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ON DEVELOPMENT OF INFORMATION COMMUNICATIONS IN HUMAN SOCIETY

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ABSTRACT

Information is very important. Information is also very complicated, making that people have no common understanding and conclusion for the nature of it up today. There are too many papers and some books to describe information; however it is rather difficult to find the description and analysing for the whole history of information from the advent of human beings to the present day. Two parts of information in prehistoric period and the time interred divinization are described. Every part is separated according to several succeeded stages for description. It is near impossible to describe in detail such entire historical facts of information in human society in a paper, so the description and discussion is focused on their comprehensiveness and integrity. By knowing and analysing all these solid historical facts of information, some relative issues e.g. "did information age really exist in the development of material civilization in human society" can be recognized easily.

KEY WORDS

information, history of information, information communication, matter, substance civilization, six-stage theory

CLASSIFICATION

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INTRODUCTION

Near everybody knows the importance of information because nobody can leave the information and it communications. From the moment human beings leave their mothers' bodies, they use crying to attract the attention of the parents. Especially, they proclaim to the world in a high-profile way: I am coming. Except a person has died otherwise he/she is never left information communications. We use every emotion that we portray on our faces, the movement of our hands, the way we look at someone and our speech to communicate our ideas to others. In fact all aspects of our life such education, study, work, social, movement, travel, love, etc. need information and its communications.

However, do we understand the history of information for humankind? How does the development of information communications in human society progress from the advent of human being to the present day? A lot of papers on the field of information subject have published; no one has answered these problems with the solid historical facts completely and comprehensively. Fortunately there is a good book of *The information: a history, a theory, a flood* by Gleick [1], but it is not a real book of the history of information. From the book people are rather difficult to understand a rather complete history of information because the stories are more than history in it. Similarly there is a good paper of *History of information science* [2], in which the authors write "We have treated IS (information science) inclusively in two senses. First, we include specialized applications areas, such as archival, library, and corporate information services as specialties within a broad view of IS rather than specialties outside of it. Second, we agree with VAKKARI (1994) that it is misguided on theoretical grounds (as well as difficult in practice) to separate the theory of library science and of documentation from that of IS." That is to say that that paper is still not mentioned the whole history of information as we want.

That is why the aim of the article is focused to discuss such problems in order to sketch out the history of the entire information communications of human beings. Then people can know the history of information from the advent of human beings to the present day. Information is accompanied with the whole time of humankind, never stopped, never regressed, always progress along with human development. Of course, we do not want to describe the history of information for human society in detail, but just to sketch out the whole information history for human beings completely and comprehensively. Two parts are discussed separately: prehistory and the time of civilization. Every part is separated according to several succeeded stages for description.

Then we will analyze the whole historical facts of information and see what they can tell us.

THE NATURE OF INFORMATION

A lot of papers and books have discussed the nature of information in the literatures. It is obviously that the historical development of information is closely related to this issue, so knowing the nature of information is necessary. Here we just cited only few papers discussed the issue early in 1920 years. Before such discussion, we must point out what mentioned Mingers and Standing [3]. These two authors said that even up to 2017 "there is still not an agreed and explicit conceptualization or definition of information" in the world. In addition, there are more than 200 information definitions available in the literature according to the statistics by Hu and Wengen [4]. This situation indicated that the issue of the nature of information is very complicated so that there is no united definition of information up today.

Early in 1924 Nyquist [5] published a paper in which he derived a formula of the speed of transmission of intelligence W:

$$W = K \log m, \tag{1}$$

where m is the number of current values, and, K is a constant. According to Nyquist, the meaning of the speed of transmission of intelligence is that the number of characters, representing different letters, figures, etc., which can be transmitted in a given length of time assuming that the circuit transmits a given number of signal elements per unit time.

Four years later Hartley published another paper [6], and he also derived a formula for the amount of information associated with *n* selections:

$$H = n \log s, \tag{2}$$

in which *s* is the number of possible symbols available at each selection in a transmission, and *n* the number of selections of primary symbols. Equation (2) shows that the practical measure of information is the logarithm of the number of possible symbol sequences. Pierce [7] evaluated Hartley's work as follows: "his idea of defining the quantity of information as the logarithm of the number of symbols seems very modern, but its success in elucidating knotty problems was not great. It is Shannon's feeling, and mine, that Nyquist's work was more fruitful". In addition, Rioul and Magossi [8] also evaluated Hartley's work. They proved that some "historical" statements in the literature for the relationship between "Hartley's rule" and Shannon's formula (will be described below soon) are somewhat wrong, because their careful calculation shows that "Hartley's rule" in fact coincides with Shannon's formula. They found that this mathematical coincidence by deriving the necessary and sufficient conditions on an additive noise channel such that its capacity is given by Shannon's formula and construct a sequence of such channels that makes the link between the uniform (Hartley) and Gaussian (Shannon) channels.

In 1929, Szilard [9] in his famous paper published his information definition i.e. information is entropy. Szilard wanted to understand the "Maxwell's demon" and how much energy the demon would consume in its operations, so he designed a thermodynamic "gedanken experiment". Such experiment was called Szilard's engine later in the literature. From the mathematical calculation Szilard obtained the mean value of the quantity of entropy S_A and S_B, per measurement as:

$$S_A = -k \log p(T_0),\ S_B = -k \log q(T_0), \tag{3}$$

where $p(\cdot)$ and $q(\cdot)$ are the probabilities which are in the lower or upper state respectively because Szilard only evaluated these expressions for the very simple case of a body with only two energy states; a lower and a higher state. In (3), T_0 is the temperature of the heat reservoir.

After near 20 years, 1948 Shannon in his paper of [10] wrote that "If the number of messages in the set is finite then this number or any monotonic function of this number can be regarded as a measure of the information produced when one message is chosen from the set, all choices being equally likely". Then, Shannon asked: "Can we define a quantity which will measure, in some sense, how much information is 'produced' by such a process, or better, at what rate information is produced?" After some mathematical derivation, he obtained:

$$H = -K\sum_{i=1}^{n} p_i \log p_i, \tag{4}$$

for the definition of information. He said that "Quantities of the form $H = -K\sum p_i \log p_i$ (the constant *K* merely amounts to a choice of a unit of measure) play a central role in information theory as measures of information, choice and uncertainty". Quantity *H* will be recognized as that of entropy as defined in certain formulations of statistical mechanics. That is to say that Shannon defines information as the entropy in the statistical physics. Here *K* is a positive constant, p_i is the probability of a system being in cell i of its phase space. How do we measure information? It uses bits. According to Shannon [10] "The choice of a logarithmic base corresponds to the choice of a unit for measuring information. If the base 2 is used the

resulting units may be called binary digits, or more briefly bits, … A device with two stable positions, such as a relay or a flip-flop circuit, can store one bit of information. N such devices can store N bits, since the total number of possible states is 2^N and $\log_2 2^N = N$." Therefore, Shannon was the first user to use bit as the unit for measuring information.

It is interesting to point out that the cited above four papers all are defined the entropy using an equation, and Shannon's paper published later than near 20 years or more. Shannon pointed himself in the beginning of his paper, Nyquist in 1924 and Hartley in 1928 published important papers, building "a basis for such a theory (a general theory of communication − the author)". Of course, Shannon [10] has extended "the theory to include a number of new factors, in particular the effect of noise in the channel, and the savings possible due to the statistical structure of the original message and due to the nature of the final destination of the information". So that, a formula for measuring the average amount of information is given by Shannon, realizing the leap of communication science from qualitative stage to quantitative stage as mentioned above. That is to say that Shannon's merits must be affirmed in terms of the entropy definition of the information.

Why Shannon said that Nyquist and Hartley built a basis of information theory? The equations (1) and (2) given by Nyquist in 1924 and Hartley in 1928 evidently show such point.

However, the meaning of equation (3) is the same as that in equation (4) which means that Szilard not only correctly defines the quantity known today as information, which has found a wide use in the work of Claude Shannon and others in the field of communication science. The history fact indicates evidently that Shannon is not but Szilard is the real first man to define information using the entropy. In addition, though Shannon's paper was published in 1948 later than that of Szilard in 1929 for 19 years, but Shannon's paper did not cited the paper by Szilard. Some articles have said that it seems that the definition and theory of modern entropy only began with Shannon's article in 1948. All credit is attributed to him, which is obviously not in line with historical facts. Here we seriously point out such issue using these words in order to treat historical facts fairly.

