The concept of information in Library Science, Sociology and Cognitive Science

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Abstract

The term *information* has become and essential concept in the field of library science and associated disciplines. The proper meaning of this term necessarily depends on epistemological context. Moreover, its intra-theoretical and polysemic potential has led the term to be used in multiples senses, ranging from the contexts of cognitive psychology to library science; however, the analysis offered herein underscores the need to define the term more precisely for use in library science and associated fields, so that its meaning is neither degraded nor over-simplified when building useful explicative models. This paper also shows that the meaning of this term has tended to stabilize as re-

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quired by theoretical models in which it is employed, while as an isolated theoretical term it retains some degree of ambiguity.

Keywords: Information; Library Science Theory; Information and Society.

Resumen

El concepto de información: dimensiones bibliotecológica, sociológica y cognoscitiva
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El término *información* se convirtió en un concepto esencial para la bibliotecología y otras disciplinas afines. El significado adecuado de este vocablo depende necesariamente del contexto epistémico en que se utiliza. Por otra parte, su carácter intrateórico y polisémico ha multiplicado los sentidos en que se ha utilizado, como es el caso de la teoría de la información, la sociedad red, las sociedades del conocimiento, la teoría de sistemas, la psicología cognoscitiva y, por supuesto, la bibliotecología. Sin embargo, el análisis que se hace en este artículo demuestra la necesidad de precisar el significado con el cual ha de aplicarse, principalmente dentro de la bibliotecología y las disciplinas afines, con objeto de no degradar o simplificar al máximo la utilidad teórica requerida en la construcción de modelos explicativos. En este artículo también se prueba que el significado de este término tiende a estabilizarse, aunque necesariamente articulado a las entidades teóricas de la disciplina y no más como un término teórico aislado.

Palabras clave: Información; Teoría Bibliotecológica; Información y Sociedad.

Introduction

The concept of information is increasingly ubiquitous and the same has occurred with the information processing technology. Both of these areas have undoubtedly been protagonists on the world stage for several de-

cades in national and international academic communities. Moreover, the upsurge of information theory and technological-scientific development accompanying it has exerted multiple impacts on society, culture and the diverse disciplines of science. Consequently, Library Science is no exception, and far from being exempt from this influence, it has had to reconfigure its explanatory and normative theoretical models in the light of information theory and attendant technology, and social, linguistic and cognitive conceptions.

This paper identifies three major currents of thought regarding information theory. The first is the sociological approach, the second cognitive and the third arises from Library Science itself. The researcher endeavors to describe the meaning of each concept and the theoretical framework in which each unfolds. It is worth mentioning, that the facets analyzed are an initial approach from the perspective of Library Science, which has the intellectual advantage of establishing the theoretic limits or the empirical scope of the concept of information, something that is key to contributing to the construction of transparent theoretical models in the discipline of Library Science.

From the standpoint of information theory

Common sense tells us that over the course of several decades the word information has become indispensable in practically every situational context or discipline. In the common parlance, we know the term has multiple meanings, or otherwise takes on arbitrary meanings; and this rather indifferent usage is something that must be corrected.

Let us begin by reviewing the definition provided by the Dictionary *of the Spanish Language* (DRAE)[1], which basically enumerates eight meanings for the word *information*, herein abbreviated "I": In the first instance, the dictionary states I as the action or effect of informing; the second definition mentions it as the juridical or legal office where something is informed, the third states that I is the juridical and legal investigation of an event or crime; the fourth specifies it as the proof regarding the quality and circumstances needed for a person to secure employment or honors; the fifth describes it as acquisition or communication or knowledge allowing broader or more precise understanding of a given matter; the sixth calls I the knowledge either communicated or acquired; the seventh definitions understands I as the in-

1 *Diccionario de la Real Academia de Español,* 22th ed., *s.v. información*.

trinsic property of certain biological polymers, such as nucleic acid, originated by the sequences of the component units, and the eighth designates it as education or instruction.

On the basis of dictionary definitions, the diverse contexts are circumscribed to 1) the action and effect of informing; 2) orientational nature of legal proof; 3) cognitive and communication processes; and 4) the biological sphere. The DRAE also mentions the old manner of understanding I as education or instruction.

In the early 1980s, Campbell provided an interesting summary of the cultural and scientific fields in which I played an important role. In this regard he asks:

> What do the codes used to send a message from space and the DNA molecules have in common? How is the second law of thermodynamics, elucidated by a physicist, related to communication in such a way that it is possible to speak of "entropy" of a musical score, a page of text or a conversation? Why are the intricate mathematical theories of probability related to the way in which we express ourselves in spoken and written language? The answer to these questions is "information," and the fact that a single term can link these disparate ideas reveals its great breadth and power.[2]

Campbell goes on to assert that the meaning of I has yet to be determined, something which is still true today, and he mentions that in the Middle Ages the term had several popular and literary uses, but that it also possessed the more active and constructive meaning of: "[…] something which gives a certain form or character to matter or mind, a force that models behavior, trains, instructs, inspires or guides."[3]

Campbell describes that once the concept of I was defined scientifically in the decade of the forties, the impact was so great that the word recovered other meanings, stressing the active sense, as something that "informs" the material world in a way similar to the messages carried in genes, which instruct the machinery of the cells to build the organism, or the signals emitted by a radio transmitter that guide a space ship. Thus, in addition to a scientific definition and its theoretical and technological implication, the concept became a universal principle, which operates and "gives form to the formless, specifying the particular character of living forms and even helping to deter-

2 Jeremy Campbell, *El hombre gramatical*, p. 13.
3 *Idem.*

mine by means of special codes the models of human thought."[4] In this way, according to Campbell, I spans across disparate fields from the space-age computing, through classical physics, molecular biology, human communication and evolution of language to human evolution itself.

The creation of a scientific concept of I can only be accomplished from a theory of information, that is, as part of an explicative system that strives to resolve theoretical or abstract problems and other issues both phenomenological and practical. Campbell explores said theory and posits it as a gateway to a field of knowledge as vast as nature itself and as complex as the human mind. Interestingly, I should be understood within the framework of complementary forces that allow for an explanation of the world, that is, entropy as an agent of chaos in which I is not simply a chance element "that exploits the inherent incertitude in the principle of entropy in order to generate new structures for the purpose of conforming the world in new ways."[5] Likewise, the central idea posited is summarized as follows:

> The information theory shows that there are good reasons to believe that the non-accidental forces are as universal causality, even when entropy has been presented as the most overwhelmingly powerful principle. The appropriate metaphor for the process of life perhaps is not the tossing of two darts, nor a spin of the roulette, but rather the phrases of a language which carry information that is partially predictable and practically unpredictable. These phrases are produced through rules that obtain a lot from very little, generating an unlimited wealth of meanings from a limited set of words, allowing language to be both familiar and surprising, limited while entirely unpredictable within its boundaries.[6]

In this way Campbell concludes with a universal assertion that can be understood by virtue of information theory and which stands counter to the assertion of entropy (exception and confusion as a rule governing the world), which states that sense and order can prevail against chaos in such a way the order is also completely natural.[7]

As such, in conjunction with common uses of I, distinct concepts have been proposed, even though on occasions one gets the impression that it is a matter of a *presupposed* concept whose use in other theories generates *theo-*

4 *Ibid*., p. 4.
5 *Ibid*., p. 9.
6 *Ibid*., p. 10.
7 *Idem*.

ry-dependent concepts, or that the idea has achieved the status of *meta-scientific* concept.[8]

In the era of information and the knowledge society

In this intellectual track, the concept of I also became a sociological theory, as a way of observing and explaining the development of society. This conception is a regular fixture in the discourse of the so-called "Information Society."[9] Similarly, I became so relevant that Castells coined the phrase "the information era," which includes the economy, society and culture. Since both conceptions have been discussed broadly in specialized literature, I will merely highlight some facets which I believe are particularly relevant.

