Visualization-Based Decision Support Systems: An Example of Regional Relationship Data

Vicki L. Sauter, University of Missouri - St. Louis, USA
Srikanth Mudigonda, St. Louis University, USA
Ashok Subramanian, University of Missouri - St. Louis, USA
Ray Creely, Consultant, USA

ABSTRACT

Increasingly, decision makers are incorporating large quantities of interrelated data in their decision making. Decision support systems need to provide visualization tools to help decision makers glean trends and patterns that will help them design and evaluate alternative actions. While visualization software that might be incorporated into decision support systems is available, the literature does not provide sufficient guidelines for selecting among possible visualizations or their attributes. This paper describes a case study of the development of a visualization component to represent regional relationship data. It addresses the specific information goals of the target organization, various constraints that needed to be satisfied, and how the goals were achieved via a suitable choice of visualization technology and visualization algorithms. The development process highlighted the need for specific visualizations to be driven by the specific problem characteristics as much as general rules of visualization. Lessons learned during the process and how these lessons may be generalized to address similar requirements is presented.

Keywords: Anchoring, Collaborative Networks, Data Model, Filtering, Information Systems, Interactive Visualization, Public Sector

INTRODUCTION

Decision support systems provide decision makers with appropriate tools to design and evaluate alternatives available to them. Historically those alternatives were evaluated by comparing them in some discrete manner with well-known tools. With newer data-capture and storage capabilities, systems to support decision making are increasingly being used to find patterns in data for improving business processes, changing markets or in some way improving the organization.

Decision makers considering large quantities of interrelated data often are frustrated trying to make sense of them, and information systems professionals have been challenged to represent those data in a meaningful fashion. When numeric estimates, such as measures of centrality

DOI: 10.4018/jdsst.2011010101
and dispersion, represent the phenomenon sufficiently, we know how to proceed. When such estimates fail to represent the richness of the data, and the full extent of the phenomenon, IS professionals might employ data visualizations to help decision makers understand their data so they can make necessary choices. This paper describes one such example.

A regional chamber of commerce engaged a university research team to facilitate economic development of the region, with a particular focus on strategies to attract, develop and retain a skilled Information Technology (IT) work force to the region. They discerned that one factor influencing corporations considering relocation to the region is the existence of strong relationships among companies and higher education institutions with strong IT programs in the region; this factor signals the potential for a new company also to have strong relationships with those institutions. Because the chamber of commerce is fundamentally concerned with the economic base of the region, its leaders needed a tool to help them understand existing relationships and identify those that might be bolstered to improve corporate growth. In addition, these leaders needed a tool that could visually demonstrate existing university-corporate interactions while making their case for corporations or entrepreneurs to relocate to the region. Such a tool needed to demonstrate not only what relationships exist currently, but also how a new corporation might create relationships if it were to relocate to the region. There are no simple statistical estimates that would provide the kinds of support desired.

Given the above-stated context, the research team decided that a visualization-based DSS in the form of a network of associations between area universities, businesses, and governmental entities, would meet the goals of the project. The use of visualizations to represent social networks has become common place, thanks to social-networking related websites, where individual users can see a representation of their social connections. Professional-oriented sites utilize the concepts of network theory to display to their members information about potential contacts based on dyads of relationships. These sites, however, provide only a rudimentary visualization tool to their users that is not sufficient to meet the decision making needs discussed in the previous paragraph.

In this paper, we demonstrate a model for developing a network visualization application that is geared toward addressing the robust needs of understanding regional-based social networks. As Fry (2007) notes, the development of a visualization is an iterative process that includes parsing the data to provide structure, filtering the data to remove unnecessary components, and interacting with the visualization to develop methods for allowing the user to control the content and its visual representation. Such a process requires that the tool be sophisticated enough to create meaning in the size and location of interrelationships. In addition, however, the tool needs to be capable of engaging the users to enrich their understanding of the significance of that meaning. Not only do the users need to pursue questions of intensity and location of interrelationships, they need to understand the “who?,” “how?,” “why?,” “what?”, and “where?” aspects of those interrelationships. Hence, a visualization effort must determine how to present ideas, and to provide the interaction which allows the user to clarify and enrich the meaning of those ideas (Wujec, 2009).

This paper describes the process of selecting a visualization, the dimensions of that visualization and the interactivity of that visualization. It addresses the specific information goals that the application was designed to meet, the various constraints that needed to be satisfied, and how the goals were achieved via a suitable choice of visualization technology and visualization algorithms. Finally, the paper identifies the lessons learned during the process and how these lessons may be generalized to address similar requirements that exist in other organizations.
Related Content

Towards a Novel Approach for Enterprise Knowledge Capitalization Utilizing an Ontology and Collaborative Decision-Making: Application to Inotis Enterprise
Fatima Zohra Benkaddour, Noria Taghezout and Bouabdellah Ascar (2016).
www.igi-global.com/article/towards-a-novel-approach-for-enterprise-knowledge-capitalization-utilizing-an-ontology-and-collaborative-decision-making/148624?camid=4v1a
Asset Management for Buildings within the Framework of Building Information Modeling Development
[www.igi-global.com/chapter/asset-management-for-buildings-within-the-framework-of-building-information-modeling-development/176754?camid=4v1a](www.igi-global.com/chapter/asset-management-for-buildings-within-the-framework-of-building-information-modeling-development/176754?camid=4v1a)

Situational Synchronicity for Decision Support
[www.igi-global.com/chapter/situational-synchronicity-decision-support/11322?camid=4v1a](www.igi-global.com/chapter/situational-synchronicity-decision-support/11322?camid=4v1a)

Towards Informed Maintenance Decision Making: Guiding the Application of Advanced Maintenance Analyses
[www.igi-global.com/chapter/towards-informed-maintenance-decision-making/164057?camid=4v1a](www.igi-global.com/chapter/towards-informed-maintenance-decision-making/164057?camid=4v1a)