

Information and neural information assimilation

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An epistemology, based in the information that rules our lives, is stated - Informationism - . Information, or perhaps the message, reaches the brain as tiny impulses - quanta or useful information -, hitting and activating the neurones; as a consequence becoming quanta of useful information. The physical, psychic and pragmatic, etc. connotations of information are studied, including its energetic aspect; within a Cosmo vision. Among other matters, human neural evolution due to information is studied. Other neural information theories are also studied. Some definitions of information are quoted, as well as its connotations and peculiarities.¹

Informationismus und neuronale Informationsassimilation

Es wird eine als Informationismus bezeichnete Erkenntnistheorie vorgestellt, die von den Informationen ausgeht, die unsere Leben bestimmen. Informationen oder möglicherweise Nachrichten erreichen das Gehirn als kleine Impulse. Es können massenhafte oder nützliche Informationen sein, die die Neuronen erreichen und aktivieren; als Folge entstehen daraus riesige Mengen nützlicher Informationen. Physikalische, psychische, handlungsorientierte und andere Konnotationen von Information, einschließlich ihrer energetischen Aspekte werden aus einer gesamtheitlichen umfassenden Sichtweise heraus untersucht. Unter anderem wird auf die auf Informationsaufnahme basierende neuronale Entwicklung der Menschen eingegangen. Dabei werden auch andere neuronale Informationstheorien behandelt und einige Definitionen für Information angeführt, sowie Konnotationen und Besonderheiten von Information beschrieben.

Introduction

In these historical times of changes in social structures, a transmutation process is taking place, which affects all human manifestations. Its main influence can be noticed in the conceptual principles related to the theoretical basis of many scientific disciplines. Considered as a whole as an essential element, information is also affected by the transmutations that are currently taking place. The concept of information is

modified and widened; there are even doubts about its identity as an entity in it. For instance, Lutz Herrschaft [1] states, in 1996, that information is an attribute, a quality from the object, an added value. It could even be considered nearly as a meta-predicate. We are also warned about its incoherence and the mirage it can turn out to be.

However, underlying information there is a whole process typical of living beings, to adapt their existential passing to the environment in which they live; also to adapt the environment to their natural living condition. Among human beings, this process acquires very special connotations; it is an ontological process involving intelligence. Therefore intelligence, as a human competency, plays an essential role, directly affecting information.

Considered both as a natural phenomenon and as a dynamic and evolutionary process [2], information acquires a new dimension, going from the being to the environment and from the environment to the being. It is therefore an unavoidable means for the integrating process which builds up society. Alexander I. Mikhailov [3] pointed out that society exists because information does. Without information there would be no link between individuals. These individuals are, on the other hand, doomed in fact to coexist, in an unlimited unity of universal destiny, thus articulating society [4].

The number of studies about information, its nature, its idiosyncrasy, its intrinsic values, its applications and economic repercussions, is increasing lately. These studies have always been carried out taking into account the essential characteristic of information, which provides its reason for being: its usefulness. Authors such as Norbert Henrichs [5], Rafael Capurro [6], Peter Ingwersen [7], Jiri Cejpek [8], J. Zeman [58], D. Katuscák [59], and the author of this article [9], have mainly based their information theory on how to make information attainable for whomever it is necessary. There is research on means and methods, either manual or computerized, to make the data contained in documents accessible and useful. Classification, storage and retrieval systems, etc., are thus studied, emphasizing on the use of computing techniques. All this make obvious that information is consid-

ered as a process; a process involving a theoretical and industrial evolution. Most of the compiled bibliography refers to information from this point of view.

However, information includes a phenomenological connotation which has an impact on the development of individuals and on their scientific and social actions as well.

Historic evolution

As it is usual when I study a given subject in depth, I will refer to its evolution with time, in order to place it within a historical context and be able to consider its evolution throughout the years.

Mainly in the last 50 to 60 years, great changes have been observed regarding "information" as an entity of general and particular usefulness; changes in which there has been a major shift towards computerization. Information is considered to be the first link in any human activity, and even the basis to formulate an "Information Society". Bear in mind that information, as an essential element to the development of human beings, is inherent to them [17] and their coexistence on Planet Earth in an associated way of life. Information society has therefore always existed; since the beginning of times. Babylonians and Egyptians, as well as later Greeks and Romans, already knew how important an adequate spreading of ideas (information) is for the development of their corresponding civilizations; holding back information sometimes, in order to manipulate their people at will. Likewise, information was considered a crucial link in wars.

Not wanting to go too far back in time, and to mention only some relevant authors, we notice Socrates (469-399 BC) [20], who said that virtue is in learning, and virtue lies in studying; in which information is implicit. Also around that period, Plato (427-347 BC) [20] included information in his Poetica, as part of philosophy. Poetica entails a connotation of usefulness – (note of the author:

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first written reference on the usefulness of information that has ever been found). Poetica also refers to its pedagogical aspect. Around the same period of time, as far as Aristotle (384-322 BC) [20] is concerned, the soul and intelligence can be formed through information; thus granting it an ontological nuance: "life comes from life". He also states that the concept of "information" comes from in-form which is equivalent to give-form - "morphe" in Greek means form -, con-form. This derivation of the concept passed on later to the Roman world, from which it has been taken for Romance languages like Castilian (Spanish).

