Interaction

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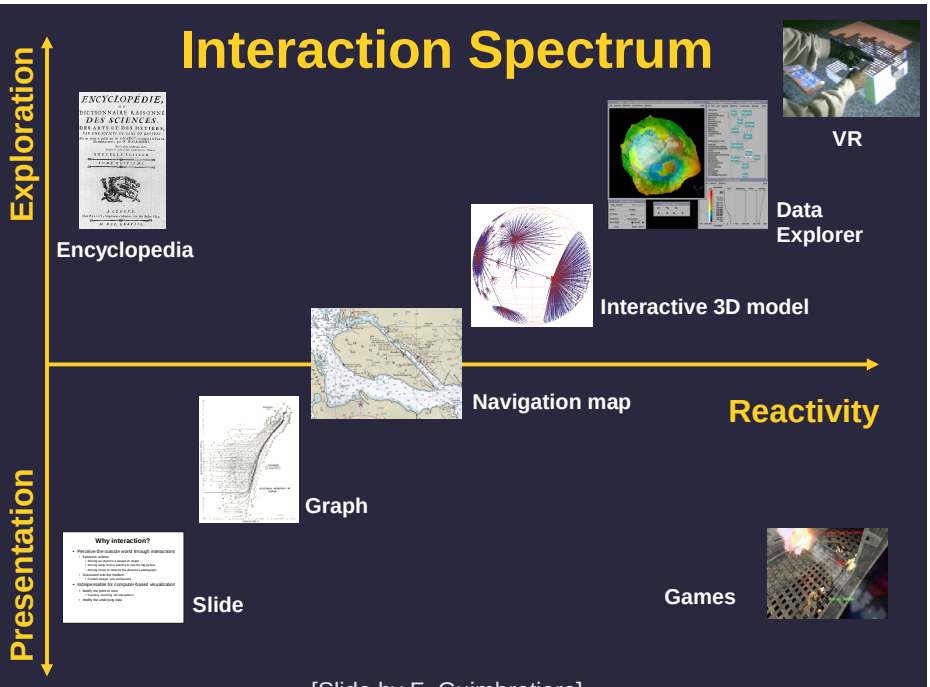
CS 558: Visualization
Winter 2005

Lecture adapted from Hanrahan 2004

Interaction Spectrum



[Slide by F. Guimbretiere]

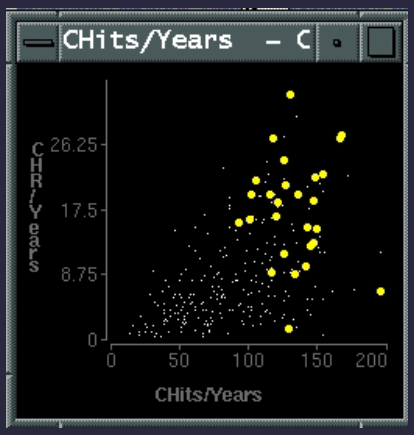
Topics

- 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]

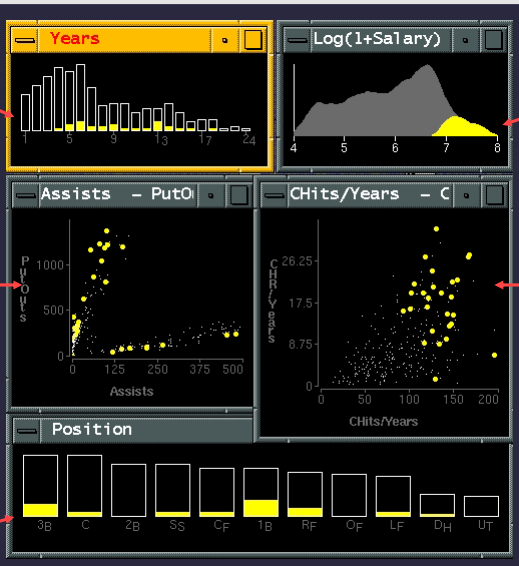
how long in majors

select high salaries

avg assists vs avg putouts (fielding ability)