As mentioned previously, there is a lot of definitions of information. They mutually differ, often overlap and sometimes are in conflict. Why? The concepts from various proposers are not the same. Their angles and ways of looking at the problem are not only the same. In addition, the issue is complicated. It is not easy to catch the nature. It is somewhat similar to what is said in the old story of "Blind men sizing up the elephant."

Considering the above situation, we want to propose ourselves definition of information. We do not believe that it is the best one, but just want really easy to understand the nature and the meaning because people are difficult really to catch the meanings from many existed definitions of information. Our definition of information is that information is not a substance but needs to have a physical carrier, which sends, communicates and stores messages, knowledge, data and intelligence directly or indirectly through human's expressions or hints, things they write or create as well as tools or media they used, so as to make people to perceive insight or excitement, worriment or angry, calm or indifference.

INFORMATION IS ALWAYS ACCOMPANIED BY THE HISTORY OF HUMAN EMERGENCE AND DEVELOPMENT

Information and communication develop with the development of human being throughout. As the progress of civilizations of mankind, information and communications technology (ICT) can be divided two big parts separately: prehistory and the time of civilization. Every part is separated according to several succeeded stages for description.

PREHISTORY STAGE

Archaeological research by White et al. in 2009 [11] found that earliest human ancestor lived in Ethiopia about 4,4 million years ago. In their paper, White et al. [11] show the ARA-VP-6/500 skeleton their found. Later on some of our ancestors went out to other areas in the world. Very recently, a group of Chinese scientists [12] proved first from their underground excavation that Hominin occupied the Chinese Loess Plateau since about 2,1 million years ago. In other words, Homo erectus went out of Africa at least before 2,1 million years. After very long time, the development of mankind entered into the so called the period of historical records. As the typical example of China, she entered into such period at about BC 2070 of Xia dynasty. That is to say it lasts more than 4.3 million years for the primitive society that mankind lived without recorded history. It is difficult to say and describe the real information for human being in the period because no historical data can be used. However, from the researching data for the communications of animals, legend stories, and some descriptions of the stage in some famous books such as [13] and [14], humankind not only have communicated using information, but such information is developed with the progress of human being. We can easy to image that from the very beginning of period ancients transfer information such as safety, panic, intimidation, warning, courtship, food search and so on through their eyes, facial expressions, head and limb movements, voice changes, objects, simple tools, etc. More in detail, several methods can be divided as follows.

One is visual transmission

The aim is to cause the attention of the other party. The methods are using gestures, mimicry, using pyrotechnics or physical objects etc. Because of only using general physical objects cannot be far from meeting the needs of human interaction, our ancients developed painting to transfer and store information. As a whole, developments in Eastern painting historically parallel those in Western painting, in general, a few centuries earlier. As example, two paintings are mentioned here. One is a rock painting found in the north-west Kimberley region of Western Australia c. 15 000 BC [15]. Another is a human head shape mouth color painted pottery bottle, which was excavated from Dadi Bay, Qinan County, Gansu Province, China at Yangshao mid by Zhang and Pengchuan [16].

The second is sound transmission

The most important method of course is using mouth and language to transmit various information included storytelling. However, such method only can transfer information in a short distance. For long distance transmission, ancients used some nature or their made simple vocal tools such as bird language, bamboo blowing, blowing horn, signal drum to perform it. In hunting, in order to trap prey, primitive people imitated the sound of birds, so that the prey was not alarmed and easy to hunt. Later, it was developed to transmit hunting information with birdsong.

Bamboo flute is rather easy to prepare. Even if there are only stone knifes and axes, bamboo flute is not too difficult to make in the place where the bamboo is produced. The conch is easy to pick up at the seaside. Therefore, they can be used for transmitting information in a rather larger area. Just because of such things are not difficult to make, easy to use, even up today, they are still used in many nations.

Ancients used wooden trunks to make wooden drums. The drumbeat can make different sounds, and so as to convey different kinds of information. Gleick in 2011 called the drum as “talking drum” in his book [1]. He described the ancient’s drums very vivid. He wrote that the drums of the uncivilized barbarians can travel along the river, through the quiet night, and

spread nearly ten kilometers. Such a message, transmitted from village to village, during only an hour, can go one or two hundred kilometers away.

The third is optical transmission

Our ancestors must know the natural fires i.e. lightning and mountain fire. After they eaten the roasted meat by the natural fire, it is very easy to image that they are very eager to have a fire to eat cooked animal meat. After a very long time, they found finally how to make fire, which is drilling wood and rubbing stones to make fire. From unearthed cultural relics in Cross-Lake Bridge, Zhejiang Province, China, Chinese scientists certificate that at least before BC 6 000 ancient Chinese people known how to get fire with drilling wood. There were 51 pieces of wood cone unearthed [17].

Brain and Sillent [18] also proved that during their excavations of hominid-bearing breccias in the Swartkrans cave altered bones were recovered from Member 3 (about 1,0-1,5 million years ago) which seemed to have been burnt. They believed that the appearance of burnt bones in Member 3 from Swartkrans is the earliest direct evidence of fire use in the fossil record. Once our ancestors have mastered the fire, they must use fire to make lights such as Kong Ming lamps [19], flares, Beacon Tower, wolf smoke, etc. for transmitting information. We only want to say more words about Beacon Tower here. Many ancient nations in the world were used Beacon Tower, but it was more famous in China. Just mentioned the Beacon Tower built on The Great Wall, a number of Beacon Towers have built on it. The famous one is called "The First Beacon Tower". In ancient times, on a military fortress and a road leading to a fortress, a beacon tower was built at regular intervals. When the enemy invades, the bonfire is lit, and the information is transmitted one by one. For example, in the Han Dynasty, the generals led hundreds of thousands of troops to attack the invading Huns (Xiongnu), but they used the bonfire as a signal to enter the army. In just one day, this signal was transmitted from the west of Gansu Province to the east of Liaoning Province; the distance is thousands of miles away.

The fourth one is language transmission

Atkinson concluded in his paper [20] that "An origin of modern languages predating the African exodus 50 000 to 70 000 years ago puts complex language alongside the earliest archaeological evidence of symbolic culture in Africa 80 000 to 160 000 years ago". That is to say our ancestors can speak various languages before a very long time ago; they used language to communicate naturally. So we can find many authors in their papers called as "oral communication era". After ancients mastered language, their communications became wider and deeper. Not only the general information, but their thinking even their emotion also can be transmitted face to face. Language communication enables personal experience and knowledge to be shared by all, and the cultural accumulation of predecessors is inherited by future generations. However, language communication receiving terminal is the human auditory organ ears, the transmission effect is very limited, the information loss is large, and it is still not conducive to preservation and inheritance.

The fifth is symbol transmission

Except their brain, primordial human using some symbols to enhance their memory. For example, they used knot rope and carved wood to help their memory. From the most ancients' book in China, it wrote that primitive mankind used rope to keep records, and the later generations use the words to replace it. Such method of using rope to keep records also was used in many ancient nations in the world.

Then, Chinese ancients discovered hieroglyphics which was origin from the pictures. Early at the beginning of Xia Dynasty at 2 070 BC, Chinese ancients discovered oracle that is the earliest mature text. First, the oracle was carved on oracle bones, tortoise shells or pottery, till to the late Spring and Autumn Period, the oracle was carved onto the bamboo slips and wooden slips. So that till to 770 BC, the real books were born in China. Of course, that time was interred into the period of civilization for a long time; and we just consider the describing convention so as to add some words here.

The sixth is postal service in ancient times

From the oracle bones excavated from Yin Ruins, the scientists found the earliest written record of “postal service” in China [21]. These two words were found in the report (at 1400 BC) which was written by the frontier guards to report the military situation to the emperor. It is evidently that the postal service was existence at least before BC 1400 in China. In fact, the situation should be similar for many other nations in the world. In order to describe serially and to understand more clearly, the following contents which are not belonged to the prehistory stage are still arranged here.

