

Interaction II

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CS 448B: Visualization
Fall 2018

There are large gaps between white children and their black and Hispanic classmates. The gaps are largest in places with large economic disparities.

● White students ● Hispanic ● Black

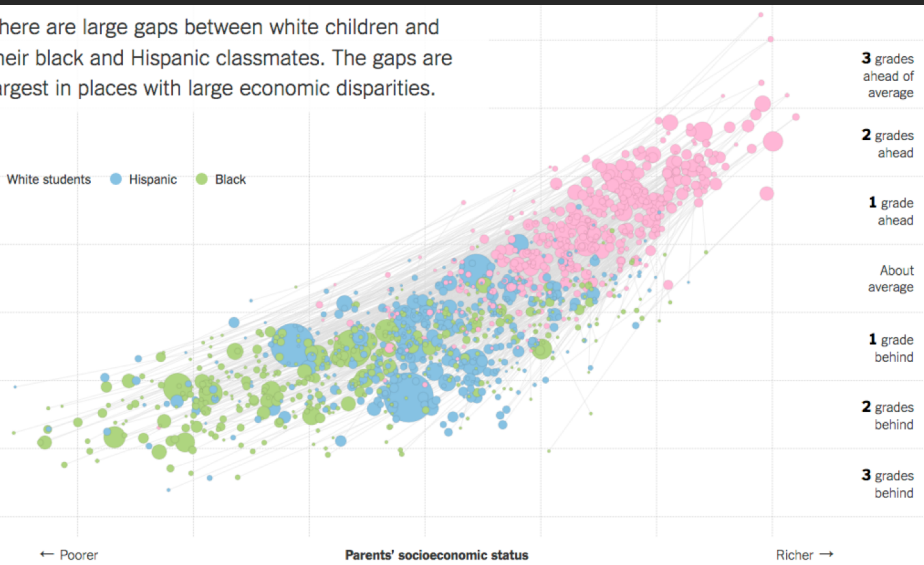
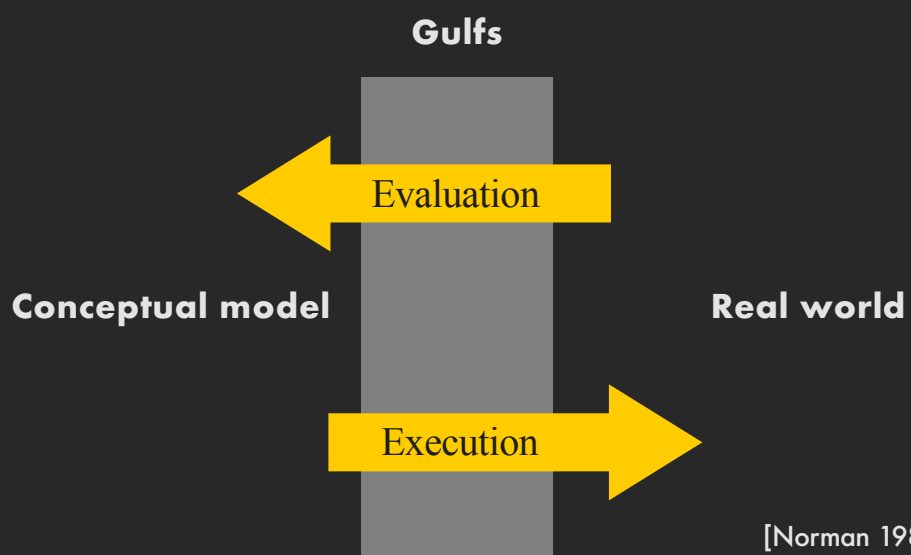


Chart shows districts with at least 100 white, 100 black and 100 Hispanic students per grade. Reliable estimates are not available for Asian-Americans.

Last Time: Interaction

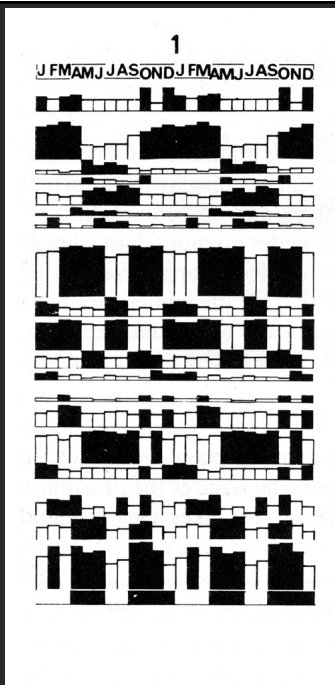
Gulfs of execution & evaluation



[Norman 1986]

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	57	55	46	55	43	15	% —" — 35-55 —" —
25	22	17	15	19	19	19	19	20	19	22	16	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

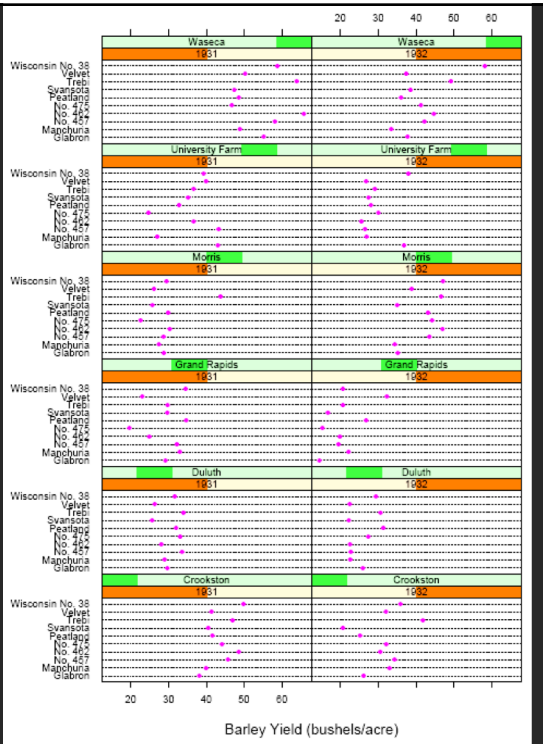
[Graphics and Graphic Information Processing, Bertin 81]