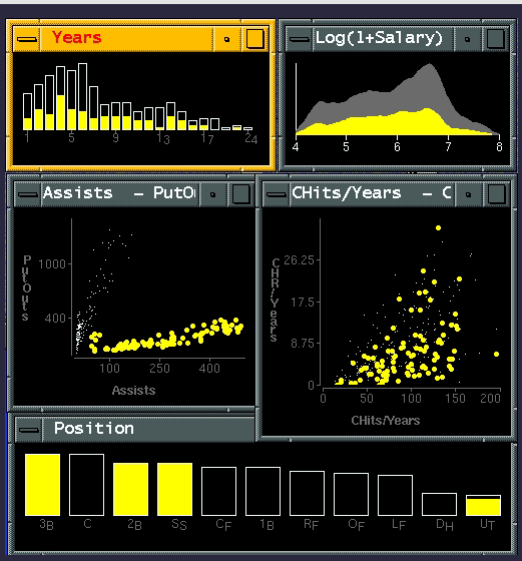
avg career HRs vs avg career hits (batting ability)

distribution of positions played



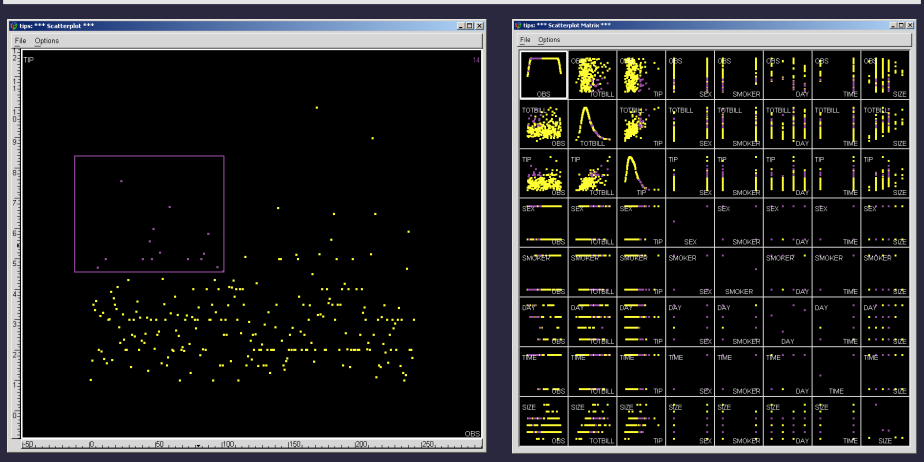
[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Linking assists to positions



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

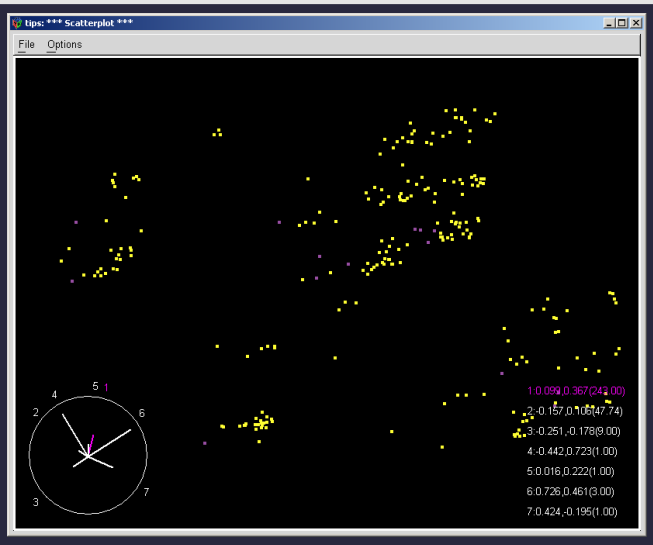
GGobi: Brushing



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

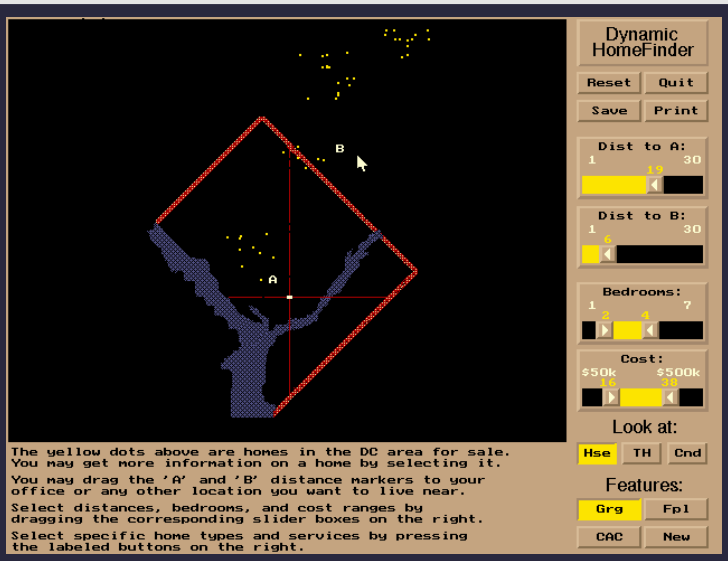
Comments

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



[Ahlberg and Schneiderman]

