Exchange Information or Knowledge?

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ABSTRACT

Despite the great variety of technical means available to acquire and to share knowledge, the searching for knowledge in response to a particular need still seems to lack efficiency. The aim of this paper is to contribute to a better understanding of this established fact. The formalization of the exchanges of knowledge between the producer and the consumer and the model thus obtained, allows to analyse the deficiencies of the technologies concerned as well as to map out propositions for their improvement.

Keywords: Knowledge, Communication, Knowledge Modelling, Ontology, NIAM, ORM.

1. INTRODUCTION

Nowadays, in the information age, the major challenge of scientific community is to intensively deploy new efficient Information and Communication Technology (ICTs) to face up the increasing amount of scientific information avaible today. That means a development of a real Knowledge Communication witch is a need of both researcher and industrial community.
Major motivation for scientists is to communicate their researchs in large community – scientists or engineers - to improve academic or applied research. The paper is organized to explore and to model the mechanism of this communication. The authors of the paper base their work on a ICTs tools and methods state of art.
Nevertheless, it is an established fact that one of the key issues of ICTs is still the lack of relevance of their answers in response to specific information or knowledge searches. Currently, these problems are mainly treated by technological ways such as Semantic Web [1] (W3C[1]) or by more conceptual ways such as Ontologies [2]. Their aim is to give a better structure to the information contained within Web pages by giving them a form allowing a more direct access to their semantic content. This evolution stresses the fact that information is not knowledge and that knowledge is not information. Information is considered as a support to communicate knowledge, and "to inform" is the activity to transform knowledge into communicable and usable information [3]. It can be noticed that, in spite of advanced ICTs solutions embedding knowledge into communicable information, the relation between a knowledge needed by a user and the knowledge (or "information"?) he receives remains however not sufficiently relevant. One of the main originality of our paper is to base the analysis of these insufficiencies on a modelling of the knowledge exchange processes between producers and users of this knowledge. The proposed modelling uses a method based on linguistic principles, the NIAM method (Natural language Information Analysis Method or Nijssen Information Analysis Method) [4][5] also well known as ORM (Object Role Modelling) [6]. On the one hand, this method enables to model an informal Universe of Discourse (UoD) expressed in natural language into a semi-formal model containing the semantic description of the significant concepts of the UoD. On the other hand, it enables to compare an equivalent of the resulting model in natural language with the original discourse allowing a more significant validation of its content, because stated in the same (natural) language. In this paper, we will use NIAM to gradually formalize the different available means supplying knowledge exchanges between producers and users. To illustrate it, we will limit our purpose to the particular case of knowledge exchanges between Researchers and Engineers which can be considered both as producers and users of knowledge. Through the analysis of this case, we wish to contribute to answer the following question: in the same way as ICTs support information, is it possible to imagine that KCT technologies (Knowledge Collaborative Technologies) could support knowledge in a collaborative process mixing efficiently humans actors and numerical agents?

2. ICT TOOLS TODAY: STAT OF THE ART

Today to share and to exchange informations is very easy with the new ICT tools. We can separate there tools in three categories:

- ICT with "Human-Human" relations,
- ICT with "Technological" relations,
- ICT with "Techno-Human" relations.

The "Human-Human", relations can be view as a direct relation between knowledge producer and knowledge consumer. Such as the synchronous exchanges between human actors must be considered as complementary to the asynchronous relations performed during the production and the search of Knowledge Objects. This

[1] World Wide Web consortium (http://www.w3.org/)

complementarity integrated today in the collaborative platforms is one of the success factors of this technology [7]. We can note that an integration of the knowledge search and communication means but there is not a real homogenization of the knowledge representations facilitating the semantic relations between producers and users of this knowledge. In fact, these platforms really improve the distant access to information in many various forms, but don't bring new solutions for a better understanding of the knowledge embedded in this information?

