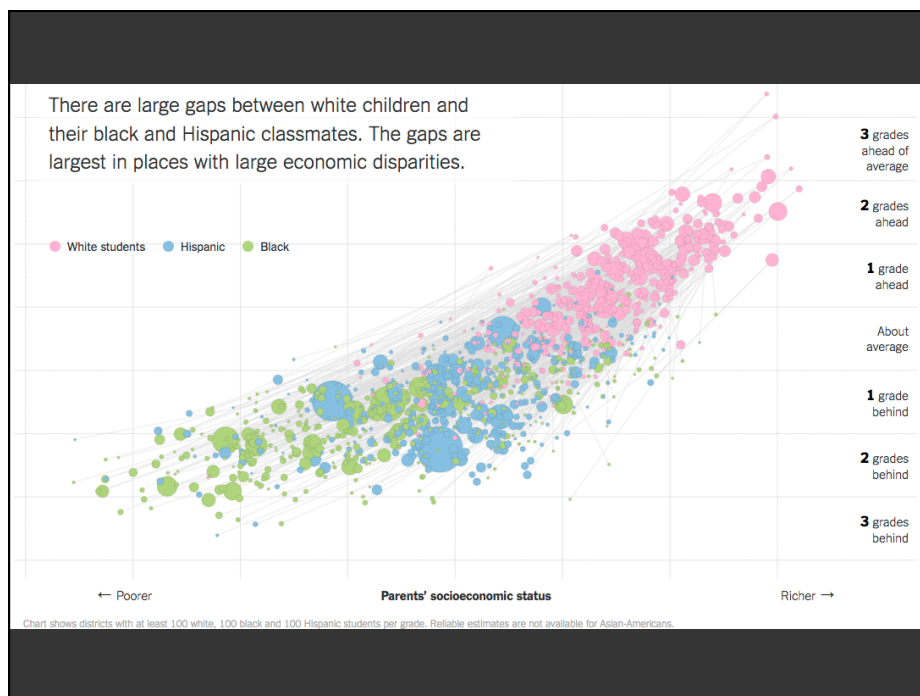


Interaction II

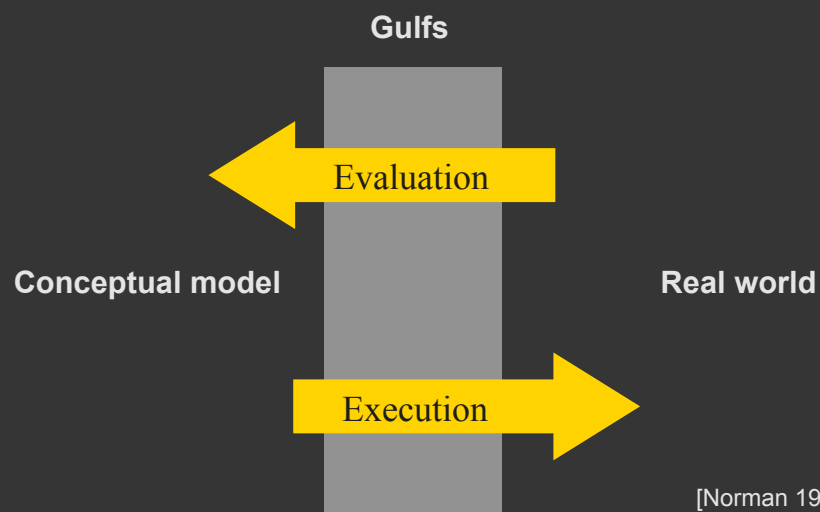
Maneesh Agrawala

CS 448B: Visualization
Fall 2017



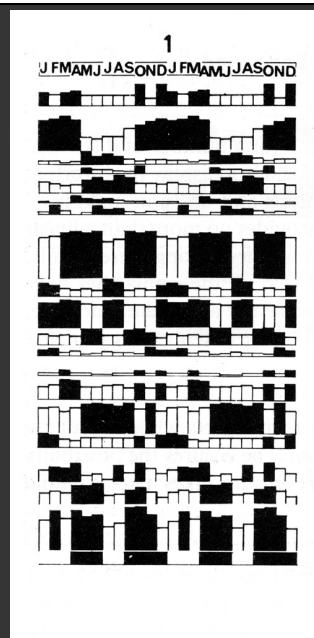
Last Time: Interaction

Gulfs of execution & evaluation



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	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