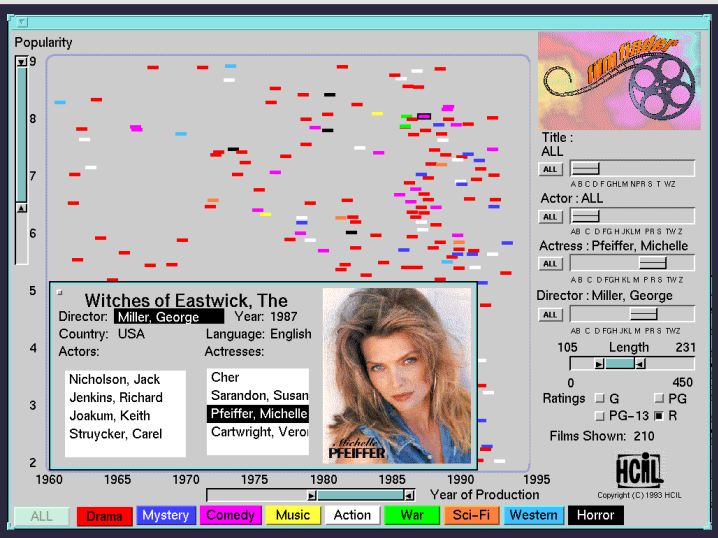
Cellphones

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

Alphaslider

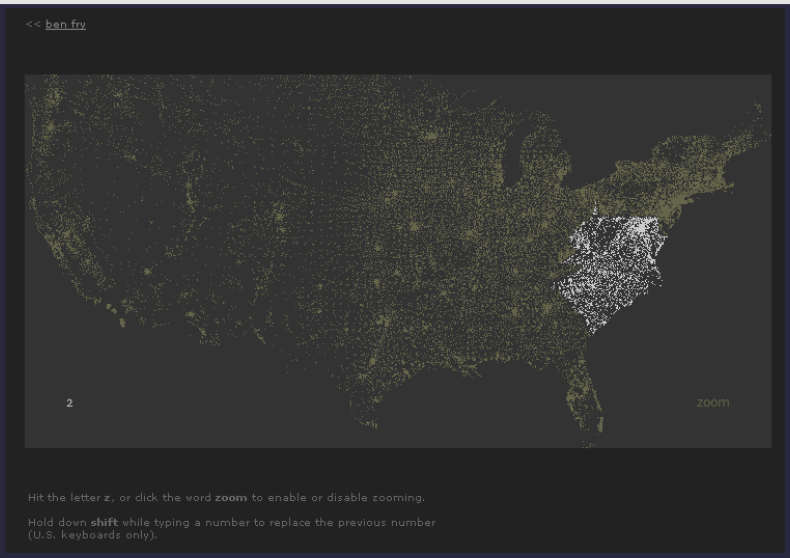
[Ahlberg and Schneiderman 94]

FilmFinder



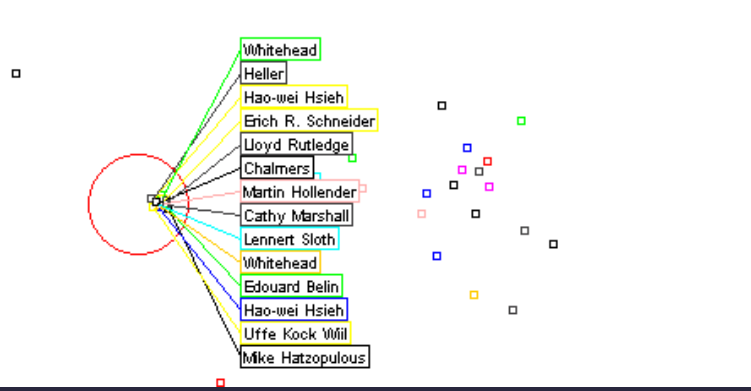
[Ahlberg and Schneiderman 93]

Zipdecode [from Fry 04]



