# Visualization Interaction
# SI649/EECS548

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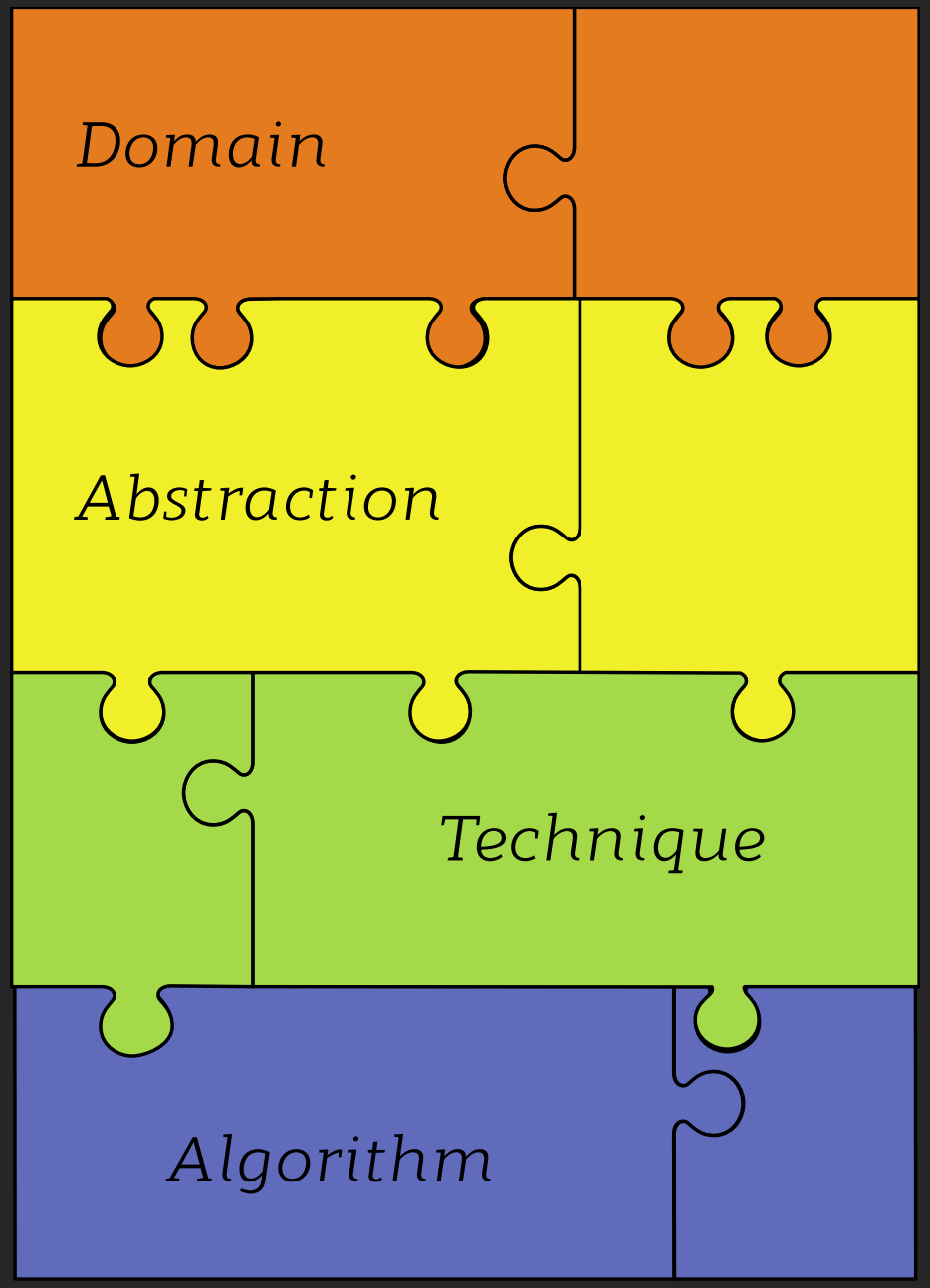
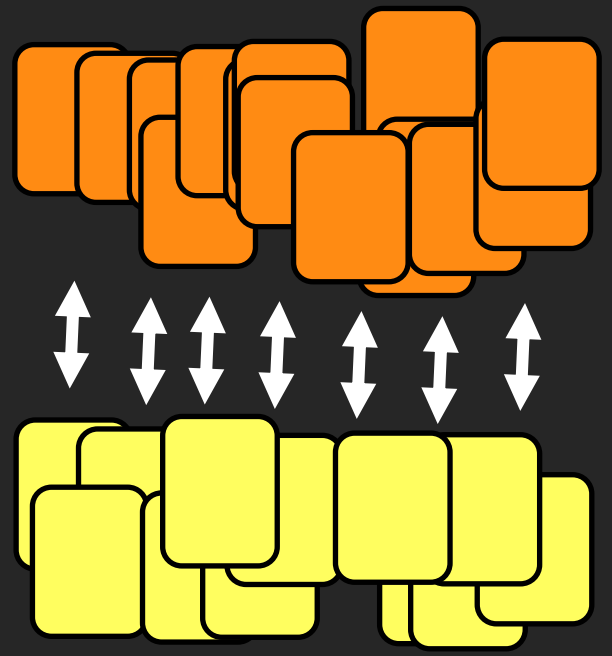
October 4, 2021

