

Visualization, Metaphors and Direct Manipulation

Metaphors

Direct manipulation

Dynamic queries

Information Visualization

Graphics should reveal the data

- show the data
- not get in the way of the message
- avoid distortion
- present many numbers in a small space
- make large data sets coherent
- encourage comparison between data
- supply both a broad overview and fine detail
- serve a clear purpose

E. Tufte
Visual Display of Quantitative Information

Representations

Solving a problem simply means representing it so as to make the solution transparent

(Simon, 1981)

Good representations

- allow people to find relevant information
 - information may be present but hard to find
- allow people to compute desired conclusions
 - computations may be difficult or “for free” depending on representations

Good representations

captures essential elements of the event / world
deliberately leaves out / mutes the irrelevant
appropriate for the person and their interpretation
appropriate for the task, enhancing judgment ability

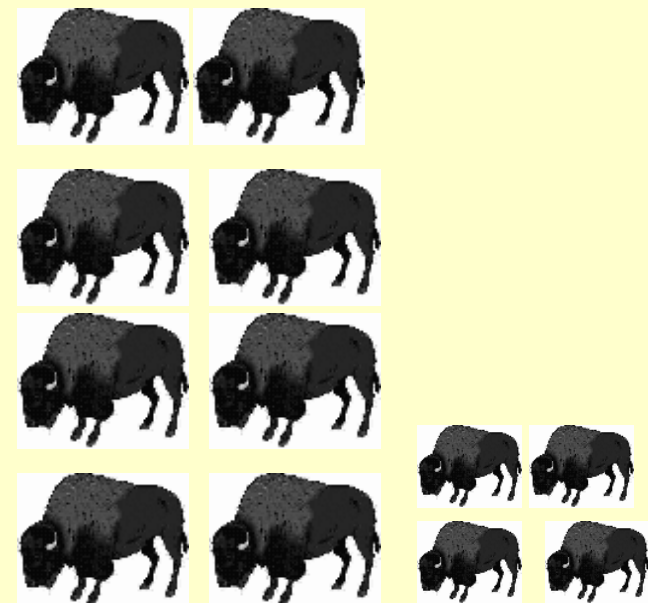
How many buffalo?



||||| ||||| ||
Buffalo

||||| ||||| |
Buffalo

||||| |||| |
Adults # calfs
8 4



Which is the best flight?

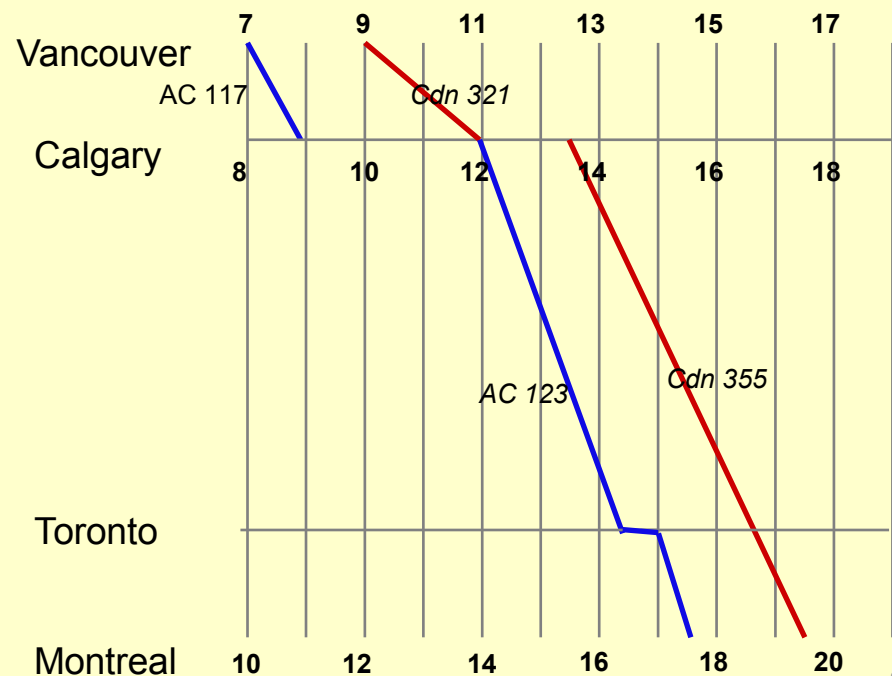
length

stop-overs

switches...

