

# CPSC 481: Beyond Simple Screen Design

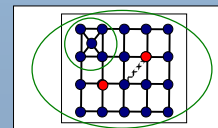
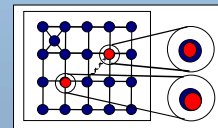
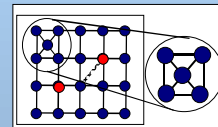
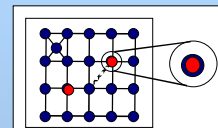
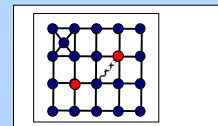
Interacting with visual representations  
screen real estate: detail in context  
navigation: detail on demand  
metaphor: use and misuse

*Sheelagh Carpendale*

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## Information Exploration Tasks

- **Global overview:** - searching for patterns and trends.  
How well do airline routes cover the whole world?
- **Individual details:** - specific information about data items.  
When is the first flight in the day between Calgary and Montreal?
- **Subgroups:** - information about a collection of data items  
How many international flights leave from Calgary?
- **Comparisons:** - questions between one or more data items of the same resolution  
Does New York or Boston have more direct flights to San Francisco?
- **Correspondences:** - questions across resolutions.  
What percentage of the total flights originate in Canada?



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## **Screen Real Estate: detail & context**

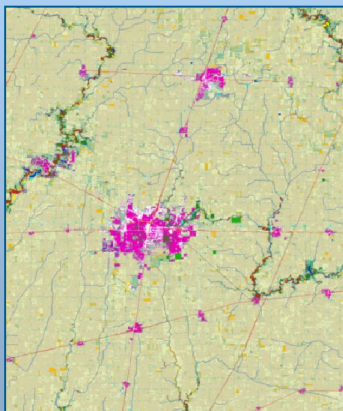
**Problems are intensified by the discrepancy between large information spaces and the relatively small available screen space.**

- How to find a given piece of information?
- How to move through the information?
- How to gain overall perspective?

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## **A Presentation Problem**

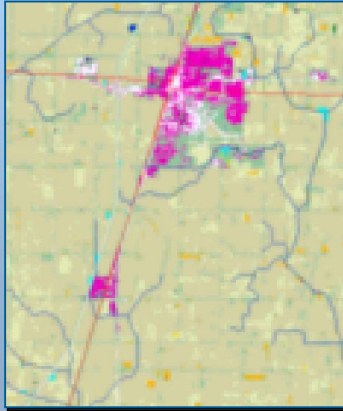
### **Insufficient detail**



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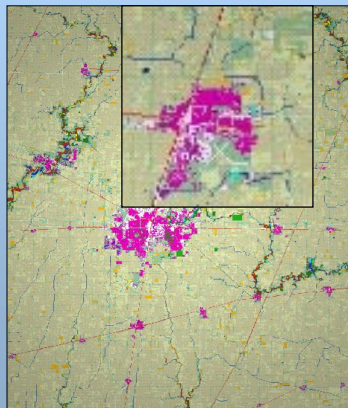
## A Presentation Problem

### Insufficient context



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## A Presentation Problem

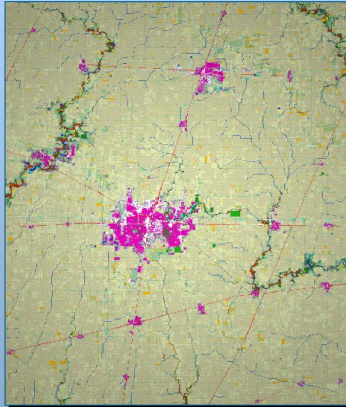


### Insets

- have detail
- have some context
- lose local context
- not detail-in-context

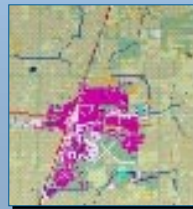
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## A Presentation Problem



