On revolutions and the 'information revolution'

Alan GILCHRIST

Cura Consortium and Metataxis Ltd.
alangilchrist77@gmail.com

Resumen

La denominada 'revolución de la información' es contrastada con las revoluciones clásicas de la agricultura y la industrialización; y se descubre que el concepto es confuso debido a la naturaleza abstracta del término información. Se arguye que, en realidad, se trata más bien de una revolución de las comunicaciones, construida sobre una sucesión de revoluciones previas y dramáticas en las tecnologías de la comunicación. En el momento actual, la nueva revolución de las comunicaciones está inundando el mundo con 'mensajes', que pueden o no constituir información significativa. Se especula que el advenimiento de los medios sociales y del trabajo en red puede finalmente resolver este problema de sobrecarga informativa y extraer algún sentido del caos aparente; y que todavía puede haber un papel que desempeñar para los científicos de la información en este proceso.

Palabras clave: Revolución de la información. Revolución de la comunicación. Información. Historia. Evolución.

Abstract

The so-called 'Information Revolution' is contrasted with the classical revolutions of agriculture and industry and found to be misleading because of the abstract nature of the word information. It is argued that in fact there is rather a Communications Revolution following on from a succession of prior and dramatic lesser revolutions in communication 'technologies'. At the moment, the new Communications Revolution is swamping the world with 'messages' that may or may not constitute meaningful information. It is speculated that the advent of social media and networking may eventually solve this problem of overload and make some sense out of the seeming chaos; and that there may still be a role for information scientists to play in this process.

Keywords: Information revolution. Communication revolution. Information. History. Evolution.

1. Introduction

There is no doubt that the advent of the computer, followed by the Internet, the World Wide Web and mobile computing have made a huge impact on the lives of millions of people —and will continue to do so for the foreseeable future. That impact is the focus of much debate and study from which it is not yet clear what the exact social and economic effects will be; so it may cloud issues to refer to an 'Information Revolution' in such debate and study unless we are clear just what might be meant by that expression. As information scientists we should be conscious of the slippery nature of the concept of information, particularly when it is used in combination with words like revolution. As Roszak (1986) has said "Information has come to denote whatever can be coded for transmission through a channel that connects a source with a receiver, regardless of semantic content". This paper will discuss revolutions, not from the vie of a trained historian, but as an information scientist, before treating the concept of 'information' within the context of the expression 'information revolution' and concluding that the expression 'information revolution' can be dangerously misleading.

2. On revolutions

It is the big Revolutions that get the headlines: the French and American in the purely social sphere and the Agricultural and Industrial in the march of technological progress with associated social change. But history is punctuated with many minor revolutions, often having significant effects, some but not all of which are labelled as revolutions. Consider the advance made when Neolithic man first created a spear by fixing a sharpened flint to a wooden shaft, thus making hunting more effective and safer. Much more revolutionary was the discovery of fire, possibly by *Homo erectus* some 400,000 years ago, a discovery that allowed early man to cook his food, keep warm and extend his activities beyond daylight. Such discoveries, of course, affected only small communities but still marked significant advances in man's technical, economic and social development. The later and larger revolutions made greater impacts because the communities were larger, and because there were greater connections between cities and

towns, city states and later between nations. Between the larger revolutions there were smaller revolutions often occurring as continuations; or interacting with other revolutions as in the mechanization of agriculture in the 19th Century, so that we may rather think of a series of waves becoming higher and more complex.

2.1. The first Agricultural Revolution

Agriculture in a limited form of planting and cropping and the rearing of domesticated animals probably existed amongst nomadic hunter-gatherers, but the first widely noted Agricultural Revolution did not occur until people began to settle in the fertile plains of Mesopotamia in about 3,500 BCE. This evolution involved a wider range of cultivated crops and techniques such as irrigation and food storage; and this supported the production of food surpluses. The dramatic effect of this was to support the creation of complex settlements in which emerged centralized administrations and political structures; a hierarchy of citizens, division of labour; art and architecture; and in about 3,000 BCE the 'invention' of writing.