The influence of Greek philosophy can be seen on Saint Augustine (354-430 AD) [20], and later on Saint Tomas D'Aquino (1225-1275 AD) [20]. They both emphasize the ontological value of information, giving the first priority to the soul. There is a great deal of references to the concept of information coming from learned authors from the Middle Age, such as San Isidoro de Sevilla, San Alberto Magno, Maimónides, Santo Toribio de Liébana, Alfonso X the Wise and many others that should be discussed in another paper. Moving on to the Modern Era now, one must quote Descartes (1596-1650 AD) [19]. In his famous statement "I think, therefore I am", he grants an absolute value to human thinking, valid by itself; which confers nature to the being. This "thinking" is reached through a process of assimilation of information producing knowledge. The point of view of Cristoph Martin Wieland (1733-1813 AD) [20] which deals with information, with the understanding and the information of the heart is also interesting.

In the Oxford English Dictionary, there is a great deal of definitions for information, dating from the XIV century. Apart from pointing out information as an element to form the mind, to teach and to learn, it mentions its function as an advice, as a warning; as well as in legal terms. The "Diccionario Enciclopédico Abreviado", published by Espasa Calpe, gives the same characteristics and attributes to the concept.

Evolution in the XIX, XX and XXI centuries

Going up to the XIX century, authors such as Dewey, Paul Otlet, Henri La Fontaine, Husserl, etc. come up. These authors mainly focussed on "documentation", considering information as a subsidiary, auxiliary element; as a consequence of the "documentary" process. The influence of the use of technical methods for the production of useful data can here be observed. There was even a period, already in the XX century, during which information was mistaken with knowledge. Several authors dealt with dif-

ferentiating these two concepts. Jason Faradane [21], already a classic amongst them, marked the difference between knowledge, information and information science. Still in 1997, Greame Johannson [22] made a distinction between information, knowledge and research. It has been discussed how the first is the driving force to the rest. Likewise, during the XX century, data was mistaken with message and information. I have dealt with clarifying this subject in various papers [22] myself. It is very interesting to consider the authors from former Czechoslovakia, who have been pioneer in some aspects. For instance, when the Czechoslovakian Republic was founded in 1918, and it joined the trends of Eastern Europe countries, it gave a great significance to public, scientific and administrative libraries. The article published by AABADOM is very interesting [60].

From the many studies and applications, that are more and more abundant and necessities, arose the concept of "information science". Nobody can tell precisely who the first was to coin this expression, since it is known how a same idea may arise nearly at the same time, in different parts of the world. It seems like the progress has a rhythm of development such that at certain moments, the levels reached are roughly parallel. In spite of the mentioned, application of which will be useful for subsequent historical developments; we will here risk pointing out A. J. Meadows [23] as one of the authors who has studied the subject the most. Also, Alan Gilchrist has been publishing papers on this topic in the Journal of Information Science for over thirty years.

The truth is that the amount of studies about information has been increasing throughout the XX century, sometimes arousing controversy about whom, when and how these have been carried out. Important debates have even arisen about the origins of the word "information". It has even been said that it was created by a columnist from New York. One of the most recent works treating the concept of information is the one whose authors are R. Capurro and B. Hjørland [23], which has been referenced in a paper published on the Journal of Information Science in 2003. In a general sense, it may be pointed out that, once information was seen as an entity in itself, around the 60's of the XX century, studies started to be carried out about its nature, properties, influences and uses. Information is being granted an aim, as a way to know and provide the contents of the documents. Also at these times, its physical and ontological components started to be discussed, which implies carrying out studies related to psychology, pragmatic, sociology, ontogeny, phylogeny, philosophy, metaphysics... It may have been the end of the 80's of the XX century - one has to be cautious with these statements -, when its neurological connotations started to be studied as such

- neural assimilation -, along with its connection with theology [15] and hermeneutics [24].

Perhaps a little earlier, at the end of the 70's of the same century, a relationship is established, in the context of information sciences [2], between information and the inscrutable theories of Hermes Trismegisto, the ones by Karl Popper, the Pensática, and the philosophic theories of knowledge themselves. This is also the period in which the impact of information in subsequent attitudes and activities was studied in detail. For instance, it was added to it a connotation of intentionality [28], of receiver's will for understanding and, obviously, of its value for the industrial and economical world, as well as for business organization.

All these studies are carried out at the same time as the development of computerized communication techniques, the computer science, and all that is related to computational science.