Some slides modified from Stasko ’09 + Heer ‘09


http://www.slido.com
event code **#Z176**

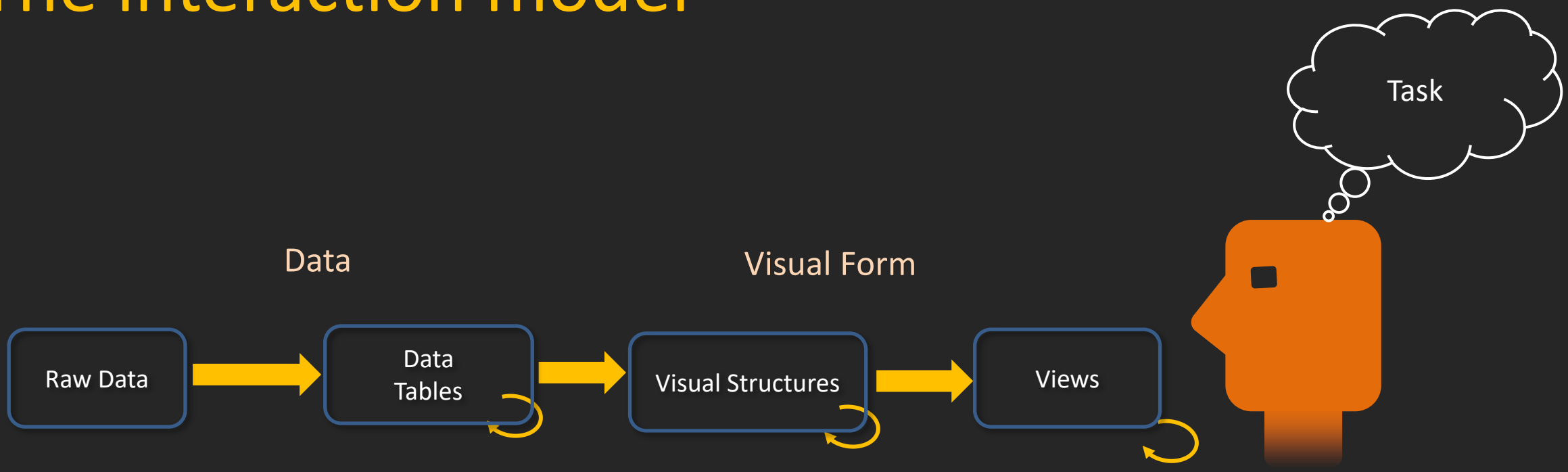


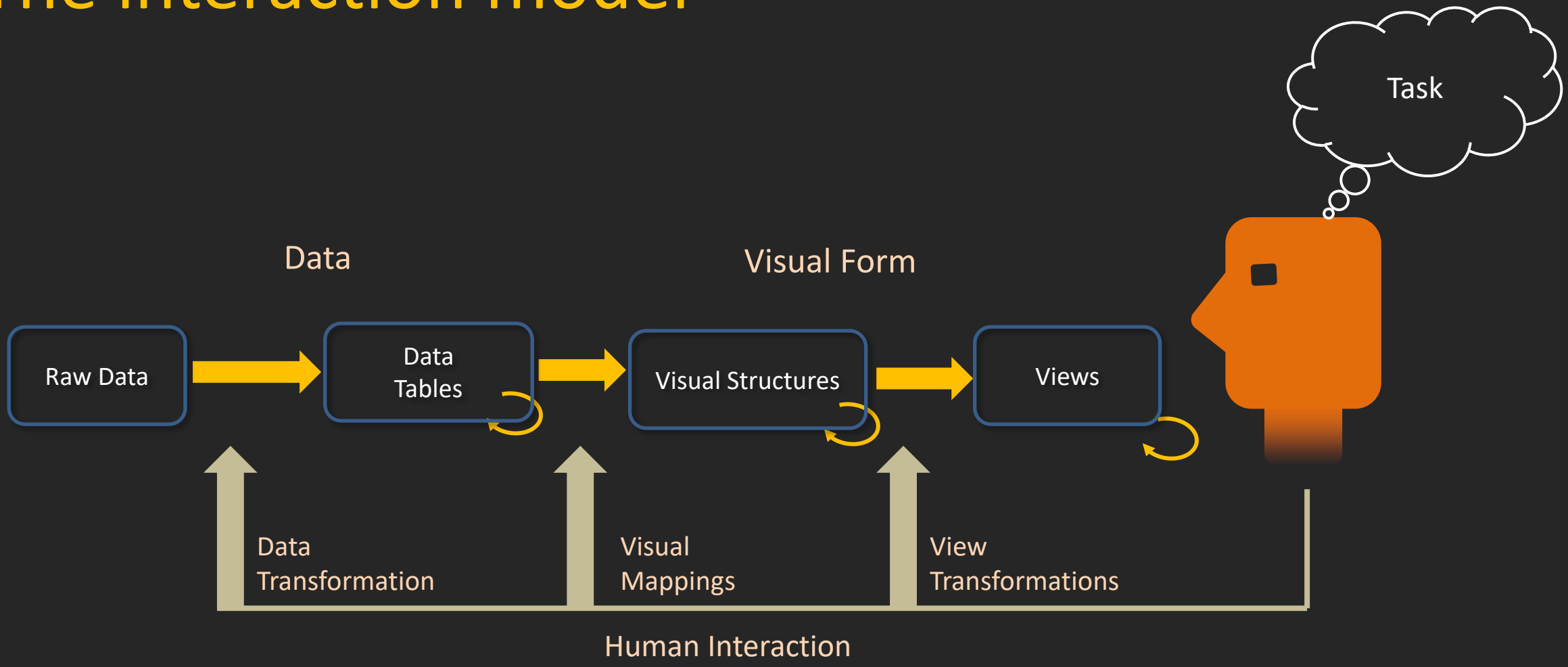
All comparisons can be supported in one display