2.2. Writing and writing materials

At first, writing was considered to be a sacred gift of the gods, but when traders got to understand this invention they realised it was a better way of communicating than by the use of simple 'tokens'. These consisted of clay tablets inscribed with rough drawings of, for example, grain or oil and attached to goods in transport or storage. It wasn't long before this innovative cuneiform writing on clay tablets spread to neighbouring tribes, such as the Akkadians, the Assyrians and later the Babylonians. There is evidence that writing was taught in the schools and Fara (2009) notes that archaeologists working on digs in Nippur, a city of Sumeria, discovered a school dating from about the 18th Century BCE, complete with "clay tablets inscribed with copies of lists and tables: children were learning to read, write and do arithmetic". In the courtyards they found "recycling bins for soaking old tablets with water and fresh clay so that they could be used again. Scribes made their own tablets, and the presence of clumsy shapes with awkward writing shows that children were being taught this craft".

During the period 1,550 to 300 BCE, the Phoenicians from the Eastern Mediterranean had established an extensive mastery of trading across the whole of the Mediterranean, establishing trading posts at such places as Carthage, even journeying as far as Britain, attracted by its tin mines. Developing the earlier proto-Sinaitic alphabet, they produced the first truly international phonetic alphabet consisting of 22 consonant letters. This spread to Ancient Greece (which added two vowels) and thence to ancient Rome; even, remarkably, to its use in Hebrew and Arabic where it easily supported these two languages that are read from right to left. This Phoenician alphabet, produced in the support of trade, is the ancestor of all modern European orthographies.

The Sumerians wrote on clay because it was the most abundant and accessible material available. Likewise, the Ancient Egyptians wrote on papyrus, manufactured from the acres of reeds growing by the Nile, and this was still the most common medium when the great Library of Alexandria was built. There is a story that its founder later banned the export of papyrus because he was jealous of the growth of the library at Pergamum. That library responded by inventing parchment as a writing material (1). Parchment can be made anywhere, being manufactured from the skins of animals, principally sheep and goats. (A better class of parchment, known as vellum is made from calfskin). Parchment was the main medium used till the arrival of paper, invented in China, but slow to arrive in the West, via Baghdad and Al-Andalus (modern Andalusia) during the "Golden Age of Islam" some time after the 8th Century CE and finally in Germany around 1338 and in England not until 1494. When Gutenberg first printed 210 copies of *The Bible,* he produced 30 on parchment and 180 on paper. It is estimated that each parchment copy required 300 sheep skins (Fan, 1997). No wonder that paper became the dominant medium till challenged by digitization.

2.3. Natural Philosophy to Science — from the "Golden Age of Islam" to the Renaissance

The expression 'Scientific Revolution' has been the subject of much debate. Some scholars regard it as a period stretching roughly from the beginning of the Italian Renaissance to the end of the Northern Renaissance; roughly from the 14th Century to the 17th Century, from Copernicus to Newton. Undoubtedly, this was a fertile period, but others argue, notably Thomas Kuhn, that scientific progress is largely cyclical, consisting in Kuhn's terms (Kuhn, 1962) of periods of 'normal science': "the normal state of a science and of the community of researchers who constitute it", interspersed with 'paradigm shifts': when a new paradigm occurs it produces "a non-cumulative scientific change, a rupture, a break from the past". With this view, it is impossible to

define when science began. As Fara (2009) says, in asking this question:

> It is possible to pick out ideas and discoveries that later became incorporated within a global scientific enterprise. But at the time, they belonged to other projects —finding an auspicious time for religious festivals, winning wars, vindicating biblical prophesies, and (above all) surviving.

Writing supported the advance of science, allowing the compilation of lists of natural phenomena such as animals and plants, to which were added poetry and stories, all of which came to be stored in libraries, the early repositories of knowledge. Sargon the Great, king of Assyria between about 2270 and 2215 BCE is known as "the father of libraries" and Ashurbanipal, king of Assyria between 668 and 662 BCE, maintained a large library that was catalogued and which lent clay tablets to borrowers. Thus, libraries were common by the time of the great philosophers of Ancient Greece, when Plato, philosopher and mathematician (424 — 348 BCE) established the Academy, thought to be the first institution of learning in the Western world. One of its most notable students was Aristotle, philosopher and polymath (384 — 322 BCE), the founder of Western philosophy whose thinking endured till the Renaissance, and whose philosophical work included early and influential thoughts on classification and logic. He was also in advance of his time in the study of 'natural philosophy', the philosophy of nature, and the precursor of modern science (2). It was another famous Greek, either Ptolemy I or Ptolemy II who founded the great Museum of Alexandria some time between 323 and 246 BCE, which included a large library. It is said that Ptolemy instructed his soldiers to seize any books on ships arriving in the harbour, offering back a copy, and mention has already been made of his attempt to impede the progress of the library at Pergamum.