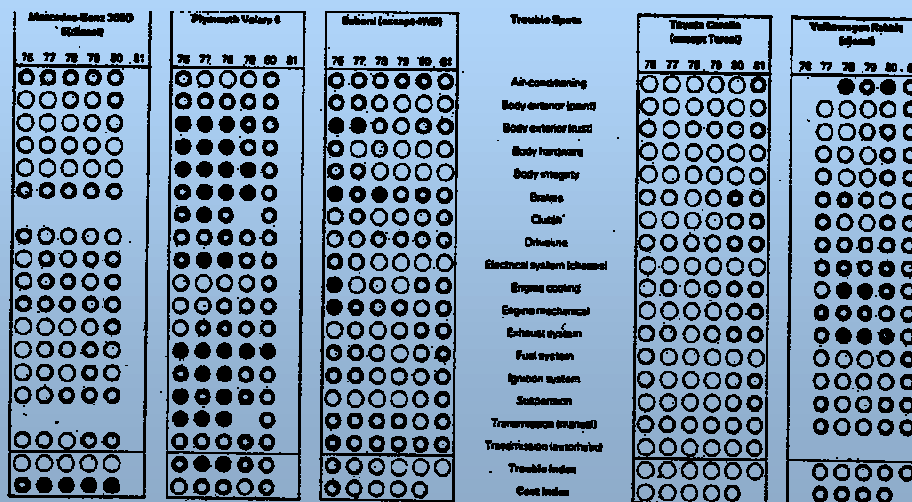
### Separate views

- have detail
- have context
- not detail-in-context



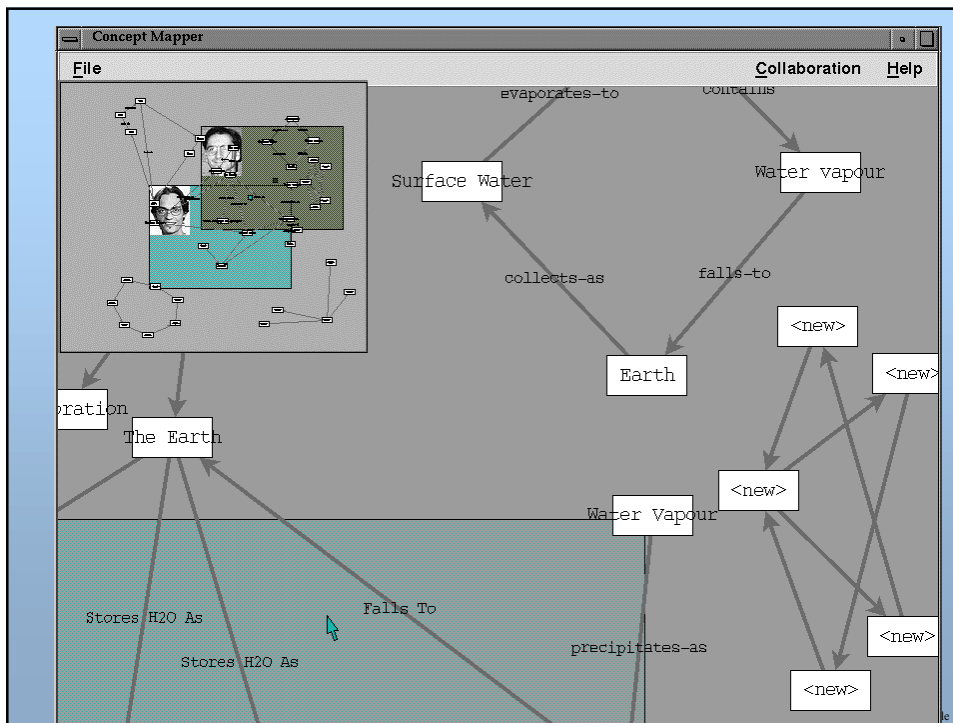
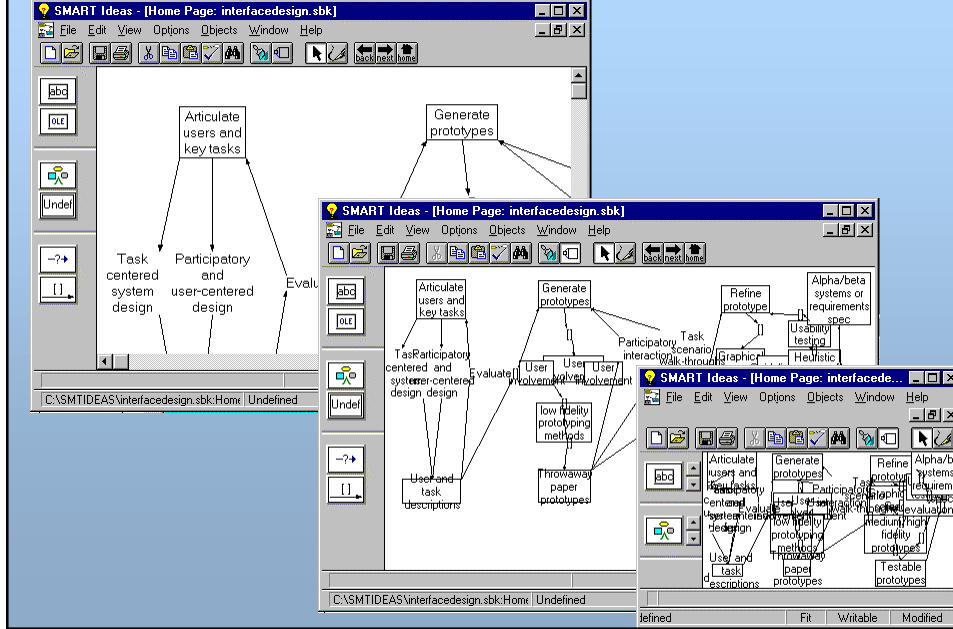
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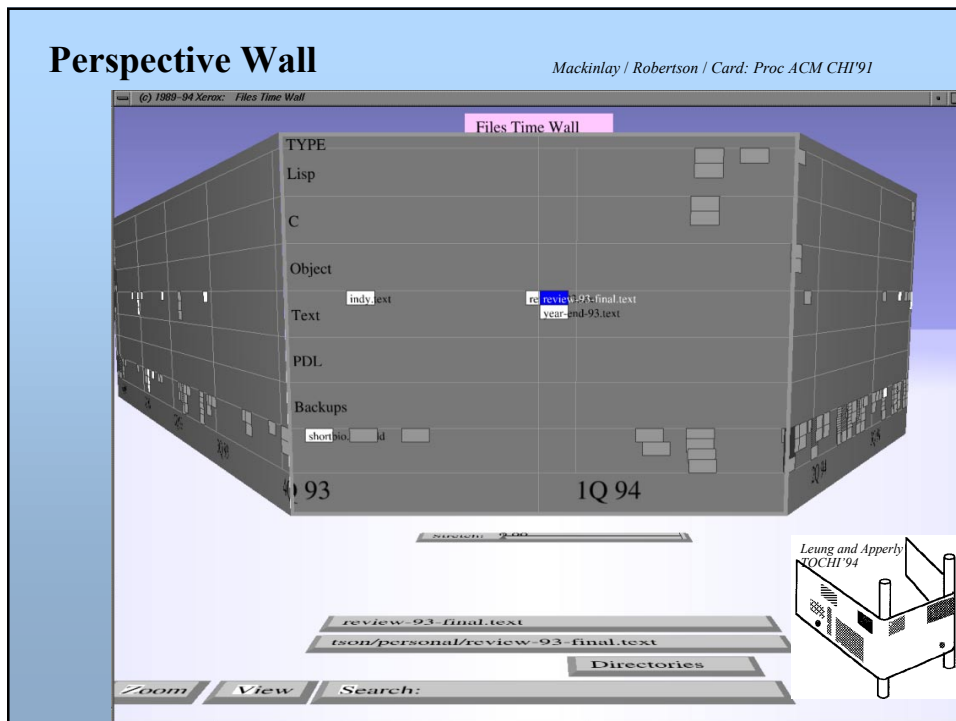
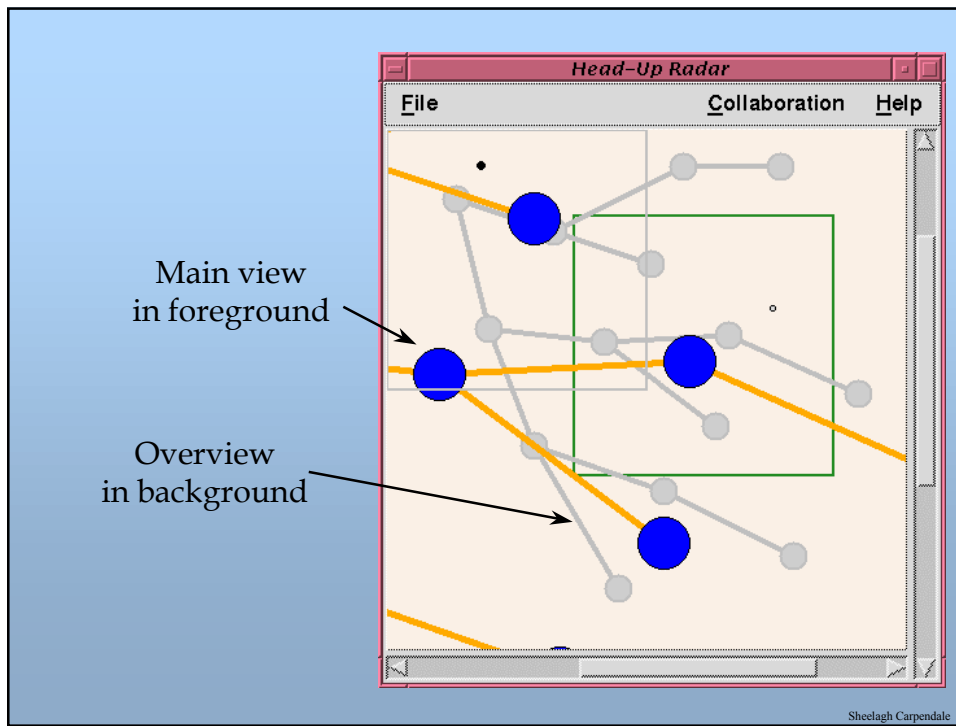
## Overview & detail for comparisons using small multiples and data density



