Technology Based Diffused Knowledge Acquisition & Sharing. Constraints and Possibilities (*)

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ABSTRACT

The paper discusses basic possibilities and constraints in technology mediated knowledge acquisition and sharing, both for personal and community needs, levering on cognition pragmatic paradigms and knowledge representation technology. Knowledge acquisition and sharing possibilities apparently increase as computer and communication technology spread world-wide, often thanks to multimedia information infrastructures and to diffused embedded technological mediators as instruments of governance of natural, artificial and cultural ambits and of social economic development. But actual cognition processes of an agent (natural or artificial) experimenting a technology mediated "reality" in a given context, appears to be a contingency biased by the aim of the agent. Accordingly to the work the efficacy and efficiency of specific trade-off among constraints and possibilities in technology diffused knowledge acquisition and sharing may be discovered in practice, leveraging both on human-agents experience and pro-active intelligent infrastructures, supported by advanced logic paradigms, as suggested by pragmatist philosophical conceptualization. The necessity to "ground" technology mediated "realities" by mean of common practice and technological standards, suggests the opportunity to leverage on Government needs as well as on the media industry historical experience.

Keywords: Communication, Knowledge Representation, Technology Diffusion, Pragmatic, Social Development.

1. KNOWLEDGE TECHNOLOGY DIFFUSION

Information and communication infrastructures are recognized since a long time as a fundamental support to knowledge, democracy and general social development [1]. *Technology diffusion* and *embedding* processes, as stressed a few years ago, are considered a fundamental source of new social and economical opportunities, as well as of new threats [2].
Learning, and knowledge sharing and enhanced cognition appear a fundamental leverage to boost general productivity and a strategic source of competitive advantage and economic growth [3]. In fact, as increasingly smaller and powerful systems become available, appears more possible than in past to use transducers and to embed "intelligent" devices in several objects common in living and working contexts, or diffused in the territory. It is generally accepted that these technological platforms might boost diffused learning (and related economies) in a near future and provide even more robust possibilities to augment personal functions and possibilities (such as the possibilities provided by enhanced vision devices), supporting mobile (anytime-anywhere) communications and the access to large knowledge repositories. Technology diffusion promise to boost these possibilities for the general public thanks to technology diffusion processes that appear to follow the path of telecommunications, where Internet now offers to residential users possibilities available only to corporate employees just a few years ago. In fact while often industrial control applications as shop floor and robotics system collect "real" field data directly, these functionality will be very likely extended to the territory particularly thanks to the diffusion and embedding of technology in living contexts (as lightweight devices / transducers thanks to other enabling information infrastructure as hybrid - wired/wireless - networks). But very likely a new generation of "intelligent" artificial agents, embedded in social contexts, will boost personal possibilities to experiment a mediated "reality" and the need to re-use and share real-time or stored digital common "knowledge" (to achieve economy of scale, of scope and to speed up learning curves, cutting "transaction" costs), eventually emphasizing knowledge representation and standardization related problems [4], that sometimes appear to be as old as the history of the western civilization.

2. KNOWLEDGE REPRESENTATION PARADIGMS

It is generally accepted by scholars and practitioner, (in the Anglo-Saxon community), that abduction, as Peirce called hypothetical inference [5], is a fundamental cognition process that support common sense judgements and decision making.
"Real" objects are accordingly identified as independent entities (a primary character called Firstness by Peirce) or as being relative to a second entity (to an agent - this is the case of a relation - called Secondness by the same Author). When a first entity and a second are brought into relation by a third one, a mediation category is originated: a Thirdness for Peirce. Business practice seems to support Peirce categories. For example for a device Firstness is a technology, Secondness the benefit of that technology for someone, and Thirdness is its impact to a business, that by definition involves producers, customers and more, in general, an industry community. Accordingly to Peirce and to Whitehead characterizations [6] a cognition processes will be characterized as a general *occasion of experience* where an actual entity (a Firstness) is "prehended" by an agent "concern" for a patient, creating a Secondness, that is related to the agent's personal expectations, goals and abductions in a context. Two agent-patient prehension in a context may create a *nexus* of interrelations - Thirdness - that represents a typical structure of a mediated process of knowledge sharing and acquisition.