While the Ancient Greeks were principally philosophers, the Romans, in a broad sense, were more noted for their feats of engineering and colonization, though they inherited much of Greek thinking and many of their books. In 476 CE, Rome finally fell to the invasions of the Ostrogoths, ushering in what has been erroneously called the Dark Ages, but which included two important developments from the point of view of this article. The first of these was the widespread establishment of monasteries by the Hiberno-Scottish mission in which Scottish and Irish monks spread Christianity throughout the British Isles and continental Europe, and by the founding of the Benedictine monastery of Monte Cassino which was, in turn, followed by many more Benedictine monasteries and others established by different monastic orders. The importance of these monasteries was enormous; first of all because they were centres of learning and education, and secondly because they included scriptoria where the monks assiduously copied very many books, not only of a religious nature, but many secular works that had survived from the fall of Rome and from older times still, including texts from Ancient Greece. The second even more important development, mentioned earlier, has been referred to as "The Golden Age of Islam", which ran from the 8th to the middle of the 13th Century. This astonishing period saw tremendous advances in philosophy, astronomy, the sciences and medicine, art, architecture and agriculture; laying the foundations, as some scholars maintain, for the Italian Renaissance. Of a great many Arabian, Persian and other polymaths of this era two can be named as outstanding examples: al-Khwarizmi (780-850, known in Latin as Algorithmus) and Ibn Sina (980-1037, known in the West as Avicenna). The former, an astronomer, mathematician and geographer, combined Greek geometry with arithmetic to produce algebra (al-jebr in Arabic), was influential in introducing the Hindu numeral system to Islam and Europe as the system we use today, and gave his name to algorithms. Avicenna, another polymath, is most famous for his *Canon of Medicine,* a codification of all medical knowledge; Greek, Persian and Indian as well as his own work. It was translated into Latin and was a basic text in European universities for the next 600 years. Of particular interest in relation to this essay is the enormous amount of translation that took place in three main centres over this period: Baghdad, Toledo and Cordoba. As well as the indigenous Arabs, Jews and Christians living in reasonable harmony in these centres, many scholars arrived from England, Italy, France, Germany and elsewhere translating ancient Greek, Latin and contemporary Arabic works into Arabic, Latin and Hebrew. The arrival of paper-making in Baghdad and Al-Andalus added hugely to the production and dissemination of texts. At its zenith Cordoba boasted of having over 100 libraries, and the Royal Library built by al-Hakam in the 10th Century is said to have contained almost half a million books, compared with the largest library in Christian Europe which contained no more than a few hundred manuscripts.

Before the end of Western Islam when the Moors were forced out of Al-Andalus by King Ferdinand and Queen Isabella, universities were springing up in Western Europe, Bologna in Italy being one of the oldest, some 130 years before Salamanca. Then came the Italian Renaissance in the 14th Century starting off as a literary mo-

vement recalling the old Latin texts and moving to Greek philosophy and science, the bridge notably being crossed by the two polymaths Leonardo da Vinci and Michaelangelo. This period also saw the invention of printing with moveable type as a further and vital spur to progress and increased literacy. Though some writers regard the ensuing period, when the Renaissance spread to the rest of Europe, as a 'scientific revolution', most regard it as an acceleration of scientific thinking and new awareness, spearheaded by such scientists as Copernicus, Galileo and the anatomist Vesalius. Also important were the contributions of Galileo and Francis Bacon in formulating the concept of 'scientific method'. Continuing the acceleration, the following period known as the 'Age of Enlightenment', produced Isaac Newton and the *Encyclopédie,* compiled by Diderot and his colleagues, and culminated in those two great expressions of free thought, the French Revolution and the American War of Independence, events that can justifiably claim to be revolutionary.

