CoGZ: Cognitive Support and Visualization for Semi-Automatic Ontology Mapping

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Abstract—Much of the focus of ontology mapping research has been on how to automatically produce mappings. However, creating mappings between ontologies is a difficult, semi-automatic process, requiring user intervention. In our research, we have been investigating the user's role in the mapping creation process, specifically attempting to uncover how we can best support and aid the user with their decision making processes. Based on a set of investigative studies, we have derived specific design guidelines for the development of ontology mapping tools. In this demo, we will showcase one instantiation of these guidelines in a tool called CoGZ. The CoGZ tool combines a visual representation of mappings with powerful user-driven filtering to help reduce task complexity.

I. INTRODUCTION

Members of the biomedical research community often use ontologies or structured vocabularies to annotate and classify data. People often rely on overlapping, but independently developed terminologies. This representational divergence becomes problematic when researchers wish to share, find, and compare their data with others. One approach to resolving this is to create a mapping across the vocabularies. Generating these mappings is a difficult, semi-automatic process, requiring human intervention. There has been little research investigating how to aid users with performing this task, despite the important role the user typically plays. Much of the research focus has been to explore techniques to automatically determine correspondences between terms.

For the last several years, we have been investigating how to support the user's decision making process and exploration of mappings. We have combined data gathered from theories of human inference and decision making, an observational case study, an online survey, and an interview study to propose a cognitive support framework for ontology mapping [1], [2], [3]. The framework describes the user information needs and the process users follow during mapping. We also have proposed a number of design principles and guidelines, which help guide the development of semi-automatic ontology mapping tools.

We have used these guidelines to help with the design of our own mapping tool called CoGZ. In this demo, we will illustrate how to carry out mappings using CoGZ, how to produce mapping reports, and how to use CoGZ's user-based filtering to help reduce task complexity. In the following sections, we describe the CoGZ tool and some of its functionality.

II. THE CoGZ TOOL

Rather than building a completely new tool, we created a plugin framework for an existing tool. We recognized Prompt as a good candidate for extension, as it is an open source tool and is widely used. The framework allowed us to create CoGZ as a user-interface (UI) plugin focusing on cognitive support. The current version of CoGZ is implemented as an *alternative perspective* in Prompt. This extension allows us to completely replace the default Prompt UI, but still use Prompt's other facilities. CoGZ is available with the default installation of Protégé 3.4. Below we describe a few of the main features of the latest version of the CoGZ tool.

A. The main interface

Figure 1 presents the main CoGZ interface. Figure 1(A) and 1(B) show the source and target ontologies. Concepts with "C" icons represent terms with candidate mappings that were discovered automatically, while concepts with "M" icons (e.g. Article) are terms that have been validated and mapped. Figure 1(C) shows a visual representation of mappings. Candidate mappings are represented by dotted, red arcs, while validated mappings are represented by solid, black arcs. Figure 1(D) shows the main toolbar. Each ontology view has a set of buttons for applying filters, moving through the mappings, and representing the overall progress. The central buttons correspond to global functionality for filtering and carrying out mappings. Finally, Figure 1(E) shows three tabs. The first tab displays all the candidate or suggested mappings found automatically. The second tab displays only the mappings validated by the user. The final tab displays a side by side visual comparison between the concepts selected in the source and target ontologies.

