可视化与可视计算概论

Introduction to Visualization and Visual Computing

董笑菊

2018 年 3 月 20 日

Interaction

Interaction Spectrum

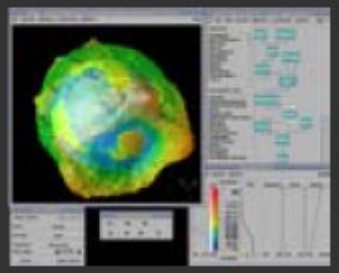
Exploration

Presentation

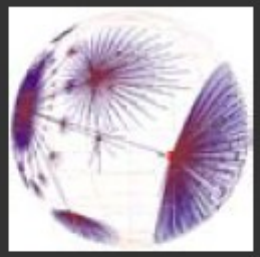
Reactivity

Encyclopedia

VR

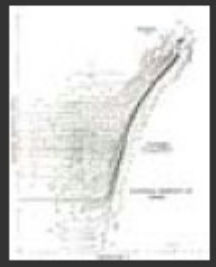


Data Explorer



Interactive 3D model

Navigation map



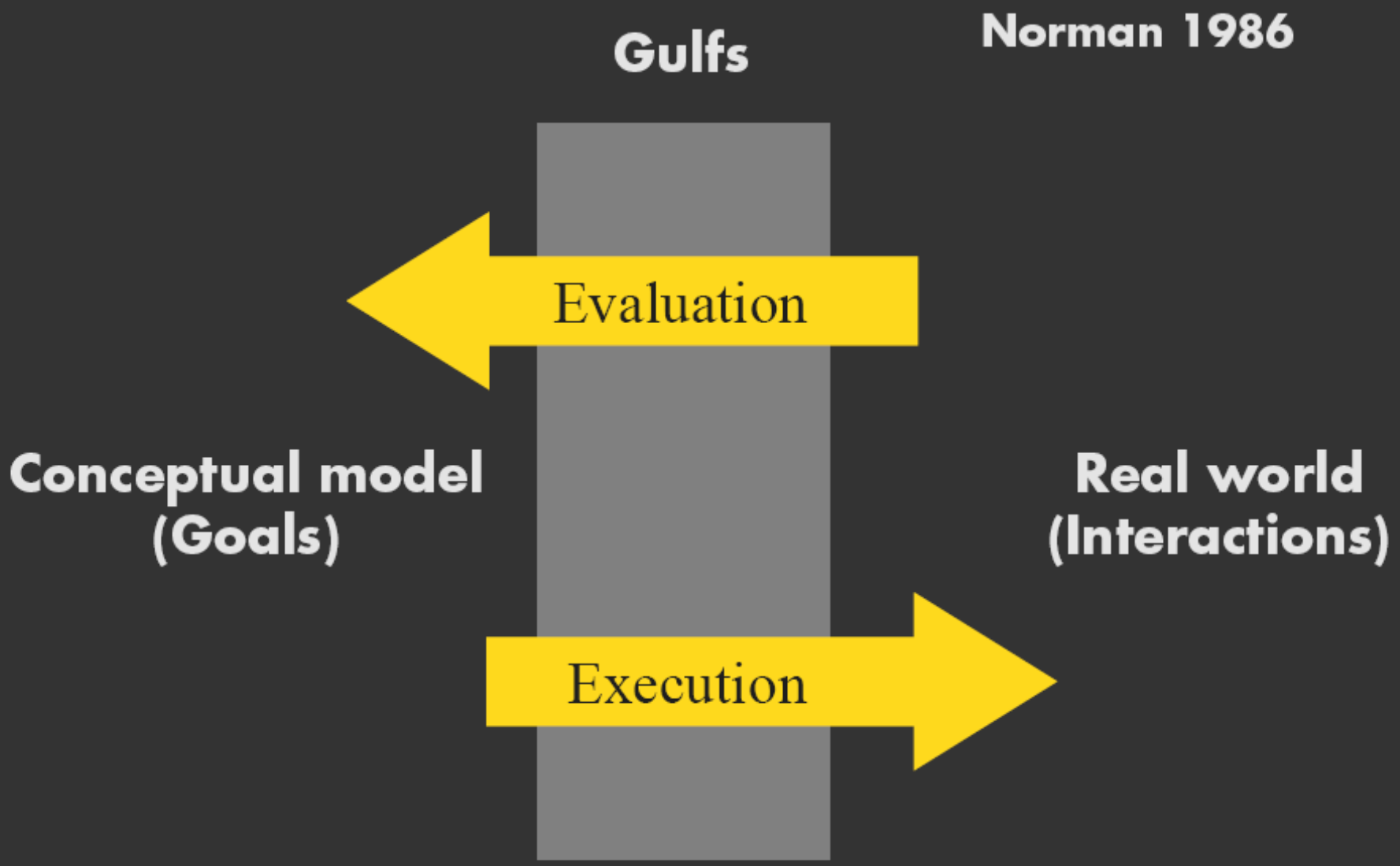
Graph

Text slide

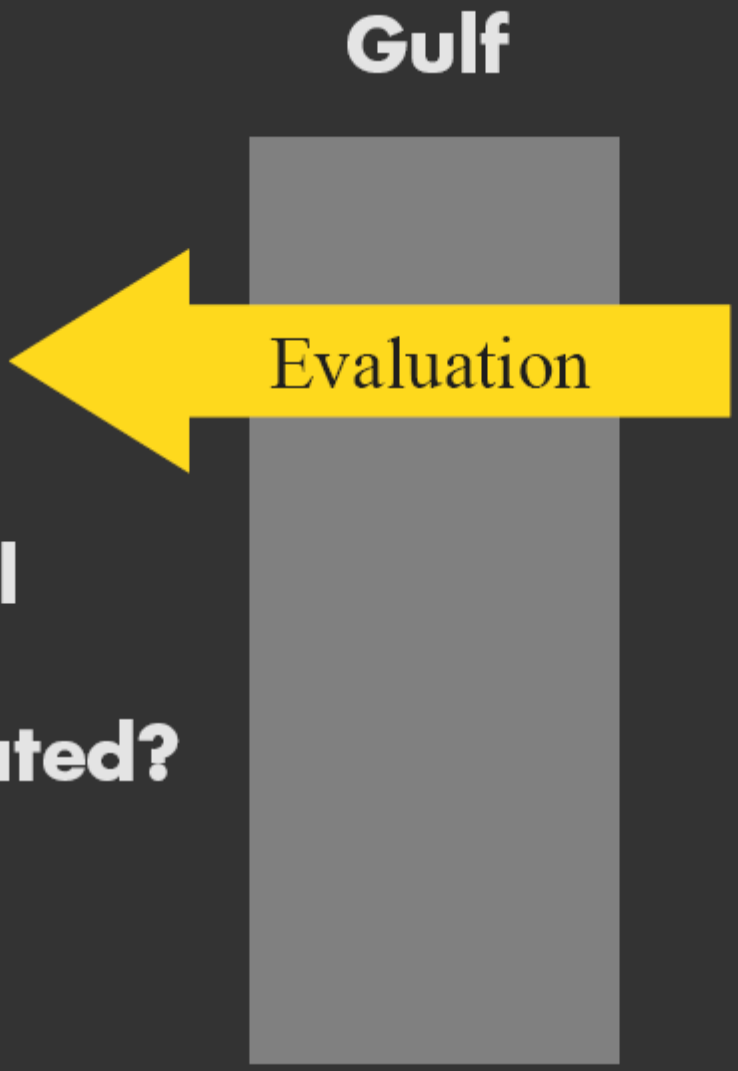
Games

Slide by F. Guimbretiere

Gulfs of Execution & Evaluation



Gulf of Evaluation



Conceptual model: x,y correlated?

Real world:

X	Y
0.67	0.79
0.32	0.63
0.39	0.72
0.27	0.85
0.71	0.43
0.63	0.09
0.03	0.03
0.20	0.54
0.51	0.38
0.11	0.33
0.46	0.46

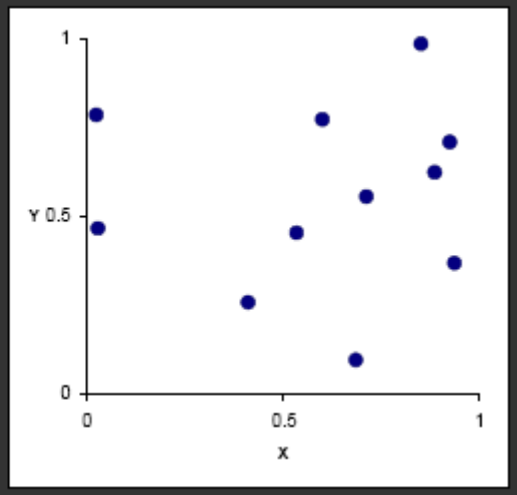
Gulf of Evaluation

Gulf

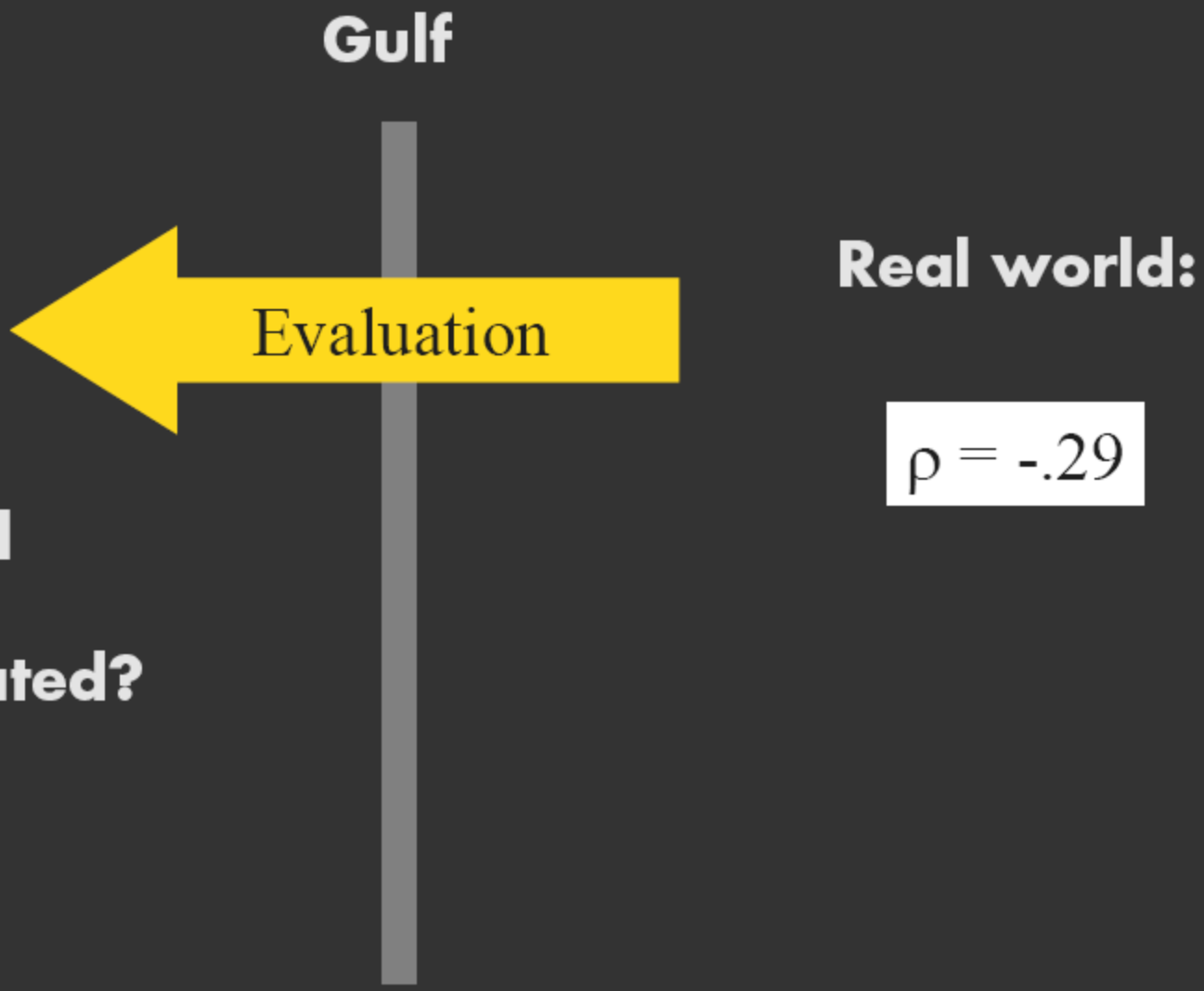
Evaluation

Conceptual model: x,y correlated?

Real world:



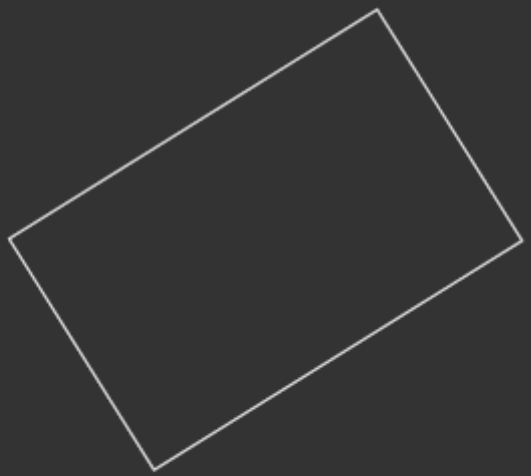
Gulf of Evaluation



Gulf of Execution

Gulf

Conceptual model: Draw a rectangle



Execution

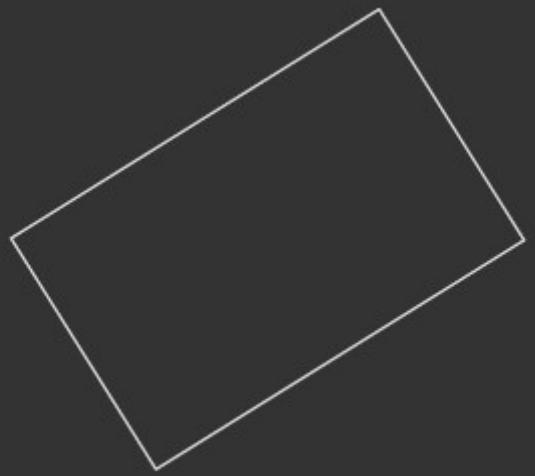
Real world

Move 90 30
Rotate 35
Pen down
…

Gulf of Execution

Gulf

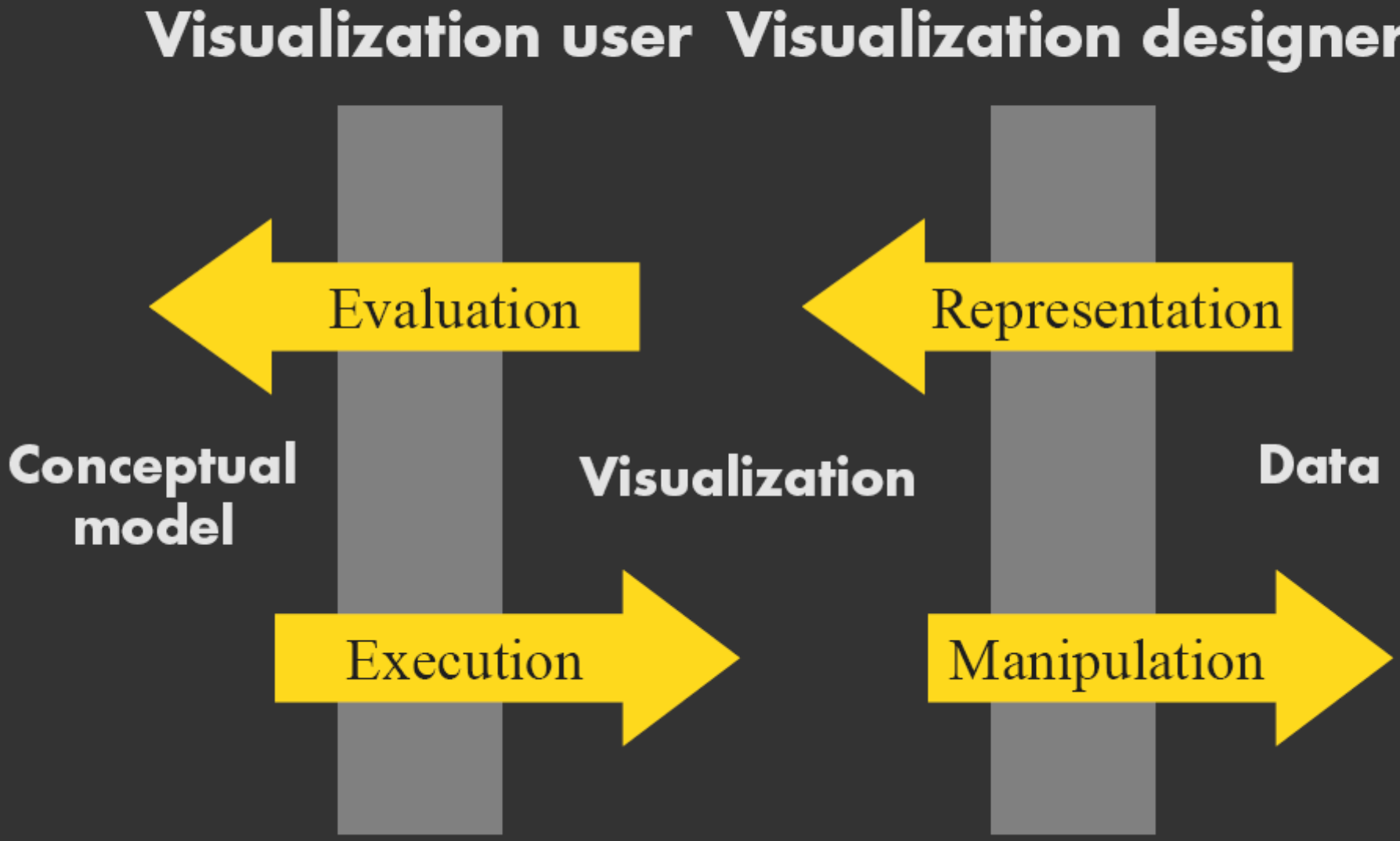
Conceptual model:
Draw a rectangle



Execution

Real world

Visualization: A Double Gulf?



Bad visualization?

Visualization user Visualization designer

Evaluation

Representation

x,y correlated?

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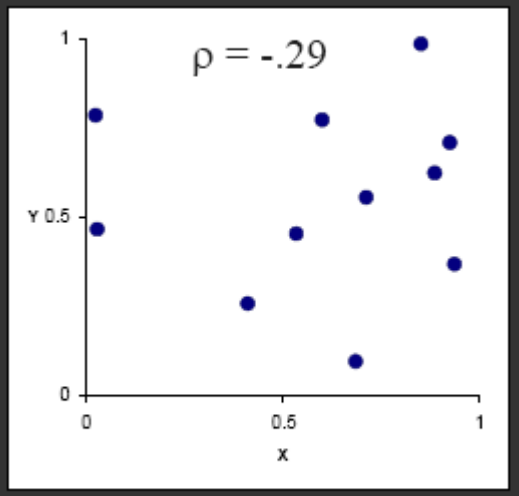
Good Visualization?

Visualization user **Visualization designer**

Evaluation

Representation

x,y correlated?



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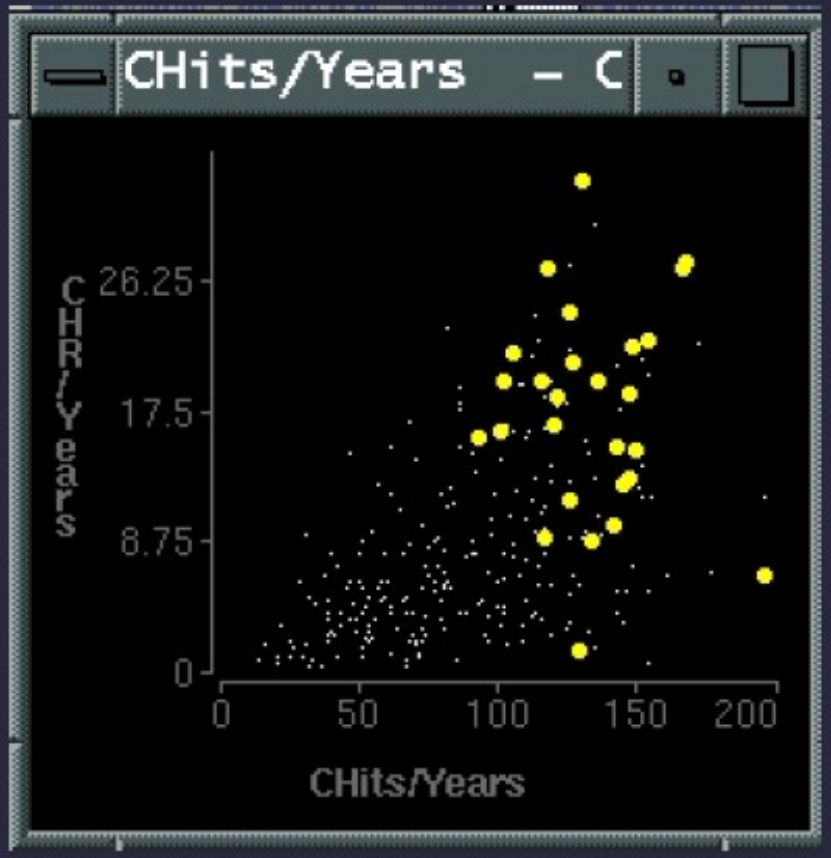
Topics

- Brushing and Linking
- Dynamic Queries
- Rearrangements

Brushing and Linking

Highlighting

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



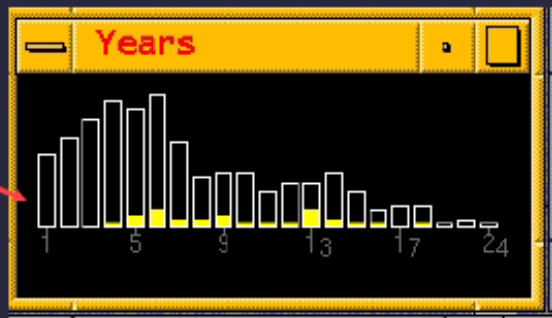
[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

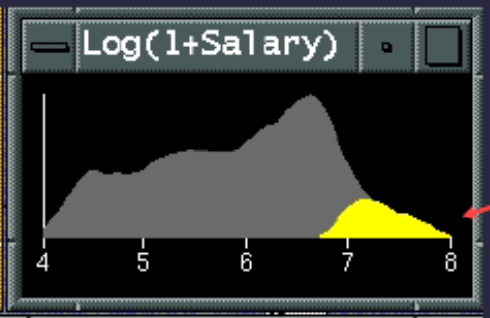
Brushing

- 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]

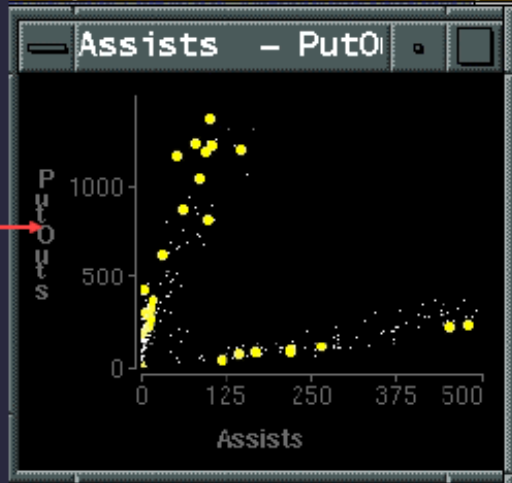
how long in majors

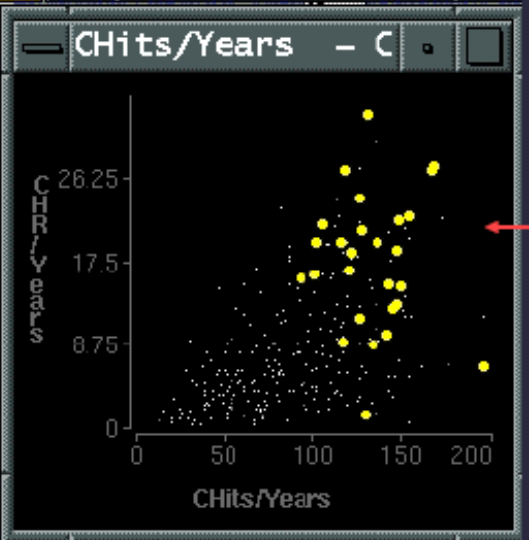




select high salaries

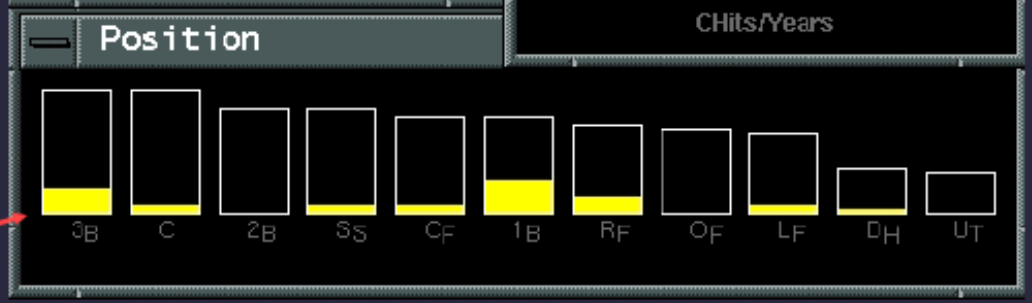
avg assists vs avg putouts (fielding ability)





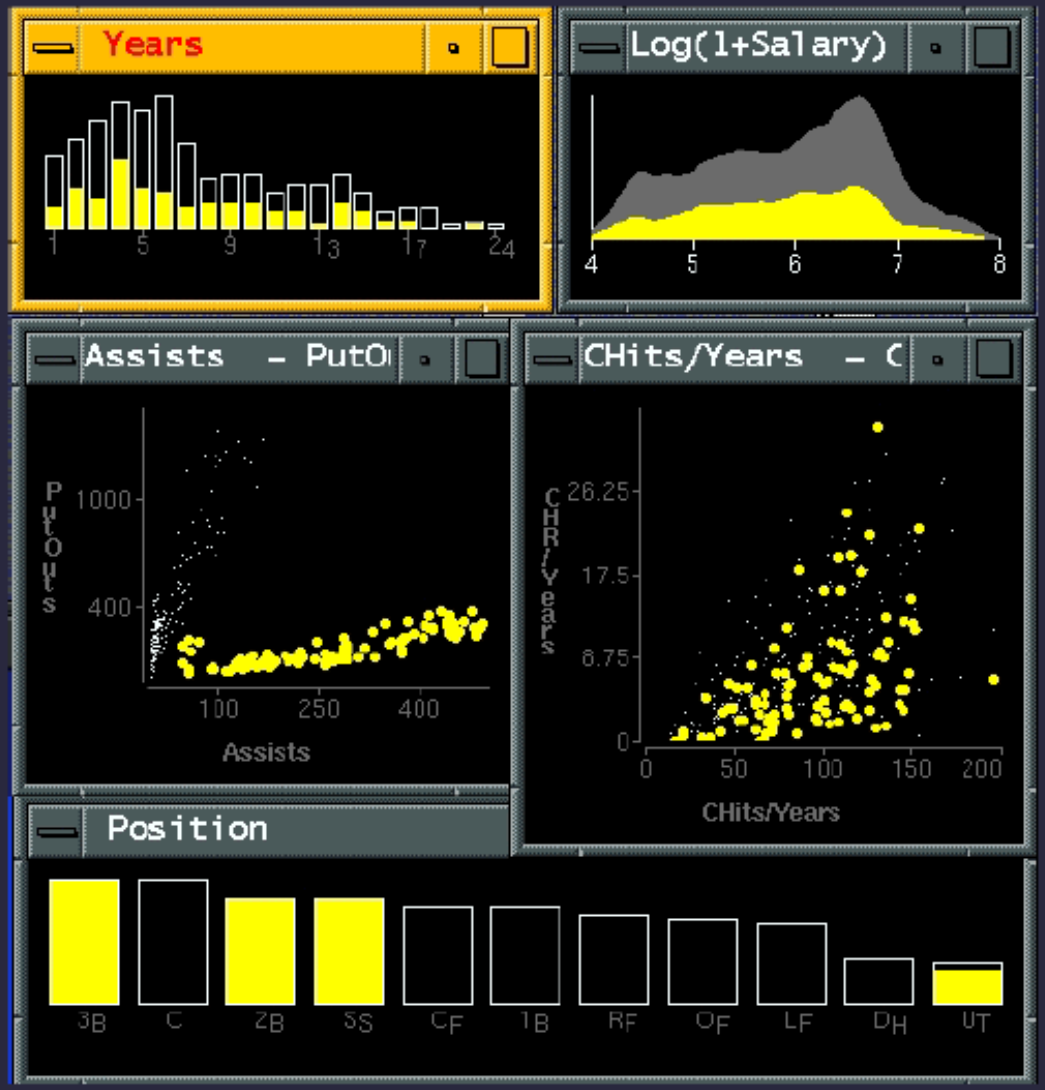
avg career HRs vs avg career hits (batting ability)