Since ancient mankind entered into the so called civilization era from primitive society, slavery country has been built, the ruling class created the postal station systems in order to control their countries. The so called postal station is that in order to meet the needs of the political and military activities for the government of ruling class, a post station was set up on the main road about thirty miles apart, equipped with good horses, carriages, and boats, which was responsible for the transmission of official documents and the reception of officials and transportation of goods, forming a relatively complete postal system. In this respect, ancient Rome is the same as China. The Roman Empire built the most advanced postal delivery system known until that time except for the service in China. Its area was the whole Mediterranean world. Reliable communication from Rome to governors and military officials in far away provinces was a necessity. Rome met the need by developing the cursus publicus literally, "public course" a state-sponsored series of post roads with relay stations at intervals. The speed with which government dispatches and other mail could be carried about the empire was not equaled again in Europe until the 19th century. Using the relay stations, riders could cover about 170 miles (270 kilometers) in a 24-hour period. Such situation was described clearly in the book edited by Radner [22]. In the Introduction of the book [22; p.7] one can also see that: “With the expansion of the Assyrian Empire (at 670 BC), the hugely expensive relay system was extended to link all new provinces to the Assyrian heartland and each other. When the Assyrian Empire disintegrated at the end of the 7th century BC, the Royal Road system did not. Its successor state, the Neo-Babylonian Empire (612–539 BC), continued to invest in the maintenance of the infrastructure, as a number of administrative documents illustrate”. Two pictures of mail couriers can be as examples evidently. One is from ancient China at AD 220-240 [23], which is the unearthed tomb of the painting “post map” of the Wei and Jin Dynasties. Another is the mail courier in Persia [24]. It is very interested to compare the pictures of ancient mail couriers. It must be pointed out that during ancient times, only government and military officials could use the postal system, but ordinary persons could not use the system in anyway.

AFTER ENTERING INTO THE STAGE WITH HISTORICAL RECORDS

Like the prehistory stage, several new information technologies have been invented and different transmission methods can be separated with the progress of substance civilization of human society.

The seventh is writing communication

In the early age of Western Han Dynasty (starts from 206 BC), Chinese began to use paper [25]. We have mentioned in the above that there was last a very long time from used rope to keep records → hieroglyphics → oracle → till 770 BC, the real books were born in China. However, such kind of book was still rather heavier; the lighter paper was discovered finally after another long period of time. Such papers were made by linen fiber, which is not easy to obtain for mass production. In the Eastern Han Dynasty (25-189 AD), Cai Lun (63-121 AD) was the official residence in charge of the imperial weapons, playthings, and utensils. Cai Lun improved the papermaking process, using cheap and easy-to-get bark, broken fishing nets, rags, etc. as raw materials, greatly reducing the cost of paper production, and really invented the paper. According to expert research, at the latest in 289 AD, papermaking was passed to North Korea and Japan. During the Tang Dynasty (618-907 AD), it was passed to Arab and Southeast Asian regions. And then it spread from Arabia to Europe, Oceania, Africa, the Americas and other parts of the world, effectively promoting the development of world civilization.

The eighth is printing communication

Early in the Neolithic Age, Chinese ancients have known the embossing method to prepare various decorative patterns and colors onto the surface of pottery products. They used the prepared ceramic mold with patterns and/or colors to imprint onto the surface of not yet dried pottery waiting to be baked, then the crafted pottery with patterns and colors can be produced. This is the earliest printing method in the world. The raw materials of this section were cited from the book "History of printing in China" [26].

In the Warring States Period, stamps began to appear, the words on it are chiseled irony, coated with mud printed out of the text is the main text. To the North Qi (562-564 AD), the seal should be on paper. At the end of the Eastern Han Dynasty, there was a style of lettering on wooden boards.

When did the Blocking Printing real appear in China? There were a variety of statements. After a long analysis and comparison from a lot of raw materials, in 1989 Zhang and Xiumin [26], concluded that it was at Ten years of Zhenguan (636 AD), as for appearing in the Han Dynasty, the Eastern Jin Dynasty, the Six Dynasties, the Sui Dynasty, the Five Dynasties, and the Northern Song Dynasty are all untrue. It is very interested to note that in the Tang Dynasty writer Sun Wei's "The Collection of Sun Kezhi", there was a record at the 851 AD of "Reading Kaiyuan (713-741 AD) Miscellaneous Newspapers", which means that there is already a real newspaper. Therefore, the Kaiyuan Miscellaneous Newspaper was about nine hundred years earlier than the first newspaper published in Germany in 1609.

During the reign of Renzong Qingli in the Northern Song Dynasty (1041-1048), Bi Sheng, a civilian in China, invented movable type typesetting and printing, about 400 years earlier than Gutenberg, Germany, used movable type to print the Bible. Shen Kuo (1031-1095), a famous scientist at that time, clearly recorded Bi Sheng's invention in his famous book of Mengxi Bi Tan (Vol. 18), which can be convinced without any doubt. We must say that the adoption of movable-type printing in Europe brought about the Renaissance and the rapid development of science and culture, while China lagged behind. This is a historical regret. The described invention process of printing in China: Stamps → Blocking Printing → Movable-Type Printing can be found the same writing map in the book by Carter [27]. However, Carter did not mention the embossing method to prepare various decorative patterns and colors onto the surface of pottery products in the Neolithic Age.

The ninth is telegraph and telephone transmission

Even though human kind have used several kinds of information communications as mentioned above and you can send letters from here to there in your county, but time constraints did not have been solved yet till to the end of the eighteenth Century. At that time of period a variety of ingenious attempts to establish long lines of communicating devices were needed. This was prompted by the requirements of the military: the navy in England and the army in France. As first developed in Europe, the signaling systems adopted were mechanical structures, and significant changes in the appearance of the mechanism could be observed at a distance. So that the so-called Optical Telegraphy has been discovered. A visual system for sending information by means of two flags that are held one in each hand, using an alphabetic code based on the position of the signaler's arms. Because it was discovered first by Chappe [28], it is called the Chappe telegraph in the literature. The first practical telegraph system was inaugurated in France by Chappe in 1794; this was a semaphore or moving-arm type [29]. The idea was quickly adopted in Britain, where there were clear advantages in rapid communication with the coastal ports where the British Navy was based. After tests a shutter type was adopted, rather than a semaphore, and by the end of 1796 two telegraph lines were in operation. A shutter telegraph station had six pivoted boards, which could be swiveled by the ropes leading down to the cabin, so they were either visible or edge-on. Six shutters gives a 6-bit binary code, allowing 63 non-zero states to be transmitted. These were allocated as the 26 letters of the alphabet, ten numerals, and some useful preset sentences, such as "Defeat the French Navy immediately" [30]. However, until 1816 the Shutter telegraph was replaced by a Chappe or semaphore type, trials having convinced the authorities that this system gave better visibility.

It is not difficult to imagine that the Optical Telegraphy of Chappe or semaphore type was very useful at that time. The first is its transmission is very fast. For example, the average London-Portsmouth (the distance between the two towns is about 60 miles) message took about fifteen minutes to get there in 1796. The second is that the Chappe's telegraph network system has built in France and other European countries. In France, an entire system was working by 1794, with a line of 15 stations over a distance of 230 km. It was over this line that the first formal telegraph message was sent announcing Napoleon's capture of Le Quesnoy from the Austrians in 1794. The extent of this impressive network was completed by the middle of the 18 century, with extensions to Spain, Italy, Belgium, Switzerland and Germany. By 1852 a total of more than 4 000 km of lines were in operation, with over 550 stations in France, but by this time the electric telegraph was beginning to replace Chappe's lines, and they gradually fell out of use during the next three decades [31]. As well as France's extensive network of stations in Europe, the turn of the nineteenth century saw Chappe's semaphores widely adopted in the countries of Europe and in America. In Russia, some lengthy semaphore lines were developed linking St Petersburg, Kronstadt, Pushkin and Galchina, and one 830 km in length from St Petersburg to Warsaw. The Warsaw link was staffed by 1320 personnel and contained 220 stations. The first semaphore in the United States, again based on Chappe's system, was built by Jonathan Grout of Belchertown, Massachusetts, in 1801. It was over 100 km in length, linking Martha's Vineyard off the New England coast with Boston, and its purpose was to transmit news about shipping entering the straits. Sixteen stations were established along the route.