		<i>depart</i>	<i>arrive</i>
AC 117	Vancouver - Calgary	7:00	9:00
Cdn 321	Vancouver - Calgary	9:00	12:00
Cdn 355	Calgary - Montreal	13:30	19:30
AC 123	Calgary - Toronto	12:30	16:30
AC 123	Toronto - Montreal	16:45	17:30

*time zone: +1 van-cal, +2 cal-tor, mtl



When do I take my drugs?

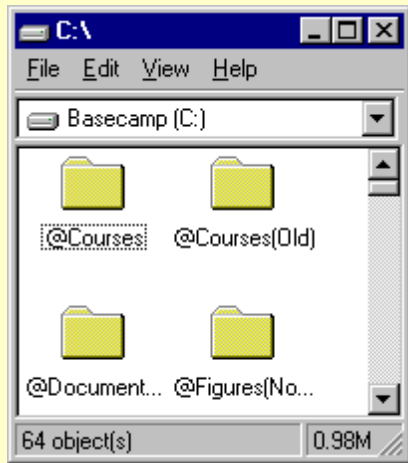
10 - 30% error rate in taking pills, same for pillbox organizers

- Inderal - 1 tablet 3 times a day
- Lanoxin - 1 tablet every a.m.
- Carafate - 1 tablet before meals and at bedtime
- Zantac - 1 tablet every 12 hours (twice a day)
- Quinag - 1 tablet 4 times a day
- Couma - 1 tablet a day

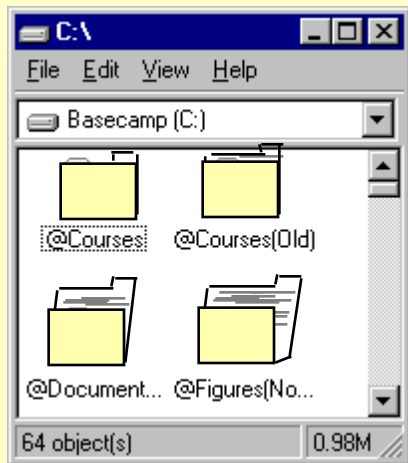
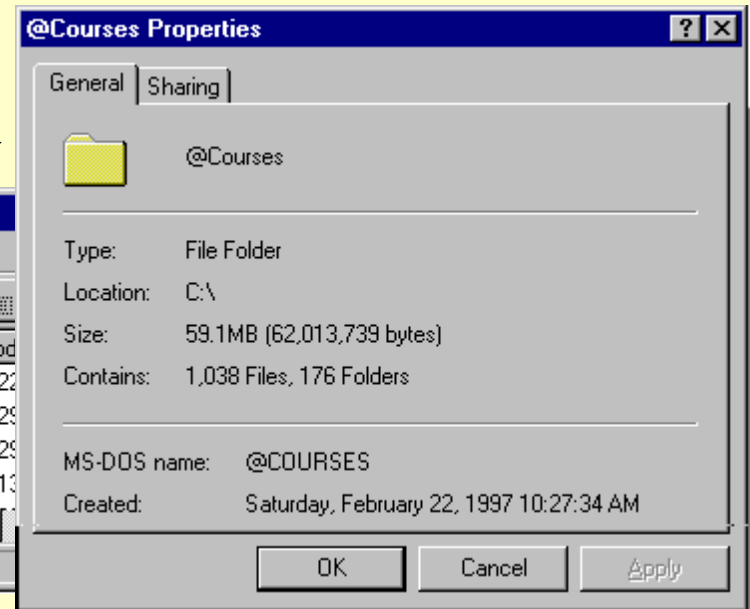
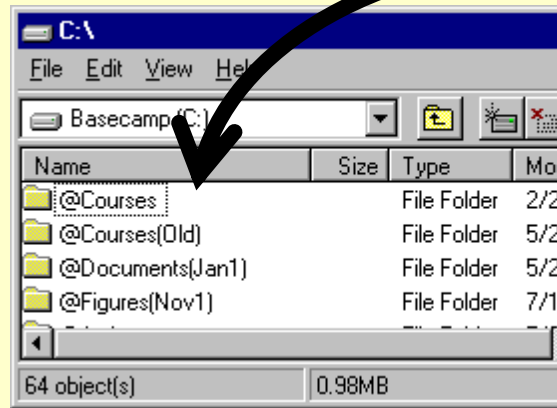
	Breakfast	Lunch	Dinner	Bedtime
Lanoxin	O			
Inderal	O	O	O	O
Quinag	O	O	O	O
Carafate	O	O	O	O
Zantac		O		O
Couma				O

	Breakfast	Lunch	Dinner	Bedtime
Lanoxin				
Inderal	Inderal	Inderal	Inderal	Inderal
Quinag	Quinag	Quinag	Quinag	Quinag
Carafate	Carafate	Carafate	Carafate	Carafate
		Zantac		Zantac
				Couma

Which folder has the most documents?