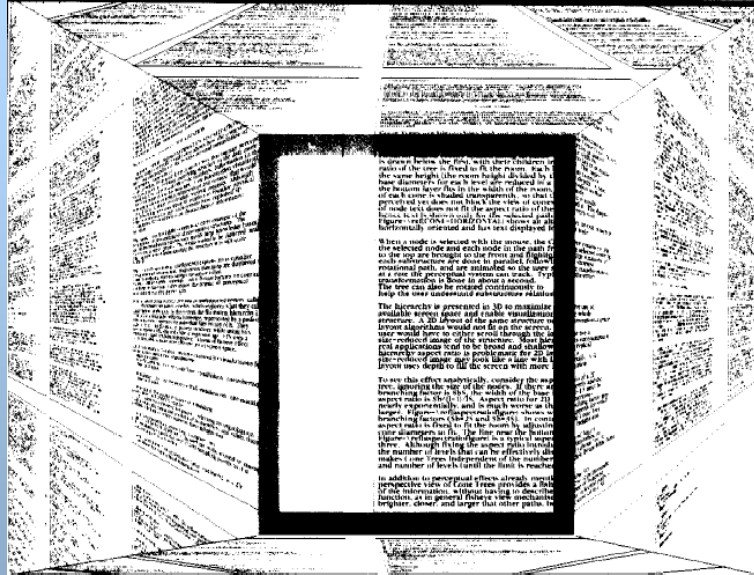
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# Case study: Concept mapping





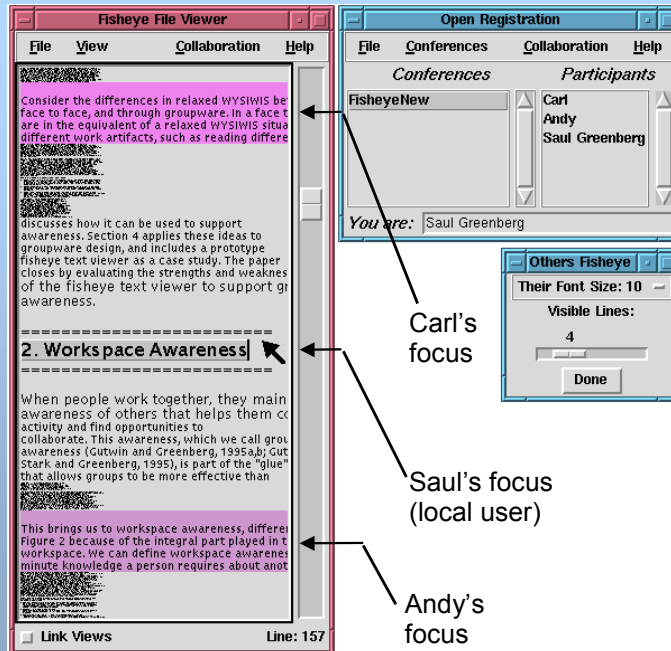
# Document Lens



Robertson / Mackinlay ACM UIST 1993

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# Fisheye Text groupware



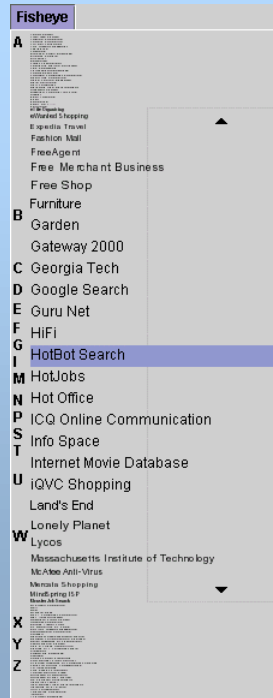
Carl's focus

Saul's focus (local user)

Andy's focus

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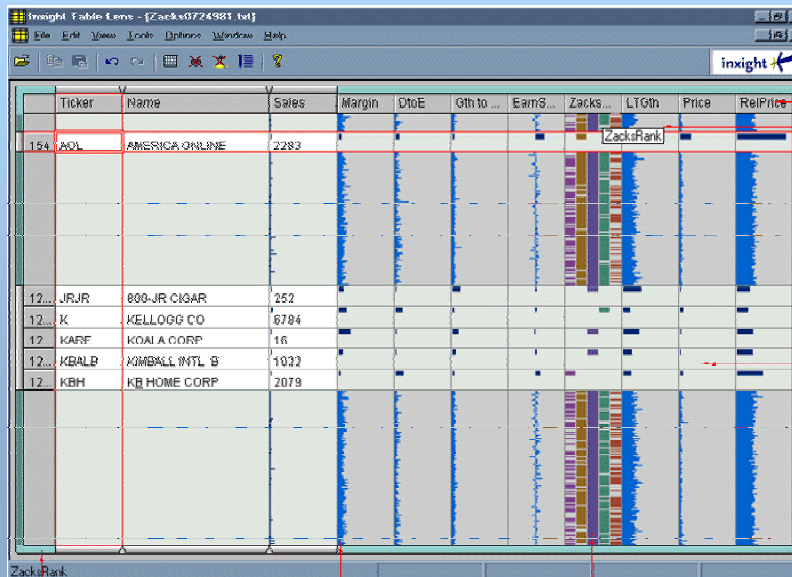
## Fisheye Menus



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

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## Embedding Detail Within Overviews



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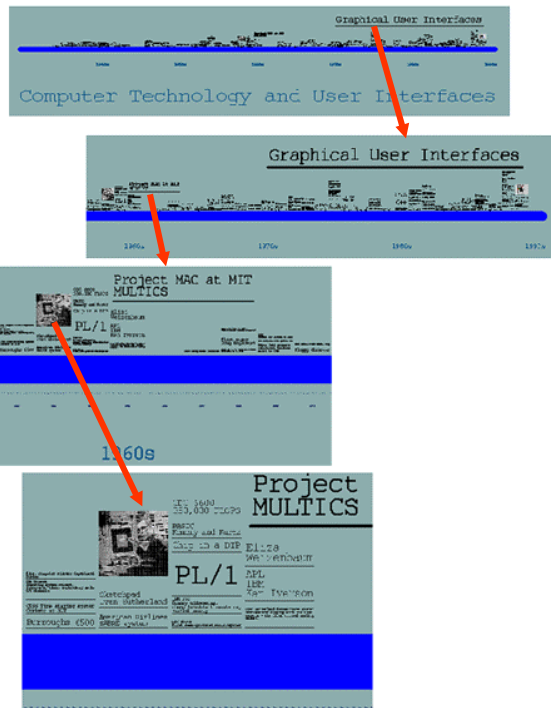
## Table Lens

Housing Market for Santa Clara County, CA - March 2000

Bedrooms	Price	Square Foot	Status	Baths	Address	City	State	Zip	Realtor	MLS #
5	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

