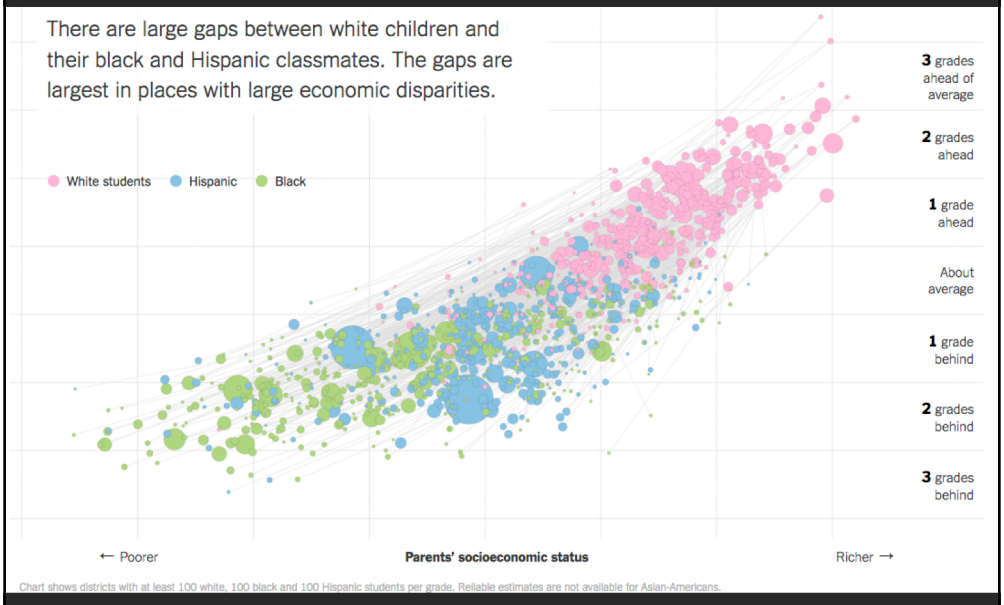
Interaction II

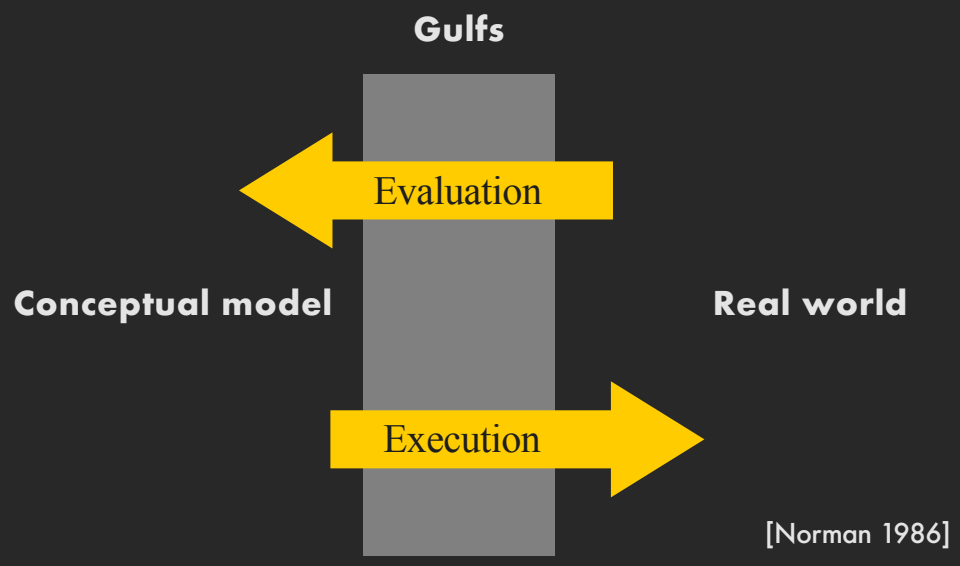
Maneesh Agrawala

CS 448B: Visualization
Fall 2018



Last Time: Interaction

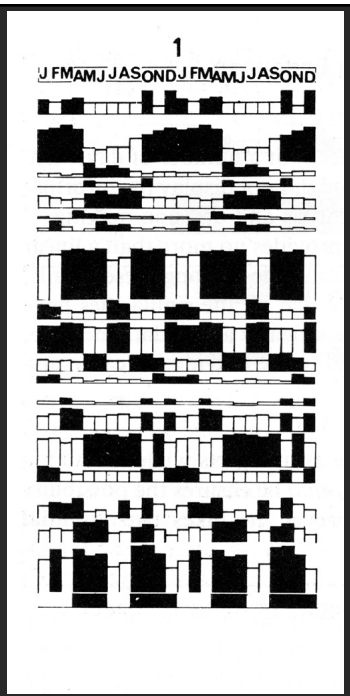
Gulfs of execution & evaluation



[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	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

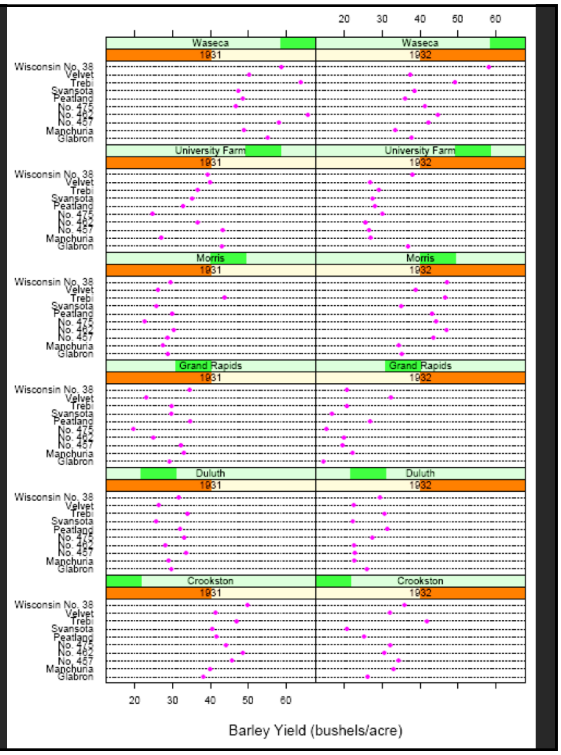
[Graphics and Graphic Information Processing, Bertin 81]