*right menu
+ properties*

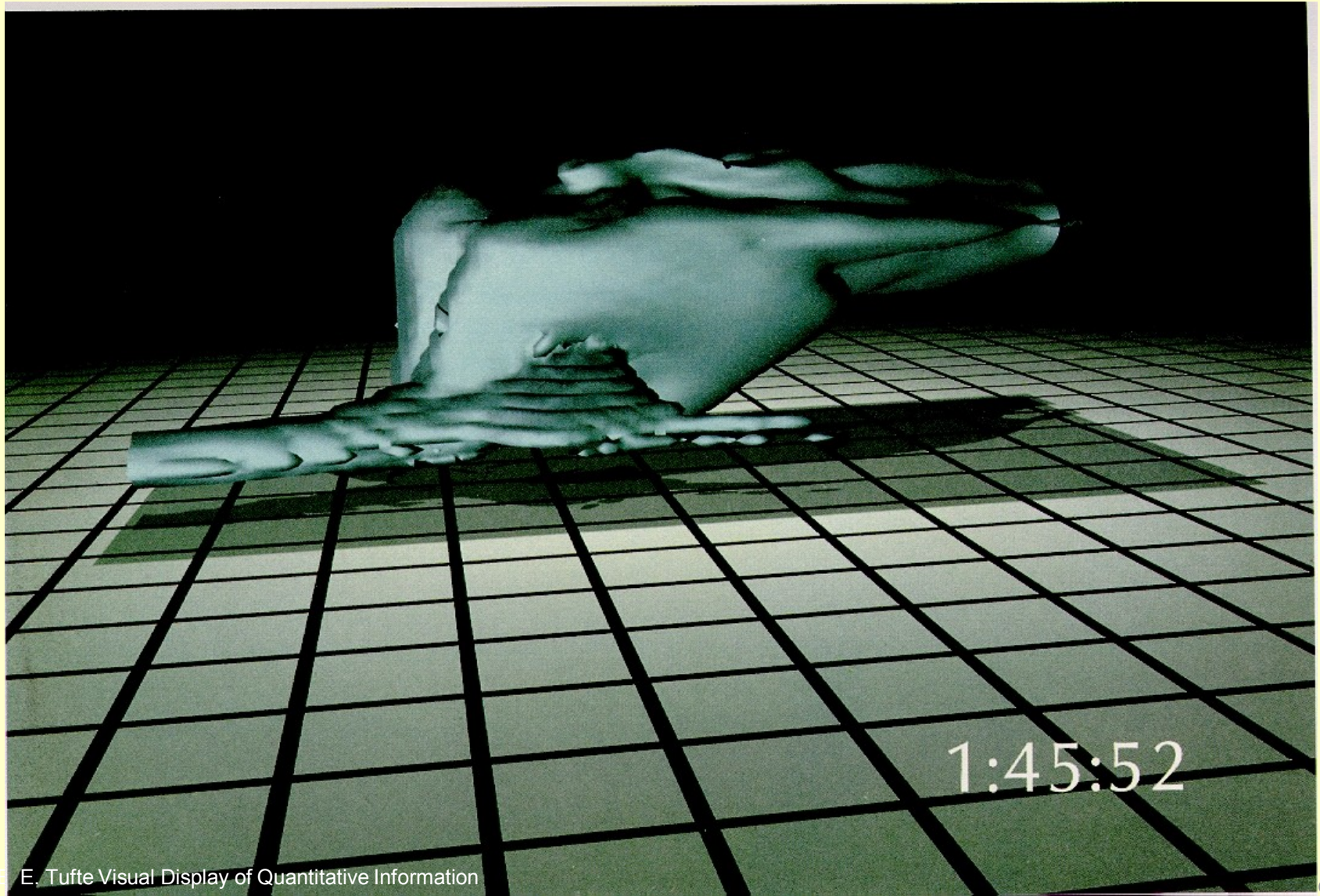


Visual information-seeking mantra

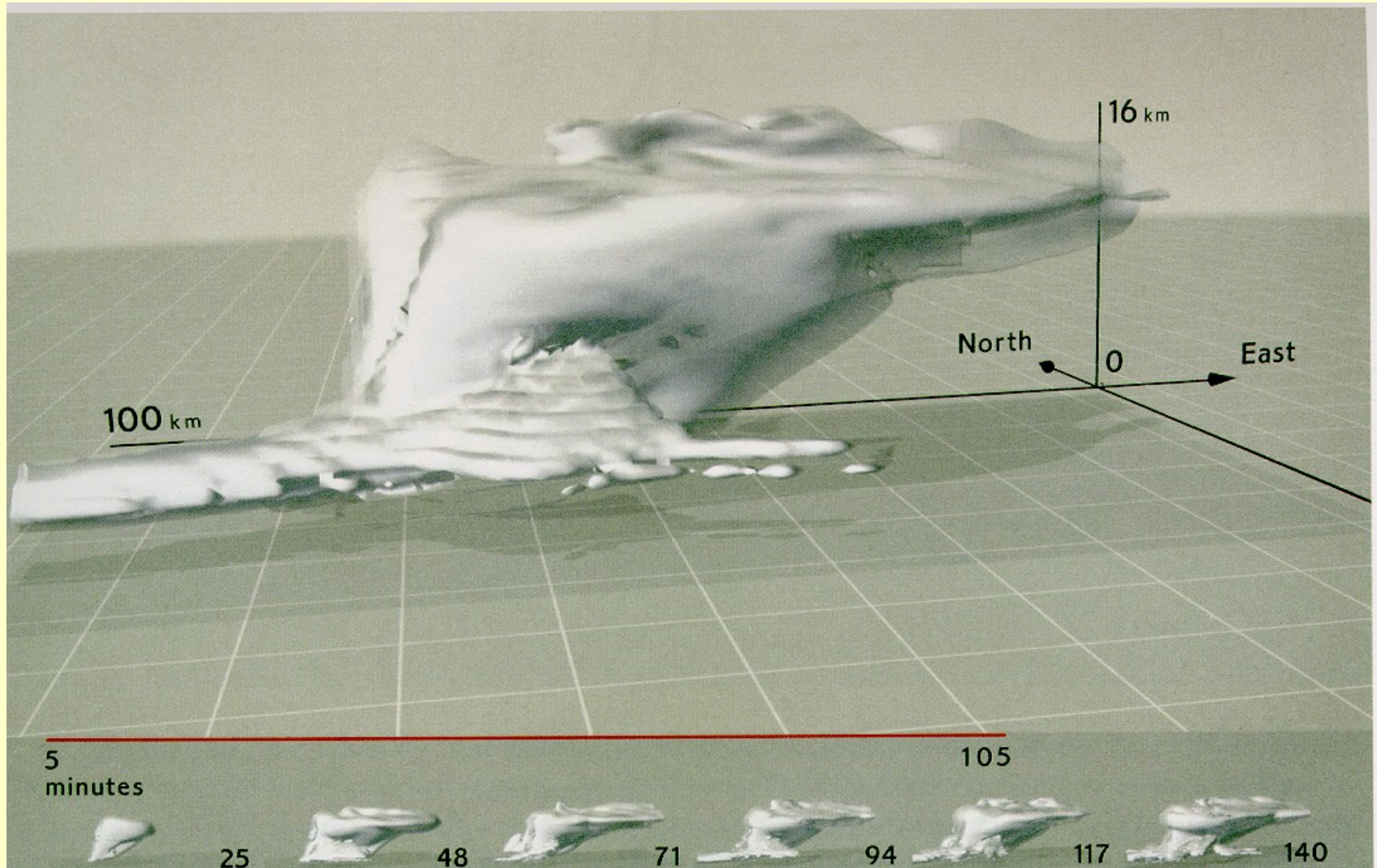
Overview first, zoom and filter, then details on demand
Overview first, zoom and filter, then details on demand
Overview first, zoom and filter, then details on demand
Overview first, zoom and filter, then details on demand
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Overview first, zoom and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

Shneiderman, Designing the User Interface 3rd Ed. 1997 p523

Small multiples: Showing time and change



Small multiples: showing time and change



Metaphors in interfaces

Definition

- represents a system object as if it were another type of object
 - disc / network file structure *represented as* file folders