[Graphics and Graphic Information Processing, Bertin 81]

Trellis

[Becker, Cleveland, and Shyu 96]

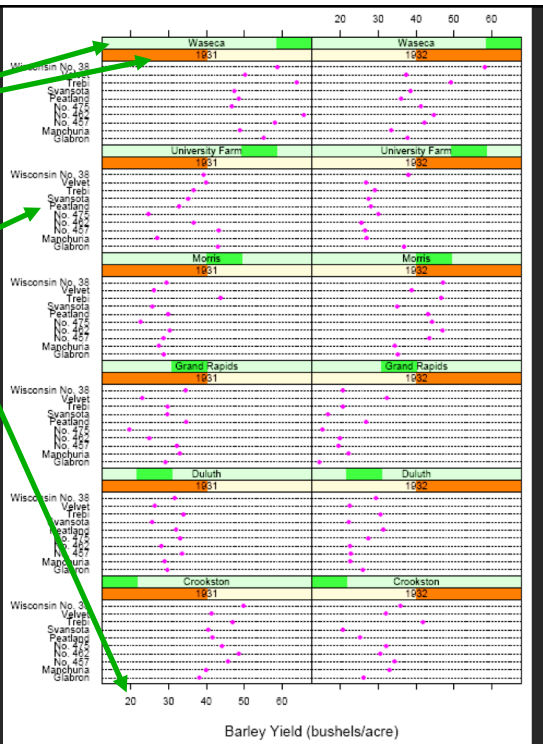


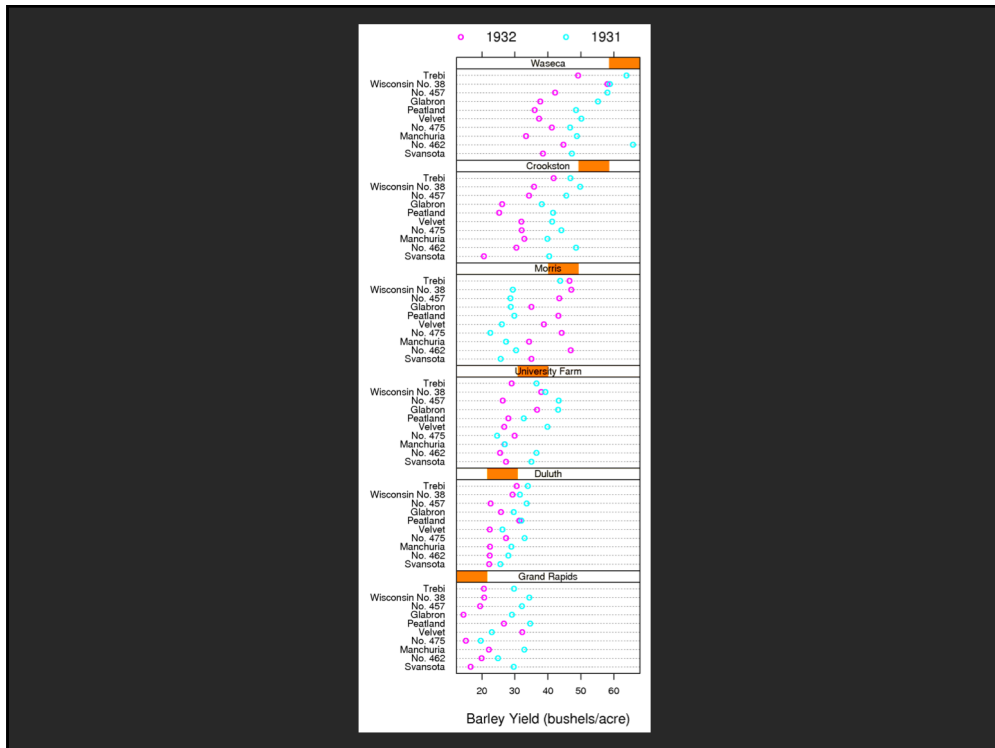
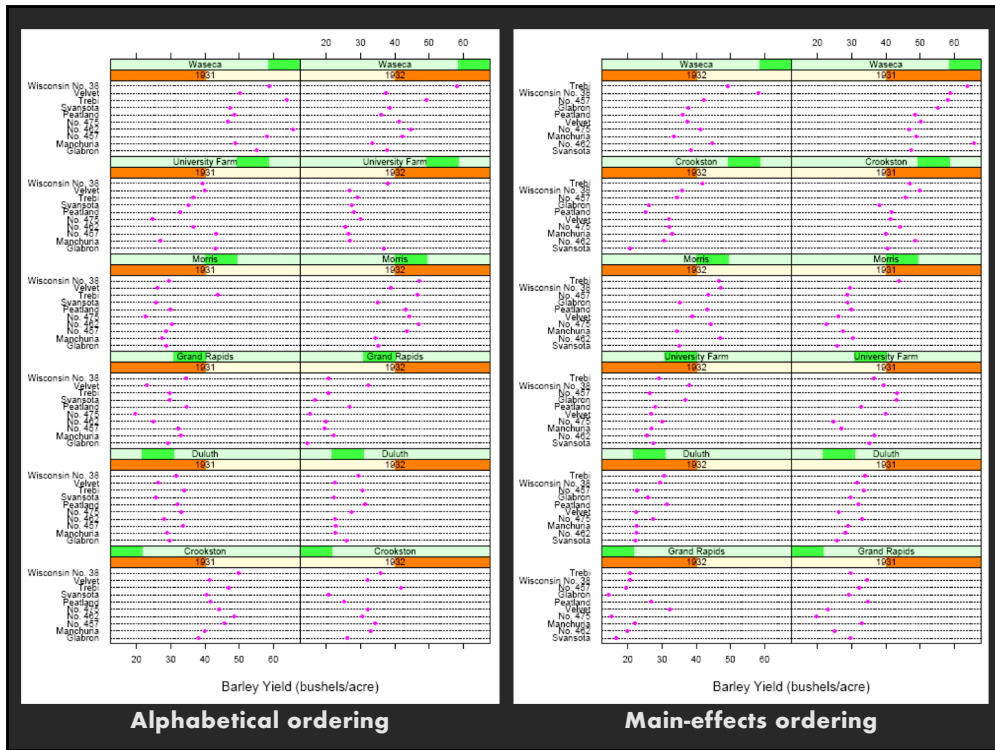
Condition variables
location, year