[Graphics and Graphic Information Processing, Bertin 81]

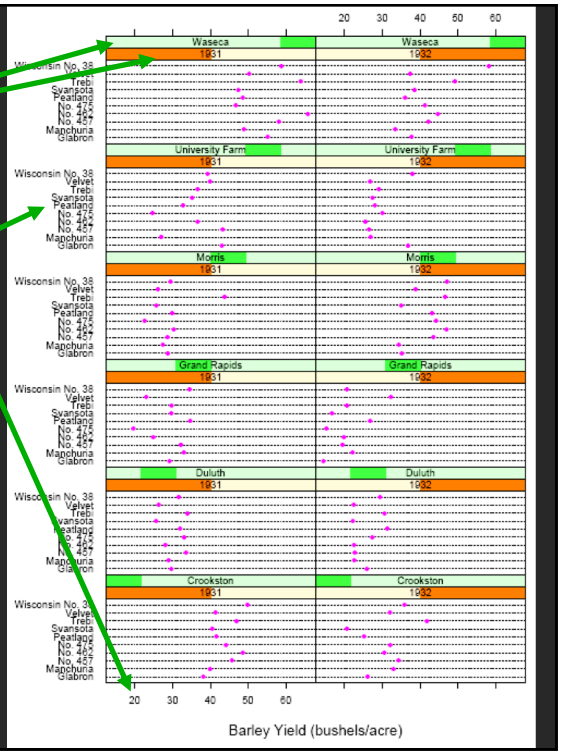
Trellis

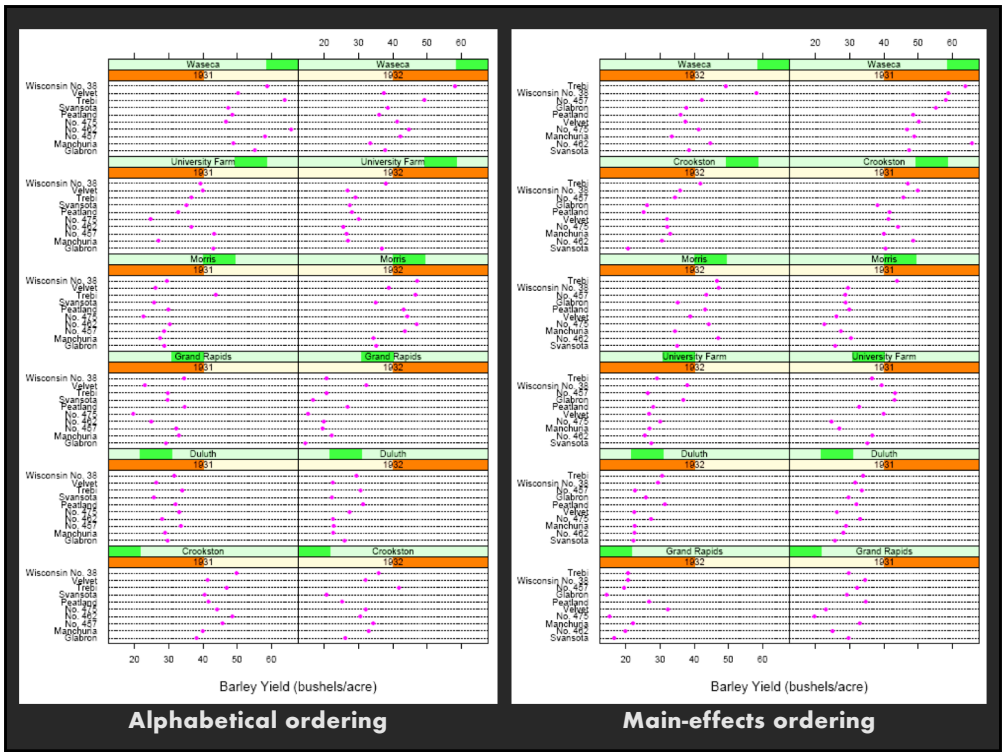
[Becker, Cleveland, and Shyu 96]

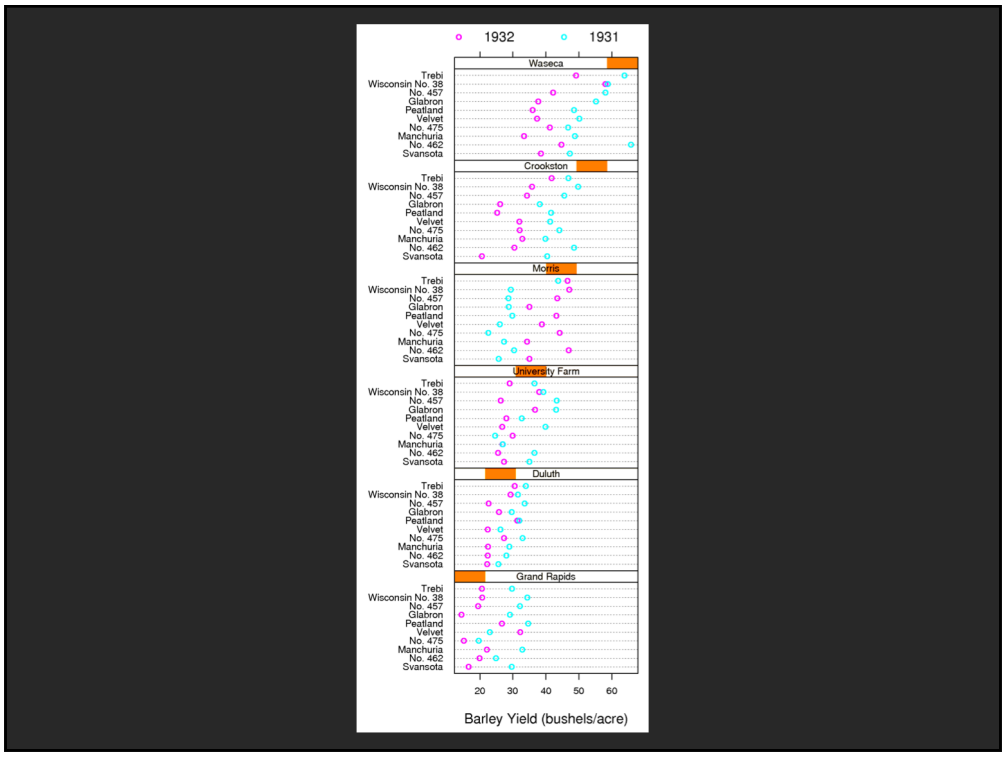


Trellis

[Becker, Cleveland, and Shyu 96]