2.4. The three Industrial Revolutions

With an accelerating pace of change, supported by a growing understanding of science and technology, it was not long before the first Industrial Revolution followed the Age of Enlightenment and the French Revolution (3). The British Agricultural Revolution between the 15th and 19th Centuries had solved the problem of cyclical famines and food shortages thereby stabilizing the population, and this helped to support the first Industrial Revolution of the 18th and 19th Centuries in Britain, followed by many other countries. This technological revolution was based on coal, iron, steam and textile production; and it is significant to note that steam-powered printing enabled the mass production of newspapers and another corresponding rise in literacy. The national growth was explosive: between 1760 and 1810 the production of pig iron had increased eightfold, and the UK population had increased from 7. 7 million to 13. 2 million between 1791 and 1831, and to 25 million by the 1860s, with a population shift from the rural areas to the towns. The second Industrial Revolution followed on consecutively from the first, usually being dated as lasting from 1850 up to the start of the first World War in 1914. This period was characterized by steel production and rail-roads, the oil-powered internal combustion engine, electricity, chemicals, the telegraph and the radio, and the clear transformation to the contemporary age. In his book with the long title *The third industrial revolution; how lateral power is transforming energy, the economy and the world,* Rifkin (2011) has explained that "I came to realize that the great economic revolutions in history occur when new communication technologies converge with new energy systems". Specifically, and perhaps controversially Rifkin, in advancing his theory, is referring to the Internet and renewable energies.

3. On 'Information'

As the word 'information' has become increasingly widely used, its abstract nature has become increasingly vague. It is worth quoting at some length an observation by Abbott (1999):

> The arrival of the Internet and especially the World Wide Web in the media-inflamed public consciousness has at last upped the profile of information as a commodity, yet there is still an emphasis on quantity and speed over quality or meaning. As so often happens, we are seduced by technique at the expense of content, and all information increasingly comes to have the same value, or no meaning at all. Often, it appears, information is regarded as a kind of homogeneous fluid, an indifferent material whose processing demonstrates the wizardry of our technology, but which in itself should concern us no more than the electricity supply that makes computing possible.

The neuroscientist Rose (2003) puts it more succinctly: "Meaning is not synonymous with information" and "Brains do not work with information in the computer sense, but with meaning".

3.1. 'Information' in the abstract

Not surprisingly, there is a large body of literature by information scientists examining the possible meanings of the word 'information'. The discussion in this section, though, is confined to supporting the case made in this paper regarding the nature of the so-called 'Information Revolution' (4).

In a seminal paper published thirty-seven years ago, Belkin and Robertson (1976) proposed that the tangible manifestation of information might usefully be called a 'message' and they placed this in an 'information spectrum' of cognitive contexts in which messages can be transmitted and alter 'structure'. This use of the word 'message' can be detected in the book by Nonaka and Takeuchi (1995) in which they proposed the concepts of 'tacit knowledge' (oral) and 'explicit knowledge' (recorded), and the four transformations between them. It is proposed here that the word 'information' may justifiably be used instead of 'knowledge' in which case the concept of explicit information corresponds exactly with Belkin and Robertson's use of the word 'message'. The transformations that Nonaka and

Takeuchi propose can then be seen as tacit to tacit (conversation), tacit to explicit (physical recording), explicit to explicit (combining of records) and explicit to tacit (assimilation). This reasonable extension of Nonaka and Takeuchi's thesis also suggests the useful relationship between the concepts of 'information' and 'knowledge', which was proposed by Brookes (1980) in the simple formula; $K[S] + \Delta I = K[S+\Delta S]$ where a knowledge structure K[S] is changed to the new modified structure $K[S+\Delta S]$ by the information ΔI, the ΔS indicating the effect of the modification. Thus, to repeat, information has no intrinsic meaning. Miller (2002) makes the same point as Rose above when he says:

> We have progressed from the industrial age through the information age into what is being promoted as the 'golden age' of knowledge and, in the process, we've been led to believe that information contains meaning —rather than just standing for, provoking or evoking meaning in others.

