CHAPTER 1

MATERIAL INFORMATION CARRIERS: HISTORICAL DEVELOPMENT

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Abstract

In this study, we will briefly try to describe what material information carriers were like in each period of the development of human society, what the advantages or disadvantages of these carriers were, and how society changed with the change of the material information carriers themselves. In conclusion, we will highlight an interesting fact of current development: the digitization of material information carriers, the separation of the information itself from its material carrier, and the risk that it will face in the future.

Keywords: Data, Material information, Material information carriers, History

Introduction

Material information carriers are an integral part of the development of human society. The historical development of human society is based primarily on the knowledge that we have been left with by our predecessors, and secondly, on the medium through which this knowledge has been recorded. From the earliest times of our existence, information that was to be long-term or permanently preserved was inevitably linked to a particular material carrier (stone, clay tablet, papyrus, wax plates, birch bark, animal skin, parchment, and later paper which became the primary carrier of information in the modern era, and in the current period and the period to come, an era of digital information media is emerging). But what do all these material information carriers have in common? Using the current vocabulary of modern language, we can conclude that in all cases, the material information carriers mentioned had a nature of an "external memory" (similar to an external storage disk on a computer). They were supposed to be used to preserve information, whether for later use of the person who wrote the information, or for another person who later gets access to the material information carrier.

1. Material information carriers in prehistoric times and in antiquity

Human history is usually divided into the prehistoric period and the historic period (and the latter period is divided into antiquity, the middle ages and the modern era). The prehistoric period is dated "from the earliest time of man's existence" to the period around the 31st century BC (but this time-frame refers primarily to the history of Egypt and the lands of Mesopotamia). It is characteristic of the prehistoric period that we get to know it primarily on the basis of sources of knowledge other than written sources. [1] It is characteristic of the historic period that we recognize it primarily on the basis of written sources. [2] To put it

1 Prehistoric period is examined primarily by the methods of archaeology.

2 The historical period is known primarily by examining the written sources of knowledge: the examined are information recorded as written. However, it must not be excluded that some aspects of historical times can also be explored on the basis of archaeological methods: for example, the Middle Ages can be explored by historical methods (that is, written recorded information from a given period is examined), but archaeological methods are also used, towns are explored, dwellings, burial grounds, human remains, and written recorded information are complemented by information obtained archaeologically.
The main difference between prehistoric and historic times is that while historic times can also be explored by archaeological methods of exploration, the prehistoric period cannot be explored by historical methods, i.e., by examining written information, as these did not exist in the prehistoric age (as there was no script). The dividing moment between the historical and the prehistoric is thus the emergence and use of the script. However, since the origin and use of scriptures in different cultures fall within a different period, we must specifically describe the historical and prehistoric periods in the history of each nation. For example, while the Egyptian landmark is about the 31st century BC, in Slovak history this is the landmark of the 9th century AD. (The difference between the prehistoric and historical times between the Near East civilizations and our Slavic ancestors was almost four millennia.)

simply, we talk about the historic period from the time when we can get to know the history of the culture in question on the basis of written records of that culture. If a given company did not use written information records in a particular period, in history such a period is considered prehistoric.

People also differ from the animal kingdom by the fact (among other things) that they can exchange information effectively (they can communicate effectively verbally). It is this ability that is considered to be one of the factors that have enabled people to survive and spread, almost into all parts of the earth.[3] However, for the purpose of getting to know our oldest history it is also essential that people have tried to capture information by transmitting information to persons who were not present at the time of publication. The first link between information and the material carrier thus arises.

Although written scripts were not used in prehistoric times, graphic representations of certain scenes have been found (and these were used fairly frequently). In Europe alone we have more than 350 locations with discovered Paleolithic art. Wall paintings (not only in caves) exist from a period of about 14,000 years ago, some of them even from about 40,000 years ago (Coward, 2010).[4] Although it may seem at first sight that they are exclusively works of art, there are now also opinions that these images also contain some "communiqués", that is, they are not just art, but also contain information that was meant to be kept for a longer period. If it really is so, although this information is not quite clear to us, it is remarkable that such messages have been preserved for so long.[5]

In addition to the above-mentioned examples, whose information content is not yet accessible to us, we are slightly better off with other works of the period just before the prehistoric era ends . For example, in ancient Egypt we have a period of the so-called Zero Dynasty (a label for a series of rulers of Egypt in the period prior to the rule of Minya - the official "first" ruler of Egypt). We have, for example, a preserved "scraped" image in a stone wall showing a male figure with something reminiscent of a royal crown, and one foot stands on the body of the enemy, and the other hand maces the enemy. At the head of the male figure

3 In practice, it may have looked like this: in a period of great drought, an old man who cannot walk will tell the younger members of his family where they can find water in the dry season. This vital information will help family members survive. Animals - not using speech, cannot submit such information. Although an animal parent may show his offspring a source of water, but in the case of his immobility, the animal is unable to provide information about the water source to its offspring. Just providing information through speech makes us unique (among other things).