Simplest, cleanest representation possible that still has all the data

# The interaction model



# The interaction model



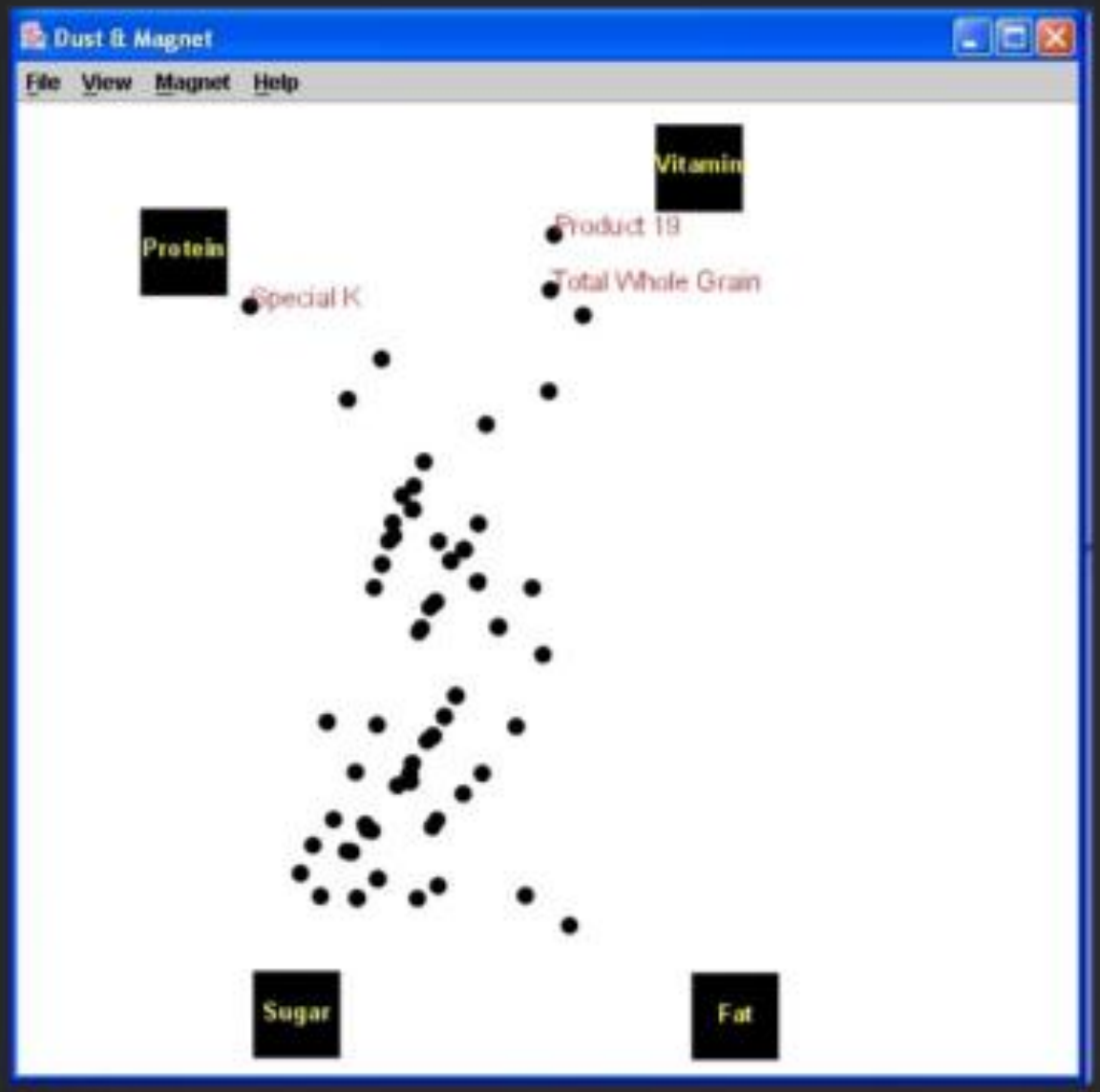
The mantra:

# Overview first, Zoom & Filter, Details on Demand

# 7 Categories (Based on Intent)

- Select
- Explore
- Reconfigure
- Encode
- Abstract/Elaborate
- Connect
- Filter

