

Interaction II

Maneesh Agrawala

CS 294-10: Visualization
Spring 2011

Announcements

Assignment 3: Visualization Software

Create a **small** interactive visualization application – you choose data domain and visualization technique.

1. Describe data and storyboard interface
2. Implement interface and produce final writeup
3. Submit the application and a final writeup on the wiki



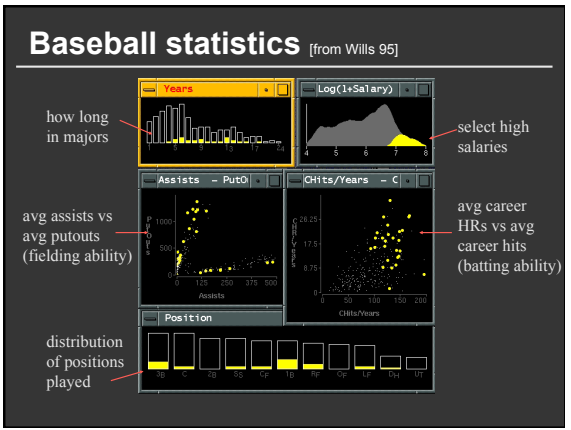
Can work alone or in pairs
Final write up due before class on **Mar 7, 2011**

Last Time: Brushing and Linking

Brushing and Linking

Brushing

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



Topics

Dynamic Queries
Generalized Selection

Dynamic Queries

Query and results

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

House#	Building Address	City
2	House 5556 S. Capitol St.	Beltsville, MD
4	House 5236 S. Lincoln St.	Beltsville, MD
5	House 5163 Jones Street	Beltsville, MD
6	House 5029 Jones Street	Beltsville, MD
9	House 4872 Jones Street	Beltsville, MD
17	House 5068 S. Capitol St.	Beltsville, MD
20	House 5496 S. Capitol St.	Beltsville, MD
85	Condo 5859 S. Lincoln St.	Laurel, MD
84	Condo 5051 S. Lincoln St.	Laurel, MD
88	Condo 5159 Hamilton Street	Laurel, MD
92	Condo 5139 Hamilton Street	Laurel, MD
93	Condo 5281 S. Lincoln St.	Laurel, MD
94	Condo 5083 S. Lincoln St.	Laurel, MD
95	Condo 4970 Jones Street	Laurel, MD
97	Condo 4077 Jones Street	Laurel, MD
94	Condo 4896 S. Capitol St.	Laurel, MD
99	Condo 5048 S. Capitol St.	Laurel, MD
100	Condo 4937 31st Street	Laurel, MD
101	Condo 5306 S. Lincoln St.	Laurel, MD
103	Condo 5555 Glass Road	Laurel, MD
105	Condo 5546 Hamilton Street	Laurel, MD
223	House 7610 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

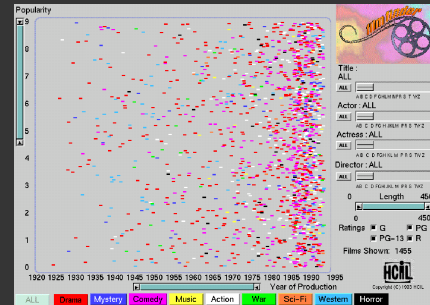
The yellow dots above are homes in the DC area for sale. You may get more information on a home by selecting it. You may draw the 'A' and 'B' distance markers to your office or any other location you want to live near. Select distances, bedrooms, and cost ranges by dragging the corresponding slider boxes on the right. Select specific home types and services by pressing the labeled buttons on the right.