CoGZ uses a visual representation for candidate and verified mappings. Interaction with the visualization and ontology trees is synchronized. Selecting a node with mapping candidates automatically expands the corresponding candidate terms in the other ontology and highlights the mapping arcs. This helps users explore all the candidates for a term. Multiple inheritance in an ontology is supported by displaying alternative arcs traveling to the multiple hierarchies where a concept exists. The visualization helps support exploration of the parent, child and sibling mappings of a term, as clusters of potential
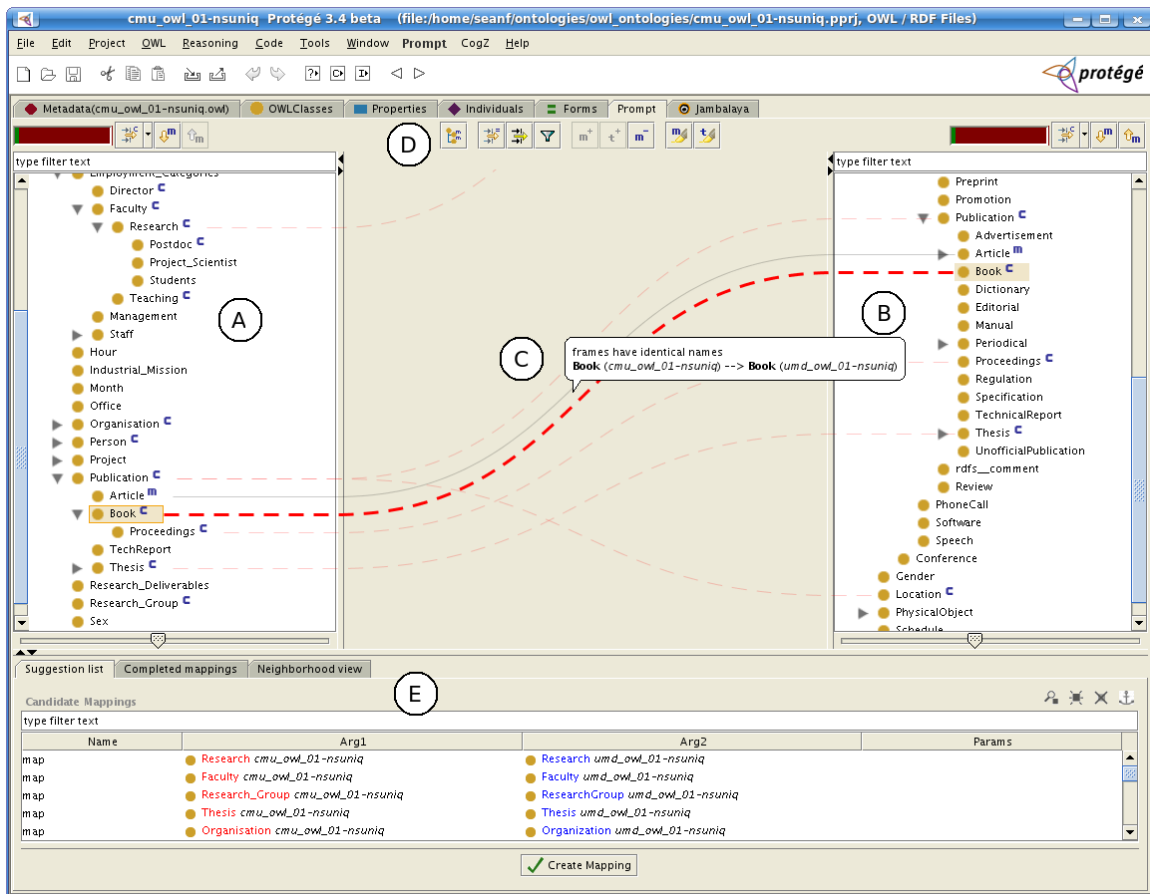
Fig. 1. The COGZ perspective in Prompt. **A** and **B** show the source and target ontologies. **C** shows a visual representation of mappings, while **D** shows the main toolbar. Finally, **E** points to three tabs that can be used for switching from mapping suggestions, completed mappings, and a visual concept comparison view.

mappings are visible when two hierarchies closely correspond (see the Publication hierarchy in Figure 1).

COGZ supports the visual construction of user-defined mappings. A user can select a source concept and drag with the mouse to a concept in the target ontology. This will create a mapping between the source and target term.

A large variety of filters are supported by COGZ. These filters help support the user's mapping process as well as help users cope with the complexity of mapping ontologies. The search for the source, target, candidate and verified mappings is both a search and a filter for the corresponding display. As a user types, the display is filtered to display only matching terms.

The source and target ontologies can also be "re-rooted". That is, any term in the ontology can become the root of the tree. This removes all other terms that are not a subclass of the selected term from the display. It allows users to focus on particular areas of the ontology. Also, the source and target ontologies can be filtered to display only the part of the ontology necessary to see the candidate mappings or verified mappings. Besides filtering, to help users cope with the potential clutter of this representation, mappings that do not have at least one visible concept in the display are automatically filtered from the view. Non-selected mapping lines are semi-transparent and if the user desires, they can be filtered completely. All the filters are toggle buttons and can be used in combination, creating a powerful, user-driven approach to the complex problem of mapping.

III. CONCLUSION

The COGZ tool assists users with creating and evaluating mapping correspondences between ontologies. The design was based on principles and guidelines that were derived from a number of in-depth exploratory studies. In the demo session, we will demonstrate the main features and benefits of COGZ, specifically how to validate mappings, create new mappings, produce mapping reports, and use the COGZ filters to help reduce task complexity.

REFERENCES

[1] S. M. Falconer, N. F. Noy, and M.-A. Storey, "Towards understanding the needs of cognitive support for ontology mapping," in *Ontology Matching Workshop*, 2006.
[2] S. M. Falconer and M.-A. Storey, "A cognitive support framework for ontology mapping," in *Proceedings of ISWC/ASWC*, November 2007, pp. 114–127.
[3] S. M. Falconer, N. F. Noy, and M.-A. Storey, "Ontology mapping - a user survey," in *Ontology Matching Workshop*, November 2007.