

## **Information Visualization In Practice**

**How the principles of information visualization can be used in research and commercial systems**

James Tam

## **Putting Information Visualization Into Practice**

### **A Common Problem**

- There is too much information to represent all at once
- Providing all the details all at once is not useful (results overload)
- Context is lost when the details of a only subset of the information is shown.

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## Too Much Information To Show All At Once



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## Another Example Of The “Large Data Set – Limited Display Space Problem” : Games



Dungeon Master (Java version) <http://www.cs.pitt.edu/~alandale/dmjava/>

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## Too Much Information To Show All At Once

Approaches to the problem:

- 1) Scrolling
- 2) Magnification
- 3) The DragMag
- 4) Transparent overlays
- 5) Overview and detail
- 6) Focus and context
- 7) Zooming

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### 1) Scrolling



From <http://www.dansmc.com/microfiche.jpg>

Image from "Information Visualization" by Robert Spence

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## 2) Magnification: Inline

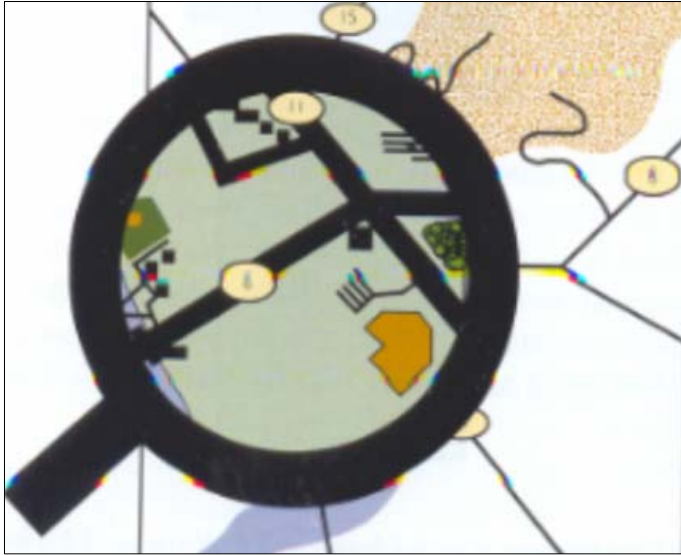


Image from "Information Visualization" by Robert Spence

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## 2) Magnification: Mutually Exclusive



Icewind Dale © Interplay productions

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## 2) Magnification: Mutually Exclusive



Icewind Dale © Interplay productions

James Tam

## 3) The DragMag

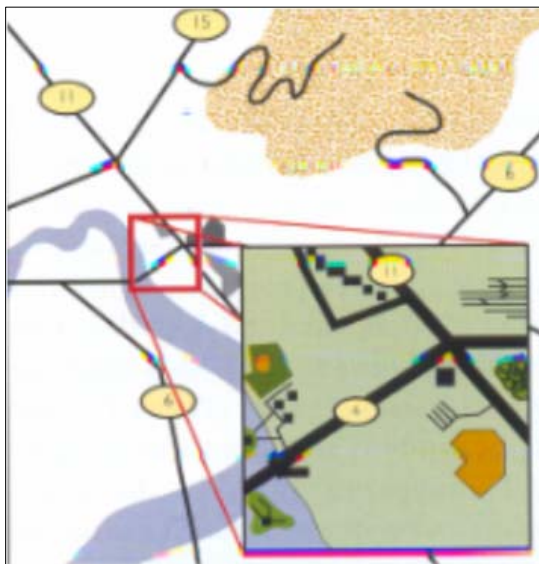


Image from "Information Visualization" by Robert Spence

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#### 4) Transparent Overlays

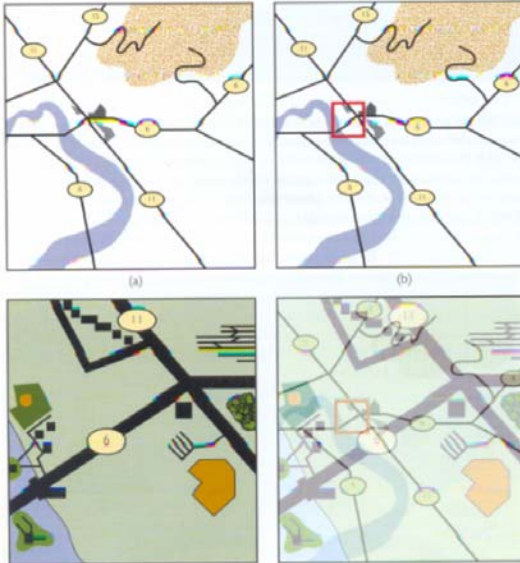


Image from "Information Visualization" by Robert Spence

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#### 4) Transparent Overlays