distribution of positions played



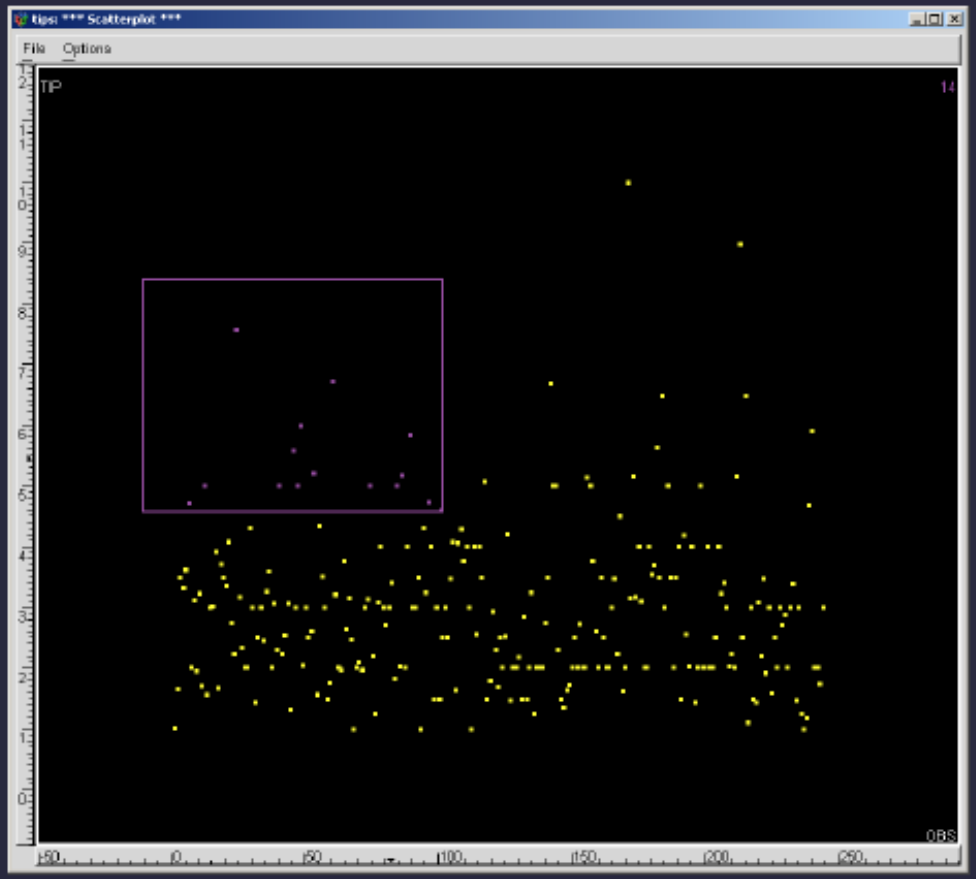
[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

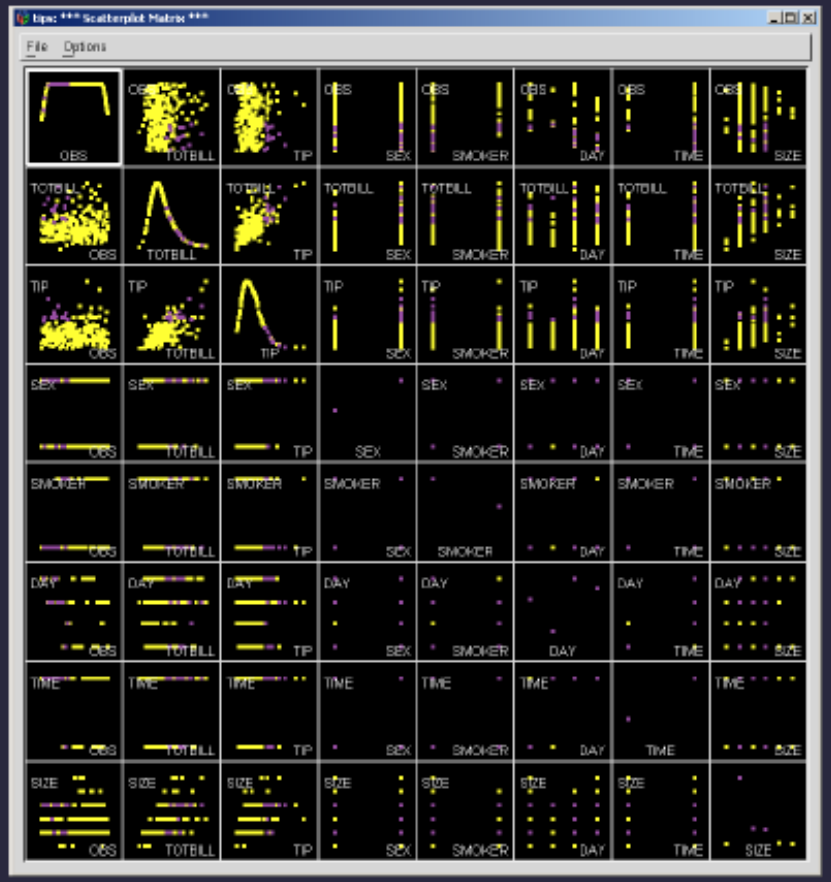
Linking assists to positions



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

GGobi: Brushing





http://www.ggobi.org/

Dynamic Queries

Query and results

SELECT house

FROM east bay

WHERE price < 1,000,000 AND bedrooms > 2

ORDER BY price

Issues

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**

HomeFinder

[Ahlberg and Schneiderman 92]

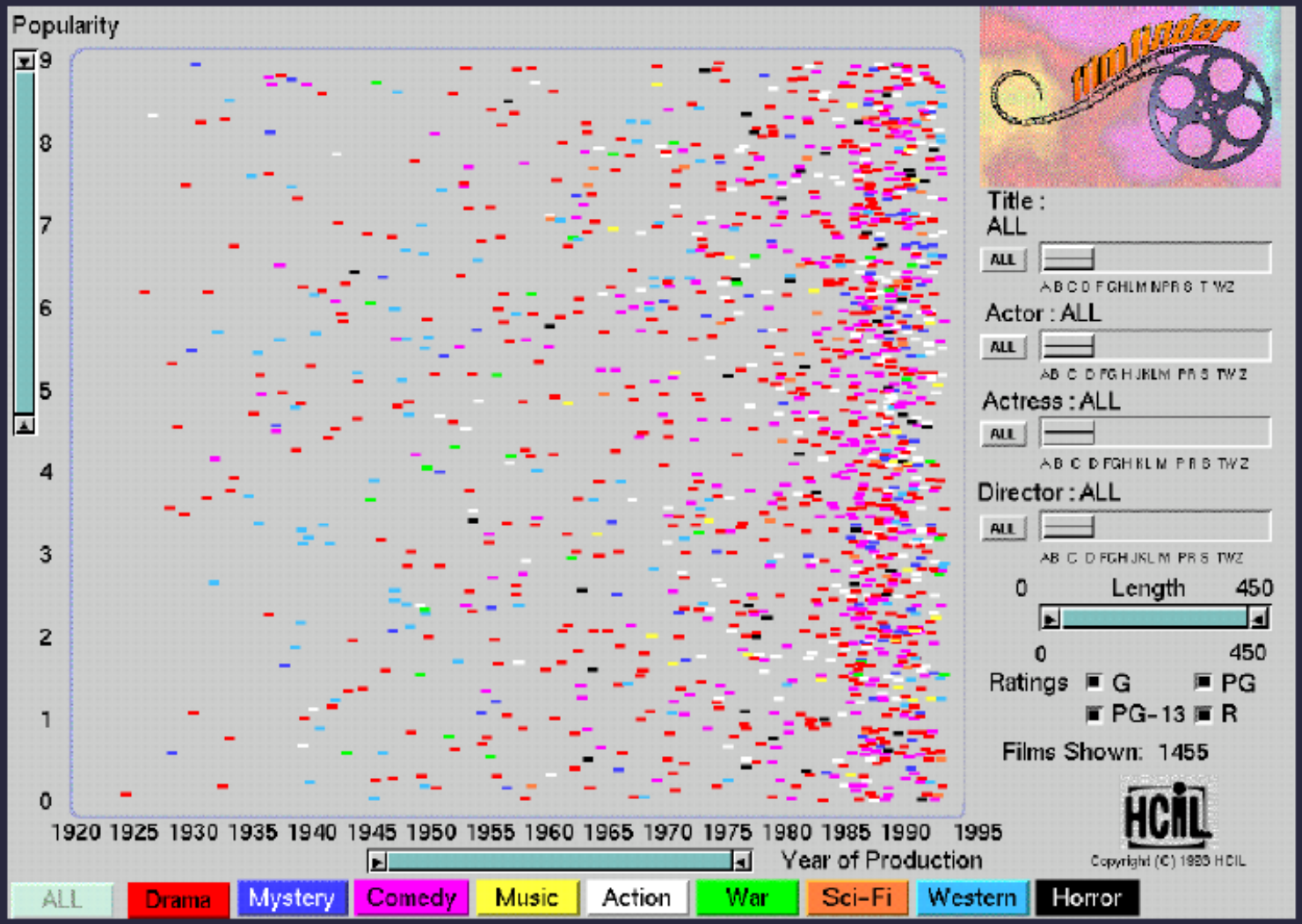
Direct manipulation

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

Alphaslider

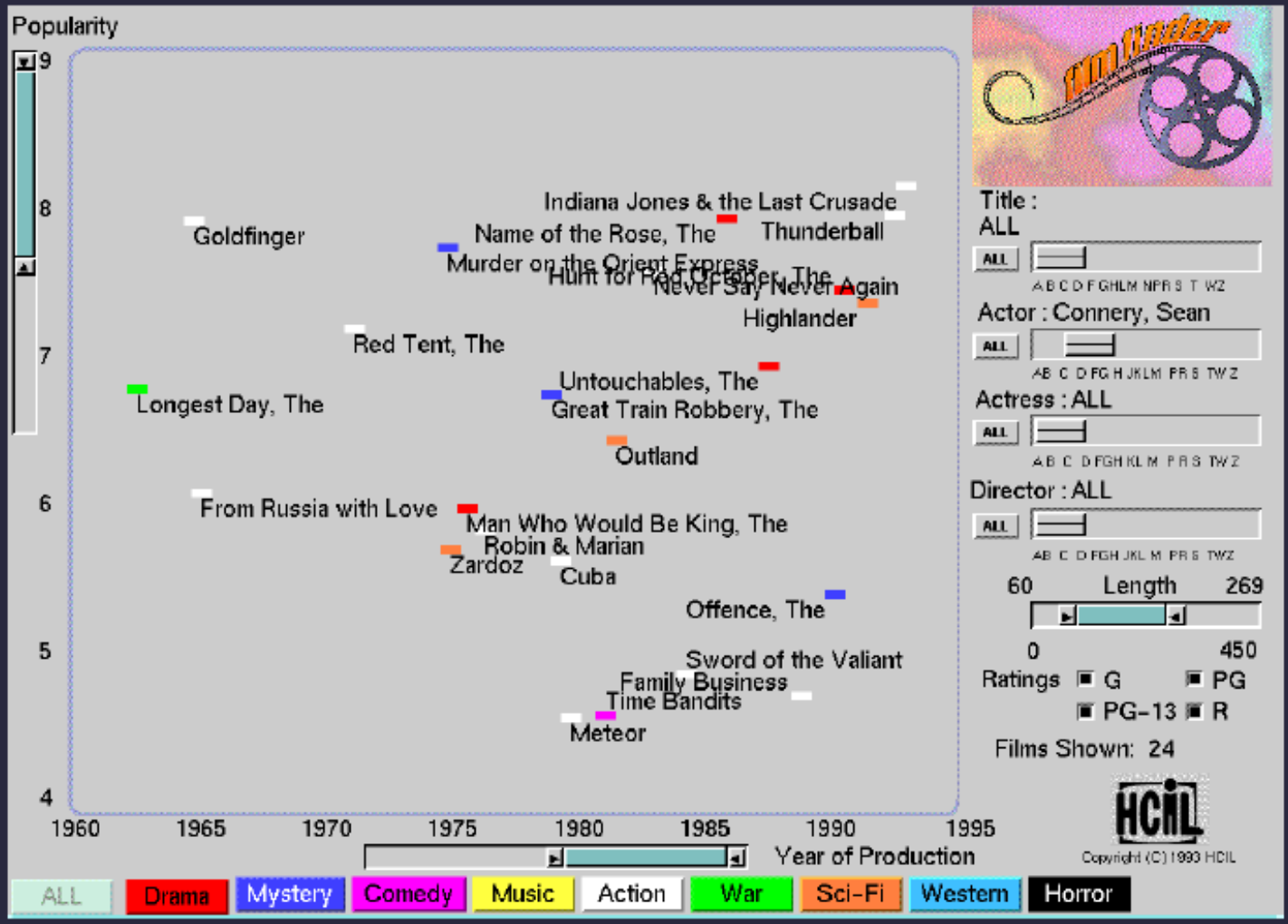
[Ahlberg and Schneiderman 94]

FilmFinder



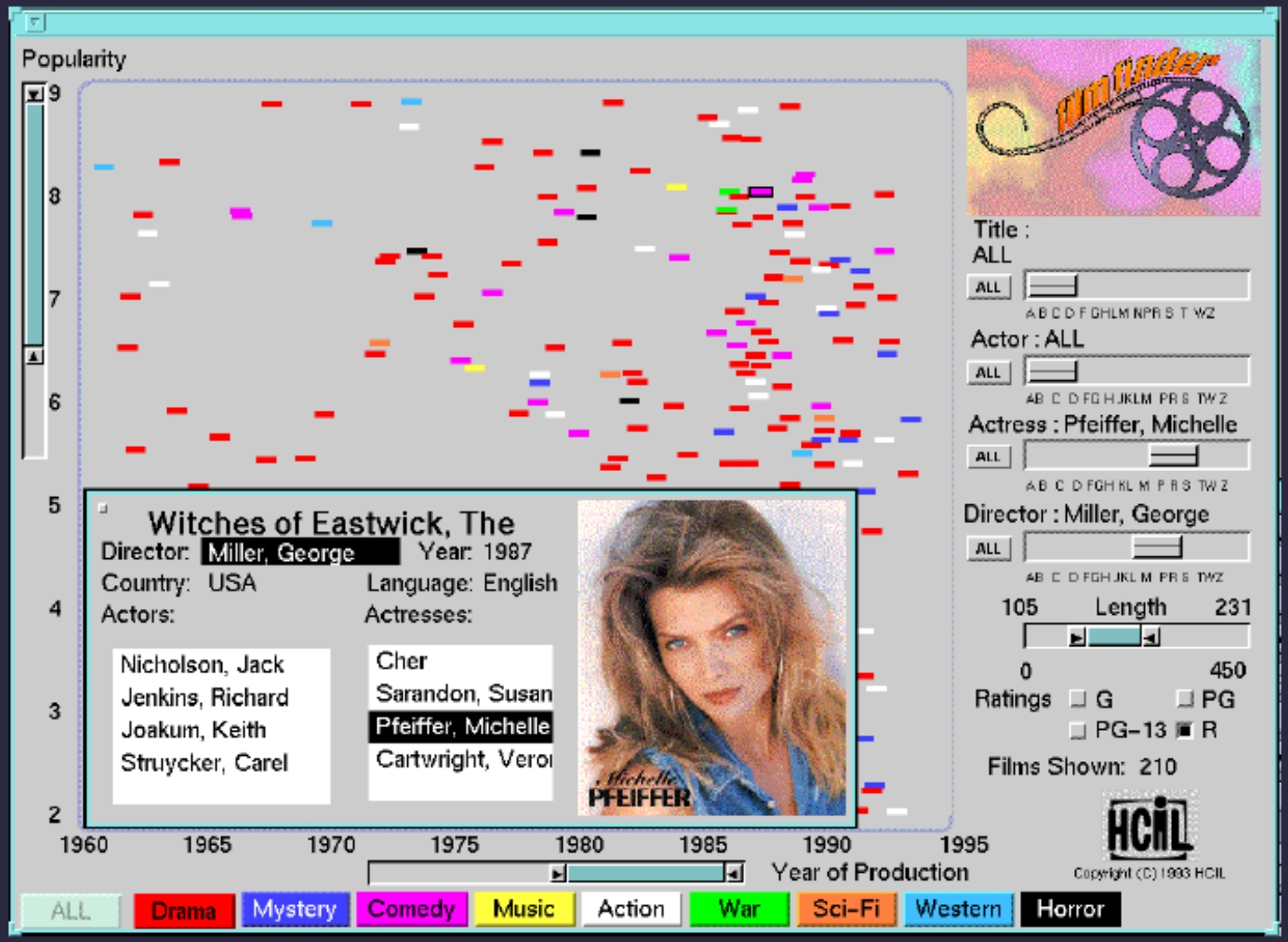
[Ahlberg and Schneiderman 93]