The stated telegraph was not using the electrical signals, which is not the real telegraph. The real electrical telegraph was discovered by S.F.B. Morse. However, before Morse's electrical telegraph, several kinds of telegraphs using such as static electricity etc. were proposed, it is necessary to be mentioned. For simplicity we just only illustrate the road map using the names of such telegraphs, which is: 1809, The von Sömmerring electrochemical telegraph [32] → 1816,

Francis Ronalds's electric telegraph[1] [33] → Wheatstone's single-needle telegraph [31] → 1837 Wheatstone's five-needle 'hatchment telegraph' [30].

Before discovering telegraph, Professor Morse was already a well-known painter; and there was a long story for his discovery [30]. For the Morse' discovery of telegraph, It should be noted as below. The first he thought that all of the methods as mentioned above were too complicated, and must be giving up. The second is that from the very beginning his original intention was to use the code for numbers only. The third is that he strives for help from others, for example Professor L. Gale and A. Vail. Gale was familiar with the work of the American physicist J. Henry on the efficient construction of eletromagnets. It was primarily A. Vail who, possessing the mechanical skills that Morse lacked, perfected the early instruments for the coming patent application and for public demonstrations. It is obviously that working with Gale and Vail was very helpful for Morse' discovery. As for his discovery, Morse described its principle features himself as: 1, a 'marking instrument', consisting of a pencil, pen or print-wheel; 2, use of an electromagnet to impress the instrument on a moving strip of paper; 3, a 'system of signs' (Morse code) identifying the information transmitted; 4, a 'single circuit of conductors'.

From Morse's return to the USA and beginning of creation of his telegraph in 1832, till the end of 1837, he had entered into a patent agreement with Gale and Vail for his discovery of a recording electric telegraph. Morse was inspired by the fact that the current flowing through the wire would burst into sparks when the wire suddenly stopped: if the current was cut off for a moment as a signal, the current was turned on and no spark is used as another signal, and the longer the current was turned on also as a signal. When these three signals are combined, they can represent all the 26 letters and numbers, and the text can be transmitted to the distance by electric current. In 1837, Morse finally devised the famous Morse code, which used different combinations of "dots", "strokes" and "spacing" to represent letters, numbers, punctuation and symbols. Morse and his assistants spent 4 years for their discovery. You can find the Morse' first crude telegraph instruments [34]. The first telegram in the United States was sent by Morse on 11 January 1838, across two miles (3 km) of wire at Speedwell Ironworks near Morristown, New Jersey.

In Russia, scientists also contributed to the telegraph. Pavel Shilling launched his first type of the electromagnetic telegraph in 1828 [35]. The first public demonstration of the electromagnetic telegraph took place on October 21 in 1832. The Russian emperor Nicolai I was present at this demonstration, when the first telegram consisting of 10 words was transferred over a distance of 100 meters. Pavel Shilling projected lying electromagnetic telegraph line between Peterhof and Kronshtadt. The successor of P. Shilling, Boris Jacobi, invented his first type-writing telegraph. In 1841 B. Jacobi implemented the communication line equipped with the type-writing telegraph that connected the Winter Palace with the Supreme Headquarters. In 1850 B. Jacobi designed his first printing telegraphy.

From the previous discussion, it is known that the telegram transmits symbols. To send a telegram, you must first translate the message into a code and then send it out by telegraph machine. On the receiving side, you must go through the reverse process, translate the received code into a message, and then send it to the receiver. This is not only troublesome, but also a timely two-way information exchange. Therefore, people began to explore a communication method that can directly transmit human voices. This is the "telephone" that will be discussed here. The invention of telephone can be represented by the following roadmap [36-42]:

- 1844 Innocenzo Manzetti first proposes the idea of an electric "speaking telegraph" (telephone),

- 1854 Charles Bourseul publishes the principles of a make-and-break telephone transmitter and receiver in L'Illustration, (Paris),
- 1854 Antonio Meucci demonstrates an electric voice-operated device in New York[2] [43-49],
- 1861 Philipp Reis constructs the first speech-transmitting telephone[3],
- 1872 Elisha Gray establishes Western Electric Manufacturing Company,
- 1875 Alexander Graham Bell uses a bi-directional "gallows" telephone[4],
- 1876 Elisha Gray designs a liquid transmitter for use with a telephone[4],
- 1876 Tivadar Puskas invents the telephone switchboard exchange,
- 1877 Edison files for a patent on a carbon (graphite) transmitter. 1875 Thomas Edison experiments with acoustic telegraphy and builds an electro-dynamic receiver,
- 1877 Emile Berliner invents a microphone based on "loose contact" between two metal electrodes.

The facts evidently indicated that the modern telephone is the result of work of many people; it is not just the merits of one or two people, but the result that has nothing to do with anyone else.

The invention of telephone makes the communication of information of human kind another big step forward. Anyone if he/she like can talk with anybody freely at anyplace in the world if there equipped with telephone wires and post office. However, during the process of inventng the telephone, there were too many additional stories appeared, here simply mentioned in Remarks 2, 3 and 4stories for which most of the people have not wanted to happen because they are not what people want.

The tenth is vacuum tube and transistor

Vacuum tube is an electronic vacuum element that can be used for controlling the flow of electrons through the emitted electrons by applied potential within a sealed glass or metal container. Usually, one only mentions the invention of diode in 1905 by J.A. Fleming [50] and triode in 1907 by L. De Forest [51]. In fact, some works before their must be mentioned because they were the basis and guide for the works of Fleming and De Forest, which just like the invention of telephone. For example, in 1857 Heinrich Geissler [52, 53] studied low-pressure gas filled tubes, which ultimately led to fluorescent lamps. Johann Wilhelm Hittorf in 1869 [54] also studied similar gas discharges. Eugen Goldstein in 1876 called these the "cathode rays", and was interpreted as moving charged particles in 1879 by William Crookes [55]. Joseph John Thomson discovered the electron during 1897-1899 [56]. In addition [57], vacuum arc deposition (VAD) was first investigated at the end of the 19th century by A.W. Wright and T.A. Edison, as mirror coatings and seed layers for phonogram replication molds, respectively. The VAD research was also helpful for the invention for vacuum tube. The invention and application of the vacuum tubes caused the information communications for human kind a big step forward, especially during the decades from World War I to World War II, basically adapted and met the needs of radio communications and intelligence.

However, even during in the World War II, people felt eagerly that the heavy and backward vacuum tubes and electromechanical switches should be replaced by solid devices because a standard radiotelephone at the time, almost 40 % of its weight and half of its volume came from bulky vacuum tubes and dry batteries [58]. In addition, the quantum theory of solids was fairly well established by the mid-1930s, when semiconductors began to be of interest to industrial scientists seeking solid-state a1ternatives to vacuum-tube amp1ifiers and e1ectromechanical relays. So, early in 1938 Mervin Kelly in Bell Labs set up a research group, and the program of the group was basic research on solid-state physics. World War II forced them to stop. At the end of the war, Kelly [59] (who was Bell Labs Executive Vice

President, initiated in 1945) immediately reopened the research team and invited Schockley, Bardeen and Brattia to join the group. After several years of hard research, they finally created the world's first solid-state transistor in 1947, and the three persons won the Nobel Award in 1956 [60]. The invention of transistors has undoubtedly brought human information communication to a higher level, faster and more efficient. It also promotes the advancement of science and technology and industry to a certain extent. However, the title "The birth of the information age" used by Riordan and Hoddeson's book[5] [61] is obviously inappropriate. There is no special argument for it in the book on the one hand, and it is exactly the opposite of the subject of another article [62] on the other hand. This article argues and confirms that there is no information age in the whole developmental stages of the substance civilization in human society.

The eleventh is computer network transmission

After the invention of vacuum tube, the inform communication of human kind has input into the stage of wireless communication. Radio station communication cannot be lack of electronic tubes. The subsequently computer communication network cannot be lack of computers. So, the invention of electronic computers is a key issue. 1946, John W. Mauchly and J. Presper Eckert at the University of Pennsylvania developed the ENIAC I (Electrical Numerical Integrator and Calculator) [63]. The ENIAC contained 17 468 vacuum tubes, along with 70 000 resistors, 10 000 capacitors, 1500 relays, 6 000 manual switches and 5 million soldered joints. It covered 167 m^2 of floor space, weighed 30 t, and consumed 160 kW of electrical power. In one second, the ENIAC could perform 5 000 additions, 357 multiplications or 38 divisions. The use of vacuum tubes instead of switches and relays created the increase in speed, but it was not a quick machine to re-program. Programming changes would take the technicians' weeks, and the machine always required long hours of maintenance. It took the team two years and $ 750 000 to build it. However, John Atanasoff and Clifford Berry of Iowa State University worked from 1935 to 1939 on the Atanasoff-Berry computer (the automatic electronic digital computer) [64]. In 1939, they built the first electronic digital computer, named ABC computer. Atanasoff said that "I later called the Atanasoff Berry Computer (ABC), to honor the memory of Berry's extraordinary competence)" [64]. The final computer was the size of a desk, weighed 700 pounds, had over 300 vacuum tubes, and contained a mile of wire. It could calculate about one operation every second. There is also a stories about the computer, but not the ones people want to hear[6].

