CMP

ENTERPRISE SOLUTIONS FOR BUSINESS INTELLIGENCE

www.intelligententerprise.com

Intelligent ENTERPRISE

JUNE 5, 2000

Volume 3 · Number 9

decisiondashboards

Analytic Apps Gauge E-Business Performance

TOPPRIORITY
Can Data Profiling Save Your Project?

PRIMEMOVER
The Supply Chain Drives System Design

CURRENTEVENTS
WorkWise's Data Agent Server

$5.95 ($6.95 Canadian)

09>

0 73361 87392 7

DISPLAY UNTIL JUNE 26, 2000

DIVERSE NEW VISUALIZATION METHODS ARE IMPROVING INFORMATION DISCOVERY

BARRY GRUSHKIN

Eye Spy

SECONDS AFTER NATO TROOPS KNOCKED ON THE DOOR, THEY KNEW THEIR intelligence was right. Using super-sophisticated technology that pushed the limits of visualization and database integration, they had located and arrested a notorious war criminal. The technology used in this real-life spy thriller reminds us that the potential for visualization tools may extend as far as our imagination.

Starlight is the government visualization technology this NATO mission probably used. Visualization tools are proliferating as a way to represent integrated data intuitively for research, analysis, and discovery in data mining, databases, online analytic processing (OLAP), and the Web.

Visualization tools have now moved far beyond simple charts and graphs that display a handful of facts. They have become the method of choice for understanding many complex business issues. Pictures are no longer worth just a thousand words; they're worth millions of dollars in the business value they generate.

Figure 1 (page 24) depicts a screen shot from Starlight. At the left of the selected Starlight image, you see dots or small planes inside a cube. The user clicks these markers to read the unstructured data to which they point, such as transcripts of radio intercepts turned into text by voice recognition software. The markers appear in a 3D conceptual map — they are arranged so that spatial proximity indicates content similarity — with methods related to what Semio Corp. uses in 2D. (For an introduction to concept mapping, see "The Solution Engine," Decision Support, Dec. 21, 1999.)

The structured attributes appear on the large sphere in Figure 1, arranged as shown by radio frequency and other transmission signatures (mapping to vertical and horizontal angles respectively). Additionally, you can opt to pile them (that is, arrange them from center out) by sorting on still other attributes such as date. Starlight gives you slider controls to select combinations of attribute values, such as time, person, or frequency, in order to create link lines that connect unstructured, structured, and mapping components.

The derived image lets you explore hunches and clues about associations and find connections between texts, between text and structured data, and between either of those resources and land maps. You can view the map information from a "distance," as on the floor in Figure 1, or in detail, as on the back wall. A complex set of interconnected querying methods allows for a step-by-step comparison of clues that would make any sleuth, in government or business, into a mastermind.

A visualization tool transforms mathematical relations that represent reality (such as the attrition rate of customers) into colorful geometric patterns. The human mind has powerful identification, organization, and recognition skills in this visual domain. Choosing the transformation and corresponding images just right unleashes a lot of power for discovering information, perhaps even the completely unexpected.

In Figure 2 (page 24), you see another kind of war room, a financial one. This zoomed-out view from Metaphor Mixer by Maxus Systems International Inc. lets you observe global market conditions. A zoomed-in view (Figure 3, page 24) offers details for selecting and trading in specific companies. Stock chips float on a grid in the zoomed-out view, creating sets of virtual surfaces — one for each industry sector in any of a chosen set of world financial instrument exchanges.

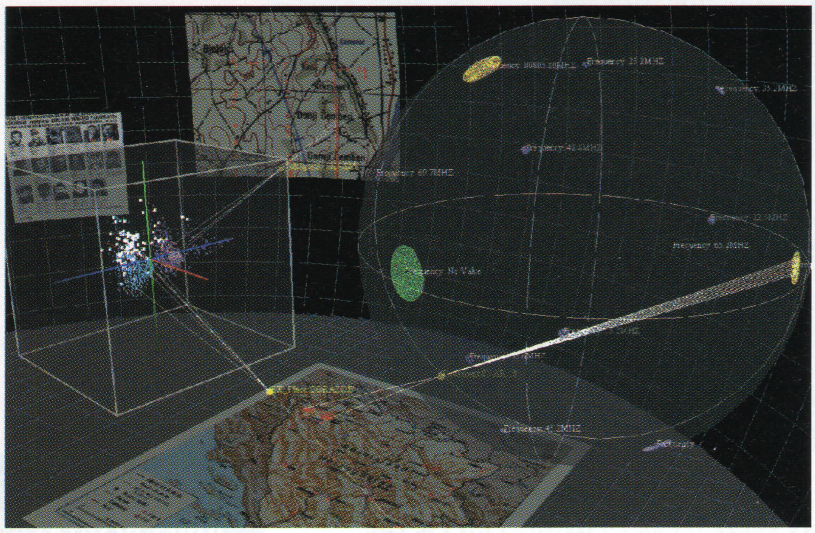

FIGURE 1 The Starlight war room.

