Interaction II

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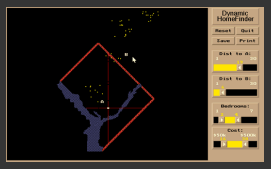
CS 294-10: Visualization
Spring 2011

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

Baseball statistics [from Wills 95]

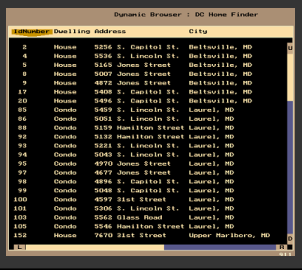
Topics

Dynamic Queries
Generalized Selection

Dynamic Queries

Query and results

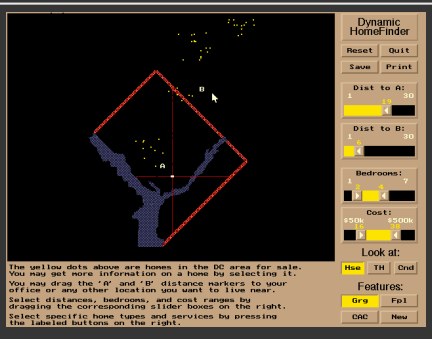
SELECT house
FROM east bay
WHERE price < 1,000,000 AND bedrooms > 2
ORDER BY price



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

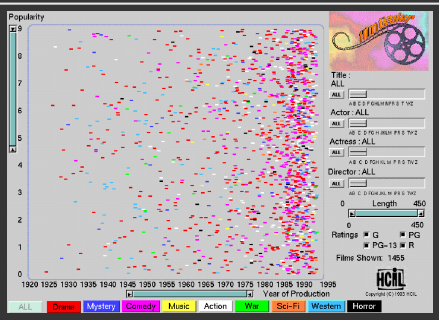


[Ahlberg and Schneiderman 92]

Direct manipulation

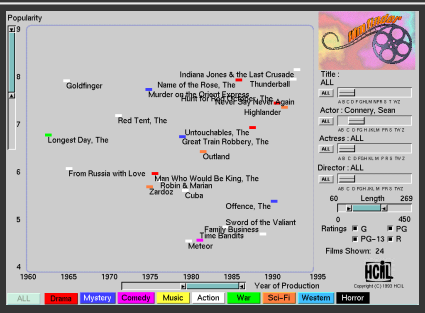
1. Visual representation of objects and actions
2. Rapid, incremental and reversible actions
3. Selection by pointing (not typing)
4. Immediate and continuous display of results

FilmFinder



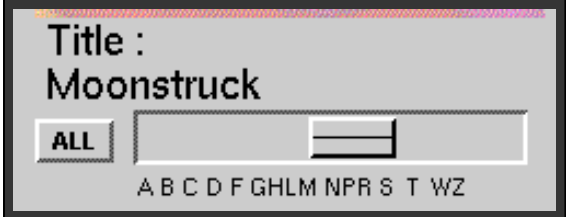
[Ahlberg and Schneiderman 93]

FilmFinder



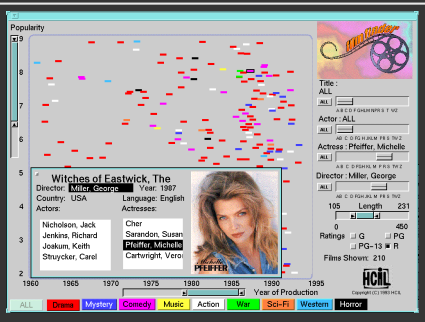
[Ahlberg and Schneiderman 93]

Alphaslider



[Ahlberg and Schneiderman 94]

FilmFinder

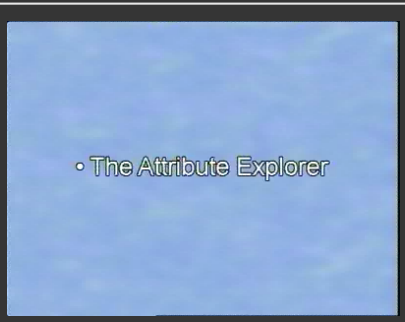


[Ahlberg and Schneiderman 93]

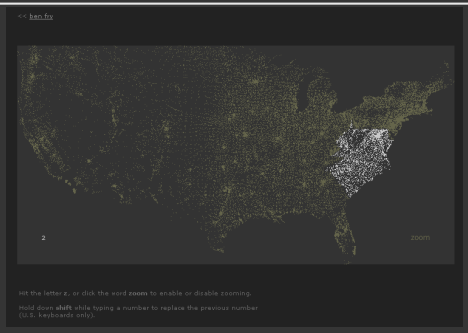
Cellphones

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

Attribute explorer [Spence and Tweedie 98]