[Ahlberg and Schneiderman 92]

Direct manipulation

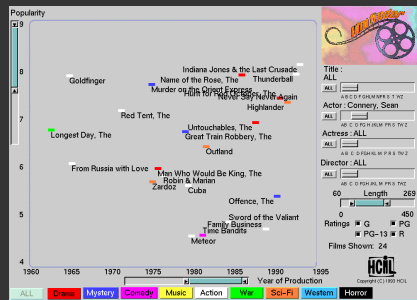
1. Visual representation of objects and actions
2. Rapid, incremental and reversible actions
3. Selection by pointing (not typing)
4. Immediate and continuous display of results

FilmFinder



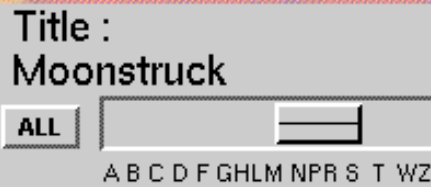
[Ahlberg and Schneiderman 93]

FilmFinder



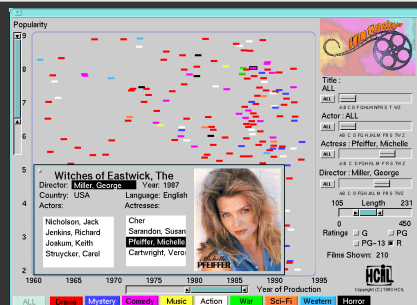
[Ahlberg and Schneiderman 93]

Alphaslider



[Ahlberg and Schneiderman 94]

FilmFinder



[Ahlberg and Schneiderman 93]

Cellphones

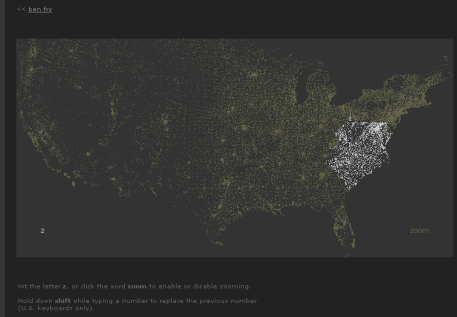


<http://www.myrateplan.com/cellphones/>

Attribute explorer [Spence and Tweedie 98]

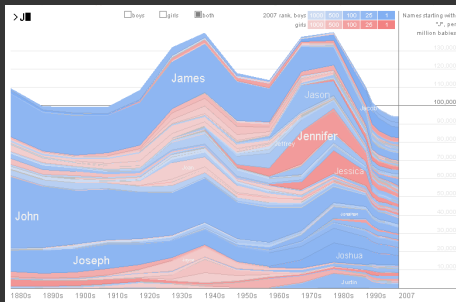
• The Attribute Explorer

Zipcode [from Fry 04]



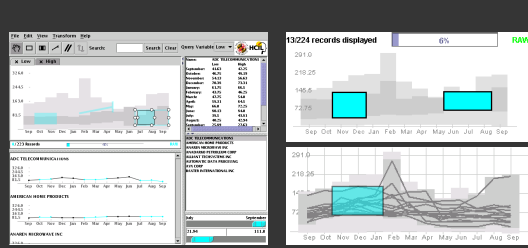
<http://acq.media.mit.edu/people/fry/zipcode/>

NameVoyager



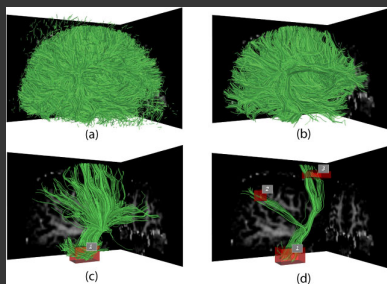
<http://www.babynamewizard.com/voyager>

TimeSearcher [Hochheiser & Schneiderman 02]

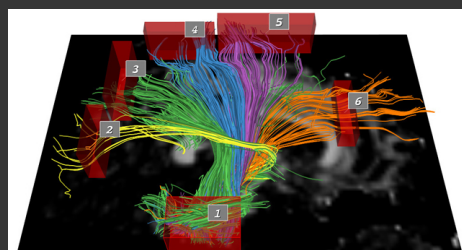


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



3D dynamic queries [Akers et al. 04]



Pros and cons

Pros

- Controls useful for both novices and experts
- Quick way to explore data

Cons

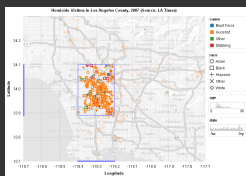
- Simple queries
- Lots of controls
- Amount of data shown limited by screen space

Who would use these kinds of tools?