What is understood by "information"

When I try to explain during my lectures what may be understood by information, I start by saying that it is both "everything" and "nothing" at the same time. On the one hand, it is indeed "everything", due to the fact that, through its mental or physical use, one can reach knowledge; and from that, taking as an example its most pragmatic sense, research, science, wisdom and the truth - objective, relative and conditioned truth -. From this reasoning, it can be concluded that information has a transcendental connotation, given that, following the same line of thought; from truth one can reach evidence and certainty. Finally, wisdom would be reached. Information will also be "everything", when its use in the fields of economy or industry is considered.

On the other hand, with the idea that information is "nothing", one refers to its properties: intangible, abstract, inexhaustible, non contaminant and recyclable. It cannot be touched; however, it is there.

It is there, as a result of a human process, carried out within human brains, and composed of the following stages: seizure, comprehension, storage, adaptation, perception, understanding, response capacity. The response takes shape into ideas production. Through a new process of development, of new assimilation, where conscious or perhaps unconscious reasoning takes place; knowledge production is finally reached, knowledge that may be useful or not.

However, the logical question would be to ask oneself what this "human process" may be. According to Krumholz [63], the internal brain mechanisms capable of assimilating

external impulses, and producing the subsequent information, are not yet known. There seem to exist “dark regions”, impossible to reach with the current research methods. Nevertheless, many authors have conceived different theories. On the one hand, we are told that, first, the meaning is reached; and then, through a sensory transformation within our brain, we reach knowledge. On the other hand, it is mentioned [19] that, from stimulus from the outside world reaching the brain, an inner world is elaborated. An ontogenic principle is assumed, since the resulting inner world is subjective, depends on receiver's idiosyncrasy, and on his cultural, environmental and social background. In several of his papers, Professor Kaula [13] states that information has a human nature as well as an influential one, regarding the building of its knowledge, which is also human. Many other points of view could be quoted on the subject.

Definitions of Information

Throughout the years, there has always been a need and concern for knowing what we refer to by information. There are many definitions in the bibliography of all times. In certain definitions, one can notice an anthropological and ontogenetic sense, involving a characteristic that affects the influence of information on human beings, as well as its connotations and behaviours. In other definitions is stated its practical and pragmatic nature, which results in proceedings for information processing, mainly by computerized methods, to supply the information - maybe the message - to whoever needs it.

Hereafter, the definitions given by some information specialists are quoted. Through them can be deduced what information “may be”, in its primary nature. In the Oxford English Dictionary one reads that information is the communication of knowledge, as an informative “thing”, and it gives the example of a newspaper, which produces information.

Similarly, Michael Buckland [11,14] states information must be considered as a “thing” to generate informative data - note of the author -, that is, it refers to “information processing, or data processing”. As far as Fred I. Dretske [12] is concerned, information includes a perceptive, sensory process on the one hand; and a cognitive process on the other hand. Sensory information is an analogical phenomenon, and conscious information is a digital phenomenon.

Michael Hill [19] defines information through its causes, given that it is through information that we perceive and receive the outside world, giving us the chance of making decisions and expressing judgments. To Rafael Capurro [23], there is a controversy between the definition coming from cybernetics, and another coming from the field of sociology (language, culture). He also writes [6] that information has an anthropological nature, as a non-human process of being.

Norbert Henrichs [15] relates information technology to human beings when he mentions that, because of its use, the human being discovers he is somehow an information processing system... Human intellectual activity will be influenced by machines... Also, this author defines information as an exchangeable knowledge and as a process through which, starting from an informative base, one can obtain raw material on the one hand, and energy on the other hand (synonymous of usefulness). To Lawrence McCrank [17], information is a compound data structured for its interpretation; but it can also be seen as something apart from interpretation in itself. The Slovakian authors D. Katuscák, M. Matthaidešová and M. Nováková [59], consider information from a realistic point of view. They consider it is a reflection of reality, both in its conventional sense, and in the scope of its use. As far as Silveira Zaragoza is concerned [16], information is a physical act, followed by psychical act. The physical act is supposed to be the message, whereas the

psychical act corresponds to the perception and assimilation activities of the mind. Many more definitions could be quoted here, since every researcher priding himself on being a scientist and specialist formulates some definition of information. However, for the purpose of this paper, the mentioned ones are sufficient and illustrative enough.

Information: phenomenon, process

When the definitions above are examined thoroughly, one can notice, on the one hand the tendency of considering information as a process (phenomenon) that often modifies, or has an influence, in the state of knowledge of the human being. On the other hand, a (physical) process is mentioned, in which take part its usefulness and its use, applying processes that are most of the times computerized and high-tech related. In other words, information is some times presented as a “phenomenon” and others as a “process”. Therefore, as far as I can see, the difference between both can be established considering:

- Information [16] as a phenomenon
- Which takes place around us, independently of ourselves, and which we receive conscious or unconsciously.
- Produced by the environment of our noosphere, which surrounds us and gives shape to the development of our daily activities.
- Information as a process
- Developed by us, from some documents, for its subsequent use.
- As a consequence of an information science process that consciously affects the activities of human intellect; and which reverberates in the development of mankind, in its scientific, technical, or artistic aspects.