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

Excentric labeling [Fekete & Plaisant 99]



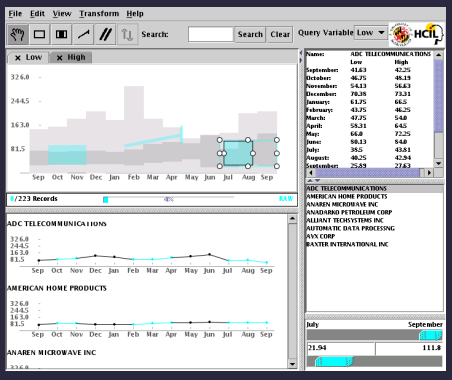
http://www.cs.umd.edu/hcil/excentric/

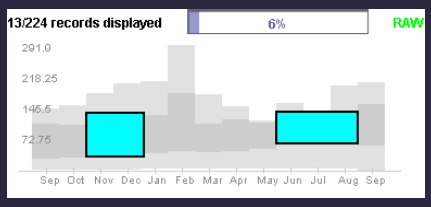
Brushing, Linking & Dynamic Queries

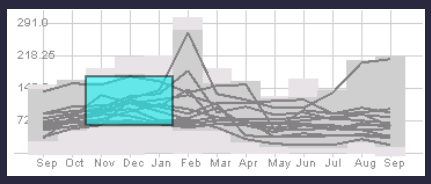
Attribute explorer [Spence and Tweedie 98]

Video Clip

TimeSearcher [Hochheiser & Schneiderman 02]