To support the search of Knowledge Objects with "Technological" relations, ICT tools correspond to the classical search engines which can be found on the Web and which give access to thousands of Web-pages available on any subject. Other tools as the channels RSS allowing to display a permanent updated Web-page and the automatic alarms on an electronic mailer are emerging today. For general knowledge exchange, the results are more hazardous. Who has not found information with these engines without really seeking it? This technique defined as the "serendipity" can give some positive results in contribution to Disruptive Innovation as shown in [8]. These automatic alarms use a technology based on "numerical agents" [9][10]. But, their role is limited to extract automatically information without real semantic analysis and to alert of the search results periodically. In fact, these agents have no more ability to find a required knowledge than human users they try to replace and who have configured them. Thus, as well as for collaborative platforms, we can doubt of the real contribution of these technological means to the improvement of the semantic level of the Knowledge Objects they find?

This lack of semantic analysis and the waste of time that "technological" results from this, very often encourages companies to contact expert companies in economic intelligence. These companies propose to personalize the search of information in the Web by taking into account the specificities of the customers and the requests.
The visual result is generally presented as a Web portal. This type of Web solution, which corresponds to the Semantic Web, aims at extending the simple search of information using syntactic comparison with *key words*, by supplementing this information syntactic definition by a more formal semantic characterization of its contents via metadata schemes.
The "techno-human" technology represented by the Semantic Web gives the user more precise results. Tim Berners [11] stresses that "*…the Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation …*". But, can we say that a semantic description added to the information representation is sufficient to transform it in a real knowledge?

3. NIAM METHOD: AN EXAMPLE OF MODELLING

Our research's approach does not want to develop a new ICT, because we risk to have the same pitfalls of the ICTs tools view previously. In fact, we propose the modelling of understanding when knowledge exchanges emerge between a researcher and an industrial. But, to model the emergence of a new common knowledge object is very difficult. This difficulty is most important when two actors who want to share knowledge in two Univers of Discours. The NIAM method adapt itself to this problematic.

The NIAM method is most frequently used today in the field of Software Engineering. It is essentially dedicated to the design and the implementation of Information Systems. The way to formalise a UoD into a conceptual model consists in (Figure 1):

1. Understanding of the UoD (by interviews of experts, reading of reports, etc.) and linguistic analysis of the natural language sentences (elementary sentences, constraints, etc.) describing the UoD (Figure 1.a),
2. Modelling in NIAM/ORM formalism the elementary sentences and the related constraints (Figure 1.b),
3. Validation of the resulting NIAM/ORM model by submitting the equivalent of the model in Binary Natural Language to the experts (Figure 1.c).

❶ A NOLOT (NO Lexical Object Type) describes an object/ actor identified in the discourse and characteristic of the UoD.
❷ A verb/predicate describes the role played by an object in relation with another object.
❸ A uniqueness constraint is a rule to declare that the role played by an object will be only one time. The absence of uniqueness constraint indicates that the object can play the role more than one time. When the arrow is extended above the two roles (like in this example), it means that there is no uniqueness constraint on each role.
❹ A mandatory constraint specifies that any occurrence of an object will necessarily play the role of which it is the subject. The absence of mandatory constraint indicates only that the object not necessary plays the role of which it is subject.