In this paper, information will be considered as a “phenomenon”, and its connotations, characteristics and properties will be studied.

Outstanding characteristics

There is a basic attribute for information to be considered as such, that has not been explicitly mentioned so far, although indirectly it has been. That is its usefulness. It has been said that Plato included information in his "Poetica", precisely where this characteristic was granted to it. Therefore, information must be useful; it has to get out from wherever it is, and reach a receiver... It can be deduced from this that information cannot be innate, intangible, imperceptible and endless... nor can it?

Let us now move on to the level of real and tangible things. It must be admitted that, for knowledge to have a given consistency, it needs to be supported by something also real and tangible, such as a sheet of paper, a floppy disk, a hertz wave, etc., forming thus a document which can also, nowadays, take many different formats. If we consider the idea as the first product of the brain activity, at a practical level this concept will also need to have a tangible support in order to become a "useful knowledge", which is itself composed by small portions forming a whole. These portions have come to be called "data".

The data therefore corresponds to a quantum [22] of knowledge, which is coherent, objective, neutral and without value. In a different level, L. McCrank [17] thinks that "data" is what is given by the unit itself, from the digit to the line, forming a compound of lines and bits. They cannot be counted or collected. They are not acts, and they do not constitute any evidence by themselves. They are the raw material to build a piece of information.

When a given value, scientific, economic or artistic, etc, is added to the data, it becomes a "message". This is the definition adopted in this paper for the concept of message, because it is in agreement with the text that is written and discussed. There are obviously other definitions for the concept of message, considered from different points of view, such as linguistic, semiotic, philosophic, economic, and several others.

From this we deduce that, in order to have useful information, either the data or the message need to leave the document, and then be put at the disposal of whoever may need it. In general and wide terms, this would be the duty of "information science": "ciencias de la información"; o "ciencias de la documentación" ("documentation science"), terminology coined by the author and used in Spain. When the empirical-practical value of information is studied, the concept is granted with a linguistic, philosophical and neuronal origin. To Alwin Diemer [34], information is the vehicle for the circulation, transfer, evaluation and application of knowledge. In this sense, we

consider it is an element of transmission of culture [27], bringing peoples together, in a globalizing and universalizing sense. However, in order to have information it is not sufficient with the data leaving the document, and one expecting it to be used. It also needs to be emitted, transmitted, perceived, understood and interpreted [2, 29]. To Harm Glashof [19], there is a difference between the processes of understanding, comprehending and knowing. Each of them involves a higher complexity in the corresponding brain processes. To this author, the simplest, easiest one is the concept of knowing something, an object or idea... In a more complex state of reasoning one gets to understand; and adding one more stage of higher complexity, the capacity of comprehending is reached.

Nowadays, in the economic and industrial fields, information has acquired a great relevance. It is not considered anymore as something secondary, marginal, and insignificant. Economical principles are used today, in which information is considered to be a raw material, an added value, a consumer good, a currency producer, a form of energy (driving force, in the mechanical, intellectual and social senses), and even as grey gold [2]. Norbert Henrichs [15] gives also a social value to information, when he considers it is crucial to the education of peoples, especially the least developed ones, to the elimination of cultural barriers, to establish a bridge between cultures and eliminate the barbaric behaviour of peoples. Also [30], this author considers information can have an effect on production; on the one hand creating work, and on the other giving rise to capitalism. Acting on knowledge, information creates raw materials and energy. L. McCrank [17] grants information a positive attribute, and a value he assumes as true.

Ontological connotations

Thus, information is inherent to human beings. It is necessary for their development, both at individual and at species level. It is thought that there is an innate [19] genetic information, which is brought at birth by the individual itself - note of the author - and is therefore naïve, and unintentional. According to the argument that information has an influence in human development, John McHale [26] mentions it is information that will give us the opportunity of learning how to become human beings. Along this same line of thought [19], information is supposed to be neutral, without value. It is the individual who, depending on his set of values, chooses certain behavioural criteria.

In the speech I made when I joined the Royal Academy of Fine Arts and Historical Sciences of Toledo [27], I also granted infor-

mation an ontogenetic connotation, including it in the same category as vital elements such as water, earth, etc; given that it is considered the fourth vital element. An "information route" is outlined, in parallel with the silk route, silver route, gold route, black gold route and so on. Throughout the centuries, such route has turned out to be cyclic; given that it had its origin in the East, continued towards the West and, after going around the world, it has come back to the East. Things have changed, nowadays. Due to communication technologies, the World has become smaller and, in a way, more homogeneous. As a result of this, information does not have a circular motion anymore, but a translational one; horizontal and multidirectional.

Cosmic information

Human beings are at the same time on Planet Earth, and immerse in a complex, scattered and changing Universe, from which it constantly receives influxes; which in turn means receiving information. One can therefore speak about cosmic information, within the Omni cosmos. So far, this cosmic information is quite unknown of, although indeed known by intuition, due to its influence both physical and on the state of mind. One can predict it can be perceived in an imperceptible way. Its effects and peculiarities are also unknown and unappreciable, except from in so-called cases of intuition and foretelling.