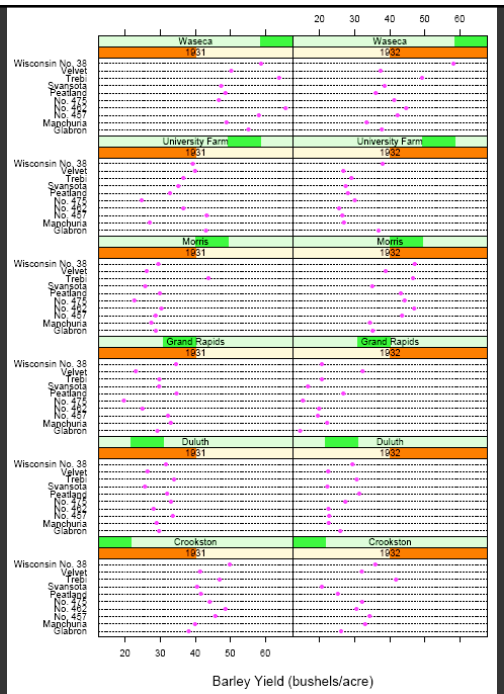
[Graphics and Graphic Information Processing, Bertin 81]



[Graphics and Graphic Information Processing, Bertin 81]

Trellis

[Becker, Cleveland, and Shyu 96]

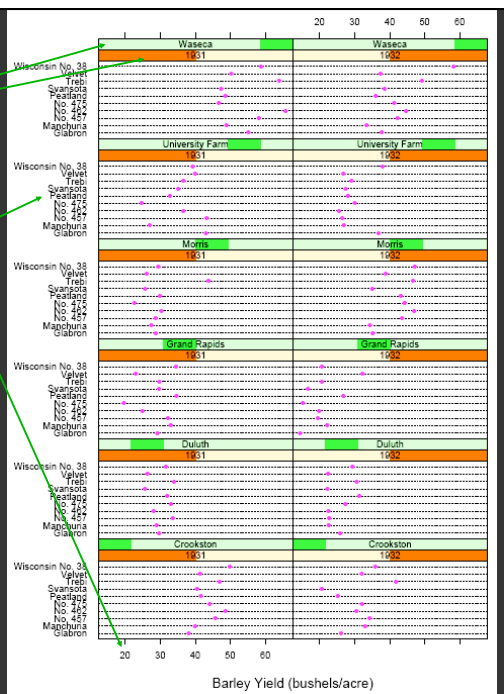


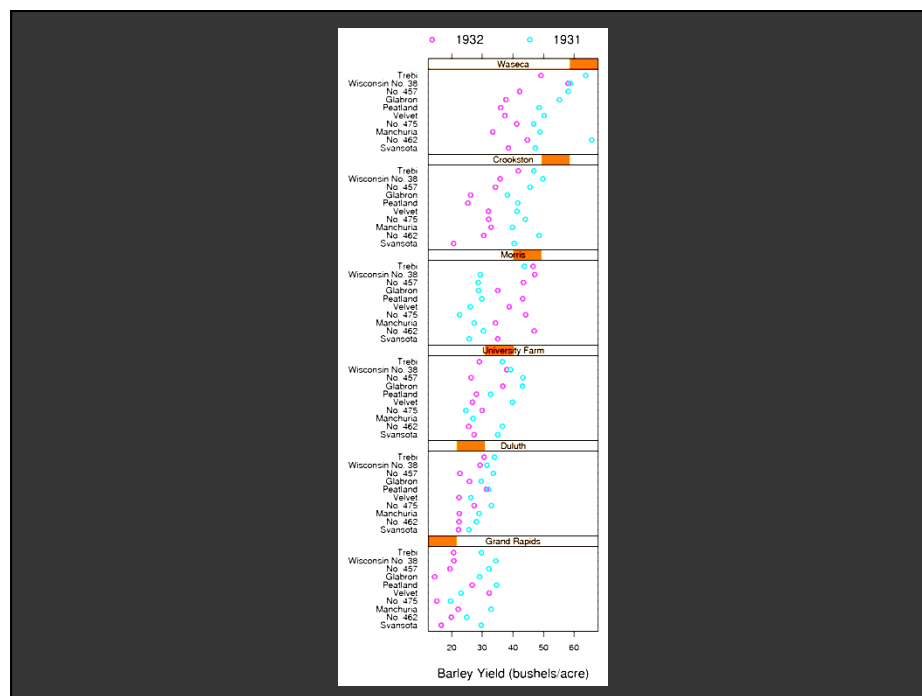
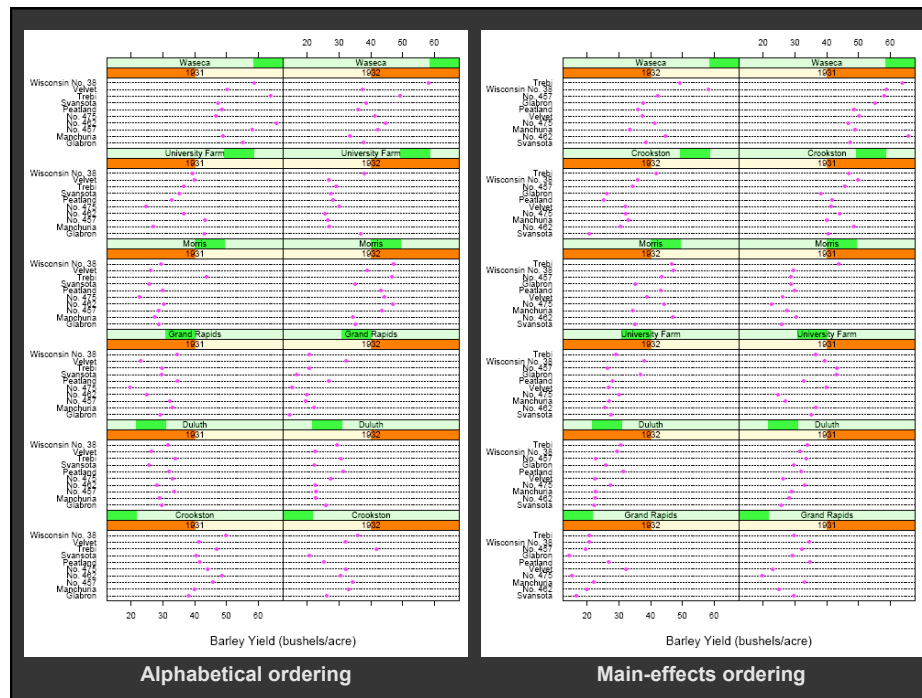
Condition variables
location, year