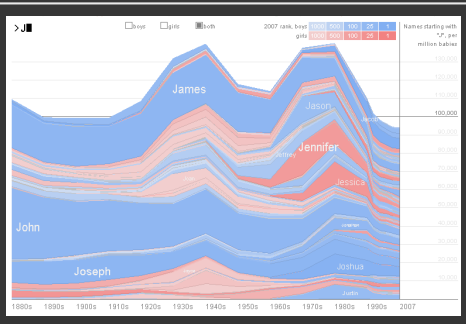


Zipdecode [from Fry 04]



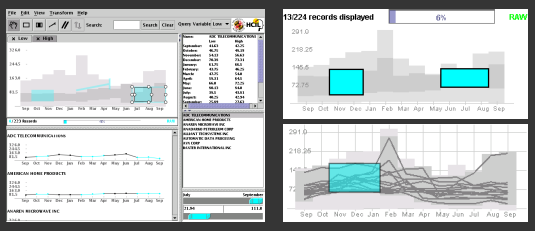
http://acg.media.mit.edu/people/fry/zipdecode/

NameVoyager



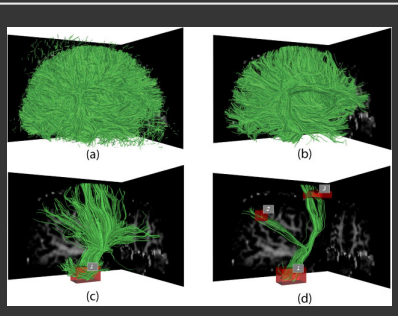
http://www.babynamewizard.com/voyager

TimeSearcher [Hochheiser & Schneiderman 02]

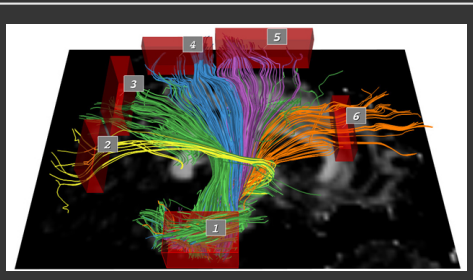


Based on Wattenberg's [2001] idea for sketch-based queries of time-series data.

3D dynamic queries [Akers et al. 04]



3D dynamic queries [Akers et al. 04]



Pros and cons

Pros

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

Cons

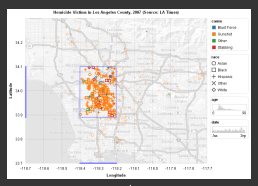
- Simple queries
- Lots of controls
- Amount of data shown limited by screen space

Who would use these kinds of tools?