Regarding the first term, I stress the overview provided in the UNESCO report titled *Toward the Knowledge Society* with regard to the Information Society, which, it is asserted, is based on technological progress. Nonetheless:

> […] despite the fact that we are witnessing the coming of a global information society in which technology has surpassed all prediction regarding the growth in the amount of available information and the speed of its transmission, we still have a long way to go in order to achieve genuine knowledge societies.[10]

The shift in perception of I to knowledge is key to understanding the paradigm shift of social development. Similarly, a serious criticism is made of the limits placed on societies that base their progress on the expansion of information and communication technologies. Thus:

> Even though it can be "improved", for example, interferences or erroneous transmission aside, a piece of information does not necessarily create meaning.

8 León Olivé has explained the existence of terms whose meanings are built from a given theory, but this does not exclude them from appearing in other that depends on the first. Consequently, the second theory *presupposes* the first, since the latter bestows fuller meaning to the terms in question. In contrast, when a concept is qualified as meta-scientific, it is obvious the terms is common to all scientific fields and it must be developed at a different level tan scientific theories. See León Olivé *El bien, el mal, y la razón: facetas de la ciencia y la tecnología*, Mexico. Paidós, UNAM, 2000.

9 Note 2 from Chapter I of the UNESCO report, titled: "De la sociedad de la información a las sociedades del conocimiento", states that the first part of the World Summit on the Information Society was organized by the International Telecommunications Union (ITU) and was held in Geneva from December 10 to 12, 2003. The second part of the Summit was slated for 2005. See: UNESCO, *Informe mundial de la Unesco: Hacia las sociedades del conocimiento*, p. 231.

10 *Ibid*., p. 19.

> Moreover, the information will continue to be a mass of undifferentiated data until everyone in the world enjoys equal opportunity in the field of education and thereby are capable of dealing with information available with discernment or critical spirit, analyzing, selecting and assimilating what they find relevant to a base of knowledge. *Many will realize that instead of mastering information, they are dominated by it*. Moreover, the excess of information is not necessarily greater knowledge. The instruments to use, treat and handle information must be equal to the task.[11]

The UNESCO report clearly establishes that these conceptions of society should not be conflated. In all events, the birth of the Information Society founded on the basis of the revolution of new technologies is merely an instrument to achieve the model of the knowledge society. This assertion also implies differentiation between the use of the concept of I with regard to knowledge, since "Information is effectively an instrument of knowledge, but it is not knowledge in and of itself."[12] Moreover, the social dimension is important in order to distinguish a conception of a more just society, since:

> Information potentially is a sort of merchandise that can be bought and sold in a market, and whose value is based on scarcity; while knowledge, despite certain limitations such as, for example, State secrets and traditional esotericism,legitimately belongs to any reasonable mind, without prejudice to the need to protect intellectual property rights. The excessive importance granted to information with respect to knowledge reveals the degree our relationship with knowledge has been modified by the spread of the economic model of knowledge.[13]

One component driving the spread of the concept of the Information Society was the implied promise regarding the possibility of get to scenarios of beneficent social development based on technological leaps and the immense potential they offer. In line with this analysis, Manuel Castells (1996) stated that the technological revolution focused on information technologies was quickly modifying the material basis of society and stressed that it was a matter heralding the "information era."[14] Specifically, Castells proposes the concept of a society that is at once informational and global. From a techno-economic and socio-technical standpoint, Castell stresses that during the last two decade of the twentieth century, the information technology revolution was

11 *Ibid*., p. 20. My italics.
12 *Ibid*., p. 10.
13 *Ibid*., p. 19.
14 The monumental, three-volume work by Castells published in the mid-1990s is titled: *La era de la información: economía, sociedad y cultura.* The first volume addresses the network society; the second deals with the power of identity, and the third analyzes the end of the millennium.

in full swing. To explain how new information technologies flourish, Castell believes several factors are essential: in the first place he points out the role of macro-research programs in the United States and the vast market developed by the State. He also alludes to decentralized innovation by a technologically creative culture and models allowing rapid personal success, such that "they immersed themselves amid networks of companies, organizations and institutions to conform a new socio-technical paradigm."[15]

It is useful to discuss the author's considerations of the technological transformation undergone by society. From the de decade of the 1990s, a new epistemological paradigm shared by scientists and researchers has arisen in opposition to "chaos theory" to which Campbell also refers.[16] This new proposal was identified with the term *complexity* and it is centered on the understanding of the advent of self-organizing structures that create complexity from simplicity "and an order superior to chaos by means of diverse levels of interactivity among the founding elect working at the origin of the process."[17]

He adds that thought about complexity must consider a method of understanding diversity rather than a unified meta-theory, and points out that the epistemological value comes from the acknowledgement of the gifts of nature and society to reveal themselves without setting out to do so. Of course, one cannot work without rules, "but the rules are created and changes in a process of unique, deliberate actions and interactions."[18]

Using language reminiscent of Luhmann,[19] Castells asserts that the paradigm of information technology does not evolve toward closure as a system, but rather toward opening up as a multifaceted network.

He qualifies this paradigm as powerful and imposing in its materialness, but its historical development is also adaptable and open, in such a way that its qualities reside in its integrative character, complexity and interconnectivity.

Contrary to Campbell's assertion, Castell refers to I more objectively and without pretending to turn it into a universal principle, indicating that I and knowledge have always been crucial components of economic growth. For Castells the evolution of technology has determined the productive capacity of society and the quality of life, as well as the social forms of economic organization. He also mentions that:

15 Manuel Castells, *La era de la información: economía, sociedad y cultura,* p. 87
16 Campbell, *op. cit.*
17 Castells, *op. cit.,* p. 91.
18 *Idem.*
19 See Niklas Luhmann, *Introducción a la teoría de sistemas: lecciones publicadas por Javier Torres Navarrete.*

> The rise of a new technological paradigm, organized around new, more powerful and flexible information technologies makes it possible for information to become the product of the production process. To be more precise, the products of new information technology industries are devices used to process information or the processing of the information itself.[20]

In view of this situation and by transforming information processing practices, new information technologies intervene in all domains of human activity and establish infinite connections between these diverse domains, agents and elements of said activities.[21]

One of the central ideas Castells contributes for gaining a better understanding of the technological revolution consists of characterizing the application of knowledge and I to knowledge generating devices and "processing of information/communication"; which cumulatively feeds back into innovation and its uses. Consequently, what is distinctive is not knowledge and the I as such, but rather their application as per the terms indicated. In other matters, he summarizes the Information Technology Paradigm in accord with five features:

1. I is its raw material and they are technologies for acting upon I.
2. The permeating capacity of the effects of new technologies. This new technological model can mold the entire process of individual and collective existence, though it does not determine them.
3. The interconnection of all systems or sets of relationships using these new technologies, therefore, the network morphology is best adapted "to the growing complexity of interaction and unpredictable patterns of development that arise from the creative power of that interaction."[22]
4. The flexibility and capacity for reconfiguration, without destroying an organization, since the material basis of said organization can be reprogrammed and reequipped.
5. Growing convergence of specific technologies within a highly integrated system, from which the old separate technological trajectories become indistinguishable.

