EDITORIAL

by Luigi Colazzo and Nicola Villa

Focus on: Semantic Web and e-Learning

This issue is dedicated to an exploration of how research on the Semantic Web has affected **learning technologies** and **knowledge management**, the two main areas of interest of this journal. Our aim is to provide a – partial – overview of current research on the subject in Italy. To this end, we have asked a number of research groups in Italy to send us some of their work on the analysis of the various possible connections that exist between the semantic web and learning.

The implementation of these ideas has become both more widespread and more fruitful in recent years; this issue attempts a, somewhat delayed, celebration of the tenth anniversary of the birth of the Semantic Web.

The observation that all communicative acts are possessed of different aspects at the logical level (syntactic, semantic, pragmatic) was made by C. Morris[1]. The first of these levels, the syntactic, initially attracted most interest from computer science researchers. In its early years, in fact, the discipline was dominated by research into artificial languages linked to the implementation of algorithms. Artificial languages created specifically to be *context free* are basic syntactic structures with rigidly defined semantics, according to which there is only one valid semantic interpretation for any expressible syntactic proposition in a language. *Context-free* artificial languages abhor ambiguity as they are required to describe the semantics of algorithms precisely in order to turn them into programmes. However, the semantic problem, as was almost immediately understood, went well beyond the modelling of procedural knowledge captured in the concept of algorithm.

Academics immediately identified three problems. The first was the **automatic translation of one natural language into another natural language**. It quickly became evident that this was not a straightforward process, in fact no technological solution has yet been found for the problem. Knowledge only of the syntactic structure of two languages is not sufficient for the translation

[1] C. Morris (1938) Foundation of the Theory of Signs. International Encyclopedia of Unified Science, ed. Otto Neurath, vol. 1 no. 2. Chicago: University of Chicago Press, 1938.

of an idea from one language into another: it is also necessary to model them at the semantic and pragmatic levels.

The other problems involve **data collection, organization and retrieval**. If the data is made up of documents (*information retrieval space*), the meaning – the semantics – of each document is encapsulated in the language in which the document is written. The solution is to make the meaning explicit in structures of greater or lesser complexity, distinct from the document and compatible with artificial processing systems (*meta data*). This process of semantic annotation can be either manual or mechanical but is, in either case, very unreliable. If, however, the data are collections of records in a set format (*Data Base space*), then it is semantics that make the data comprehensible and they therefore form part of the definition of the collection of records. In other words, the semantics are captured by the model of the file through the names given to the different elements of the records. Thereafter, the problem of meaning has been differently conceived by academics in the AI field. The introduction of logic into computer scientists' sphere of interest has increased understanding of the problem of semantics and has, above all, allowed the development of algorithms and data structures suitable for the execution of automatic inference processes on logical clauses.

Tim Berners-Lee's original vision of the Web did not include semantics. In a HTML document semantics are encapsulated as they are in a paper document: in the text. The links incorporated into web documents describe the network of connections between documents but not the text semantics, nor, in fact, the meanings of the connections between the documents. In other words, the original form of the Web was that of a huge universe of documents. It was left to either the person browsing a document or to the search engine's information retrieval algorithm to decide the relevance of each document. Tim Berners-Lee himself realised that this state of affairs was not sustainable because it did not allow for in-depth artificial processing of the knowledge contained in web documents. In a 2001 article Berners-Lee[2] launched the ***Semantic Web*** initiative, defining it as:

"*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.*"

The project to allow semantic annotation of the web has undoubtedly opened new perspectives in computer science and in web based applications. After

[2] Tim Berners-Lee (2001), The Semantic Web in Scientific American

more than ten years we are beginning to see the first results of this effort; the work presented in this issue represents a revealing cross-section of the situation in Italy, particularly regarding the use of semantics within education projects.

Giorgio Poletti, in the first article of this issue (*Describing documents: from the search for terms to the search for meaning*), introduces some of the fundamental ideas of the Semantic Web, reflecting on its relationship with didactic technologies.