Panel variables
type, yield

Trellis

[Becker, Cleveland, and Shyu 96]





Dynamic Queries

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: Gr9 Fp1 CAC New

[Ahlberg and Schneiderman 92]

Direct manipulation

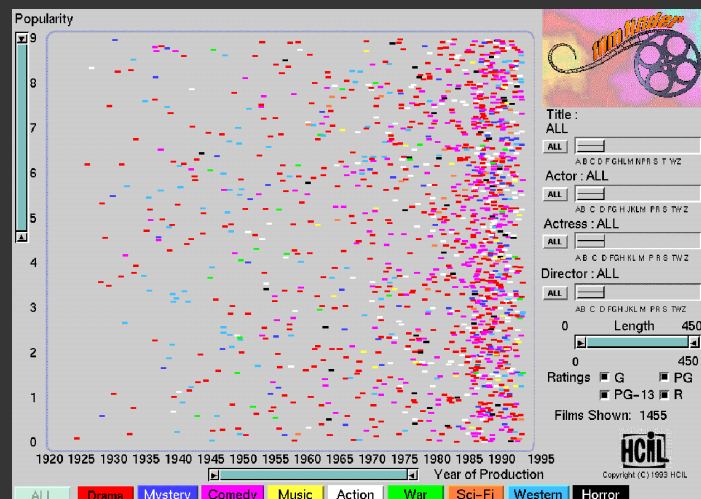
1. Visual representation of objects and actions
2. Rapid, incremental and reversible actions
3. Selection by pointing (not typing)
4. Immediate and continuous display of results

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

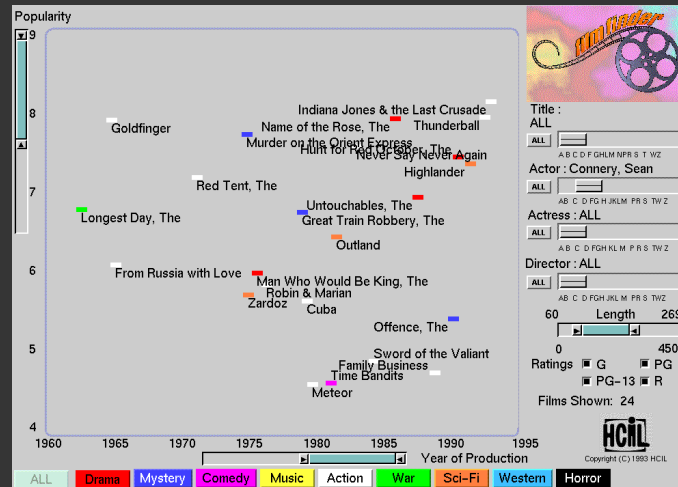
[Miller 1968]