FilmFinder



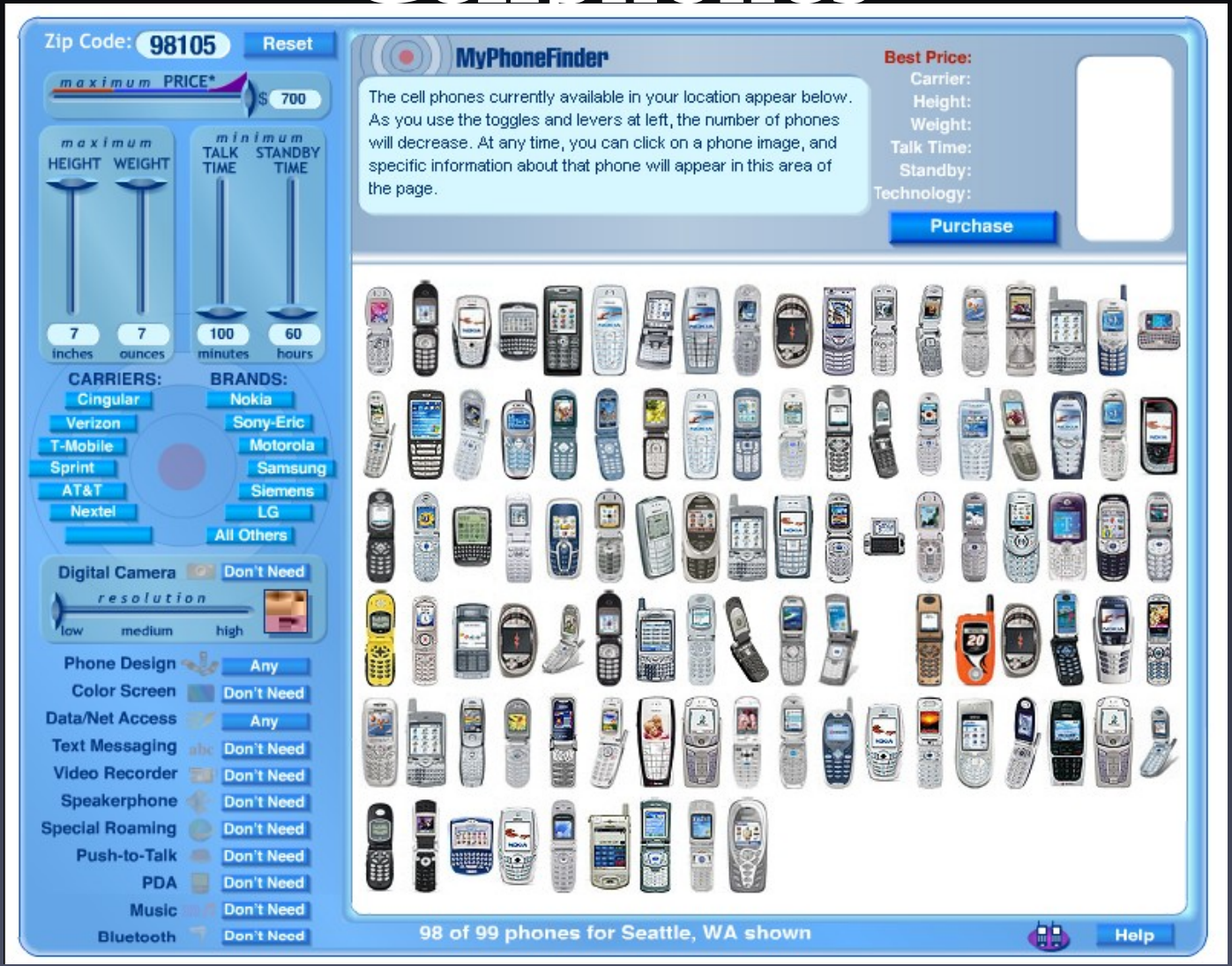
[Ahlberg and Schneiderman 93]

FilmFinder



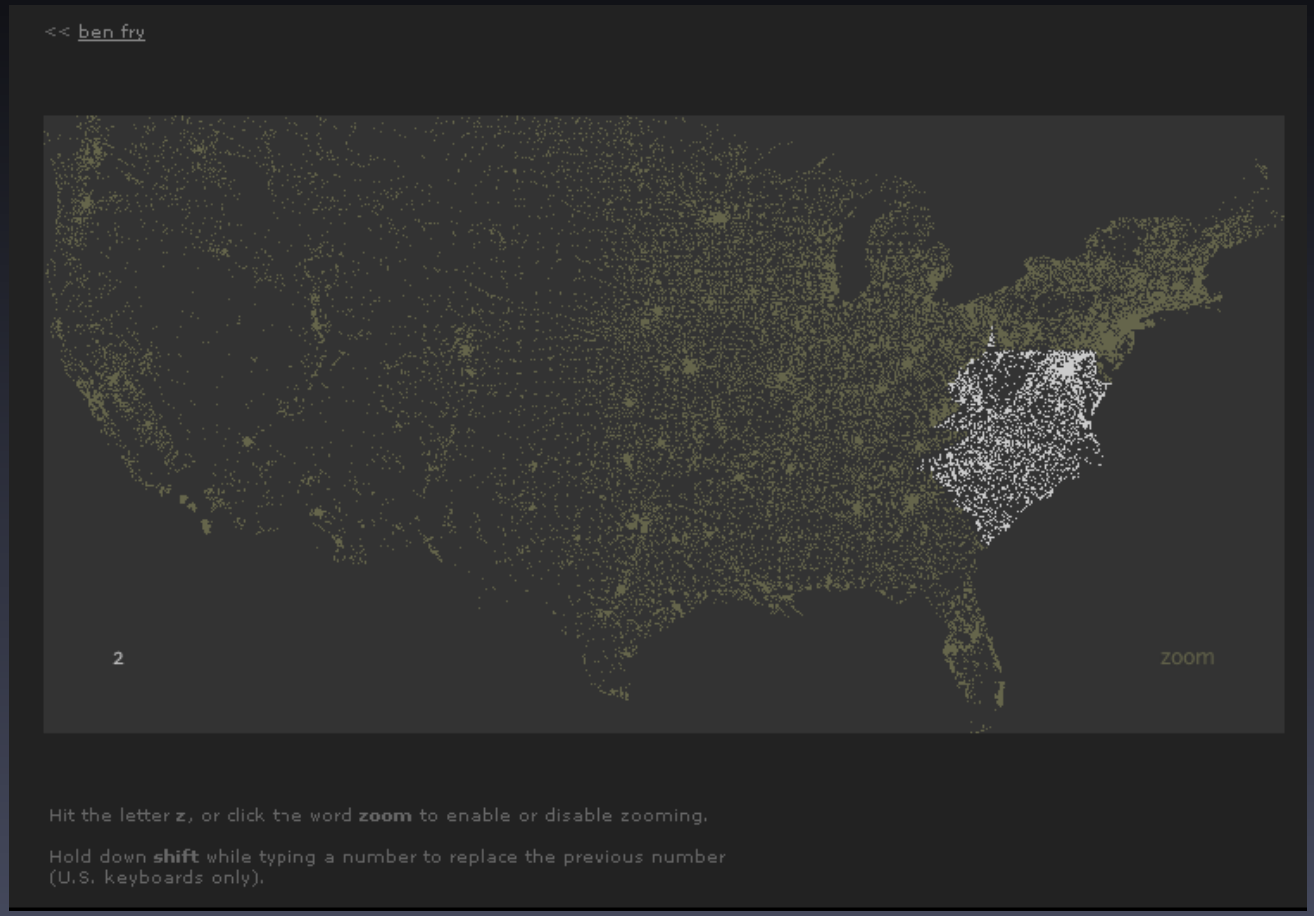
[Ahlberg and Schneiderman 93]

Cellphones



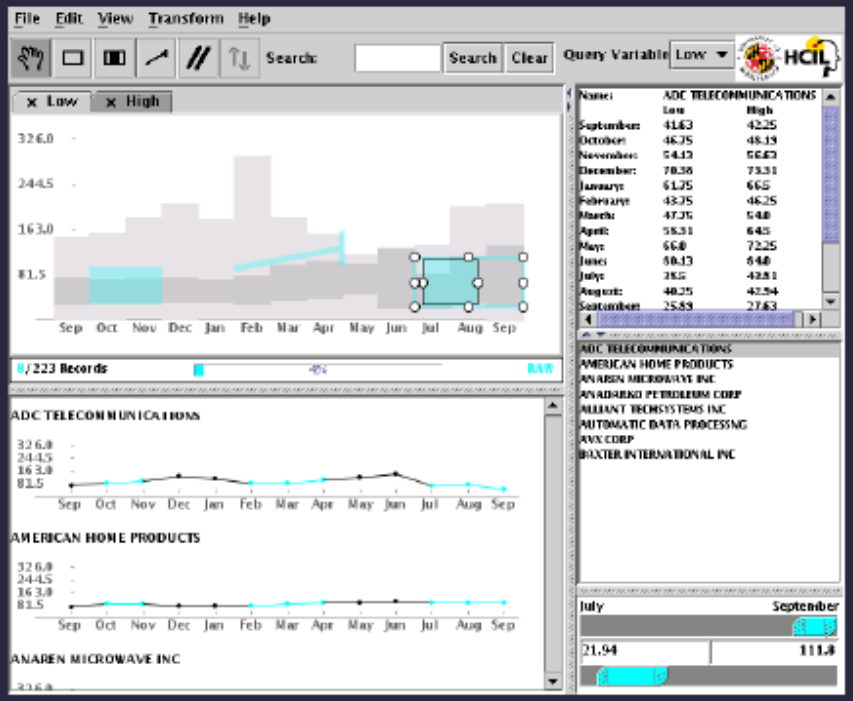
http://www.myrateplan.com/cellphones/

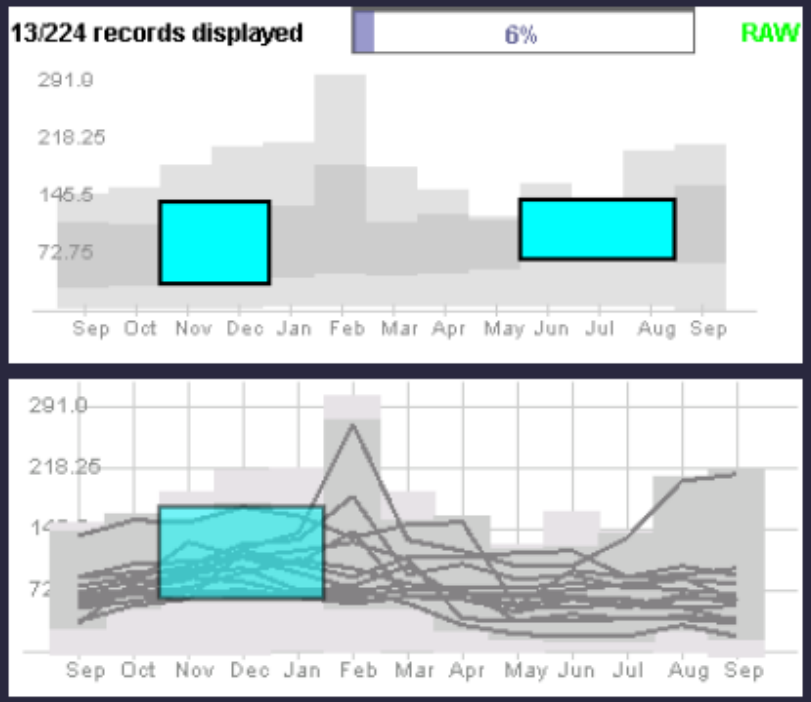
Zipdecode



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

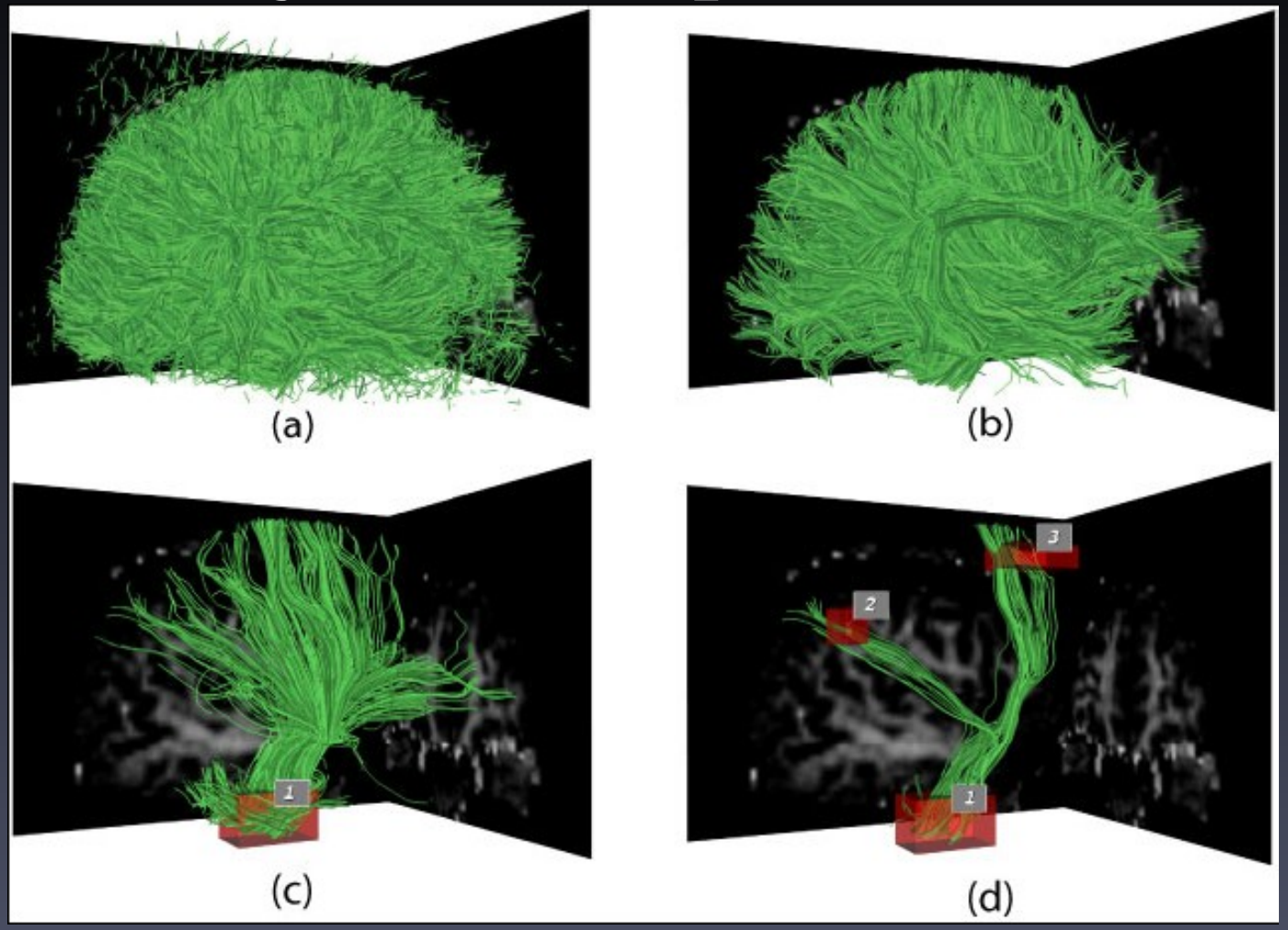
TimeSearcher [Hochheiser & Schneiderman 02]