A triadic structure is common to other well known (often mechanistic) conceptualizations used to characterize a natural agents interaction with patients, in contexts [7], but Whitehead concept of occasion of experience may be mapped to Peirce categories and appears a very useful analysis tool. In fact the concept allows easily to note that knowledge acquisition experience actually may be very different for the same human agent, in the same context of communication with a patient, using the same media, but in a different occasion, for instance if agent's expectations change in time. This stresses the known fact that technology and artifacts, that generally are introduced in social life processes to improve human and artificial agent possibilities, actually may operate as constraints in unplanned occasions of experience. But there are other structural constraints that may arise in the case of mediated knowledge processes, accordingly to Whitehead, that may affect in depth even basic characterizations of "reality", because while entities may endure in (some) time as do Scientific Law of Nature, and conceptualizations recur, new, previously unknown, things may just occur. But to predict ex-ante "knowledge" mediator function in every context is not easy for the reason that, accordingly to Whitehead and field practice, recognition of entities may change in a different occasion of experience or if changes the individual agent "concern" for the patient. In other word if there is a change in the relation of the agent with the patient.

Whitehead in fact stresses the complexity of human experience emphasizing that civilization itself appears to be the result of basic intertwined patterns: behavior, emotions, belief and technologies, all with some degree of overlapping and variability. Researching a common root to all these occasions of experience he visits Plato's basic ontology (the being, space and becoming) and particularly the concept of the "foster-mother of all becoming" (the so called Receptacle [8]) as the "matrix of all begetting". Whitehead accordingly characterizes agent-patient context continuum of interrelations as a "nexus" in which "a person" appear to be actually a society of societies (where every agent has goals and occasions of experience). For instance it is a vision accordingly to which an Army can be seen as macro-micro society of societies made of regiments, men, cells (as blood and bone but also as human experience and – we say - cultural objects as powerful as beliefs), atoms and so on. This conceptualization allows to describe a frame of knowledge related to some "reality" as a vector-description of objects and events in a continuum that include past-present and future (expected or possible) events.

Accordingly to the pragmatic framework "reality" is a continuum where even physical objects may be considered to endure or to occur (that is to say to be "continuants" or "occurrents" to use accepted definitions), accordingly to a given context and to a particular concern of the agent for the patient (as in the case - for instance- of a river that stands in time but flows with a variable course). Another basic critical constraints for an efficient use of available standard knowledge bases is the level of details and persistence with which objects, rules and contexts are represented in a knowledge repository, designed to support common prehensions (dyadic relations). For example a geographic information systems in order to serve a community of users requires the definition of specific thematic maps and -more in general - a "nexus" of concepts and rule representations linked in a lattice of possibly conflicting relations (as it is known) with different users' views of basic common territorial entities.

The granularity of the knowledge base actually defines which subset of common prehensions, out of the many possible for every single object in the various contexts, is represented, in front of a common set of "objects" (or ontology), of common rules (or epistemology) as Law and so on, that can be provided to an agent to support knowledge acquisition and decision making. In practice human agents appears to adapt ontology and epistemology in every occasion of experience dynamically, accordingly to the agent goals in every given context. It is easy to understand, for instance, using an "intelligent" word processor, that often intelligent devices or mediators are based on a set of knowledge representation and technologies that are tailored for out of context experiences occasions. But for what attractive and powerful the system may be, its embedded logic has the limited scope (time /or space) of application and the relativity of any scientific knowledge. To try to summarize a knowledge acquisition and sharing process may be characterized as a continuum of a natural, artificial and cultural *common ambit* , specific to a community of users, each of them characterized by their own *personal ambit,* extended from the past to the future. Even reading a book of a dead writer in a remote resort appears to be the result of a nexus of social relations and entities, such as a human body set of sub-agents, that provides common basic feeling and needs. Is a nexus that includes manufacturing of raw material, paper, ink and machines used to edit and produce the book, parents and educators that provided the common language, knowledge, as for instance logic, and other cultural assets that "connect" the agent with the author, where past present and future (as the reader's particular aims or expectations for the future in reading) are parts of the continuum. Applying to this continuum the described pragmatic characterization in every instant a "person" appears in fact to be part of a complex nexus made of a number of natural, artificial, cultural and social interrelations. Such a personal ambit for an agent may be represented as *the space of that agent's possible prehensions (all Firstness and Secondness)*, while a nexus establish a *common ambit with another prehensions' space*, that may augment the personal possibilities or introduce constraints, for instance limiting the number of signs in a communication context (Fig.1).

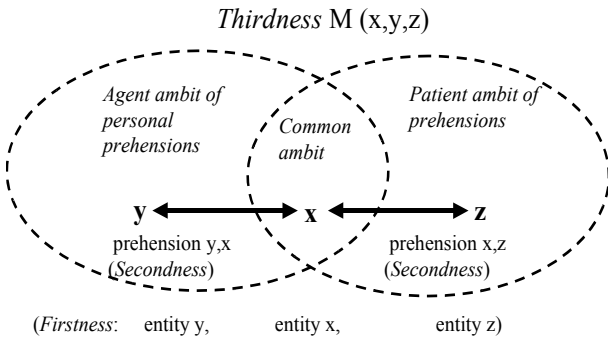

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Fig 1.

