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From human knowledge to information technologies: some epistemological remarks

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***Abstract*— The knowledge based society developed the new technologies of information and communication in order to use better all the data at different levels and to manage them efficiently. Computers have the capacity to store information, to select it, or to provide it. Human mind, memory and other capacities, are replaced by the upgraded capacities of the computers. Computers are able to store just semantic information, but they do it better than any human epistemic subject. Computers incorporates tacit knowledge and use it also as information or rules to manage the data. Therefore, in KBS the human transition from information to knowledge is accompanied by a reverse computational transition from knowledge to information.**

Keywords*— *information, knowledge, knowledge based society, tacit knowledge

I. SOME PRELIMINARY REMARKS[1]

The classical distinction proposed by Weaver between three level is still a good starting point. The first is the technical level which refers to "the accuracy of transference of information from sender to receiver", the second is the semantical level, related with "the interpretation of meaning by the receiver, as compared with the intended meaning of the sender", and the third is the so-called "influential" level, which concern "the success with which the meaning conveyed to the receiver leads to the desired conduct on his part." [2, p. 11]

If the first level implies only technical problems which are solved increasingly better in an engineering mode by developing technology, the other two levels contain in themselves premises for a philosophical approach. I will follow here an epistemological path which is focused on the dynamics of knowledge and information in a knowledge based society. Some preliminary remarks are necessary in order to clarify some concepts.

I agree without any doubt, at least for argument's sake, and I will use in the following considerations the so-called general definitions of data, information and knowledge based on an erotetic approach. [3, pp. 106-107]

An item is a piece of information if it has a semantic content. This means that it is a piece of information if and only if:

1. It consists of one or more data;
2. These data are well-formed;
3. These well-formed data are meaningful.

From sentence 1 results that without any data we don't have any information. So, what are the data? I think that the most elementary definition is also philosophical acceptable. If the world would be characterized by absolute uniformity we don't have any data. Therefore, a datum is the effect of a difference in the world. A homogenous world, with identical parts, isn't able to produce some data or it is able to produce a single datum about it, that about the fact that it is. From sentence 2 results that the data have to be ordered according to some rules which are structured in a syntax.

From sentence 3 results that the data are related with meanings and they become semantical items which should be understood and interpreted correctly and even in terms of truth.

For example, 12 is a sign that makes a difference, but isn't yet informative because we have to attach to it a meaning to transform it from an empty sign into an informative one. 12 can become an astrological sign, a number of chairs or a bus route. Therefore, a datum becomes information if and only if it becomes meaningful.

In conclusion, according to the general theory of information, information is described as data plus meaning. I will use this idea of semantic informational content in an epistemological context as an acceptable definiens for the concept of knowledge.

Following the causal analysis of information, beliefs and knowledge proposed by Dretske in [4, part III], I will define beliefs as semantic structures with an executive function, namely, they have the role to shape the system's output. If this condition is fulfilled, then the semantic structures work as cognitive structures in that system. This means that a belief will be stored in memory,

[1] For a development of the ideas from this paper see [1].

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which is a part of the cognitive system, in an accessible way and it will be used when it will be necessary for a cognitive process. Therefore, the semantic structure is a cause of the output in the system. This means that a semantic structure is qualified as a cognitive structure and as a belief if and only if its semantic content determine in causal mode the output in the system in which it appear. As a result of these assumptions, we have to make a difference between semantic structures and cognitive structures. The concept of information helps us to understand the difference.

Dretske's definition for information as a causal process is this:

"Information (in signal or structure S) causes E insofar as the properties of S that carry this information are those the possession of which (by S) makes it the cause of E." [4, p. 198]

Let's take into account a perceptual belief. All the information about angles, lines and gradients will be used causally as ingredients but all of them won't be structured immediately in a cognitive content even if they will be related with a semantic content. The cognitive status as belief is given but the capacity to exercise a control over the final output.

Therefore, following Dretske, "information is commodity capable of yielding knowledge, and what information a signal carries is what we can learn from it... Knowledge is identified with information-produced (or sustained) belief." [4, p. 44] These being said, if we preserve the definition of knowledge as justified truth belief, we could claim that knowledge as a "dynamic human process of justifying personal beliefs toward the truth" is similar to and different from information: "First, knowledge, unlike information, is about beliefs and commitment. Knowledge is a function of a particular stance, perspective, or intention. Second, knowledge, unlike information, is about action. It is always knowledge 'to some end'. And third, knowledge, like information, is about meaning. It is context-specific and relational." [5, p. 142].

II. THE TACIT DIMENSION OF KNOWLEDGE AND ORGANIZATIONAL KNOWLEDGE

My thesis is that in the knowledge based society the development of new technologies changes also the communication practices and the way in which knowledge is transferred and conveyed. As a result of these practical changes the concept of knowledge itself is reconsidered especially in terms of its objectivity. The idea of an objective knowledge which is free of context and values is revised. Michael Polanyi in [6] criticized the idea of an objective knowledge which is free from any subjective influences and tried to argue that at least in the context of discovery the subjective dimension of knowledge is very important. It is obvious that the scientific discoveries are related with some feelings and beliefs. In Polanyi's view there is a tension between reason and explicit critical interrogation, on the one hand, and the tacit dimension of knowledge, on the other hand. Polanyi argues that personal choices and imagination are inherent parts of research process which are motivated, always significantly, by passions. Therefore, the discovery of truth isn't independent from any personal elements. Moreover, the scientific research needs some abilities which depend from the individual characteristics of the researcher.