Panel variables
type, yield

Trellis

[Becker, Cleveland, and Shyu 96]

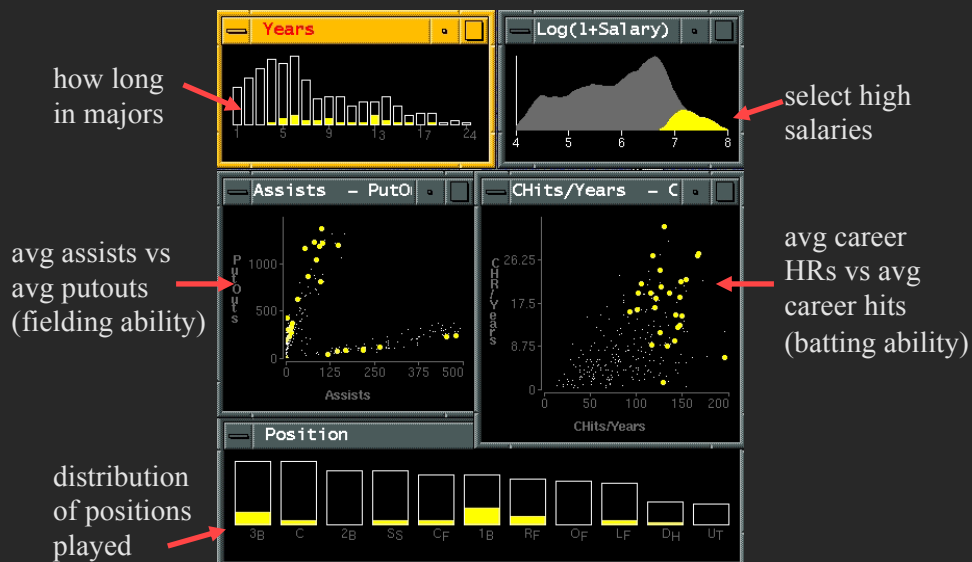




Brushing

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

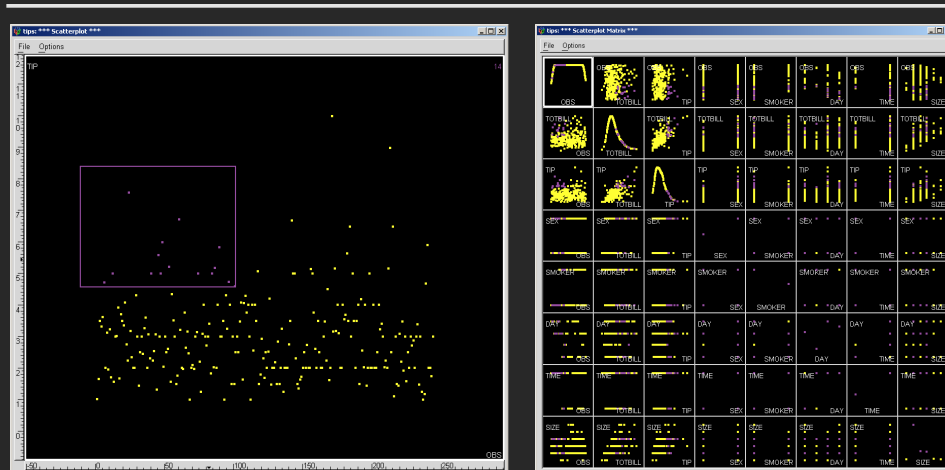
Baseball statistics [from Wills 95]