Diablo © Blizzard

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## 5) Overview And Detail: Separate



Images from "Information Visualization" by Robert Spence

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## 5) Overview And Detail

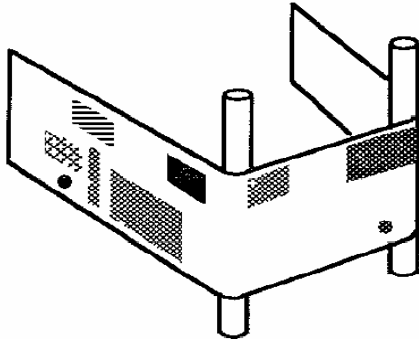


Defender © Midway Home Entertainment Ltd.

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## 6) Focus And Context

- Again the amount of the information is too large to display all at once.
- With this approach detailed view can still be viewed within its surrounding context.



*Leung and Apperly TOCHI'94*

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## Approaches To Applying A Focus And Context View

1. Employ selective omission
2. Employ a fisheye view

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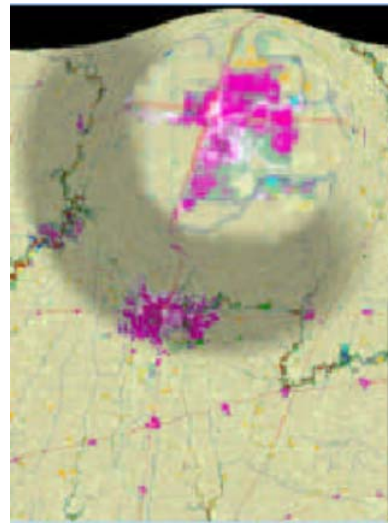
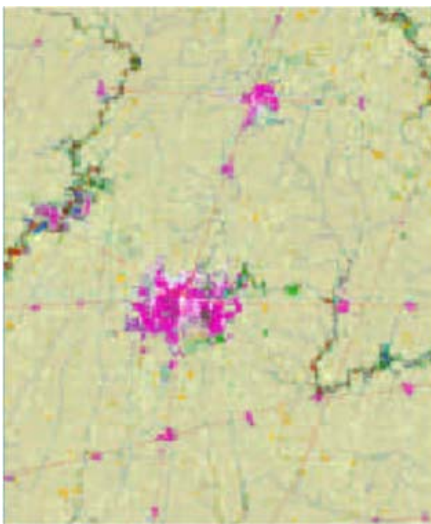
## The Fisheye Lens: Photography



Image from: [http://rick\\_oleson.tripod.com/](http://rick_oleson.tripod.com/)

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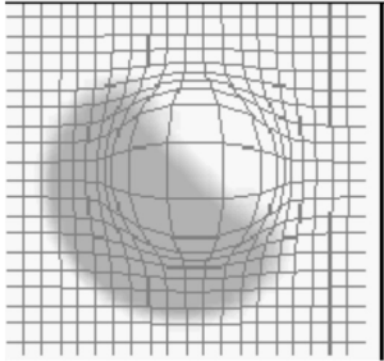
## Fisheye View



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# Fisheye View: Visual Cues For The Distortion

Distortion is understandable through the use of a grid and shading



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# Table Lens

Housing Market for Santa Clara County, CA - March 2000

Bedrooms	Price	Square Foot	Status	Baths	Address	City	State	Zip	Realtor	MLS #
5										
151	389,000	3531	Sale Pending	4	6755 STEPH...	Gilroy	CA	95020	CENTURY 2...	4361
152	389,000	2261		3	3583 BAYO...	San Jose	CA	95111	BAY CITES ...	10970
153	389,000		Sale Pending	1.5	1781 ANGEL...	San Jose	CA	95111	ROSE GARD...	944120
4										
3										
2										

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## Focus And Context: Distortion In One Dimension