A basic "molecule" M(x,y,z) of mediated knowledge may be represented by a triadic relation of three entities structured in at least two relations (or "prehensions").

Using (with Sowa) a simple notation to express a "molecule" of mediated knowledge, that will be called here the basic mediation context M, it is easy to see that the minimum mediation nexus M will require at least three entities x, y, z: M(x, y, z), where x mediates y and z entities. If y and z are human agents x may be as abstract as a representation of price, and M a market. Or as real as a physical telephone, and M a communication context. In a communication nexus x may represent an event as a visual sign, as a sadden opening and closing of an eye. As shown by Peirce in a mediation context an entity may be related to another, via several types of sign (as icon - index or symbol). But the same physical object, represented with the same symbol, could be related to a different concept (y') to a different agent. Knowledge sharing require in fact to deal with different hierarchy of representations. *And it is interesting to note that an agent is characterized by the space of his direct and mediated prehensions. The agent is a contingency in any occasion of experience as well as the patient and the context.*

The "grounding" of a mediation nexus, that is to say the action of providing a feedback to communication, is another occasion, and is a contingency as well. The process may require to create an additional nexus among y and z. It is interesting to note that the characterization emphasizes the role of *occasions* as drivers of cognition events, neither any agent nor any patient role, and that the agent and the patient in the nexus influence each other. As expected a particular represented nexus appear to be effective accordingly to ex-ante expectations only with reference to a given context and to a given set of particular occasion of experience. In fact the triadic basic relation expresses a nexus of relations that can be grounded only by practice. It seems at this point of the discussion very opportune to remind a fundamental John Dewey' s observation [9]: that the human-agent selection of the proper representations in the actual context is the problem of living. Accordingly to Dewey learning and knowledge sharing occur in a networked community of learners-experimenters.

3. MEDIATED KNOWLEDGE SHARING

Humans share a common physiology, a set of basic needs and common feelings and the likes that are themselves sources of mediation to a common ambit. Nevertheless, to share a common knowledge, is required a common language and some degree of common practice. In fact often organizations develop special meaning for words or community specific slang. And while human can face a good deal of ambiguity in the language and fuzziness, knowledge in order to be stored in bits, first must be formalized, as it is known, with the help of logic and of various kind of computable conceptualizations. As mathematics or philosophy, these are domains of specific scientific researches.

These higher level abstractions, as it is usual in science, may actually became a constraint to a cognition act. This is what may occur when some expert, "biased" by his own past occasions, defines knowledge representation hierarchies, for instance designing a software application. Unfortunately knowledge representations practice often appear to be directly inspired by a kind of Aristotelic materialistic thinking [10]. An approach that arises with the assumption that exists principles or framework of knowledge related for instance to physics such as infinity, continuity, place, time, motion or to biology, where living being parts appear related to purpose, that can be applied to human agents as well, that are human-agents and contexts independent. Or, when rule or other objects are assumed to be contexts dependent, that is to say that may exists a vector of relation rule-to-contexts that is universal or context independent. But "information is information", and may generate effective communication processes only in a known social or technological (as network ISO/OSI standards) context, for instance in a context of communication using a given channel (a telephone, a digital network and the likes). And while Aristotle privileged experience, in artificial agents such a knowledge-base system, logical and computational manipulations of knowledge coded in artificial intelligence shells appears not very different from the idealistic vision of a reality made of framed "abstracts ideas or notion of things", that can be found in Berkeley's philosophical writings [11], that is to say to a problem of knowledge representation, rooted in Plato. In other word such a systems, even when they may adapt to the context and learn from the context, appears to be bound to their designers experience and philosophy (or abductions about the word). Fortunately the practice of system building and design (particularly field prototyping carried up together with users) often introduces pragmatics. Users practice actually do the required semantic "grounding", and these systems works.

Nevertheless conceptually it appears that several system are the result of the worst outcome of both a materialist and a idealist approach. These are design limits that may eventually became critical when "knowledge" or conceptualizations are used in a different context o in a different practice.

This kind of problem will probably increase with the need to share knowledge among human or artificial agents and systems related to diffusion technology processes.

Researches on knowledge representation and symbolic computation sciences appear fundamentals tools for knowledge sharing and communication as powerful as the discovery of binary systems for number representations.

