Supporting the Construction of Conceptual Ontologies with the ROO Tool[1]

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Abstract. This demonstration will present the first stage of the ROO tool, a Protégé plugin that facilitates domain experts with little or no knowledge engineering experience to build ontologies. The ontology authoring process is assisted by offering task-driven suggestions and appropriate help, based on an ontology construction methodology developed at Ordnance Survey. The knowledge construction is further aided by the use of a controlled language for OWL called Rabbit, which provides an intuitive way to create OWL ontologies.

1. Introduction

Most existing ontology construction tools are designed to be used by specialists with appropriate knowledge engineering skills but who may lack the necessary domain expertise to create the relevant ontologies. Domain experts have to provide relevant knowledge sources, or have to collaborate in knowledge elicitation techniques to discover information, while knowledge engineers encode the ontology using available tools. This approach can hinder the ontology construction process and may have a negative impact on the quality of the resultant ontology (e.g. poor documentation, inconsistency of terminology used, incorrect or incomplete knowledge constructs). Hence, tools that facilitate the ontology construction process and are tailored to the needs of domain experts can speed up the authoring process and improve the quality of the resultant ontologies.

Recently, controlled language (CL) interfaces have been provided for entering knowledge constructs in an intuitive way, see the recent review in [3]. The major deficiency of these tools is that they focus solely on the CL aspect while ignoring the whole ontology construction process. We will present a prototype of a tool called ROO (Rabbit to OWL Ontology authoring) that not only provides a CL interface but offers systematic guidance throughout the whole ontology construction process. The

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development of ROO is driven by the needs of a large public organisation – the national mapping agency of Great Britain, Ordnance Survey. The Ordnance Survey is developing an extended semantic reference system that includes several foundational domain ontologies and aims to empower the integration of heterogeneous topographic data and their reuse by third parties [2]. At the heart of ontology development at Ordnance Survey is the *active involvement of domain experts* (e.g. geographers, ecologists and emergency planners) [6].

ROO is a Protégé plug-in that guides domain experts with little or no knowledge engineering experience to build conceptual ontologies. The novel aspects of ROO are that it: (a) is grounded on a methodology for ontology construction used for the development of several large ontologies at Ordnance Survey [6]; (b) utilises a controlled language to enter knowledge constructs which is carefully designed focusing on the needs of domain experts and is compliant with OWL 1.1; (c) guides the user through the ontology construction process. This aims to ensure rigour and effectiveness of the ontology development process, in order to produce better quality ontologies that can be reused more efficiently.

2. Design Rationale for ROO

ROO is based on a systematic approach for facilitating domain experts' involvement in the ontology authoring process, which has been derived from the experience at Ordnance Survey. This identified a number of factors hindering the ontology authoring process: (a) lack of appropriate methodology for capturing the knowledge of domain experts, (b) difficulty in expressing knowledge constructs in a formal language, and (c) usability of existing ontology construction tools that can be challenging to users without knowledge engineering skills. These factors have been taken into account in the design of ROO.

ROO follows the main steps in **Kanga**, the Ordnance Survey's methodology for authoring ontologies [6] centred on domain experts, including:

- identifying the scope, purpose and other requirements of the ontology;
- gathering sources of knowledge (e.g. documents and external ontologies);
- defining lists of concepts, relationship and instances supplied with natural language descriptions;
- formalising *core* concepts and their relations in structured English sentences;
- generating the OWL ontology.

The formalisation follows a controlled natural language, called Rabbit, developed in response to a need for domain experts to be able to understand and author ontologies [4]. Rabbit covers every construct in OWL 1.1 [4, 2], allowing domain experts to express sufficient detail to describe the domain. Rabbit is regarded as the *authoritative source* of the ontology, while OWL can be viewed as the *compiled version*. Ordnance Survey has involved domain experts from the outset in the core language design decisions.