Linking assists to positions



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
```

Dynamic Browser : DC Home Finder

IdNumber	Dwelling	Address	City
2	House	5256 S. Capitol St.	Beltsville, MD
4	House	5536 S. Lincoln St.	Beltsville, MD
5	House	5165 Jones Street	Beltsville, MD
8	House	5007 Jones Street	Beltsville, MD
9	House	4872 Jones Street	Beltsville, MD
17	House	5408 S. Capitol St.	Beltsville, MD
20	House	5496 S. Capitol St.	Beltsville, MD
85	Condo	5459 S. Lincoln St.	Laurel, MD
86	Condo	5051 S. Lincoln St.	Laurel, MD
88	Condo	5159 Hamilton Street	Laurel, MD
92	Condo	5132 Hamilton Street	Laurel, MD
93	Condo	5221 S. Lincoln St.	Laurel, MD
94	Condo	5043 S. Lincoln St.	Laurel, MD
95	Condo	4970 Jones Street	Laurel, MD
97	Condo	4677 Jones Street	Laurel, MD
98	Condo	4896 S. Capitol St.	Laurel, MD
99	Condo	5048 S. Capitol St.	Laurel, MD
100	Condo	4597 31st Street	Laurel, MD
101	Condo	5306 S. Lincoln St.	Laurel, MD
103	Condo	5562 Glass Road	Laurel, MD
105	Condo	5546 Hamilton Street	Laurel, MD
152	House	7670 31st Street	Upper Marlboro, MD

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

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: Grg Fp1