4 Coward, (2010)

5 *„Most of the art objects of prehistoric art were linked to the spiritual ideas of prehistoric people and their symbolic world. However, this does not mean that there were no exclusively ornamental objects."* Šída, P. (2007)

there is something that resembles a scorpion. Although this image is just a sketch, and although a certain amount of imagination is required to understand these "lines" (or "scratches") creating the image described above, Egyptologists say it is perhaps one of the first depictions of the Scorpion king, one of the rulers of the so-called Zero Dynasty.[6] Although this image does not have the artistic value of the images of the rulers of the Old Empire, the message is similar: here, I am the ruler, and I will defeat the enemies that may intend to seize my land (almost all later portrayals of Egyptian pharaohs have such a meaning).

The graphical representation described above (e.g. the ruler defeating the enemy) was an intermediate step in creating a script of sorts. The oldest form of script only involved depicting symbals (it is assumed that they were made to record the economy: a sort of proto-accounting about things in warehouses or stock), an intermediate stage was a graphic representation of real facts (a sovereign versus an enemy) and later a picture script was created in Egypt, also in the cultures of Mesopotamia, or the oldest Chinese script).[7]

It is interesting to note that we can observe a similar development for our Slavic ancestors in the period preceding the use of Latin script in Great Moravia. Even in the period texts of Great Moravia it is said that before the Slavs adopted Christianity, they used various "features and cuts".[8]

So what were the oldest carriers of written information? The oldest carrier of information was stone walls. However, for practical reasons, it was necessary to gradually replace the stone. The stone wall could not be moved or sent to another recipient. Stone slabs were used,

6 We do not have the existence of this ruler in the written documents of the Ancient Egyptian period, but the present Egyptology considers his existence to be - at least - very likely.

7 On the development of the Egyptian script from the original signs serving mainly for economic and administrative purposes, see e.g.: Manley (2004)

8 This suggests that Slavs had been using "signs" to record important data for a long time. However, there were two fundamentally different types of signs, on the one hand, features and notches (which are a primitive level of writing development), and on the other hand, the graphemic features of the Greek and Latin alphabets. It should be emphasized that there is a vast history gap between these developmental stages of the graphical record, which can only be filled by inserting into the expected development line the transformation of "features" into ideograms, then into syllable script and finally a long stage of evolutionary change of the syllable to phonetic script ... (Slavs probably "skipped" this long development: by being in contact with advanced ethnicities using Latin and Greek scriptures, they simply took over these scripts./a note by R. J/). „*From the history of the evolution of the scriptures of great civilizations, it is well known that individual nations used the scriptures of advanced cultures to create their own alphabetic systems according to their pattern. This is how the Phoenician alphabet originated from the Egyptian model, and then from the Phoenician the Hebrew or Greek alphabet and from the Greek the Latin, but it was always centuries-old processes closely linked to the development of specific languages.* "Kralčák (2014). Some authors tried to fill in the above-mentioned gap between signs and complex letters by the so-called runic alphabet that Slavs allegedly used. Any attempts to present evidence of Slavic runes later turned out to be fake and forgeries. *Vales's book*, whose runes are noticeably similar to later Cyrillic, also has such a character, and the Cyrillic reader can read these texts without much difficulty. For more details on this subject, see, for example: Jáger (2017)

which were lighter and could be sent to the recipient, but were still impractical because the information had to be engraved on the stone slab, which was both time-consuming and involved a lot of physical effort . Although stone slabs could be transported, they were still relatively difficult to carry in larger quantities, and were still relatively fragile. It was also difficult to archive more records of information recorded only on stone slabs. Therefore, the stone was gradually replaced by a material that did not have these shortcomings. What replaced the stone depended mainly on what material was available in the country. In the countries of Mesopotamia it was clay, in Egypt it was papyrus.[9]

In the lands of Mesopotamia, where there was plenty of quality clay, clay tablets played the role of information carrier. These tablets were formed by the wet processing of the clay, shaping the clay into the desired (rectangular) shape and, when the clay was still soft, the required information was engraved with a wooden digger. After drying the clay (in the sun), this carrier was relatively easy to carry, was durable, light and well archived. In this form, parts of the oldest Epic of Gilgamesh have been preserved ,[10] as well as official records or bills, or insurance contracts.