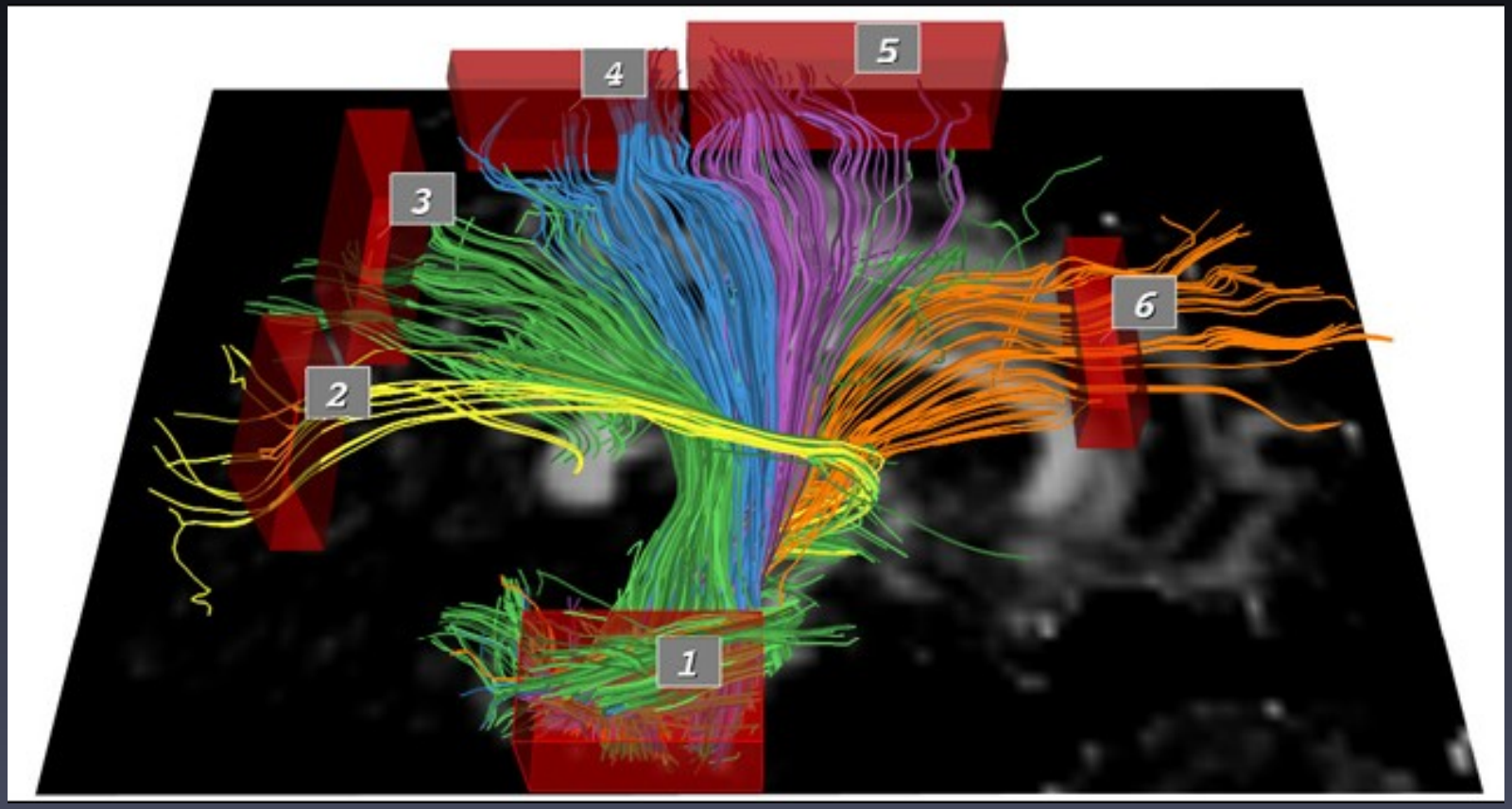


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



3D dynamic queries [Akers et al. 04]



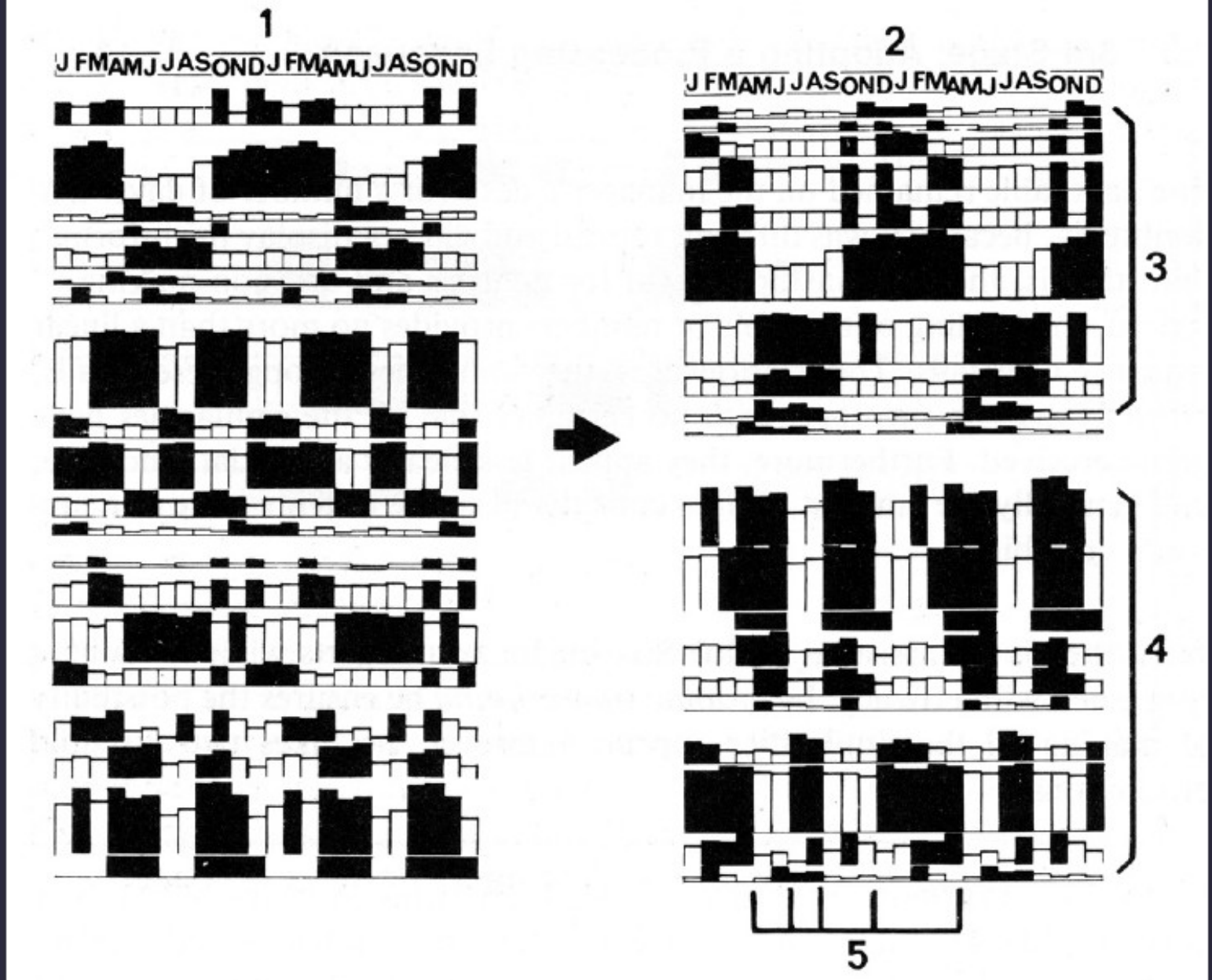
Pros and cons

- **Pros**
  - Controls useful for both novices and experts
  - Quick way to explore data
- **Cons**
  - Simple queries
  - Lots of controls
  - Amount of data shown limited by screen space
- **Who would use these kinds of tools?**

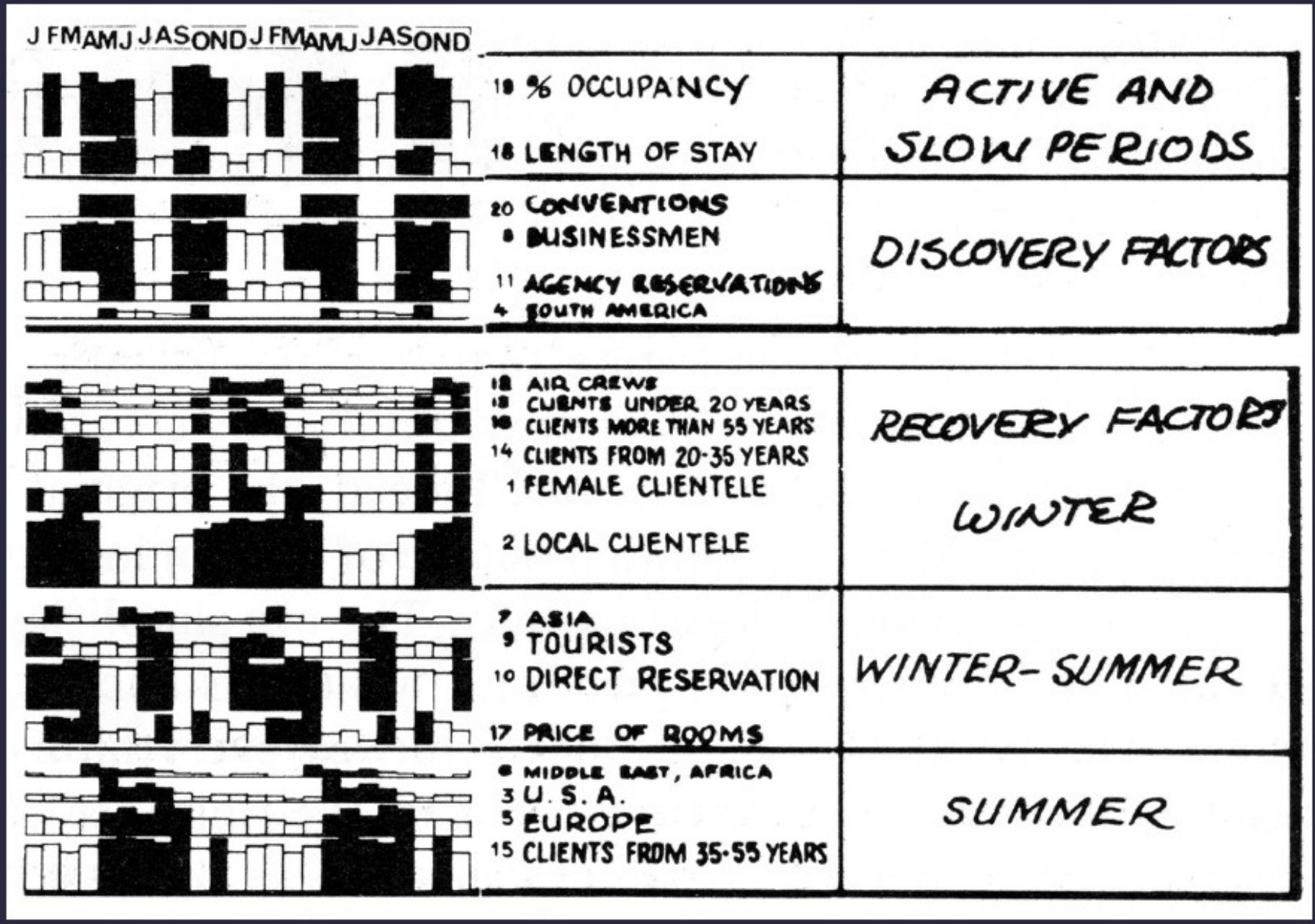
Rearrangements

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]