In order to grasp this difference and to conceptualize it, Polanyi proposed the distinction between personal knowledge and propositional knowledge which is understood in terms of the differences between tacit knowledge and explicit knowledge. This means that we are able to know more than we can say with the help of our language. We can convert tacit knowledge in propositional knowledge, for example, we can transform some tacit procedures associated with a practice in explicit rules but something will remain always at the implicit level. Anyway, this dynamic of the two knowledge forms is based on the possibility of reciprocal transformations between tacit and explicit knowledge, but if we take into account the historical process of knowledge development then we have to accept in principle, following Polanyi, that all knowledge is somehow and ultimately either tacit knowledge or rooted in tacit knowledge.

Another crucial feature of knowledge based society which is also related with the tacit dimension of knowledge consists in the new role of different organizations in the production of knowledge. If we think in the light of the traditional Cartesian distinction between subject and object or between the knower subject and the object which is known and try to rethink it, then we'll understand an organization as a mechanism which has not only the capacity to process the information received from outside in order to be able to adapt to the environment, but also the capacity to create knowledge and new information with the help of its own inner mechanisms, to send them from the inside out to the environment and to modify this environment.

Nonaka and Takeuchi in [5] proposed a theory of organizational knowledge or of knowledge creating organization which is based alike on the distinction between explicit and tacit knowledge and on supposition that knowledge is socially created and transformed through the interactions between the individuals which work in an organization. Their paradigm could be better understood with the help of a case study. The two Japanese philosophers discuss the case of a bread making machine. They describe the way in which the tacit knowledge which is owned by the bread maker can be extracted and worded in such a manner that become possible to incorporate it in a bread making machine[2].

[2] In terms of Collins's distinctions between kinds of tacit knowledge it is obvious that this approach starts from one case of relational tacit knowledge, but the case should be redefined if we want and Collins himself did this. See [7], Appendix 1..

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Nonaka and Takeuchi have made in [5] a distinction between the four modes in which knowledge is transformed in an organization:

- from tacit knowledge to tacit knowledge, a conversion which is called socialization,
- from tacit knowledge to explicit knowledge, a conversion which is called externalization,
- from explicit knowledge to explicit knowledge, a conversion which is called combination, and
- from explicit knowledge to tacit knowledge, a conversion which is called internalization.

Socialization is an interactive process in which an individual learn and acquire knowledge, mental models and skills from others without using language, but only by observation, imitation, and practice, all of these understood as forms of sharing experience. The information is extracted from a mixture composed sensations, feelings and thought contents embedded in a context.

Externalization is a process of converting tacit knowledge into explicit concept and judgments with the help of language. Tacit knowledge may become explicit not only if the informational content is constrained to take the shape of an assertion, a theory or a hypothesis but also if it take the shape of a metaphor, an analogy or a model. By externalization the new explicit concepts are created from tacit knowledge.

Combination is a process of fitting and incorporating the concepts into systems. In this process the epistemic subject uses different technical equipments, facilities and networks. The previous information and knowledge is reconfigured, sorted, and combined with new information which was added. In the knowledge based society were developed new technical means which have the capacity to store in databases and to process the information according with the cognitive aims which were previously established.

Internalization is a learning by doing process of transforming explicit knowledge into tacit knowledge in the form of mental models and the so-called know how. The explicit knowledge is expressed linguistically in theories, documents, books, manuals, databases, and also it is spread in universities, or by the help of mass/media and other interactive means. Therefore, knowledge is re-experienced and interiorized by the epistemic subjects, individuals and organizations.

Nonaka and Takeuchi theory, following Polanyi, gave a definition of tacit knowledge which is based on the presupposition that it could be made explicit in some conditions. Therefore, in their view tacit knowledge is equally with implicit knowledge and it is opposed to explicit knowledge. This means that tacit knowledge is reduced to a relational property. Harry Collins developed in [7] this analysis of tacit knowledge and he has made a distinction between three types of tacit knowledge:

- somatic tacit knowledge which is embodied in the human body and brain;
- relational tacit knowledge which is able or not to become explicit in some circumstances;
- collective tacit knowledge which is embodied in society.

The approach proposed by Collins enlarged the traditional meaning of tacit knowledge and assured a new perspective on the role of it in knowledge based society.

I think that in the light of previous distinction proposed by Collins we can identify other two components of organizational knowledge which have a tacit dimension:

1. Knowledge embedded in organizational technologies, rules and procedures. Any organization tends to regulate itself with the aim to use efficiently its own knowledge. A person won't have any knowledge of these rules outside the organization and he or she is able to have some performances only within the organization.

2. Knowledge culturally embedded as aggregate of perceptions, values, beliefs, faiths and visions. This kind of knowledge contains a diversity of elements, from the neural software which have a cognitive interface to the so-called anonymous collective thinking in which an individual is kept. Some philosophers mentioned the importance of a biological or a historical a priori that grounds the knowledge and establish the conditions of its possibility.

last name only). Use the Dr. or Prof. title with each name separately; do not use plural Drs. or Profs. with lists of names.

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