### •Distortion in the X-dimension

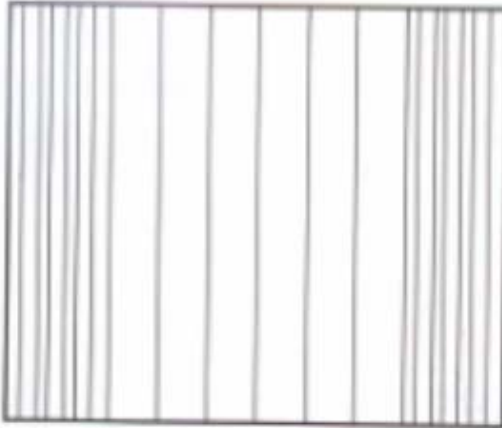
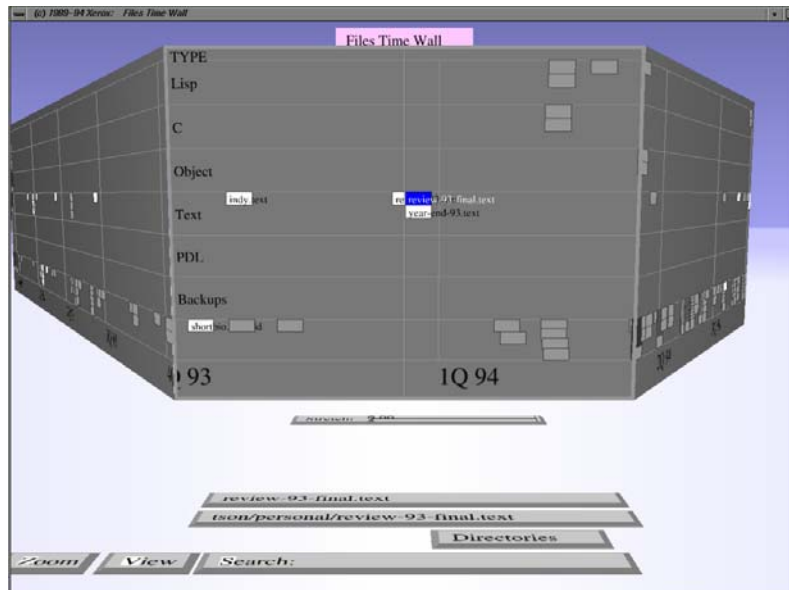


Image from "Information Visualization" by Robert Spence

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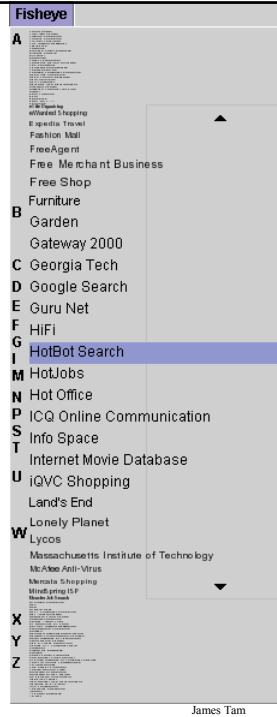
## The Perspective Wall



Mackinlay / Robertson / Card: Proc ACM CHI'91

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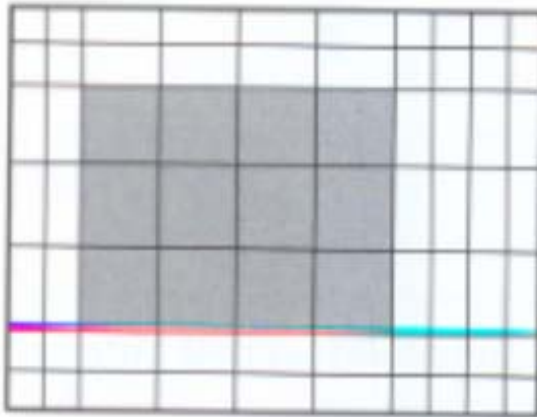
# Fisheye Menus



Bederson, B.B. (May 2000)  
University of Maryland  
[www.cs.umd.edu/hcil/fisheyemenu/](http://www.cs.umd.edu/hcil/fisheyemenu/)

