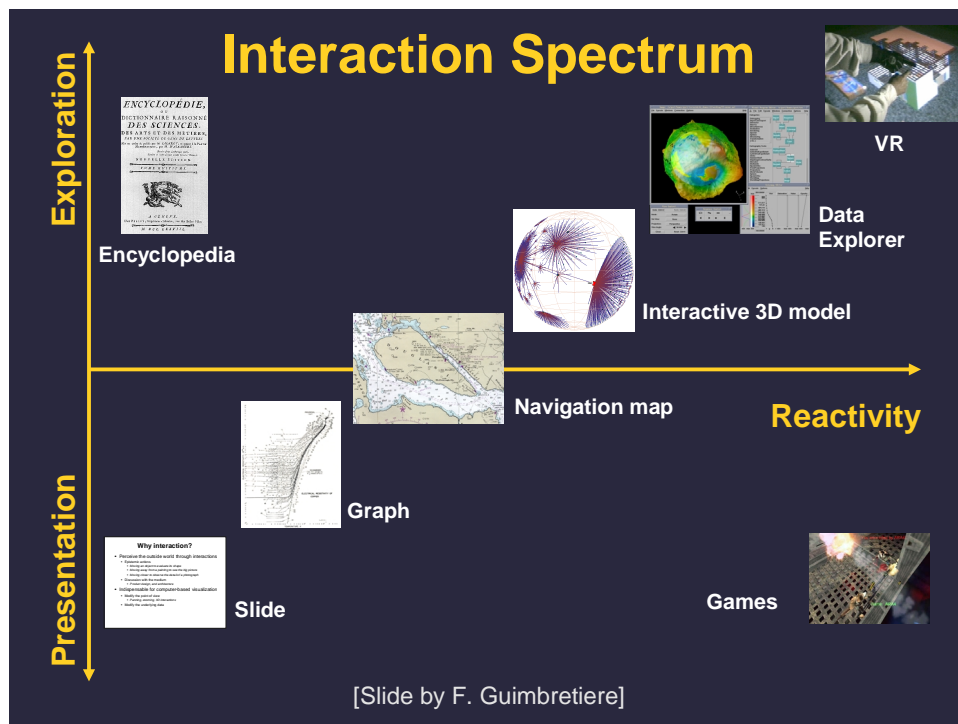


Interaction

Maneesh Agrawala

CS 558: Visualization
Winter 2005

Lecture adapted from Hanrahan 2004



Topics

Brushing and linking

Rotation and rocking

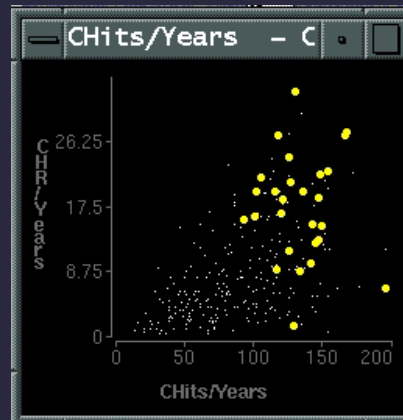
Dynamic queries

Rearrangements

Brushing and Linking

Highlighting

Focus user attention on a subset of the data within one graph [from Wills 95]

