A New Conception of *Representation of Knowledge*

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ABSTRACT: The new term *Representation of knowledge*[1], applied to the framework of electronic segments of information, with comprehension of new material support for information, and a review and total conceptualisation of the terminology which is being applied, entails a review of all traditional documentary practices. Therefore, a definition of the concept of *Representation of knowledge* is indispensable. The term *representation* has been used in western cultural and intellectual tradition to refer to the diverse ways that a subject comprehends an object. *Representation* is a process which requires the structure of natural language and human memory whereby it is interwoven in a subject and in conscience. However, at the present time, the term *Representation of knowledge* is applied to the processing of electronic information, combined with the aim of emulating the human mind in such a way that one has endeavoured to transfer, with great difficulty, the complex structurality of the conceptual representation of human knowledge to new digital information technologies. Thus, nowadays, *representation of knowledge* has taken on diverse meanings and it has focussed, for the moment, on certain structures and conceptual hierarchies which carry and transfer information, and has initially been based on the current representation of knowledge using artificial intelligence. The traditional languages of documentation, also referred to as languages of representation, offer a structured representation of conceptual fields, symbols and terms of natural and notational language, and they are the pillars for the necessary correspondence between the object or text and its representation. These correspondences, connections and symbolisations will be established within the electronic framework by means of different models and of the "goal" domain, which will give rise to organisations, structures, maps, networks and levels, as new electronic documents are not compact units but segments of information. Thus, the new *representation of knowledge* refers to data, images, figures and symbolised, treated, processed and structured ideas which replace or refer to documents within the framework of technical processing and the recuperation of electronic information.

1. Introduction

The term re-presentation refers to *re* in as much as it expresses repetition. *Representation* is the act of representing, symbolising or meaning and refers to a figure, work, image, symbol or idea that replaces or presents reality again. *Representation* has been used in traditional western culture and intellect as a general term which refers to the diverse ways a subject, by means of a symbol, understands an object or a concept. Understanding perceives similarity or correspondence and associates the concept or object with the symbol or image. In other words, representation refers to a signification, symbolisation or reference to something which is different from itself; where thought, memory, learning and perception are activities or capacities which operate symbolically; where symbols establish a correlation with that which they represent or replace. The human mind is the symbolic machine *par excellence* and the *representations* are symbolisations. Thus, the term *representation* has always referred to a category that has psychological and/or transcendental grounds, as *representation* is to the degree that a subject (with a conscience) exists which perceives, remembers, imagines or hallucinates; if there is no subject that represents, perceives, imagines or hallucinates, to sum up, no subject with a conscience, there is no representation at all.

Furthermore, the term *representation* also comes from considering that knowledge is a mental representation (necessarily finite) of a complexity (presumably infinite) capable of passing through reality to reach another mind. When it is possible to transmit this complexity, then it is no longer intuition, living experience, or vision, but knowledge, which is why knowledge can be considered as the form that an idea assumes in its passing from one mind to another. This is knowledge. It is a piece of reality which is transformed in such a way that a new represented reality is created through which the very channel or route of transmission of that knowledge is what we have been properly calling knowledge. Thus, the new idea of *representation of knowledge* is going to take the original idea of knowledge as a channel or route. Nowadays, this conception is applied to the processing of electronic information and this is how a transfer of this process has been made. Knowledge is going to be the channel and the symbolisation is going to be its representation. Therefore, human symbolisation has transferred to the processing of electronic information, which is now also going to try and act as a symbolic machine.

2. Construction of the Current Concept of *Representation of Knowledge* Based on American Pragmatism

In our intellectual tradition, the term *representation* has developed greatly. The fundamental principle of Aristotle, and the philosophical schools that follow his thought, was to study the human mind to the extent that the latter tried to search for pre-existing order in the universe, which is why the problem of *representation* did not exist as such. Thus, all traditional representationist conceptions attribute to knowledge a correspondence or *representation* which is very suited to reality. Nowadays, this traditional conception has fallen into disuse insofar as it originates from the idea that representations correspond totally to reality exactly as it is.