## Focus And Context: Distortion In Two Dimensions

•Distortion in both the X and Y dimensions

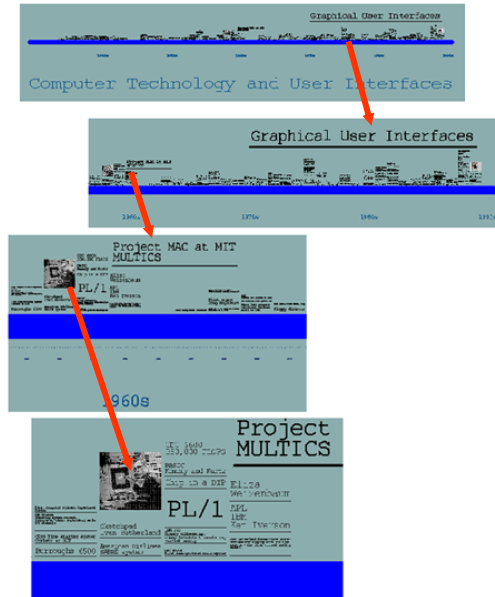


Images from "Information Visualization" by Robert Spence



## 7) Zooming

Pad++: A Zoomable Graphical Sketchpad for Exploring Alternate Interface Physics  
Bederson et al  
*Journal of Visual Languages and Computing* 7, 1996



Browsing of digital images

<http://java.sun.com/features/2001/08/photomesa.html>

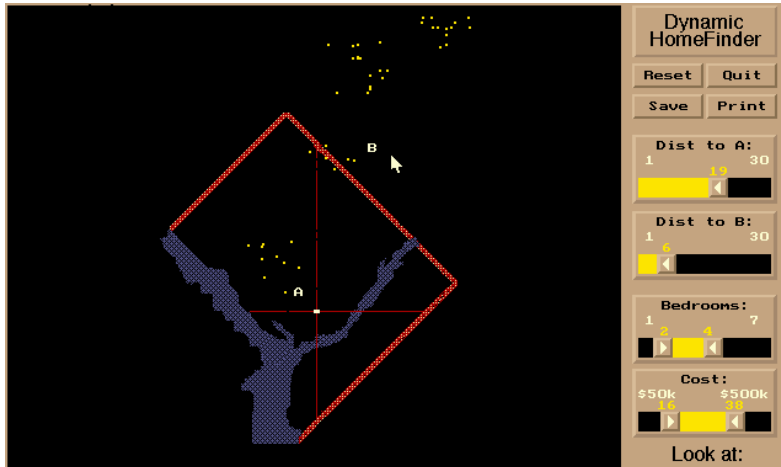
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## Visual Information-Seeking Mantra

- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand



## Dynamic Queries: HomeFinder



The yellow dots above are homes in the DC area for sale. You may get more information on a home by selecting it. You may drag the 'A' and 'B' distance markers to your office or any other location you want to live near. Select distances, bedrooms, and cost ranges by dragging the corresponding slider boxes on the right. Select specific home types and services by pressing the labeled buttons on the right.

Dynamic HomeFinder

Reset Quit

Save Print

Dist to A: 1 30

Dist to B: 1 30

Bedrooms: 1 7

Cost: \$50k \$500k

Look at: Hse TH Cnd

Features: Grg Fp1

CAC New

Shneiderman et al University of Maryland <http://www.cs.umd.edu/hcil/spotfire/>

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## HomeFinder: The Details

**Start with an overview of the data**

**Dynamic queries (rapid, incremental, reversible actions)**

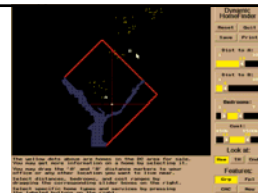
- All results are displayed instantly
- No “search button”
- Prevents errors

