1. Introduction

1.1 Motivation

What does it mean for a student to come to an understanding of a philosophical standpoint and can the variety of resources now available on the web support this process? The philosophical scholarship is undoubtedly based on processes such as the *interpretation* of a view (or a text), and the *argumentation* supporting or contrasting such interpretations (Carusi, 2003). How can the most recent computer technologies support these activities?

The amount of information people produce and consume daily online is, without any doubt, one of the distinctive traits of our era (Porter, 1997). We are constantly involved in activities such as *searching* for items of interest, or *browsing* the web to learn more about a subject. These activities may be satisfying many of our needs, but from the point of view of a learner, do they help us building new and meaningful representations of the world (Laurillard, 1993)? Unfortunately, often this is not the case. Negative examples of this are well known phenomena such as information overload or inconclusive navigations, which occur on the web but have been studied since the early days of *hypertext* research (Conklin, 1987). Metaphorically, the web may resemble a large forest, mysterious and exciting for the incredible amount of unexpected paths it conceals, but at the same time, confusing and distracting for the seeker who wanders without a guide.

Our philosophy-learner, is indeed a quite special type of seeker. The learning of 'abstract' notions is an especially complex and subtle process to support (Laurillard, 1993). A common view among the scholars (Bruner, 1960), which is also easily testable in our everyday lives, claims that successful learning always needs some sort of *structure* (of course, among other 'ingredients' too). For example, the structure may come from a school teacher, from the organization of a book, or from the intrinsic design of an e-Learning system. They all are *ways* to *guide* our steps and *control* our experiences, in such a way that we are led towards mastering a technique, understanding a problem, or grasping the significance of a concept.

In the scenario brought forward by the world wide web, where is the structure necessary for effective learning to be found? In particular, we are starting our investigation by looking at the social and technical advances the web has undergone in the last ten years. Phenomena such as the Semantic Web (Berners-Lee et al., 2001) define a trend towards the making available of *structured* data sources. That is, data which is codified so to be easily processed by a software application and possibly re-published semi-automatically according to a different purpose or rationale. Using a metaphor, the web is more and more being enlarged with a layer of *machine-processable* data.

This is the context we are starting from. How do such advances facilitate the need of learners for structure? How can we support the processes involved in

philosophical scholarship by means of these new technologies? These are the ideas motivating and underlying the work presented in this dissertation. The path we are about to undertake is strongly multidisciplinary. As we will see, it raises a variety of issues, touching on disciplines such as humanities computing, semantic technologies and digital narratives.

1.2 Approach

The approach we have adopted for supporting philosophical scholarship online can be summarized with two main points. The first one is more theoretical in its nature, since it concerns the pedagogical strategy we decided to embrace. The second one instead is more practical, as it has to do with the choice of using a specific type of technologies for the realization of our system.

1) **Theoretical** approach: from the theoretical point of view, we have been guided by a *narratology-inspired* model. This model can be broken down into two components. Firstly, following a number of authors (Schank, 1996,Bruner, 1991) we see the learning process as strictly coupled to the ability of *telling stories* about a topic, and even more, to the process of discovering and being able to use the *connections* from one story to the others. Secondly, following structuralist theorists (McQuillan, 2000) we sketch out the structure of a *narrative* as the union of a *story* (what is told) and a *discourse* (the 'how' of what is told, that is, the specific way in which the basic elements of a story are re-organized and conveyed to the

listener, in order to create different effects). The process of learning, thus, becomes inherently linked to the capacity of creating the structures that connect the different stories. Within an educational scenario, this approach would correspond to the learning *paths* that assemble learning units into a coherent curriculum. In other words, the structure needed by philosophy-learners, when looking for resources online, may come from an explicit *organization* of the relevant resources (the items in the *story*) according to a pre-defined *coherence principle* (which is embodied in the *discourse*).

