Is there a Value in Detours? - Experiences with Designing a Visual Browser for the Linked Lexical Resource UBY

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ABSTRACT

This poster paper describes experiences and results of a collaboration between computational linguists and visualization experts whose goal was to design a visualization for a web interface of the large-scale linked lexical resource *UBY*. Besides introducing the problem and the resulting design, we reflect on the iterative design process, thereby focusing on lessons learned that are applicable to all kinds of interdisciplinary visualization projects (including industrial projects). Furthermore, we briefly discuss the value of detours when working as a visualization expert with practitioners.

1 BACKGROUND

We describe the results of a collaboration of visualization researchers and computational linguists which aimed at the re-design of the visualization component in the Web user interface (Web UI) of the large-scale linked lexical resource *UBY* [1]. *UBY* combines a wide range of information from expert-constructed (e.g., WordNet, FrameNet, VerbNet) and collaboratively constructed (e.g., Wiktionary, Wikipedia) resources for English and German, see https://www.ukp.tu-darmstadt.de/uby. All resources contained in *UBY* distinguish not only different words but also their senses. For instance, *UBY* lists for the verb *"run"* (among others) a sense from Wiktionary with the sense definition *"To go at a fast pace, to move quickly"* and a sense from WordNet with the definition *"carry out a process or program, as on a computer or a machine"*.

A distinguishing feature of *UBY* is that the different resources are aligned to each other at the word sense level, i.e. there are links connecting equivalent word senses from different resources in *UBY*. For senses that are linked, information from the aligned resources can be accessed and the resulting enriched sense representations can be used to enhance the performance of Natural Language Processing tasks.

Targeted user groups of the *UBY* Web UI are researchers in the field of Natural Language Processing and in the Digital Humanities, in particular, lexicographers. In the context of exploring the usually large number of senses for an arbitrary search word, the *UBY* Web UI should support the targeted user groups in assessing the added value of sense links for particular applications.

2 THE DESIGN PROCESS & LESSONS LEARNED

When we started our collaboration project, an initial design and implementation for a visualization of the alignment already existed [2]. Fig. 1 shows the graph visualization for the lemma[1] "run". Each sense is displayed as a rectangle (a sense node) and is labeled with the corresponding sense id. Each resource is assigned a distinct color that is used for color-encoding the resource membership of a sense. Senses that are aligned to each other are linked to an alignment node (red nodes) which itself is linked to the root node respresenting the lemma of interest (black node in the middle). Similarly, all nodes that are not part of an alignment are directly linked to the root node.

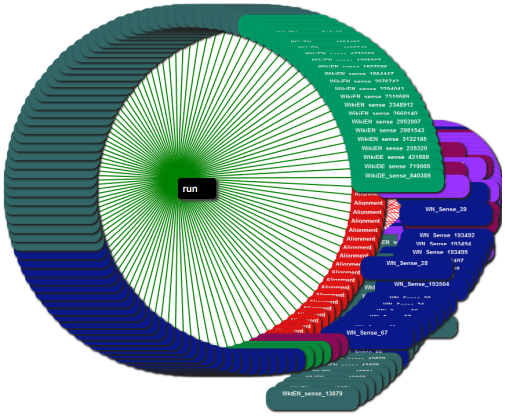

Figure 1: Initial graph-based design (lemma "run").

It is self-evident that the visualization in Fig. 1 does not scale for words with many senses. Also, at the time when this early prototype was built, exactly specifying the user needs was very difficult, because at this early stage, there were no clearly defined use cases; instead, the main user need was support in exploring the novel aspects of the underlying resource UBY. Therefore, it was decided to revise the current interface, this time in a collaboration with a visualization expert.

Involving someone with expertise in visual design can help a lot to ensure that the resulting visualization is as expressive and effective as possible. However, as it is often the case in such a collaboration, the visualization expert was lacking the domain knowledge that is necessary for designing a good visual interface. At the same time, the practitioner had only a vague understanding of the possibilities a visualization can offer and how exactly it would enhance the Web UI.

Consequently, the collaboration project started with a detailed interview in which the visualization expert inquired as much information as possible about the application domain, usage scenarios and the requirements which the visualization must meet. According to our experience, the main problem of such a meeting is not technical vocabulary that may be unknown to one side. Unknown vocabulary can be asked for. The bigger challenge is that in different domains everyday vocabulary such as "complex" or "random" may be used differently, leading silently to misunderstandings. One of our lessons learned was therefore that it is critical for success not to build the design on implicit statements and define key terms even if their meaning seems to be obvious.

[1] The *lemma* of a word is its base form, e.g., the lemma of "playing", "played", "plays" is "play".