FilmFinder



[Ahlberg and Schneiderman 93]

FilmFinder



[Ahlberg and Schneiderman 93]

Alphaslider

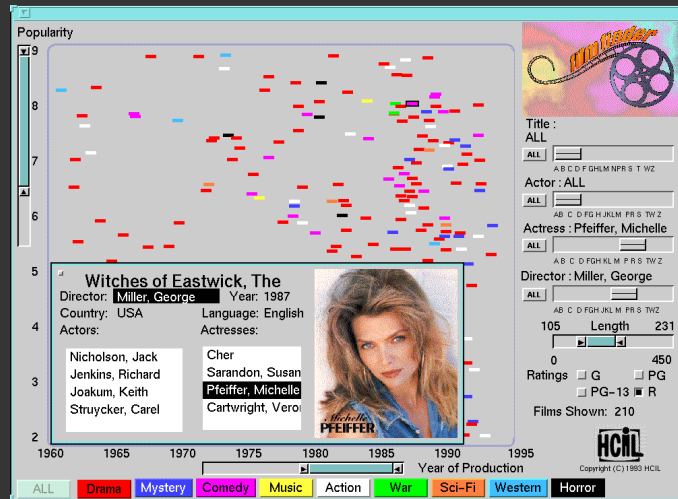
Title :
Moonstruck

ALL

AB C D F GHLM NPR S T WZ

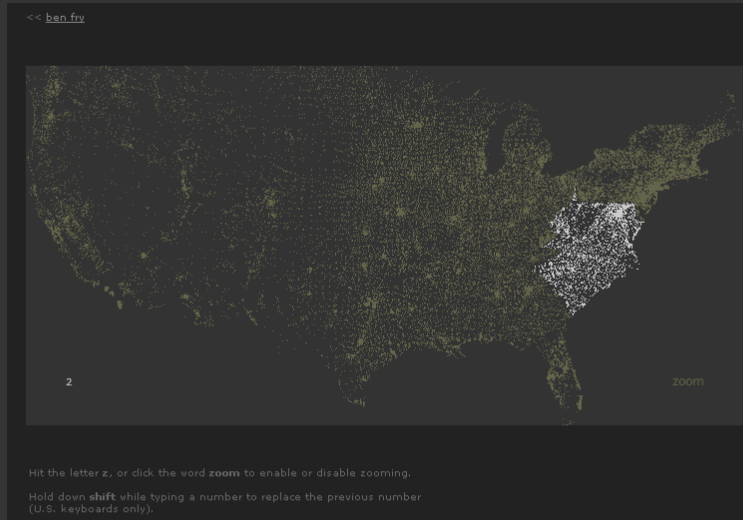
[Ahlberg and Schneiderman 94]

FilmFinder



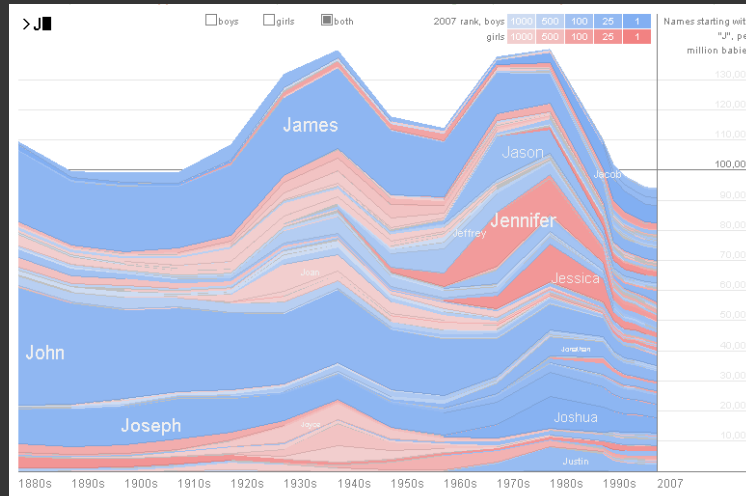
[Ahlberg and Schneiderman 93]

Zipdecode [from Fry 04]