3.2. 'Information' in practice

So, information regarded as message can be transmitted in many different forms, through different channels and with widely different attributes, and the intrinsic meaning may vary accordingly in the mind of the recipient. As already indicated, it can be oral (tacit) having different weight between two people in conversation, a formal lecture, or disembodied via radio or telephone; or it can be recorded (explicit) in the very many forms available. It can be factual (and even this may be relative) or speculative, and may or may not attract a wide consensus. It may be requested, or very often in this 'noisy' age not requested, transitory and/or trivial as with advertising (75% of Internet sites are commercial and emails automatically generate advertisements in sidebars). Worryingly, information may also be 'misinformation' or worse, 'disinformation', disseminated by agencies (even those we may normally trust) with amoral intentions. The recipient of this multitude of varied, and often conflicting, messages has somehow to make sense of it all, trying to select and evaluate on the basis of (amongst other less tangible properties) his or her current understanding of both the message and the status and trustworthiness of the source.

In addition to the above there is the problem of closed or less accessible communities, either through 'non-membership' or through a lack of adequate knowledge to understand the language of those communities. The most obvious of these communities is the scientific one which, despite the efforts of writers of 'popular science', remains a complete or partial mystery to many so that alternative beliefs may then be preferred. For example, it has been estimated that 40-47% of Americans endorse the creationist view that God created human beings within the last 10,000 years, whereas less than 5% of scientists in general and less than 0.1% of life and earth scientists doubt the theory of evolution, broadly defined (Henriques, 2012). Branches of the social sciences, notably economics, are likewise difficult for the ordinary person to comprehend. Even within science, and because of the enormous expansion of scientific knowledge there are barriers of understanding between the narrow specializations within a greatly expanded population; and multidisciplinary teams are formed to tackle complex topics such as the physics of fundamental particles or neurochemistry. In addition to a lack of the required knowledge there may also be a lack of interest —or worse, a cynicism that seems to be increasingly found in consideration of, for example, political issues— and which has led many commentators to question whether people are actually better 'informed' in these matters despite the enormous coverage by the mass media.

4. An 'Information Revolution'?

Most people understand the term 'Information Revolution' to mean the abundance of information made possible by the new technologies, and this view is supportable in an everyday sense. The term is so commonplace that it may seem pedantic to question its validity, but as has already been argued in this article it is the word 'information' that is being questioned. The short history presented above has encompassed the invention of writing and the alphabet; the development of writing materials; the activities of copying and translating — the latter greatly enhanced by the manufacture of paper; the importance of monasteries and universities supporting the Renaissance and the invention of printing with moveable type; all culminating in telecommunications, the mass media and the Internet. These are successive stages in a continuous series of 'Communication Revolutions', each creating new channels and widening the reach of access by individuals, so that now a large proportion of this populous world is interconnected both as recipients and as senders of messages. This is further complicated by what Crystal calls the 'Language Revolution' in his book of that title (Crystal, 2004). Crystal argues that English has now arrived as a global language, though admitting that it is rapidly diversifying, involving regional standards in which 'new Englishes' begin to proliferate. Crystal also argues that the Internet has radically affected the way in which we communicate, "initiating a process of

graphic translation from paper to screen of all previous styles of written language, and motivating the emergence of brand-new linguistic varieties in the form of Netspeak". In this process one can detect a possible fuzziness of meaning in communication, at least for a sizeable proportion of the population, though subsequent developments will almost certainly counter that initial problem. The most important of these, in this respect, will surely be the growing use of social media, particularly in the form of social networks. These can clearly be regarded as a further Communications Revolution, capable of transmitting more 'meaningful information' particularly within the 'membership' of the network. The Internet guru Tapscott has argued that these new networks will provide alternatives to what he calls "nation-state-based institutions", citing as examples Advocacy networks on a global scale capable of generating a massive public outcry on such issues as the activities of Ugandan warlord Joseph Kony; Knowledge networks such as TED (Technology, Entertainment and Design) formed to generate and disseminate 'ideas worth spreading'; and Watchdog networks to scrutinise institutions to see that they behave appropriately (Tapscott, 2013).

5. … and Information Science?