The Atanasoff Berry Computer, later named the ABC, was built at Iowa State University from 1939-1942 by physics professor J.V. Atanasoff and his graduate student, Clifford Berry. The Atanasoff-Berry ABC Computer is in the Department of Computer Science at the Iowa State University, http://jva.cs.iastate.edu/operation.php.

It must to point out that Atanasoff and Berry did not apply for a patent for the computer because Atanasoff was moved to a new place, although in August 1940 he wrote a comprehensive manuscript which fully described the principles of his machine, including detail design features. After Atanasoff and Berry learned that Mauchly and Eckert were granted a patent on ENIAC, they filed a lawsuit in court to defend their original right to invent the computer. After near 30 years of public lawsuit, it was finally solved in 1973. Atanasoff was declared by the U.S. Supreme Court to be the true inventor of the electronic computer.

After invented the transistor in 1947, the first fully transistorized computer was appeared in 1954 successively. The period time from transistor to transistor computer is shorter than one from vacuum tube to computer equipped by electric tubes, the reasons result from that the experience of manufactured the vacuum tube computer. The real first fully transistorized computer was invented by the Felker Group at Bell Lab in 1954 [65]. They manufactured the

Tradic (Transistor Digital Computer) from 1951. In the Tradic Ge point-contact diodes were used for logic operations and other circuit functions, and point contact transistors were used in circuits to reshape pulses distorted by the logic networks. 684 transistors and 10 358 Ge point-contact diodes were used. Word size is 16 bits-serial. Number storage is 16 addressable electrical delay lines. Addition or subtraction time is 16 microseconds. Multiplication or division time is less than 300 microseconds. Digital-to-analog converters are two that converted numbers to voltages. Clock: 30 W at 1 megacycle supplied by an electron tube because no transistors were available which could supply this much power at this frequency.

The first practical ICs (Integrated circuit) were invented by Jack Kilby at Texas Instruments and Robert Noyce at Fairchild Semiconductor [59]. By 1961, the first integrated circuit (IC) computer made by Texas Instruments with 587 integrated circuits, this integrated circuit computer is only one-half the size of the latter compared to a computer made with 8 500 transistors of the same function, and weighs only 1/150 of the latter.

It is obviously that the size of computers is greatly reduced as the used electronic elements from vacuum tubes to transistors to IC.

The twelfth is mobile communication

After the invention of telegraph and telephone, people are thinking that telegrams and telephones cannot talk to anybody anytime, anywhere, although people with the right equipment can communicate anywhere. Is it possible that everybody can have a phone to use it freely? This is the motive of the invention of mobile phones.

Nathan Stubblefield in 1902 invented wireless telephone first in the world [66]. In 1908, he was granted the US patent 887 357, the title of the patent being the Wireless Telephone. The patent states that "The present invention relates to means for electrically transmitting signals from one point to another without the use of connecting wires, and more particularly comprehending means for securing telephonic communication between moving vehicles and way stations. … The principle object of the invention is to provide simple and practical means of a novel nature whereby clear and audible communication can be established, said means being simple and of a character that will permit certain of the station mechanisms to be small and compact". However, Stubblefield made no headway in commercializing his latest invention. In addition, Stubblefield himself made no further progress beyond his previous work.

After then, others also reported their inventions of mobile phones. For example, Bell Labs in 1938 made the world's first "mobile phone" for the US military, some engineers from Motorola took part in the work. During World War II Motorola Corporation had manufactured a series of (Walkie Talkie) SCR for the US military, contributing to the victory of World War II. But such Walkie Talkies are very heavy, for example, SCR300 is a tunable high frequency FM communication device, with 16 kg weight and the effective distance of communication of around 16 km. (Handy Talkie) SCR-536 which was made in 1942 weighs 4 kg and its range of communication is 1,5 km in the open space but only 300 m in the woods. On March 1, 1948 the first fully automatic radiotelephone service manufactured by Bell Labs began operating in Richmond, Indiana, eliminating the operator to place most calls [67].

In 1973, the well-known real mobile phone was made by Martin Cooper at Motorola. On October 17, 1973, Motorola filed a patent for its own cellular radio system; and the US patent 3 906 166 was granted to Cooper et al. on Sept. 16, 1975 [68]. The patent states that "This invention relates generally to communications systems, and more particularly to organized radio telephone systems having a plurality of base station and portable units, each having a predetermined coverage area, and means for adjusting the operating frequencies of the portable units to provide the optimum communications path". What Cooper's team invented

was the first handheld cell phone. But not the cell phone itself. That had already been done on the Metroliner train. Motorola's successful field work caused the American magazine Popular Science to picture the portable phone on their cover in July, 1973.

However the mobile phone DynaTAC invented by Cooper was still too heavy, weighing around 2 pounds. It needed 10 hours for charging, only for half an hour of talk. The price of the phone was as high as $ 3 995 for one set. The Motorola DynaTAC is the prototype of the first hand-held cellular telephone, which was the first public call ever made on a cellphone by Martin Cooper on April 3, 1973, and it is real like a heavy brick. From the Washington Post in September 9, 2014 [69], one can find the picture of Cooper holding that brick.

More than ten years later when someone visited Cooper, he talked about the phone very interesting [70]. He said: "People thought I was crazy to think that cellular, mobile phones you could carry around in your hand would be successful". Now, the idea of cellular phones seems trivial, obvious. But Cooper does not like to dwell on the past: "For me this is exciting – being here right now, this year. It's just amazing the difference between now and four years ago, when it was really pretty boring." Cooper also mentioned that "My idea was that it wasn't natural for people to stand around talking to a big box fixed to a wall. So why shouldn't you be able to use a data communications device that you can take anywhere you want to go?" Like a philosopher, Cooper may be self-effacing, but he is confident: "It is fun being part of history; what better thing can you do in your life than try to change the world?"

Early cell phones were just for talking. Gradually, features like voicemail were added, but the main purpose was talk. Eventually, cell phone manufacturers began to realize that they could integrate other technologies into their phone and expand its features. The earliest smartphones let users access email, and use the phone as a fax machine, pager, and address book. The purpose of the cell phone has shifted from a verbal communication tool to a multimedia tool, often adopting the name "mobile device" rather than being called a phone at all. We now use our cell phones more for surfing the web, checking email, snapping photos, and updating our social media status than actually placing calls. The cell phones of today are also replacing our other gadgets, such as cameras and video cameras. Right now, 5G mobile phone will be appeared soon. For the past four generation of mobile phones 1G-4G, not only their appearance, especially their functions and applications are much advanced, one generation is better than one generation. Today the mobile phone: Its evolution from a communication device to a universal companion. Therefore, most of the people in the world everyone has a cell phone.

As the progress of materials civilization of human society Mobile Phone users in the world constantly increased in the world, reaching to an astonishing degree. Presently about 5,6 billion people uses Mobile phones out of the total world population of about 7,012 billion people. So, almost 80 %, of people in the whole world has a cell phone. Figure 1 [71] shows top 10 Countries by number of highest mobile phone users and percentage of their total population.

