Exploring Information with Visage

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ABSTRACT
The Visage prototype responds to data-intensive work environments where users, exploring and analyzing data, struggle to make useful multiple applications with disparate visualizations of potentially related information. Visage seeks to coordinate the exploration, analyses, and visualizations of information regardless of their source or type. This coordination is accomplished by using an *information-centric* approach to user interface design to eliminate impediments to direct user access to information objects across applications and visualizations. Visage consists of a set of data manipulation operations, an intelligent system for generating data visualizations and a briefing tool that supports the conversion of visual displays used into interactive presentation slides.

Keywords:
Data visualization, graphics, data exploration, user interface environment

INTRODUCTION
Visage is an evolving user interface and software environment [1] with the goal of creating four important component capabilities:

1. A unique data navigation method using drill-down and roll-up techniques for navigating multi-dimensional data.

2. An information-centric drag-and-drop user interface paradigm by which users interact with data and applications.

3. Intelligent tools for dynamic generation of visualizations.

4. A fully integrated presentation and briefing environment.

The information-centric approach of Visage allows the operations applied to information be applied directly to the physical objects representing this information and not by the mechanics of running other applications to do so. In Visage, no data query needs to be constructed in advance in an abstract language; users can 'get their hands on the data', and perform whatever operations they would like.

A VISAGE SCENARIO
In order to convey the basic elements of Visage, it is useful to consider some simple displays and operations in a detailed example. The example is based on an application of Visage that we are developing to support the next generation of logistics' tracking and planning systems. These systems are being developed by the government to enable analysts to access information about the location, quantities, status, transportation, distribution, consumption and other properties of equipment and supplies and the people who need them worldwide.

One of many displays that can be produced in the Visage environment is an outliner-style table (Figure 1). It is one way to provide a hierarchical perspective on tabular data and efficiently displays tabular information.

Data-navigation: Drill-down, Roll-up
Starting from any point in a data network users may access a menu of alternative dimensions along which they may navigate. The user can choose to drill down along one of these dimensions by selecting any of the relations from the menu. The result is a more detailed organizational breakdown. This drill-down process can occur across different relations. For example, it is possible for a user to drill-down from a division to the equipment it possesses and then from one type of equipment to the parts or supplies it requires and then to all the supply points that have those parts available. This is a process of turning a network or web of relations into multiple hierarchies for navigational purposes. Users can select any attribute of the objects in the hierarchy that they want to have displayed, like the weight of supplies a unit requires, its echelon, the number of people in the unit, etc. As the hierarchy is expanded, the data attributes are expanded with it. The dynamic drill-down and expression of attribute values is a fundamental operation in Visage that can occur in every display. That is, drill down can occur as easily in a bar-chart or on a map as on the outliner.

The complement to the data navigation technique of drill-down is roll-up (aggregation). Subsets of units can be rolled-up (i.e. aggregated) into a single object and named by the user, in this case, “North hi supply units." It appears in the bottom of the outliner and its attributes are the appropriate totals of those for the units it aggregates. The new aggregate can be treated as a single object, which may be drilled down to show other units, their support, inventory or other information. This approach enables users to compose a complex query through a series of drill-down, drag, paint and roll-up operations. In Visage very complex queries may be composed entirely by direct manipulation.

Information-Centric Data Manipulation: Drag-and-Drop

An important operation in this information-centric interface approach [2] is the direct-manipulation movement of information throughout the Visage environment. Objects representing information are moved directly in groups or individually among visualization and application interfaces via simple drag-and-drop operations. In order to display some of the attributes of these units graphically, one simply drags the unit names from the outliner to an empty bar chart display. In this case, a bar chart shows the weight of supplies that the units require. Displaying unit supply weights in a bar chart makes it easy to select units requiring the most supplies - those with the longest bars. Focusing on the units with highest supply weights provides an opportunity to display the locations of just these units on a map, perhaps to determine the locations where supply points should be established. Units are transferred to a mapping application using the same drag and drop operation.

The map application used in Visage is a product called MATT which was developed prior to and independently of Visage by Bolt, Beranek and Newman. This is an example of one of the primary goals of this work, which is to provide the mortar necessary to cement together separately developed analysis tools into what the user will experience as an integrated work environment. By default, the map arranges objects by latitude and longitude, and uses standard military symbology to represent the units.

Another technique used in the Visage user interface environment to improve exploration and analysis of data is color highlighting or painting. By color highlighting a subset of units on the map, (perhaps to identify a region where large quantities of supplies will be needed) multiple displays may be visually coordinated [3]. Painting an object in one display causes it to be similarly colored in all other displays. Together, the three displays show the selected units, how many supplies they need, and where they are located.

Intelligent Visualizations with Sage

Visage incorporates the capabilities of Sage, a knowledge-based presentation system that designs graphical displays of complex data (e.g. quantitative, relational, temporal, hierarchical. categorical, geographic) [4] to provide automatic graphics generation. We have demonstrated the use of Sage to automatically assume the burden of visualizing information for other applications and for computer-supported graphic design, especially for large data sets. Complete integration between Visage and Sage is the goal of our work during the next year.

Integrated and Interactive Presentations

The Visage environment has a simple briefing or "slide show" feature completely integrated into the application. As analyses are performed, text and graphics can be captured and saved in special frames called “slides.” A slide is simple a frame designed to make it easy to "paste up" other frames and elements for visual presentations. The user simply "drags and drops" the desired displays onto the slide frame, where they are scaled appropriately. Note that elements on the slide do not lose their separate identity--they are still fully-functional interface objects that can be used for further analysis--even in the midst of a briefing. Collections of slides are accumulated in a "slide sorter" frame, used to sequence a presentation via simple drag operations, and to display each slide sequentially at full-screen size. Thus, the briefing function has been seamlessly integrated with those of data exploration and analysis.

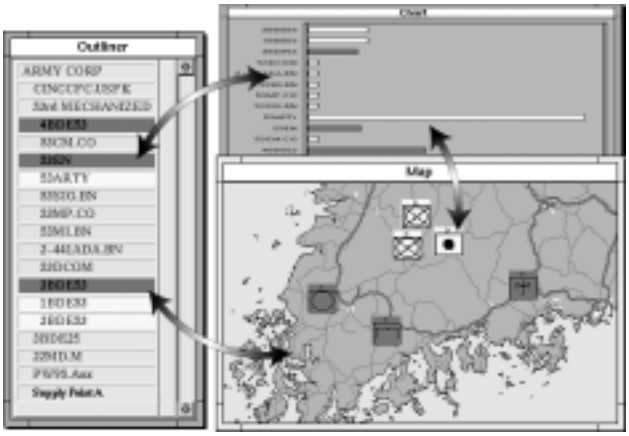

Figure 1. Visage interface

REFERENCES

1. J. M. Ballay. Designing Workscape: An Interdisciplinary Experience. Proceedings CHI'94, ACM, April 1994, pp. 10-15.

2. S. F. Roth and P. Lucas, C. C. Gomberg. Visage: Dynamic Information Exploration. Proceedings CHI '96, ACM, April 1996.

3. J. Goldstein, S. F. Roth, J. Kolojejchick, and J. Mattis. A framework for knowledge-based, interactive data exploration. Journal of Visual Language and Computing, no. 5, 1994, pp. 339-363.

4. S. F. Roth, J. Kolojejchick, J. Mattis, and J. Goldstein. Interactive graphic design using automatic presentation knowledge. Proceedings CHI'94 Human Factors in Computing Systems, ACM, April 1994, pp. 112-117.

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