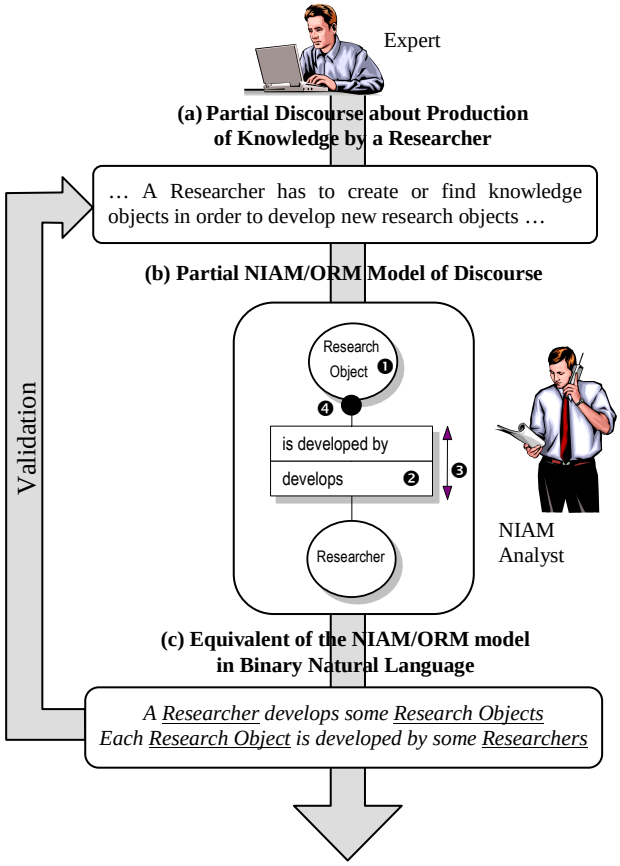

Fig. 1. Partial NIAM/ORM Model of the development of a Research Object by a Researcher.

This linguistic analysis method leads to a model that formalizes the knowledge extracted from the textually formulated information. The resulting model holds more semantics than the initial expression, in the sense that it includes the expression's context and minimizes its

implicit character. The NIAM/ORM models presented in this paper have been designed with the Microsoft VisioModeler case tool[2].

4. TOWARD AN INTEGRATED KNOWLEDGE AND COMMUNICATION OBJECT

So, we can note that the "human-human", "technological" and "techno-human" means seem to be dedicated to only transmit information and not knowledge embedded in this information. Even if these means really facilitate the search and the exchange of information, the user is still in charge of the extraction of the knowledge from the information he has received. Adding easily new information on the Web, finding very quickly any information resulting from a very powerful search are not sufficient facilities to solve the main problem of extraction and common understanding of knowledge included in this information.
So, we propose an alternative to these current approaches that promote extensions of the Communication Objects by integration of some features of the Knowledge Objects to be communicated, but maintaining a separation of their respective technologies. On the contrary, our approach aims to deduce the Communication Objects from the Knowledge Objects to be exchanged and to better integrate their respective technologies. Let us comment this approach by illustrating it on the NIAM/ORM model.

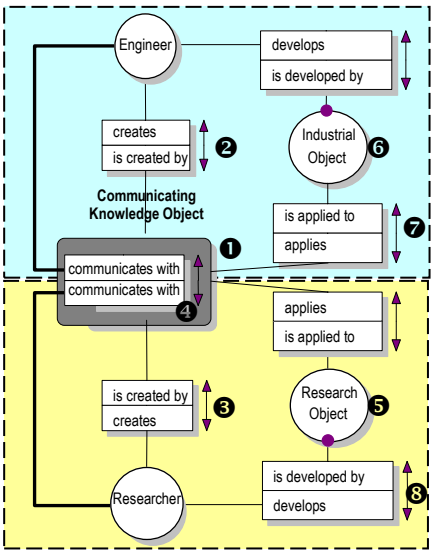

Fig.2 "Communicating" Knowledge Object Model

The communicating knowledge object is the center of the knowledge exchange into two different Univers of Discours. Industrial and Researcher are in two Univers of Discours, this is the "communicating knowledge object" context (❶ in Figure 2). Engineer creates the Communicating Knowledge Object (❷ in figure 2) and to create new Knowledge object, the Engineer has previously to consider other existing Knowledge Objects produced by other Engineers (or by other source of production). The researcher creates new Knowledge object in the same conditions(❸ in figure 2). Once Knowledge Object created, Industrial communicates with Researcher (❹ in figure 2).