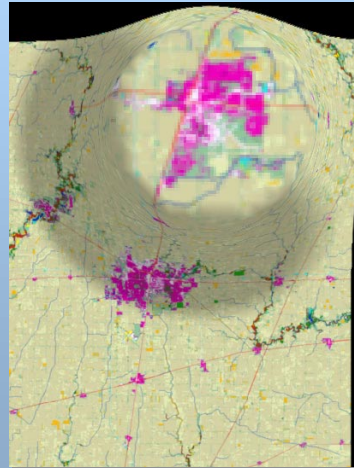
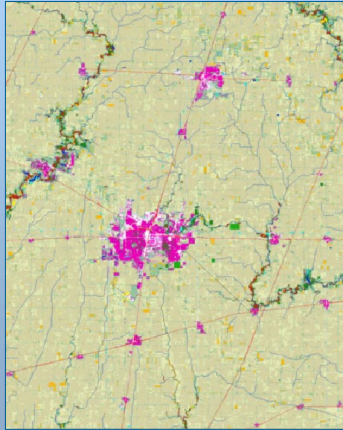
Inight: [www.inight.com](http://www.inight.com)

## Infinite Zoom



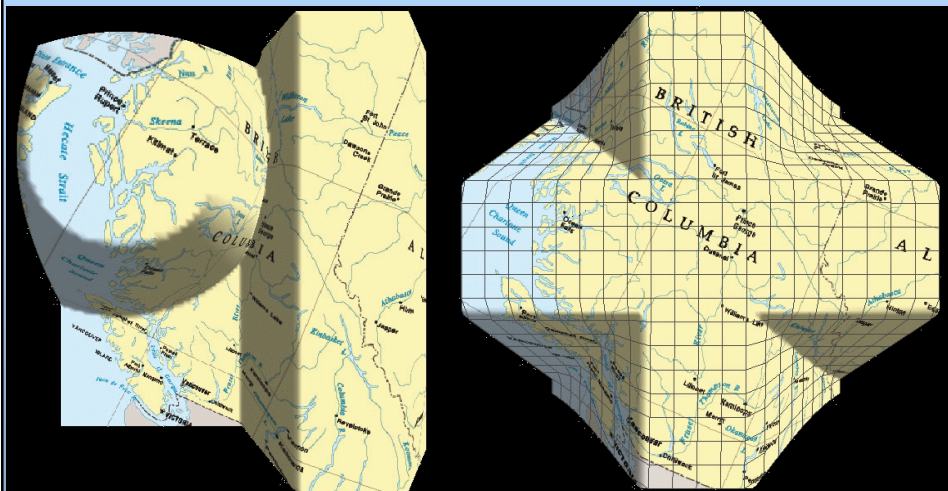
Pad++: A Zoomable Graphical Sketchpad for Exploring Alternate Interface Physics  
 Bederson et al  
*Journal of Visual Languages and Computing* 7, 1996

## Detail-in-Context



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## Elastic Presentation



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## Data Mountain

Robertson / Czerwinski / Larson / Robbins / Thiel / van Dantzig  
Data Mountain: Using Spatial Memory for Document Management  
Proc ACM UIST'98



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Proc ACM UIST'98



## Task Gallery

[www.research.microsoft.com/ui/TaskGallery/](http://www.research.microsoft.com/ui/TaskGallery/)



## Navigation: detail on demand

### **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

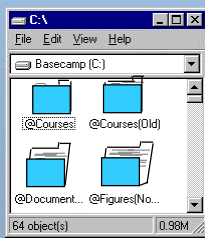
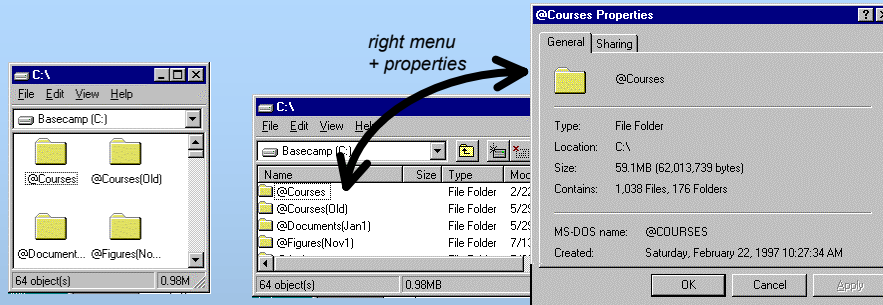
Overview first, zoom and filter, then details on demand

Overview first, zoom and filter, then details on demand

*Shneiderman, Designing the User Interface 3<sup>rd</sup> Ed. 1997 p523*

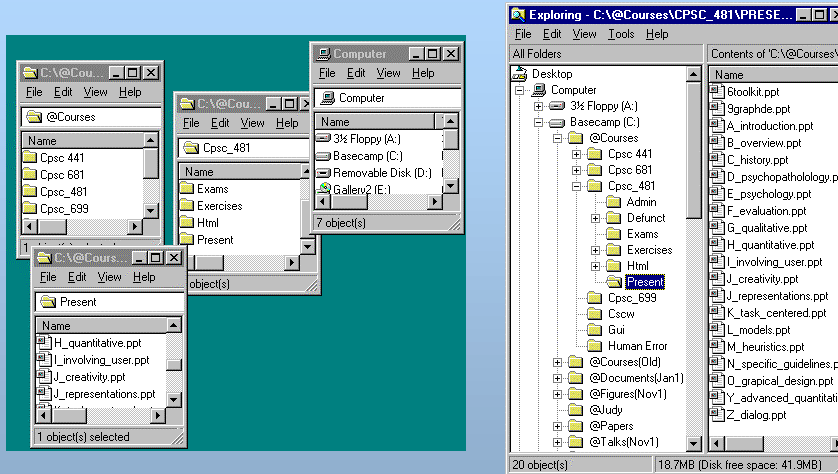
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## Which folder has the most documents?



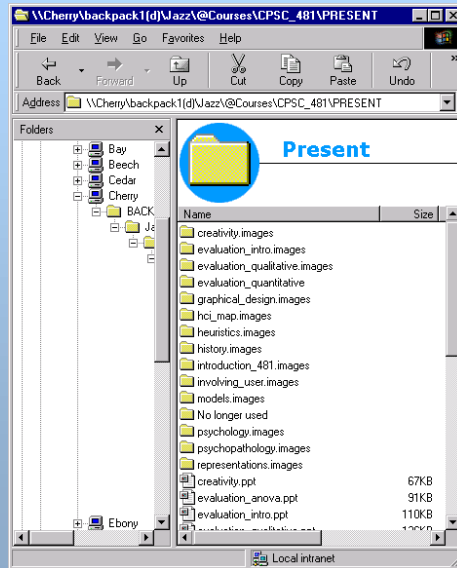
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## Where am I?