CAC New

[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

How quick does it need to be? (*rules of thumb*)

0.1s: Instantaneous

1.0s: Flow of thought uninterrupted

10s: Keeping user's attention on dialogue

Announcements

Assignment 3: Dynamic Queries

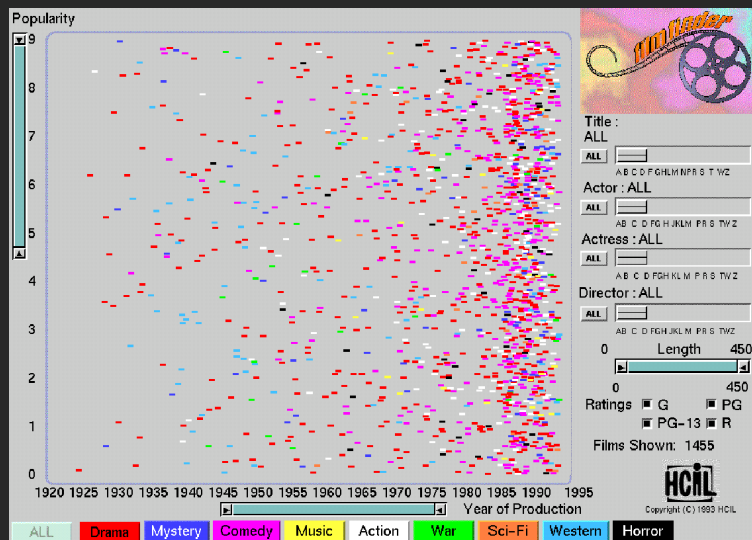
Create a **small** interactive dynamic query application similar to Homefinder, but for SF Restaurant Data.

1. Implement interface and produce final writeup
2. Submit the application and a final writeup on canvas



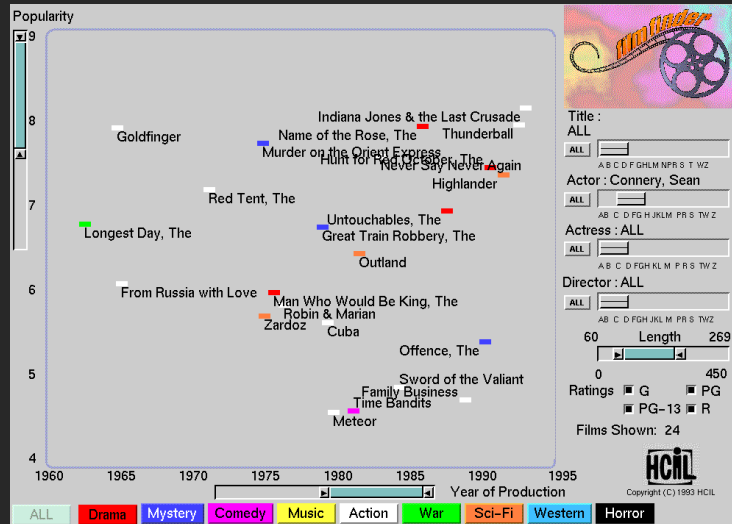
Can work alone or in pairs
Due before class on **Oct 29, 2018**

FilmFinder



[Ahlberg and Schneiderman 93]

FilmFinder



[Ahlberg and Schneiderman 93]

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

Popularity

Year of Production

Witches of Eastwick, The
Director: Miller, George Year: 1987
Country: USA Language: English
Actors: Nicholson, Jack; Jenkins, Richard; Joakum, Keith; Struycker, Carel
Actresses: Cher; Sarandon, Susan; Pfeiffer, Michelle; Cartwright, Verol

Michelle PFEIFFER

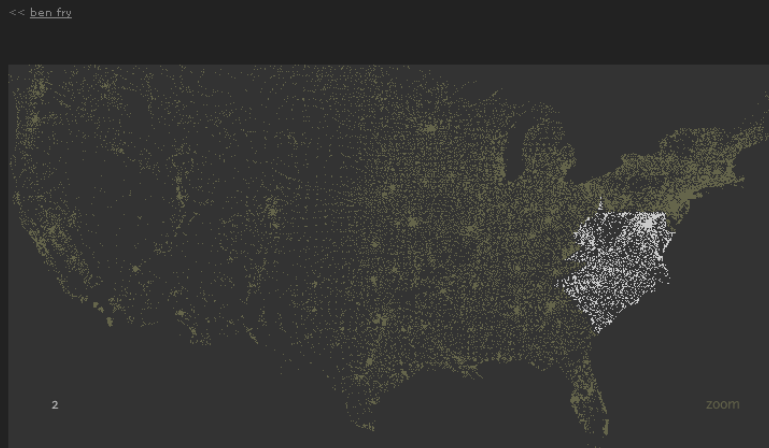
Title: ALL
Actor: ALL