Castells establishes that at the end of the first volume of the Information Era that, if the technological revolution to which I is associated and knowl-

20 Castells, *op. cit.,* p. 94.
21 *Idem.*
22 *Ibid.*, p. 88.

edge are analyzed in sociological terms, the societal network represents a qualitative shift in the human experience, whose touchstone is the social action model for changing the relationship between nature and culture. Under such a light, this premise indicates that three models have existed: the first is characterized by the imposition of nature over culture; the second arose in the early Modern Age and is associated with the Industrial Revolution and the triumph of reason, which allowed culture to dominate nature. The third model is distinguished by "culture referring directly to culture," which is to say: once nature is mastered it arises anew or is preserved artificially as a cultural form.[23]

One of his conclusions closely related to I is:

> Owing to the convergence of historical evolution and technological change, we have entered into a model that is purely culture, consisting of social interaction and organizations. As such, information is the key ingredient of our social organization, and the flow of messages and images from one network to another constitutes the basic fibers of our social culture […]. It is the beginning of a new existence and, in effect, of a new era, i.e., the era of information, marked by the autonomy of culture before the material foundations of our existence. This is not, however, a time for rejoicing, because alone at last in our human world, we are forced to look into the mirror of historical reality.[24]

In other matters, Castells summarizes the essential sense of the era of information in the "Finale" of the third volume of his work:

> *The promise of the information era is the unprecedented unleashing of the productive energies of the mind.* I think, therefore I produce. By doing so, we shall have free time to experiment with spirituality and the possibility of reconciling with nature, without sacrificing the material well-being of our children. The dream of the Enlightenment, that reason and science would solve the problems of humanity, is now within reach. Nonetheless, there is an astonishing gap between our technological overdevelopment and our social underdevelopment.[25]

In this final reflection, Castells comes quite close to the postulates and problems of justice and knowledge enunciated by UNESCO,[26] as well as

23 *Ibid*., p. 514.
24 *Idem*.
25 *Ibid*., p. 394. My italics.
26 See UNESCO, *op. cit.*

those matters examined by Nussbaum[27] and Sen and in the UN[28] Human Development Reports. [29]

The Information Age is indispensable to understanding the technological revolution occurring in recent decades, but it is particularly important for researchers in the discipline of Library Science, because the central agents of this movement into a new age directly involve I, and knowledge and information technologies. As previously discussed, Castells identifies it as the informational development model. In said model, the source of productivity lies in two interdependent processes: on one hand, the technology to produce knowledge and, on the other, the processing of I and symbols.

The informational model is characterized by the action of knowledge on itself as a source of productivity. With regard to processing of I, this focuses on the triumph of said processing technology. In short, the model refers to the interaction of sources of technological knowledge and its application in order to improve the production of knowledge and the processing of information.[30] Consequently, the work of the Library Science discipline is enriched under this informational development model serving as an auxiliary in the action of knowledge upon itself and the processing of information and communication of symbols.

Interestingly, in his book Castells make use of only a single note in order to clarify his understanding of information and knowledge.[31] This is odd since both concepts are essential to clarifying the informational development model. It is pertinent, therefore, to revisit the definitions he uses. Castells resorts to Daniel Bell, who defined knowledge as a series of organized affirmations of fact or ideas that offer a reasoned judgment or an experimental result that is transmitted systematically to others by way of some communications media. For the definition of I, he cites Porat: "Information are the data that have been organized and communicated."[32]

In note 4 of the Introduction of to the UNESCO Report[33], the definitions used by Castells also appear, but these are inserted in completely different intellectual contexts, as both concepts, in the case of the informational mod-

27 See Martha C. Nussbaum, *Crear capacidades: propuesta para del desarrollo humano*, Madrid, Paidós. 2012.
28 See Amartya Sen, *La idea de la justicia*, México, Taurus, 2010.
29 Human Development Reports are available online at: http/www.undp.org/cpontent/undp/es/home/librarypage.html.
30 Castells, *op. cit.,* p. 43.
31 *Ibid*. Note 27 of vol. I. See also Daniel Bell, *El advenimiento de la sociedad posindustrial,* Madrid, Alianza, 1975, and Marc Porat, *The information economy: definition and measurement*, Washington D.C., Telecommunications Office, Wash. D.C., 1997.
32 Castells, *op. cit.,* p. 43.
33 See UNESCO, *op. cit.*

el, are articulated toward a theory centered on productivity to explain the advent of the information era. In contrast, the perspective of knowledge societies offered in the UNESCO Report folds these concepts into a normative theory, whose philosophical and political grounds are derived from political theories of justice and capabilities, something amply expounded by Sen and Nussbaum, and in the Human Development Reports of the UN.

It is also worth observing that the UNESCO, in addition to stressing the concept of knowledge, in no way rejects the postulates and assertions established in the informational model; but rather considers said model as a precursor to achieving a more just society, in such a way that economic and scientific productivity shall be focused on the human development of societies. In this way, the informational model acquires an instrumental character.

As such, the rise of new information and communication technologies has created new conditions for the appearance of the knowledge society, and he adds that:

> The gestation of the *world-wide information society* shall only be realized if it becomes a medium in the service of a higher and more desirable goal: the construction at the global level of *knowledge societies* that are sources of development for all, and more importantly for the least advanced countries. To achieve this end, two challenges posited by the information revolution take on special importance: access to information for all and a future of freedom of expression.[34]

Likewise, in the opinion UNESCO, the central element of the knowledge society is the capacity to identify, produce, treat, transform, disseminate and use the information with the vision of creating and applying the knowledge needed for human development. The report also mentions these societies "are based on a vision of the society that encourages autonomy while bringing together notions of plurality, integration, solidarity and participation."[35]

UNESCO's criticism is aimed at the consequences of the third industrial revolution, i.e., the new technologies and the new phases of globalizations accompanying it, since:

> […] they have radically modified numerous points of reference widened the existing gaps between rich and poor, industrialized and underdeveloped countries, and even between the citizens of the same country. The UNESCO estimates that the edification of knowledge societies is that which "opens the way toward the humanization of the process of globalization."[36]

34 *Ibid*. p 29.
35 *Idem*.
36 *Idem*.

It is important to reiterate that the theoretical paradigm shift proposed in the information era with respect to the knowledge societies pursues different epistemological objectives. The first of these paradigms is descriptive and explicative, while the second is normative, i.e., it possesses an instructional character. This is key, because several problems cited in the UNESCO report were also discussed by Castells; however, the distinct treatment in each paradigm obeys argumentations seeking difference ends. Thus, with regard to the information era the following observation is included in the conclusions: "The twenty-first century shall not be a tenebrous era, nor will it be able to provide the promised miracles to the majority of people, despite the most extraordinary technological revolution in history. Rather, it is characterized by informed perplexity."[37]

As for knowledge societies, the work concludes with instructions and recommendations of the following type:

> Faced with these challenges, the international community –since we are dealing with governments and international governmental and non-governmental organizations and the private sector—should prioritize three initiatives that will constitute additional pillars upon which authentic knowledge societies can be erected for all:
> - An improved appreciation of existing knowledge in order to help close the cognition gap;
> - A more participative focus regarding access to knowledge, and
> - Better integration of knowledge policies.[38]

Because of its high social value and tie-in to the work of Library Science, it is importantto enumerate the recommendations proposed at the end of the UNESCO Report:[39]

1. More investment in quality education for all in order to guarantee equal opportunity.
2. Multiply community sites for accessing information and communication technology.
3. Encourage universal access to knowledge by increasing available contents.
4. Work in the "co-laboratory" toward an improving shared exploitation of scientific knowledge.
5. Sharing environmental knowledge to promote sustainable development.