The character of this material carrier was also determined by the development of the script. The original script used in the lands of Mesopotamia looked similar to Egyptian hieroglyphs (“pictorial” script, signs originally resembling what they expressed), but in clay tablets the round shapes were difficult to engrave by the chisel, so the shapes of the characters in the sign system gradually became more abstract and “more angular” in shape. One could describe these as “wedge shaped”, that is, by the imprint of a chisel into the clay (the sun sign no longer had a round shape but a square shape). Thus, the very nature of the material carrier also determined the development of the script. From an historical point of view, clay tablets could be considered an effective material carrier of information, used in the countries of Mesopotamia for several millennia, and they were able to preserve information about the bearers of the original culture in sufficient quality and quantity to the present. However, the disadvantage of such tablets was that after the entry was completed and dried, no changes or corrections could be made to the record.

Also in Egypt, a material information carrier was used which came from aproduct that was readily available in the Nile Valley: papyrus. Its production was time-saving and

9 Parchment, smoothed animal skin was also used at the same time.

10 The main theme of the Gilgamesh Epic is the search for eternal life and the meaning of life, but Gilgamesh was just inspired by the death of his friend Enkidua. Only after his death did he realize that he, too, was mortal, and found the meaning of life itself in the search for eternal life and immortality. See more: Zamarovský (2002)

inexpensive. It had properties similar to today's paper, was light and durable. Papyrus proved to be easily archived and transmitted to the recipient of the information. In addition it was easy to write on, and round shapes of more complicated characters were easy to write compared to the clay tables. Therefore, in Egyptian script we do not see the process of individual characters "becoming angular", as can be seen in the wedge shaped script. The hieroglyphic sign system evolved so that even more abstract terms could be recorded by it. If we used hieroglyphs in Slovak, we could give the following example. The "mouse" sign and the "ladybird" sign would be read together as a mouse (in Slovak *myš*) + ladybird (in Slovak *lienka*), i.e. *myšlienka* - idea.[11]

The papyrus itself, as a carrier of information for three millennia of Egyptian history, did not see much change. Its appearance was similar in all developmental periods of Egyptian history. The main advantage of papyrus as an information carrier is its light weight, and durability when properly stored. It is also significant that it can be archived in large quantities. In its flourishing period in the 1st century BC, the Library of Alexandria had more than two million books in the form of papyrus scrolls.[12] Like the clay tablets, it can be stated that the Egyptian papyrus was a very effective material carrier of information. One of its advantages was that it could be reused. The old text could be scraped off the papyrus carefully, and it was possible to write on it again.

From Egypt, papyrus also spread to Greece and to the Roman Empire (and thus practically to many European countries). Unlike Egypt, however, much written information on papyrus has not been preserved in European countries. This is mainly due to the way of burying. Most of the papyrus was stored in tombs in Egypt, where it "survived" the millennia. However there was a different way of burying in Europe, where the body was burned and the burial equipment was not used so that papyrus scrolls could be found untouched. Although Egyptian papyrus enjoyed great popularity in European countries, its price was extremely high as it had to be imported only from Egypt (papyrus does not grow in Europe). Papyrus was not like other material information carriers, which were common products found in every home (such

11 However, the hieroglyphic sign system was extremely difficult to memorize, so two simpler sign systems (demotic and hieratic script) are emerging, which were significantly easier to learn and for practical administrative purposes. Hieroglyphs were used throughout Egyptian history, but in the earlier times they were used only as a script to record religious texts, for the practical purposes of everyday life, the above-mentioned scriptures were used.

12 The Egyptians demanded that every ship that entered the port of Alexandria brought 'books' by way of a city entry tax, which they had to hand over to the library upon arrival. These were rewritten onto papyrus scrolls, copies were archived, and the original books were returned to the owner. The library was burned down during the siege of Alexandria by Caesar. The library was restored and continued operating until the 4th century, when a crowd of Christians plundered it and burned it down, for its "ungodly" character.

as today's paper), but it was a significant commodity that only wealthy scholars or government officials could afford.