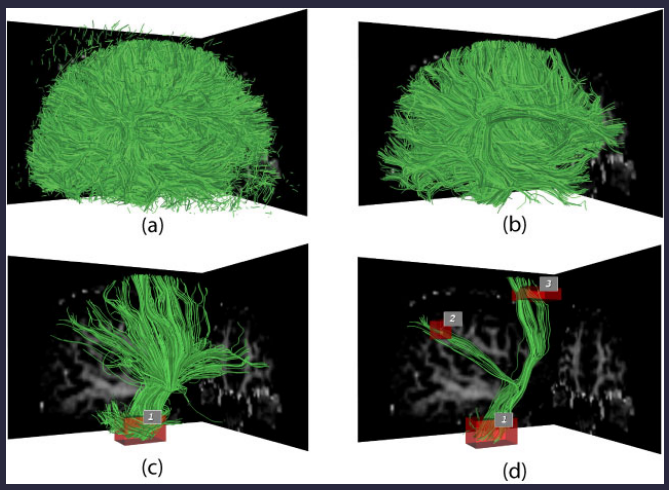




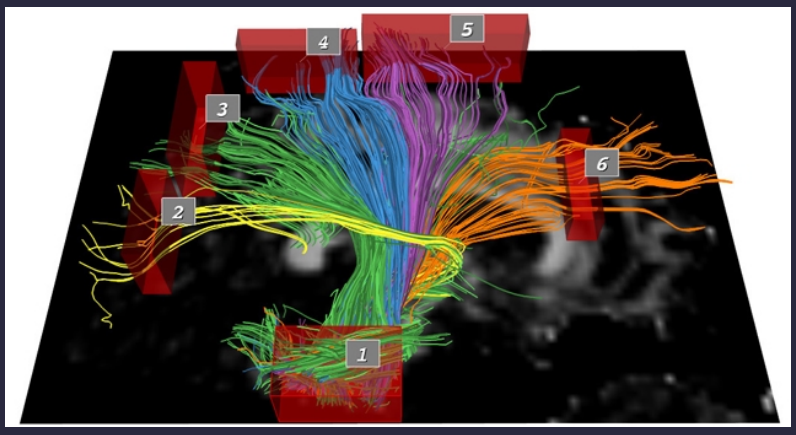


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



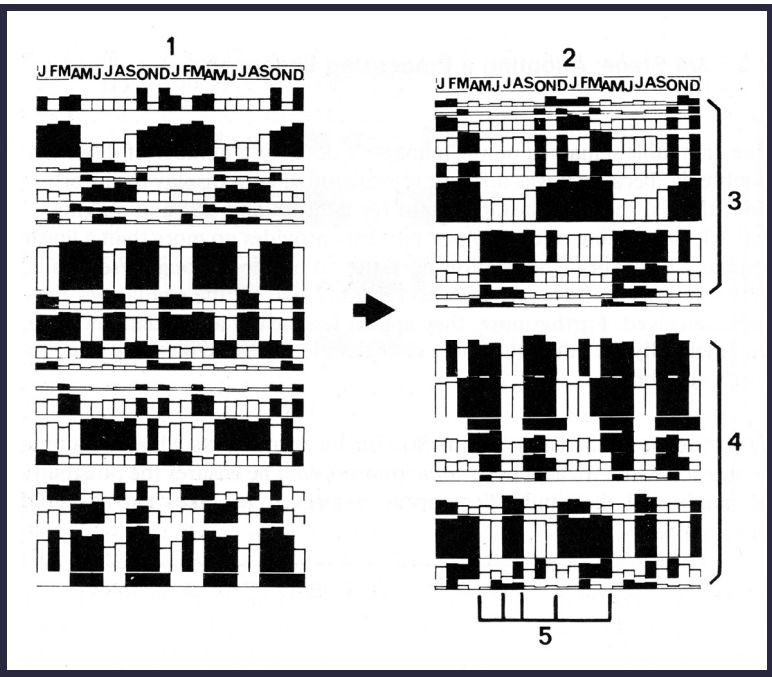
3D dynamic queries [Akers et al. 04]



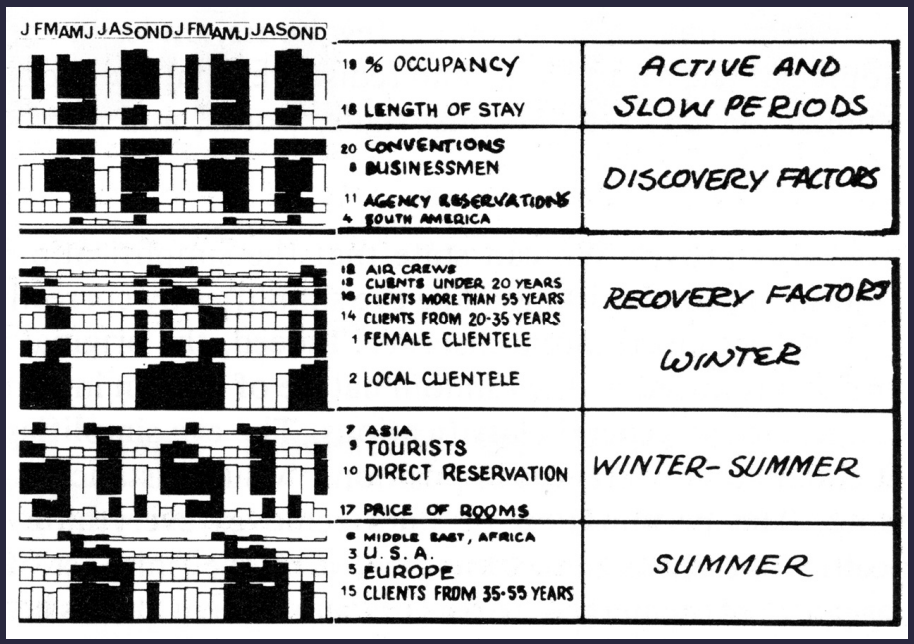
Rearrangements

J	F	M	A	M	J	J	A	S	O	N	D		
26	21	26	28	20	20	20	20	20	40	15	40	1	% CLIENTELE FEMALE
69	70	77	71	37	36	39	39	55	60	68	72	2	% —〃— LOCAL
7	6	3	6	23	14	19	14	9	6	8	8	3	% —〃— U.S.A.
0	0	0	0	8	6	6	4	2	12	0	0	4	% —〃— SOUTH AMERICA
20	15	14	15	23	27	22	30	27	19	19	17	5	% —〃— EUROPE
1	0	0	8	6	4	6	4	2	1	0	1	6	% —〃— M.EAST, AFRICA
3	10	6	0	3	13	8	9	5	2	5	2	7	% —〃— ASIA
78	80	85	86	85	87	70	76	87	85	87	80	8	% BUSINESSMEN
22	20	15	14	15	13	30	24	13	15	13	20	9	% TOURISTS
70	70	75	74	69	68	74	75	68	68	64	75	10	% DIRECT RESERVATIONS
20	18	19	17	27	27	19	19	26	27	21	15	11	% AGENCY ———〃———
10	12	6	9	4	5	7	6	6	5	15	10	12	% AIR CREWS
2	2	4	2	2	1	1	2	2	4	2	5	13	% CLIENTS UNDER 20 YEARS
25	27	37	35	25	25	27	28	24	30	24	30	14	% —〃— 20-35 —〃—
48	49	42	48	54	55	53	51	55	46	55	43	15	% —〃— 35-55 —〃—
25	22	17	15	19	19	19	19	19	20	19	22	16	% —〃— MORE THAN 55 —〃—
163	167	166	174	152	155	145	170	157	174	165	156	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	1.44	18	LENGTH OF STAY
67	82	70	83	74	77	56	62	90	92	78	55	19	% OCCUPANCY
			X	X	X			X	X	X	X	20	CONVENTIONS