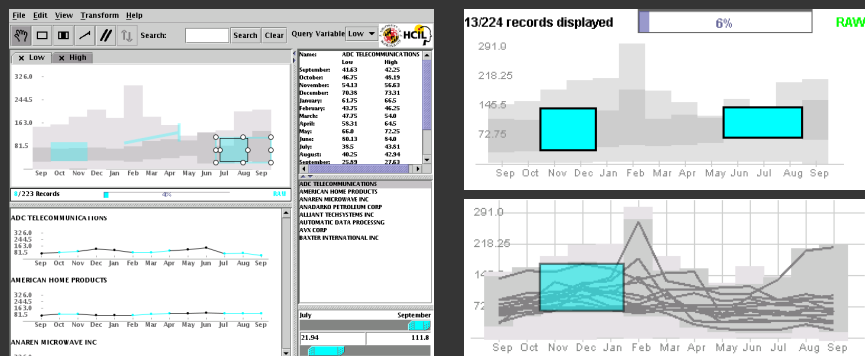
<http://acg.media.mit.edu/people/fry/zipdecode/>

NameVoyager



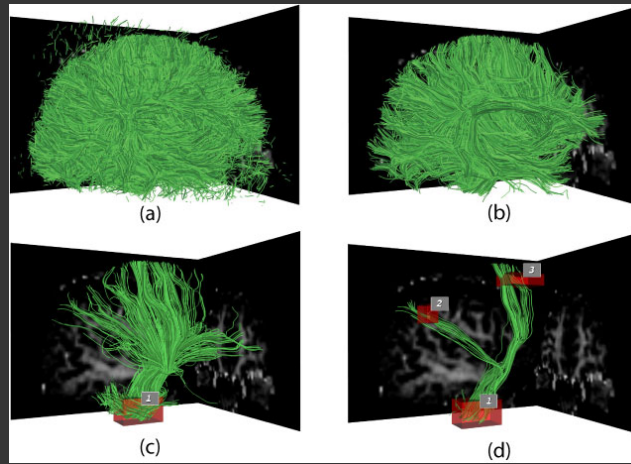
<http://www.babynamewizard.com/voyager>

TimeSearcher [Hochheiser & Schneiderman 02]

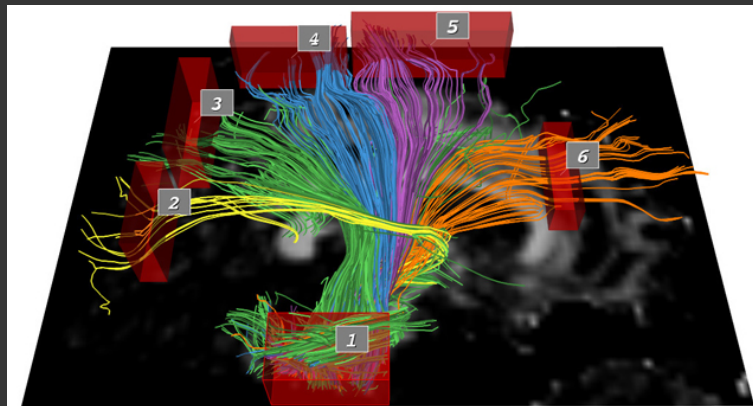


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



3D dynamic queries [Akers et al. 04]

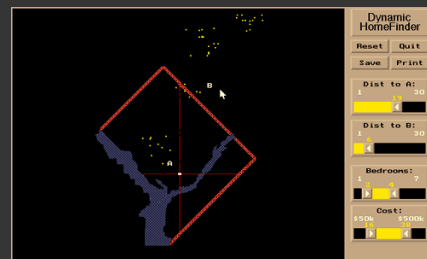


Announcements

Assignment 3: Dynamic Queries

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

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

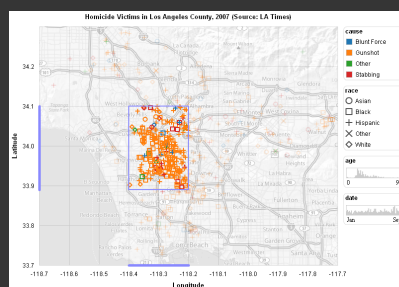


Can work alone or in pairs
Due before class on **Oct 30, 2017**

Generalized Selection

Visual Queries

Model selections as declarative queries



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

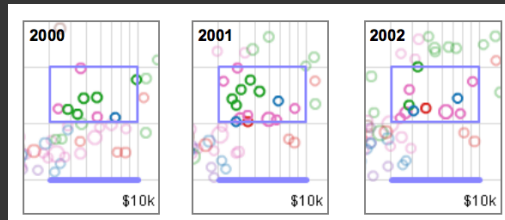
Visual Queries

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”