Also, the high price of papyrus caused the use of parchment (fur-free animal skin, finely worked to a thin thickness) to be developed as a material information carrier in European countries during ancient times and in the Middle Ages. Parchment was already used in ancient times in countries where there was plenty of fur, and Egyptian papyrus was not imported there or was too expensive. However, the parchment had a disadvantage compared to papyrus: when rolled up and deposited for a longer time in archives it dried up and it was not possible to unfold it without cracking or breaking. Therefore, the parchment was not rolled, but was stored as paper is today "put one on top of another". Once, someone sewed several parchments on one side, and the first book was made. As this happened in Byblos (in Lebanon today), the first book was called the "Bible" due to the place in which this happened. Thus, the term bible originally referred to any book, and later on, the word of God began to be called the Bible.[13]

In addition to the material information carriers mentioned above, others have also been used. In Greece, for example, expensive papyrus was not used to teach writing or for temporary administrative records, but waxy petals, stored in a wooden case. This wooden case with wax petals was called "diplomas". The wax was simply engraved with letters, and when it was not necessary to archive the recorded information, the wax was warmed up, and it was smoothed again, allowing the material carrier to be used again. Such records were also used in the state administration: the messenger, who was given the mandate to negotiate with foreign countries, carried with him "credentials" in the form of wax plates. Therefore, the area of public relations dealing with international relations has also become known as diplomacy. (Králik, 2016)

In describing material information carriers in antiquity, we will point out another interesting aspect. Information in the ancient world was not commonly available to "everyone" as it is now. Restricted access to information in antiquity was due not only to the high cost of the material information carrier and the illiteracy of the vast majority of the population, but also to the deliberate non-disclosure of much information. For example, in Egypt, knowledge (education) was practically accessible only to monks who lived in the temple. If someone wanted to gain access to their knowledge (such as mathematics, astronomy, or geography), they had to join their monastic community, and after several years of staying in that community, the knowledge was made available to them. These were closed communities

13 Also papyrus sheets were similarly connected, so the name bible does not only refer to "parchment" books. Cf. Králik (2016)

with strict rules, similar to sects. It was forbidden to make the monastic community's knowledge available to "uninitiated" persons.

Even Pythagoras, when he wanted to study mathematics, had to enter a monastic community in Egypt that made their knowledge of mathematics available to him, and after his return to Greece he presented this knowledge as "his" discoveries. Also, his school was atypical in Greek terms. His school was a closed association with strict rules whereby his students did not see him for several years (he would speak in the dark and only behind a curtain), and both teachers and students were very superior to other people who did not belong to their community, and thus, other people had no access to their information and knowledge (De Crescenzo 2006, 2004). This character of his school was inspired by the character of the monastic communities in Egypt. Thus, access to information in antiquity was not as automatic as it is in modern times and now.

2. Material information carriers in the Middle Ages

The production of medieval books was concentrated mainly around monasteries, centres of medieval education. It is logical, since, in the period under review, almost nobody was literate apart from the clergy (not even monarchs or civil servants in the state administration). Books in the Middle Ages were rewritten in monastic scriptoria, with a great emphasis on the aesthetic side of the text. The text of the book would be rewritten for several years, and after the text had been rewritten, the text was decorated with hand paintings. When the text was finished, the cover of the book was decorated with gold platelets inlaid with gems. Books in the Middle Ages had an extremely high price: the average book in the Middle Ages had the value of a middle-class car today. Only a very wealthy man could possess just one book in the Middle Ages, and the possession of a library with several books was a sign of immense luxury. That is why the books in the medieval libraries were carefully guarded and books were often chained to prevent them from being stolen.(Turošík 2016, 2016a)

Another interesting aspect of medieval books, such as the contemporary primary information carrier, is the number of titles available in the Middle Ages. Given that in early Christianity resistance to "pagan" literature arose, non-Christian books ceased to be transcribed in the Middle Ages over time, and were gradually forgotten. In the early and high Middle Ages, approximately 50 book titles were available in the average library. Compared to the many books in the ancient Library of Alexandria, this ratio is woefully low. While the number of book titles in medieval Christian Europe was minimal, a different situation entirely existed in the Muslim world. There was no resistance to Greek and Roman literature in the

early Middle Ages, and so many works of ancient philosophers (such as Aristotle's works) were preserved mainly in libraries of Muslim countries. It was not until the 13th century that these works were translated into Latin and made available for knowledge in Europe. Thus, if Muslims had not been tolerant of ancient literature, today's philosophy would be very impoverished.

It is interesting to note here that although the Muslim and Christian worlds fought frequent wars against each other during the High Middle Ages, it was precisely the area of science that was the point of contact between the two cultures. For example, the Spanish Cordoba was a place where scholars from both the Christian and Muslim world came to exchange their information. However, in Europe, it is overlooked that, in particular, information from scientists from the Muslim world was more valuable in exchanging this information, as Arab science was much more advanced at that time, as compared to science in Europe.