**Direct manipulation of**

- Queries
- Query results
- Can be interacted with like real-world objects

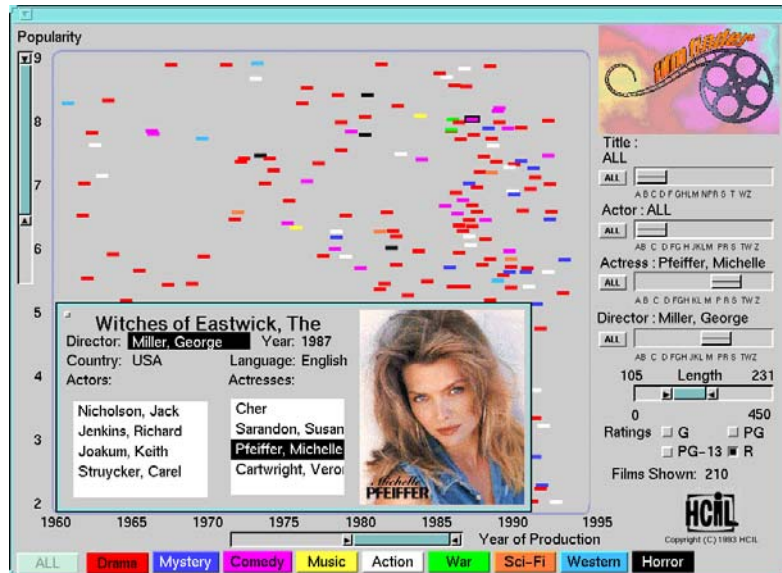
**Details on Demand**

- When the data set is small enough additional information can be provided



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## Starfield Display: FilmFinder



Ahlberg, University of Maryland <http://www.cs.umd.edu/hcil/spotfire/>

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## FilmFinder: The Details

### **Filmfinder employs many of the principles employed in HomeFinder:**

- Overview of the data
- Zoom and filter through
  - Dynamic queries
  - Direct manipulation
- Details on demand

### **But with FilmFinder system there are additional concepts:**

- Starfield display
  - The entire data base can be viewed and manipulated on one screen
- Tight coupling of interface components (to the state of the system)

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## A Student Project: HomeBay

The screenshot shows the HomeBay application interface. On the left, there are search filters for Price Range, Square Footage, Property Type, and Advanced filters for Bedrooms, Bathrooms, Age of Property, and Description. A 'Search Results' table is displayed below the filters. On the right, a map of Calgary shows property locations with colored markers. A 'Click for details' popup shows a property image and its price and area. Three callout boxes on the left point to specific features: 'Dynamic Queries' points to the search filters, 'Radar Overview' points to the map, and 'Progressive details on demand' points to the property details popup.

#	Price	Area	Property Type
01	\$154,800	Marlborough Park	Bungalow
02	\$199,900	North Cochrane	Two-Story
03	\$199,900	Vesivale	Bungalow
04	\$199,500	Coventry Hills	Two-Story
05	\$199,500	Brimwood	Bungalow
06	\$229,725	Ingleswood	Condo
07	\$229,000	Tuscany	Manor
08	\$249,900	Capitol Hill	Duplex
09	\$249,900	Arbour Lake	Townhouse
10	\$249,500	Berdi Trail	Bungalow
11	\$289,000	Shalocosa Park	Two-Story
12	\$288,800	Patterson	Townhouse
13	\$370,000	Arbour Lake	Two-Story

481 Student Project (April, 2000) Rob Pearson, Kashama Willms and James Chisan

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## Multiple Views Of A Large Data Set: PhotoFinder

The screenshot shows the PhotoFinder application interface. On the left, there is a 'Library Views' pane showing a stack of photo thumbnails. The main area displays a 'Collection View' of 129 thumbnails. Below the thumbnails, there is a 'Photo Viewer' for a selected photo. The viewer shows the photo and a 'People in Library' section with fields for 'Last Name' and 'First Name'. A 'People in this photo' section is also visible. At the bottom, there is a metadata form with fields for 'Description', 'Keyword', 'Starting Date', 'Ending Date', and 'Location'. The status bar at the bottom shows the date '2/21/00' and time '2:20 PM'.

University of Maryland  
Human Computer Interaction Laboratory  
<http://www.cs.umd.edu/hcil/>

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## Representing Connectivity

- **The problem of having large data set – but limited display space must still be dealt with**
- **Also there is the additional problem of showing how things in a large data set relate e.g., How to show Internet connections between servers?**
- **Some issues:**
  - Occlusion of information
  - Edge crossing
  - Overwhelming quantity of edges

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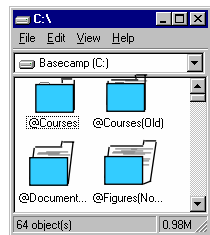
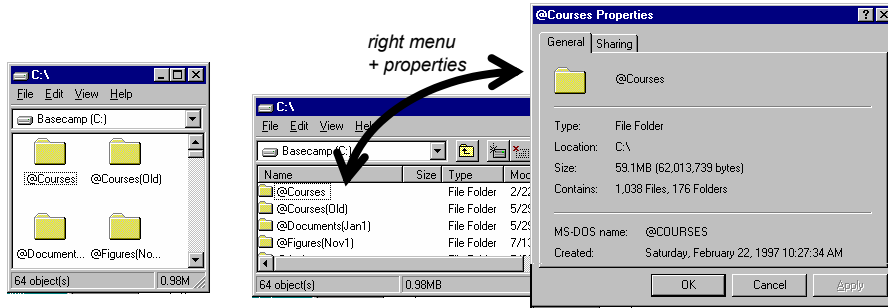
## Representing Phone Network Connections