FIGURE 2 The Metaphor Mixer financial war room observing down-turning markets.

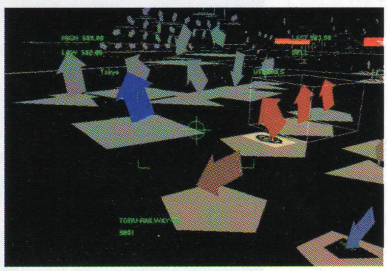

FIGURE 3 Individual stock markers telling about their value and trade indicators through movement, color, and form.

The shape and colors of the surfaces can rapidly clue a user into whether the market sector is turning — that is, starting to fall, rise, consolidate, or diverge. Zoomed in, individual chips display company logos as well as arrows showing movement momentum. These chips can spin, blink, and rock to draw your attention to important technical and fundamental conditions.

Metaphor Mixer contributes more than a memorable visual method for understanding markets in new and unexpected ways. It has saved some financial institutions tens of millions of dollars by offering early warning of such events as the recent turmoil in the Asian financial markets.

I believe that the following comments about metaphors from the insightful philosopher Max Black (a student of both Bertrand Russell and Wittgenstein) applies equally well to the potential of such visualization tools as Metaphor Mixer in their ability to reveal key business issues and relations:

"A memorable metaphor has the power to bring two separate domains into cognitive and emotional relation by using language directly appropriate to the one as a lens for seeing the other; the implications, suggestions, and supporting values entwined with the literal use of the metaphorical expression enable us to see a new subject matter in a new way. The extended meanings that result, the relations between initially disparate realms created, can neither be antecedently predicted nor subsequently paraphrased in prose. And as with other weddings, their outcomes are unpredictable."

— *Models and Metaphors*

Let us look at some other marriages, this time between visualization and data mining methods used in customer and product analyses. It seems the line between data mining and visualization is rapidly disappearing.

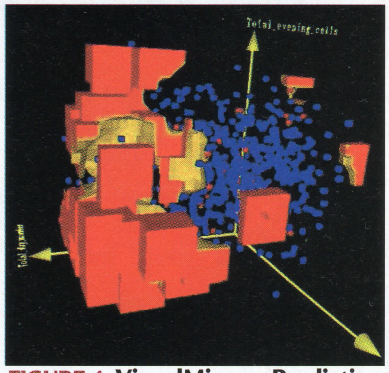

FIGURE 4 VisualMine — Predicting churn in phone customers.

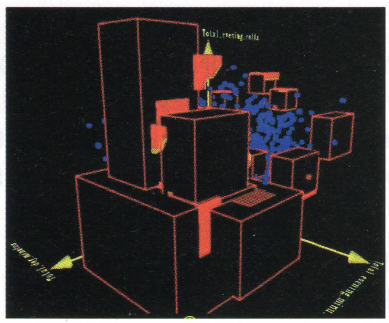

FIGURE 5 More than 70 business rules displayed in an easily digested image.

Figure 4 shows an image from VisualMine (by AI Software SpA, built in part using the Advanced Visual Systems Inc. AVS visual library), which is designed to integrate with SPSS Inc.'s Clementine data mining systems. Here a telecommunications company is determining what rules define customers that churn. The red denotes regions with a high density of churners (represented by the red dots that are mostly covered). The yellow indicates regions of a bit lower density.

The program automatically targets areas, but the user can turn dials to adjust details. Figure 5 shows regions automatically turned into 3D rectangles and cubes. Approximately 10 of these objects are the visual, and far more succinct, equivalent of 60 business rules of the sort a decision tree would find to define these churners.

The boxes are in fact action trigger regions, 3D versions of the keyhole regions I discussed in "Learning in Time" (Decision Support, March 20, 2000). To use a psychophysical metaphor, visualization is the sensory component, min-

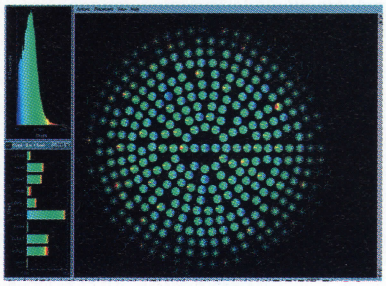

FIGURE 6 Product affinity clusters in Visual Insights.