But not all the Logician emphasizes that it is thanks to pragmatics and practice that "knowledge" representation is "grounded", allowing common knowledge sharing in a community of users. In fact even Berkeley noted the power of natural language and that, while it is difficult to common people to frame abstract ideas from particular objects, "..this is not necessary for communication, which is so easy and familiar to all sorts of men". These words perhaps may explain the success of wide band telecommunication infrastructures that often appear be easily used by users that share a common practice and all the flexibility of every day language. Users of these infrastructures in fact create a hybrid human-artificial agent based system, a contingent informal communication context that is based on a number of (hidden for the user) levels of highly structured engineering objects, abstractions standard technologies and cultural customary practices.

It is in fact generally accepted that engineering is a science and an art where abstraction and creativity go together with practice, where often complex systems that work (described as hierarchy of subsystems and components) evolved from a simpler prototype, developed with the community of users [12].

4. COMMON LOGIC PLATFORM & PRATICE

Standard are needed, and several efforts are underway in almost every main industrial industry, as in ISO or IEEE organizations [13], that may provide a strategic conceptual common backbone to fundamental industries and to government. For what have been said, particularly promising appears the work on Common Logic Standard, that for instance is looking to avoid ex-ante syntax distinctions between entities and relations (or predicates making use of just one predicate "apply" – for instance "blue" to an entity x), a feature useful to implement agent-patient-context relative ontologies, that is currently engaging a number of contributors to the IEEE 1600.1 Working Group. We can say that, in general an artificial intelligent agent should have some degree of (a) metaphysical learning capability, (b) abduction possibilities to identify a patient in context of a prehension, (c) as well as the possibility to learn from the context practice in the interest of a (d) community of users for conceptual and practice definition, for every specific (e) aim or goal of the system.

4. CONCLUSIONS

Knowledge acquisition and sharing appear to occur when commons are created in a community of user, where knowledge representation is "grounded" by a number of shared assumptions (abductions) and by a given practice. The problem to identify modes to link general tools for knowledge representation to contexts and to a community of users specific needs and practice, appears paramount for the effective and efficiency of knowledge acquisition and sharing, in front of technology diffusion processes. There is both the opportunity and the need to embed pragmatics in autonomous artificial intelligent systems and in systems design practice to support human knowledge acquisition and sharing. This may be considered just a return to basic for Artificial Intelligence where, in the early beginning, interdisciplinary researches (from philosophy to physics and biology) where a normal research practice. Governance needs may provide a conventional backbone of conceptualizations and knowledge representation standard, tailored to strategic social and economic needs, useful for general public actions. This means that there is the need to find a trade off between standardization and conformance to common needs (as security or law enforcement) and agents' freedom and creativity, to guarantee effective knowledge acquisition and sharing processes in the various contexts. It seems opportune to create a government driven learning community, extended to the industry of strategic corporations and of the research institutions. Given the huge amount of data that is currently accumulated in computers, the definition of standards for conceptualization and knowledge representation appear to be critical success factors for social and economic development. Intelligent systems designed to extract information from daily operation and communications seem to be particularly suitable to help general knowledge sharing. Often users of commercial systems appears to be embedded in a sphere of ex-ante knowledge, where everything appears to work up to next breakdown. There is clearly the problem to reinforce field knowledge acquisition feedback in such systems. More possibilities to embed information in various objects, intelligent agent diffusions (as artificial intelligent agents, robots and other intelligent devices) show that the need to acquire and share technology mediated knowledge very likely will increase. In fact personal cognition processes, accordingly to pragmatic characterizations, appears more clearly than in the past related to a social network of technology mediated human and artificial agents. System design for that reason should be "grounded" as well in front of the actual practice of the users' community. Learning and knowledge sharing appear to require the creation of an hybrid human-artificial nexus of nexus, supported by common practice, of technology mediated common ambits, *where an agent is identified by the space of his prehensions.* Autonomous artificial agent should be able to adapt and learn from the contingency, both dealing among themselves and human agents, in contexts. But it appears that *developments of knowledge representations science and technology require the study of new practices as well,* to improve the efficacy, the efficiency of related users social and economic processes: in short society and business learning. Diffused knowledge acquisition and sharing processes in fact are recognized as one of the main development engines of our modern world-class society, and it appears useful to leverage on established experience of the traditional media industry to "ground" knowledge sharing and acquisition practice accordingly to general public practice. In fact human and artificial actors' freedom to learn and share knowledge should be granted as much as possible in order to protect creativity, entrepreneurship and social diversity.

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