With semantic resonance it might be thought that an information revolution would be good news for information scientists, but we are as much caught up in the communications revolution as everyone else. Core librarianship will presumably continue to provide custodians and curators of explicit knowledge, while knowledge management experts will continue to address the issues of tacit knowledge, now brought into sharp focus by the advent of social media. While the accelerating pace of disintermediation and the increasing power of modern search engines pose serious questions for the future of information science, there are at least three areas where their skills can be effectively deployed. The first is in the growing area of Linked Data which may be seen as a maturation of the original World Wide Web concept; the second, not unrelated, is the currently somewhat anarchic area of social computing; and the third is the seemingly perennial problem of Enterprise Search. One question that information scientists should ask themselves is whether they should be concerned with all the many forms, communication channels and aspects of 'information' as described above. Of course, specialization has always been possible and pursued, but the new breadth of 'message' types and their complex interweaving largely through social computing presents new problems, many of which may be solved, or at least ameliorated by the spread of Linked Data and the associated registries and authority files. So there should be an opportunity to be found in the present jungle created by the social media; and information scientists should be ready to meet a need, as yet perhaps unperceived, for guides who know their way around the various products of social media and their interactions with more traditional forms and stores of information; and who can thus advise, direct and help to evaluate sources and their information contents. They must also be intellectually prepared to work closely with Knowledge Engineers (and here it is encouraging to note that many occupied in the areas of Knowledge Organization and Knowledge Representation are beginning to find common ground). While these activities may be effectively pursued at what might be termed the macro level, there remains a significant problem at the micro level —that of Enterprise Search. A recent study shows, yet again, the dire situation. To the question posed to senior management "How critical is finding the right information to your organization's business goals and success?", 22.2% answered "Imperative", and 52.8% "Significant" —a total of 75%. However, another question posed to knowledge workers —"How easy is it to find the right information within your organization today"— elicited responses "Very easy" 2.8%, and "Fairly easy" 11.2%, totalling 15%. Almost half (44.8%) found it "Moderately hard" and 14.7% found it "Very hard", totalling 59.5% (White, 2013). Here, information scientists must be competent in working with Information Architecture, ensuring that this works within the wider Enterprise Architecture. So, there should be plenty of opportunities for information scientists, especially those who are prepared to extend their traditional skill sets.

Appendix A

A somewhat arbitrary chronology to accompany this article. Some of the dates may be approximate or open to argument, but the overall picture holds true. Note that there is a gap of just under 4,500 years between the invention of writing and that of printing, but a mere 550 years between printing and the emergence of the World Wide Web. The 'singularity' is the situation predicted by the mathematician Vernor Vinge of the creation by technology of entities with greater than human intelligence. The futurologist Ray Kurzweil has predicted (controversially, one hopes) that this event will occur by the year 2045.

Date span	Revolution/Movement	Date	Event/Place/Person
3, 500 BCE onwards	First Agricultural Revolution Middle East/Sumerian		
		3000 BCE	Writing
			Temple and Palace archives
		1050 BCE	Phoenician Alphabet
C 6th BCE — C 4th BCE	Ancient Greek Philosophy	428 — 348 BCE 384 — 322 BCE	Plato (Academy) Aristotle (Lyceum)
		323-246? BCE	Alexandria Museum (inc, Library)
		129 216 CE	Galen
		476 CE	Fall of Rome
517 — 1250	Monasteries; Hiberno-Scottish Mission (563 —)		Scriptoria
C 8th — 1258	Golden Age of Islam	 780— 850 980— 1037	Baghdad, Cordoba, Toledo al— Khwarizmi Ibn Sina (Avicenna)
		793	Paper-making in Baghdad
1088 — 1240	Mediaeval Universities Bologna, Siena, Salamanca, etc.		
		1150	Paper-making in the West (Xàtiva)
		 1439 1476	Printing (Gutenberg — Germany) (Caxton— Britain)
C 14th — C 16th	Italian Renaissance	1452 — 1519 1473 — 1543 1475 — 1564 1564 — 1642	Leonardo da Vinci Copernicus Michaelangelo Galileo
		1605	First European Newspaper
C 15th — 17th	Northern Renaissance	1561 — 1626	Francis Bacon
C 17th — C 18th	Age of Enlightenment	1642 — 1727 1646 — 1716	Newton Leibniz
		1660	Royal Society of London
		1665	*Philosophical Transactions of the Royal Society* *Journal des Sçavans*
		1713 — 1784	Diderot — Encyclopédie
1750 —1830	First Industrial Revolution		
		1809 — 1882	Darwin
1860 — 1914	Second Industrial Revolution		
		1876	Telephone
		1895	Radio (Marconi)
		1879 — 1955	Einstein
		1912 — 1954	Turing
		1925	Television
		1948	Digital computer
		1971	First email
		1974	Internet
Current	'Third Industrial Revolution'		

