Interactive Fisheye Views for Groupware

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ABSTRACT
Fisheye views are well-known visualisation techniques that provide a sense of global context as well as local detail. We have developed a prototype system that differs from traditional fisheye views in two ways. First, the user can create, edit, and move objects in the fisheye workspace. Second, our system is groupware, so several people can see and manipulate the data at the same time, using individual focal points. These differences raise usability questions concerning interactive fisheye views for groupware. These include a user's difficulty in maintaining layout fidelity as objects and focal points change, and the difficulty of showing where others are working and what they can see.

INTRODUCTION
Fisheye visualisations typically distort a two-dimensional space to provide the viewer with both a high-level overview of the data and fine detail around a particular location. Generally, fisheye views are look-only displays used at a single workstation: the user can move their focal point, but cannot edit objects seen through the fisheye lens. We have developed a prototype system that differs from traditional fisheye views in two ways. First, it implements an *interactive fisheye* view, in which the user can create, edit, and move data objects within the fisheye workspace. Second, it is *groupware*, where several people, each at a different workstation, can be active in the space at once.

THE GROUPWARE CONCEPT MAP EDITOR
Our prototype implements a direct-manipulation editor for concept maps. Concept maps represent entities and their inter-relationships, realized on a computer as an editable graph with typed and labelled nodes and edges. Concept maps are often too big to fit, undistorted, in one window. Consequently, we impose a fisheye effect on the map using Sarkar and Brown's algorithm for fisheye graphs [3]. Figure 1a shows a sample concept map in our system, with a user's focal point on the node "The Vatican Bank."

The editor allows users to create new typed and labelled nodes, and to link nodes with typed and directed edges. Labels and types can be changed through popup menus. Nodes can be dragged to new positions in the workspace, or deleted.

Gutwin, C. and Greenberg, S (1997).
Interactive Fisheye Views for Groupware. Short technical note, Department of Computer Science.

The editor is also a real-time groupware application. Several people can view and manipulate the concept map at the same time, and any change made by any user is immediately updated on all workstations. As a groupware fisheye [1], each person can set their own individual focal point, allowing them to work independently on different parts of the map. Every person's display shows the focal points of all participants, although at lower magnification than their own focus. Thus, every person's display will differ, as more visual emphasis is placed on the local focal point than on remote ones (Figures 1a+b show this effect).

This multiple focal point display has several advantages in groupware. Because the entire map fits in one window, and because others' locations are magnified (and highlighted in particular colors), all members of the group are able to maintain awareness of where others are, and what they are doing.

USABILITY ISSUES
Our development and use of this interactive fisheye editor for groupware has raised a number of design and usability issues. These fall into two general categories: the difficulty of editing spatial layouts in a fisheye view, and the subtleties of how people interact and maintain awareness in a fisheye space.

Spatial layouts. People organize concept maps through spatial relationships. They may, for example, cluster nodes together or line them up in ways that imply meaning in the task domain. For example, Figure 1a shows the nodes "Elvis," "Saul," and "Superman" placed at the same horizontal level to indicate their equal importance in a hierarchy. Unfortunately, these relationships are difficult to construct in a fisheye space. Similarly, changing a focal point distorts each node differently, which can upset how an existing spatial organization is perceived. Consequently, a user may be forced to adjust node positions every time they change the focus, if they want to keep the visual relationships intact. In a groupware editor, this problem becomes far more severe, as different users can engage in "layout wars," where a user with one focus changes things to her liking, only to have another user with a different focus change them back again. For example, Figure 1b shows how the three nodes (Elvis, Saul, and Superman) can lose their spatial meaning when the focus shifts.