Actress: Pfeiffer, Michelle
Director: Miller, George

105 Length 231
Ratings: G PG PG-13 R
Films Shown: 210

ALL Drama Mystery Comedy Music Action War Sci-Fi Western Horror

[Ahlberg and Schneiderman 93]

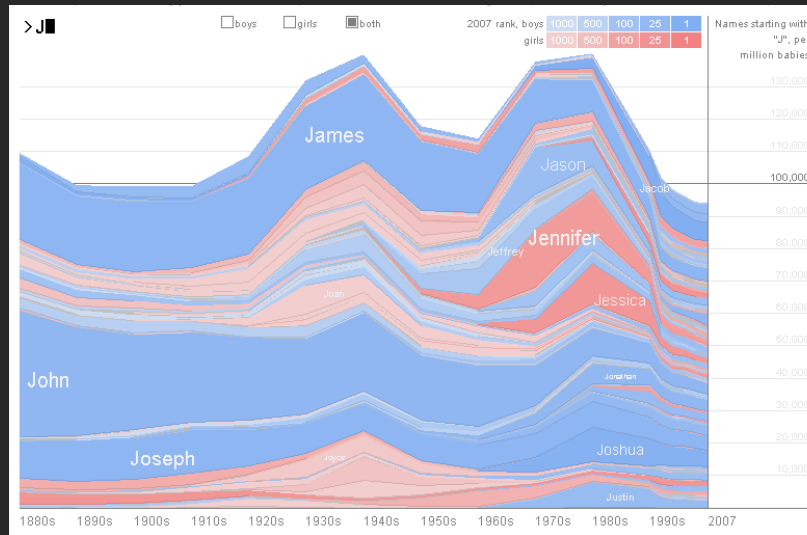
Zipcode [from Fry 04]



Hit the letter z, or click the word zoom to enable or disable zooming.
Hold down shift while typing a number to replace the previous number
(U.S. keyboards only).

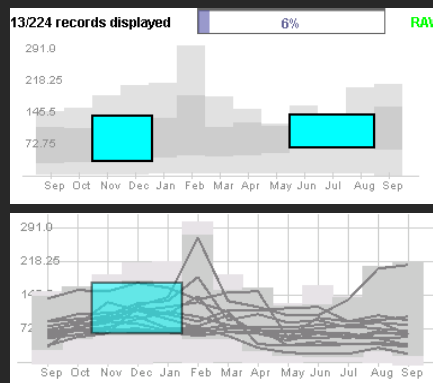
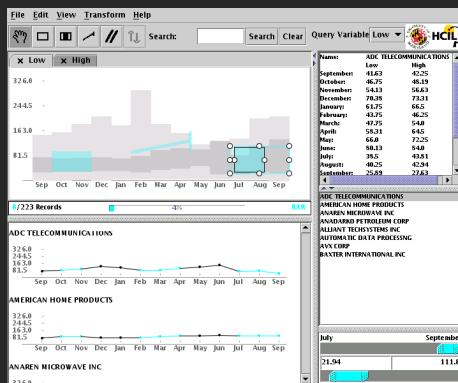
<http://benfry.com/zipcode/>

NameVoyager



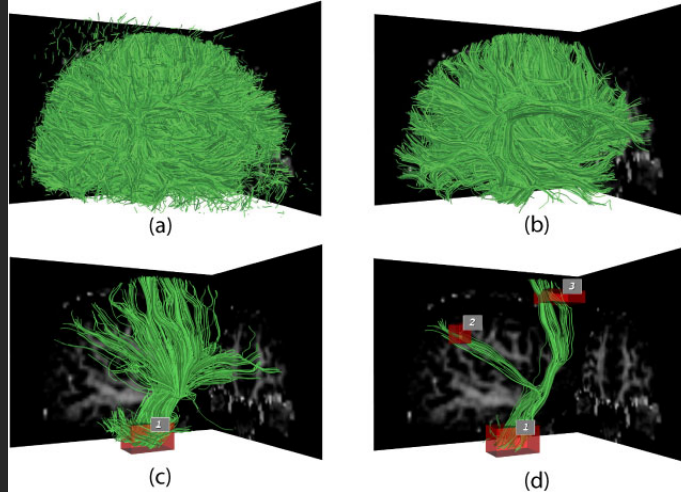
<http://www.babynamewizard.com/voyager>

TimeSearcher [Hochheiser & Schneiderman 02]

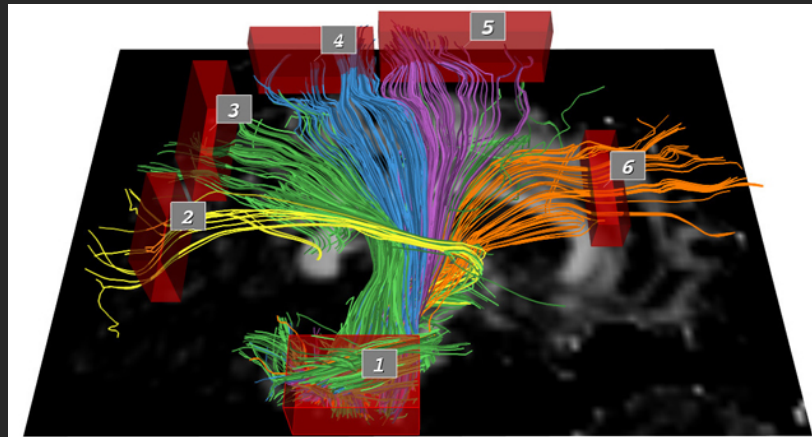


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



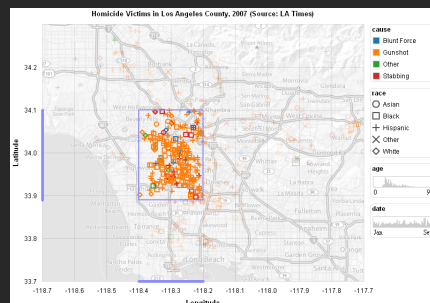
3D dynamic queries [Akers et al. 04]



Generalized Selection

Visual Queries

Model selections as declarative queries



$(-118.371 \leq lon \text{ AND } lon \leq -118.164) \text{ AND } (33.915 \leq lat \text{ AND } lat \leq 34.089)$

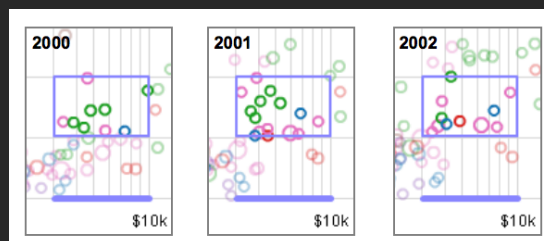
Visual Queries

Model selections as declarative queries