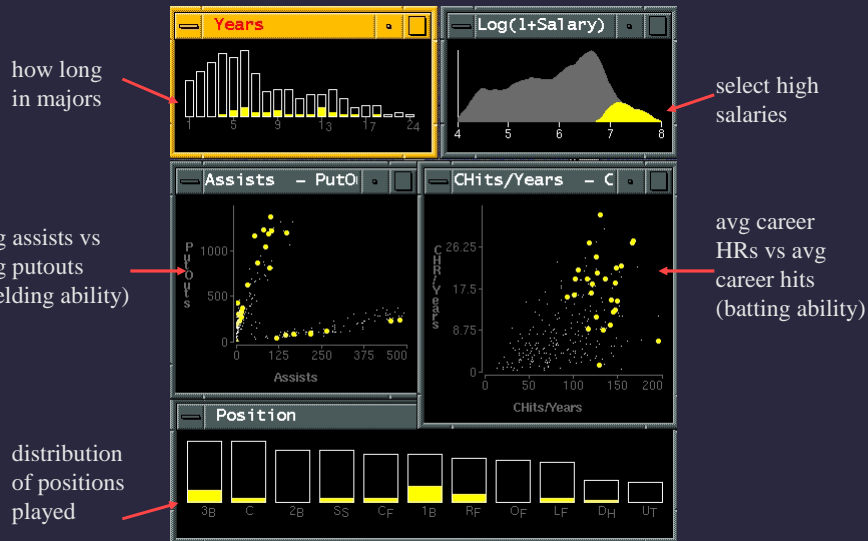


[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Brushing

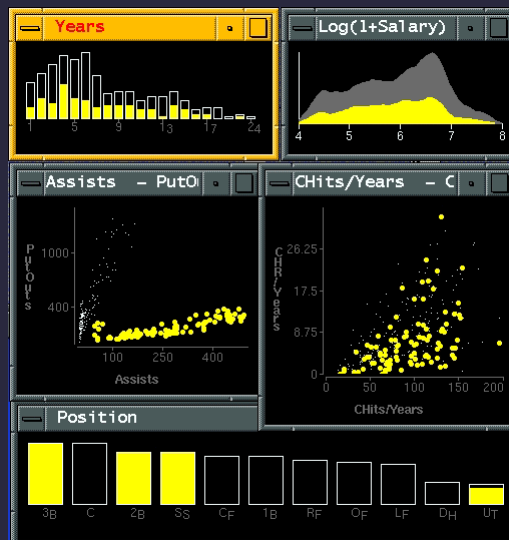
- Interactively select subset of data
- See selected data in other views
- Two things (normally views) must be *linked* to allow for brushing

Baseball statistics [from Wills 95]



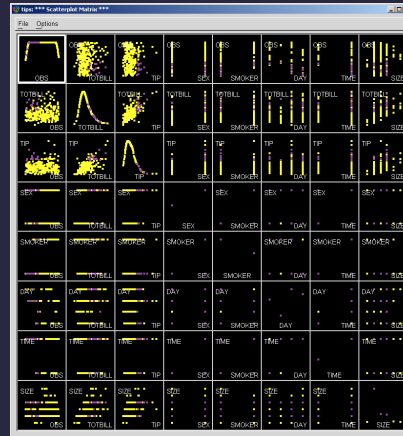
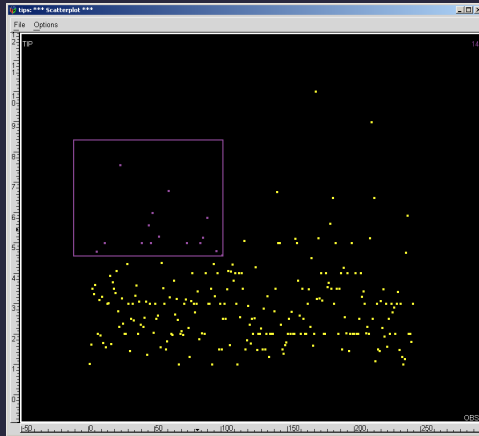
[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Linking assists to positions