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

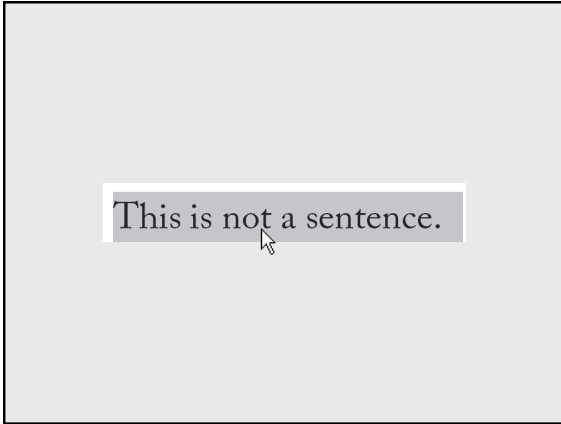
Point to an example and define an abstraction based on one or more properties [Clark, Brennan]



“Blue like this”

“The same shape as that”

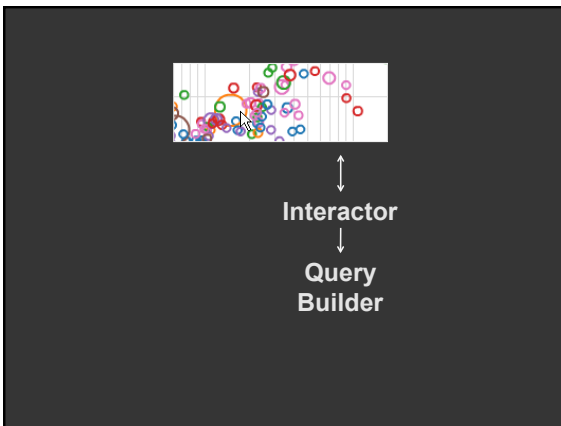
Abstraction may occur over multiple levels



Generalized Selection

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

Expand selections via **query relaxation**

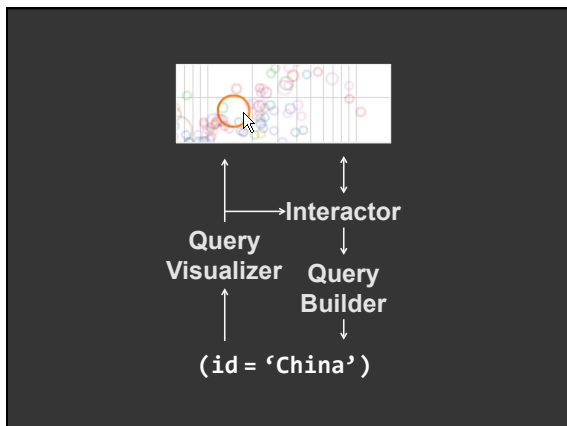
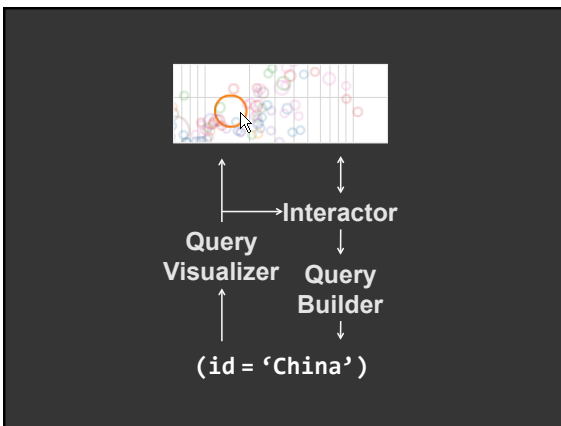