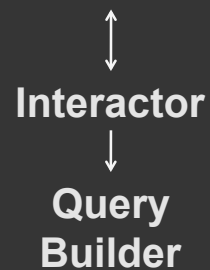
Abstraction may occur over multiple levels

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*



Query Builder



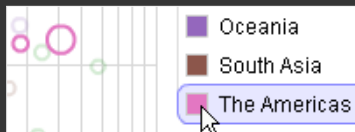
Click: Select Items

(id = 'China')



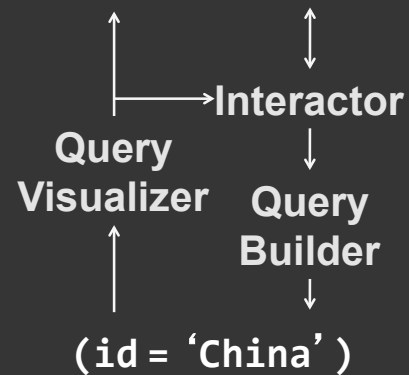
Drag: Select Range

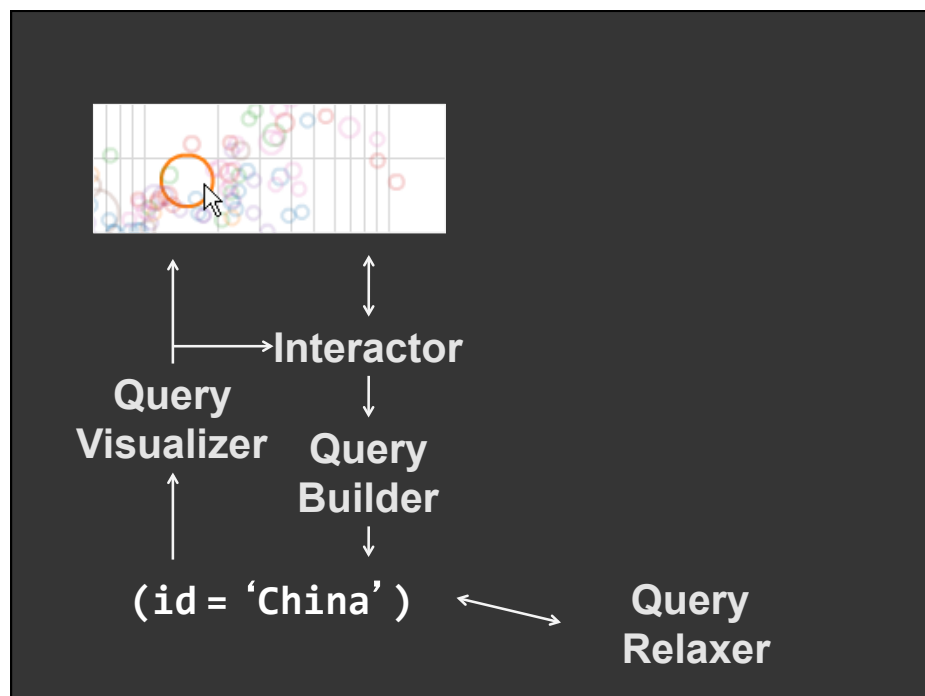
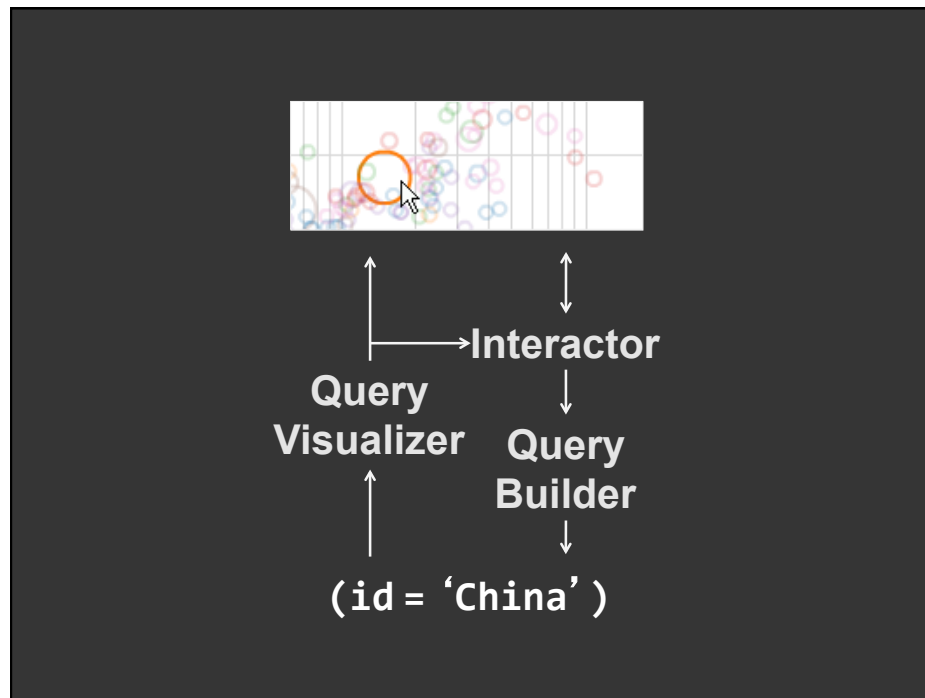
(2000 < gni AND gni < 10000) AND (.1 < internet AND internet < .2)