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


1932
1931
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Crookston
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Duluth
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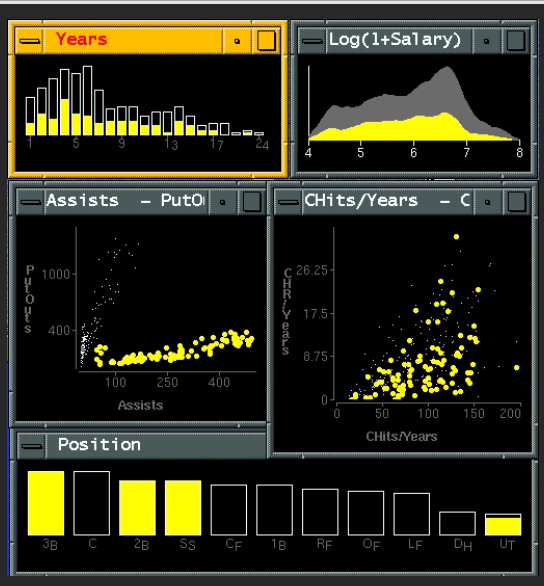
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
20
30
40
50
60
Barley Yield (bushels/acre)

Brushing

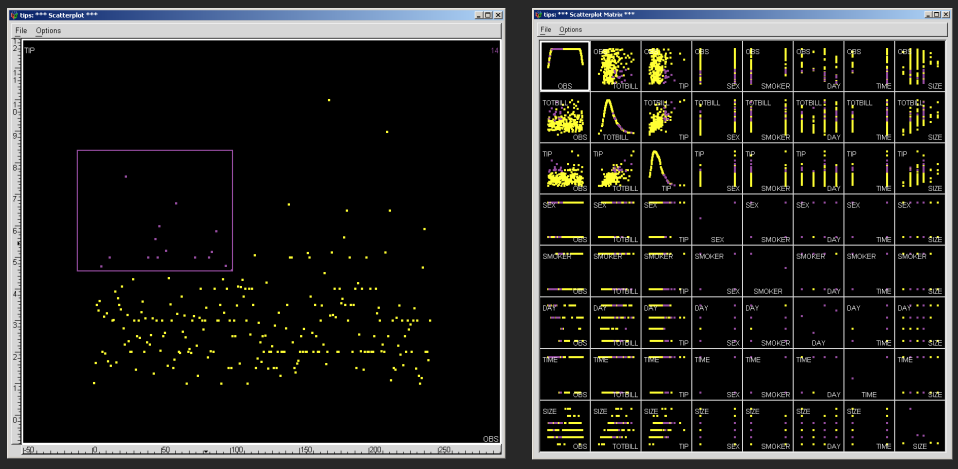
- Interactively select subset of data
- See selected data in other views
- Two things (normally views) must be *linked* to allow for brushing

Baseball statistics [from Wills 95]

Linking assists to positions



GGobi: Brushing

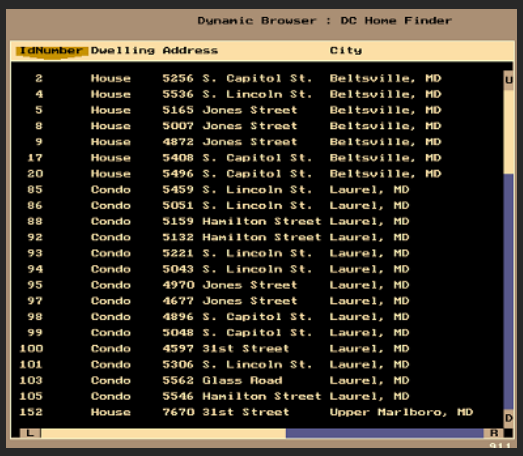


http://www.ggobi.org/

Dynamic Queries

Query and results

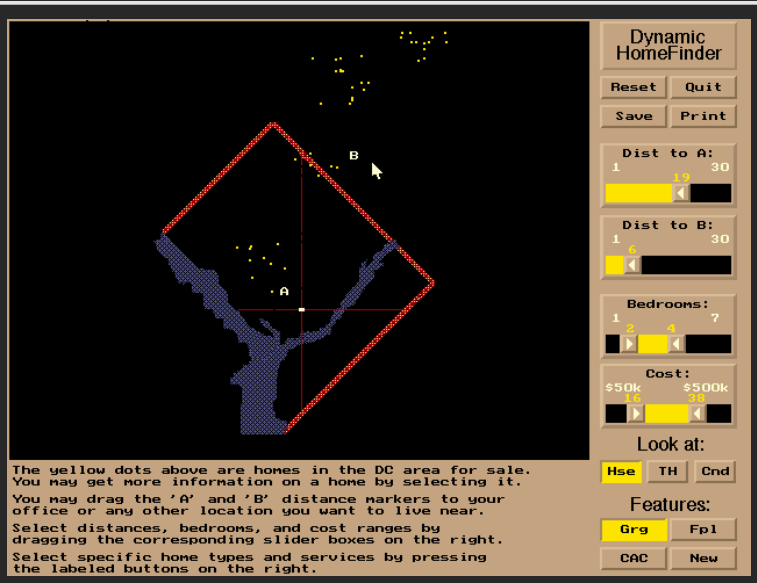
SELECT house
FROM east bay
WHERE price < 1,000,000 AND bedrooms > 2
ORDER BY price