[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

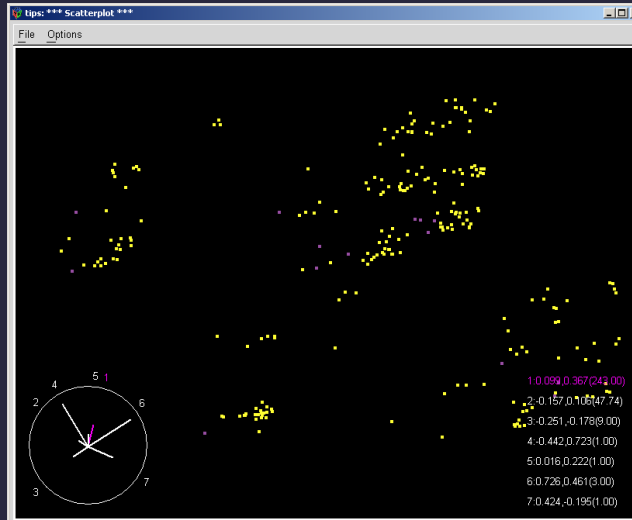
GGobi: Brushing



<http://www.ggobi.org/>

Rotation and Rocking

GGobi: Projections of nD data



<http://www.ggobi.org/>

Dynamic Queries

Query languages

```
SELECT house  
FROM peninsula  
WHERE price < 1,000,000 AND bedrooms > 3  
ORDER BY price
```

GROUP BY and AGGREGATE

Comments

1. For programmers
2. Rigid syntax
3. Only shows exact matches
4. Too few or too many hits
5. No hint on how to reformulate the query
6. Slow question-answer loop
7. Results returned as table

Direct manipulation

1. Visual representation of the world, including both the objects and the actions
2. Rapid, incremental and reversible actions
3. Selection by pointing (not typing)
4. Immediate and continuous display of results

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: 30
Dist to B: 30
Bedrooms: 7
Cost: \$50k \$500k
Look at: Hse TH Cnd
Features: Grq Fp1 CAC New

[Ahlberg and Schneiderman]

Cellphones

The screenshot shows the MyPhoneFinder website interface. At the top left, the zip code is set to 98105. A 'Reset' button is next to it. Below the zip code, there are sliders for 'maximum PRICE' (set to 700) and 'maximum WEIGHT' (set to 7 ounces). There are also sliders for 'maximum TALK TIME' (set to 100 minutes) and 'maximum STANDBY TIME' (set to 60 hours). The interface includes sections for 'CARRIERS' (Verizon, T-Mobile, Sprint, AT&T, Nextel) and 'BRANDS' (Nokia, Sony-Eric, Motorola, Samsung, Siemens, LG, All Others). There are also checkboxes for various features like Digital Camera, Color Screen, Data/Net Access, Text Messaging, Video Recorder, Speakerphone, Special Roaming, Push-to-Talk, PDA, Music, and Bluetooth. A 'Purchase' button is visible on the right. The main area displays a grid of 99 phone images for Seattle, WA. A 'Help' button is at the bottom right.