According to Kant, the *representation of knowledge* is based on the reversal of this representationist proposal as here it is the thinking subject which *a priori* intervenes and imposes mental order on the multiplicity and chaos of reality and phenomena. The current pragmatist line initiated with Peirce will continue Kantian principles, as (in spite of the fact that he sustains that reality exists as such, nevertheless, as regards shared and scientific knowledge) this will be mediated by the context itself or the subject. Although Peirce acknowledges the existence of things aside from thought, in the perception of these he considers that there exists a conditioning of the same which will determine their being known, or rather, *our idea of something is our idea of its sensitive effects* (Peirce, 1971, p. 13). Thus, the idea of truth is proposed as practical principles whose validity will be proven by their satisfactory functioning in experience. This school of thought is here called Pragmatism in order to separate its principles from Phenomenism (based on phenomenon, on perception); nevertheless, its philosophy points towards a transcendental idealism in the sense that it reiterates the constructive nature of the concepts until it succeeds in adjusting to the very reality that it tries to conceptualise and define.

Twentieth century analytical philosophy of language has tried to replace the opposition between realism and idealism of modern philosophy based on Descartes. It has transferred the problem of *representation* and has tried to replace mind by language. Nevertheless, linguistic trends have become the heirs to mentalist schools, which is why both attitudes are heirs to representationism. Thus, faced with the problem of *representation*, Wittgenstein's proposal initially points towards the early Wittgenstein in his work *Tractatus*; here language is representation. It is a physicalist idea where language represents the world, compared to the later Wittgenstein of *Philosophical Research* where he highlights that everything is language games, and everything is due to the construction and compulsion of language. To sum up, he highlights the idea that there is no reality since all knowledge does not refer to reality itself but to language. In this sense, we would be tackling the linguistic inflation of contemporary knowledge.

Present day pragmatism considers that there is no strict *representation* as such, which means that it is situated in an anti-representationist school of thought. Rorty (Vegas González, 1983, p.13) alleges that knowledge is not the mirror that reflects nature, but that there is constructivism. Rorty states, '*To know is to represent exactly what there is outside the mind; to understand the possibility of knowledge in this way is to understand the way in which the mind is capable of understanding such representations. The fundamental concern of philosophy is to be a general theory of Representation*' (Rorty, 1983, p.13). Representation as a mirror is a physical metaphor which expresses that what is represented and that which represents are very similar. Nevertheless, representations are inundated by the subject that prescribes them.

To sum up, the anti-representationism of Rorty advocates that the current concept of *representation of knowledge* is fundamentally based on Pragmatism even though this springs from a reaction against idealism. Nevertheless, it is an idealist philosophy in spite of its initial aim to locate an objective and independent reality. It emerged within the American political, economic and social setting of the early twentieth century, where the most conservative social classes tried to control the overwhelming advance of science, technology and industry in a context in which spiritualism was in full swing, and American society was being shaped around a religious context which was imported from old Europe. Here, transcendental philosophy was not accommodated within a context of dominant classes which primarily sought social and economic advancement, and also tried to avoid the penetration of the materialistic ideas which were very widespread in nineteenth and twentieth century Europe. The United States grew by taking advantage of the work of the large masses of immigrant workers. Within this context, Pragmatism emerged by advocating a new idealist school of thought as the optimum solution where the action of the subject would be the ultimate basis for knowledge, truth and its representation. Charles Peirce was to be the first to advocate Pragmatism, which would be continued by William James and John Dewey, and would finish by consolidating the official philosophy of the American bourgeoisie (Martín Ruis-Serner, in Peirce, 1971, p. 15).

3. *Representation of Knowledge* in the Field of Library and Information Sciences

The most up-to-date general theory of *representation*, which has had an effect on Library Sciences and Documentation, includes the principles of pragmatism, and, moreover, aims to surpass Rorty's idea of *representation* as a reflection in order to lay the foundations for a more precise concept of *representation* as the application and preservation of structures (Ibarra & Mormann, 2002, p. 287). Furthermore, this conception involves a reductionist trend which proposes that *representations* serve to reduce superfluous reality. Pragmatism will, therefore, condition the current concept of *representation of knowledge* within the context of Library and Information Sciences where, moreover, this representation of knowledge is a multidisciplinary thematic field (Sowa, 2002).