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

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

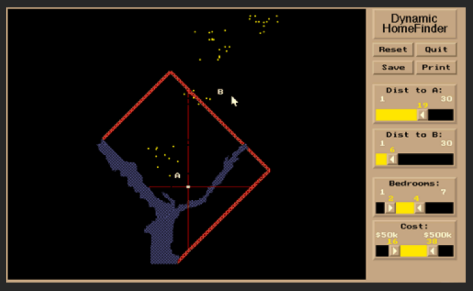
- 0.1s: Instantaneous
- 1.0s: Flow of thought uninterrupted
- 10s: Keeping user's attention on dialogue

Announcements

Assignment 3: Dynamic Queries

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

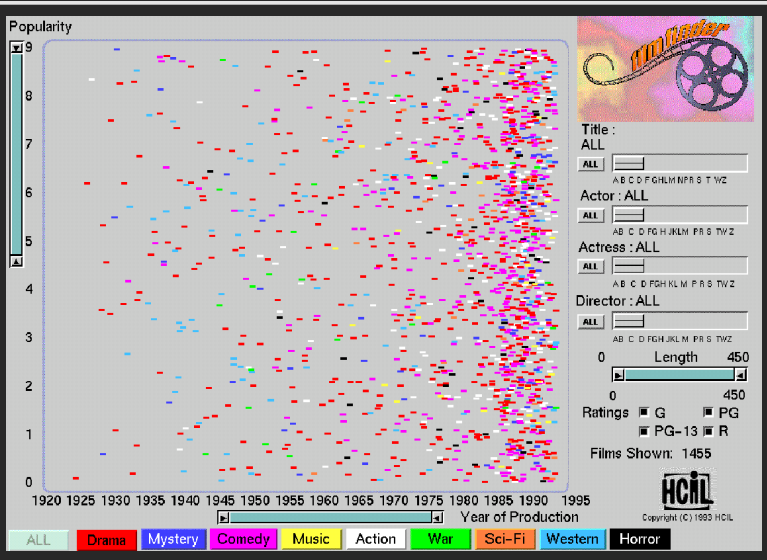
1. **Implement interface and produce final writeup**
2. **Submit the application and a final writeup on canvas**



Can work alone or in pairs

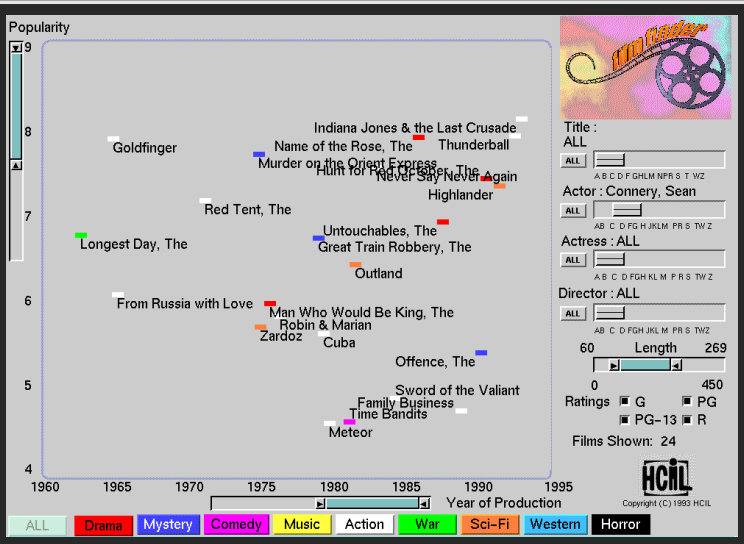
Due before class on Oct 29, 2018

FilmFinder



[Ahlberg and Schneiderman 93]

FilmFinder

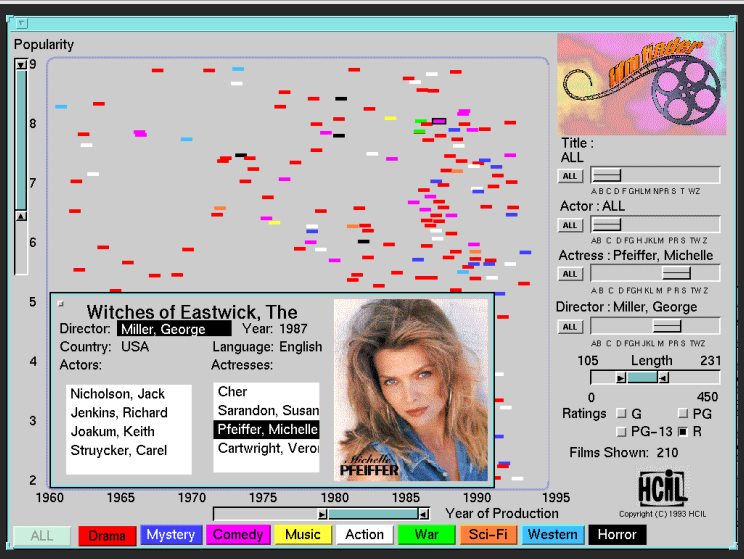


[Ahlberg and Schneiderman 93]