Purpose

- leverages our knowledge of familiar, concrete objects to understand abstract computer and task concepts

Problem

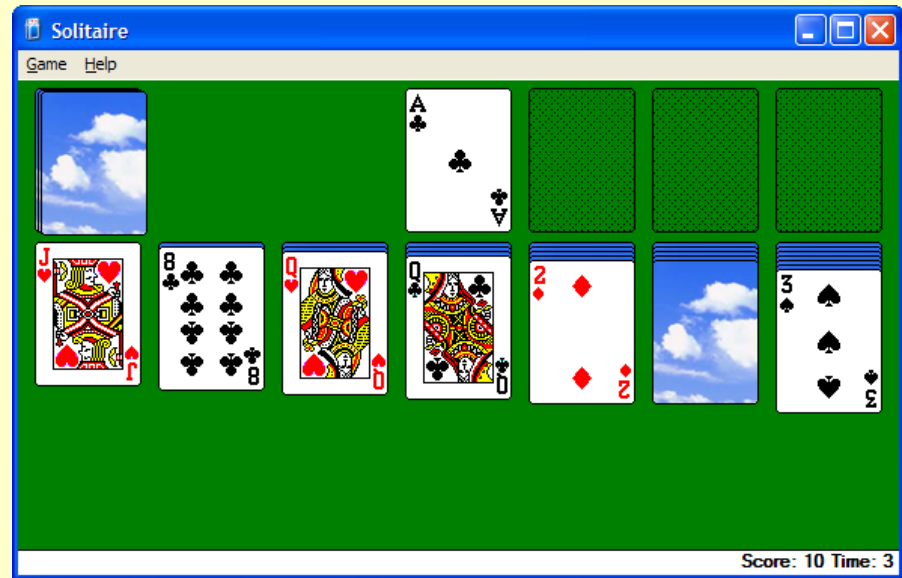
- metaphor portrays inaccurate/naive conceptual model of the system

Metaphors

Pervade excellent interfaces

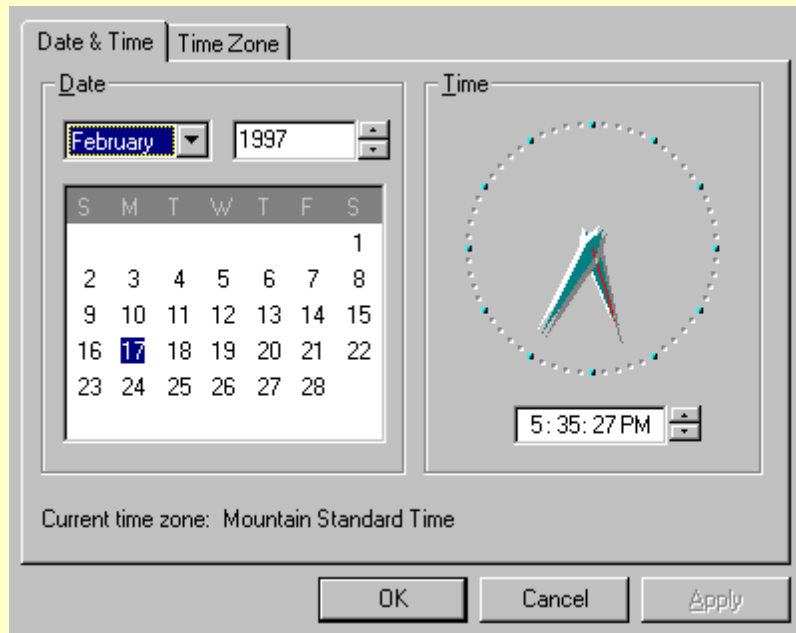
	A	B	C	D
1	Market value	Land	Improvement	Total assess
2	140.0	65,850.	73,120.	138,970.
3	147.0	77,780.	72,070.	149,850.
4	151.0	74,850.	88,740.	163,590.
5	152.0	80,110.	99,410.	179,520.
6	155.0	79,050.	109,130.	188,180.
7	170.0	94,750.	50,960.	145,710.
8	172.0	82,150.	106,250.	188,400.
9	178.0	78,560.	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	80,140.	131,340.	211,480.
17	194.5	73,400.	176,210.	249,610.
18	197.0	84,960.	129,800.	214,760.
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)