# Warmup

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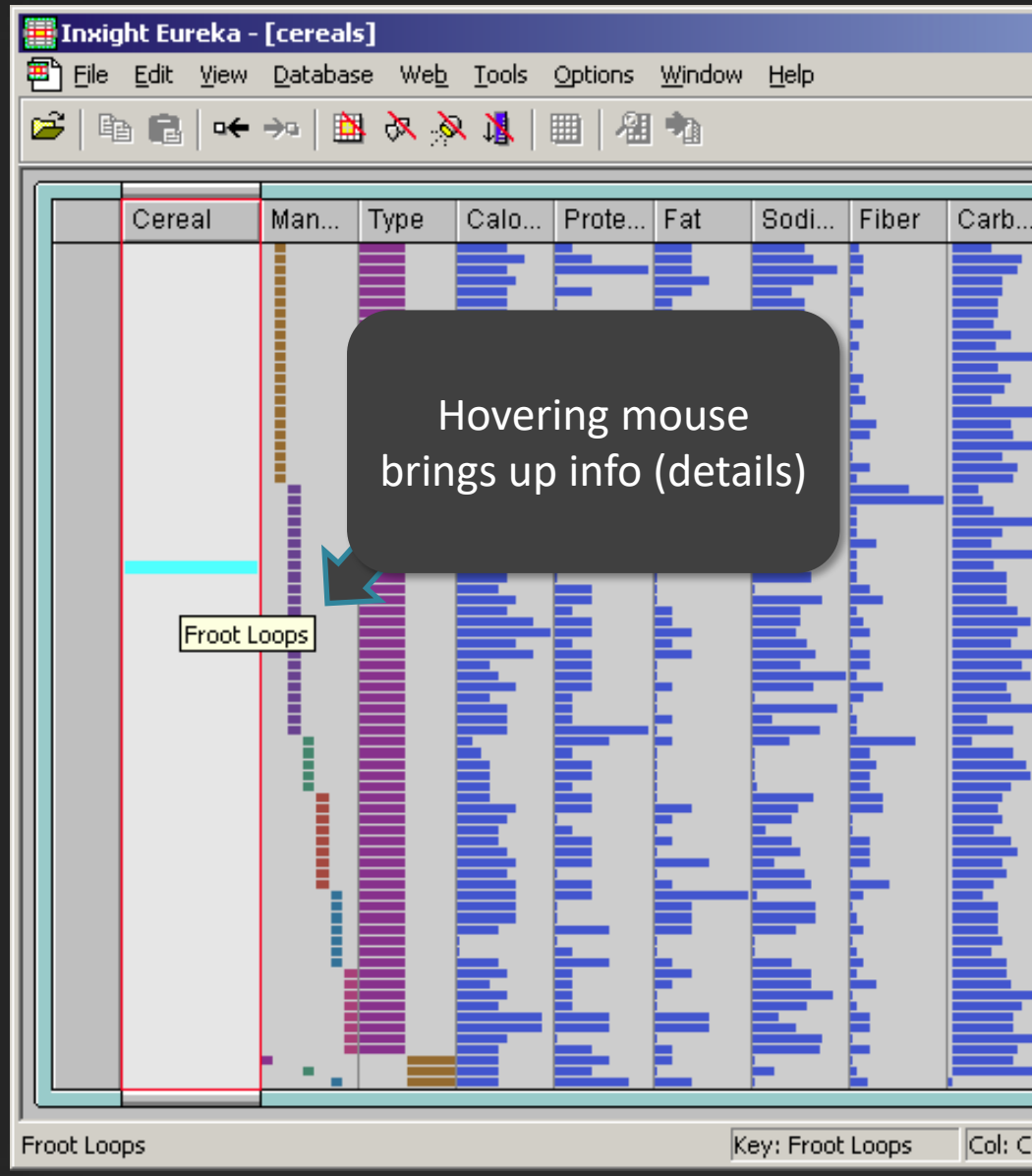
# Select

- Mark something as interesting
  - Mark items to keep track of them
  - Often precedes other operations
- Example:
  - Selecting a placemark in Google Maps