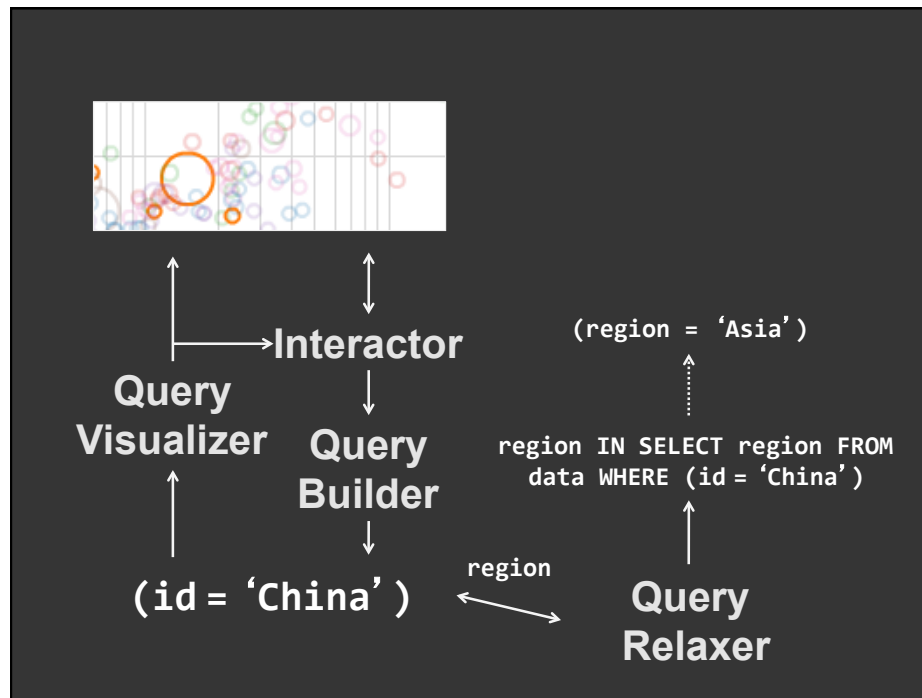


Legend: Select Attributes

(region = 'The Americas')