To create new Knowledge Objects, the Researcher has previously to consider other existing Knowledge Objects (❺ in figure 2) produced by other Researchers (or by other sources of production). Based on this "State of the Art", the Researcher potentially produces new Knowledge Objects (in various forms: PhD thesis, publications, conferences, etc.) that become themselves new basis to create new knowledge. The means classically used by Researchers to search such existing Knowledge Objects perform asynchronous and/or synchronous processes. Search bibliographical references in a university library, consult references of scientific editors or search directly on the Web are some examples of asynchronous accesses to existing knowledge. Synchronous processes can be illustrated by direct discussion between Researchers during scientific events or by using current communication technologies (e.g. phone, phone conferences, video conferences, sharing of software applications, etc.).
The same activities and means also exist in the Engineer's UoD (❻ in figure 2). In fact, an Engineer also creates and uses Knowledge Objects in the frame of Industrial Projects aiming the development of new Industrial Objects (e.g. new products, new services, etc.). He uses similar methods to those used by the Researcher to search and find existing Knowledge Objects: by asynchronous mode, for example, by consulting technical reports and professional reviews, or, in the synchronous mode, by direct contact with others Engineers for example during technical exhibitions or in the frame of his professional relations (customers/suppliers).
After de creation of the Knowledge Object, the Communicating Knowledge Object applies Object of industrial.
The Applied Research process(❼ in figure 2), which is similar to the Industrial Innovation process potentially exists when an Researcher wants to develop new Research Objects applying to them Knowledge Objects coming from his own research works or from other production sources. As we define it previously, we can propose the Communicating Knowledge Object applies the Object of Research (❽ in figure 2). For a Researcher, there is mainly two ways to justify the production and the use of knowledge. The first one aims "Applied Researches" that encourage the researcher to develop new Research Objects (e.g. a new material, a new process) by applying to it a Knowledge Object (e.g. a theory, a method, a model) already defined. The second way corresponds to more "Academic Researches" which consist for the Researcher in creating new Knowledge Objects only for the evolution of the scientific knowledge (not necessarily and directly applicable to a particular research object).

5. CASE STUDY: ACOMAS/CASA

An example, at least partial of such an approach, was already validated within the framework of the research works of [12]. One of the main results reached by these works was the prototyping of a communication tool (ACOMAS in French, or CASA: Computer Aided Standard Application) directly deduced from a NIAM/ORM model of the knowledge extracted from the standards. The general method used to develop this tool is illustrated by Figure 3.
The principal objective of this work was to allow the machines designers (particularly, mechanical presses) to have a more direct access to knowledge normative related to the safety of the machines.
In fact, the concerned standards are accessible physically shaped in texts papers but also digitalized and so facilitating the access to the information but not solving the problem regarding the access to knowledge, since this still limits the use of the norms by the machines designers.
The Universe of Discourse (❶ in Figure 3) was composed of the standards and the experts, authors of these standards
The analysis of these texts, supplemented by interviews of experts, was carried out by using the NIAM method and led to the development of a normative knowledge model (❷ in figure 3). This model was then transformed in Binary Natural Language, in order to compare it with the initial texts and to validate it by the concerned experts.

[2] © Microsoft Corporation

Once the model was validated, a software genius ISW tool [13] made it possible to seize the NIAM model and to derive the two following complementary forms: a relational structure (❸ in figure 3) translating the logical architecture of the objects and the logical architecture of the relations of NIAM model and its constraints, and an interface man/machine prototype in the form of sheets(❹ in figure 3) translating the possibilities and the access constraints to the knowledge supported by the data base.
The result is shown as a software tool prototype that is composed of a physical data base accessible by an interface "Windows" built from sheets. The use of this ACOMAS prototype shows all the interest to be able to interact with and navigate in knowledge while getting rid of the use of its textual form.
If we transpose the ACOMAS problem of to our, the researcher could correspond to the expert in standards (producing of knowledge), and to the industrialist with the originator of machines (consuming knowledge).
if we reverse Acomas's problem to our problem, the researcher could correspond to the standards expert (knowledge producer), and the industrial to the machines designer (knowledge consumer).

