy, and enriched art and literature; though it did so to a different degree in each. . . . [In China, printing] facilitated the continuity and universality of the written language and thus became an important vehicle for sustaining the cultural tradition [as evident] in the printing of the Confucian classics and similar material for the civil service examinations. (Tsien, 1985: 382-3)

Moreover, Tsien says, China had always produced an optimum number of books without pecuniary motivation because of its extensive literary tradition. In contrast, the West possessed a very limited legacy of books as it emerged from the Dark Ages at the close of the medieval period. Thus as soon as printing was available, the West utilized it 'for book production to the maximum extent' (Tsien, 1985: 283).

The world system framework makes it difficult to concede that Gutenberg 'invented' movable type independently. Tsien (1985: 303) asserts that 'although no direct relationship has yet been established between European typography and Chinese printing', a number of theories based on early references and circumstantial evidence have been advanced in favor of the Chinese origin of the European techniques, particularly in the light of the close East-West contact during the Mongol conquest. Various kinds of printed matter – playing cards, printed textiles, woodcuts and books printed from woodblocks – are known to have existed in Europe as early as a century before Gutenberg. Because of the resemblance of these artifacts to Chinese block printing, one can presume that Mongol armies, traders, missionaries and travelers introduced these to Europe from Asia. Lehman-Haupt (1966) reveals that Gutenberg played a major role in the development of copper engraving to make masters for producing playing

cards. This suggests that Gutenberg was not unaware of Chinese printing methods.

Carter concedes that for a century or more – from the mid-13th century to the mid-14th century – ‘the contact between Europe and Eastern Asia was far closer than ever before’ (Carter, 1955: 155) until the curtain fell for the next century and a half following the defeat of the Mongols. Just before the curtain fell, the first primitive block prints appeared in Europe. Italian historian Giovio (1546) was the first European scholar to assert that printing came into Europe from China by way of Russia. Tsien (1985) cites several authors who have suggested the Chinese origin of printing and its influence on European typography: Garcia de Recende, Gaspar da Cruz, Martin de Rada, Juan Gonzalez de Mendoza, Robert Curzon and others.

Tsien (1985) sums up the origins of printing in Europe as follows:

- Because block prints and books existed in Europe before and contemporary with the beginning of typography, most opinions agree that European printers were exposed to at least the principle if not the practice of block printing.
- Because of the similarity between block printing in Europe and China, there is little doubt that European knowledge of engraving on wood must have been taken from China.
- Because it is the general belief that samples of printed books, wood blocks, or metal types might have been brought to Europe from the Far East by unknown travelers via land or sea trading routes, the possibility exists that the first maker of typography in Europe had some access to such samples.
- The preceding circumstantial evidence suggests strongly the presence of a Chinese connection in the origins of European printing. (Tsien, 1985: 319)

From a horizontally integrative macrohistory perspective, what matters is not whether Gutenberg or some other European independently ‘invented’ printing, particularly typography, to boost the notion of European ‘exceptionalism,’ but rather the documentation of the development of printing as a global human enterprise. No one can dispute that printing, both xylography and typography, originated in the Far East centuries before it spread to or was ‘invented’ in Europe. It makes good sense to discard Eurocentric texts that trace printing to European ‘exceptionalism’ that supposedly bloomed in the 15th century. Communication scholars must rewrite the history of communication to reflect global holism.

A cursory look at the introductory mass communication textbooks used in the US shows varying degrees of Eurocentrism. Emery et al. (1965: 55) assert, ‘Gutenberg’s greatest contribution was the introduction of movable type’. Agee et al. (1988: 58) reassert that from the moment Gutenberg introduced movable type five centuries ago, ‘the printing press began to revolutionize people’s ability to communicate information and ideas’. Biagi (1988: 11) declares, ‘What has been called the second revolution in information and communication began in Germany in 1455, when Johann Gutenberg printed the Bible on a press that used movable type’. However, she concedes that the Chinese had invented a

printing press that used wood type some 200 years earlier, as well as a copper press in 1445. Hiebert et al. (1988: 23) point out that the invention of the printing press and movable type was 'the most important single innovation for book publishing'. They credit the Chinese with the development of printing and even mention *The Diamond Sutra* as the oldest known book. However, because the Chinese did not carry their invention much further, they revert to praise Gutenberg. Hicks (1977: 14) is the least reluctant to admit the historical fact that Gutenberg was neither 'the first printer' nor 'the first to use movable type,' and that the use of movable type 'originated in the Orient'.

Textbooks that reluctantly make some concessions to the Chinese in a Eurocentric twist that gives the final honors to Gutenberg are far from using the approach of horizontally integrative macrohistory.

Notes

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I am grateful to my MSUM colleagues Henry Y. Chan (of the History Department) and Chang-Seong Hong (of the Philosophy Department), and to Leonard L. Chu of Hong Kong Baptist University for their comments on the draft of this article.

