Thinkbase: A Visual Semantic Wiki

Christian Hirsch
The University of Auckland
Private Bag 92019
Auckland, New Zealand
chir008@aucklanduni.ac.nz

John Grundy
The University of Auckland
Private Bag 92019
Auckland, New Zealand
+64 9 3737 599 ext 88761
john-g@cs.auckland.ac.nz

John Hosking
The University of Auckland
Private Bag 92019
Auckland, New Zealand
+64 9 3737 599 ext 88297
john@cs.auckland.ac.nz

ABSTRACT
Thinkbase is a visual navigation and exploration tool for Freebase, an open, shared database of the world's knowledge. Thinkbase extracts the contents, including semantic relationships, from Freebase and visualizes them using an interactive visual representation. Providing a focus plus context view the visualization is displayed along with the Freebase article. Thinkbase provides a proof of concept of how visualizations can improve and support Semantic Web applications. The application is available via `http://thinkbase.cs.auckland.ac.nz`.

Categories and Subject Descriptors
D.2.2 [**Software Engineering**]: Design Tools and Techniques - *User interfaces.* H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces - *Collaborative computing.*

General Terms
Design, Experimentation, Human Factors.

Keywords
Semantic Web, Wiki, Visualization, User Interface.

1. MOTIVATION
According to a recent estimate, more information will be created in the next five years than has been created in the whole of human history [4]. Information overload is thus a huge problem and as most information is accessible through the internet and intranet, the web community is particularly interested in addressing this issue. The web has already seen some significant change in what is often summarized as the "Social Web" or *Web 2.0* [7]. New technologies and tools, but most importantly new behavioral and usage patterns have led to the widespread adoption of wikis and other social networking software. These help to organize content and better cope with information overload. By using social software users annotate the content with meta data in an organic, bottom-up fashion. This enables software agents to better process the content. Search algorithms and recommendation systems are examples of doing this. A more recent approach which provides a rather top-down and formal creation of meta data is the *Semantic Web* [1]. The idea of the Semantic Web is to make the web more intelligent by annotating information with meaning (that is, providing structured meta data) so that not only humans but also machines are able to reason with it. The problem of information overload is therefore decreased by delegating more and more tasks to software agents. Even though the organic approach of creating meta data in the Web 2.0 and the structured approach of the Semantic Web seem to be contradictory, more and more applications, such as Freebase [5], provide successful examples of how structured data can be created collaboratively. A further and more general approach of how to cope with information overload is represented in the field of *information visualization*. Visualizations provide effective methods for representing and organizing information- and knowledge-rich scenarios [6]. They make use of the human cognitive processing system in order to create and convey content more efficiently [3].

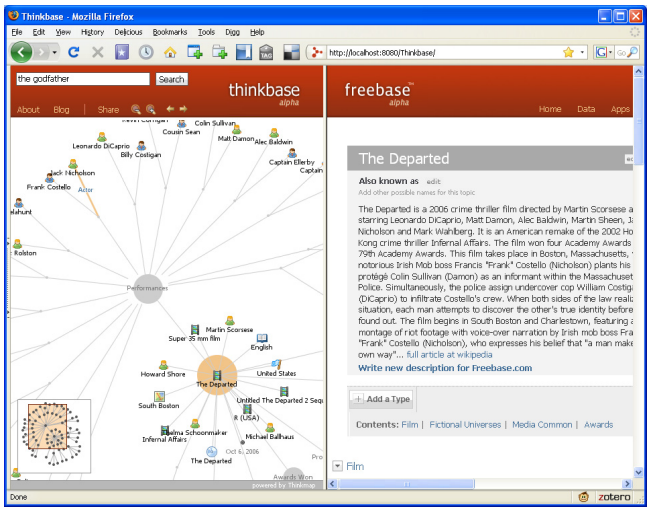

Figure 1. The user interface of Thinkbase.

2. APPROACH AND OBJECTIVE
Our approach when building Thinkbase, a "Visual Semantic Wiki", was to integrate interactive (graph based) visualizations with a "Semantic Wiki". We define a Semantic Wiki as a collaborative knowledge repository which provides semantically enriched contents. The Semantic Web with its meaningful meta data provides not only the opportunity to automatically reason with the content, but also to transform and reuse the content in ways which add significant value. We see a transformation of textual content into an alternative visual representation as a way to demonstrate some of the potentials and benefits of the Semantic Web. Our objective is to provide a proof of concept of how visualizations can improve Semantic Web applications. Existing approaches which visualize unstructured wiki content (e.g. WikiNavMap [9]) quickly run into difficulties such as coping with the complexity of a large repository. We demonstrate how to overcome this by using a structured source.

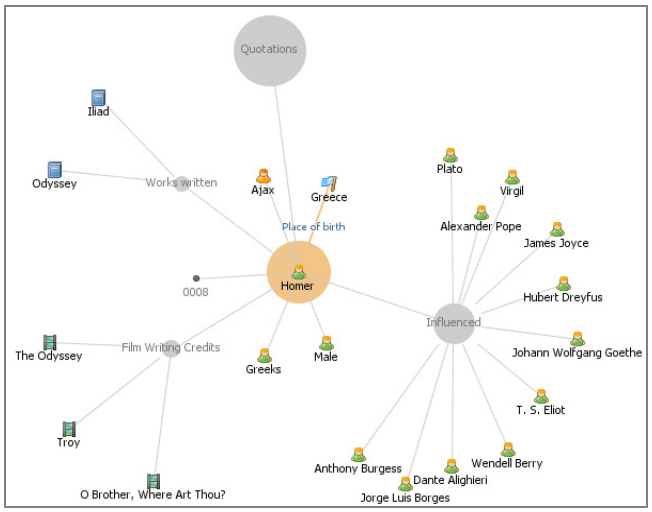

Figure 2. The Thinkbase graph for "Homer".