<http://www.myrateplan.com/cellphones/>

Alphaslider

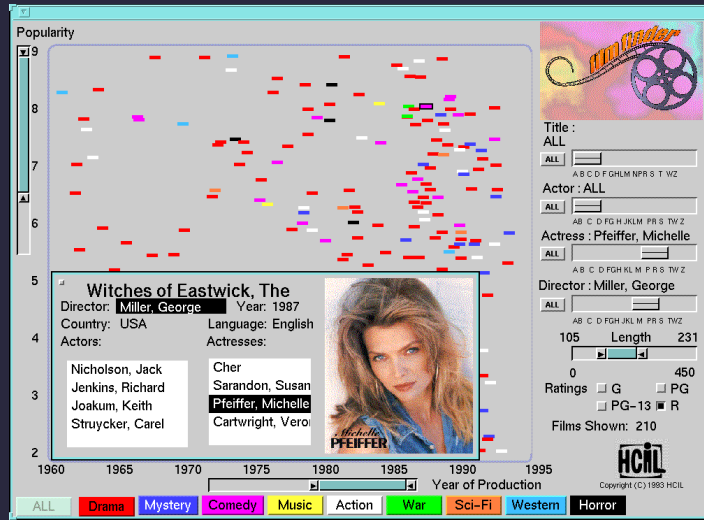
Title :
Moonstruck

ALL

A B C D F G H L M N P R S T W Z

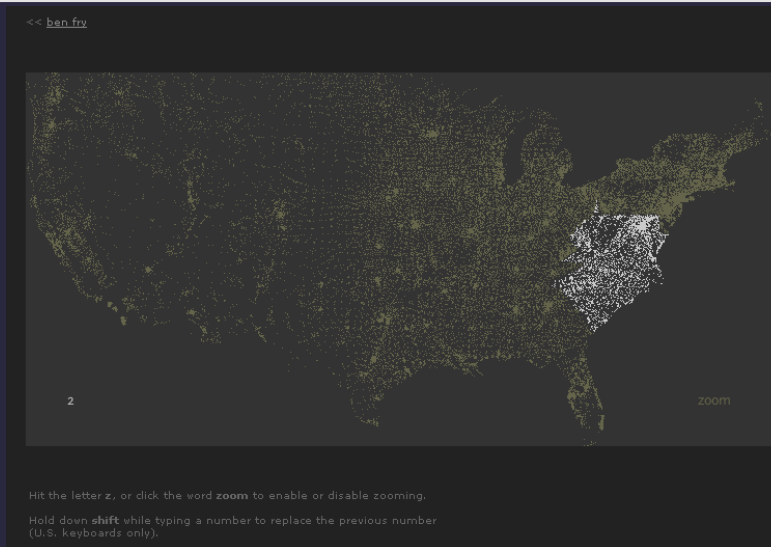
[Ahlberg and Schneiderman 94]

FilmFinder



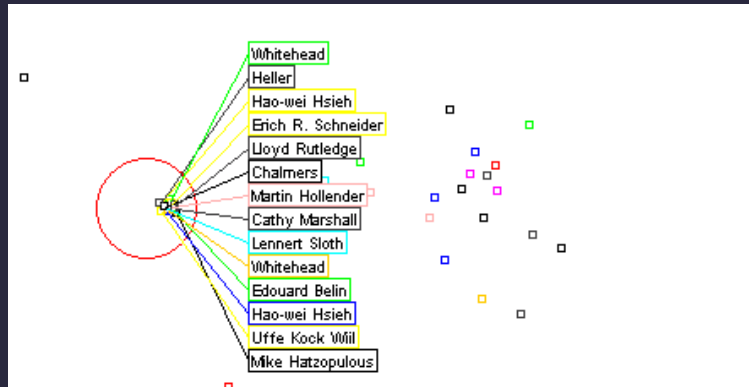
[Ahlberg and Schneiderman 93]

Zipdecode [from Fry 04]



<http://acg.media.mit.edu/people/fry/zipdecode/>

Excentric labeling [Fekete & Plaisant 99]



<http://www.cs.umd.edu/hcil/excentric/>

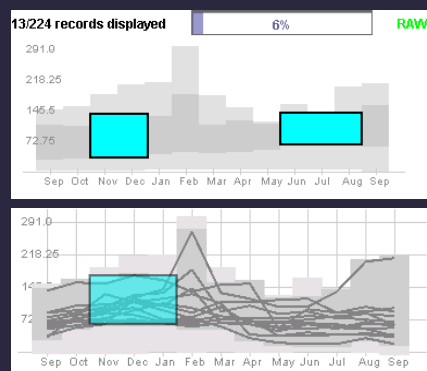
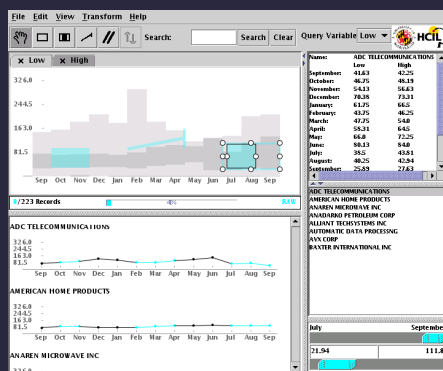
Brushing, Linking & Dynamic Queries

Attribute explorer [Spence and Tweedie 98]