Alphaslider

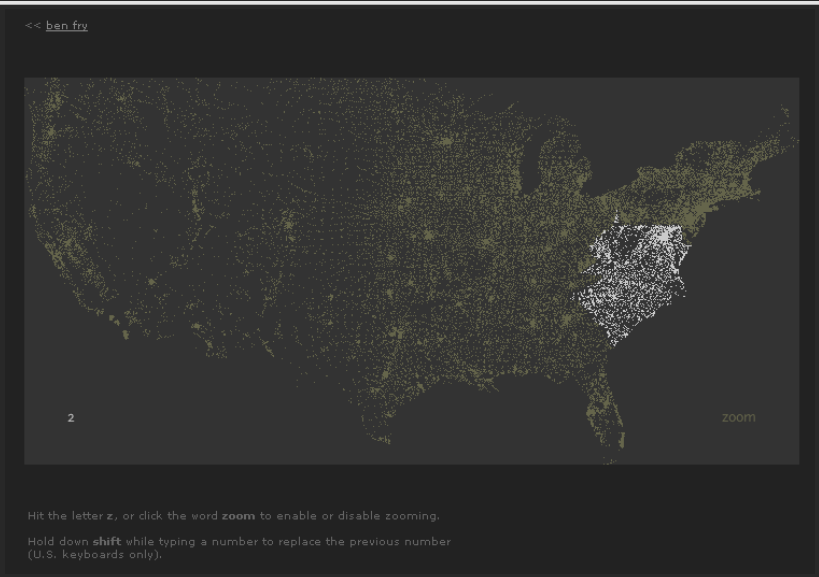
[Ahlberg and Schneiderman 94]

FilmFinder



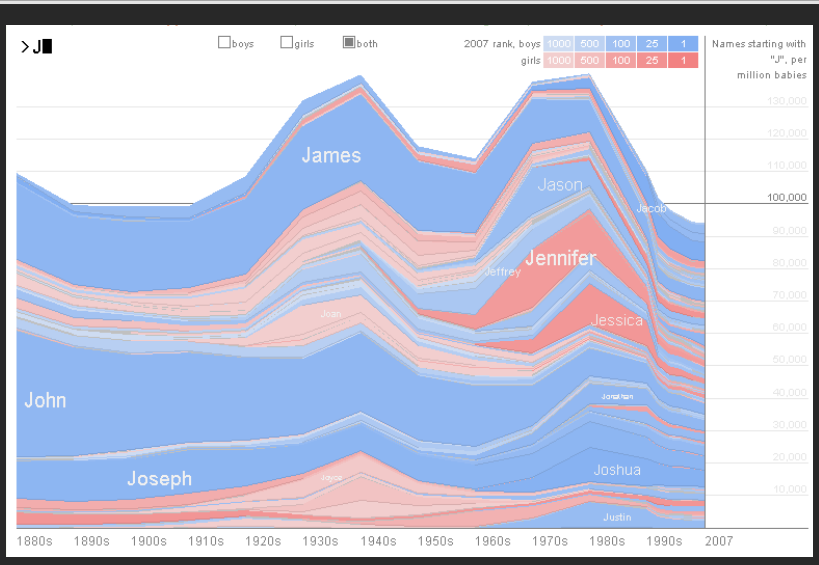
[Ahlberg and Schneiderman 93]

Zipdecode [from Fry 04]



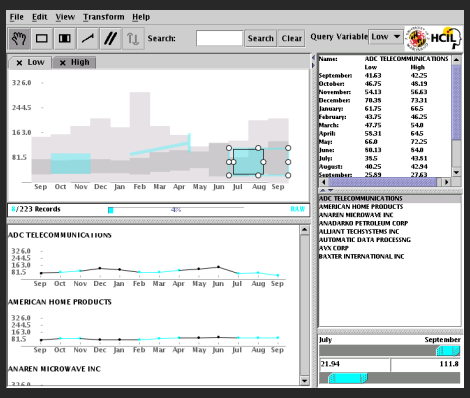
http://benfry.com/zipdecode/

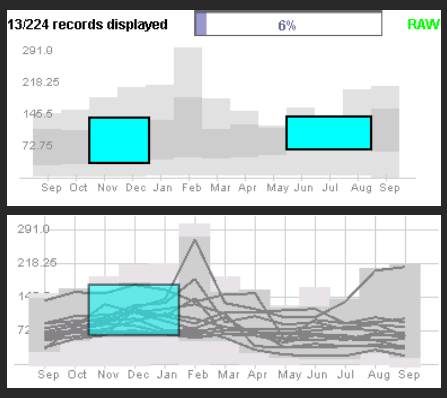
NameVoyager



http://www.babynamewizard.com/voyager

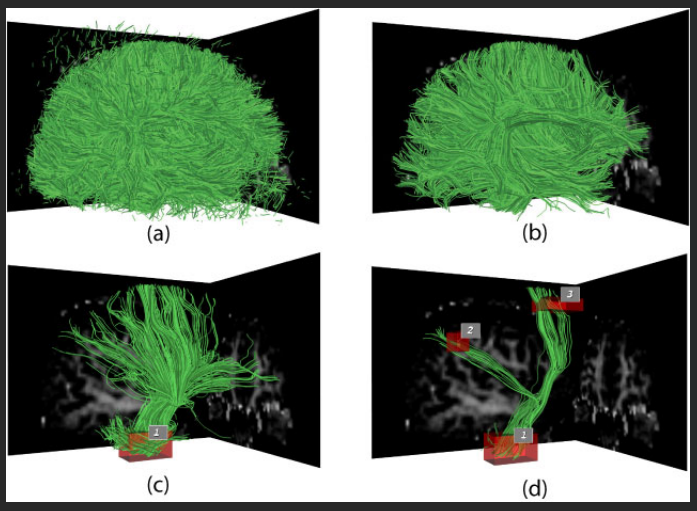
TimeSearcher [Hochheiser & Schneiderman 02]