3. THINKBASE

Thinkbase is a visual navigation and exploration tool for Freebase, an open, shared database of the world's knowledge [2]. Figure 1 shows the general user interface of Thinkbase. The application is divided into two frames. The right frame displays a Freebase topic including all the details; the left frame displays an automatically generated, interactive, force directed layout graph of that same topic including all related topics. The Freebase API is used to access the content and display it in this alternative, visual form using the Thinkmap visualization toolkit [8]. The two alternative representations of the same underlying body of knowledge enable a focus plus context view.

For example, Figure 2 shows the Thinkbase graph for "Homer". Each Freebase topic is represented as a node using an icon which corresponds to its type (e.g. person, movie). Users can navigate from node to node, which will refresh the graph as well as the Freebase frame. The type of relationship between topics is visible when hovering over an edge. The example in Figure 2 shows that the "Place of birth" of "Homer" is "Greece". Related topics of the same type are combined in an aggregation node as seen e.g. for the type "Influenced". These aggregation nodes can be expanded and collapsed, which helps to focus on specific contents while hiding others (e.g. "Quotations"). Further visual cues such as the length of edges, size of aggregation nodes, and text color are used to encode additional information.

In standard mode, Thinkbase provides a topic centered view. That is, a specific Freebase topic is visualized including all of its relationships. This visualization metaphor can be extended by (repetitively) expanding and collapsing not only aggregation nodes but all nodes of the graph to ones liking. This feature gives the user the ability to create unique and informative visualizations. Figure 3 shows an example where the lower and higher classifications of an animal class (here: "Reptile") has been expanded repetitively. The resulting visualization represents a small subset of the tree of life, ranging from "Vertebrate" to "Dinosaur". Our research prototype also provides some functionality to edit the content of Freebase through the visual representation (e.g. add new relationships). This is only possible due to the semantically enriched content.

4. EVALUATION AND CONCLUSIONS

We undertook a qualitative evaluation in the form of an online survey among 14 participants in order to find out about the usability of Thinkbase. The questions were aimed to investigate how the visualization on top of Freebase improves different tasks (create, organize, transfer, search/navigate information). The overall consensus was that Thinkbase adds most value for search and navigation, followed by organizing and transferring. A specific type of search which could be called "search by exploration" was described as being "incredibly addictive". We concluded that creating a visual exploration tool on the basis of *structured* data has the advantage that semantics can directly be translated into meaningful visual icons, and filter mechanisms can automatically be applied which helps to deal with complexity.

5. FUTURE WORK

Future work for Thinkbase focuses on three different areas: (1) improving its usability as a visual exploration tool, e.g. more control over the display, advanced filtering mechanisms; (2) extending features such as the ability to explore relationships between multiple nodes will add new metaphors of information discovery; and (3) we have a proof of concept for a "Visual Wiki", which demonstrates some of the potentials and benefits of the Semantic Web and can now be explored for further Semantic Web applications.

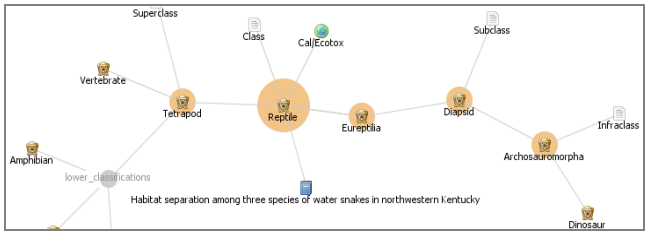

Figure 3. A small extract of the "tree of life".

6. REFERENCES

[1] Berners-Lee, T., J. Hendler, and O. Lassila, *The semantic Web.* Scientific American, 2001. 284(5): p. 28-37.

[2] Bollacker, K., R. Cook, and P. Tufts, *Freebase: A Shared Database of Structured General Human Knowledge.* Proceedings of the national conference on Artificial Intelligence, 2007. 22(2): p. 1962.

[3] Burkhard, R., *Towards a Framework and a Model for Knowledge Visualization: Synergies between Information and Knowledge Visualization.* LNCS 3426. Springer: Berlin, Heidelberg, New York, 2005.

[4] Department of Education, Science and Training. *Backing Australia's Ability - An Ongoing Commitment*. 2007. http://backingaus.innovation.gov.au/info_booklet/on_commit.htm.

[5] Freebase. Metaweb Technologies, Inc. www.freebase.com.

[6] Keller, T. and S.O. Tergan, *Visualizing Knowledge and Information: An Introduction.* in Knowledge and Information Visualization: Searching for Synergies. Springer 2005.p.1-23.

[7] O'Reilly, T., *What Is Web 2.0.* O'Reilly Media 2005.

[8] Thinkmap. www.thinkmap.com.

[9] Ullman, A.J. and J. Kay, *WikiNavMap: a visualisation to supplement team-based wikis.* Conference on Human Factors in Computing Systems, 2007. p. 2711-2716.