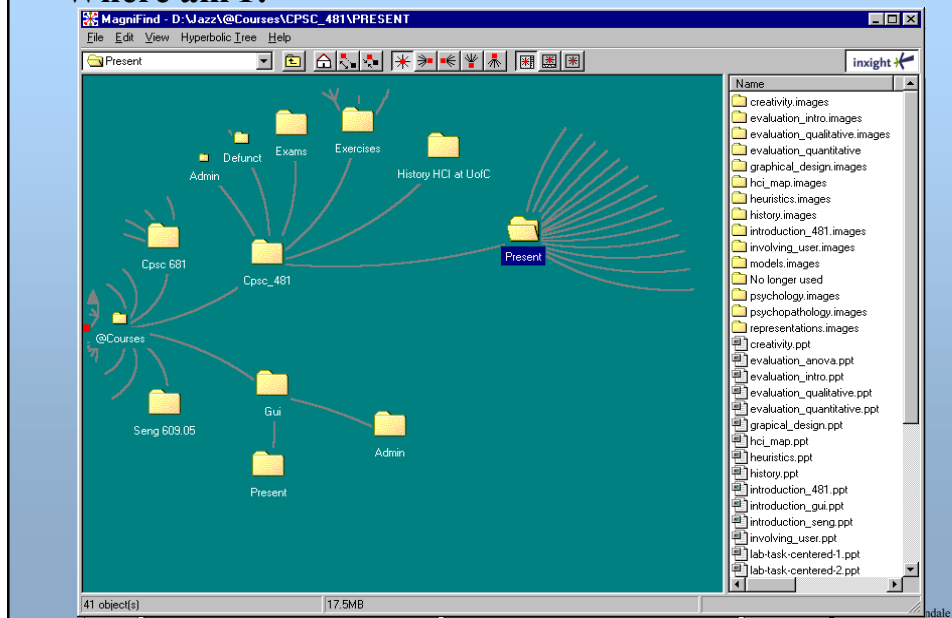
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## Where am I?

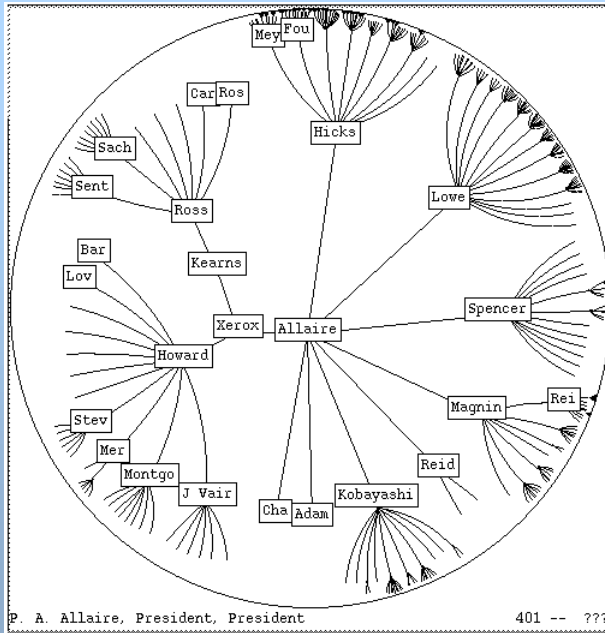


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## Where am I?



## Hyperbolic Lens



P. A. Allaire, President, President

401 -- ???

### Xerox Parc/Inxight

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## Where am I?

Detailed navigation plus precision



General navigation plus orientation

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## **Direct Engagement & Direct Manipulation**

### **Direct Engagement**

- the feeling of working *directly* on the task

### **Direct Manipulation**

- An interface that behaves as though the interaction was with a real-world object rather than with an abstract system

### **Central ideas**

- visibility of the objects of interest
- rapid, reversible, incremental actions
- manipulation by pointing and moving
- immediate and continuous display of results

### **Almost always based on a metaphor**

- mapped onto some facet of the real world task semantics)

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## **Direct Engagement**

### **Xerox Star: pioneered in early '80s, copied by almost everyone**

- simulates desktop with icons
  - in and out baskets
  - file folders and documents
  - calculators
  - printers
  - blank forms for letters and memos
- small number of generic actions applicable system wide
  - move, copy, delete, show properties, again, undo, help
    - eg same way to move text, documents, etc
  - property sheets
    - pop-up form, alterable by user
- What you see is what you get (WYSIWYG)

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## Xerox Star continued

### Star's observers:

- objects understood in terms of their visual characteristics
  - affordances, constraints
- actions understood in terms of their effects on the screen
  - causality
- intuitively reasonable actions can be performed at any time
  - conceptual model

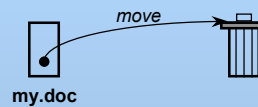
*A subtle thing happens when everything is visible:  
the display becomes reality*

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## Object-Action vs Action-Object

### Select object, *then* do action

- interface emphasizes 'nouns' (visible objects) rather than 'verbs' (actions)

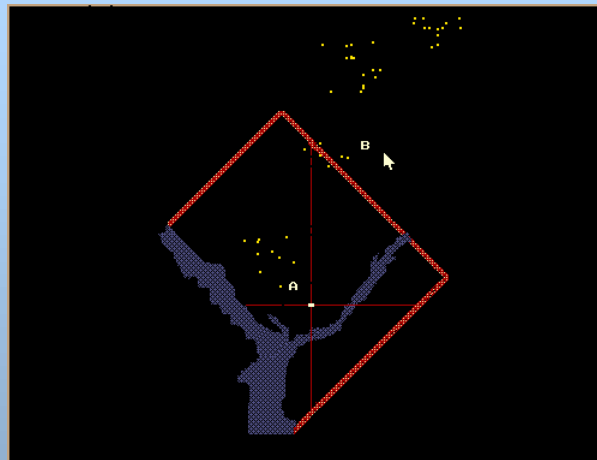


### Advantages

- closer to real world
- modeless interaction
- *actions* always within context of object
  - inappropriate ones can be hidden
- *generic commands*
  - the same type of action can be performed on the object
  - eg drag 'n drop:
    - folders
    - files
    - paragraphs
    - text
    - numbers...