Video Clip

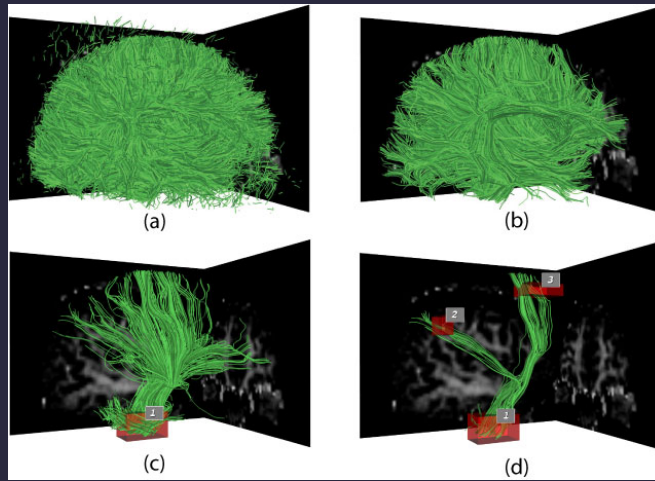


TimeSearcher [Hochheiser & Schneiderman 02]

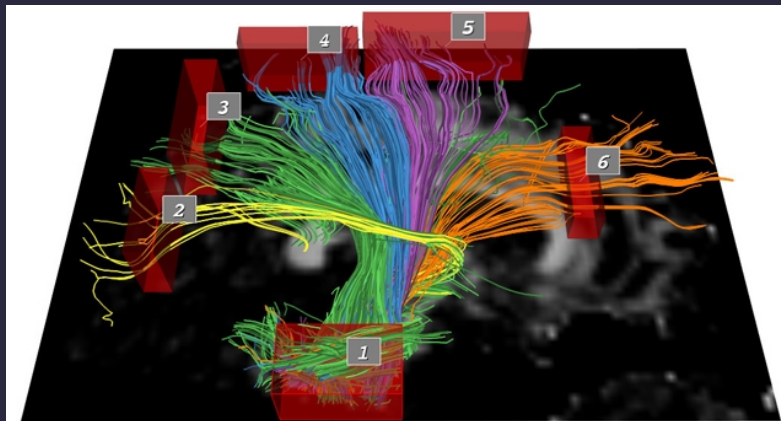