Images from "Information Visualization" by Robert Spence

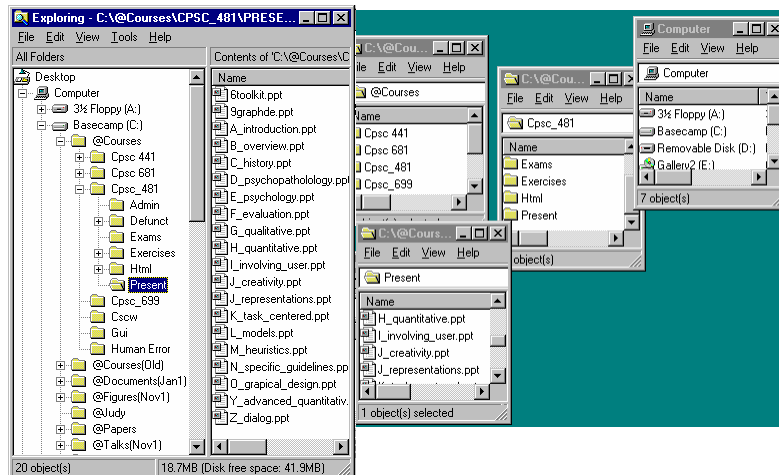
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# Which Folder Has The Most Documents?



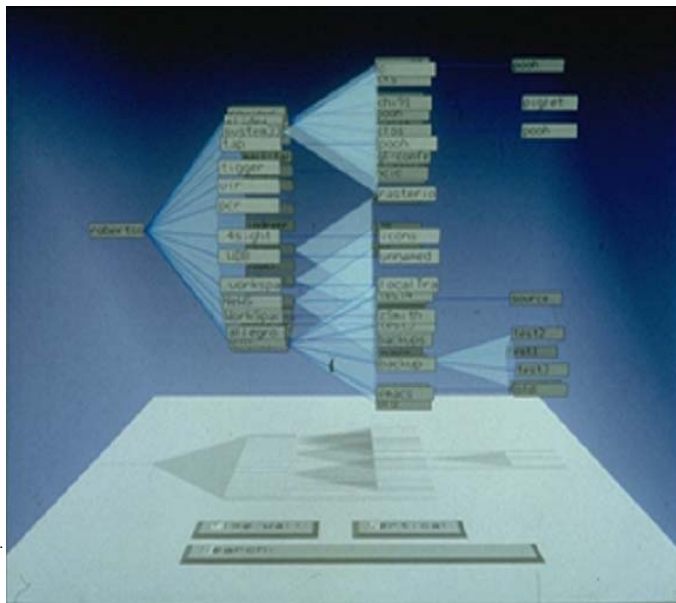
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# Where Am I? Where Was I Going?



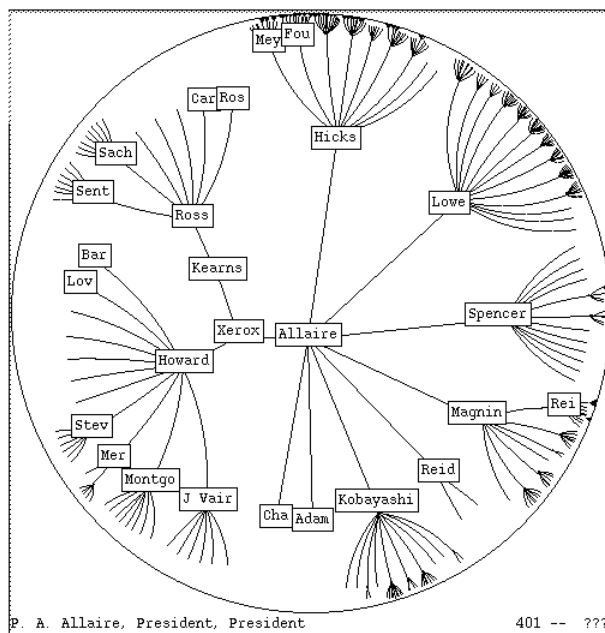
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# Cone Trees



Robertson / Mackinlay / Card  
Cone Trees: Animated  
3D Visualizations of  
Hierarchical Information.  
Proc ACM CHI'91

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P. A. Allaire, President, President

401 -- ???