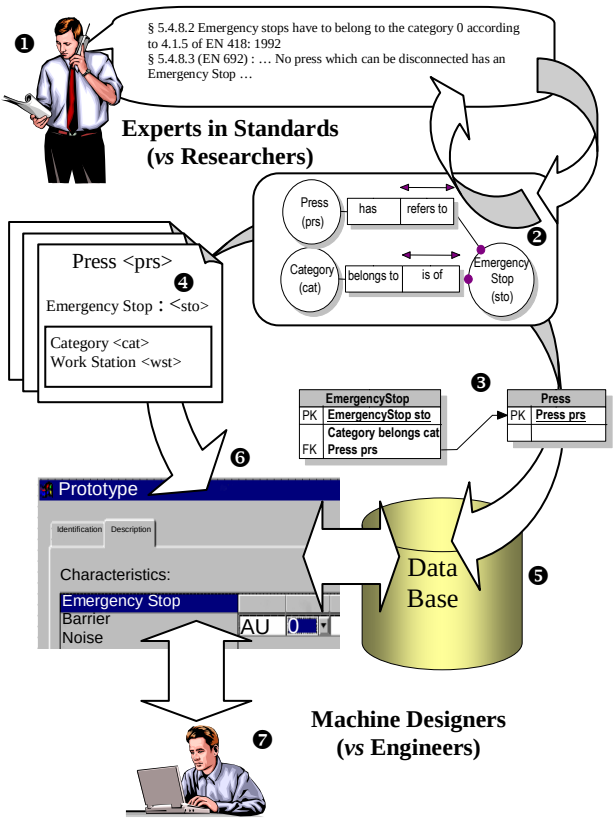

Fig. 3. Overview of the ACOMAS/CASA Method

The result is a software prototype that is composed of a physical database (❺ in Figure 9) generated from the relational data structure, and a "Windows" interface (❻ in Figure 9) generated from the man-machine interface specification. The use of this ACOMAS/CASA prototype (❼ in Figure 9) has shown the interest to enable direct interactions with the normative knowledge rather than to use their textual form. Finally, if we transpose the ACOMAS/CASA approach to the purpose of this paper, for example, Researchers could be assimilated to Experts in Standards (knowledge producers) and Engineers equivalent to Machine Designers (knowledge users).

6. CONCLUSION

The construction logic of the normative knowledge model provided by ACOMAS, requires a formalization effort of the Knowledge Object, which implementation and long and expensive. This effort, to practise with the appearance with each Object of Knowledge constitutes today an obstacle with the generalization of this approach. This effort applied to the appearance of each Knowledge Object constitutes today an obstacle for the generalization of this approach. Nevertheless, based on these works their results, can we create a method and a tool allowing a more direct exploitation of the knowledge expressed by the generation and the development of the NTCC?
While pushing this reasoning beyond, the perspective of a world without computers, in which the knowledge transmission would be almost instantaneous and constraint-less, is this a possibility or a utopia?
Nijholt [14] imagined an intelligent environment in which man would not have to be worried any more with the physical logic and with use of a computer or a software. This environment could propose a dialogue with a virtual man rather than a screen.
We can imagine "humanized" interfaces provided with interactive agents which would be equipped with verbal or not-verbal communication capacities of (and why not equipped with feelings). This concept is currently studied by Philips: Icat [15]. In fact, research in this field is very advanced. As the European ISTAG project [16] plans for the horizon 2010, the concept of Ambient Intelligence (AmI) will allow that the daily use objects could communicate themselves and with the man. This project is structured around three axes: "Ubiquitous Communication" which concentrates on the various communication methods between the physical objects of our environment; "Intelligent to Use Interface" which relates to the interface between the physical people and the physical objects; and finally "Ubiquitous Computing" which concentrates on the digital processing part based on the agents and their numerical architecture. From Nijholt Futuristic vision, integrating the ambient intelligence of the ISTAG project, we can thus expect to see New Knowledge and Communication Technologies (NTCC) which would answer to the problems of this article. So, an industrial in search of knowledge produced by a researcher, would be able to understand them in his own language and with his own terminology, by the use of a simple dialogue with an "intelligent" interface. In fact, the Knowledge Object would configure the Communication Object in order to make the knowledge more accessible to any user, this same Communication Object must, at the same time, contribute to the evolution of the Knowledge Object from which it was created.

It is in this direction that we aim our current research tasks in order to contribute to the emergence of these NTCC in a context of "extended" Intelligence Ambient, i.e., indistinctly integrating human agents and numerical agents in the same "Intelligence System" allowing them to share and develop common Knowledge Objects in a transparent way.

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