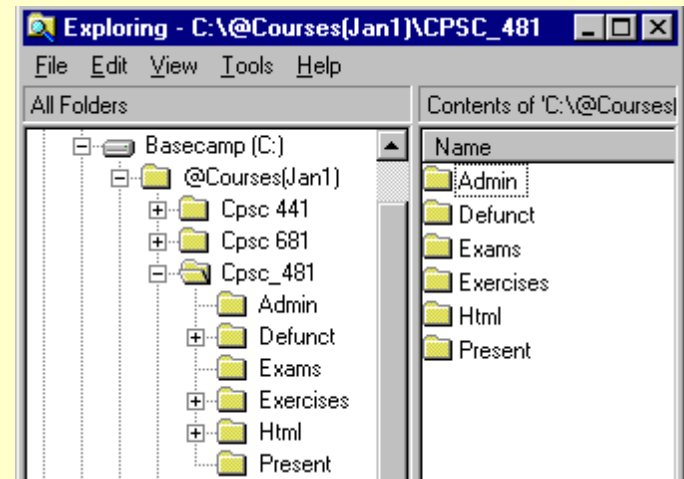
Metaphors of „everyday things“



Control Panels with familiar controls

Name: _____
Address: _____
City: _____
Province: _____
Postal Code: _____

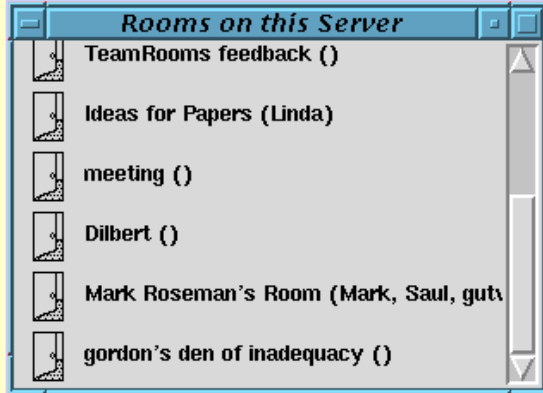
Forms



Hierarchical Folders

TeamRooms

List of rooms

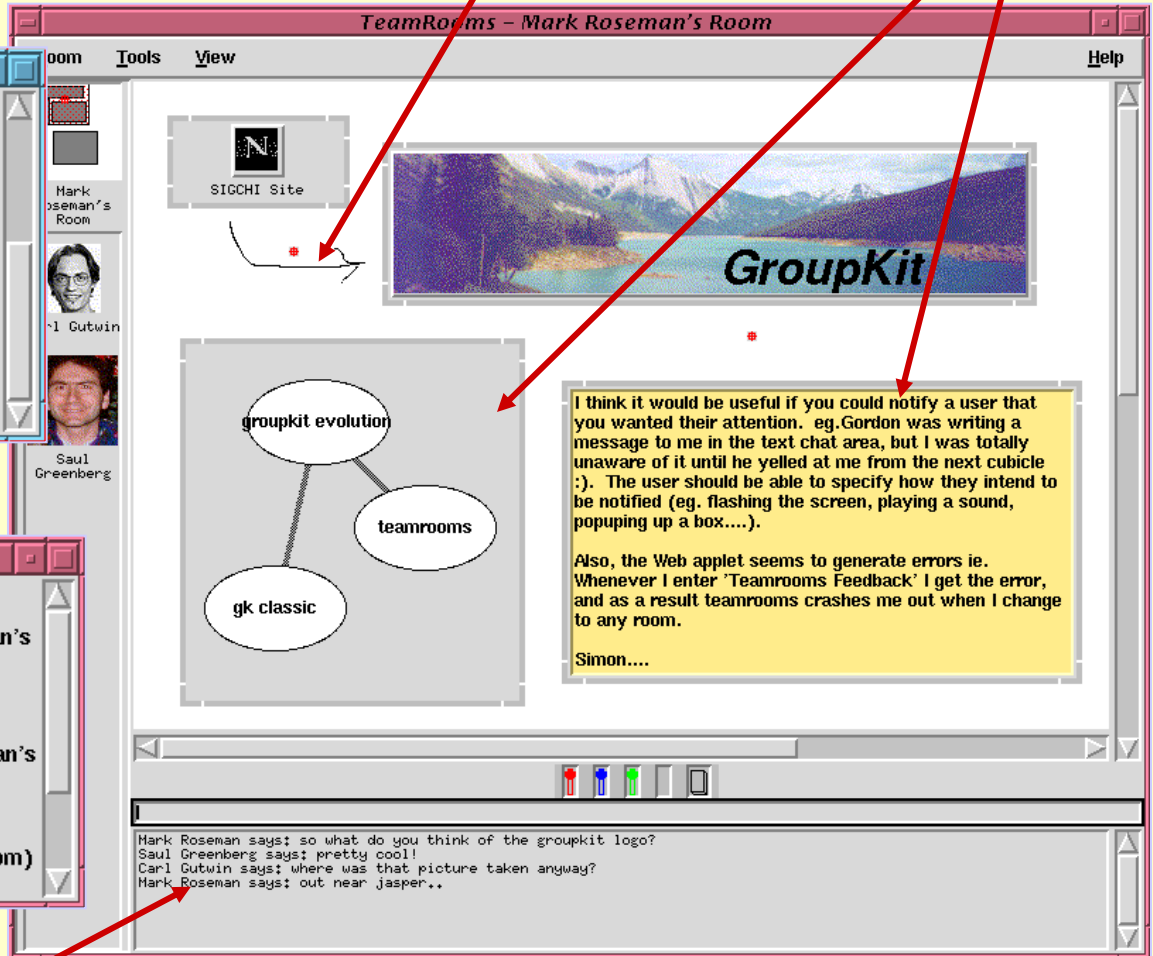


List of users



shared whiteboard

applets



chat tool

TeamRooms

Room 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
- ...

Metaphors on Direct Manipulation

Direct manipulation

- interface behaves as though the interaction was with a real-world object rather than with an abstract system
- the feeling of working *directly* on the task

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

Direct manipulation

Representation affects what can be directly manipulated

The image displays two overlapping windows of Microsoft Schedule+, illustrating how the representation of a calendar affects direct manipulation. The left window shows a monthly view for February 1997, with a vertical axis for days and a horizontal axis for months. The right window shows a weekly view for the same period, with a vertical axis for hours and a horizontal axis for days of the week. Both windows show a schedule of events represented by blue bars.

Monthly View (Left Window):

Day	Event
Jan 26	< Judy gone sk...
Jan 27	< Judy gone ski... 9AM CPSC 481 2PM Distrib Sys...
Jan 28	< Judy gone sk... 9AM 10AM
Feb 2	< Judy gone sk...
Feb 3	9AM CPSC 481 2PM Distrib Sys...
Feb 4	9AM 12PM
Feb 9	9AM CPSC 481 2PM Distrib Sys...
Feb 10	8AM Intel Wor...
Feb 11	8AM 9AM 11AM
Feb 16	12AM Family day 2PM Distrib Sys...
Feb 17	9AM
Feb 23	9AM CPSC 481 2PM Distrib Sys...
Feb 24	9AM
Feb 25	9AM
Feb 2	12AM Reading... 2PM Distrib Sys...
Feb 3	< Reading Week
Feb 4	< Reading Week

Weekly View (Right Window):

Hour	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M