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



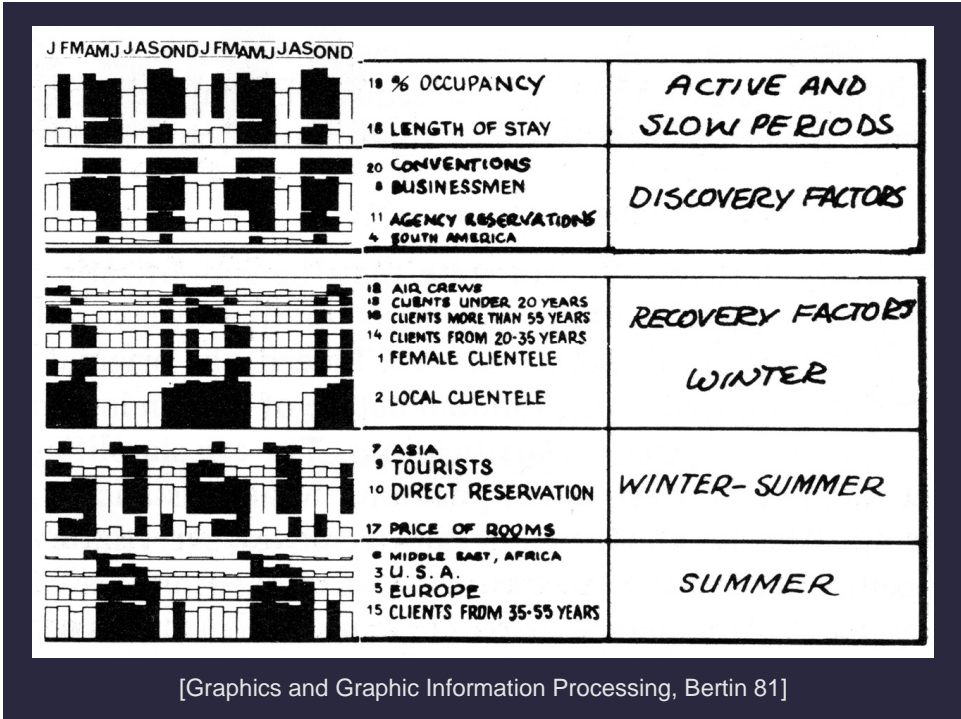
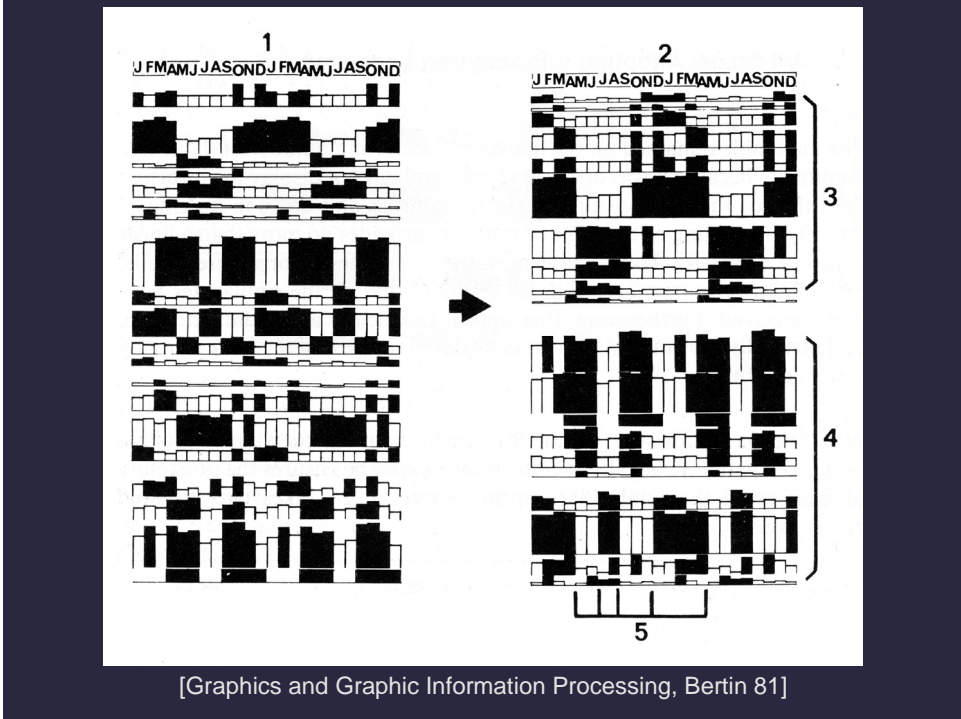
3D dynamic queries [Akers et al. 04]