The thirteen is internet communication

After invented computer, people must consider the issue of computer network, in order to improve and enhance greatly its role and capabilities compared to single computer in information communications, control, storage and etc. In fact, during the 1950s and 1960s, there were various computer networks in the word, but they were independent of each other and have no connection. This is so-called the first generation of computer networks, which is a single host computer-centric remote connection system. For example, in the 1950s, the U.S. military radar system Semi-Automatic Ground Environment (SAGE) was the early networks of computers included [72]. Another one is the aircraft booking system consisting of a computer

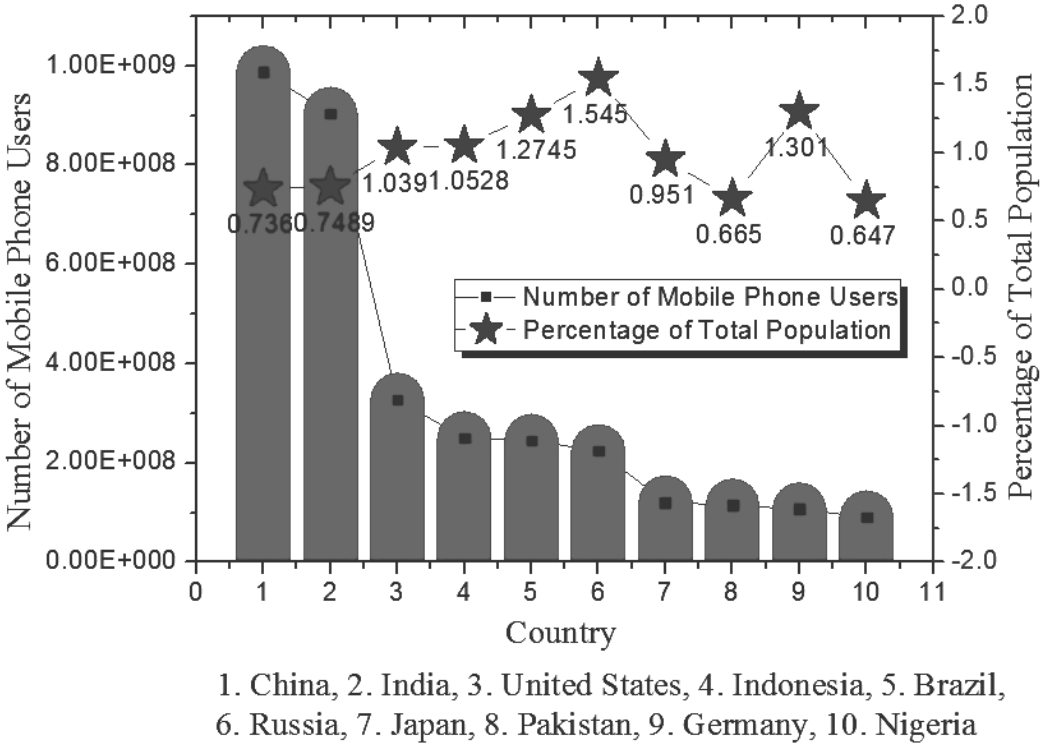

Figure 1. Top 10 countries by number of highest mobile phone users and percentage of total population, the data were taken from [71].

computer and more than 2 000 terminals across the United States in 1950s. The terminal is a computer's external device including display and keyboard, no CPU and memory. In such computer network, because all terminals share host resources, the terminal and the host each occupy a separate line, making the low utilization of lines. The host is responsible for communication and data processing, so the host is inefficient. In addition, this kind of network organization is a form of centralized control, so the reliability is low. Once the host has a problem, all terminals must be forced to stop working. In a word, such network is not the real computer network what people want.

Except such demand for the development of computer network, other reasons from two sides promote it progress as well[7] [73-76].

However, the Internet was originally a brainchild of as trategic study in the cold war years, but the key problem is that how USA authorities could communicate and command centers could function after a nuclear strike. Therefore answer must be that a special command-and control network was needed. This network would be perceived in any traditional wisdom to be unreliable at all times because it was not centrally commanded. It would be designed from the get-go to transcend its own unreliability. All the nodes in the network would be equal in status to all other nodes, each node with its own authority to originate, pass, and receive messages. Nodes can also be easily added on or removed without disturbing the function of the network. Such a network would serve as the primary purpose of a working network in the event of local malfunctions.

With ideological and theoretical guidance, with political and military urgent needs, and with the deployment of the highest level of the country and the generous financial and material support, coupled with the hard work of a lot of bright people[8] [76-78], the real computer network has no reason to be unsuccessful. In fact, the first four nodes of the ARPANET (ARPA stands for Advanced Research Project Agency) were connected using 50 kbit/s

circuits between the University of California at Los Angeles, the Stanford Research Institute, the University of California at Santa Barbara, and the University of Utah in 1969. This real computer network was created by the commission of the US Department of Defense.

One can see evidently that the advent of the internet was not accidental.

After a lot of hard work by many professionals and non-professionals during many years, the internet, from the prototype of the four-node host computer at that time, has made a great strides forward, and has become a convenient World Wide Web for everyone in all countries of the world.

The today's internet includes educational, scientific, commercial, governmental, and other networks, all of which use the same set TCP/IP of communications protocols, consists primarily of the collection of billions of interconnected WebPages, and allows almost all computers worldwide to connect and exchange information. From the simple type internet consisted of four hosts in 1969 to present highly developed internet, there are many things needing to be described. Because it is not the main aim of this article, only two segments are pointed out briefly in the Remarks 9 and 10.

Figure 2 shows top 10 countries by number of all internet users and percentage of total population [77]. It is clear that for these top countries, internet user numbers are all over 50 % of their population, two of them are over 90 %. As for the whole world, internet user numbers are 4 021 billion, or 53 % of the world's population [78].

Figure 3 shows growth of internet hosts from 1969 to December 2017 [79]. The number of internet hosts was only 4 in 1969, but over 1 billion till December, 2017, the growth rate is near10^{10}. The internet has changed much in the past years since it came into existence. The internet will be definitely changed a lot in future. The obvious example is the Internet of Things.

There is an important issue should be pointed out finally though we just describe it very simple. The point is that the emergence of internet also carried some negative effects. For example, the network is crowded, the advertisements on the webpage suddenly appear, the actual network speed is much lower than the indicated speed, hackers, especially network harassment and cybercrime, etc. These are making the network users, especially those who are basically inseparable from the network search and other people suffering. Of course, these serious problems are not all caused by the internet itself, but mainly by management problems and social boredom. This may be why Jakobsson wrote a 386-page book of "The Death of the Internet" [80].

Solid historical facts can explain the problems

The exchange of information and communication between humans from the initial era of the past, until today's highly developed internet communication, in accordance with the development of the civilization, was divided into 13 stages (of which 6 were prehistoric and 7 were historical recorded) for discussion. Though such description and discussion were not very detailed, they were quite comprehensive. What can these solid historical facts of information tell us?

1) All historical facts show that from the very beginning of human beings, information and its communication and dissemination have emerged. These always accompanied human beings, never left, never interrupted.
2) Along with the development of human material civilization, information and its transmission are also accompanied by development from low level to advanced level.
3) In the course of development, when human beings feel that information and its transmission are not very compatible, there must be some people, intentionally or unintentionally, individually or in small organizations to develop information and its

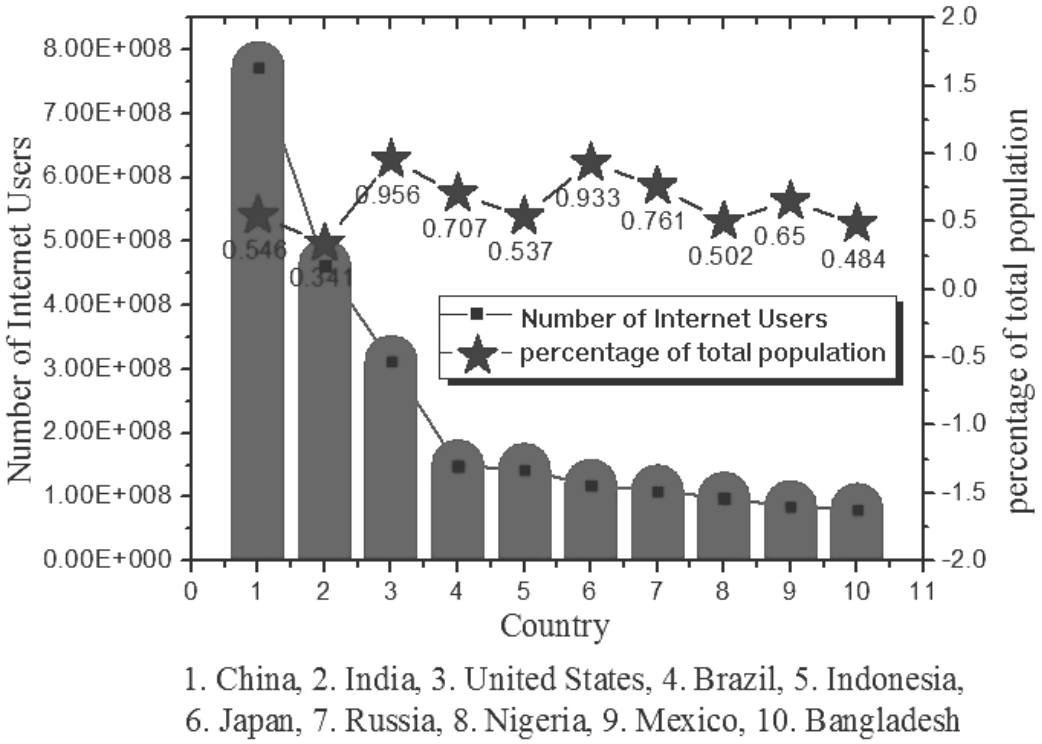

Figure 2. Top 10 countries by number of all internet users and percentage of total population, the data were cited from [77].