37 Castells, *op. cit.,* p. 392.
38 UNESCO, *op. cit.,* p. 207.
39 *Ibid.*

6. Prioritize linguistic diversity: the challenge of multi-linguicism.
7. Advance toward a certification of knowledge of the internet: toward quality denominations.
8. Intensify the creation of association promoting digital solidarity.
9. Increase the contribution of women in the knowledge society.
10. Measuring knowledge: Toward indicators of the knowledge societies?

As can be seen, Library Science has the institutional capacity to exert influence in all ten of these recommendations aimed at achieving development for all. Moreover, the sphere of knowledge Library Science cultivates through research, education and professional practice remits to three areas of great economic, social and cultural relevance: 1) Information and productivity; 2) Information and research/education; and 3) Information and human development.

Given that diverse formulations have been touched upon, i.e., the birth of the theory of I, the informational society model and the knowledge societies (and these have provided general models for observing society,[40] since each of these concepts of I is invariably associated with the concept of knowledge, whether as an antecedent or consequence), the concepts of information and knowledge technologies are also included.

The methodological issue consists of limiting the theoretical framework in which the aforementioned concepts are used, since their indiscriminate use has led to extreme banality; so much so that without the theoretical benchmark the concept is inevitably used make false or superfluous assertions. In this regard, Moulines states that scientific disciplines are characterized by their use of specific vocabularies, "certain words and expressions that are not in the common parlance, but rather are introduced specifically in a scientific context. The meaning of such terms cannot be fully expressed if one does not have a minimum threshold of knowledge of the context discipline."[41] Moulines adds that the essential aspect of such terms "is not their scientific origin, but rather that their use can be sanctioned by a scientific theory and only those who grasp this theory well can may genuine use of them."[42]

With regard to the terms in question, it would be useful to specify what is meant when we refer to I or a piece of knowledge as a "theoretical term," or

40 This concept is taken from René Millán, *Complejidad social y nuevo orden en la sociedad mexicana*, México, UNAM, IIS, Miguel Ángel Porrúa, 2008.
41 Ulises Moulines, "Conceptos teóricos y teorías científicas", p.147.
42 *Ibid*., p 148.

"theoretical concept." For example, Shannon's theory of information, which redefines I, in essence posits a "theoretical term."[43] In contrast, both Castells and the UNESCO report cited herein posit "theoretical concepts." The difference between these is that the former is a linguistic entity appearing in the canonical formulation of a theory, while the latter is a more general expression without venturing a more specific formulation.[44]

On the basis of these clarifications and to answer the question about what kind of concept is conveyed by the term "information"; we can state that depending on the theory, three uses are evident:

1. Information as a metrical concept or measure of magnitude
2. Information as idealization; and
3. Information as a term with a real referent, but in principle unobservable.

The first case constitutes a fundamental contribution by Shannon, who

> […] choose as his information unit the binary digit or bit. A bit is a measure of an amount of information, something like a gallon, once or inch used to measure volume, weight and length, respectively. A bit is merely a choice between two equally probably messages. It is the answer, either yes or no to the hypothetical question: This one? If the answer is yes, all incertitude in the mind of the recipient is resolved, because he knows which of the two possible messages is real. If the answer is no, this incertitude is also resolved, because he knows the real message is not the first alternative, but he second.[45]

According to Campbell, information became a scientific concept early in the twentieth century at the dawn of the era of electronic communication. Much like the definition of concept of energy in the nineteenth century, the concept of information was "made into a theory, bestowed with laws expressed in equations and generally striped of all ambiguity and mystery."[46]

The impact of the theory of information, not merely the concept, has been so great that according to Campbell its nature cannot grasped in terms of matter and energy, nor can its secrets by fathomed through:

> […] the lenses of chemistry and physics, despite the power and success of these disciplines in our century. Any explanation of the world that pretends to be com-

43 See Campbell, *op. cit.*
44 This distinction is made by Moulines in paper previously cited.
45 Campbell, *op. cit.* p. 99.
46 *Ibid.*, p 15.

> plete must contain a third component. The powerful theories of chemistry and physics must be complemented by a new arrival: the theory of information. Nature must be understood in terms of chemistry, energy and information.[47]

Early on, the theory of information addressed key concerns existing in diverse disciplines, expressed in questions such as: How are order and disorder possible; How are error and error control possible; What are the roles of chance and the realization of chance; What is incertitude and what are its limits?

Campbell is transparent when he states the following with regard to the theory of information:

Scientists still ask why the artifacts of nature are so improbable. Why is there is so much order, when giving into confusion and error, which prevail overwhelmingly in nature, would be more likely? This is still one of the overriding concerns of science, a question that is the near cousin of the philosophic query: Why is there something, instead of nothing? In his 1948 essay Shannon proved that contrary to expectation, "something," i.e., a message, can persist in the midst of "nothing," i.e., chaos or random noise.[48]

The theory of information is now 50 years-old and its impact has been so great it has become that premise theory used to sustain explanations in other social disciplines, such as pedagogy, communications science and Library Science. Currently, it is a vast field of study, attracting researchers largely from the fields of Library Science, Sociology and Linguistics to mentions only a few.

With regard to the second case, which would comprehend information as entirely fictional, it admits reiteration that such a use is associated with highly mathematical disciplines for which it is often asserted that there are concepts under which no real entities fall. According to Moulines, however, these are not purely mathematical terms, because:

> […] on the contrary, even though its referent is empty, there are associated "idealizations" or "approximations" to real entities: for example, real particles, real machines, real gases, or human beings of flesh and blood. Moreover, it would be a mistake to deem them superfluous terms. Many times (as in the example cited), the theory to which they belong, which is a good empirical theory, could not be formulated without them.[49]

47 *Ibid*., p 14.
48 *Ibid*., p 17.
49 Moulines, *op. cit.,* p. 156

According to this explanation and on the basis of the analysis proffered up to now, both in Library Science and other disciplines, the concept of information is used as an idealization or approximation to real entities.

A good example of this is the distinct approaches of Bateson and Luhmann.[50] The former developed an interdisciplinary vision, entailing epistemology, linguistics and biology; and the latter worked from the field of sociology. Both of these thinkers made relevant contributions.

Information and difference

Bateson poses the following question: What aggregate or increase in knowledge is derived from the combination of information from two sources?[51] He points out that he is interested in the varieties of information offered to the information gathering party regarding the surrounding world or as a part of that external world; that is, how knowledge is increased through the combination of information sources.[52]

Bateson earned world-wide recognition for having observed that information or the elemental unit of information is the difference that makes the difference.[53] It is important to stress that this definition of information is used by Luhmann to develop and explain his theory of systems in the field of Sociology.[54] As such, Bateson, indicates that in order to create a difference, at least two entities are needed. He goes onto explains that:

> To produce information, i.e., news about a difference, there should be two real or imaginary entities, so that the difference between them can be inherent to their mutual relationship; and the entire question must be such that news about their difference can represents themselves as a difference inherent in a certain information processing entity, such as a brain or, perhaps, a computer. [55]

Bateson observes that there is a deep unanswered question about the nature of these things, since "as a minimum of two," which between them generates the difference that becomes information because it is difference.

