From Overview to Facets and Pivoting for Interactive Exploration of Semantic Web Data

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ABSTRACT

The proliferation of Linked Open Data on the Web has increased the amount of data available for analysis and reuse. However, casual users find it difficult to explore and use Semantic Web Data due to the prevalence of specialised browsers that require complex queries to be formed and intimate knowledge on the structure of datasets. The authors address this problem in the Rhizomer tool by applying the data analysis mantra of overview, zoom and filter. These interaction patterns are implemented using information architecture components users are already familiar with but that are automatically generated from data and ontologies. This approach makes it possible to obtain an overview of the dataset being explored using techniques, such as navigation menus, treemaps or sitemaps, which are usually not available in text-based semantic web browsers. From there, users can interactively explore the data using facets. Moreover, facets also feature a pivoting operation, motivated during tests with lay users, that removes the main constraint of most faceted browsers, i.e. the inability to combine filters for differently faceted views to build complex queries.

Keywords: Human-Computer Interaction, Interaction, Linked Data, Semantic Web, Usability, User Interface

1. INTRODUCTION

The amount semantic data available in the Web is rapidly increasing, for instance as part of the Linked Open Data cloud (Bizer, Heath, & Berners-Lee, 2009). However, from the end-user perspective, the situation continues to be that the available datasets are monolithic and opaque files, which usually can just be explored using complex semantic queries or complex user interfaces. The objective is now to make this data more usable so that non Se-
mantic Web experts can easily grasp what kind of entities are contained in a dataset, how they are interrelated, what are the main properties and values, etc. This will increase the awareness of the semantic data currently available on the Web and also facilitate the development of new and innovative applications on top of this data.

The common approach to make a dataset more usable to a wider range of users is to use some sort of Data Web publishing tool like Pubby\textsuperscript{1}. Such tools usually provide at least an HTML rendering for each resource in the dataset. Each HTML page lists all the properties for the corresponding resource. Pages are interlinked based on the connections among resources and the user can follow HTML links. However, this feature is only useful if the user has some a priori knowledge about the dataset, especially the identifier for a resource of interest. There are very limited ways to obtain an overview of all the kinds of resources in the dataset. Additional tools like Semantic Web browsers can be used. However, as discussed in Section 2, most of them also lack mechanisms that make the dataset structure comprehensible for lay users or help them building complex queries without requiring advanced technical skills.

The proposal we make in this article is to draw from the experience accumulated in the Information Architecture (IA) domain (Morville & Rosenfeld, 2006) as well as to reuse and adapt existing IA components to provide browsing, exploration and visualisation guidance to users. Such IA components are well known to Web users, as they are present in most web pages: navigation bars, facets, sitemaps, breadcrumbs, etc. This approach is implemented in Rhizomer, a tool for publishing Semantic Web datasets while facilitating user awareness of the published content. It is also being evaluated with lay users as part of a User Centred Design development process. Iterative evaluations have motivated and guided the introduction of new features, like pivoting, and validated improvements in the context of a quality in use model (ISO/IEC-25010, 2011).

Evaluations with users show the usefulness of an approach based on interface components that provide an overview of the explored dataset and facilitated navigation, especially when dealing with highly structured data like Semantic Web data. Moreover, due to its richness, it also shows that it is fundamental to provide a pivoting operation. Facets are sufficient when the data model is simple, comprising a main type of resources described with a set of attributes and relations that are used to generate the facets. Similarly, facets are suited when the data is explored in a fragmented way, without requiring the combination of constraints on facets for different types of resources, i.e. different faceted views.

However, if full power to explore the data is required, for example, to express complex queries such as “actors from Spain, which have acted in films directed by Woody Allen”, it is necessary to be able to pivot from the actors’ faceted view to the films view. The proposed approach and its implementation in Rhizomer, are among the few Semantic Web data exploration tools offering this functionality. Moreover, as our evaluation shows, Rhizomer provides the best user experience when compared to the two other main tools featuring pivoting.

The remainder of this paper is organised as follows. First, related work is presented in Section 2. Then, the proposed approach is detailed in Section 3 and the results of its evaluation with lay users are discussed in Section 4. Finally, conclusions and future work are presented in Section 5.

2. RELATED WORK

Dadzie and Rowe (2011) present the most exhaustive and comprehensive survey to date of existing approaches to visualising and exploring Semantic Web data, particularly Linked Data. This survey is used to situate our contribution, implemented in a tool called Rhizomer and available online\textsuperscript{2}. First of all, Rhizomer can be classified mainly in the category of text-based visualisation tools, though it also includes graphical representations for dataset overviews. However, it is important to note that it is not intended as

\textsuperscript{1}Dadzie and Rowe (2011)

\textsuperscript{2}Dadzie and Rowe (2011)
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