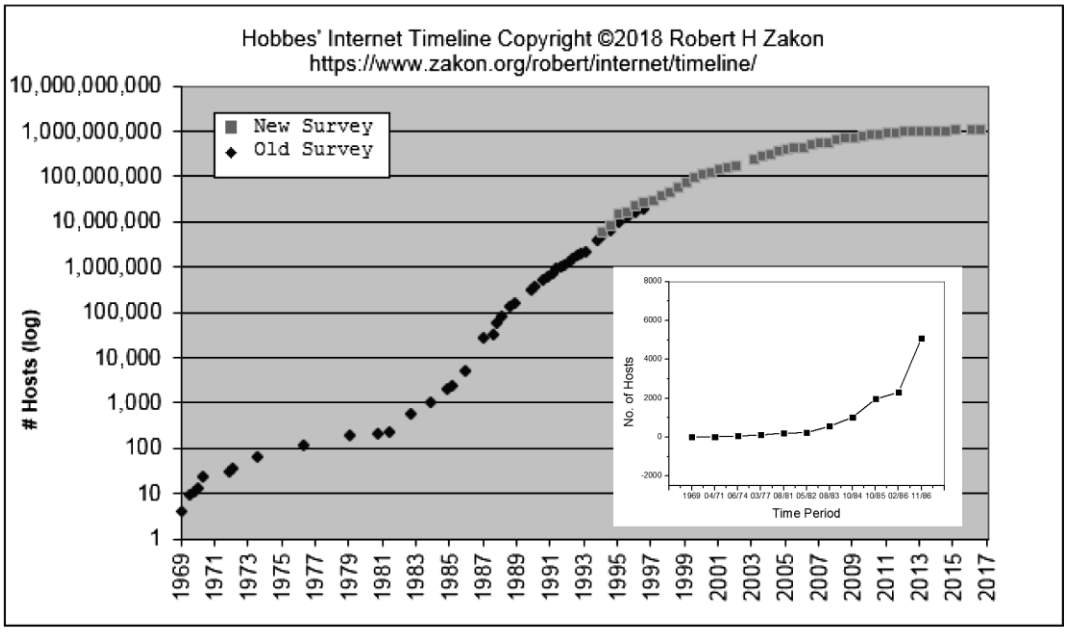

Figure 3. Growth of internet hosts from 1969 to December 2017 [79]. The inset shows the detail growth of internet host from 1969 to November 1986.

transmission mode, and make it adapt again. Such a period of time is uncertain, but human society has not had any historically recorded chaos.

4) Information and its exchange and dissemination are necessary conditions for human beings to emerge, survive and develop. Humanity has survived for several million years, with a history of civilization of 5-6 thousand years. Without the exchange and dissemination of information, people are absolutely an isolated individual. Human beings cannot be produced, and it is impossible to survive and develop. Information and its communication

and dissemination are as necessary as air and water to human beings, and cannot be left without it any moment. Each king of animal in the animal kingdom has its own information exchange and dissemination, otherwise it will be destroyed. The animal world is still the same, not to mention the highly developed human beings, who can make themselves without any information exchange and dissemination, and become individuals who are absolutely isolated?

5) All we described the historical facts that about the whole information and its communication and dissemination for the emergence and development of mankind, completely refutes all at once the notion or theory that the occurrence of information age (or information society) results from the advent of computers or the internet or any other invention. As long as we still respect the history, but also face the facts, it is pale and powerless to say that the invention of certain artifacts has led to the emergence of the information society. Information and its dissemination have followed mankind from the very beginning, never leaving, but only gradually evolving from the lower to the higher.

Then why was it proposed that after the invention of computers or the Internet, human society has entered into an information age. That was shouted loudly in the world, and there are still many authors following that? Let us try to analyze it in a simple way.

The first is that they themselves are not studying and looking for the entire history of information that is closely following human development and its spread. Even if they read the historical descriptions from others, they have to think them carefully. This argument is particularly clear when comparing the contents and conclusions of two books. One is "The Information Age: Economy, Society and Culture" by Castells [81], and the other is "The Information: A History, A Theory, A Flood" by Gleick [1]. The former basically does not involve the occurrence and development of information technology that has been followed by human society as described above, indicating that the author does not care about the history of the development of information, so the title of the book is marked obviously as "The Information Age"[11] [82, 83]. The latter basically writes about the history of the development of information, even the terms "information society" and "information age" are hard to see in the book. In addition, Gleick [1] also wrote that "The alphabet was a founding technology of information. The telephone, the fax machine, the calculator, and, ultimately, the computer are only the latest innovations devised for saving, manipulating, and communicating knowledge. … We know about streaming information, parsing it, sorting it, matching it, and filtering it. … so we see information in the foreground. But it has always been there. It pervaded our ancestors' world, too, taking forms from solid to ethereal, granite gravestones and the whispers of courtiers. The punched card, the cash register, the nineteenth-century Difference Engine, the wires of telegraphy all played their parts in weaving the spider web of information to which we cling. Each new information technology, in its own time, set off blooms in storage and transmission. From the printing press came new species of information organizers: dictionaries, cyclopaedias, almanacs – compendiums of words, classifiers of facts, trees of knowledge. Hardly any information technology goes obsolete. Each new one throws its predecessors into relief". The meaning of this rather longer paragraph by Gleick indicates obviously in agreement with our opinions analyzed above: information always exists since the very begging in human kind, every information technology either the old The Beacon Tower or the newest and advanced internet is the same from the nature, no difference, thus claiming that "human beings have entered the information age" violated all historical facts, and is without a basis hence untenable.

The second is that the age and society are big words, which should be a long period of human society. Only by carefully studying and analyzing the whole process of substance civilization

of the whole human society and having its own theoretical description (of course, it is not impossible to analyze it by the theory proposed by others), one can be able more accurately to name all or one of them. Otherwise, it will be difficult to avoid blindness or following the statements of others. Most of the authors who put forward this kind of "information age" in their articles or books may have problems in this respect.

The third is that because many articles and books are talking about the information age, so some people may follow the trend which cannot be ruled out.

The last point is that the vicious speculation of the media. After the computer and the network were successively invented, the media, under the excessive noise of some people in the industry, has spared no effort to hype viciously. It seems that except these newly invented information technologies, human beings have never had any other information tools. Human society seems that never have lived an appropriate information life and service. This of course is totally different from the fact that so many information technologies and means we discussed above. Such kind type of media hype has actually been opposed and criticized before. Early in the 17th century, Thomas Hobbs resisted the new media hype of his time. He said in his book [84] "The invention of printing, though ingenious, compared with the invention of letters, is no great matter". Gleick [1] cited the words of Hobbes also, indicating that he agrees with this point of view.

CONCLUSIONS

For the nature of information too many papers and books have discussed this problem. Though "there is still not an agreed and explicit conceptualization or definition of information" [3] in the world, and according to the statistics [4], there are more than 200 information definitions available in the literature, however, the common points of view from the mainstream academic community of information sciences do not believe that information is a matter. Of course, though information is not a matter but it relates with matter, just as said in our definition of information that information is not a substance but needs to have a physical carrier. The nature of information is too complicate so there is still no common understanding and conclusion up today.