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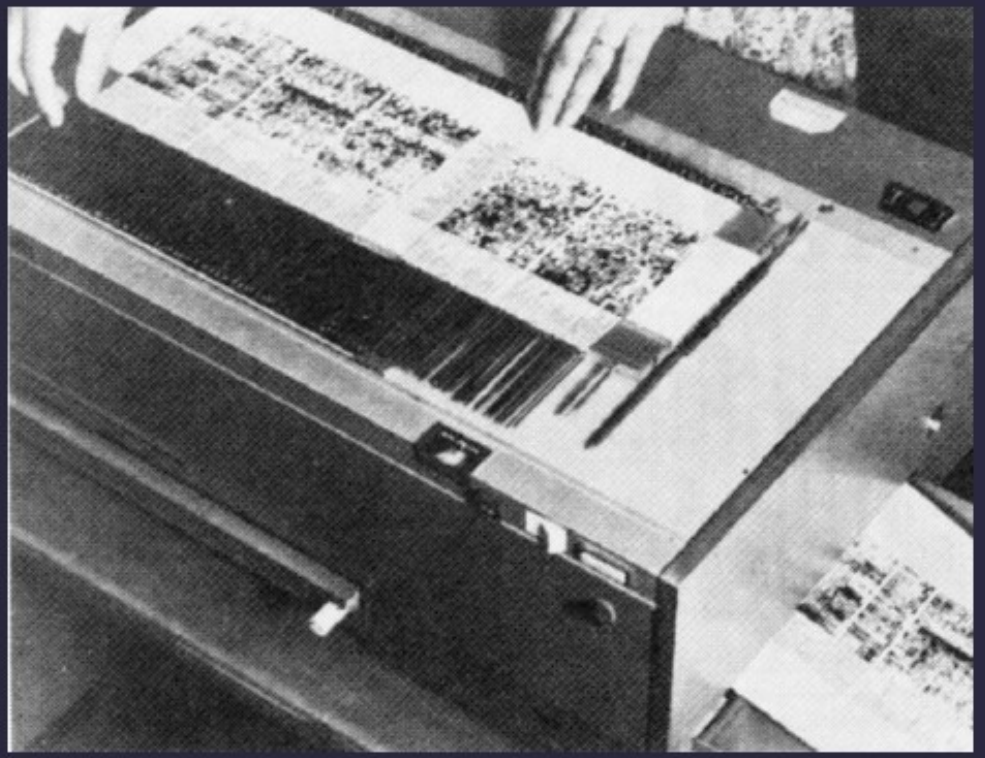

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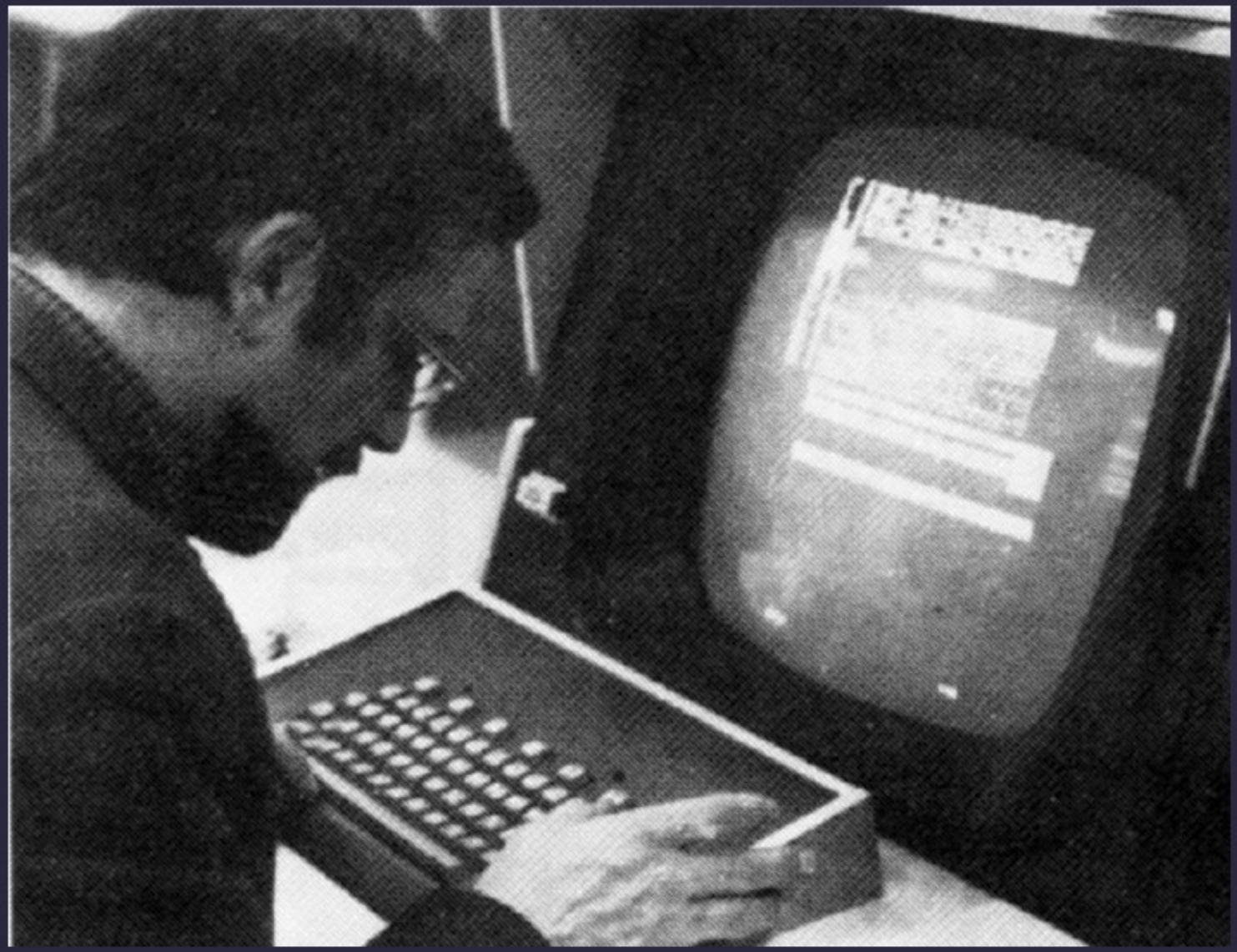
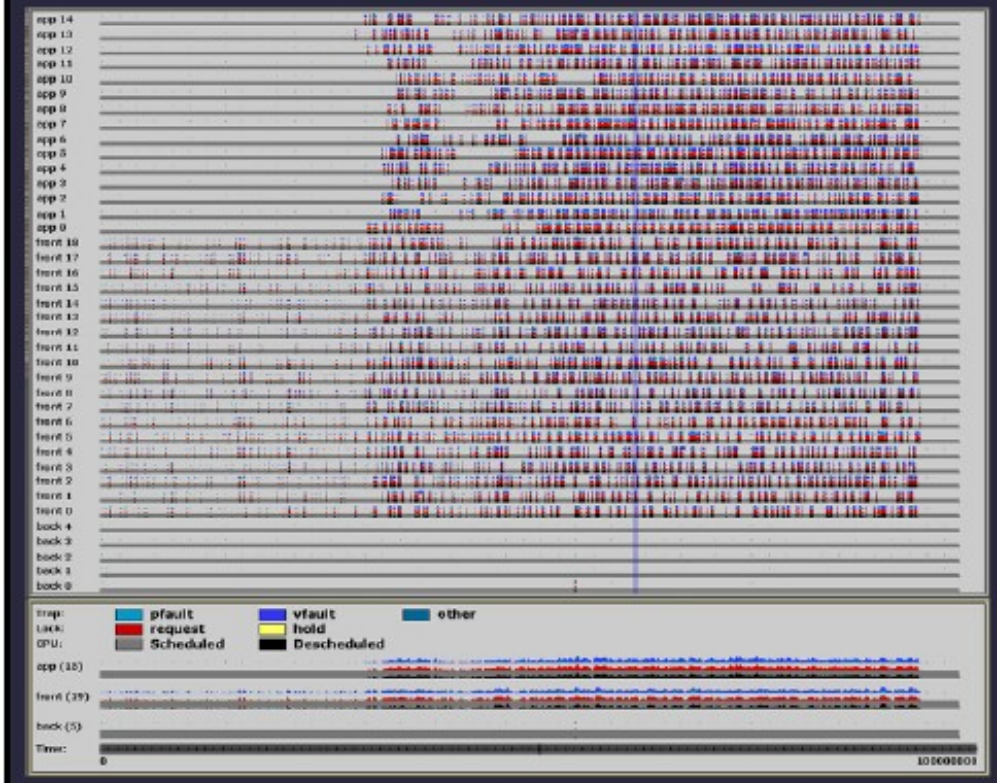


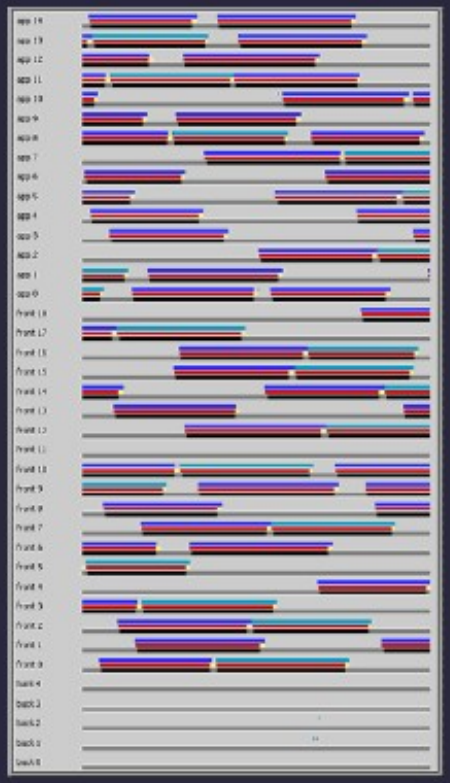
[Graphics and Graphic Information Processing, Bertin 81]

Rivet: Interactive reordering

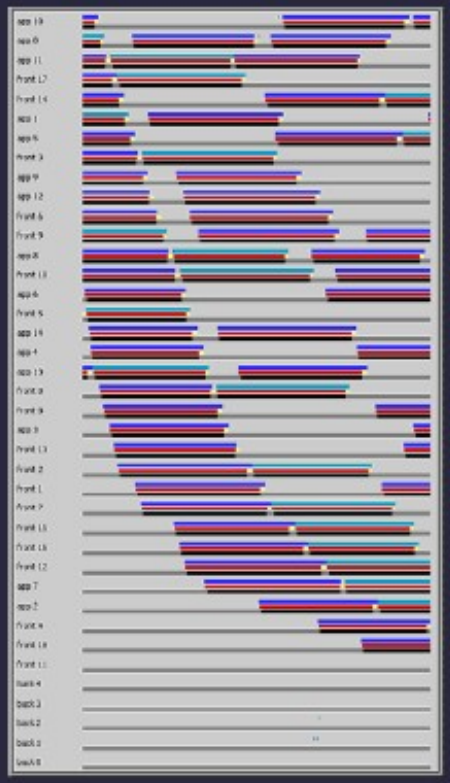
Overview



Zoom



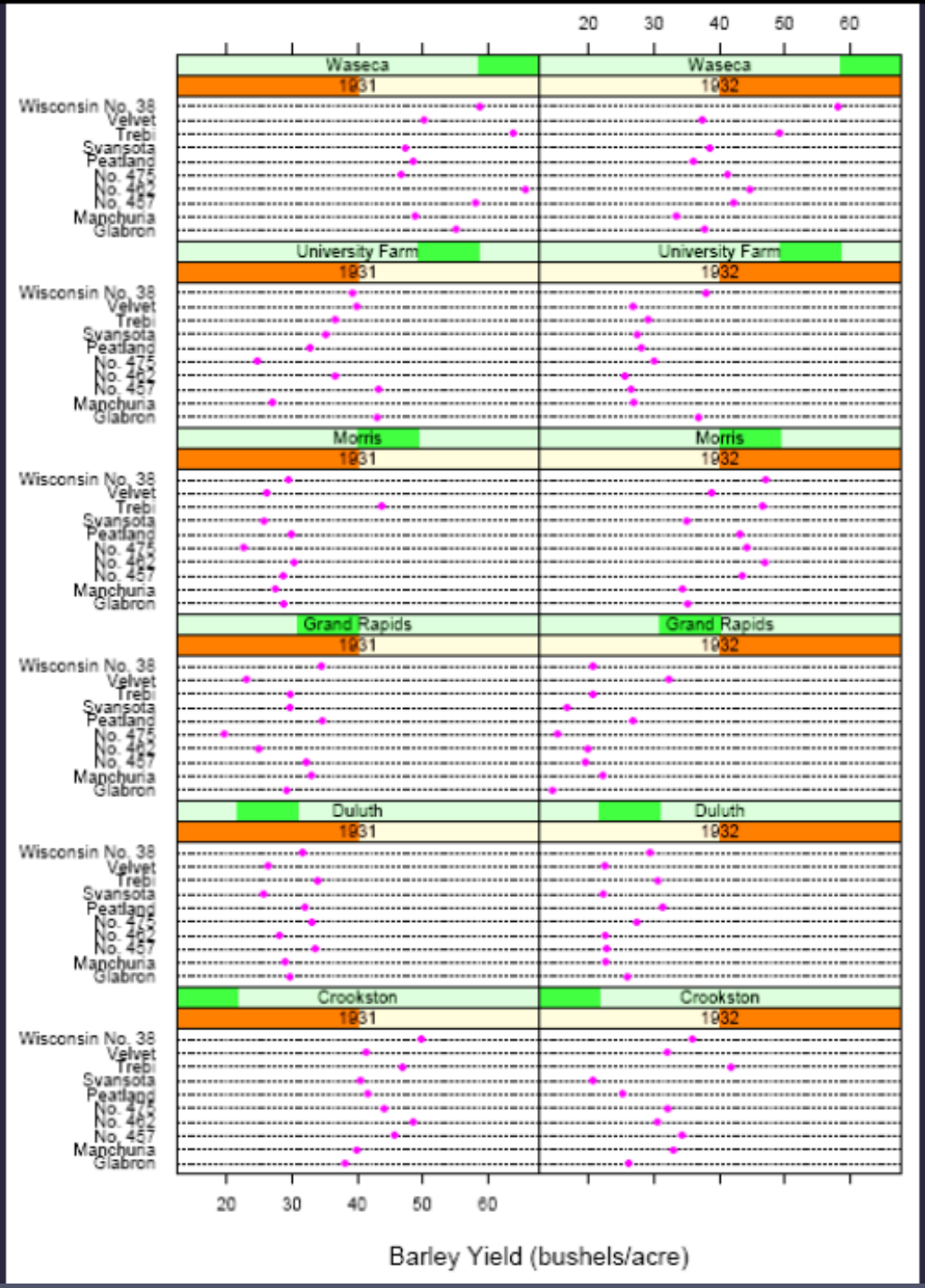
Reorder



Performance Analysis and Visualization of Parallel Systems Using SimOS and Rivet: A Case Study [Bosch et al. 00]

Trellis

[Becker, Cleveland, and Shyu 96]