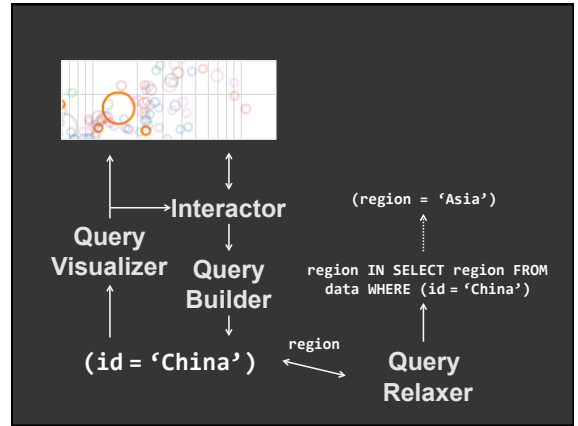
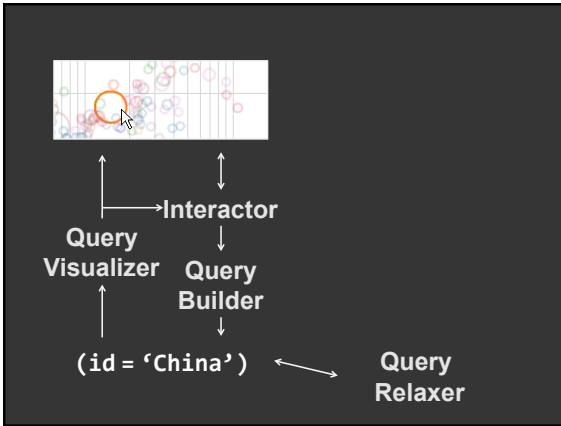
Query Builder

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')

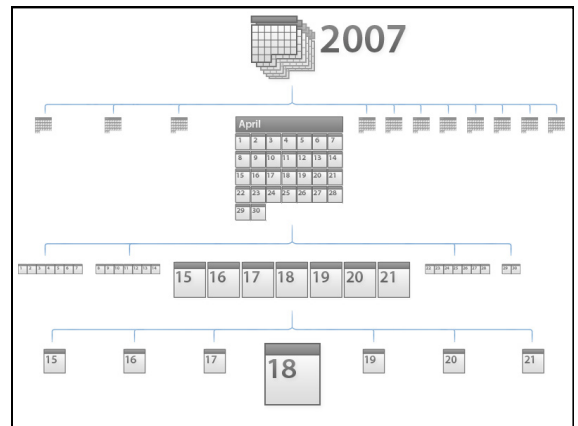




Query Relaxation

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

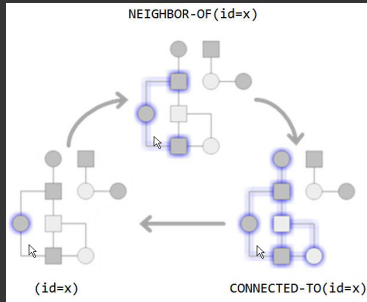
Relaxation using Attributes

If no explicit semantic structure is available,
treat data itself as a "flat" hierarchy

Select all items with matching values along
the attributes chosen for relaxation



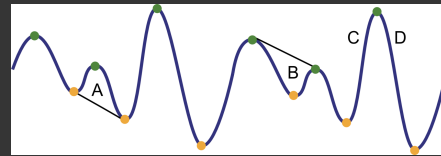
Relaxation of Networks



Lesson

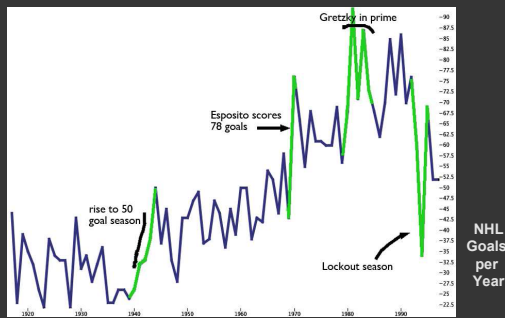
Consider how the structure and/or semantics of the data might be leveraged to aid analysis

Extension: look beyond data features to incorporate perceptual features of the display



Peaks, valleys, & slopes

Perceptual Annotation [Kong & Agrawala 09]



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