In the specific context of Library and Information Sciences, the term *representation of knowledge* is widely known and means the symbolisation of books and documents, and, moreover, is influenced by the most up-to-date philosophical schools of thought. Thus, Pragmatism and Reductionism contribute that there is constructivism in this symbolisation and that the superfluous is eliminated. Consequently, in our scientific context, *representation* encompasses physical description, and the content of books and documents and superfluous complexity is eliminated insofar as the description does not contain information which is not relevant. That is to say, bibliographical references of any kind are representing signs of books and documents, and the catalogue as a whole is a system which represents the library. From a pragmatist and reductionist perspective, we can consider that representing objects function as substitutes for the objects represented, and, in this process, there exists a representation, construction and elimination of the superfluous.

In this way, a language of the representing domain is created, or in other words, the systems of symbols or the different documentational languages comprise titles, arguments and rules which have no direct correlation with the represented domain. Consequently, the new complexity which is represented is not superfluous, but, quite to the contrary, it is that which essentially facilitates each representation. In this way, a new knowledge has been produced over the domain of representation which will be called *Organisation and representation of knowledge.* Thus, the *representation of knowledge* (Barité, 1997, p. 125) has been defined as '*a branch of the organisation of knowledge which comprises all the processes of notational and conceptual symbolisation of human knowledge within the field of any discipline. Classification, indexing and all computer and linguistic aspects related to the symbolic translation of knowledge are included in the representation of knowledge*'. He even defines the symbol as a '*codified or conceptual representation of a notation (that is, a notation or a term), which is the result of the processes of analysis and synthesis of a document, image, figure, or sign which expresses a concept in a conventional way*'.

4. Transfer of the Positivist Bibliographical Paradigm to the Pragmatist Man-Machine Paradigm

Current representation construction processes, in our scientific field, attempt to base themselves on pragmatic aspects which will fix, in a very dynamic way, conceptual meanings. In the same way as the biblio-

graphical paradigm based on twentieth century Positivism has been abandoned in our scientific field, now the man-machine paradigm based on Pragmatism is used. The theoretical model of information recovery based on mere invariable comparison, called the bibliographical paradigm, is falling into disuse due to an interactive process of information search, evolutionary but not totally comparable, called the man-machine dialogue paradigm (Fernández Molina & Moya Anegon, 1998, p.84).

Representation of knowledge will mention the process of symbolisation resulting from a formal and content analysis of a document within the framework of electronic information; it will be the symbolisation of treated, processed or structured data, images, figures or ideas, which replace or make reference to information and mention the technical process and recovery. In its symbolisations, *representation of knowledge* encompasses concepts and structures by establishing structural, systematic relations of association and distinction. Furthermore, certain systematic structures are necessary in the representation of knowledge, and they need structural requisites as much as they do formal properties. Moreover, *knowledge* has been defined as productive and useful electronic information (San Segundo, 2002, p. 239-245), consequently the *representation of knowledge* will be the symbolisation of productive and useful electronic information. If knowledge is an integration process, *representation of knowledge* will be: concepts, theories, models, formats, descriptions and structures that have a significant dimension of symbolisation of information and, more currently, of electronic information. In the same way as in natural or artificial memory representations are made, whether they be classification, cataloguing, organisation or others, documental languages of any type offer an organised representation of conceptual fields and natural language terms which are the basis for the representation of electronic information.

This complex structure has generated an extensive theoretical corpus and rules on classification, indexing, cataloguing and structuration. But, furthermore, the inference rules of the representing system are as complex as those of the represented system. This implies the abductive nature of the representation, or, in other words, the so-called representational abduction which tackles the construct nature of the representation as this seems to be a neutral transfer, although the representation also has a construction and intentional function. Thus, two primary features of the *representation* will be reduction and induction, insofar as they highlight its intentional pragmatic aspect; that is to say, that the *representation* is always for a subject. Nevertheless, the concept of *representation* as a reflection does not include this with the active presence of a subject (Ibarra & Mormann, 1997, p. 292-293).

If a good representation were only precision or exactness with that which is represented, it would not require a mediator or an interpreter at all. Thus, an attempt has been made to present traditional systems of classification in this way, by contributing a classification and structuration of 'things known' and positivist knowledge, languages without significant elements and with a smattering of objectivity, compared to current proposals where the subject intervenes with more force than the object in documental representations.

