**Navigation/Zooming**

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**Papers Reviewed**


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**A multi-scale, multi-layer, Translucent Virtual Space**

- Browsing very large spaces of displayed information at different scales.
- Introducing multiple translucent layers to avoid the problem of losing visual context.

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**The Macroscope: Translucent Zooming and Panning**

- A typical zooming operation and its problem.
  - Blows up the viewfinder to fill the entire image
  - Problems: the viewer loses the context of where the blown-up image came from.

- Solution – the macroscope:
  - Makes the zoomed in and zoomed out views share the same physical screen space by displaying them in multiple translucent layers.

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**Typical Zooming vs. macroscope**

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**An Example of a Three Layer Zoom**
Interactive Control of the Macroscopes

- Multiple scales can be seen simultaneously
  - Viewers can select the viewfinder in the layer that is at the appropriate scale and adjust it
- The system can make the correspondence between viewfinders and their layers
- Viewers can dynamically adjust the translucency levels between layers

Examples of Macroscopes

- Superimposed on the original map is the enlarged image of the viewfinder area
- The resolution and the sizes of features (roads, city names) help in distinguishing the two layers

Examples of macroscope (Cont.)

- As the viewfinder is dragged, the scale of the zoomed-in view changes size
- When panning the viewfinder, the background remains the same, but the superimposed layer changes

Shifting Attention and Generating Multiple layers

- Relative translucency of the layers can be dynamically adjusted to emphasize either the higher or lower layers
- Selecting a rectangular portion of the image can generate a three-layer macroscope

Multiple resolution maps

- One can also use multi-resolution maps, so that zooming into a map brings up a map of higher resolution

Another Example: Graphic Display of Hierarchical file System

- A conventional graphical display of a hierarchical file system
- In the macroscope version, each icon graphically contains all of the files and folders within it, at a much reduced size
Hierarchical File System (cont.)

- No opening or closing of folders, just zooming into the contents of a folder.
- One can zoom into the contents of an individual file containing text.

Critique

Strong Points
- Effective and sufficient examples
- Effective techniques
  - Interactive control
  - Multiple layers

Week Points
- The figures and pictures are not labeled
- Doesn’t show how to adjust the transluency levels
- No implementation details

Where We Are


DataSplash

- DataSplash is a direct manipulation system in which users can construct and navigate visualizations.
- DataSplash provides a layer manager, which allows users to visually program the way objects behave during zooming.
- It’s difficult to construct visualizations that display an appropriate amount of detail at all elevations.
- This paper proposes an extension of the DataSplash database visualization environment (VIDA).

Principle of Constant Information Density

- Number of objects per display unit should be constant.
- The amount of information should remain constant as the user pans and zooms.
- To maintain constant information density
  - Either, objects should be shown at greater detail when the user is closer to them
  - Or, more objects should appear as the users zooms into the canvas
  - Or, both.

The DataSplash environment

- Each layer appears as a vertical bar in a layer manager.
- All objects in a canvas are organized into layers.
- Each object is a member of exactly one layer.
- Each layer is associated with exactly one database table.
- Each row in the table is assigned an x,y location in the canvas.
The DataSplash environment (cont.)

- The current elevation is shown with a horizontal elevation bar.
- Any layer bar that is crossed by the horizontal elevation bar is considered to be active and objects are rendered.
- An icon of the type of the object displayed by each layer appears in the bottom below its layer bar.

VIDA - Providing visual density feedback

- The width of each layer bar reflects the density of corresponding layer at the given elevation.
- A tick mark is assigned one of three colors to indicate which condition patterns at a given elevation (Users can specify the bound to define a range of acceptable densities).
- If within the density bound
  - fall below the minimum density bound
  - exceed the maximum density bound

What does the figure tell us?

- Elevations 40%-60% are too dense.
- The area of the native space visible increases quadratically, therefore, the object density increases quadratically as the elevation increases.
- The rate of change in width is more pronounced by the layer bar on the right, because the right hand layer bar contains more objects.

User Interaction With the New layer Manager

- Users can modify the layer manager:
  - Adjust the top or bottom of a layer bar.
  - Drag the entire layer bar up and down.
  - As the user modifies the bar, the colors of the tick marks change to reflect the modification.
- Users can change the contents of layers:
  - Use the paint program interface to modify the contents of a layer.
  - For example, to modify the number of objects.
  - Use the visual select and pin mechanisms. These operations affect the number of rows in the table associated with the layer.
- The extensions of the layer manager also teach the user about the properties of density function in general.

Non-uniform Data

A Clutter Application

Improved Version

Conclusions

- Introduced the notion of well-formed applications, ones that display an appropriate amount of information at any given elevation.
- Introduced a system, VIDA, that helps users construct well-formed applications in the DataSplash database visualization environment.
- Conducted a pilot study that suggests that information density affects user navigation.
Critique

Strong points
- The density feedback is effective and informative
- Interaction with the layer manager is intuitive

Weak Points
- Not sure how effective with other density metrics
- Modification tasks may not be easy when the density metrics and data objects are more complex
- Semi-automated adjustment of layer density is still in progress, which would better be put in the future work

Where We Are


Motivation

- After following a number of links, users often have trouble revisiting a page that was previously viewed.
- The history mechanisms in the current browsers are not appealing to users.
  - 42% of the pages were revisited using the Back button.
  - 6.1% of the pages accessed used the history list.
- The shortcomings of the common history mechanisms are:
  - Whenever a user follows a branch point, a large part of the history is lost.
  - The history list is textual and page titles may lack cues needed to find a particular page.
  - The history list is cumbersome.

The Domain Tree Browser

- It constructs a hierarchy as the user traverses the links.
- It organizes the visited URLs based on web-site domains.
- The zoomable user interface automatically resizes thumbnails to fit the window.
- The Domain Tree Browser (DTB) is divided into two parts:
  - Domain panel displays all the domains visited so far.
  - Tree panel displays the tree visualization of the visited URLs of the domain selected on the domain panel (in a top-down manner).
- A node is a rectangle which contains the screen grab of the web-page it represents.

Some Features of DTB

- Color coding is used to indicate the last visited node in the tree.
- Size coding on a tree node is used to indicate the number of visits to the corresponding URL.
- When a user visits a web-page, and its corresponding domain does not exist, a new domain is added to the domain list and is made current (in red color).
Some features of DTB (cont.)

- All the frame separators are elastic.
- Domain names are searchable.
- Users can sort the domain names.
- Users can prune a tree.
- DTB provides zooming and centering. Users can also manually zoom in or zoom out of the tree.

Pruning Along with Zooming and Centering

[Images of diagrams showing pruning along with zooming and centering.

Implementation

- Domain Tree Browser is implemented in Java Swing Package and Jazz.
- The list of visited domains is maintained using a hashtable.
- The tree pane is a Canvas, a subclass of JComponent in Jazz, which provides zooming and panning capabilities.
- Thumbnails are generated by continuously taking the screen grabs of the web browser window.

Conclusions

- Organizing URLs by domains and visualize each visited domain is an effective way to visualize history.
- The usability study shows that the users took less time with DTB browser to revisit already visited pages.
- This was a preliminary study, the utility of DTB need to be enhanced (related to design and interface).

Critique

Strong points

- Zooming and centering is an effective technique for displaying the tree.
- Thumbnails provide effective cues for users to find a particular page.

Weak points

- Scalable? It's hard to find a node if the tree is large.
- Lose the relationships among domains.