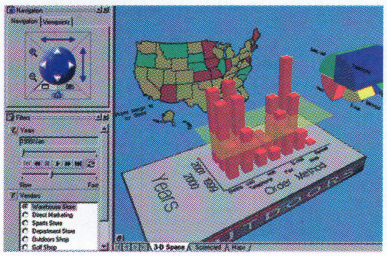

FIGURE 7 The Cognos Visualizer offers multiple image views that integrate and interact directly with cube structures.

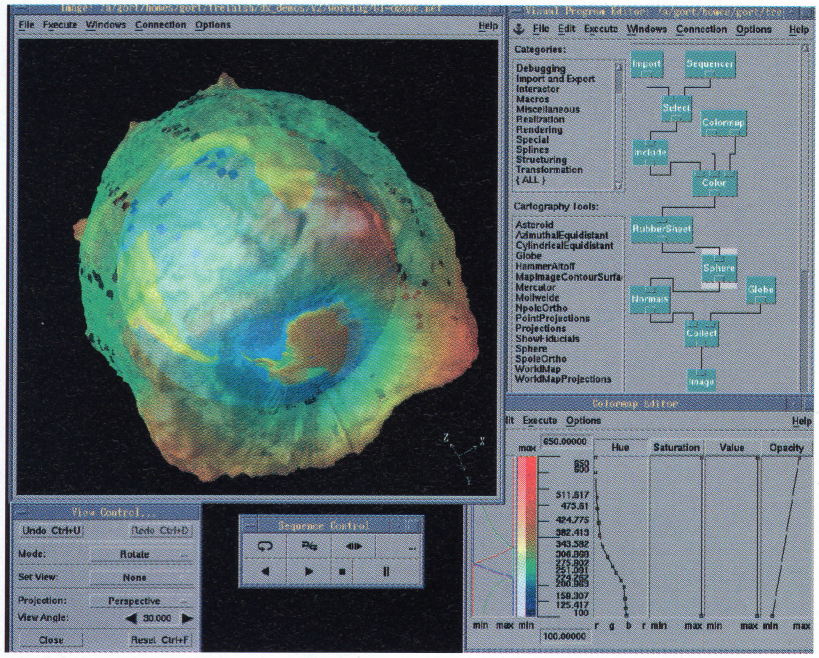

FIGURE 8 World ozone level analyses using IBM's DX visualization library.

ing is the intelligence component, and the resulting business rules equal the motor or action component. This process, for example, lets the company identify customers for whom costly up-front promotions would not make sense, but for whom the company should focus on competitive retention pricing.

The Visual Insights Inc. software pictured in the large right panel of Figure 6 also integrates a data mining component. The clusters here are grocery products grouped by checkout affinities using a generalized k-means method that not only clusters products that tend to be purchased together, but also organizes clusters into approximate affinity relations. Moving the cursor over any pixel tells you what product it represents and which (nearby) products are often bought with it. Colors offer profit-level information; red is the highest, blue the lowest. The other windows offer other product segmentations that you can lasso with the mouse to see the results for subsamples selected on other criteria.

Data source integration can be another important feature. Some visualization products, such as Cognos Inc.'s Visalizer (See Figure 7), offer full integration with cubes. By cubes, I mean hierarchically indexed, multidimensional database schema of the same sort that OLAP products use. You can drill down on dimensions, say from state to city, or change measures, such as sales to profits, and the images instantly redraw correspondingly.

The human mind has powerful identification, organization, and recognition skills in this visual domain

Cognos's product is an example of a ready-made application that lets you create images via menu operations. Other tool sets offer complex visualization software libraries, which often include sophisticated image processing and statistical software modules. Some also offer a visual programming interface where you can simply drag and drop the component modules right into place to form the data-to-image processing stream. One example is IBM's Data Explorer (DX) visualization programming library.

Figure 8 shows a component of a major DX library analysis of world ozone depletion. At the right side of the image are the data transformation steps used to create the atmospheric analysis image at the left.

The potential for creating new imaging tools for solving business problems is perhaps unlimited, for as Max Black points out, "... science, like the humanities, like literature, is an affair of the imagination."

For larger versions of images, extensive references, resource information, and a product list sorted by whether they offer libraries, are menu driven, or are Web enabled, see the online version of this article at IntelligentEnterprise.com. IE

Barry Grushkin *(bgrushkin@dsslab.com) is the senior lab researcher at the DSS Lab (www.dsslab.com) in Cambridge, Mass.*

RESOURCES

Advanced Visual Systems: www.avs.com
AI Software: www.ais.com
Black, Max: *Models and Metaphors,* Cornell University Press, 1962
Cognos: www.cognos.com
IBM: www.ibm.com
Maxus Systems International: www.maxussystems.com
Semio: www1.semio.com
Visual Insights: www.visualinsights.com