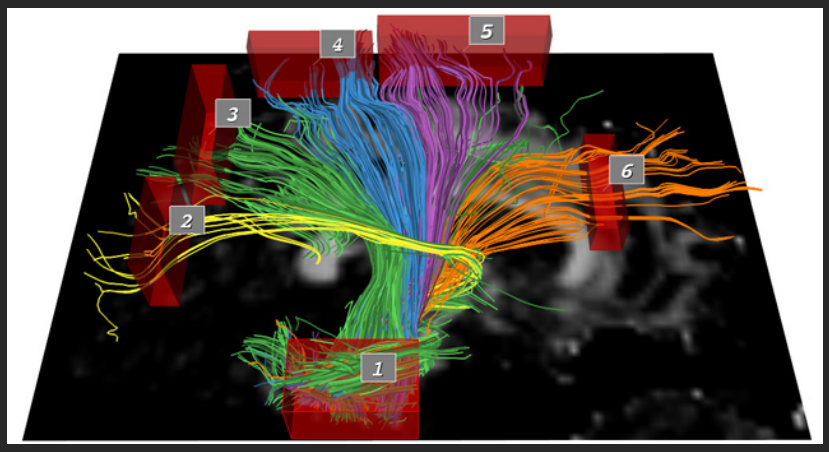


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



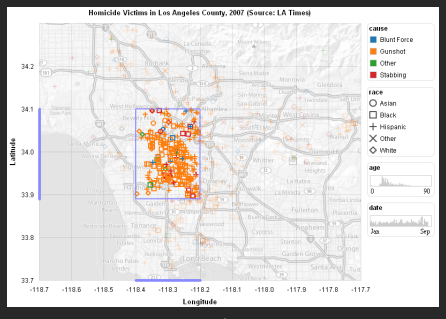
3D dynamic queries [Akers et al. 04]



Generalized Selection

Visual Queries

Model selections as declarative queries



(-118.371 ≤ lon AND lon ≤ -118.164) AND (33.915 ≤ lat AND lat ≤ 34.089)

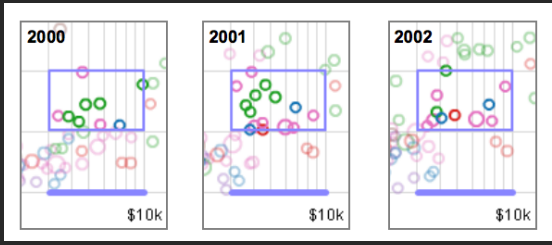
Visual Queries

Model selections as declarative queries

Applicable to dynamic, time-varying data

Retarget selection across visual encodings

Perform operations on query structure



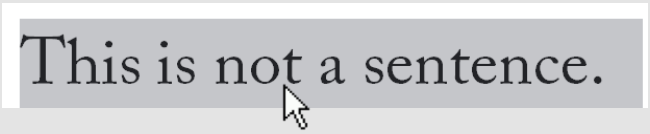
"Select items like this one."

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"

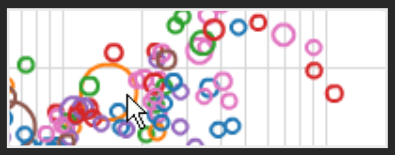
Abstraction may occur over multiple levels



Generalized Selection

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

Expand selections via **query relaxation**



↕

Interactor

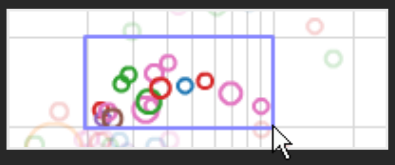
↓

Query Builder

Query Builder

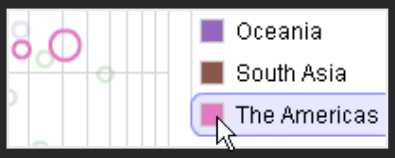
Click: Select Items

(id = 'China')



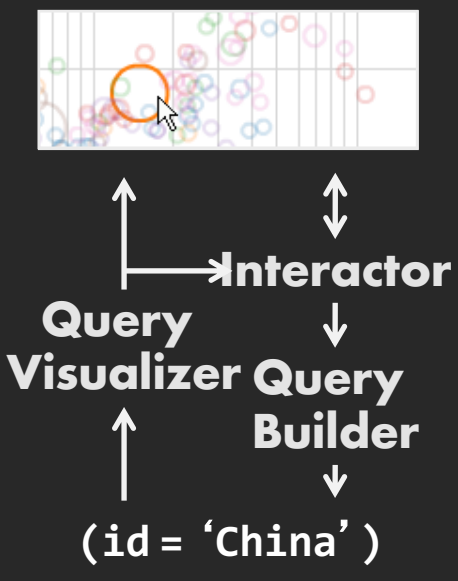
Drag: Select Range

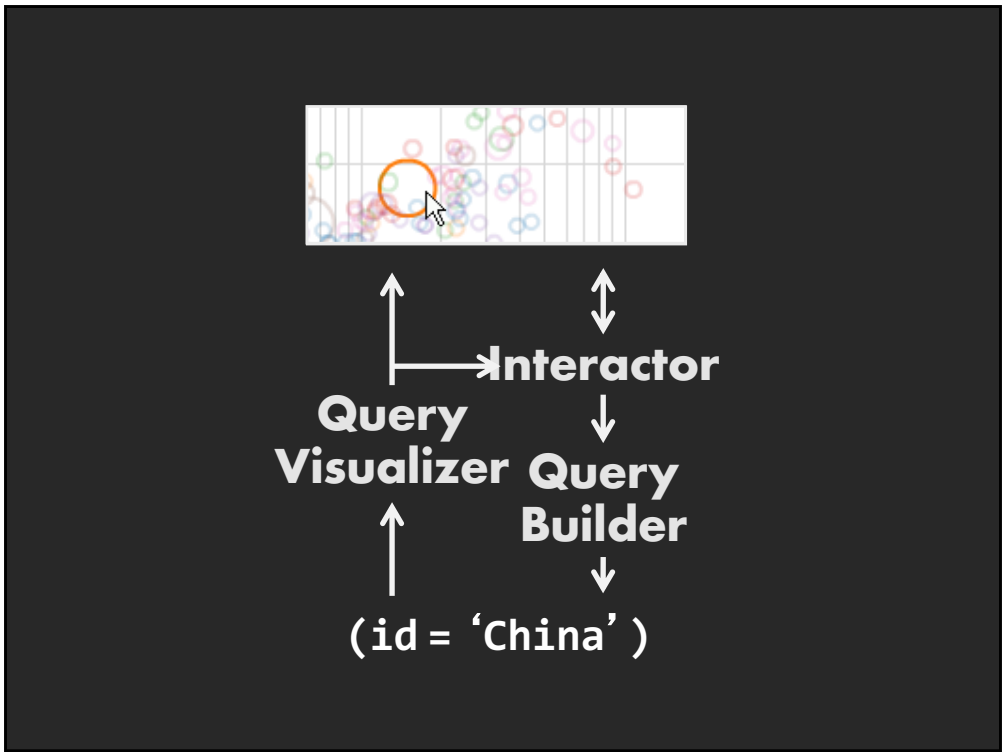
(2000 < gni AND gni < 10000) AND (.1 < internet AND internet < .2)