50 See Gregory Bateson, *Espíritu y naturaleza,* p. 81 and Luhmann, *op. cit.*
51 Bateson, *op. cit.*, p. 80.
52 *Idem.*
53 Luciano Floridi states that MacCrimmon MacKay wrote the following: "Information is a distinction that makes the difference"; he also comments that Bateson restated the dictum somewhat less precisely, saying: "information –the elemental unit of information—is a difference that makes the difference." See Floridi*, Information: a very short introduction.*
54 Luhmann, *op. cit.,* p. 63.
55 Bateson, *op. cit.,* p. 81.

This is the focal point of his proposal and, although complex, each one of these taken alone is a non-entity or "a non-being no different from being and not different from non-being. Something inconceivable, a Ding an sich, the sound of one hand clapping."[56]

To fully illustrate the idea of increasing knowledge as a product of information, Bateson points out that any object, event or difference in the external world can be turned into a source of information, provided it is incorporated into a circuit with an appropriate network made from flexible material that can produce change. He expands on this idea, saying:

> Let's examine then, the broadest possible statement proposed by Korzybski: the map is not the territory. Seeing things from the broad perspective we now enjoy, the map for us is a kind of effect that gathers difference, organizing news about the differences in the "territory." Korzybski's map is a convenient map and has been useful to many people; but reduced to its simplest terms, his generalization asserts that the effect is not the cause.[57]

The aforementioned proposals sufficiently clarify how the increase in knowledge is produced from the information (the difference in the difference), and stresses the need to have a flexible network capable of producing change. In this way we have the concept of "information" as an idealization that represents the differences that matter in the plane of epistemology or cognition of subjects.

In addition to addressing the concept of information, i.e., the difference that makes the difference, Luhmann incorporates an explanatory context based on communication, in which the sense and function of information are articulated.

In this regard, Rodriguez M.[58] explains that the fundamental change introduced by Luhmann brings conceptual innovation to Sociology, because the previous view of Parsons, based on social action, was the dominant academic discourse in the twentieth century. He adds that this reconceptualization is important because only communication is always a social phenomenon, in contrast to action, which is generically individual and requires qualification as social phenomenon. Nonetheless:

> Communication does not consist of a transmission from person to person, as the theory of action insists, but rather involves a synthesis of three selections that occur in the presence of alter and ego, but which does not consist of their actions.

56 *Idem.*
57 *Ibid.*, p. 123.
58 Niklas Luhmann, *Organización y decisión.*

> Communication, therefore, is an emerging phenomenon characterizing the move from the individual psychological level to the social level in which individual are an essential to the environment.[59]

Likewise, Rodríguez stresses that for Luhmann there is a continuing job of selection associated with information. He summarizes his point as follows:

> The three selections whose syntheses configure communication are:
> a) Information selection: Alter must choose the information is wishes to share with Ego. Information is understood by Luhmann, in accord with the definition of Bateson, as the "difference that makes the difference." Because of this, information always surprises and it is only information at the moment it is received, in the instant that it "makes a difference" with what the Ego knew: not before, because it does not know it, not after because now it knows.
> b) Selection in order to make the information selected known. Moreover, the words and gestures are also chosen to be used in its expression.
> c) Selection of an understanding. Ego selects what it understands about what it has read or heard. It tries to elucidate the information conveyed as being made known and which it has received from Alter.[60]

Likewise, he explains that for communication, he is not particularly interested in the selections, but rather in their synthesis; and this is where it has social significance. Moreover, "it is only produced at the moment the Ego selects comprehension, which, naturally, includes incomprehension." [61]

In the next section, we shall review what Luhmann[62] has written about information and selection. He begins by clarifying that since the 1950s the use of the concept of information has grown, but without conceptual clarity. For example, when genetic information is mentioned, it is treating structure as information contents. He also explains that the relevant question about the concept of information is: What is the scale by which information can be selected? Consequently, one is faced by a two-fold concept:

1. Information is a concept aimed at that which has not yet been processed in the system.
2. It is separate from that which has already been created or deals with that which is being worked on permanently.

59 *Ibid*., p. 14
60 *Ibid*., p. 15
61 *Idem*.
62 Luhmann, *Introduccion a la teoría de sistemas.*

Therefore, Luhmann explains that what is called information is the event that selects the states of the system. For this purpose, limiting structures are required to preselect the possibilities, in such a way that information presupposes structure, but in and of itself does not constitute a structure. It is rather, a matter of an event that actuates the use of the structures, since the events are elements that are fixed in time, occuring only one time and only in the minimum lapse of time needed for its appearance. Consequently:

> This passage of time identifies them; therefore, they cannot be repeated. Because of this, they serve as unifying elements of the process. This is shown by means of information. A piece of information whose surprising aspect is repeated is no longer information. It preserves its meaning in the repetition, but loses its value as information. The University, which is still there and endures, because it does not assess the value of information, because it does not change the state of the system, though structurally exhibits the same kind of selection. On another front, information is not lost, even though it has vanished as an event. The state of the system changed and thereby left a structural effect: the system reacts to these changed structures and changes along with it. Pieces of information, as such, are always information of a system.[63]

Luhmann also mentions the following characteristics associated to information:

a) For information to hold the value of the articulated function to the state of the system it must be an autopoietic system, that is, as a system that always works to transform its own state.
b) Information reduces the complexity insofar as it makes a selection known and, consequently, excludes possibilities. It can, nonetheless, increase complexity.
c) The information also possesses two features: on one hand, the quality of surprise and, on the other, if the surprise is presupposed in the expectation system.

Moreover, Luhmann asserts:

> Information is not an exteriorization of a unity, but rather the selection of a difference that moves the system to a change of state and, consequently, another difference is operating in it. Taking all of this together, it leads to the consideration that information is only possible within the system. Each system produces its information, since each system builds its own expectation and blueprints of order.[64]

63 *Ibid*., p. 105
64 *Ibid*., p. 106.

To summarize, Luhmann sees information as a state that arises from within a system and, for the reasons discussed, not outside of it.

An interesting example for analyzing problems of Library Science, specifically Bibliometrics, from the standpoint of Luhmann, is posed by Vélez,[65] whose study includes the following conceptual framework based on communication and information as difference, although it also includes the expression information with meaning.