Giovanni Adorni, Mauro Coccoli, Ilaria Torre - members of the research group at the Laboratory of E-learning and Knowledge Management at the University of Genoa – in their article *(Semantic Web and Internet of Things Supporting Enhanced Learning)* discuss the possible evolution of e-learning supported by tools and technologies linked to the Semantic Web, focusing on a discussion of the *Internet of Things*. The article outlines some scenarios to be borne in mind when designing new e-learning services. According to the authors, the technologies and paradigms illustrated can generate new learning models for areas which have been ignored within the field of instructional design up until now, thus contributing to teaching innovations.

Antonella Carbonaro (*Interlinking e-Learning Resources and the Web of Data for Improving Student Experience*) introduces a system for the automatic retrieval of concepts which can be used to improve web searches and the management of large data volumes. The Document/Data Web concept is introduced, within which the translation of concepts and data can be used as education resources.

Giuseppina Rita Mangione, Francesco Orciuoli, Matteo Gaeta and Saverio Salerno, from the University of Salerno, in their article (*Conversation-based Learning in the Social Semantic Web*), describe the modelling, according to the principles of the Social Semantic Web, of an adaptive environment able to support learning processes based on Instruction-based Conversation within work contexts. This approach is motivated by the assumption that collaborative approaches based on the idea of knowledge construction and creation understand learning as a direct function of social participation and dynamic discussion between equals. In an environment thus constructed conversations are guided by collaborative scripts based on the disciplinary domain, the cognitive objective to be achieved, the cognitive state of the learner and the available financial resources.

The work of Paolo Bouquet and Andrea Molinari (*Semantic Technologies*

and e-Learning: toward an entity-centric approach for Learning Management Systems) describes the application of the semantic approach within a distance learning programme based on virtual learning communities.

Paolo Maresca, Lidia Stanganelli, Ferdinando Gorga, in *Assets and intellectual capital management into the ETC project,* also write about a project based on the semantic web but more closely linked to knowledge management; of particular note is their introduction of a system which maximises the transfer of the knowledge which is built up among the members of a team working on a project with the use of *assets*.

The last invited article on this subject is that of Pierpaolo Di Bitonto, Maria Laterza, Teresa Roselli and Veronica Rossano from the University of Bari (*A semantic approach implemented in a system recommending resources for cultural heritage tourism*) which describes the use of the semantic web to facilitate the promotion of tourism; the aim of the authors' project is to help people to make decisions about tourist destinations using an improved method which supersedes that used by the traditional search engines.

The section devoted to this issue's particular theme ends with two articles accepted after editing. Mauro Coccoli, Gianni Vercelli and Giuliano Vivanet (*Semantic Wiki: a collaborative tool for instructional content design*) introduce the use of the Semantic Web as a tool for the collaborative design of teaching materials, in particular inside a classic collaborative service: the *wiki*.

Corrado Amedeo Presti and Maria Angela Nicolosi, in *Semantic Web and evaluation of learning*, focus on the possibilities for improved learning evaluation offered by the semantic web.

The issue also contains a contribution from the working group of the Task Force e-Learning (TF eL) of the Coimbra Group (*e-Learning at the Coimbra Group Universities*) held in Leuven, followed by a series of meetings of the members of the Task Force on the same theme. The Coimbra Group is a network of some of the oldest and most prestigious universities in Europe. The group's main aim is to create academic and cultural links that promote internationalization, academic collaboration and excellence in learning and research, as well as providing services to society.

The paper provides a synthesis of the current applications of technology to learning and related activities in the various institutions to which the members of the Task Force belong. We would like to thank Valentina Comba for her help, her enthusiasm and the dedication to the project that she has demonstrated.

The rest of the issue includes contributions not linked to its main theme but nevertheless deserving of publication.

Gustavo Daniel Constantino, Juliana Elisa Raffaghelli, Guadalupe Alvarez and Lourdes Moran, in their article *Qualitative research methods to analyze Learning 2.0 processes Categorization, recurrence, saturation and multimedia triangulation*, analyse some qualitative research procedures applied to research on education, with particular reference to web systems. The authors present four different studies, all of which focus on the complex, multimodal nature of communicative interaction in virtual learning environments.

Giovanni Suriano, Elisa Suriano and Simona Guzzi (*Organizational well-being and e-learning in prison*) describe the building of a "Standard for the quality of e-learning paths in the prison environment", shared across Europe as a base upon which to build new educational methodologies.

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