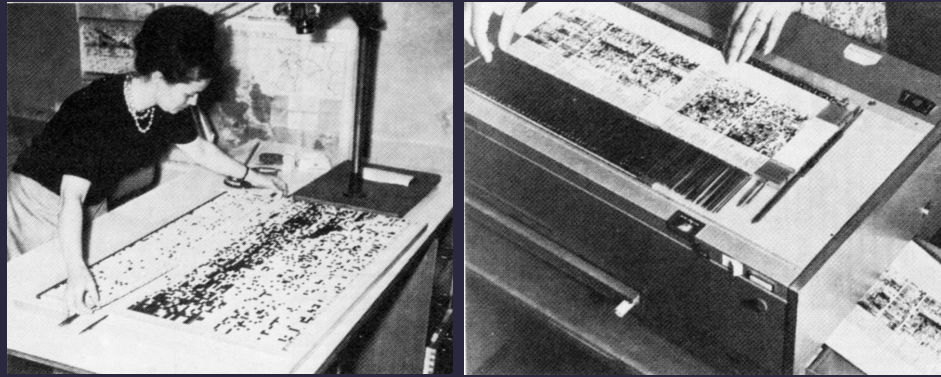


Rearrangements

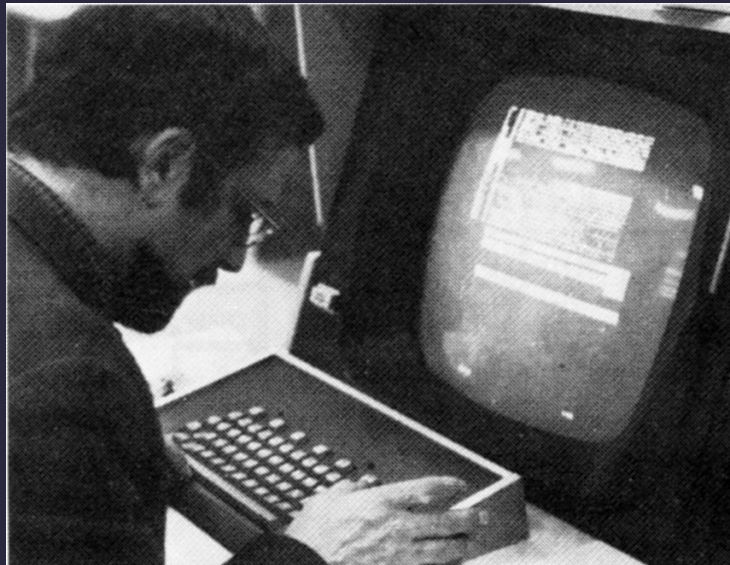
J	F	M	A	M	J	J	A	S	O	N	D	
26	21	26	28	20	20	20	20	40	15	40	1	% CLIENTELE FEMALE
69	70	77	71	37	36	39	39	55	60	68	2	% —" — LOCAL
7	6	3	6	23	14	19	14	9	6	8	3	% —" — U.S.A.
0	0	0	0	8	6	6	4	2	12	0	4	% —" — SOUTH AMERICA
20	15	14	15	23	27	22	30	27	19	19	5	% —" — EUROPE
1	0	0	8	6	4	6	4	2	1	0	6	% —" — M.EAST, AFRICA
3	10	6	0	3	13	8	9	5	2	5	7	% —" — ASIA
78	80	85	86	85	87	70	76	87	85	87	8	% BUSINESSMEN
22	20	15	14	15	13	30	24	13	15	13	9	% TOURISTS
70	70	75	74	69	68	74	75	68	68	64	10	% DIRECT RESERVATIONS
20	18	19	17	27	27	19	19	26	27	21	11	% AGENCY —" —
10	12	6	9	4	5	7	6	6	5	15	12	% AIR CREWS
2	2	4	2	2	1	1	2	2	4	2	13	% CLIENTS UNDER 20 YEARS
25	27	37	35	25	25	27	28	24	30	24	14	% —" — 20-35 —" —
48	49	42	48	54	55	53	57	55	46	55	15	% —" — 35-55 —" —
25	22	17	15	19	19	19	19	19	20	19	16	% —" — MORE THAN 55 —" —
163	167	166	174	152	155	145	170	157	174	165	17	PRICE OF ROOMS
1.65	1.71	1.65	1.91	1.90	2.	1.54	1.60	1.73	1.82	1.66	18	LENGTH OF STAY
67	82	70	83	74	77	56	62	90	92	78	19	% OCCUPANCY
			X	X	X			X	X	X	20	CONVENTIONS

[Graphics and Graphic Information Processing, Bertin 81]





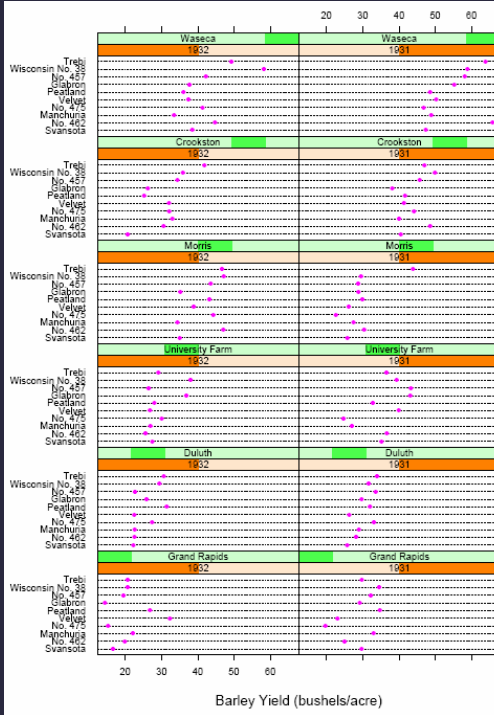
[Graphics and Graphic Information Processing, Bertin 81]