Generalized Selection

Visual Queries

Model selections as declarative queries



```
(-118.371 ≤ 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”

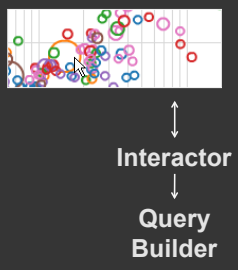
Abstraction may occur over multiple levels

This is not a sentence.

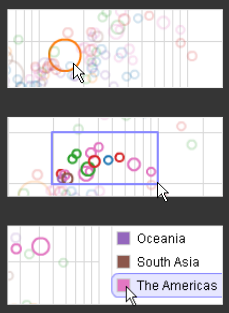
Generalized Selection

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

Expand selections via **query relaxation**



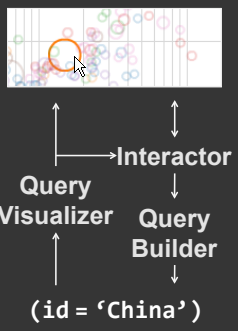
Query Builder

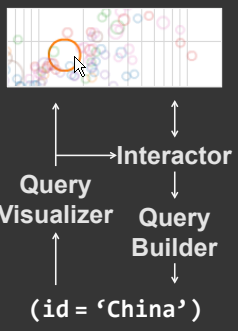


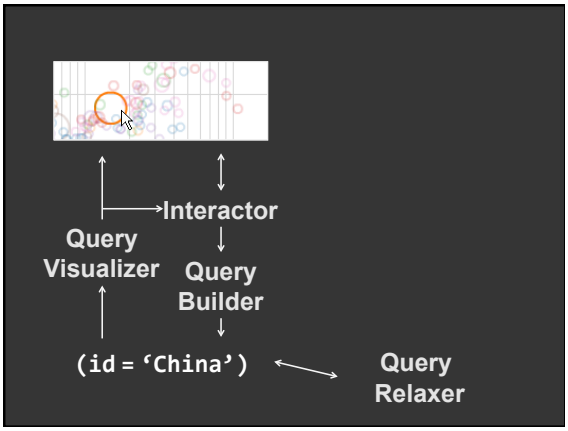
Click: Select Items
`(id = 'China')`

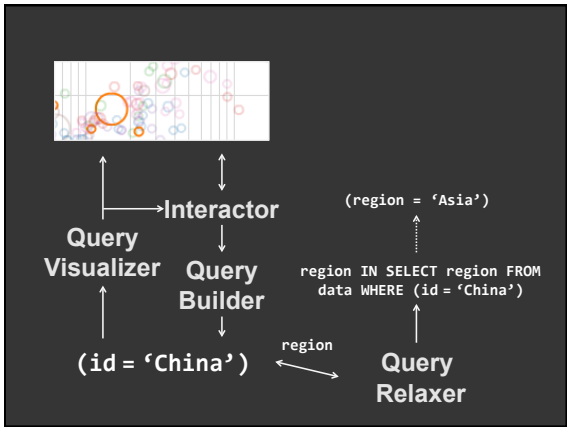
Drag: Select Range
`(2000 < gni AND gni < 10000) AND (.1 < internet AND internet < .2)`

Legend: Select Attributes
`(region = 'The Americas')`





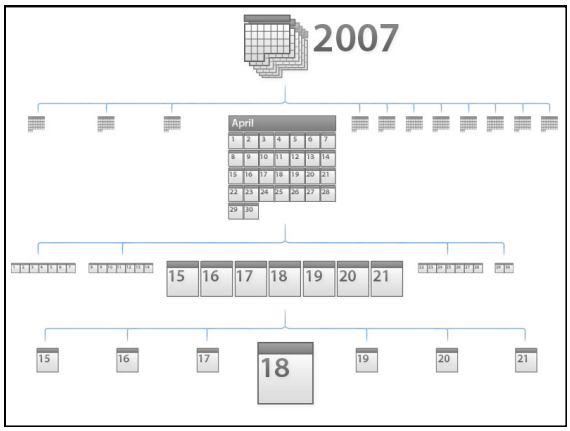




Query Relaxation

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

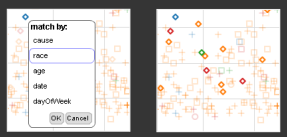
Relax using abstraction hierarchies of the data
Traverse in direction of increasing generality

Examples
A Priori: Calendar, Categories, Geography
Data-Driven: Nearest-Neighbor, Clustering

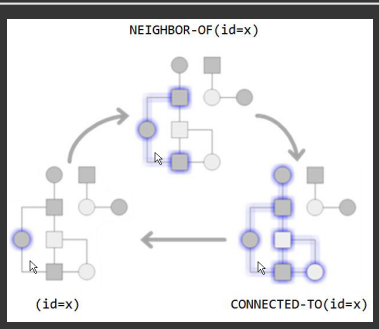
Relaxation using Attributes

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



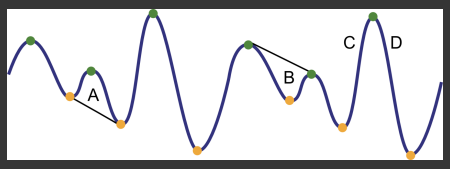
Relaxation of Networks



Lesson

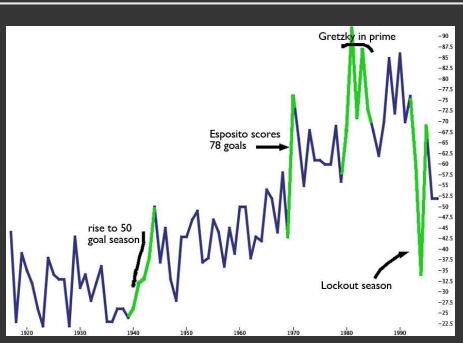
Consider how the structure and/or semantics of the data might be leveraged to aid analysis

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



Peaks, valleys, & slopes

Perceptual Annotation [Kong & Agrawala 09]



NHL Goals per Year

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