Applicable to dynamic, time-varying data

Retarget selection across visual encodings

Perform operations on query structure



“Select items like this one.”

Generalized Selection

Point to an example and define an abstraction based on one or more properties
[Clark, Brennan]



“Blue like this”

“The same shape as that”

Abstraction may occur over multiple levels

This is not a sentence.

Generalized Selection

Provide *generalization mechanisms* that enable users to *expand a selection query* along *chosen dimensions* of interest

Expand selections via *query relaxation*



Interactor



Query
Builder

Query Builder



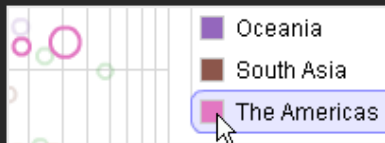
Click: Select Items

(id = 'China')



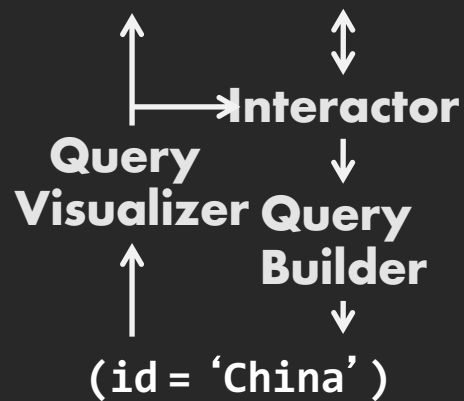
Drag: Select Range

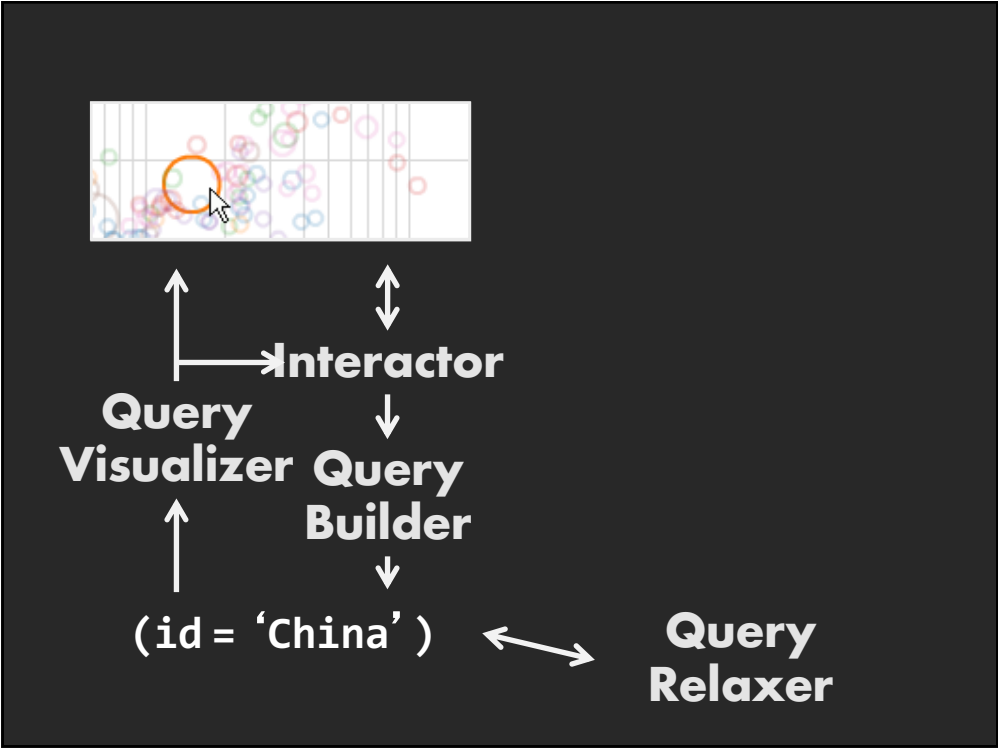
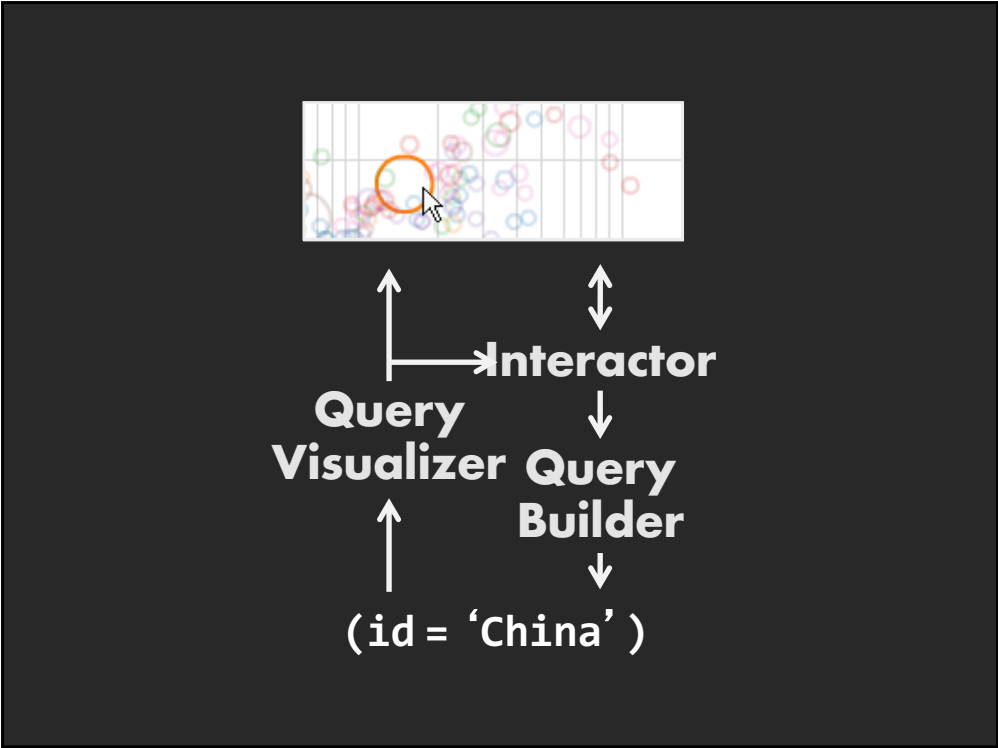
(2000 < gni AND gni < 10000) AND (.1 < internet AND internet < .2)

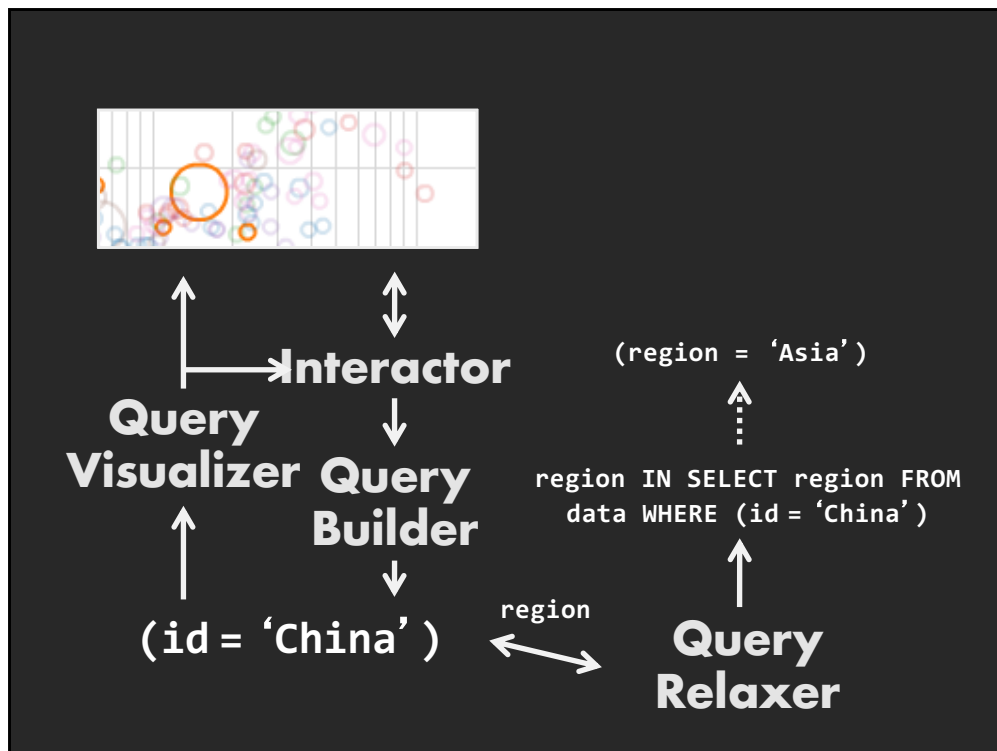


Legend: Select Attributes

(region = 'The Americas')



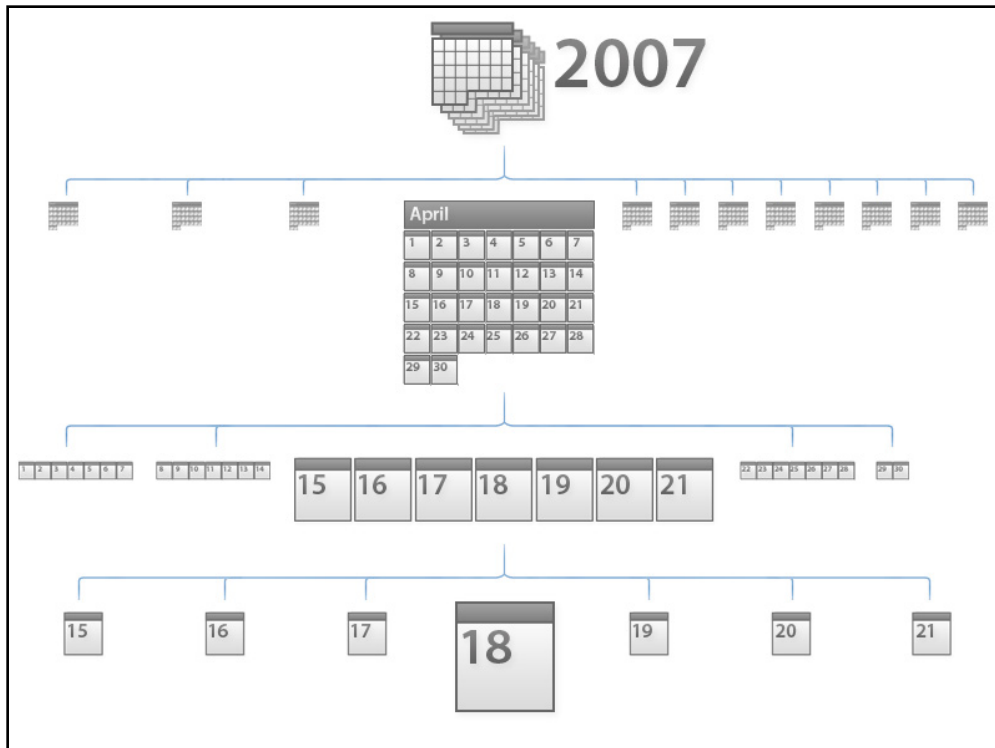




Query Relaxation

Generalize an input query to create an expanded selection, according to:

1. A semantic structure describing the data
2. A traversal policy for that structure



Relaxation using Hierarchies

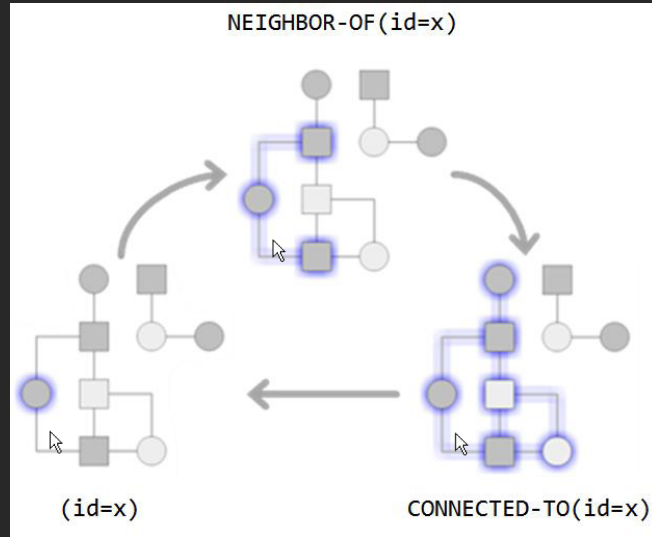
Relax using abstraction hierarchies of the data
 Traverse in direction of increasing generality

Examples

A Priori: Calendar, Categories, Geography

Data-Driven: Nearest-Neighbor, Clustering

Relaxation of Networks



Other Input Modalities

Multi-touch

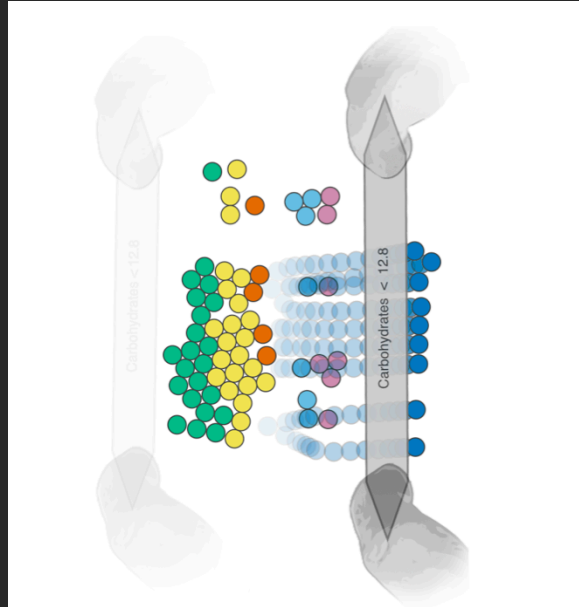
- **Tables, wall displays, tablets, whiteboards**
- **Does it facilitate visual analysis?**
- **What affordances are gained/lost?**

Kinetica

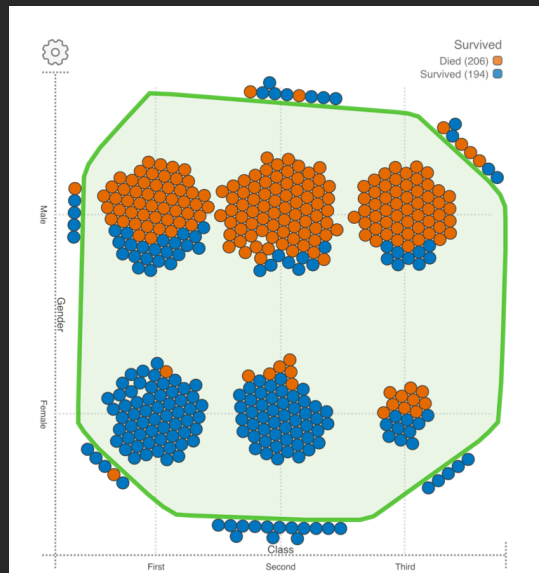
Kinetica **Naturalistic Multi-touch Data Visualization**

Jeffrey M. Rzeszotarski, Aniket Kittur
Human-Computer Interaction Institute
Carnegie Mellon University

Filtering points



Filtering points



Summary

Most visualizations are interactive

- Even passive media elicit interactions

Good visualizations are task dependent

- Choose the right space
- Pick the right interaction technique

Human factors are important

- Leverage human strengths
- Assist to get past human limitations