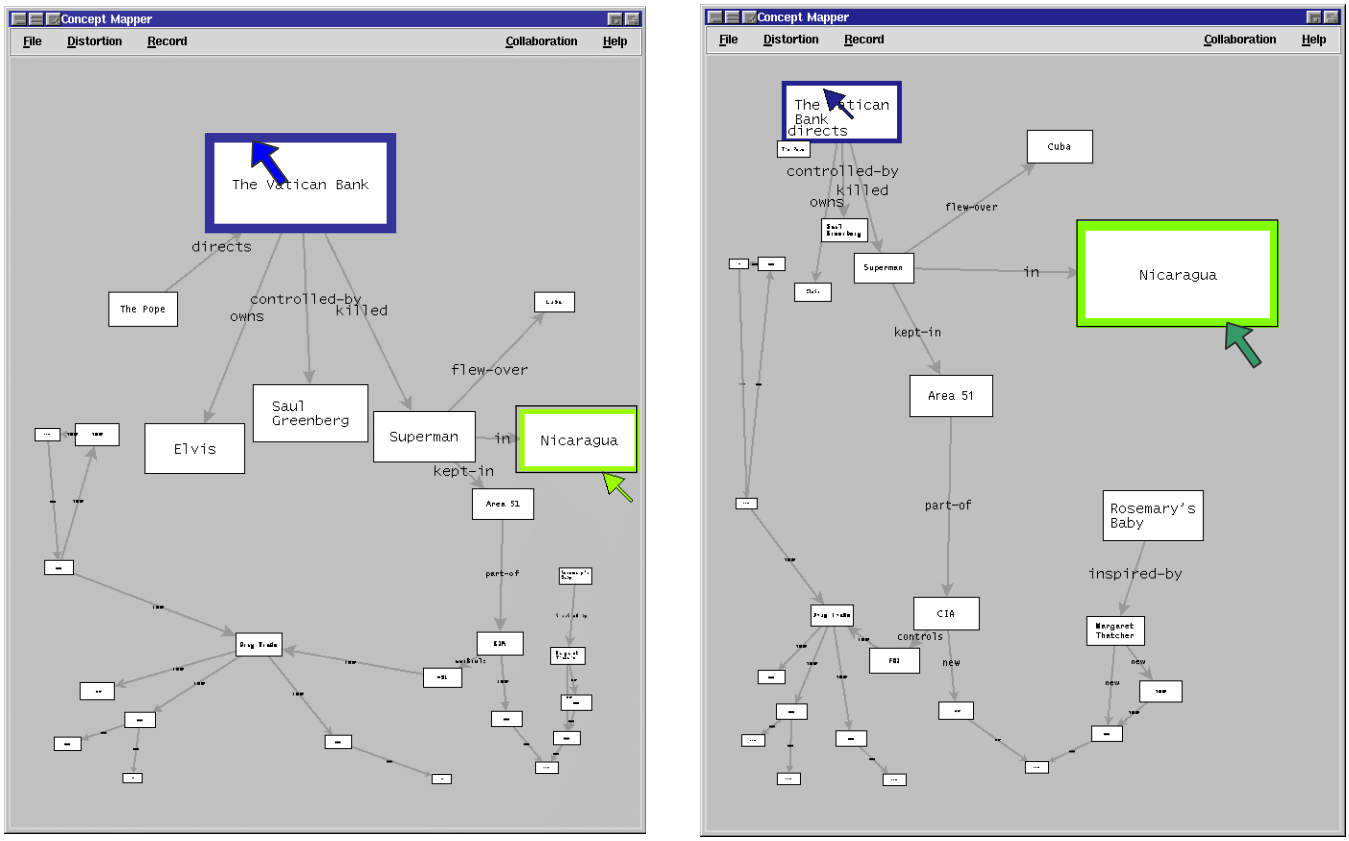

Figure 1. A concept map in a groupware fisheye view editor

Awareness. Awareness of others is critical in groupware [2]. In order to show what another person is working on, the node corresponding to the remote users' focus point is magnified, although not as much as the local one (unequal magnification balances the need for seeing local detail while still staying aware of others). This approach works fairly well in displaying awareness information [1]. However, our implementation magnifies only the node that another is focused on (that is, simple magnification is substituted for calculating a true fisheye distortion). This can be problematic, since this single node can overlap and occlude other nodes when the map is dense. This problem could be alleviated by using true fisheye functions to show other's focal points, but at considerable computational cost. Another problem comes from the disparate views. Although each person can see the entire document, particular nodes will be large in some views but too small to be accurately seen in others. If one user wishes to point to and discuss a particular node, they need to know whether others can see that node in enough detail to understand the discussion. We have experimented with "halos" around a person's focus point to show what they can see in detail [1], but with multiple users this strategy can quickly clutter the screen.

SUMMARY

Our research was motivated by design requirements of groupware. In particular, groupware workspaces tend to grow quickly; participants want to pursue both group and individual work; and people needed to stay aware of what others were doing. We thought that fisheye effects could fulfil some of these requirements on a small display. While promising, subtle problems remain to be solved. These include the difficulty of editing and manipulating objects in a fisheye space, and the trade-offs in providing awareness cues through unequal multiple focal points.

REFERENCES

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