Information is therefore being considered as a form of energy. Its energetic nature is interesting, deduced for instance from papers by N. Henrichs [30], which get to the conclusion that information is a property of Universe. To Paulo Manzelli [33], there is a matter-energy-information relationship. It is known that matter is a "condensed" form of energy, which gradually breaks down into a lighter, more manageable form of "energy". At the same time energy breaks down into something more scattered, subtle, manageable, which is supposed to be information. Naturally, through consecutive breaks down of matter into energy, and then into information, a time would come when the World and the Universe would only consist of information and... it would obviously die. This will never become true, given that there is also an inverse motion, such as: matter-energy-information-matter... and then start all over again, although not at the same level. This level could in fact be either higher or lower. A cosmic connotation of information is observed as well. In this sense, information can even be considered as a catalyst [10] for evolutionary processes. With respect to the cosmic dimension of information, within the Omni cosmos it belongs to the meso cosmos [47], which is between the macro and micro cosmos. Regarding the point of

view of information as a human product, it is included in the noosystems [35].

In the end, we can state “nothing without information and everything because of it”.

Neuronal theory: quanta of useful information

From what is written above, it can be deduced that these opinions and points of view are somewhat imprecise and incoherent, since they do not get to the core of the matter... it is said that... there is a process... caused by... The explanation occurred to me when the neurophysiologist José Manuel Rodríguez Delgado returned to Madrid with his neurological theories. In these theories was stated the fact that impulses from the outside are received by neurones, which thus start their activity. In other words, neurones are activated, giving the individual – the human being – a higher reasoning capacity and intelligence. Each generation will be more intelligent than the previous one, given that it is receiving a continuous and abundant flow of information. This seems to hold true, if we take into account the discoveries and inventions that continually follow one another. The famous sentence of Rodríguez Delgado “knowledge does take up space” has gone around the world.

Everything became clear. The signals coming from outside the brain formed small “quanta of information”, which were immediately followed by the processes mentioned above, to develop knowledge; and subsequently, ideas becoming “quanta of useful information”. And this is a phenomenon that has been occurring since Man became Man, or maybe even before that. Helmut Anntz [25] affirms hominid became human exactly due to the consecutive reception and assimilation of information, reaching its brain from the outside, from its environment.

Neuronal theories of information

Therefore, we know information is processed - neuronal assimilation - when certain impulses, or quanta of useful information, reach the brain; thus giving rise to knowledge: a useable product. Several authors have done research on this significant subject, and have developed different theories which I can today describe as “neuronal theories of information”.

In order to study some neuronal theories, one has to go back to the middle of the XX century, when C. E. Shannon published his Theory of Information [36], which can be considered as the starting point. Somewhat later, in 1988, I had the satisfaction of re-

leasing my theory of the quanta of useful information [2]. Since then, many different theories have been developed. Most of them try to find some parallelism between the processes occurring in the brain and the mechanisms carried out by computers; in accordance with some programmes prepared beforehand, in order to have the machine carrying out the function for which it is manufactured (– by human beings – note of the author). Some authors think the process has been carried out the other way round; i. e. it was the machines operation that induced the thought of a similar operation in the brain. In any case, these theories have been developed by different specialists and researchers of the field of information science.

In order to study the mentioned process of neuronal assimilation, we will expound some relevant opinions, considered as the starting point of subsequent researches. On the one hand, John McHale [26] considers information is a consumer good, which humans should use in their benefit and to obtain better living standards. He assumes living beings use their senses to collect information from the environment, and the difference between human beings and the other living beings is that man can “process” information consciously; humans use a system of symbols to communicate with fellow men. The author also mentions the changing and changeable environment of information - note of the author -; since he assumes that it is due to its influence and use that our life conditions, basic principles, cultural manifestations and so on vary. The use of information to a greater or lesser extent measures the level of evolution of human race. More informed societies will have more possibilities for choice.

On the other hand, Fred I. Dretske [12] grants information a holistic, primal and basic nature. He states that, in the beginning, there was information; and the world came after it. The transition, (perhaps better transmutation – note of the author), was carried out through the development of organisms with the ability of exploiting information in a selective way, with the purpose of being able to survive and endure as a species. Information reaches the brain and affects and activates the neurones. For a reaction to happen, the brain needs a reference scale; which is built through consecutive information reaching it from the outside world. These theories seem somehow incoherent to me, since the question about the origin of information arises. If the world has risen from information, perhaps the idea of an all-embracing creator loses strength... or is information then the creator?