Vélez starts from this premise: a communication event is the appearance of a distinction in the form of a brand; in the second place, stating that the brand (as the distinctive of information) is possible because there are brands with which it links, thereby making communication possible: "for example, in a conversation, the recurring themes, even though new to the interlocutors participating of the conversation, are persuaded by the experience with the information involved, its modes of expression and understanding."[66]

As a third point, Vélez explains how for science the brands possess a special feature that informs the scientific communication. In this case, a scientific paper is identified as a communication event. This event presents the specific brands which provide form and have been standardized. The indexing systems have allowed standardization of identification brands of a scientific text. Some of these are the following:

> The paper is published in a peer-reviewed journal enjoying the global prestige of indexes such as of SSCI, SCI and Scopus.
> The paper must have a proper, formal structure, as required by journals that wish to be indexed. Title, key words, abstracts (in several languages), up-to-date citations, clarity in the specialization and a discourse which in general terms follows the scheme of stating the problem and positing theories, methodologies, discussion and conclusions.[67]

According to Velez, the brands are expressed through words and the inclusion of these words in the presence of others plus the repetition or variation of the combinations of these, thereby making the meaning of the text possible. As such, scientific communication acquires a meaning through this repetition, which in diverse combinations indicate, for example: prestigious authors frequently appearing in diverse papers; distinct combinations of terms that have success for a certain time within diverse fields; and the formation of specialization, arising from the recurring association of distinct

65 G. Vélez Cuartas, "Las redes de sentido como modelo para la conservación de la ciencia: Luhmann desde un punto de vista estructural".
66 *Ibid*., p. 106.
67 *Idem*.

terms in combinations in the texts of the bibliographical citations in diverse scientific fields.[68]

The concept of the idealization of information or approximation to real entities is summed up by Floridi,[69] who defines information on the basis of data. Information as data, however, has a set of attributes that must be itemized, especially because this definition has been used frequently in Library Science and associated fields.

Floridi begins by pointing out that the General Definition of Information (GDI) posits information as being composed of data + meaning. He adds that this definition is often used in fields that handle data and information as material entities or as real referents. The definition consists of three parts, whose logical organization is as follows:

Table 1. The General Definition of Information (GDI)

GDI) σ is an instance of information, understood as semantic content, if and only if:
GDI.1) σ consists of n data, for n > 1;
GDI.2) the data are well formed;
GDI.3) the well-formed data are meaningful.[70]

Information and data

In this way information is comprised of data and meaning, which implies a circuit that spans diverse actors and components: a) the organization of the data; b) the rules (syntax) governing the chosen system and c) valid conventional meanings within the chosen system.

Because of the emphasis on the term data, Floridi proposals from the following definition:[71]:

68 *Ibid*., p. 232.

69 Floridi, *op. cit.*

70 *Ibid*., p. 21.
General Definition of Information (GDI)
GDI) σ is information, understood as a semantic content, if and only if:
GD 11) σ is comprised of *n* data, where $n > 1$:
GD 12) the data are well structured;
GD 13) the *well-structured* data are meaningful.

71 Datum$=_{def}$ "*x* is distinct from *y*, where *x* and *y* are two non-interpreted variables and the relationship of "being distinct" and the domain are left open to future interpretations."

> Dd) datum = $_{def.}$ x being distinct from y, where x and y are two un-interpreted variables and the relation of 'being distinct', as well as the domain, are left open to further interpretation.[72]

In this regard, Floridi asserts that this definition can be applied in three ways:

1. Data can be bereft of uniformity in the real world.
2. Data can lack uniformity (their perception) between two physical states of a system or signals.
3. Data can lack uniformity between two symbols.[73]

Likewise, Floridi propose the following typology:

> Primary data. Data stored in data based are linked, i.e., they are data in an information management system.
> Secondary data. These are contrary to primary data, when the latter are absent.
> Metadata. These are indications about the nature of other data, usually about primary data.
> Operational data. Data associated with operation of a data system as a whole and its performance.
> Derived data. These can be extracted from other data, provided they are used as indirect sources in pattern searches, clues or evidence that make inferences about data in and of themselves.[74]

A review of these definitions, which merely add some degree of depth, does not reveal any significant differences. For example, with regard to informatics we have the following:

> Formalized representation of objects, proper for communication or automatic processing or by persons. It is the information that has been processed by a computer program (digital data) or by analogue signals (analogue data).[75]

On another front, the Encyclopedia of Information Technology states that the terms is often used to refer to any type of information, whether a single element or set, and which can be processed by a computer. The classification proposed is as follows:

72 Floridi, *op. cit.* p 23.
73 *Ibid*., p 24.
74 *Ibid*., p. 29.
75 *Informática*: *Glosario de términos y siglas*, *s.v. dato.*

1. Input and output data: A program solves a certain class of problems and the input data determines how to process certain problems. The output data are the solutions to the problems.

2. Active and passive data. The active data are programmed instructions. Passive data are the objects of said processing activities.
3. Numeric and alphanumeric data. The former are digits and some special characters, such as the signs + and -; while the latter included numerals, letters and symbols. [76]

In the previous two cases, the definition is based on data processing. In contrast, the International Encyclopedia of Information and Library Science states that in addition to the aforementioned meanings, the general term "datum" is used for information that is encoded quantitatively or numerically, and its plural is also often used colloquially in a sense that is nearly synonymous with "information"; for example, in the phrase "bibliographical data" as interchangeable with "bibliographic information."[77]

The General Definition of Information, which entails data + meaning, and in accord with the nature of data proposed by Floridi, information is a kind of coin whose two sides are inseparable and which are constantly referring one to the other. Consequently, it is important to examine Floridi's thoughts on information as semantic content.

In this regard, Floridi asserts that when data are well structured and meaningful, this situation results in semantic content. Information, understood as semantic content, comes in two varieties: instructional and factual. The former transmits requirements by means of certain actions, while the latter represents an event in and of itself. Moreover, information as semantic content is declarative or factual, and the latter can be qualified as true or false. The definition proposed is as follows: p qualifies as factual semantic information, provided always p is well-structured, meaningful and the data are true.[78]

Therefore, the factual semantic content is the most common avenue for understanding information. Consequently, Floridi concludes that veridical semantic content is a necessary condition of scientific or academic knowledge.

In line with the concept of information as idealization or approximation to real entities, and in accord with the review of Floridi's concept of the se-

76 *Encyclopedia of Information Technology*, *s.v. data.*
77 *Encyclopedia of Information and Library Science*, 2nd ed., *s.v. data.*
78 Floridi, *op. cit.,* p. 50.

mantic content of information, an examination of how the concept of information is treated in cognition theory should be addressed, since cognition theory is largely concerned with the construction of meaning. In this regard, Muñoz[79] calls attention to what Bruner expressed decades earlier about the repercussions of information theory in Psychology.

Information and cognition

The displacement process was such that Bruner summed it up as follows: "Something that happened early on was the shift in the emphasis from "signified H" to "information, from the construction of meaning to the processing of information."[80] In light of Muñoz's observation and Bruner's asseveration,[81] the loss of meaning and the reductionism inherent in the new concept was something that:

> […] increasingly undermined not only the possibility of building meanings, but also, more fundamentally, the capacity for treating the semantic component in the notion of information. Even without denying this point, but rather reducing it to a simple condition of the occurrence of information, information is encoded in certain semantic and intentional conditions in order to enter into functional positions that can produce behaviors. Research in semantic cognition trended increasingly toward positions in which the mental factor had to be eliminated because it was deemed superfluous and unnecessary for such ends. Researchers required only the examination of syntactic processes that build chains of symbols, while in other cases they deemed information as a result of non-significant levels of processing.[82]

The fundamental concern was to promote cognition theory in the field of information in order to explain the operation of semantic components and its interaction with the intellectual work of cognition and the respective semantic increase. In accord with Bruner, Bogdan's answer,[83] and as a sort of introduction to his synthesis of cognitive information, Munoz points out the following:

1. In accord with computational theory, information is that which allows one to decide between two alternatives. As such, a message con-

79 Carlos Muñoz Gutiérrez, *Modelos narrativos de la mente.*
80 *Ibid*., p. 1.
81 Jerome Bruner, *Actos de significado: más allá de la revolución cognoscitiva.*
82 Muñoz Gutiérrez, *op. cit.,* p. 1.
83 Radu J. Bogdan, "Actitudes mentales y psicología del sentido común (contra la eliminación)".

tains more information insofar as it allows us to eliminate the largest number of equally probable alternatives."[84]

2. The contribution based on discrimination depends not only on the quantity of information received, but also on that already possessed.[85]
3. Information is described as a structure of codification imposed by an organism on an input coming from and external source.