1. If Greeks invented the alphabet, should that be interpreted as a major achievement of western culture? Dussel (2000: 466) says: 'What became modern Europe lay beyond Greece's horizon and therefore could not in any way coincide with the originary [sic] Greece. Modern Europe, situated to the north and west of Greece, was simply considered the uncivilized, the nonpolitical, the nonhuman'. He points out that the West consisted of the territories of the Roman empire that spoke Latin, while the East consisted of Greece and Asia (the Anatolia province), the Hellenist kingdoms that reached the banks of the River Indus, and the Ptolemaic Nile. After the fall of Constantinople in 1453, the western Latin world joined the eastern Greek world to confront the Turkish world giving rise to the Eurocentric ideology of German romanticism. Dussel then asserts that 'even though all cultures are ethnocentric, modern European ethnocentrism is the only one that might pretend to claim universality for itself' (Dussel, 2000: 471).
2. Blaut (2000: 208) summarizes the Eurocentric model of history thus: 'Europe, before modern times, rose above all other societies because of its uniquely progressive mentality and its uniquely bountiful environment. Europe was somehow the natural center of the world'. Blaut also draws attention to Weber's argument that people of the white race had an inherited superiority over the people of other races. Forster (1997: xix) says, 'Eurocentrism has been a formidable obstacle, not only for contemporary Europeans trying to understand and cope with the Non-Europeans, but also for present-day historians and anthropologists attempting to study them with all the advantages and burdens of hindsight'.
3. Turkish sociologist Haldun Gulap (1998), however, accuses Frank too of Eurocentrism because by talking about the 5000-year history of the present world system, Frank seems to have 'given up hope about the possibility of ending capitalism through revolution', the avenue that Frank advocated as a champion of dependency theory, which also has been Eurocentric 'from the beginning' (Gulap, 1998: 956, 951). Gulap says the postmodernist notion of authenticity has been on the rise as a critique of Eurocentrism. Postmodernity emphasizes the domination of culture and thought whereas modernity emphasizes the domination of economic or social structures.
4. Temple (1986: 9) adds that

... *modern agriculture, modern shipping, the modern oil industry, modern astronomical observatories, modern music, decimal mathematics, paper money, umbrellas, fishing reels,*

- wheelbarrows, multi-stage rockets, guns, underwater mines, poison gas, parachutes, hot-air balloons, manned flight, brandy, whisky, the game of chess, printing, and even the essential design of the steam engine, all came from China.
5. A variety of sources are available in French, German, Chinese, Japanese and Korean as well. Among the vintage sources that Carter highlights are Asakura (1909), Curzon (c. 1860), Edkins (1867), Hulle (1923), Julien (1847), Klapproth (1834), Sun (1916), Satow (1882a, 1882b), Thomas (1810), Wylie (1867) and Yeh (1911). Other sources include Barker (1971), Chibbett (1977), Chon (1990), Kawase (c. 1973), Kim, H.G. (1973), Kim, W. (1954), Korea (1970), Lee (1987), Luo (1998), P'an (1979), Wu (1943, 1950) and Yun (1992). Tsien (1985) provides a comprehensive bibliography of books and journal articles on paper and printing published in Chinese, Japanese and western languages.
 6. Barker (1971: 8) simplistically refers to Cai Lun as a 'Chinese servant [who] got tired of carrying his master's heavy wooden blocks' and thought of making 'something that is light and cheap and strong that my master can write on [and also] make my burden easier'. Cai Lun was in charge of manufacture of instruments and weapons in the imperial court (Tsien, 1985: 40).
 7. *Acta Diurna* (Daily Events), which appeared in 59 BCE, when Julius Caesar led the Roman republic, was a handwritten newspaper posted in prominent places in Rome and the provinces. Scribes probably sent news to provincial subscribers during the Han dynasty just as the Roman scribes did at about the same time (Bishop, 1989: 41). Tsien (1985: 9) says, 'Hand-copying by slave scribes could produce more texts than were needed in the Roman Empire' that perhaps delayed the advent of printing. Block printing in Europe began only after the Dark Ages. Europe used papyrus for writing until the medieval period. Paper was introduced to Europe in the middle of the 10th century, manufactured there from the 12th century, and used for printing from the middle of the 15th century (Tsien, 1985: 293).

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Shelton Gunaratne is a professor of mass communications at Minnesota State University Moorhead. His research in international communication has appeared in *Communication Yearbook*, *Gazette* and other journals. His most recent book is the *Handbook of the Media in Asia* (Sage, 2000).

Address *Mass Communications Department, Minnesota State University Moorhead, 1104 Seventh Ave. S., Moorhead, MN 56563, USA.*
[email: gunarat@mnstate.edu]