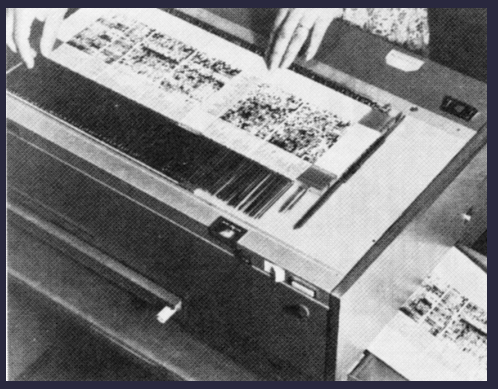
[Graphics and Graphic Information Processing, Bertin 81]



[Graphics and Graphic Information Processing, Bertin 81]



[Graphics and Graphic Information Processing, Bertin 81]



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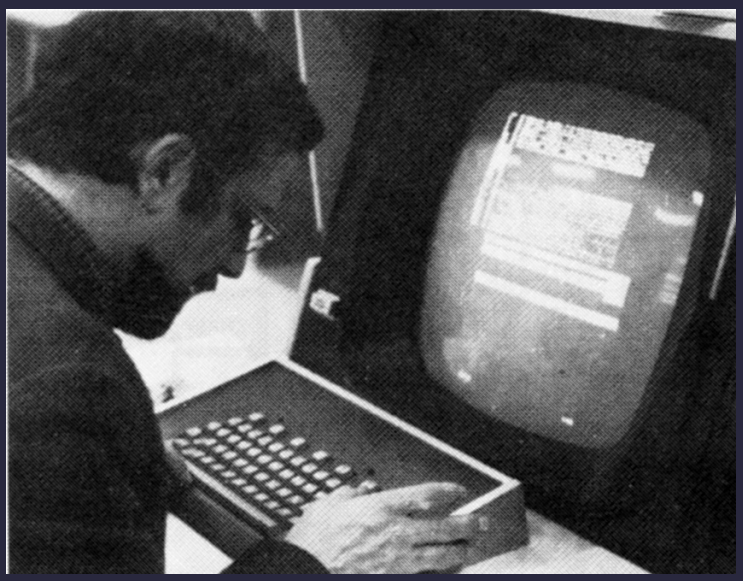
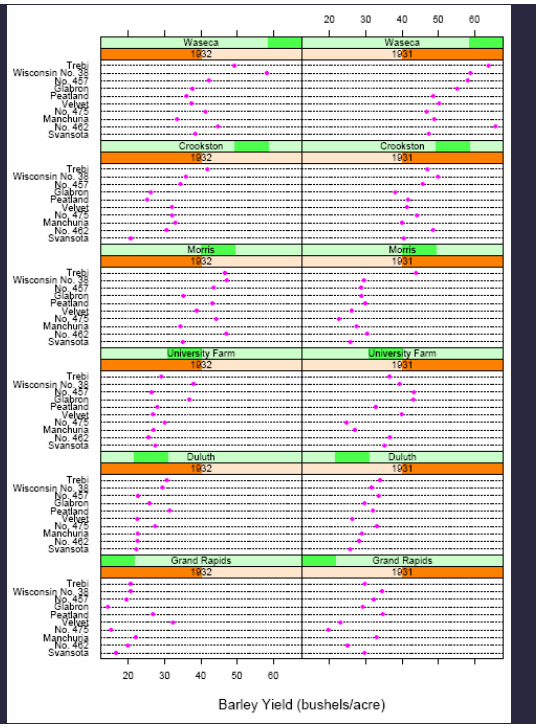


[Graphics and Graphic Information Processing, Bertin 81]

Trellis

[Becker, Cleveland, and Shyu 96]