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## Dynamic Queries (Home Finder)



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:  
Grq Fp1

CAC New

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

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## HomeBay

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

Dynamic Queries

Radar Overview

Progressive details on demand

**HomeBay**

Search

Price Range: Min: \$0 Max: no limit

Square Footage: Min: 0 sqft Max: 5,177 sqft

Property Type: Area:

Advanced:

Number of Bedrooms: Min: 1 Max: 5

Number of Bathrooms: Min: 1 Max: 5

Age of Property: Min: 0 Max: no limit

Description Keywords:

Search Results:

#	Price	Area	Property Type
01	\$154,888	Marlborough Park	Bungalow
02	\$199,900	North Crowchild	Two-Story
03	\$199,900	Westgate	Bungalow
04	\$199,900	Coventry Hills	Two-Story
05	\$199,900	Brentwood	Bungalow
06	\$239,735	Ingleswood	Condo
07	\$239,000	Luscany	Mansion
08	\$249,900	Capitol Hill	Duplex
09	\$249,900	Arbour Lake	Townhouse
10	\$249,900	Barclay Trail	Bungalow
11	\$288,000	Strathcona Park	Two-Story
12	\$288,900	Patterson	Townhouse
13	\$310,000	Arbour Lake	Two-Story

History Print

Favorites

Display Locations on Map:

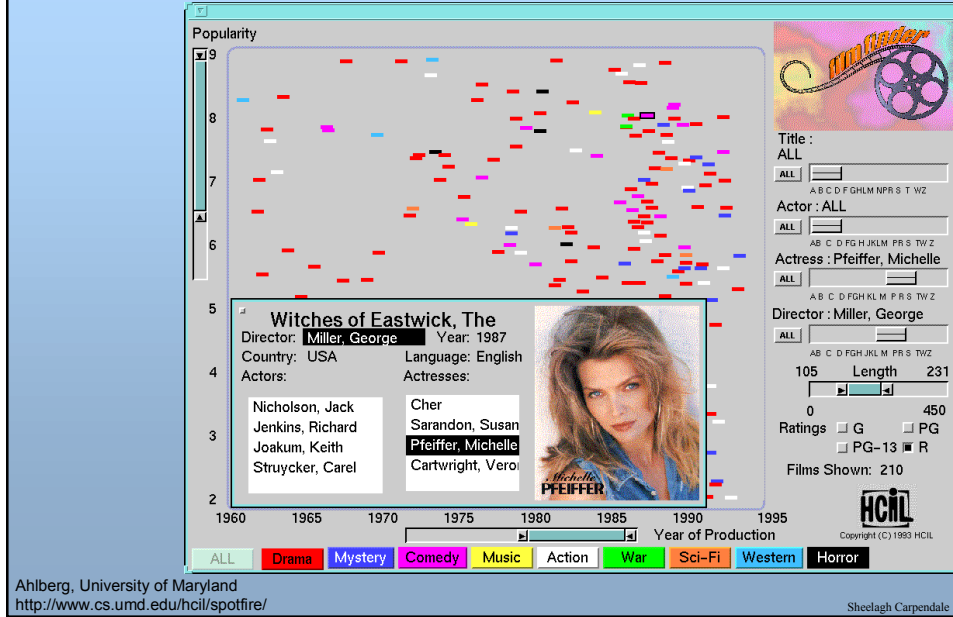
Green Space Parks Shopping Centres Schools Playgrounds

Calgary

Price: \$199,900  
Area: North Crowchild  
Type: Two-Story

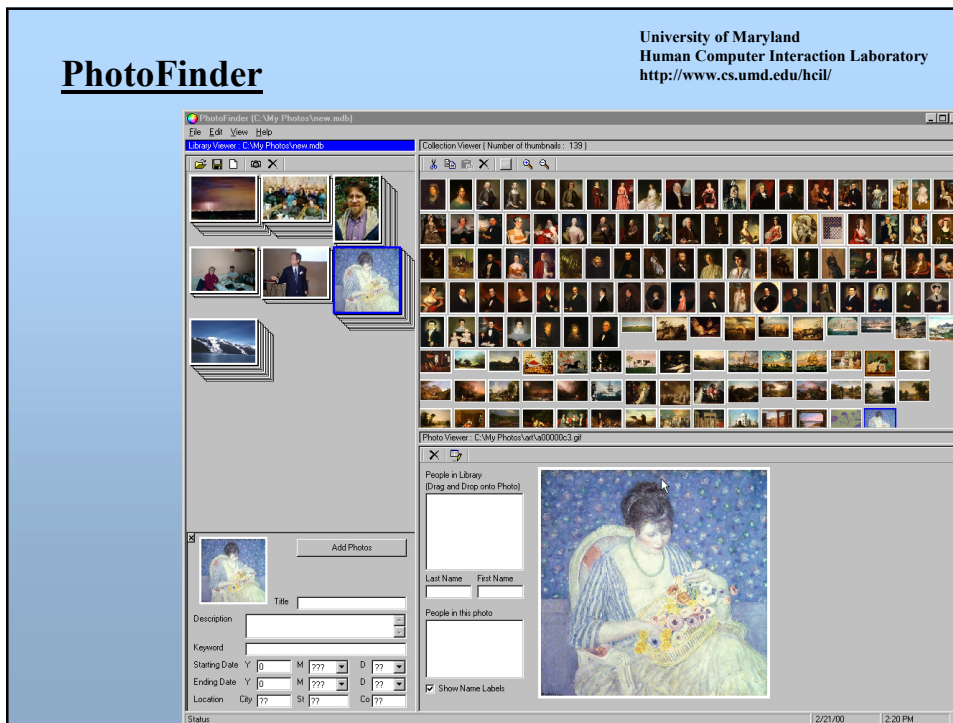
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## Starfield Display



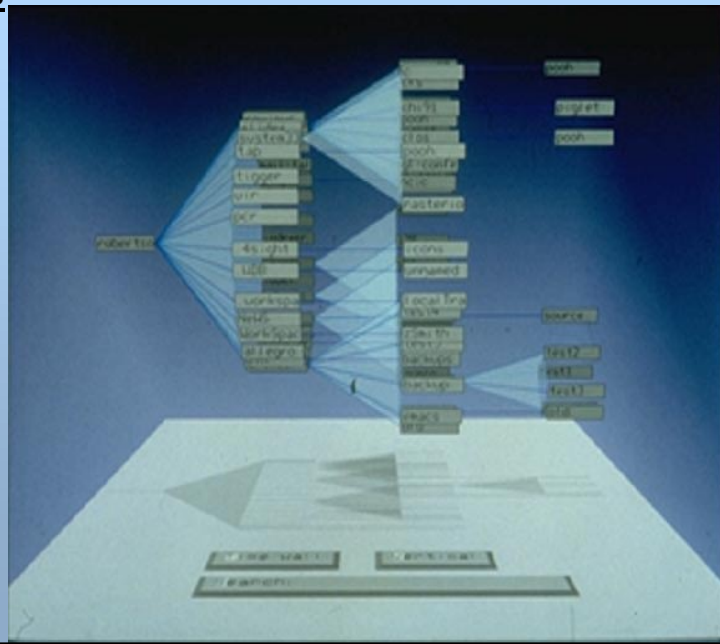
## PhotoFinder

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

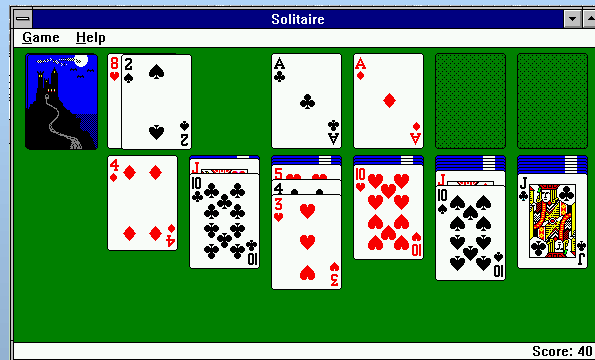


## Cone Trees

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



## Games



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## Is direct manipulation the way to go?