Likewise, Muñoz stresses that in Bogdan's view information exhibits two features thanks to which it is possible to build propositional attitudes. The first of these has to do with the internal aspect of the information and consists of symbolic encoding that can be understood by the organism or system in such a way that it enjoys a concrete state. He adds:

> This internal encoding of information (the representation), insofar as it configures the state of the system, is what is causally efficient in the cognition process. We also find an internal, intentional dimension of the information represented, or in the structure of data, concepts, significations, prototypes or patterns, all stored in memory or otherwise existing as rules or procedures.[86]

The second feature, which Bogdan calls the external aspect of information, describes the relationships between internal codification, representation and objects. Representations are the states of the world and remit to external objects. Representations are true and, therefore, possess conditions of truth.[87]

Moreover, Bogdan has analyzed the problem of the function of "mental information" tied to mental attitudes, of which he says:

> Mental attitudes must be associated with the way in which information animates and moves cognition and behavior existing in each. As we have already seen, it is not semantic information per se which animates and moves. We believe and wish because we must work, and to work we must register information that associates action with our current cognitive state. In other words, we treat information attending to the belief and wish, because that information must serve our current action and cognition.[88]

84 Muñoz Gutiérrez, *op. cit.,* p. 1.
85 *Idem.*
86 *Ibid*., p. 2.
87 *Idem.*
88 Bogdan, *op. cit*., p. 103.

According to Bogdan, semantic information is not sufficient to explain the field of cognition and the mind. Muñoz summarizes Bogdan's definition of information as the notion of mental information that is pragmatic in nature and functionally efficient for cognition and behavior (author's italics). He adds that "To the input information and its semantic form, this mental information also adds an incremental feature that affects the pragmatic sphere and is responsible for cognition and behavior."[89] Since the incremental information function is relevant, Bogdan, in the paraphrase supplied by Muñoz, states that such inputs are individualized at the time the interaction with the system takes place, emphasizing, moreover, two factors: in the first place, the topic, which defines the field of interest and frames the boundaries of potential increase, while also allowing articulation of previous increases in order to ensure continuity and relevance; and the second factor is entailed in the categorical articulation, which allows the format of the information increase to be set.[90]

Individualization of incremental information is for Bogdan, again as per Muñoz, analyzed in the following way:

[1] Roberto emptied the bottle of wine

(i) The incremental information content can be analyzed by relativizing the following parameter:
(ii) Topic: To that which is addressed (and event at home)
(iii) Given information: That which is known (Roberto dis something with the bottle of wine).
(iv) Incertitude: Identification of the action (What did Roberto do to the bottle of wine?).
(v) Projections: a class of relevant alternatives (he emptied it, he played with it, he broke it, etc.
(vi) Inference: value for the new information (he emptied it).
(vii) Categorical articulation: Agent-Action-Object.
(viii) Integration: new information (he emptied it) is the given information (Roberto did something with the bottle), which produces terminal information (Roberto emptied the bottle of wine).[91]

Along these lines, the pragmatics of cognition and behavior are supported in this model of intellectual work, which includes fixing the mental information and entails interaction with an objective representation, "and

89 Muñoz Gutiérrez, *op. cit.,* p. 3.
90 *Idem.*
91 *Ibid.*, p. 4.

affixing new information to knowledge, attending to that which is already known, expected and desired."[92]

Thus, we have it that information in the context of cognition assumes diverse denominations in accord with the function it fulfills (input, increase, terminal), and its pragmatic nature is indispensable for mental attitudes, human action and cognition.

On another front, several mental architecture theories have been proposed, which include the term information. These theories are far superior to the computer processing information model, which has little capacity for explaining overall system of mechanisms required to exhibit flexible, intelligent behavior.[93]

The limitations of the information processing model are most obvious when one examines the architecture that brings together the features, properties, processing mode and limitations of real cognitive systems that, according to Ezquerro, include:

1. Flexible behavior as a function of environment;
2. Exhibition of adaptive conduct (rational, goal oriented);
3. Operation in real time;
4. Operation in a rich, complex and detailed environment;
   a. Awareness of an immense quantity of changing details;
   b. Use of a vast amount of knowledge;
   c. Control of a motor system with many degrees of freedom;
5. Use of symbols and abstractions:
6. Use of natural and artificial languages;
7. Learning from context and experience:
8. Acquisition of capacities in the course of development;
9. Living autonomously within a social milieu; and
10. Exhibition of self-awareness and sense of ego.[94]

A mental architecture capable of explaining a cognitive system is vital to the discipline of Library Science, because it opens up great challenges for understanding and interacting from the basis of incremental information (in Bogdan's terms), and for fixing new information in cognitive systems.

92 *Idem*.
93 See Jesus Ezquerro, "Teorías de la arquitectura de lo mental", and Bruner, *op. cit.*
94 Ezquerro, *op. cit.,* p. 109.

Information and library science

In the field of Library Science, the term information is indispensable and has been in wide use for several decades, as information science has carried out applied research in libraries and information units. Moreover, there has been wide development of programs to register graphics, control systems and organizational management.

In the United States, it should be remembered, Information Science officially replaced Documentation at the end of the 1960s, and according to Lilley and Trice:

> The architects of information science in the United States wanted to be sure that it would no longer be mistaken either for the microfilm-oriented discipline that documentation had become or for the document–oriented discipline that was library science. This new discipline would be free of real or imagined appendages.[95]

The researchers cited herein also stress that in many parts of the world Documentation and Library Science co-exist and are often included in professional journals. Such is the case in Great Britain; however, in the United States these associations have not joined up, nor do they publish in the same professional journals or appear in the same indexes.[96] At the same time, according to Lilley and Trice, Information Science has advocated for an identity separate from Library Science and has driven many changes in traditional vocabulary. For their part, most librarians do not want to be overwhelmed by those who are in favor of advanced technology.

Information Science also used terminology notably different from that used in Library Science or Documentation; for example, information retrieval, descriptor or terms, relevance, precision, exhaustiveness (recall), Boolean logic, abstracts and indexation.

According to the historical narrative provided by the researchers cited, one observes that the term information is introduced conceptually as a conceptual innovation, even though not necessarily a welcome one, into a disciplinary field that was especially fertile such as Library Science.

The advent of Information Science could be interpreted as going beyond the phenomenological study focused on the book or document toward a sub-

95 "The founders of Information Science in The United States wanted to ensure that were not confused with a discipline oriented to microfilm, such as was the case of documentation, or another focused on documents, such as Library Science. The new discipline would be free of real or imaginary appendages." Dorothy B. Lilley and Ronald W. Trice, *A History of Information Science 1945 -1985*, p. 3.

96 *Idem.*

stantial or abstract level represented by information and the cycle of information, both concepts that surpass by far the immediate physical referents in such a way that the concept of document possessed greater capacity to be included than the term book. Similarly, the term information becomes an abstract concept with unlimited possibilities to be included in a wide variety of material referents, such as books, magazines, files, etc.