Another interesting researcher is Thomas J. Froelich [37], who deals with information as an element to develop knowledge, subsequently studying the latter. He states

thought is not absolute; it depends on the nature of each individual, on its reference system and on its set of values. Nothing new so far; but he carries on with the statement that thought can always and only be valid from the point of view of the individual thinking it. Therefore the famous sentence of Descartes needs to be inverted, thus considering: “I am, therefore I think”. Thinking is a human activity, and it implies information as an element, cause and effect. This activity grants a social function to thinking. Each society - social group - creates a different form of knowledge and thought.

Other interesting theories

Similarly, the theories of R. M Berstrom [38] are interesting. According to him, humans behave as a communication system, at the centre of which is the brain. Here, the signals are received from the outside and emitted to the outside. Information is supposed to be the raw material to develop these abilities. The author also states one needs to make the difference between information and the processing of it. There is a reference to this above, when the difference between considering information as a “phenomenon” or as a “process” has been mentioned. Through subsequent reasoning, the difference between “information” and “information science” can be established. As several other authors maintain, Bergstrom compares the brain with the machine - perhaps the computer -, stating that information is the raw material driving both, and thus comparing information with energy. The informative capacity of the brain, within the brain structure, is estimated to be generated at approximately 109 bits/sec. However, when it reaches the conscious level it is only about 100 bits/sec, which means there is a loss of 107 bits/sec when going from the physiological to the psychological level. Human beings have the capacity for a higher brain development; to be more intelligent. The mechanism to go from the sphere of the “unconscious” to the sphere of the “conscious” [63] is missing.

The theories of Brier [63] will now be considered. He deals with the interpretation of the message, different from the information; in order to make it understandable and comprehensible by the receiver. The brain, together with the machine, is responsible for this comprehension, in which a cognitive process is included. Brier, together with M. Leupolt [40, 41, 42] and other researchers, within whom I am included, is of the opinion that this cognitive process should be extended to every living being, i. e. plants and animals.

Alexander King [43] assumes there is a series of phenomena, events and stages of understanding, each of them at a higher and more complex level of abstraction, in order

to reach the “knowledge” of the world we live in, and to adapt our acts to this world. Information is in every one of these stages, either as a base or as a vehicle to pass from one level to the other. These theories are actually shared nowadays by several specialists and researchers. What was new about them was the historic moment in which they appeared. Alexander King was one of the pioneers, and he is well known for his many works and papers.

The principal theories of Norbert Henrichs [15] have been discussed earlier. It is worth mentioning here his interest in the creative ability of human beings, which enables them to reach science, and therefore wisdom [49]. This author also focuses on the spiritual attributes of information and, to a certain degree, grants it theological connotations. Another of his research interests is the study of the sensory, visual, tactile, acoustic information and so on, as opposed to textual information. He has also concerned himself with the founding of the “information science” as a university subject; which is today already consolidated [30]. Rafael Capurro [6] has published a paper about the introduction to the concept of information. It actually is an essay about information in itself. It is understood that he is concerned about the origin, meaning, transcription and representation of the concept of information. His theory on “Hermeneutics” [24], which has been widely spread and known, should be taken into account.

Amongst other opinions and research from the theories of Peter Ingwersen [44], we could stress those in which research is considered as the result of a modification of the structures of knowledge of whom receives the information – supposedly a human being –. He also deals with the concept of information, which he considers is limited by the influence of linguistics, pedagogy, sociology, psychology and computer science.

From either point of view, neuronal theories are based on the same principles and follow almost identical reasoning. Perhaps A. N. Leontiev [20] contributes with something new, by relating information with conscience, and assuming information is in fact the way in which conscience exist for the others. Apart from that, information is the link between individuals; obviously in a process of communication.

Informationism: former theories

After what has been written until now, it would seem unnecessary to continue justifying the possibility to formulate a new epistemology based on information: informationism. However, it may be convenient to establish relationships with other theo-

ries on knowledge organization, in order to observe perhaps the parallelism between these and information, taken now as a mental process.

On the one hand, information arrives into the brain, and activates a mental process which starts with the seizure, reaching the knowledge and then the comprehension, to end up with a total understanding of whatever was involved by the information in the origin. All this implies a process of organization of knowledge itself. On the other hand, information is considered to be the connecting thread [70] which affects the brain of human beings, helping them to form their intelligence. Each historical period has based its knowledge theories [2] on a different principle, which is itself influenced by the stage of the actual evolution of mankind. Similarly, the philosophical trends being studied by men from different points of view have had an influence; different theories have thus raised, such as causalism, empiricism, positivism, historicism, physicism and so on.

The relationships that may be applied between some of these known theories and information are now considered. Firstly, “causalism” which states there is no effect without a cause: effect = quanta of useful information reaching the brain; cause = knowledge. Realism states that real objects are the base for knowledge. Here, an idea corresponds to an object, and the former has its origin in information, which will thus become the object. Positivism is the theory which matches the best. It was devised by August Comte [2], and based on the concept that only the facts, immediately received by the senses and quantitatively verified, can generate knowledge. This author also allows for a social attitude, given that the perception of the outside world may condition our behaviour.