3. The ROO tool

The ROO[2] tool is an open source ontology creation environment that supports domain experts by guiding them through the ontology authoring process and hiding technical issues related to OWL. Figure 1 shows the main architectural elements of the currently implemented ROO tool and their interactions.
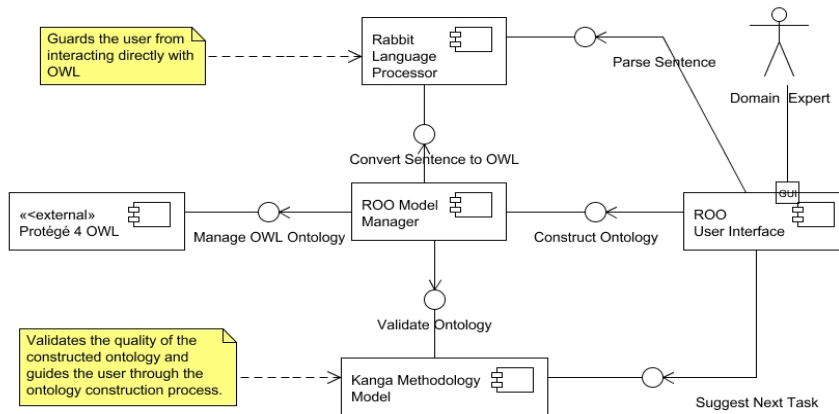
Fig. 1. UML component diagram depicts the architectural elements, interfaces and interelement connections in ROO. ROO reuses Protégé 4 for managing the OWL Ontology.

ROO offers **task suggestions** which are similar to the guidance of **wizards** that monitor the state of the ontology and the user's activities and suggest the most appropriate actions. For example, at the beginning of the ontology construction process, ROO will suggest that the scope and purpose of the ontology should be identified. Later, when a user has already defined several concepts and relationships, ROO will suggest to enter a natural language description for concepts missing such a description. The user interface is tailored to the Kanga methodology to simplify the execution of the suggested tasks.

Domain experts edit the ontology **using Rabbit sentences** instead of directly editing OWL or the Manchester Syntax. A Rabbit editor provides feedback by means of syntax highlighting and error messages and parses the sentences using the Rabbit Language Processor. For instance, suppose that a user has defined concepts `Place` and `Topographic Object` and relationship `has part`. If a user enters `Every Place contains a Topographic Object`, ROO recognizes the sentence and highlights the concepts: `Place` and `Topographic Object`. ROO also highlights `contains` as a possible relation, but informs the user that the relationship has not been defined in the ontology. The user can either define the relationship or can view the list of defined relations. In this case, the user decides that relation `has part` expresses the correct relation and changes the sentence to `Every Place has part a Topographic Object`. ROO then converts the sentence to OWL.

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[2] ROO is built as part of the Confluence project. http://sourceforge.net/projects/confluence

4. Implementation and Future Work

The current version of ROO is easily installed from a zip file[3], and can be run on any computer provided that Java 5 is installed. The guidance in the current version is implemented as a rule system based on the JBoss Drools[4] rule engine. The Rabbit language processor parses and converts nine basic sentence types into OWL (allowing domain experts to construct simple ontologies). The GUI provides syntax highlighting and error feedback to the user. The GATE[5] text processing environment is used for parsing the Rabbit sentences.

The demonstration will provide hands on experience with the tool, enabling people to create ontologies in their subject areas. We will also show videos[6] to illustrate the user interacting with the tool while creating an ontology of buildings and places. In the process, we will show more examples of entering Rabbit sentences.

In the immediate future we intend to perform an extensive user study involving domain experts from both Ordnance Survey and University of Leeds which will allow us to streamline the user interface. At the same time we are carrying out user testing to investigate comprehension and ease of authoring of the Rabbit Language, compared with the Manchester OWL Syntax [5]. Support for the full set of Rabbit patterns is being developed as well as improvements to the Rabbit editor to improve error feedback and add auto completion features. Finally, we will perform comparative evaluations to measure the impact of the ROO tool on the quality of the ontology and task efficiency compared to other ontology construction tools.

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[3] http://sourceforge.net/projects/confluence and navigate to the Downloads section.

[4] http://labs.jboss.com/drools

[5] http://gate.ac.uk

[6] http://confluence.sourceforge.net/confluenceHelp