Researchers such as Rubin have stated that Information Science vastly enriched the vocabulary and theory of Library Science. It even helped improve the understanding of the work of libraries and information units in society. The classic definition of Information Science is as follows:

> […] the science that investigates the propieties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accesibility and usability. The processes incluye the origination, dissemination, collection, organization, storage, retrival, interpretation, and use of information. The field is derived from or related to mathematics, logic, linguistics, psicology, computer tecnology, operation research, the graphic arts, comunication, library science, management, and some other fields.[97]

By virtue of the adoption over several decades of terminology from Science of Information, Library Science has made use of the term information to refer also to data or knowledge, while the material supports have lost importance. In light of Rubin's assertions in this regard, we can see further evidence of this trend; for example, he states that the term "datum" is used as a synonym for information, even though its main feature is to build constituent blocks of information and knowledge, i.e., it is the material from which information is assembled. It is represented by numerals, letters or symbols; however, data does not carry meaning, or rather, none has been assigned it.

As for the term information, he states that the definition is complex, but he makes it clear that for Library Science information means addition of data, organization or classification with meaning, which in turn implies some type of processing or comprehension.[98]

97 "The science that examines the properties and behavior of information, the forces that govern the information cycle and the meaning of information processing for optimal accessibility and usability. The process includes the creation, dissemination, gathering, organization, storage, retrieval, interpretation and uses of information. The field is derived from or associated with mathematics, logic, linguistics, psychology, computer science, operational research, graphic arts communication science, library science, management and several other fields." Richard E. Rubin, *Foundations of Information Science*, p. 31.

98 *Ibid*, p. 54.

On another front, Saracevic[99] believes that the evolution of Information Science has lent clarity to the understanding the term, not on the basis of information per se, but rather through the solution to problems associated with communication of knowledge --or otherwise entailing individual issues or as part of information needs-- and grasping of the same by human beings, whose contexts, obviously, are social and institutional.

Since the 1970s, researchers as recognized as Shera have promoted new concepts to substitute one of the foundational concepts of Library Science, i.e., the "book." In this regard, Shera states that a book is merely a synonym for graphic record.[100] This bent toward abstraction is relevant because the term record shall later acquire a meaning, like the term information, that is indispensable in the literature and explanatory model of Library Science, as is corroborated by Saracevic.

It is worth pondering why Shera associated the terms cited above, and the reason he gives has to do with the fact that the library is a secondary communication organism, specifically of graphic media, which at the same time is part of the overarching social process of communication. In this light, the library in society becomes a mediator between man and his graphic records. In this context, the objective of the library is to collect, preserve and make available the records of human experience. Consequently, the human experience is recorded in large degree through graphic representation. For Shera, the work of the Library Science discipline makes sense insofar as it serves culture.[101]

On another front, within the academic tradition of Library Science and owing to the new context of information technology, many transcendental conceptual changes have occurred. It could be worthwhile to review the summary proffered by Rodriguez Garcia of this change.[102] He states that the fundamental change occurs in the direction from bibliographic entities to information entities, including the new information entities. In terms of the first of these entities, he states that they are the central unit of the bibliographic universe, which is comprised of a set of versions that can be described and represented in a bibliographic record. As such, these units represent a portion of the interdependent bibliographic universe. According to Rodríguez García,[103] the bibliographic conceptual model includes seven entities: documents, works, superworks, editions, authors, topics and other entities.

99 Tefko Saracevic, "Information science: Origin, evolution and relations."
100 Jesse Shera, *Los fundamentos de la educación en bibliotecología*, p. 91.
101 *Ibid*, p. 190.
102 Ariel Alejandro Rodríguez García, *Las nuevas entidades de información analizadas desde la perspectiva de la organización de la información*.
103 *Ibid*., p. 7.

With regard to information entities, it is notable that the advent of the internet and computer devices lies at the origin of these entities.Some researchers have proposed substituting the terms bibliographic entities with the concept of entities loaded with digitized information, also known as information packages. These entities are an extension of bibliographic entities; however, they are also new formats with a powerful capacity to store information.

For their part, the new information entities should be understood as resources derived from technological applications whose nature is more interactive and dynamic, with the ability to combine entities that belong to other resources. Moreover, they are characterized by being fragmented; and thanks to this it is possible to access and use the information they contain.[104] The terms associated with the new information entities are as follows: informative objects or sources of information; electronic resources, digital journals, documents or digital documents and digital information objects. In light of this array of terms, Rodríguez García adds that the new entity…

> […] has been created on a digital support and medium; i.e., as an intangible object; as such it cannot be touched like a book, making its environment and constitution largely electronic. For this reason it is considered a digital object. This object and the digital information in general are based on the diverse states found in the binary code, the main medium allowing representation of numbers, text, images, sounds and instructions, whose existence is possible thanks to the short- and long-term file storage capacity of the computer.[105]

The current discussion of the objects of study of Library Science shows that the concept of information, born of Shannon's theory of information, and the context of information technologies have reconfigured standardized models of Library Science and its capacity to represent and organize the universe of records containing socially valuable information.

Finally, it is worth considering that in the new patterns of cataloging known as RDA (Recourses, Description and Access),[106] the emphasis is placed on the term resource, which at the same time is associated to manifestation or item, i.e., individual entities, aggregates and components, as well as entities both tangible and intangible.[107] As is well known, cataloguing standards have allowed the description and access to resources; however, the great challenge is to redesign these for the digital world.

104 *Ibid*., p. 20.
105 *Ibid*., p. 15.
106 See: http://www.loc.gov/catdit/cspo/RDA/rda.html
107 See: RDA Glossary definition of the term *resource*.

In synthesis, one can say that the movement has been from bibliographic entity to information entities and, at this time, has culminated with the resources of the digital world, whose fundamental referent is information technologies. This assertion does not ignore the forms of observing the society as a system, a network society or knowledge society; and explaining human cognition on the basis of interaction with information.

Conclusions

The dimensions of the concept of information are multiple, and each one of these facets has exerted influence on several fronts and, one way or another, on the discipline of Library Science. This can be explained because the concept of information is essential in diverse theories, i.e., information science, sociology and cognitive approaches. And although its use is largely fictional or meta-scientific, its use and usefulness within a theory is undeniably prodigious.

From its origins in the theory of information, this term allowed, as in the case of Library Science, introduction of analysis entailing higher levels of abstraction or substance. Consequently, it unfolded as a conceptual progress, contributing explanatory models that enrich the markedly normative perspectives that for decades have prevailed in the discipline. Nonetheless, we have reached the point of reducing or subsuming the fundamental entities of Library Science into term information, a progression driven in no small degree by technologies used in information processing. Fortunately, this subsuming has begun to dissipate.

It should be stressed that the diverse dimensions or conceptions that have accompanied the term information and the attending social study of technologies have made clear the need to carry out interdisciplinary research, thanks to which new problems relevant to Library Science can be approached. These areas include the organization of information resources and services and cognitive gaps, human development and justice, as well as cultural identity and globalization.

Methodologically, the accurate theoretical identification of how the conception of information is used becomes apparent, since its indiscriminate use has led to extremes of overvaluation, banality or it has been constrained to the field of electronic communication. In all events, it is clear that for the discipline of Library Science, the theoretical and applicative impacts of this weighty term have been underway for several decades. And even though this term is not likely to be used in the future in any narrower way, it is important to be careful with regard to its pretended explanatory or descriptive scope;

because it is increasingly used in the reconfiguration of Library Science research and the social environments in which it is uttered.

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