Condition variables

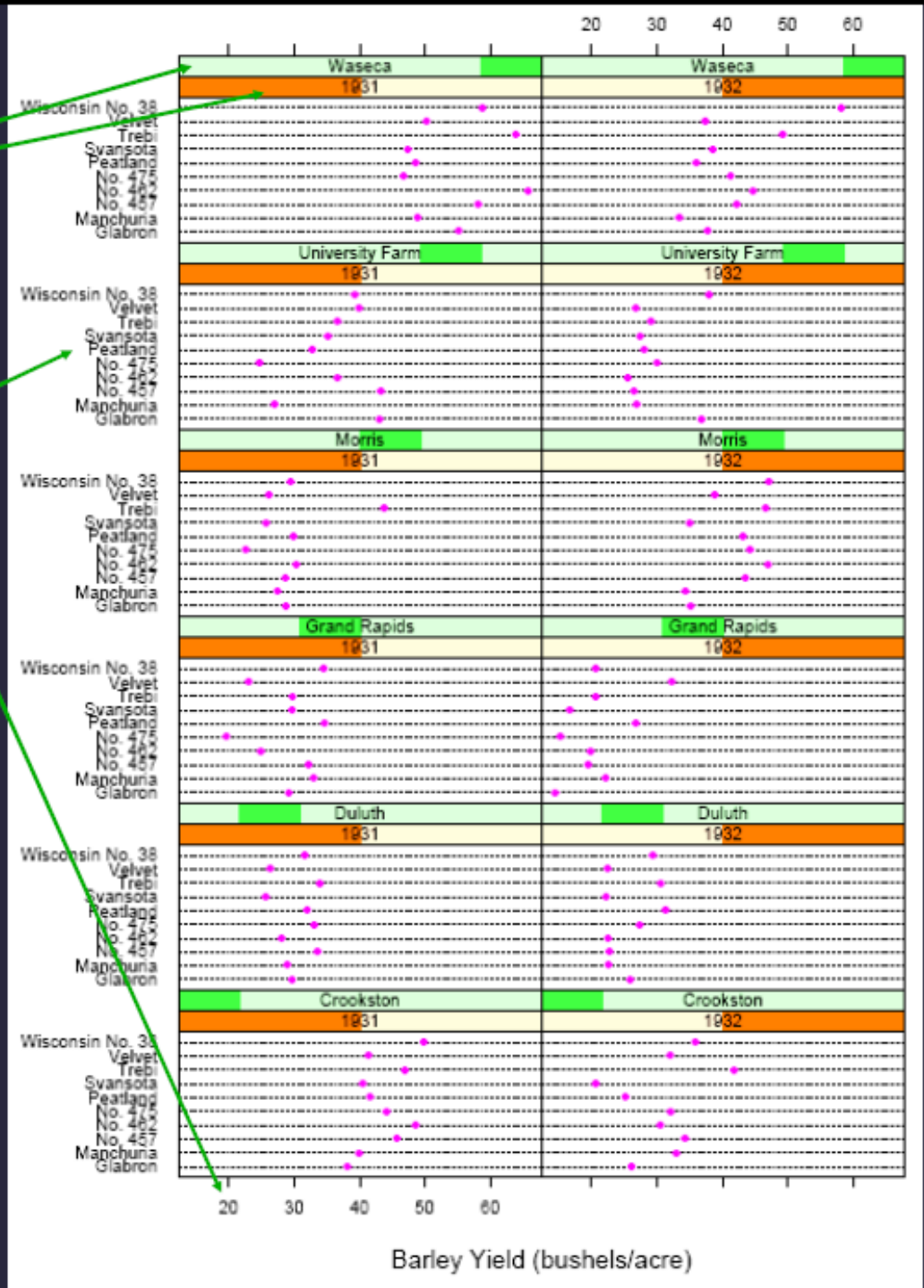
location, year

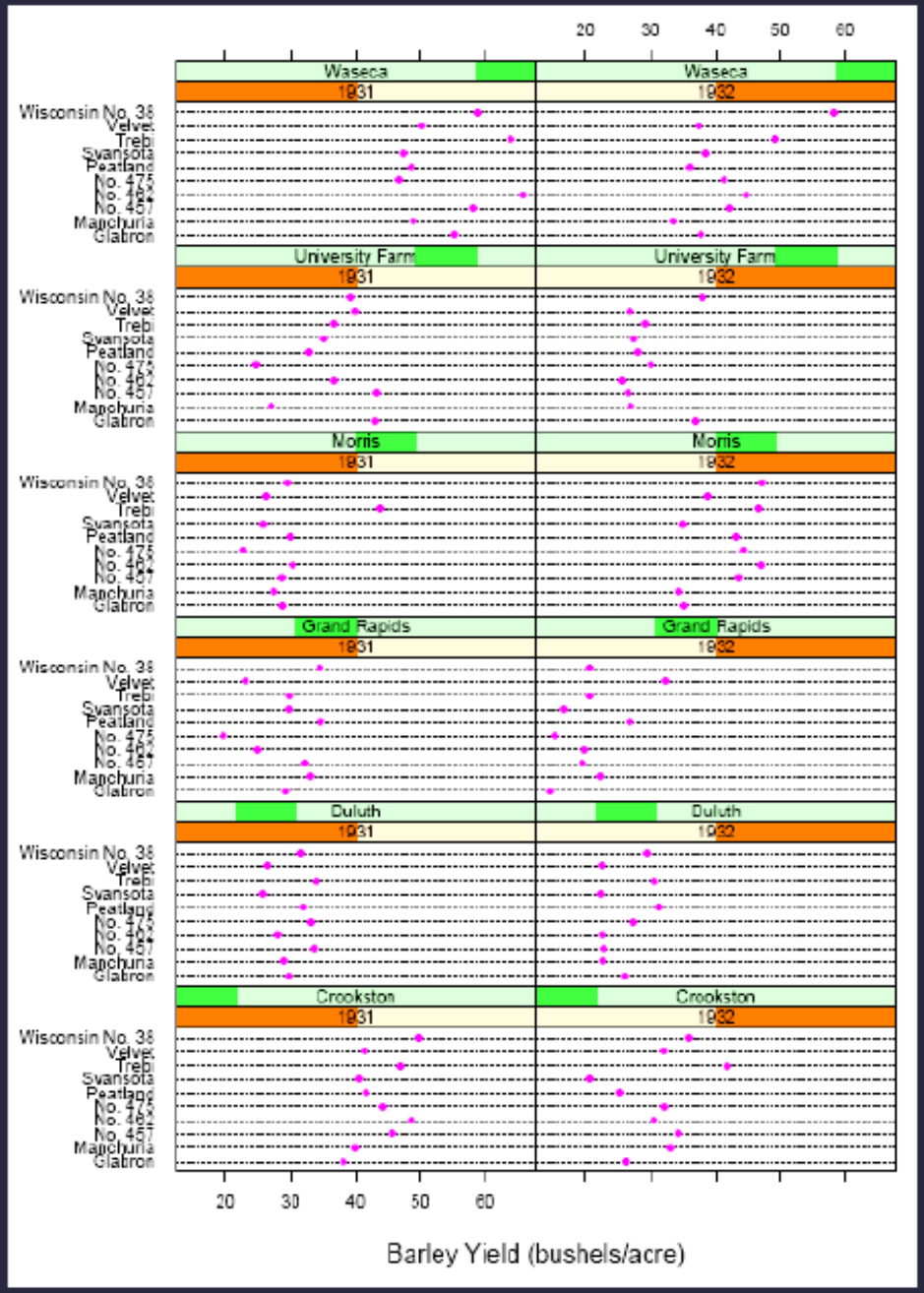
Panel variables

type, yield

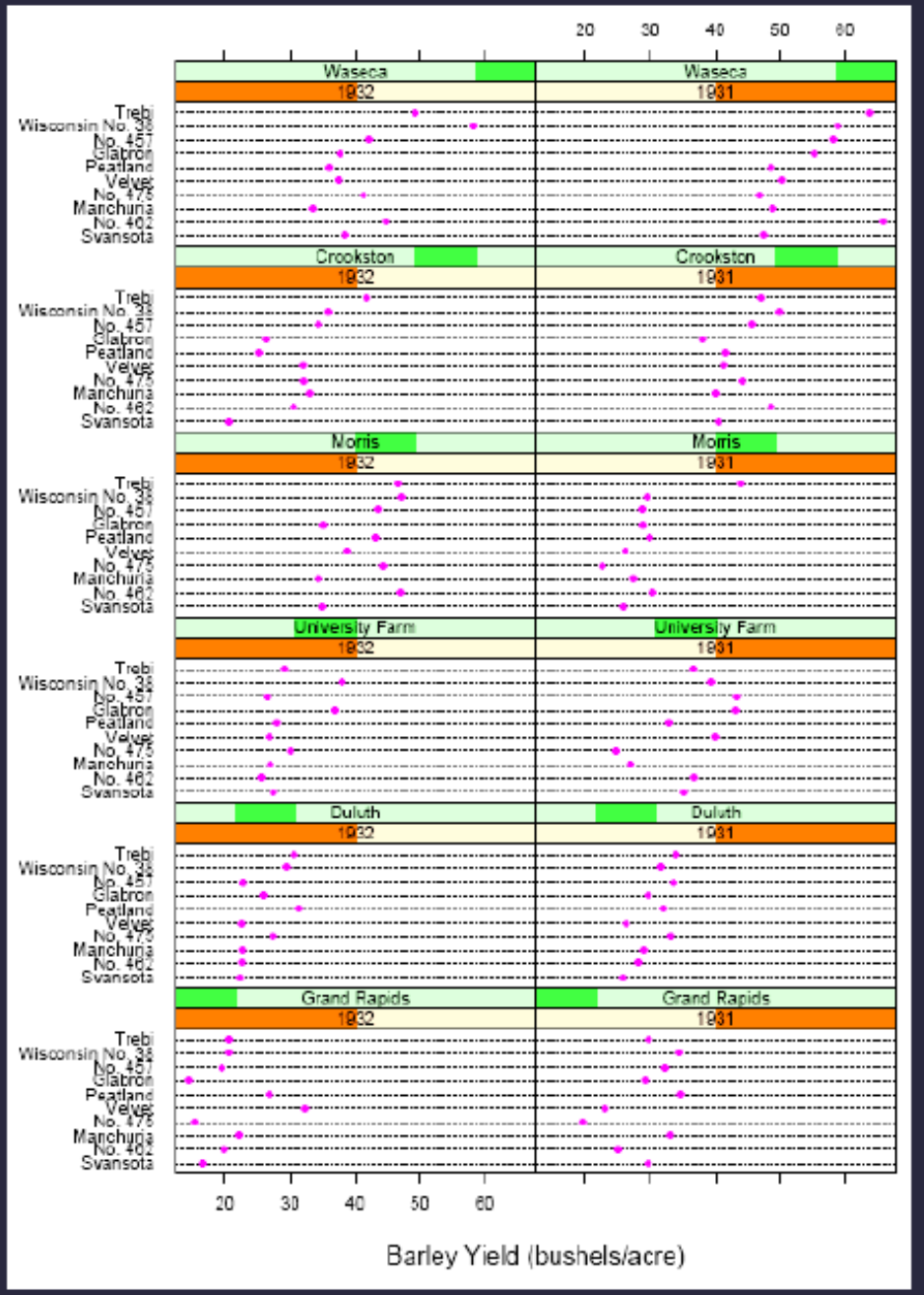
Trellis

[Becker, Cleveland, and Shyu 96]

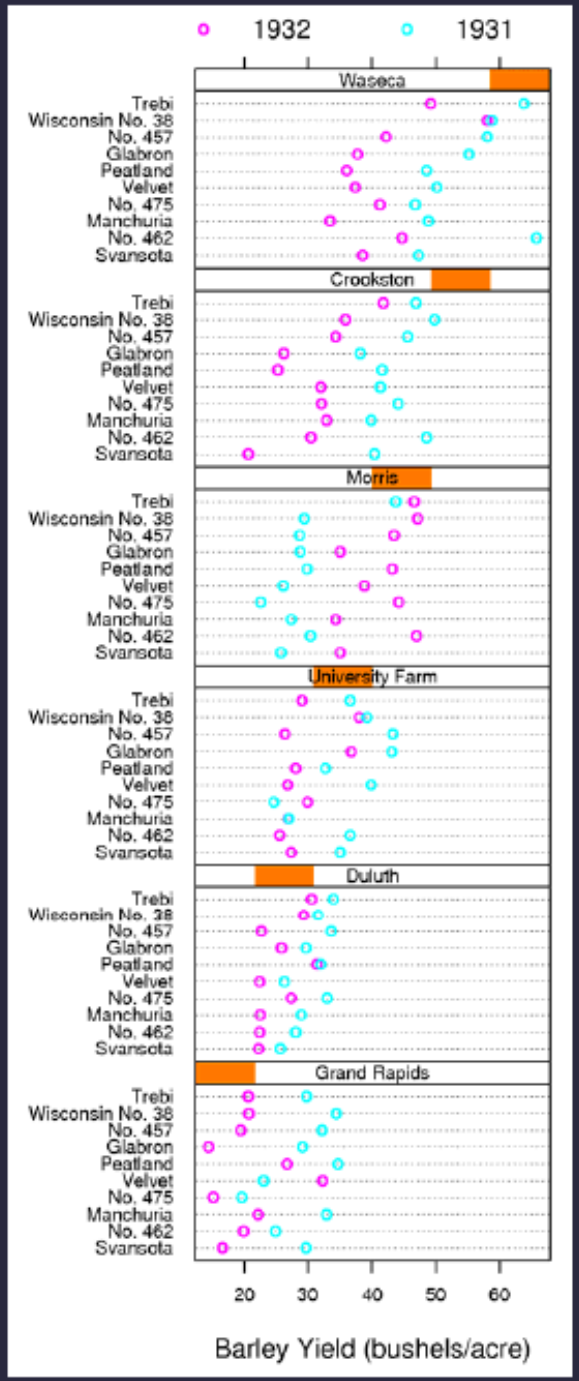




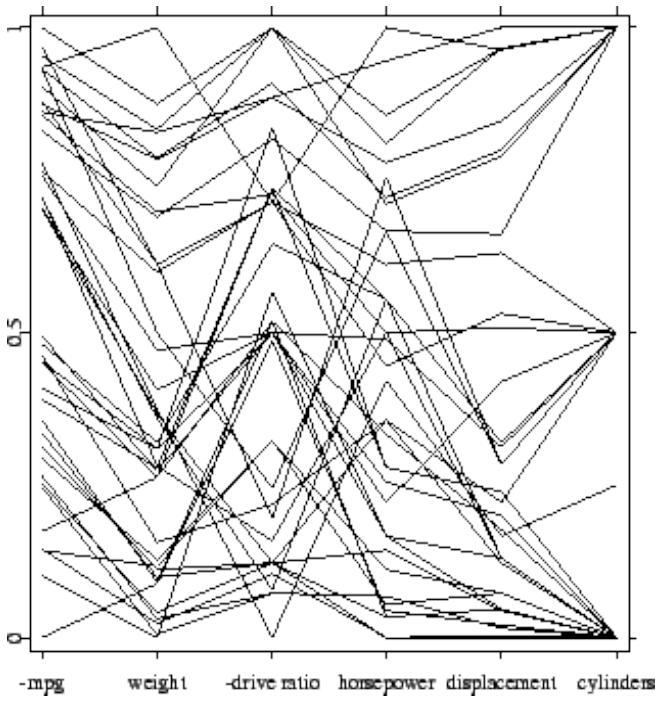
Alphabetical ordering



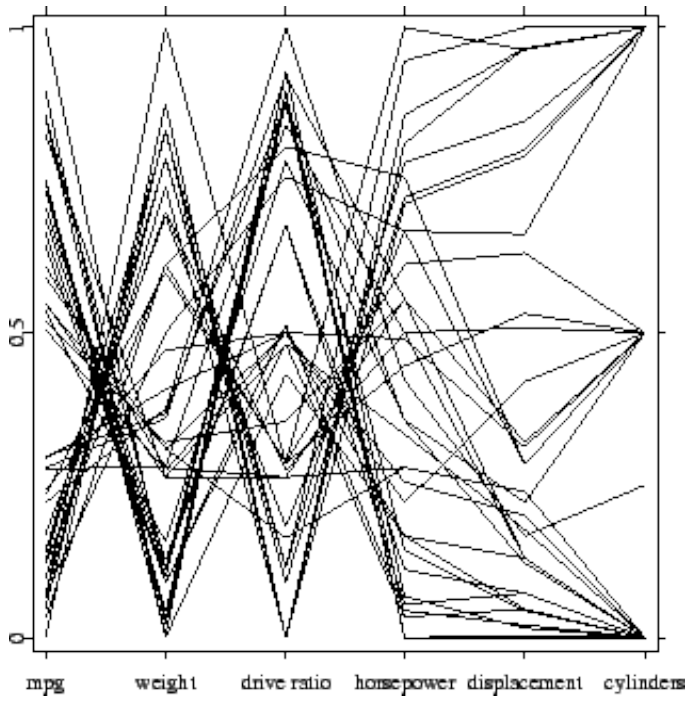
Main-effects ordering


1932
1931
Waseca
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
Crookston
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
Morris
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
University Farm
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
Duluth
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
Grand Rapids
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
20
30
40
50
60
Barley Yield (bushels/acre)