When describing books as the primary information carrier in the Middle Ages, it should be mentioned that since the vast majority of the medieval population was illiterate (about 99 percent of the population), it was necessary to disseminate information by other means. For example, rulings of monarchs that were written on parchment were published so that they were read in a public place (for example, in the market square during a market). The recording of the ruling of the monarch itself and its "publication" in writing would be ineffective for the illiteracy of the population. Another frequent means of communicating information (especially of a religious nature) was also wall paintings in churches expressing, for example, scenes from the lives of saints, or scenes from the crucifixion of Christ. For ordinary people, these wall paintings were a full-fledged source of information and at the same time they were the only source of "written" character information. Of course, in addition to these sources of publication of "written" information, clerics who spoke the message of God served the faithful with the information contained in Christian written documents.

3. Material carriers of information in modern times

The Renaissance was a great turning point for the literacy of the population. In this period, secular schools also began to be founded. If someone wanted to learn and have access to information recorded on material carriers in writing, he no longer had to enter the monastery, but only to attend a secular school. The number of literate people grew slowly, and with it a number of secular books. Another important milestone was the discovery of the printing press. The price of books began to decline rapidly (but books were still expensive for the poorest compared to the present). Even so, the average townspeople or merchants could buy

at least one book (most often the Bible). Moreover, the process of increasing the literacy of the population and lowering the price of books had started. The climax of this process can only be seen in the 19th century. Only in this period did the majority of the population become literate and the price of books acceptable to ordinary people. This was a period in which information was available to a wide range of the population.

In the 20th century, the phenomenon of mass media can be observed. Even in the interwar period, newspapers were becoming everyday information resources for everyday people. (By comparison, in the Middle Ages, an ordinary person had access to as much international information as could fit into one newspaper.)

The radio also becomes a mass medium of the interwar period. Unlike newspapers that were only able to make new information available the next day, the radio could convey information immediately. Although the radio was indeed a revolutionary means of broadcasting information at that time, its use in broad sections of the population was hampered by the fact that not all households of the period had installed and were able to use electricity. The access to electricity of most households became commonplace only after the Second World War.

After World War II, the use of the television grew rapidly. Unlike the radio, the television did not only transmit voice but also video information. Information from different cultures or companies was easier to convey to members of other cultures since this information was also associated with image information. To a large extent, the radio in the past had to use its own imagination of the recipients to know what they were hearing on the radio. For the first time in their lives, television viewers could see the presidents or rulers of their countries, whom they had previously only read about in newspapers, or whose voices they had only known from the radio. Politicians, rulers and people of public life became very close to the ordinary population.

In 1952, the US company IBM introduced the first magnetic tape storage system, putting electronic computing to use. In the 1990s, the Internet arrived : the US scientist's original network of information transfer marks the digital era we live in today. How did material information carriers change in the digital era? First and foremost, it is now easy and cost-effective to copy information from one carrier to another. By reducing the cost of a material information carrier, the price of the information itself also decreases considerably, and information is available to a wide range of recipients.

However, it is now possible to disseminate information without having a material carrier. The Internet environment creates an almost unlimited number of platforms for accessing or

exchanging information. The advantage is also the speed at which the information reaches its addressee. The distance between the originator and the recipient of the information no longer plays any role. Despite the obvious positives that the digital era certainly brings, problems arise, such as digital security of information. Since most of the information is in digital form, it is important to ensure its protection as well. The legislation of individual countries must also respond (and react) to this requirement. Cyber security is becoming a very topical issue in today's world (Rosenoer, 1997).

One of the serious problems highlighted in particular by archivists is that in the future, the exclusive storage of information on digital material carriers may pose the risk that future generations will not be able to access information contained on older material carriers (floppy disks, if the floppy disk drives will no longer work on computers, or their computers will not use them at all), and if the digital media that is to archive the information is damaged, the information collected for archiving may be lost forever.

"Unlike the previous decades, there is currently almost no physical record of most of the digital material we own. We are taking pictures on digital cameras, but few people want to take pictures, the lifetime of CDs will not last more than a few decades. We may know less about the beginning of the 21st century than about the early 20th century", says Rick West, managing data at Google. "The beginning of the 20th century is still largely archived in paper and film formats, which are mostly accessible. Much of what we do now are things we put into digital content. And that will disappear after some time. It is not something we have translated from analog to digital container", as Google's data manager concluded."[14]

Although these problems may seem petty, at least they need to be considered and addressed when setting up digital information systems to serve the long-term archiving of cultural wealth and information we currently undeniably have. It would certainly be a tremendous loss if we lost the wealth of accessible amount of information that we have gathered to date.

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