5. Proposal for Systems of Representation of Knowledge

To sum up, traditional *representation* has been considered as a process which requires the structure of natural language and of human memory, and is interwoven in a subject and in conscience. An attempt is being made to carry out similar proceedings in computerised information systems. Thus, automated digital information systems try and emulate the human mind, and, if the mental form of knowledge is not linear or hierarchical but more complex, this will imply that the electronic form of knowledge is being developed which will try and equal the natural form.

The conception of the concept of *representation of knowledge* proposed by Binwal and Lalhmachhuana defines it as semantic and syntactic descriptions subject to conventions of things. They can also be the descriptions which an intelligent machine processes and establishes (Binwal, J.C.& Lalhmachhuana, 2001, p. 5-16). On this basis, they suggest three types of representation of knowledge: Logical systems with logical proposals; Regulation systems with systems for the production of rules, laws or canons related to documentational symbolisation where Ranganathan's General Theory of Classification comes in; and Structuration systems which encompass the structuration of objects with semantic networks and hypertext links which symbolise concepts, attributes, diverse structures and conceptual relations of any kind.

6. Conclusions and Proposals

Logical systems to represent knowledge use logical propositions and logical predicates, and, in spite of the fact that human nature uses inductive reasoning more, this type of representation is only encompassed within deductive methods, which raises difficulties.

Regulation systems to produce norms, rules, laws and to solve the different types of difficulties in the implementation of these regulations propose, as was indicated by Ranganathan, five laws for these regulations: the Law of Interpretation; the Law of Impartiality; the Law of Symmetry; the Law of Parsimony; the Law of Local Variation, and the Law of Osmosis. These laws can be used to solve some difficulties in the production of rule systems. Nevertheless, they entail numerous difficulties for the formulation of a rule system as countless disciplines are not subject to strict norms, whether it is because the production of rules in taxonomical order is a true reflection of the structure built of reality or for other reasons, but, either way, they are mechanisms built with fully dependent relations, and never with a definitive establishment.

Finally, Structuring Systems encompass compared and structured objects where the latter have qualities and attributes in a comparative process. This process can be made by establishing semantic networks which create connections by means of nodes structuring notions such as hierarchy, attributes, location and parts or organs. This process can also be undertaken by means of frames which involve structures of associated data; also by means of scripts which represent knowledge but lack a hierarchical structure; and, also by means of conceptual dependencies which are based on the fact that phrases with a similar meaning have a similar representation. These structuring systems are subject to difficulties as objects may have characteristics of diverse sorts.

These three ways to represent knowledge: Logical Propositions, Norms and Rules, and Frames are parallel to the three dimensions for the Representation of Knowledge which Ranganathan established in his *Prolegomena:* Conceptualisation, which involves naming and describing characteristics; Classification, which involves organising and categorising characteristics and relating and, finally, Inheritance, which entails chains of types and their modulation, where this representation involves conceptualisation, grouping and structuring. Nevertheless, this representation is a language which entails difficulties and insufficiencies, which is why it needs a new epistemological basis.

We have, then, that *Representation of knowledge* is the symbolisation of productive and useful electronic information. This symbolisation encompasses syntaxes, semantics, notations, models, formats and structures.

Furthermore, previous classification systems were imbued with logical positivism (García Gutiérrez, 2002) where the subjectivity of the user did not intervene. There existed a unique meaning for each notation, and, in these artificial languages, significant element and meaning totally coincided. Nevertheless, new languages of the *representation of knowledge* are imbued with American pragmatism, and, as these new representations are inundated by the subject which prescribes them, the unit of the structure of the representation is correlative to the sequence of interpretants, which will determine different meanings for the same structure. This intentional content of the correspondence relations established in the *representations* means that they cannot be reduced to the mere determination that the object structurally fixes on the representing sign.

Therefore, the construction of models of representation for certain data structures is key, where cognitive processes and intentionist aims should be taken into consideration, as the models of construction of representations are not accidental, but quite the opposite, and they have a very practical function based on the already proposed systems of representation of knowledge in Logical systems, Regulation systems, and Structuration systems. It is, therefore, necessary to conceptually define the mechanisms and forms of representation, and to construct a general theory of the new *representation of knowledge.*

Notes

1 This article is a slightly modified and translated version of *Nueva concepción de la Representacion del conocimiento* In:Tendencias de investigación en Organización del conocimiento.

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