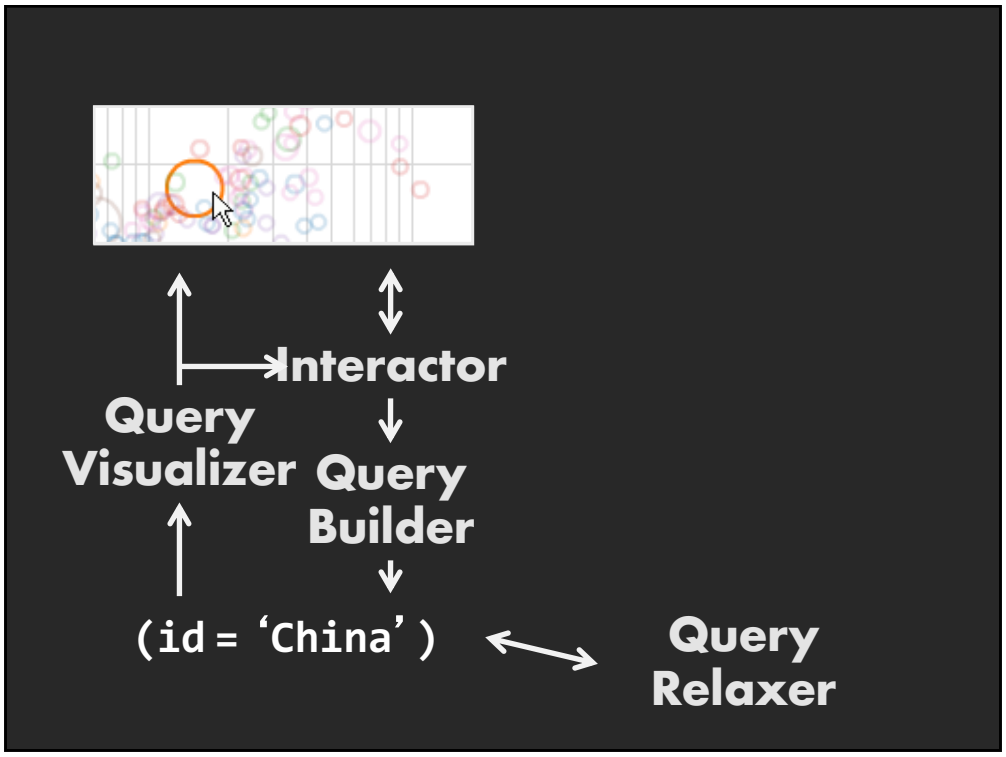


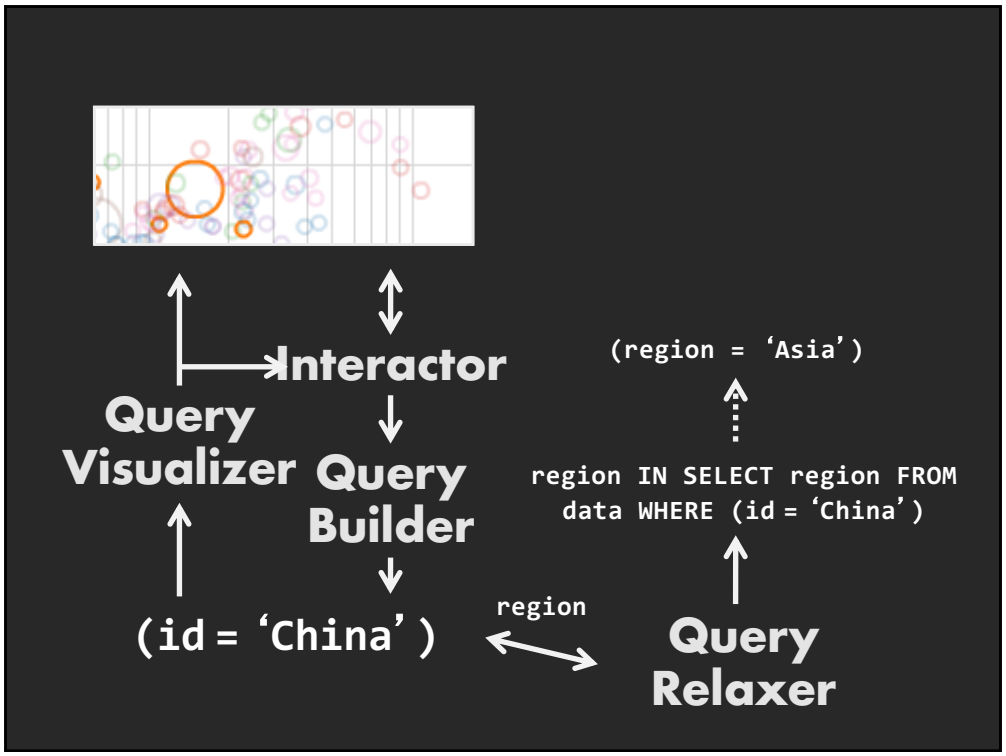
Legend: Select Attributes

(region = 'The Americas')




Interactor
Query Visualizer
Query Builder
(id = 'China')

