Collective Knowledge Development from Humans to Knowledge Systems

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INTRODUCTION

In this article we will discuss and analyze the concept and the role of knowledge produced in online social communities which interact by means of collaborative platforms.

After a formal definition of knowledge, we shall follow a path through other existing definitions specializing them to the context of interest; three visions of knowledge will spring: collective knowledge, knowledge in semantic social networks, and procedural knowledge. Collective knowledge is given a formal definition which will lead along a path to verify when a system really supports knowledge management. Procedural knowledge can be managed by means of task management systems which offer tools to deal with computational agents representing autonomous tasks in a work process. We therefore describe the knowledge life cycle in the context of online Open Source communities, the tools and techniques exploited to produce and manage procedural knowledge. Finally, we present a framework based on social networks and *folktologies* for a *better* knowledge management process.

The conclusion wishes to stimulate imagination about leveraging the interactivity in Open Source communities by means of semantic social networks and their development of procedural knowledge through the adoption of task management systems.

BACKGROUND

According to the Dictionary of Italian language by Tullio De Mauro (De Mauro, 2000), the term *knowledge* refers to:

…being aware of something (knowing something), to possess a notion, or a set of organized notions, having cognition of something, the activity of knowing through the study, the investigation and its outcome (authors' translation).

In relation to the concept of knowledge, it becomes necessary to define *intelligence*, that is (De Mauro, 2000):

…the power of the human mind to understand, think, judge, communicate facts and knowledge, to make judgments and develop solutions in response to external stimuli, to adapt to the environment or to modify it to suit his/her needs (authors' translation).

However, in recent years, the scientific community gathered around the theme of the Semantic Web, wanted to liberate the concepts of collective and connective intelligence. Gruber asserts to consider inappropriate the use of the term *intelligence*, a concept that requires intellectual activity and therefore rational, human, because it can't be, in his opinion, related to a technological system such as the Web (Gruber, 2008).

Gruber often uses the term *intelligence* as a synonym for *knowledge* (Gruber, 2008), even if intelligence presupposes *cognitive functions, adaptive and*

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imaginative, generated by the human brain, actually not comprised in the set of capabilities and function offered by a computing system.

Polanyi (1966) stated that knowledge can either be *explicit* or *tacit*. Explicit knowledge is the one we can express through the language, based on propositions and assumptions. Tacit knowledge instead, comes from and is made of experience, so that it cannot be expressed through the language. According to Polanyi,

Tacit knowledge is a form of implicit knowledge we rely on for both learning and acting […]. The 'scientific' account of knowledge as a fully explicit formalizable body of statements did not allow for an adequate account of discovery and growth. […] Knowledge has an ineliminable subjective dimension: we know much more than we can tell.

Knowledge representation, developed in the 1960s, deals with represent and organize human knowledge to allow its usage and sharing. Knowledge is not always represented by words and sentences; traditional tools for knowledge representation are taxonomies or classifications, used to organize knowledge about real entities, or thesaurus, to classify and index documents. More formal tools are, for instance, conceptual graphs or semantic networks. For what concerns new technologies, the formal representation of knowledge developed in the field of artificial intelligence. In a formal representation, knowledge is expressed by objects connected by logical properties, axioms and rules. Web development, and in particular the perspective of the Semantic Web, has renewed the field by introducing the controversial term *ontology*. A number of languages have been developed like the Resource Description Framework (RDF), Web Ontology Language (OWL) and Simple Knowledge Organization System (SKOS) to formalize knowledge through inferences, i.e., processes starting from a true proposition, and deriving a true conclusion.

Complex applications for effective knowledge representation have been developed on top of these languages, such as the RacerPro software, allowing users to build knowledge-based systems for demanding applications scenarios ranging from autonomous agents on the semantic Web to knowledge-based software engineering through the use of an easy to use interface (Haarslev et al., 2012). A system for knowledge representation must have the following characteristics:

- **Expressive Power:** The ability to express knowledge domains with different characteristics;
- A notation easy to understand;
- **Efficiency:** The ability to structure knowledge to facilitate and speed up its use to solve problems, while avoiding redundancy;
- **Flexibility, Modifiability, Extensibility:** Essential characteristics for a knowledge base (Frixione, 1994).

A Formal Definition of Knowledge

Information is an objective entity that can be created and transmitted, independently from sender and receiver. Information is such a powerful and elusive concept that can be associated with several explanations. Polysemantic concepts such as information can be fruitfully analysed only in relation to well-specified contexts of application.

According to Floridi (Floridi, 2003), false information, a misinformation or a disinformation are not kind of information. Floridi focuses on just one specific aspect of information: the semantic information, from an epistemic point of view. He defines semantic information as well-formed, truthful and meaningful data.

Creating knowledge implies the ability to give explanation or justification regarding the given information; otherwise, we should consider us simply informed about what we think we know. Dretske (1999) provides a definition of individual knowledge as *justified true belief* (JTB) that is a subject's conscious belief, sustainable by rational explanation. More formally, supposing that *S* is a cognitive subject and *p* a proposition: *S* knows that *p* if and only if:

- *p* is true,
- *S* believes that *p*
- *S*'s belief that *p* is justified.

p is a cognitive object (a signal, a proposition, a message) perceived by *S*; *p* comes from a cognitive source, from which *S* receives the information. If *S* is convinced about *p*, then what *S* thinks can be qualified as knowledge, but only if it is true.

The *truth* condition shows an expression of facts, events, or status of the things, providing a certain