Creating early mockups of possible visual designs eased the discussion a lot. It also proved useful to base the mockups already in an early stage on real datasets. This way unforeseen issues might become evident that would not have been considered when using an artificial test dataset.

Figures 2 and 3 show two of the mockups we created. Figure 2 (same data as in Fig. 1) shows an experiment with a more advanced graph layout algorithm (stress layout with manual adjustments). Compared to Fig. 1, we adapted the colors in a way that the different resources are assigned colors with a similar perceptual difference (to avoid the undesired effect of grouping). Furthermore, we removed the labels because it turned out that only the resource membership is important, which is already encoded in the coloring. However, during the following discussions it became clear that the graph structure itself is artificial because what the data actually represents are clusters.

Fig. 3 shows our first cluster-based design (here for the lemma "align") which contains one column per sense cluster and one row per sense. Here, the discussions revealed that one of the basic assumptions underlying this design, namely that a sense can belong to multiple clusters, is wrong.

We refined the requirements iteratively in the course of the process. Many new usage scenarios popped up during the discussions, some of which went significantly beyond the initial task description. In this phase it proved useful for us to take a step back and compile a document that solely summarizes the usage scenarios without any reference to design ideas to ensure that the design space is not restricted by early mockups that may be based on insufficient information.

The practitioner stated that it was during the in-depth discussions that the full potential of visualization became clear to her. Furthermore, she learned that there is not a single visualization that can address all her questions but that it could be beneficial to have multiple visualizations for the different tasks.

Finally, based on the detailed specification of the analysis questions the practitioner was interested in, the visualization expert could design a visualization that immediately convinced the practitioner because it is intuitive to read and far less complex than the initial design (compare Figures 1, 2 and 4 that all show the same data).

In the final design (see Fig. 4) each sense is represented as a colored circle (where color = resource). Senses within the same cluster are grouped together and enclosed with a border line. Within each cluster the senses are ordered according to their resource membership which eases an estimation of the distribution of resources.

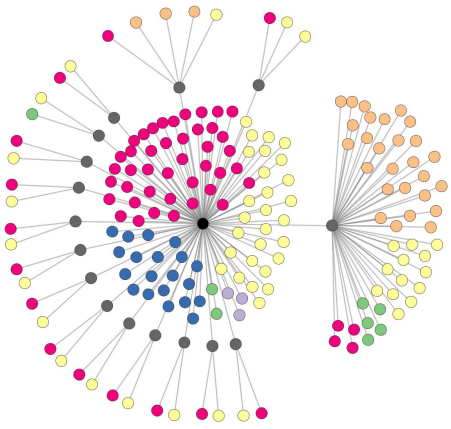

Figure 2: More advanced graph layout (lemma "run").

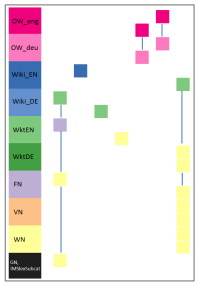

Figure 3: Initial cluster-based design (lemma "align").

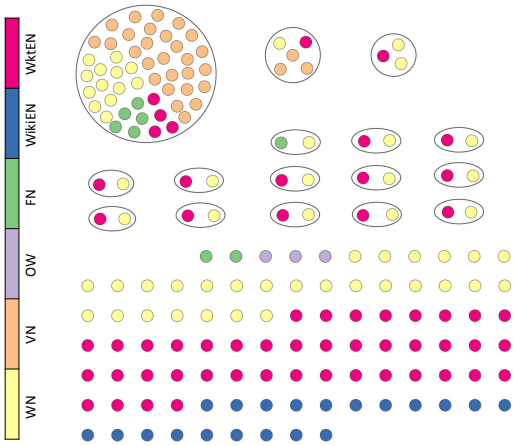

Figure 4: Final cluster-based design (lemma "run").

3 Is there a value in detours?

When looking back after the successful completion of the design process, we recognized that it took a considerable amount of time and several iterations until both sides fully understood what the requirements are and what visual analysis can do. This raises the question whether and how such detours could be avoided in future projects. At the end, our impression was that though there are certain lessons learned that we will follow up on in the next project, at least part of the iterations between requirements analysis and visualization design seemed like a necessary and inevitable stage of a successful collaboration process with a value of its own.

Acknowledgements

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References

[1] I. Gurevych, J. Eckle-Kohler, S. Hartmann, M. Matuschek, C. M. Meyer, and C. Wirth. UBY - A Large-Scale Unified Lexical-Semantic Resource Based on LMF. In *Proceedings of the 13th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2012)*, pages 580–590, Apr. 2012.

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