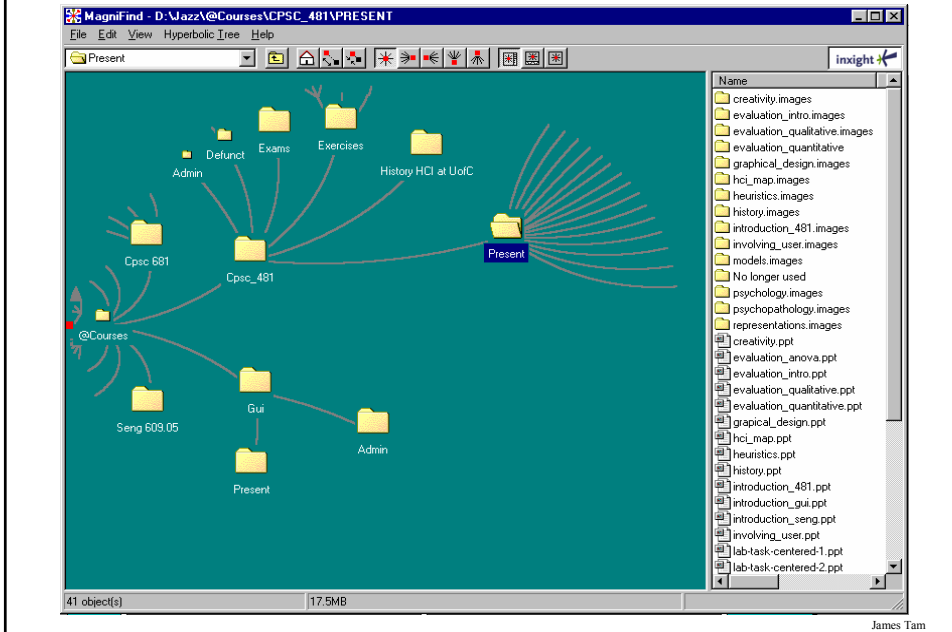
**Xerox Parc/Inxight**

Demo: <http://startree.inxight.com/>

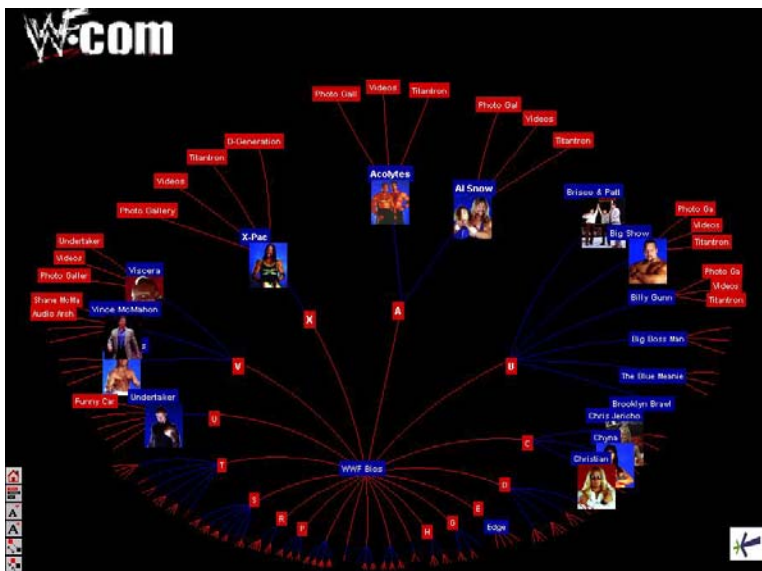
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## Hyperbolic View Of A Disk Hierarchy



## Hyperbolic View Of The Web



Demo:<http://startree.inxight.com/>

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## What You Now Know

### Ways of dealing with the “large data set but limited display space” problem

- 1) Scrolling
- 2) Magnification
- 3) The DragMag
- 4) Transparent overlays
- 5) Overview and detail
- 6) Focus and context
- 7) Zooming

### The information seeking mantra and how it has been applied in the HomeFinder and FilmFinder systems

### Problems and some solutions when representing connectivity in large data sets

James Tam