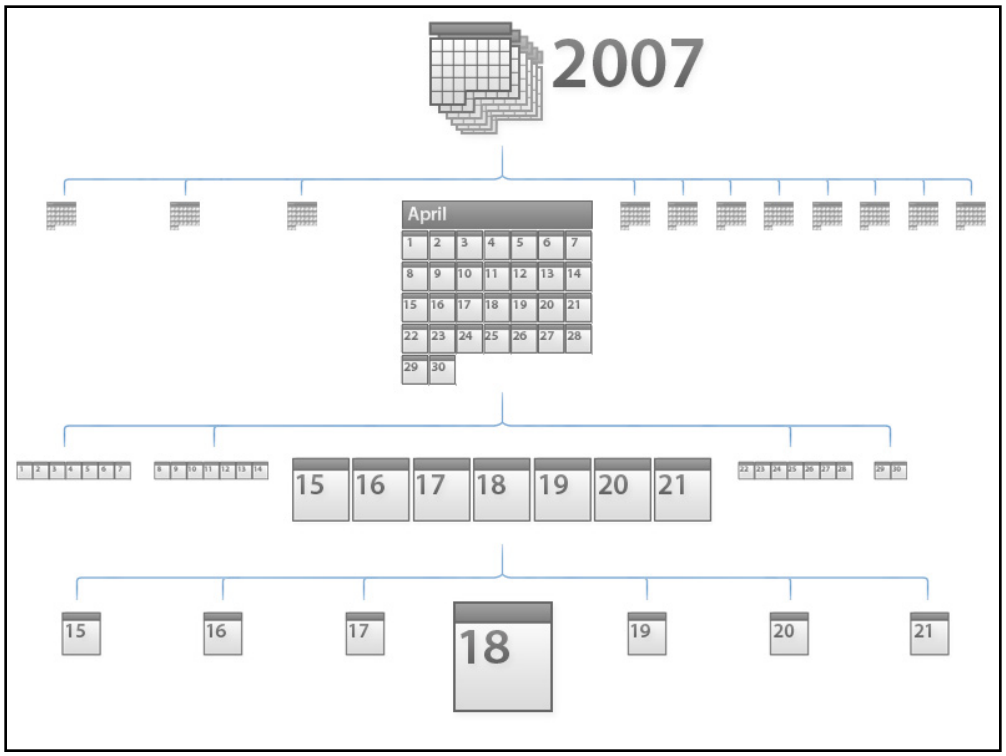

Interactor
Query Visualizer
Query Builder
(id = 'China')
Query Relaxer



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

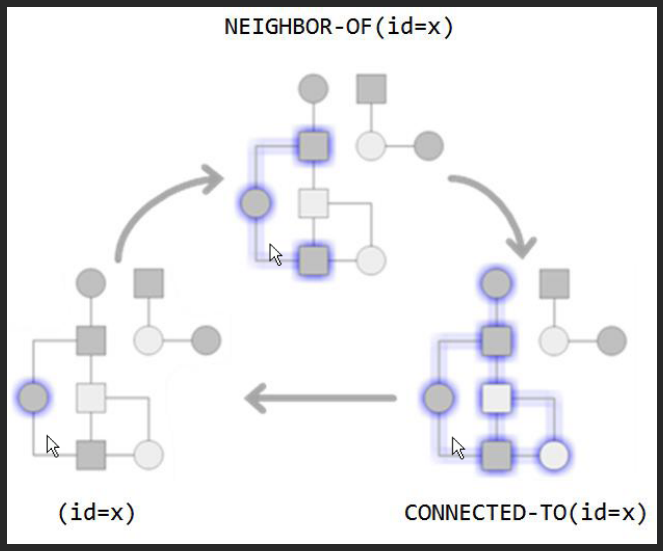


Relaxation using Hierarchies

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 is facilitate visual analysis?
- What affordances are gained/lost?

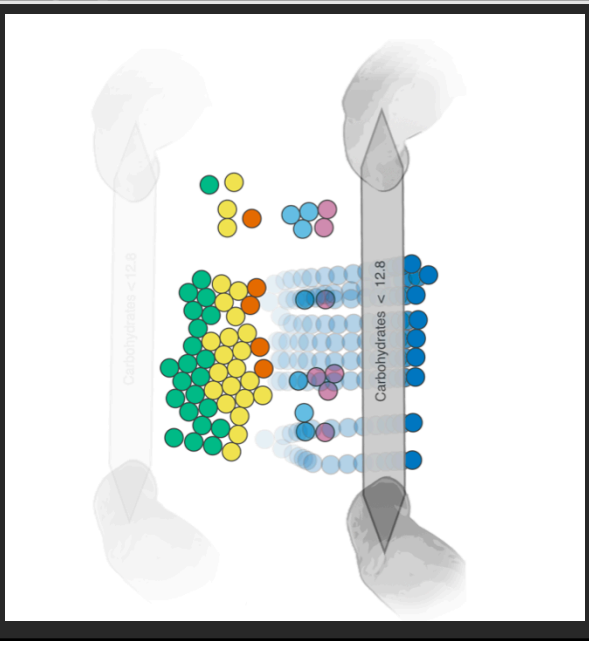
Kinetica

Kinetica

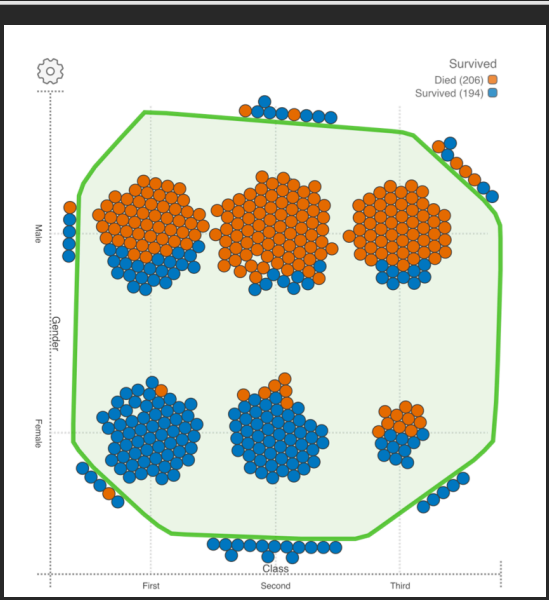
Naturalistic Multi-touch Data Visualization

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