In the past times, perhaps since 1980 to mention a guiding date, the chemical and spiritual components of human beings have been being considered; this implies a change in the postulation of such theories. A modern theory of knowledge has subsequently risen, based on the principle of “get to know you”, which has lately gained great importance. Such principle studies and examines within human beings, both physical and psychologically, in a neo-realistic attempt to turn the activities of the spirit into mere equations, and chemical and physical formulae; arguing that human being is formed by chemical elements and compounds.

More recently, a turn towards a more humanizing position is being observed. Let us for instance quote Fernando de Elzauru [45], whom bases his theory of knowledge organization on the change of paradigm of his new “vision of reality”. We live in a trans-

mutation period, and therefore old reference parameters are no longer valid. Other more highly abstracted parameters, based on system theory, should be accepted. Norbert Henrichs [15] also develops his theory from a change of paradigm, by adding a phylo-theological connotation to information, based on obtaining “wisdom” - more complex than “knowledge” -; subjective and relative knowledge, since it is human, but objective and absolute with respect to its relationship with science - note of the author - Jiri Cejpek’s [8] sets his paradigm on human conscience, as a psycho-physical phenomenon carried out in the brain when it receives information. Many other formulations, by many other authors, and deducible from the ones already mentioned, could be quoted here.

Informationism: a new theory of knowledge

Even though it is widely admitted that we are currently living in the Age of Communication, given that information flows back and forth through communication; it is obvious that information surrounds and invades us. Not even on a desert island could we escape its influence. Information is the basis for any human activity, for all our reasoning, the origin of any social attitude; it is the base... It is the base to formulate a theory of knowledge, which takes information as fundamental paradigm, and which I call “Informationism”.

On the one hand, Informationism [19, 46, 47, 48] entails an optimistic viewpoint, through the belief that a more equal and homogeneous world can be achieved, if its paradigms are correctly applied. On the other hand it implies a waiting and hoping attitude, given that it implies an uncertainty before the truth is revealed. Informationism also assumes a functional principle of thinking, a philosophic and scientific activity, with its repercussion on scientific development. Moreover, it affects daily activities, such as trade and industry. Its influence can be observed in ethical and cultural behaviours. It also has an effect on pragmatic activities such as decision-making, for instance. Having an attitude based on Informationism means perceiving the world from a higher level, on which a broader range of concepts is observed; a higher level of abstraction.

Informationism is an objective in itself. It relies, in each particular case, on real and objective reasoning, based on the existence of also real and objective information, hence true information. Therefore, Informationism is also true and real. These rather deterministic attitudes; stating a totalitarian view of information as the seed of “all” that happens in the Universe, within

which is Planet Earth and the rest of the cosmos, leads one to consider Informationism from its *pantheistic* aspect, of globalizing connotations, considering this as a positive view. Informationism can thus be considered to have positivistic attributes.

It is deduced that Informationism can be described as human, objective, realistic, optimistic, globalizing, philosophical, scientific, pragmatic, real, terrestrial, cosmic... pantheistic; all "good" qualities anyway. Some researchers and specialists may not agree with this classification and theories... let us await their reactions.

In any case, it can be stated that the *Informationism period* has arrived.

Conclusions

We live in a constantly evolving world, which leads to a continuous transmutation as well. In the past twenty years or so, to set some date, there have been greater transmutations than in the fifty years before. Information technology has been the cause of all this changes. We do not even know ourselves; neither do we get to specify our attitudes towards machines, in front of a computer for instance. What an amazing change in the way we do some research, write some conference paper, or send a letter to a friend! Machines and electronic devices would not have gained such importance in our lives... if it was not for the influence of a driving force... towards change. Here is just where information has its place, exactly in this driving force, which is mainly determined by two specific factors: quantity on the one hand, and speed on the other, in which human beings are immersed. We live rushed lives. We are in a hurry to do everything; even, or maybe due to that, to control the amount of information surrounding us.

Ours is a changing world, influenced by information. It is information itself which leads us to understand that our fields of consideration; our points of view must be broadened. Everything is related to everything; and to be able to distinguish what captures the relevance, the attention or the interest, a higher degree of abstraction needs to be reached. Things need to be looked upon from higher above; a higher level of thought needs to be reached... Likewise, there should be the aspiration of reaching a Cosmo vision... with higher level of abstraction. Information itself must be considered from the perspective of a higher level and degree of abstraction. It is a term that is used for everything; for nearly everything that is related to something, mainly in communication processes, whichever these are. In a few words, information is a term used by everyone. But is it really known what it stands for? In this paper

there is an attempt to clarify some concepts and opinions. There is also an attempt to discuss about information from different points of view, such as its nature, its social connotations, its influence on the philosophical theories about knowledge organization, etc. Only few studies have considered information in itself. Its application in order to process messages, documents, reports and so on has much greater relevance. It is the so called "information science" that attracts all the attention of both pragmatic and technical specialists and researchers. And... what information is remains unknown.