2) **Practical** approach: from the practical point of view the most important decision we have taken regards the usage of semantic technologies for the formal specification of the relevant entities in the philosophical world. We use an *ontology* about philosophy as the main technology enabling the navigation and selection of (learning) resources related to the philosophical domain. In particular, with reference to to our narratology-inspired approach, a formal ontology can be used to express the semantics of the different elements composing a *story*, so that it is also possible to formalize the way a *discourse* recomposes the same elements according to different criteria. So, for example, the same set of philosophical facts could be ordered following a *historical* perspective, a *geographical* one or even one based on the most relevant *schools of thought*. Similarly, the same ideas could be organized differently if investigated under a *problem-centered* perspective, a *theory-centered* one, or simply one based on their *historical* succession. In other words, by using the representational power of an ontology, we aim at modeling the

relevant entities in the philosophical domain so to be able to replicate a number of the classical 'discourses' which are used to 'tell the story' about philosophy.

In the following chapters we will discuss the details of both approaches at length.

1.3 Research questions

The multiple aspects of our research can be summarized with the following generic question:

a) *"How can we better support the learning process, by making use of Semantic Web technologies?"*

More precisely, with reference to the specific domain we have chosen to investigate the approach discussed above, question (a) can be rephrased as follows:

b) *"How can we support learning about philosophy by means of an ontology-based application?*

The latter question can now be made more specific by breaking it down as follows:

b1) What are the types of entities and relations which define a domain such as the philosophical one, which is normally considered hard to characterize using semantic technologies?

b2) How can we define an ontology for philosophy, so that it would support the integration of multiple data-sources in the emerging Semantic web?

b3) Is it feasible to construct an ontology-based system, which support the semantic navigation of philosophical resources?

b4) How should we structure a semantic navigation so that it could support the learning process, intended as a narrative-construction activity?

b5) What are the fundamental narratives capable of telling the 'story' of philosophy, and how can we represent them using a formal language?

1.4 Plan of the Thesis

Chapters 2 and 3 present an extensive review of the literature relevant to our research. In particular, we divided the review in two chapters, since our work touches two quite distinct subject areas. The first one (chapter 2) deals with systems which make use of semantic technologies for the presentation and navigation of resources, especially on the web. Also, within this chapter we briefly discuss the theoretical foundations of the 'story construction' approach introduced above. The second part of the literature review (chapter 3) is instead mainly focused on the prior attempts to formalize philosophical knowledge. Since the ontology we developed constitutes a major contribution of this research on its own, with this chapter we intend to compile and discuss a list of the 'state of the art' formal models, which are relevant to philosophy.

At the end of both chapters the gaps in existing research are identified and discussed.

Chapter 4 builds on the results of the literature review by outlining the limitations of existing research. In particular, we highlight the lack of semantic technologies aimed at supporting learning in the philosophical domain (and more generally, in humanities' domains). Also, here we discuss the major features characterizing our approach and set the scene for a more detailed description of our philosophical ontology.

With chapter 5 we start outlining the contributions of our work, first of all by providing a detailed description of the ontology created for describing the

philosophical world. This is a quite vast model, comprising more than 300 classes. In particular, we highlight the classes devoted to the description of philosophical events and ideas.

Chapter 6 presents PhiloSurfical, the prototype system we built in order to test the philosophical ontology in a real-world scenario. PhiloSurfical is a pedagogical tool aimed at supporting the learning of a classic in twentieth century philosophy, Wittgenstein's Tractatus Logico Philosophicus (Wittgenstein, 1921). This is achieved mainly by means of various semantic navigation mechanisms, building directly on the ontological representations. Here we discuss also the concept of 'learning pathways' and show how they can be created so to mimic the classic ways the philosophical discipline employs to 'narrate itself'.

Chapter 7 and 8 deal with the evaluation of our work. In particular, the first one presents an evaluation of the philosophical ontology by means of a knowledge elicitation experiment; the second one deals with a user-evaluation study of PhiloSurfical, our prototype.

Chapter 9 concludes the dissertation by summarizing our contributions and identifying the outstanding research issues that require further investigation.