[Graphics and Graphic Information Processing, Bertin 81]

Trellis

[Becker, Cleveland, and Shyu 96]



Condition variables

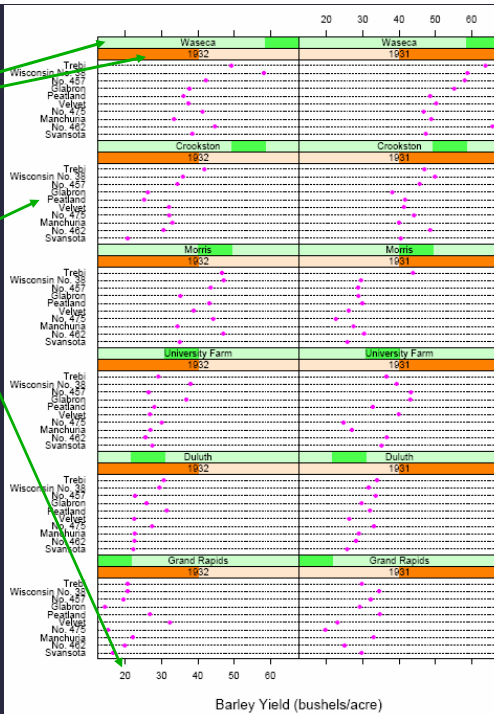
location, year

Panel variables

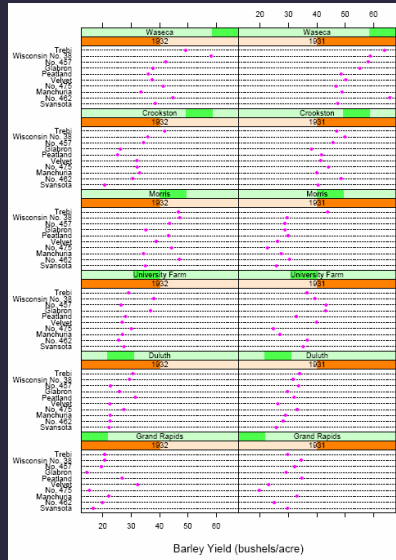
type, yield

Trellis

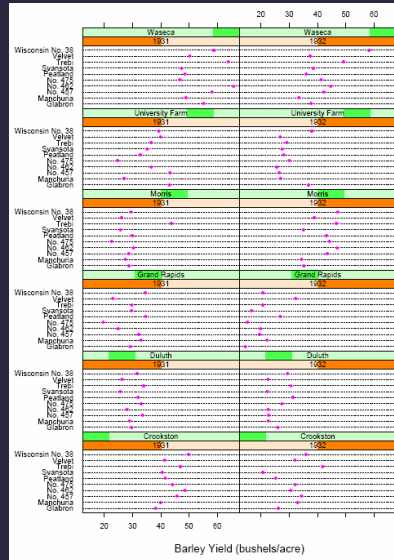
[Becker, Cleveland, and Shyu 96]



Trellis: Automatic ordering



Main-effects ordering



Alphabetical ordering

TableLens [Rao & Card 94]

Baseball.txt - TLDemo

File Edit View Options Help

inxight

League ...	Players	At Bats	Hits	Home Runs	Runs	Rbi
N	52 Andres ...	321	87	10	39	42
	53 Jose Cruz	479	133	10	48	72
	54 Bo Diaz	474	129	10	50	56
	55 Tony Pena	510	147	10	56	52
A	191 Reggie J...	419	101	18	65	58

Row 79: 35 Col: Assists Entry: 35

<http://www.inxight.com/products/sdks/tl/>

Summary

Most visualizations are interactive

- Even passive media elicit interactions

Good visualizations are task dependant

- Choose the right space...
- Pick the right interaction technique...

Human factors are important

- Leverage human strength
- Assist human limitation