8:00																
8:30																
9:00																
9:30																
10:00																
10:30																
11:00																
11:30																
12:00																
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2:00																
2:30																
3:00																
3:30																
4:00																
4:30																
5:00																

Dynamic queries

Searches and queries by

- adjust sliders, buttons, check boxes, and other control widgets
- display immediate updates *as* the control is adjusted

Why?

- rapid searching with imprecise queries
- people explore data interactions and limits

Queries: HomeBay project

Dynamic Queries

Radar Overview

Progressive details on demand

The screenshot shows the HomeBay application window. On the left, there are search filters for Price Range, Square Footage, Property Type, Area, and Advanced filters for Bedrooms, Bathrooms, and Age of Property. Below these is a table of search results. On the right, a map of Calgary displays several red markers representing property listings. A 'mini map' inset shows the current view area. A 'Click for details' popup window is open over a property, showing a photo and details: Price: \$199,900, Area: North Crowchild, Type: Two-Story. At the bottom, there are buttons for History, Print, and Favorites.

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	Inglewood	Condo
07	\$239,000	Tuscany	Mansion
08	\$249,900	Capitol Hill	Duplex
09	\$249,900	Arbour Lake	Townhouse
10	\$249,900	Banff Trail	Bungalow
11	\$288,000	Strathcona Park	Two-Story
12	\$288,900	Patterson	Townhouse
13	\$310,000	Arbour Lake	Two-Story

Click for details

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

Metaphors in interfaces

Things to watch for

- 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...