In order to carry out a somewhat detailed study on what information may be, apart from putting forward my own ideas, I have searched opinions from other researchers and specialists. Going back in time, a huge amount of varied definitions can be found. In the first periods, information is granted a philosophical, moral and practical value, which has social and cultural influences. Later, studies on its nature, psychological and ontological connotations, etc, appeared; all of them significant. Likewise, its social, cultural, economical, industrial aspects are studied.

Since the appearance of information was shown up: due to the influence on the brain of impulses coming from the outside - quanta of useful information -, thus reaching the neurones and activating them, nearly all definitions found consider this aspect; appearing then the anthropological, neurological, biological, ontogenetical, epistemological, and theological connotations. Regarding this, our colleague A. García Gutiérrez [56] mentions "bio information". We are warned that human beings have a right to information [57]. Yet, we are also warned about its illusion and incoherence. Throughout this paper, all this is demonstrated.

The influence of information on the cultural development of societies can be noticed in several sections examined in this paper. The reflection of reality within our mind is mentioned, and several Slovakian authors [59] are quoted, due to the novelty and progress involved in the incorporation of other ways of thinking in these countries. Information, as an all-times route of civilization, is also analyzed. It is supposed to belong to the mesosystem, within the noosystems. And there is also here an induction to consider the validity of Informationism: a new epistemology, based on the paradigm of the universality of information.

A new area of knowledge is emerging, independent in itself, but systematic and vertically related to the rest of the scientific areas of knowledge; that is to say, *Information itself as a science in itself*.

Finally, it is deduced that information is a science for science, and a science of science [57]; that is, it acquires the characteristic of an *Aristoscience* [2].

Once more we repeat the saying "*nothing without information and everything because of it*".

Bibliographic references

- (1) *Herrschaft*, Lutz; *Capurro*, Rafael: Einführung in den Informationsbegriff. II Kapitel: Der Informationsbegriff in der Informationswissenschaft. [www.capurro.de/infovorl-kap2.htm: looked up in May 2006]
- (2) *Currás*, Emilia: La información en sus nuevos aspectos. Madrid: Paraninfo, 1988
- (3) *Mikhailov*, Alexander I.: Science as a system of cyclic process of generation, processing, accumulation and transfer of scientific information. In: Theoretical Problems of Informatics: Place of Information in the Global Problems of the World, Moscow: VINITI, FID 659 (1982)
- (4) *Currás*, Emilia: Un nuevo concepto de Información en la Integración Científica. In: 45th Conference and Congress of FID records book. La Habana: FID (September 1990), pp. 19-38
- (5) *Henrichs*, Norbert: Informationswissenschaft. In: Grundlagen der praktischen Information und Dokumentation. 4. Aufl. München, 1997, S. 945-957.
- (6) *Capurro*, Rafael: Einführung in den Informationsbegriff. I Kapitel: Der Informationsbegriff in der Informationswirtschaft. [www.capurro.de/infovorl-kap1.htm: looked up in May 2006]
- (7) *Ingwersen*, Peter: Information Science. Integration in Perspective. In: Pors: N.O. Eds., 1996
- (8) *Cejpek*, Jiri: Informationsbegriffe. [from cejpek@cuni.cz: Received in September 2003]
- (9) *Currás*, Emilia: Dialéctica en la Organización del Conocimiento. In: Organ. Conoc. Sist. Inf. Doc. 3 (1999), pp. 23-43
- (10) *Cobos*, R.; *Alamán*, X.; *Esquivel*, J.A.: KnowCat: Catalizador de conocimiento. KnowCat: Knowledge Catalyser. In: RedIRIS, Boletín de la red nacional de I+D. N° 58-59 (December 2001 - January 2002), pp. 7-10
- (11) *Buckland*, Michael: Information and Information Systems. New York, 1991 (12) *Dretske*, Fred I.: Knowledge and Flow of Information. Oxford: Basil Blackwell Publisher, 1981
- (13) *Kaula*, P.N.: Reflections on the organisation and working of the National Library and the efforts at the establishment of the National Central Library. In: Herald of Library Science. Vol 41, n° 1-2 (January-April 2002), pp. 37-47
- (14) *Buckland*, Michael: Information as Thing. In: Journal of American Society of Information Science. Vol. 42, n° 5 (1991), pp. 351-360
- (15) *Henrichs*, Norbert: Informationswissenschaft als angewandte Anthropologie: Der Düsseldorfer Ansatz. In: Bücher für die Wissenschaft. Festschrift für Günter Gattermann. München, u.a.: K.G. Saur, 1994, pp. 445-461
- (16) *Silveira* Zaragoza, F.J.: Considerações gerais sobre a Problemativa em Informaçaõ. In: Rev. Esp. Doc. Cient. Vol. 3, n° 2 (1980), pp. 159-168
- (17) *McCrack*, Laurence. Historical Information Science: An emerging undiscipline. Medford, New Jersey: Information Today, Inc., 2001

