SemaSpace - Semantic Networks as Memory Theatre

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Abstract

SemaSpace is a fast and easy to use graph editor for large knowledge networks, specially designed for the application in non technical sciences and the arts. It creates interactive graph layouts in 2d and 3d by means of a flexible algorithm. The system is powerful enough for the calculation of complex networks and can incorporate additional data such as images, sounds and full texts.

Keywords: Semantic Networks, Graph editors

1 Introduction

Semantic networks have become a general paradigm for knowledge representation beyond their traditional application in science and technology. Under the phase of the *iconic turn* a shift from linear textual narration to diagrammatic reasoning is currently taking place. Disciplines like art history, image science and philosophy increasingly use semantic networks and diagrammatic methods in their work.

The Researcher Gerhard Dirmoser creates complex large-scale wall diagrams on topics like *25 years of ars electronica* or *performance art*[2004], influenced by the renaissance model of the memory theatre. All information in these diagrams, which often contain more than 10000 text-fields, has been acquired and organized manually. While the special form of organization of this data in clusters and tableaus can still be done manually, it is unfeasible for the creation of semantic networks with a similar level of complexity.

While many systems have been developed for the display and the analysis of semantic networks, existing tools are often not appropriate for assisting this process. Semaspace has been designed to aid the development, evaluation and navigation of complex semantic networks in a graphical, sensual way. SemaSpace fills the gap between complex tools for network analysis and simple graph editors or mind-mapping tools. It is powerful enough to handle complex graphs, maintaining a maximum of performance by keeping everything as simple as possible. It creates a browse- and readable data-space in both 2d and 3d, different media assets such as sounds, images or full texts attached to individual nodes can be included and displayed within the network.

The datamodel is designed to be simple and modular. If required, additional layers such as edge qualities, locked positions of vertices, image, sound data can be included.

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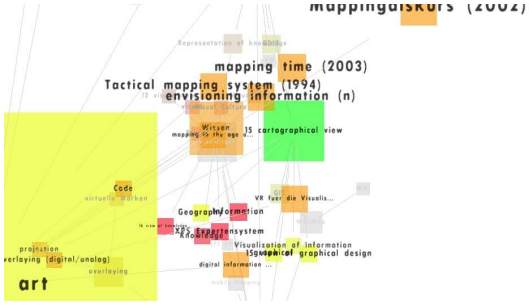

Figure 1: SemaSpace (3d mode)

2 Design Principles and Results so far

The question wether to prefer 2d or 3d graph layouts is difficult to answer. In general, we can say that two dimensional layouts are certainly easier to read and navigate, while 3d layouts are superior for examining the structure of a network.

The automatic layout algorithm is able to draw well ordered cyclical networks with more than 1000 edges and a high edge/vertex ratio at reasonable framerates for interactive graphics. Its behavior can be easily adapted to different network characteristics and shapes and further influenced by dragging individual vertices. It is also possible to manually define the overall shape of the network by placing and subsequently locking the position of individual nodes. New nodes and edges can be added while navigating the graph.

With complex networks of several thousand edges, one would like to start with a network partition by providing one or two initial vertices and the topological distance. A substring search method, node coloring based on topological distance and two different labeling methods support the visual orientation in the network. Singular "dead-end" leaf nodes can be collapsed and arranged around their parent nodes - resulting in better performance and readability of the structure.

The layout algorithm does not rely on typical spring embedders, since they tend to become unstable in graphs with high edge counts. Instead, a fixed length is calculated for each edge based on the valence of the connected vertices, which is consequently applied with damping. Additionally, radial global forces contribute to a well ordered, untangled graph layout.

Datasets developed / edited so far with the help of SemaSpace include a thesaurus on media art based on the archives of ars electronica, a taxonomy of diagrammatic representations, a verb thesaurus and the social network analysis of the Simpsons - each dataset imposes different challenges for the tool in terms of topological characteristics and level of complexity

References

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