### Some Disadvantages

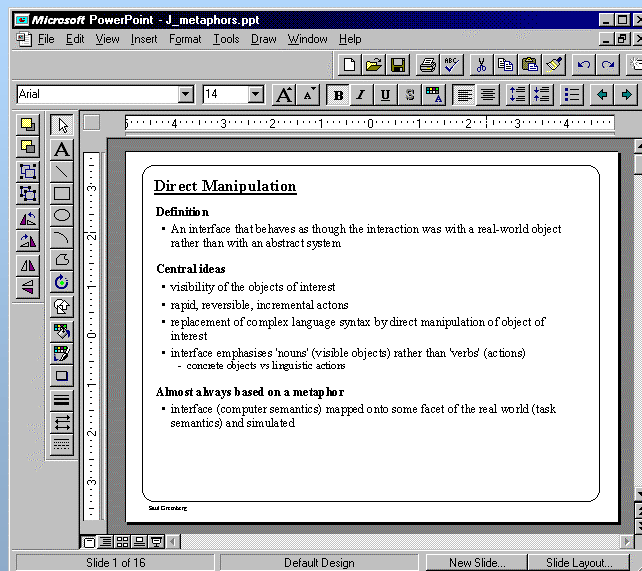
- Ill-suited for abstract operations
  - spell-checker?
- Tedium
  - manually search large database vs query
- Task domain may not have adequate physical/visual metaphor
- Metaphor may be overly-restrictive

### Solution

- Most systems combine direct manipulation and abstractions
  - word processor:
    - WYSIWYG document (direct manipulation)
    - buttons, menus, dialog boxes (abstractions, but direct manipulation “in the small”)

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## Conventional Applications: A Mix



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## Interface Metaphors

### **Definition of Metaphor**

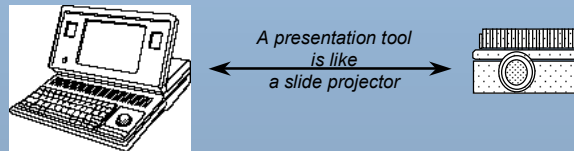
- application of name or descriptive term to an object to which it is not literally applicable

### **Purpose**

- function as natural models
- leverages our knowledge of familiar, concrete objects/experiences to understand abstract computer and task concepts

### **Problem**

- metaphor may portray inaccurate or naive conceptual model of the system



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## Creating Interface Metaphors (continued)

### **Generating metaphors**

- Use metaphors that matches user's conceptual task
  - desktop metaphor for office workers
  - paintbrush metaphor for artists...
- Given a choice, choose the metaphor close to the way the system works
- Ensure emotional tone is appropriate to users
  - eg file deletion metaphors
    - trashcan
    - black hole
    - paper shredder
    - pit bull terrier
    - nuclear disposal unit...

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## Metaphors continued

### Evaluating metaphors

- consider probable consequences
  - will metaphor restrict what people could actually do?
    - eg strict file/folder hierarchy vs system allows links between directories
  - will metaphor believe that people can do more than what is possible?
    - eg agent-based systems, Eliza...

### Evolve metaphors

- is metaphor extensible to new features?
- when is the metaphor no longer useful?

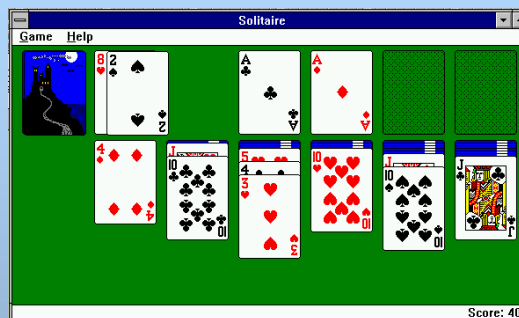
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## Metaphors

### Pervade excellent interfaces

	A	B	C	D
1	Market value	Land	Improvement	Total assess
2	140.0	65,850.	73,120.	138,970.
3	147.0	77,780.	72,070.	149,850.
4	151.0	74,850.	88,740.	163,590.
5	152.0	80,110.	99,410.	179,520.
6	155.0	79,050.	109,130.	188,180.
7	170.0	94,750.	50,960.	145,710.
8	172.0	82,150.	106,250.	188,400.
9	178.0	78,560.	132,660.	211,220.
10	180.0	92,840.	105,670.	198,510.
11	180.0	80,090.	103,130.	183,220.
12	182.0	76,650.	115,210.	191,860.
13	185.0	75,590.	152,710.	228,300.
14	185.0	85,870.	105,330.	191,200.
15	185.0	80,060.	113,600.	193,660.
16	193.4	60,140.	131,340.	211,480.
17	194.5	73,400.	176,210.	249,610.
18	197.0	84,960.	129,500.	214,460.
19	203.0	91,600.	119,170.	210,770.
20	205.0	79,460.	137,250.	216,710.
21	213.0	87,060.	124,350.	211,410.
22	221.0	97,330.	167,500.	264,830.
23	225.0	87,160.	157,290.	244,450.
24	245.0	79,520.	144,840.	224,360.
25	248.0	89,470.	183,500.	272,970.
26	278.0	82,150.	168,720.	250,870.
27	302.5	118,500.	109,800.	228,300.
28	308.0	83,100.	141,730.	224,830.

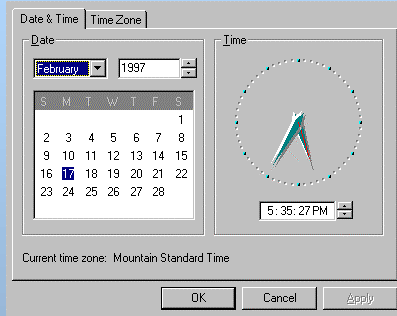
spreadsheet (actuary sheet)



games (literal world)

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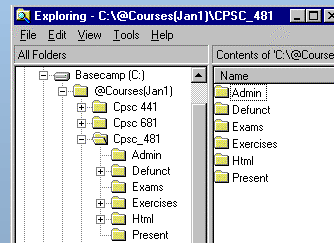
## Examples continued



Control Panels with familiar controls

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City: \_\_\_\_\_  
 Province: \_\_\_\_\_  
 Postal Code: \_\_\_\_\_

Forms



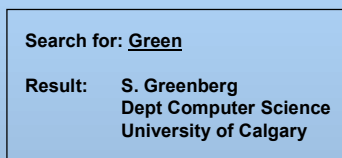
Hierarchical Folders

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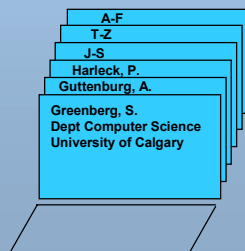
## Example: A telephone database

Find "Green"  
 >S. Greenberg  
 >Dept Computer Science  
 >University of Calgary