Reorder Parallel Coordinates

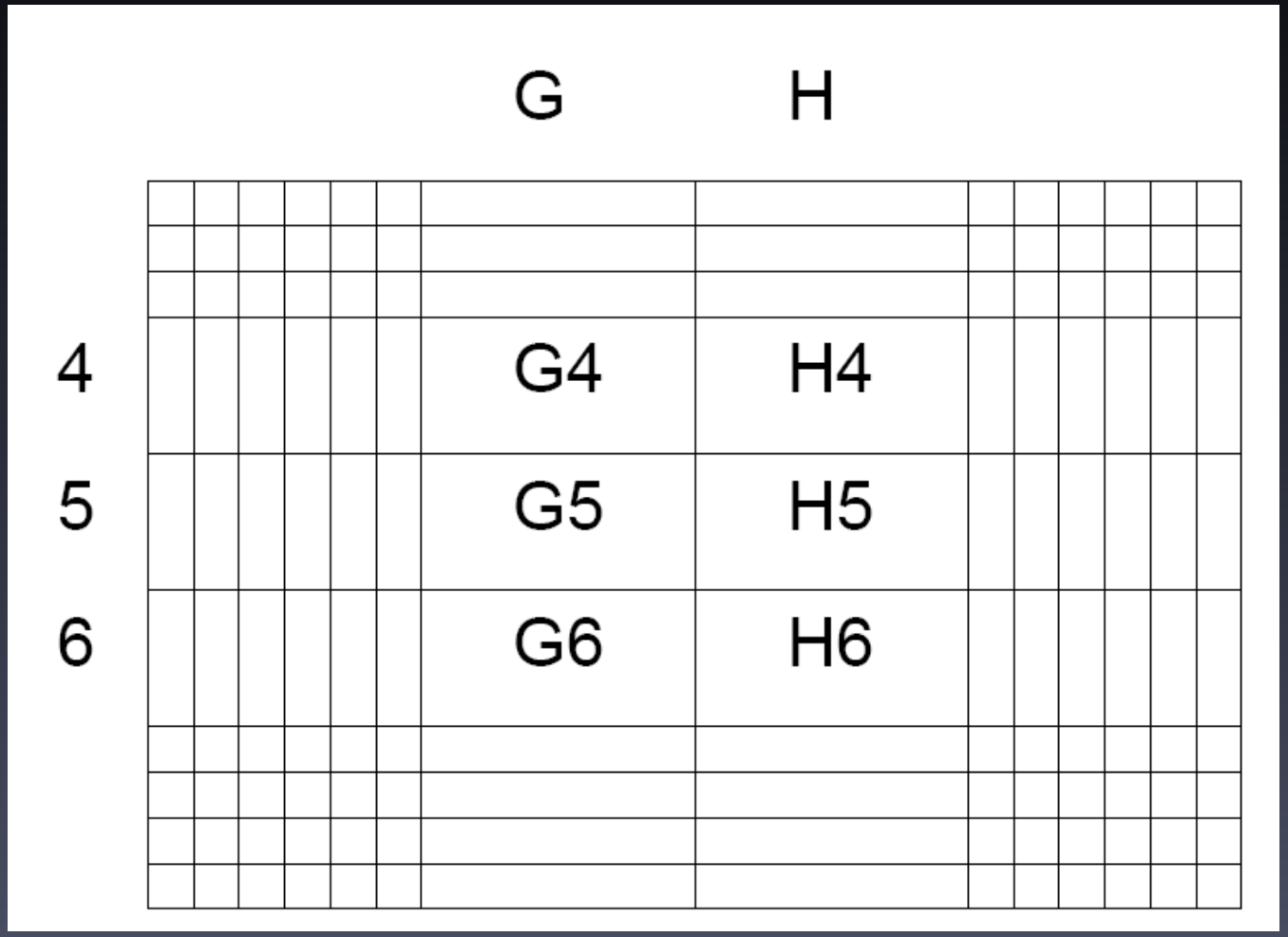


Original



Reordered

Table Lens [CHI94]



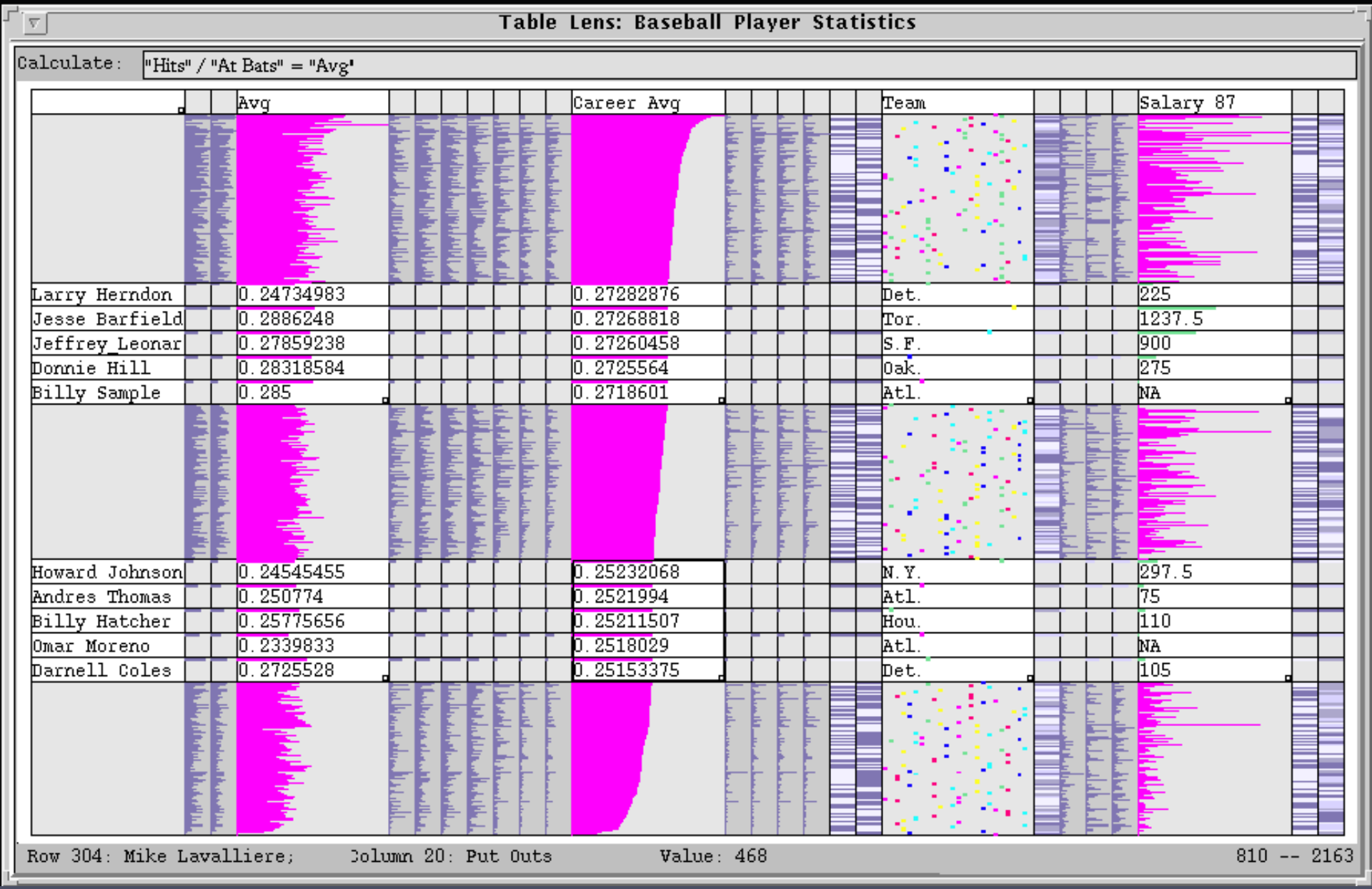


Table Lens: Baseball Player Statistics
Calculate:
"Hits" / "At Bats" = "Avg"
Avg
Career Avg
Team
Salary 87
Larry Herndon 0.24734983 0.27282876 Det. 225
Jesse Barfield 0.2886248 0.27268818 Tor. 1237.5
Jeffrey_Leonar 0.27859238 0.27260458 S.F. 900
Donnie Hill 0.28318584 0.2725564 Oak. 275
Billy Sample 0.285 0.2718601 Atl. NA
Howard Johnson 0.24545455 0.25232068 N.Y. 297.5
Andres Thomas 0.250774 0.2521994 Atl. 75
Billy Hatcher 0.25775656 0.25211507 Hou. 110
Omar Moreno 0.2339833 0.2518029 Atl. NA
Darnell Coles 0.2725528 0.25153375 Det. 105
Row 304: Mike Lavalliere;
Column 20: Put Outs
Value: 468
810 -- 2163

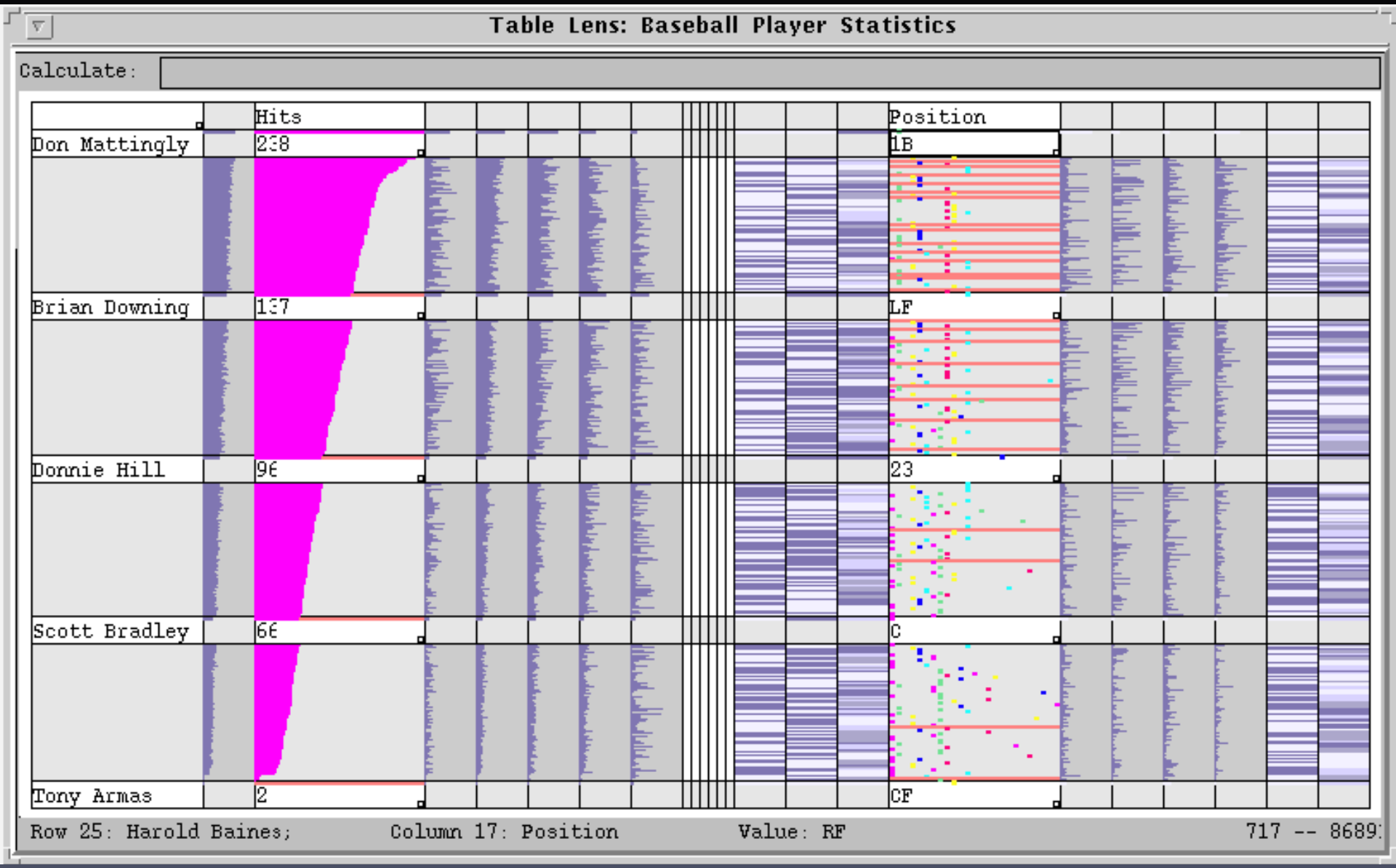


Table Lens: Baseball Player Statistics
Calculate:
Hits
Position
Don Mattingly
238
1B
Brian Downing
137
LF
Donnie Hill
96
23
Scott Bradley
66
C
Tony Armas
2
CF
Row 25: Harold Baines;
Column 17: Position
Value: RF
717 -- 8689

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 strengths
  - Assist to get past human limitations

Discussion

1. **How to improve menus?**
2. **How to improve an online map?**
3. **Interaction for large display environment?**

Assignment2

In this part of the assignment, you are required to provide a good interaction examples. You need to provide:

(1) Detailed description to the examples you found.

(2) Your findings and comments to the examples.

(3) Your learning from them, or advice for improvement.