	1991	Digital cellular phone
	1993	World Wide Web
	1997	Blogging
	2003 — 2006	LinkedIn, Facebook, Flickr, YouTube, Twitter
	2007	iPhone
	2010	iPad
	2013	Google Glasses
	2045	"The Singularity"?

Table I. A chronology of revolutions

Appendix B

Since writing and submitting this paper the following appeared in the British newspaper The Guardian (15 July 2013):

> The Royal Statistical Society and King's College London asked people [in the UK] what they think they know about the society they live in...
>
> People think that £24 out of every £100 of benefits is claimed fraudulently. (The true figure is 70p).
>
> People think that black and Asian people make up 30% of the British population. (The true figure is 11%).
>
> People think that 24% of the population of England and Wales is Muslim. (The true figure is 5%).
>
> People believe that crime is not falling. (It is falling).
>
> People think that every year 15% of girls under 16 get pregnant. (The true figure is 0. 6%).
>
> People think 36% of the population is over 65. (The true figure is 16%).
>
> People think only 43% voted in the general election of 2010. (The true figure is 65%).

It would appear that the true figures are available —even if "hidden" in official and academic reports—; but what people believe is affected by prejudice. The author maintains that these prejudices serve the purposes of the government and are strengthened by many of the newspapers. It is perhaps likely that such misconceptions are not uncommon in many other European countries.

Notes

(1) The English word parchment, and Spanish *pergamino*, being corruptions of the word Pergamum.

(2) It is curious to note that the English word 'scientist' was not invented till 1833.

(3) It has been suggested that the term 'Industrial Revolution' was coined in an echo of the Revolution in France.

(4) Any reader who may be interested in the wider literature is recommended to refer to an article by Bates (2005) in which the author presents her own detailed understanding of the word information and also includes many references to other studies.

References

Abbott, Robert (1999). The world as information. Exeter: Intellect Books.

Bates, M. J. (2005). Information and knowledge: an evolutionary framework for information science. // Information Research, 10:4, paper 239.

Belkin, Nicholas J.;Robertson, Stephen E. (1976). Information science and the phenomenon of information. // Journal of the American Society of Information Science. 27:4 (July-August, 1976) 197-204.

Brookes, B. C. (1980). The foundation of information science. // Journal of Information Science, 2:3/4, 125-133.

Crystal, David (2004). The language revolution. Cambridge: Polity Press.

Fang, Irving (1997). A history of mass communication: six information revolutions. Burlington MA: Elsevier Science.

Fara, Patricia (2009). Science: a four thousand year history. Oxford: Oxford University Press.

Henriques, Gregg (2012). Knowledge of science and beliefs about evolution. // Psychology today. (May 9, 2012). http://www.psychologytoday.com/blog/theory-knowledge/201205/knowledge-science-and-beliefs-about-evolution (16 April 2013).

Kuhn, T. S. (1962). The structure of scientific revolutions. Chicago: University of Chicago Press.

Miller, F. J. (2002). I=0 (Information has no intrinsic meaning). // Information Research, 8:1 (October 2002).

Nonaka, Ikujiro; Takeuchi, Hirotaka (1995). The knowledge creating company. Oxford: OUP.

Rifkin, Jeremy (2011). The third industrial revolution: how lateral power is transforming energy, the economy and the world. New York: Macmillan.

Rose, Steven (2003). The making of memory. Revised 2nd edition. London: Random House.

Roszak, Theodore (1986). The cult of information: the folklore of computers and the true art of thinking. Cambridge: Lutterworth.

Tapscott, Don (2013). Change networks. // RSA Journal. (Spring 2013) 21-25.

White, Martin (2013). The future of search. 3 May 2013. http://www. findwise. com/resources (last accessed 19 August 2013).

Enviado: 2013-06-20. Segunda versión: 2013-08-20.
Aceptado: 2013-09-01.