Visual Querying for the Semantic Web

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This paper presents a demonstration of visXcerpt [BBS03,BBSW03], a visual query language for both, standard Web as well as Semantic Web applications.

Principles of visXcerpt. The Semantic Web aims at enhancing data and service retrieval on the Web using meta-data and automated reasoning. Meta-data on the Semantic Web is heterogeneous. Several formalisms have been proposed. RDF, Topic Maps and OWL, e.g., and some of these formalisms have already a large number of syntactic variants. Like Web data, Web meta-data will be highly distributed. Thus, meta-data retrieval for Semantic Web applications will most likely call for query languages similar to those developed for the standard Web. This paper presents a demonstration of a visual query language for the Web and Semantic Web called **visXcerpt**. visXcerpt is based on three main principles.

First, visXcerpt has been conceived for querying not only Web meta-data, but also all kind of Web data. The reason is that many Semantic Web applications will most likely refer to both, standard Web and Semantic Web data, i.e. to Web data and Web meta-data. Using a single query language well-suited for data of both kinds is preferable to using different languages for it reduces the programming effort and hence costs and it avoids mismatches resulting from interoperating languages. **Second, visXcerpt is a query language capable of inference.** The inferences visXcerpt can perform are limited to simple inference like needed in querying database views, in logic programming, and in usual forms of Semantic Web reasoning. Offering both, inference and querying, in a same language avoids e.g. the impedance mismatch, which is commonly arising when querying and inferencing are performed in different processes. **Third, visXcerpt has been conceived as a mere Hypertext rendering of a textual query language.** This approach to developing a visual language is fully new. It has several advantages. It results in a visual language tightly connected to a textual language, namely the textual language it is a rendering of. This tight connection makes it possible to use both, the visual and the textual language, in the development of applications. Last but not least, a visual query language conceived as an Hypertext application is especially accessible for Web and Semantic Web application developers.

Further principles of visXcerpt are as follows. visXcerpt is **rule-based**. visXcerpt is **referentially transparent** and **answer-closed**. Answers to visXcerpt queries can be **arbitrary XML data**. visXcerpt uses (like the celebrated visual database query language QBE) **patterns** for binding variables in query expressions instead of path expressions – as do e.g. the Web query languages XQuery and XSLT. visXcerpt keeps **queries and constructions separated**.

Language Visualization as Hypertext Rendering. XML and hence modelling languages for the Semantic Web based on XML like RDF, Topic Maps and OWL, are

visualized in visXcerpt as nested, labeled boxes, each box representing an XML element. Graph structures are represented using Hyperlinks. Colors are used for conveying the nesting depth of XML elements. As visXcerpt's query and construction patterns can be seen as samples, the same visualization can be used for query and construction patterns. This makes visXcerpt's visualization of queries and answer constructions very close to the visualization of the data the queries and answer constructions refer to. visXcerpt has **interactive features** helping for a quick understanding of large programs: boxes representing XML elements can be folded and unfolded and semantically related portions of programs like e.g. different occurrences of the same variable), can be highlighted. visXcerpt programs can be composed using a **novel Copy-and-Paste** paradigm specifically designed for tree (or term) editing. **Patterns** are provided as templates to support easy construction of visXcerpt programs without in-depth prior knowledge of visXcerpt's syntax. Today's Web Standards together with Web browsers offer a ideal basis for the implementation of a language such as visXcerpt. They are widespread and therefore everywhere available and well-known. The visXcerpt prototype demonstrated is implemented using only well-established techniques like CSS, ECMAScript, and XSL and, of course, the run time system of the textual query language (Xcerpt [SF04] cf. `http://xcerpt.org`).

Demonstrated Application. The application used for demonstrating visXcerpt is based on data inspired by "Friend of a Friend" cf. `http://xmlns.com/foaf/0.1/` expressed in various formats, including plain XML and RDF formats. The demonstration illustrates the following aspects of the visual query language visXcerpt.

Standard Web and Semantic Web data can be retrieved using the same visual query language, visXcerpt. Meta-data formated in various Semantic Web formats are conveniently retrieved using visXcerpt. visXcerpt queries and answer constructions are expressed using patterns that are intuitive and easy to express. Hypertext features are used by visXcerpt such as Hypertext links for following references forward and backward or different renderings (such as hiding and showing of program components or XML elements) so as to help screening large programs. Recursive visXcerpt programs are presented and evaluated demonstrating that visXcerpt gives rise to a rather simple expression of transitive closures of Semantic Web relations and of recursive traversal of nested Web documents.

References

[BBS03] S. Berger, F. Bry, and S. Schaffert. A Visual Language for Web Querying and Reasoning. In *Workshop on Principles and Practice of Semantic Web Reasoning*, LNCS 2901, Springer Verlag, 2003.

[BBSW03] S. Berger, F. Bry, S. Schaffert, and C. Wieser. Xcerpt and visXcerpt: From Pattern-Based to Visual Querying of XML and Semistructured Data. In *29th Intl. Conference on Very Large Data Bases*, 2003.

[SB04] S. Schaffert and F. Bry. Querying the Web Reconsidered: A Practical Introduction to Xcerpt. In *Extreme Markup Languages*, 2004.