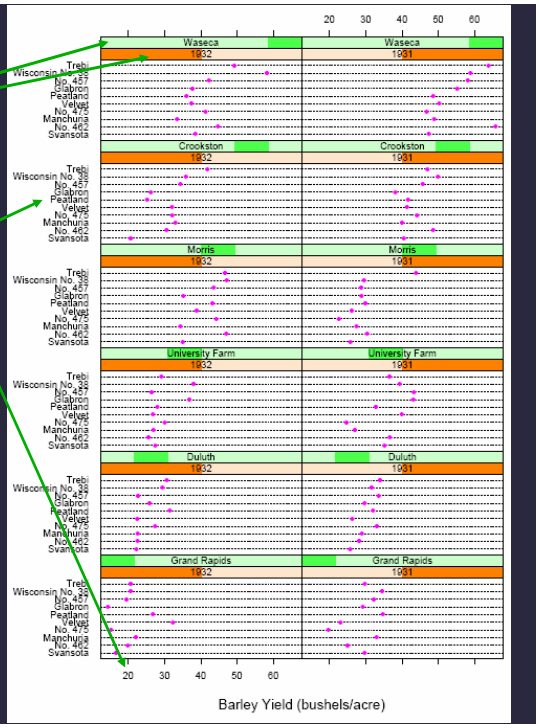


Trellis

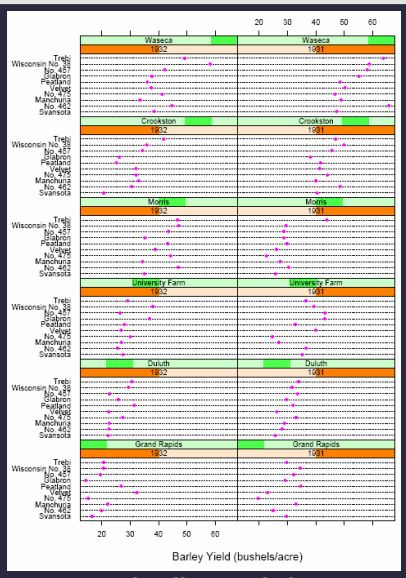
[Becker, Cleveland, and Shyu 96]

Condition variables
location, year

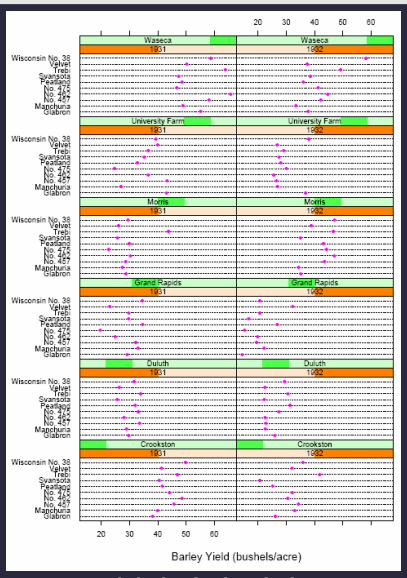
Panel variables
type, yield



Trellis: Automatic ordering

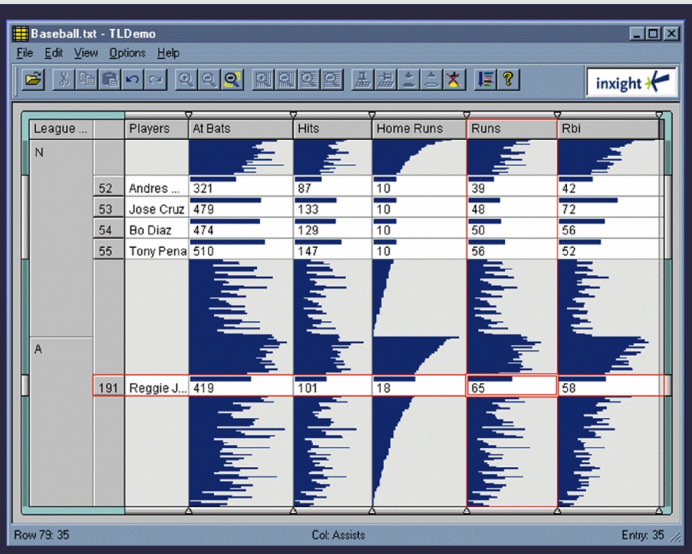


Main-effects ordering



Alphabetical ordering

TableLens [Rao & Card 94]



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