Comprehensive history of information development for human society has been discussed and analyzed in the paper though every item is not so detail. According to the all historical facts from the very beginning of human beings the conclusion is evidently that information and its communication and dissemination have emerged with occurrence of human beings, always accompanied by human beings, never left, and never interrupted. The notion or theory that the occurrence of information age (or information society) results from the advent of computers or the internet or any other invention is opposite to the whole history facts for the human society.

Just because many people do not care the whole history of information, making them easy to convince that there is an information age in the whole developmental stages of the substance civilization in human society. But they are misunderstanding. The reasons have analyzed from the whole history of information.

REMARKS

[1]B.F. Ronalds wrote in 2016 [33] that Francis Ronalds was her great-great-great-uncle, and she published his biography.

[2]Antonio Meucci (1808-1889) had already created the first model of a telephone in Italy in 1834, tested electric transmission of the human voice in Havana, Cuba in 1849 and

demonstrated his electric telephone in New York, USA in 1850. However Meucci fell into a tough period, not being able any more to pay the $ 10 annual fee for funding for a true patent of telephone in 1874, so that eventually he did not get the patent. In 1875, Bell successfully applied for the invention of the telephone patent. For that, Meucci was very angry. He repeatedly raised objections and protests to the U.S. government. Finally, in 2002, 113 years after Meucci's death, the U.S. Senate and the House of Representatives passed a resolution in front of the iron certificate, declaring Meucci is the true father of the phone. The last two paragraphs of the U.S. Congress bill (H. Res. 269 – 107th Congress (2001-2002)) states that: "Whereas if Meucci had been able to pay the $ 10 fee to maintain the caveat after 1874, no patent could have been issued to Bell: Now, therefore, be it; Resolved, That it is the sense of the House of Representatives that the life and achievements of Antonio Meucci should be recognized, and his work in the invention of the telephone should be acknowledged". Recently many authors reported such contents in details, e.g. [43-49]. That is to say that history finally completely vetoed Bell's invention of the telephone and maintained Meucci's pioneering position in the invention of the telephone.

[3]The facts shows that German scientist J.P. Reis is seen as a leading telephone pioneer. The Reis telephone was being developed from 1857 onwards. Allegedly, the transmitter was difficult to operate, since the relative position of the needle and the contact were critical to the device's operation. Thus, it can be called a "telephone", since it did transmit voice sounds electrically over distance, but was hardly a commercially practical telephone in the modern sense. Thomas Edison tested the Reis equipment and found that "single words, uttered as in reading, speaking and the like, were perceptible indistinctly, notwithstanding here also the inflections of the voice, the modulations of interrogation, wonder, command, etc., attained distinct expression".

[4]Gray and Bell submitted the patent application for the invention of telephone on the same day (February 14, 1876). As a result, although both were granted, one was patent and the other was patent caveat. For more than a century since then, there has been a constant dispute between the two sides. Bystanders have not had unified opinions on this, but it seems that there are more people who prefer the Gray. In particular, when people thought of the patent examiner charging Bell's $ 100 at that time, the negative words even the word "stealing" for Bell appeared. Because it is only related to this article, we cannot spend more discourse on it.

[5]In their book "Crystal Fire: The Birth of the Information Age", M. Riordan, and L. Hoddeson [65] describe the invention of transistor in great detail, which is worth to read.

[6]Atanasoff in 1984 published a long (54 pages) paper [64], in which he presented in more details his interest in computing, the constructed process of ABC computer and the subsequent litigations and controversies. Regarding the litigations and controversies, Judge Larson signed his decision on October 19, 1973. The decision comprised 248 pages of legal-cap paper, with an appendix of more than 60 pages. Here, just few passages are cited:

"The Court has heard the testimony at trial of both Atanasoff and Mauchly, and finds the testimony of Atanasoff with respect to the knowledge and information derived by Mauchly to be credible".

"Between 1937 and 1942, Atanasoff, then a professor of physics and mathematics at Iowa State College, Ames, Iowa, developed and built an automatic electronic digital computer for solving large systems of simultaneous linear algebraic equations".

"Eckert and Mauchly did not themselves first invent the automatic electronic digital computer, but instead derived that subject matter from one Dr. John Vincent Atanasoff".

"I find and conclude that the ENIAC [patent] is invalid and unenforceable".

[7]These two sides of reasons are from thought and theory, and Politics and military. J.C.R. Licklider in 1960 published a paper "Man-Computer Symbiosis", developing the idea of a universal network [73]. He proposed that interactive computers could provide more than a library function, and could provide great value as automated assistants. He described a computer assistant that could answer questions, perform simulation modeling, graphically display results, and extrapolate solutions for new situations from past experience. Licklider foresaw a close symbiotic relationship between computer and human, including sophisticated computerized interfaces with the brain. In 1962, Licklider and Clark published another paper "On-Line Man-Computer Communication", in the paper they presented the visionary ideas for a Galactic Network [74]. Later on Licklider sent a memorandum about Information Processing Techniques Office (IPTO). He became the first head of IPTO in October 1962. He and colleagues discussed the concept of the "Intergalactic Computer Network", a computer network intended to allow general communications among computer users.

Another was from the event that the launching of the Soviet Union's Sputnik, the first man-made object to orbit our planet during in the Cold War. It occurred on October 4, 1957. This case caught the United States by surprise and generated an awareness that we had fallen badly behind in science and technology. In response to this, in February 1958, President Eisenhower created the Advanced Research Projects Agency (ARPA), designed to promote research that would ensure that the Communists would never again beat America in any technological race [75].

One of ARPA's offices was the Information Processing Techniques Office (IPTO), which funded research in computer science and was highly successful in its early days, making great strides in the areas of time sharing, networking (spawning the Internet), packet satellite networking, packet radio networking, artificial intelligence, digital signal processing, high performance computing, hypertext, and much more. Licklider was the first head of IPTO in October 1962. He worked extremely hard to make his contribution to the advancement of the first real computer network, even though he left the IPTO in 1965 and returned to MIT to teach.

[8]As for the hard work of a lot of bright people, we just explain it using the following examples [75, 76]. In 1964, researchers at Dartmouth College developed the Dartmouth Time Sharing System for distributed users of large computer systems. Also in 1964, a research group at Massachusetts Institute of Technology supported by General Electric and Bell Labs used a computer to route and manage telephone connections. Throughout the 1960s, Paul Baran, and Donald Davies independently developed the concept of packet switching to transfer information between computers over a network. Davies pioneered the implementation of the concept with the NPL network, a local area network at the National Physical Laboratory (United Kingdom) using a line speed of 768 kbit/s. In 1965, Western Electric introduced the first widely used telephone switch that implemented true computer control. In 1966, Thomas Marill and Lawrence G. Roberts published a paper on an experimental wide area network (WAN) for computer time sharing.

[9]One of the two points is that on October 24, 1995, the Federal Networking Council (FNC) unanimously passed a defining the term internet. This definition was developed in consultation with members of the internet and intellectual property rights communities. RESOLUTION: The FNC agrees that the following language reflects our definition of the term "Internet". "Internet" refers to the global information system that (i) is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons; (ii) is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent.

Another point is that in the 1970s, computer scientists named Vinton Cerf and Bob Kahn had begun to solve the problem by developing a way for all of the computers on all of the world's mini networks to communicate with one another. They called their invention "Transmission Control Protocol," or TCP (later, they added an additional protocol, known as "Internet Protocol". The acronym we use to refer to these nowadays is TCP/IP)[10] [86]. In 2004, they won the Turing Award, the highest award in the computer science community. This is the first time that the Turing Award has given scientists who have made outstanding contributions to the creation of the internet.

[10]Cerf, V.G. and Kahn R.E.: *A Protocol for Packet Network Intercommunication*. Transactions of Communications COM **22**(5), 627-641, 1974.

[11]Such situation is also appeared in the Chinese book in describing the issue of information. Two books are just cited as examples. They all firmly believe in and promote the "information age" and "information society". One is Zhong Yixin's book "The Principles of Information Science" [82]. It claims that "human beings have entered the information age", "the entire era is called the 'information age', and the entire society has also evolved toward the "information society". The other is the "World Map of the Information Age" written by Wang Xiaodong [83], which is also the content of the information age and the information society. Neither of the two books deals with the history of the emergence and development of information in human society, and therefore all of their claims that human society has entered the "information age" have become castles in the air, without any supports by the historical facts.

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