*Command system*  
 no direct manipulation



*Form metaphor:*  
 syntactic direct  
 manipulation



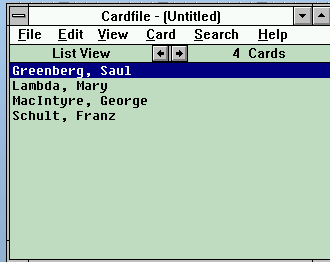
*Rolodex metaphor:*  
 full direct manipulation

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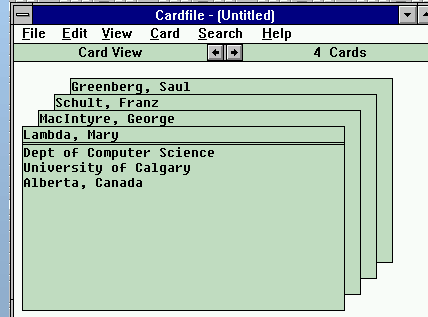


## Phone list

List metaphor



Rolodex metaphor



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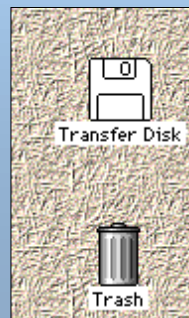
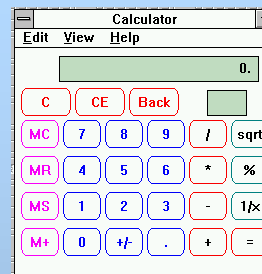
## Metaphors continued

### Caveat

- metaphors can be overdone!

### Common pitfalls

- overly literal
  - unnecessary fidelity
  - excessive interactions
- overly cute
  - novelty quickly wears off
- overly restrictive
  - cannot move beyond
- mismatched
  - does not match user's task and/or thinking

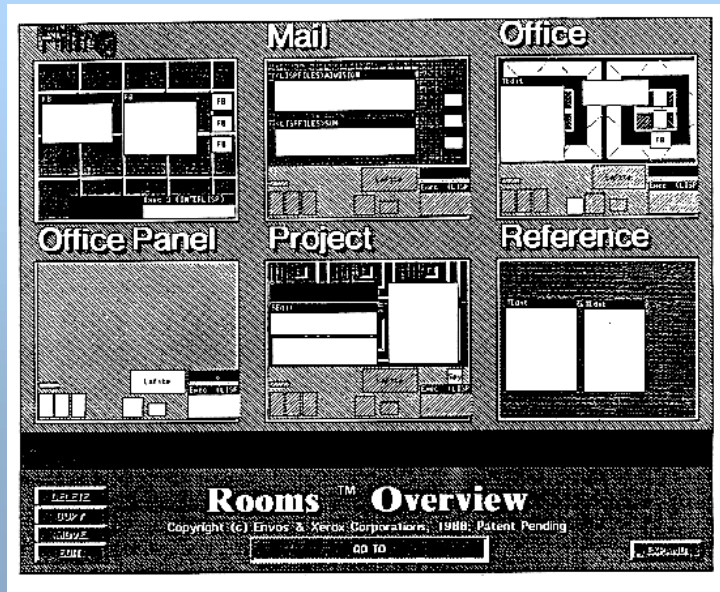


- intuitive metaphor for deleting files

- conflicting for ejecting diskettes

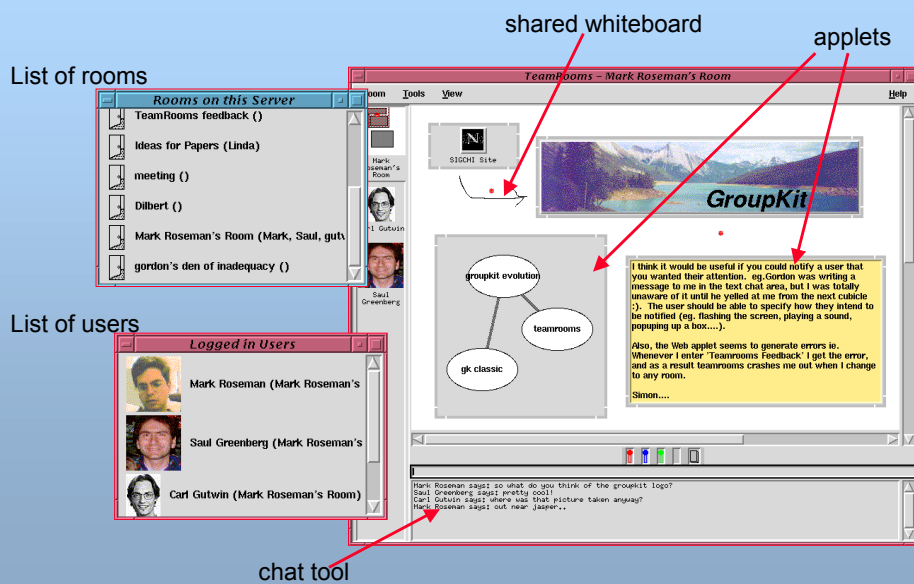
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## Example: The Rooms Metaphor



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## Example: TeamRooms



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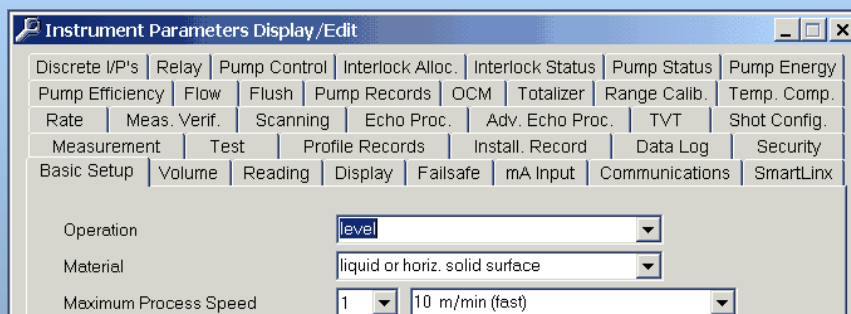
## Example: TeamRooms

### Metaphor implies:

- persistent room artifacts
- both synchronous and asynchronous activity
- asynchronous communication by sticky notes attached to artifacts
- “for free” standard tools
- ability to bring in custom tools via (applets)
- same place/different place activity
- knowing who is around
- trivial groupware connectivity
- ...

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## Misuses of Metaphors



Milltronics' *Dolphin Plus*

a configuration package for industrial level and flow sensors

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## What you now know

### Visual Representations

- captures essential elements of the event / world
- deliberately leaves out / mutes the irrelevant
- appropriate for the person, their task, and their interpretation
- Bertin's visual variables
- Tufte's principles

### Navigation Techniques

- Detail-in-context
- Detail on demand
- Mantra: Overview first, zoom and filter, then details on demand

### Direct manipulation

- visibility of the objects of interest
- rapid, reversible, incremental actions
- manipulation by pointing and moving
- immediate and continuous display of results

### Metaphors

- use our knowledge of the familiar and concrete to represent abstract concepts
- need not be literal
- have limitations that must be understood

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