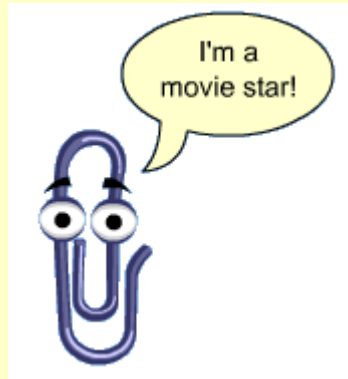
Metaphors in interfaces

Things to watch for

- will it restrict what people could actually do?
 - strict file/folder hierarchy

vs

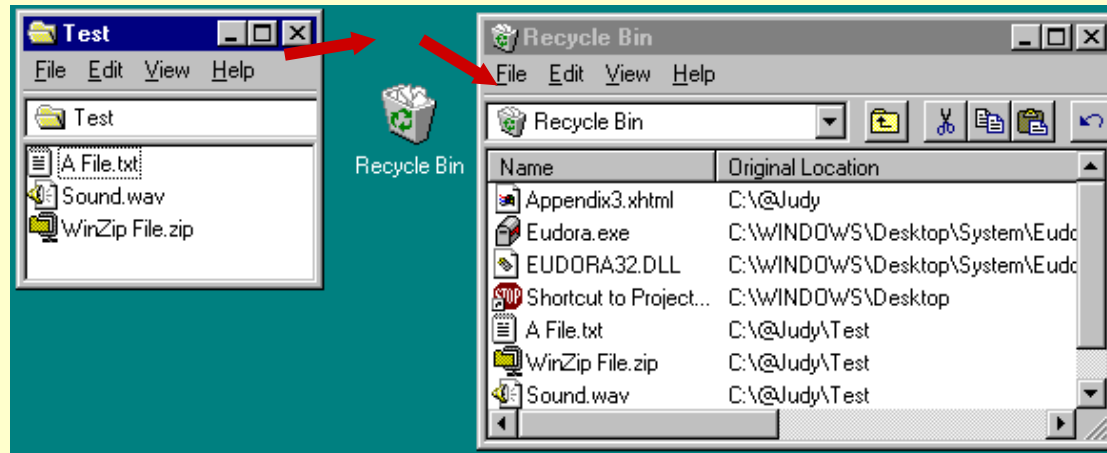
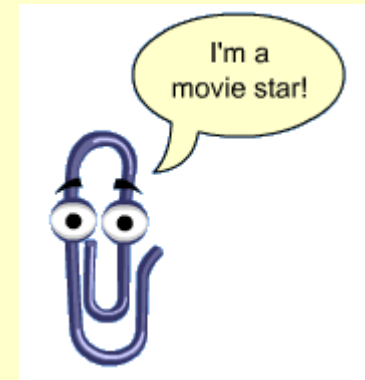
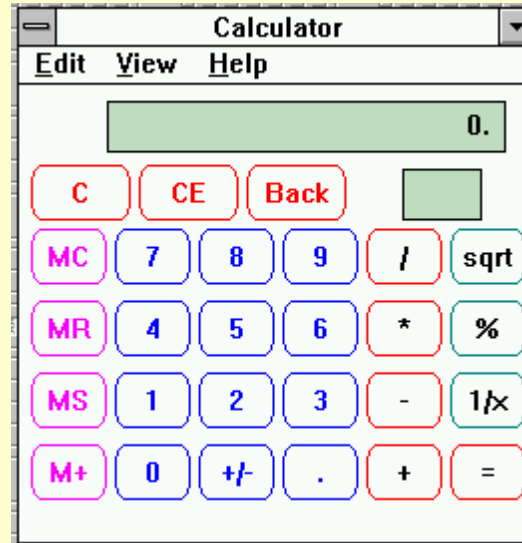
 - system allows links between directories
- will it set unrealistic expectations?
 - Clipit



Metaphors in interfaces

Common pitfalls

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



What you now know

Good representations

- captures essential elements of the event / world & mutes the irrelevant
- appropriate for the person, their task, and their interpretation

Information visualization

- Tufte's principles
- overview first, zoom and filter, then details on demand
- many techniques now available

What you now know

Metaphors

- leverages our knowledge of the familiar and concrete

Direct manipulation

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