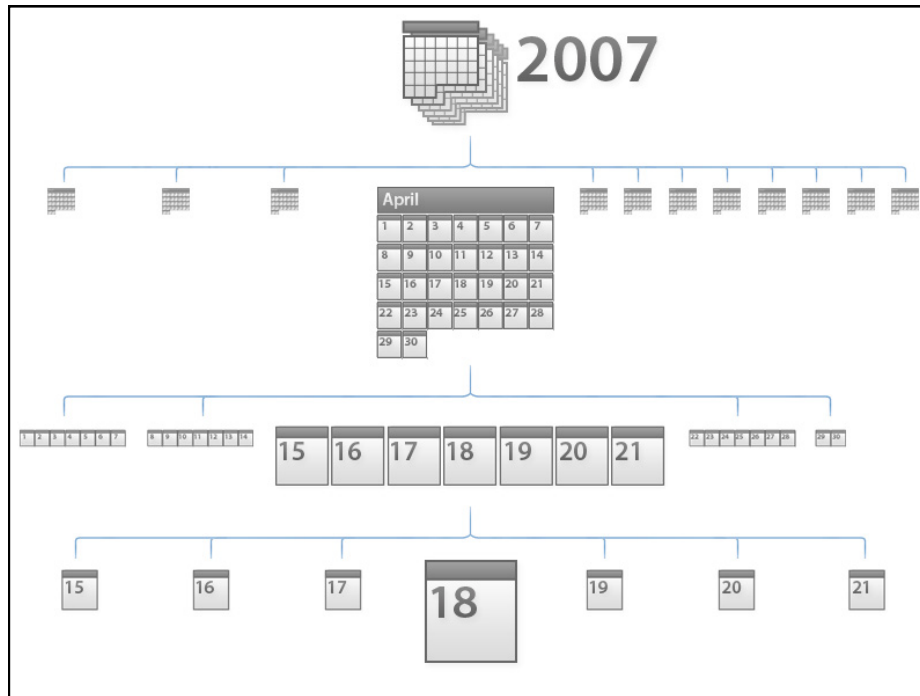




Query Relaxation

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

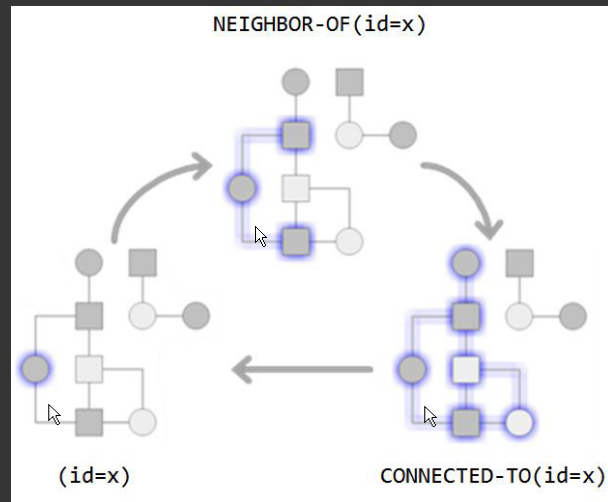
Relax using abstraction hierarchies of the data
Traverse in direction of increasing generality

Examples

A Priori: Calendar, Categories, Geography

Data-Driven: Nearest-Neighbor, Clustering

Relaxation of Networks



Other Input Modalities

Multi-touch

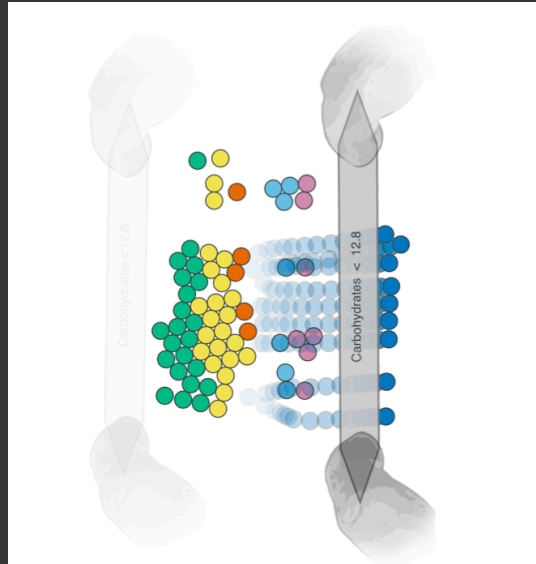
- Tables, wall displays, tablets, whiteboards
- Does it facilitate visual analysis?
- What affordances are gained/lost?

Kinetica

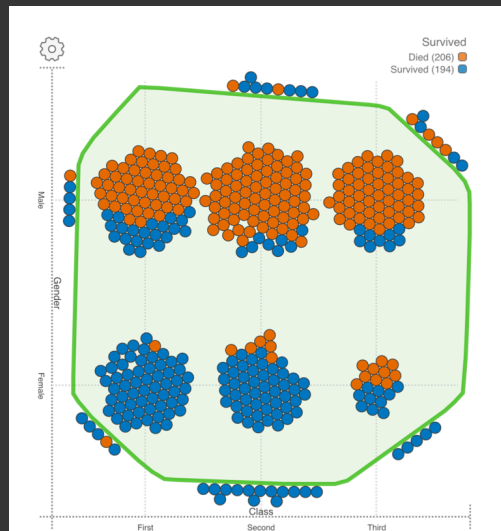
Kinetica **Naturalistic Multi-touch Data Visualization**

Jeffrey M. Rzeszutarski, 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 dependant

- Choose the right space
- Pick the right interaction technique

Human factors are important

- Leverage human strengths
- Assist to get past human limitations