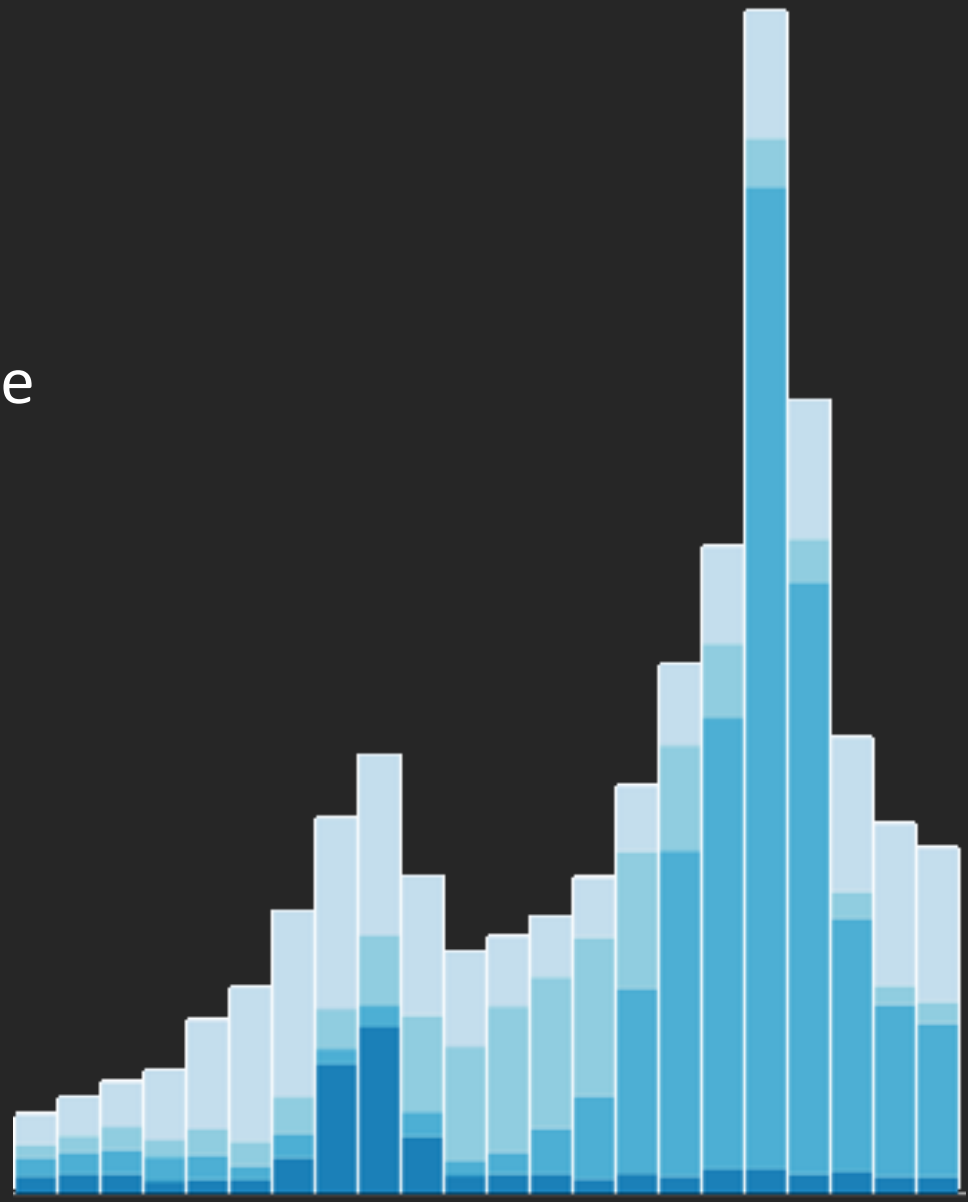
# Explore

- Show something different
  - Enable users to examine different subset
  - Overcome limitations of display size
- Examples:
  - Panning in Google Earth
  - “Walking” in Visual Thesaurus
    - http://www.youtube.com/watch?v=HGUD45_k5y0

# Explore

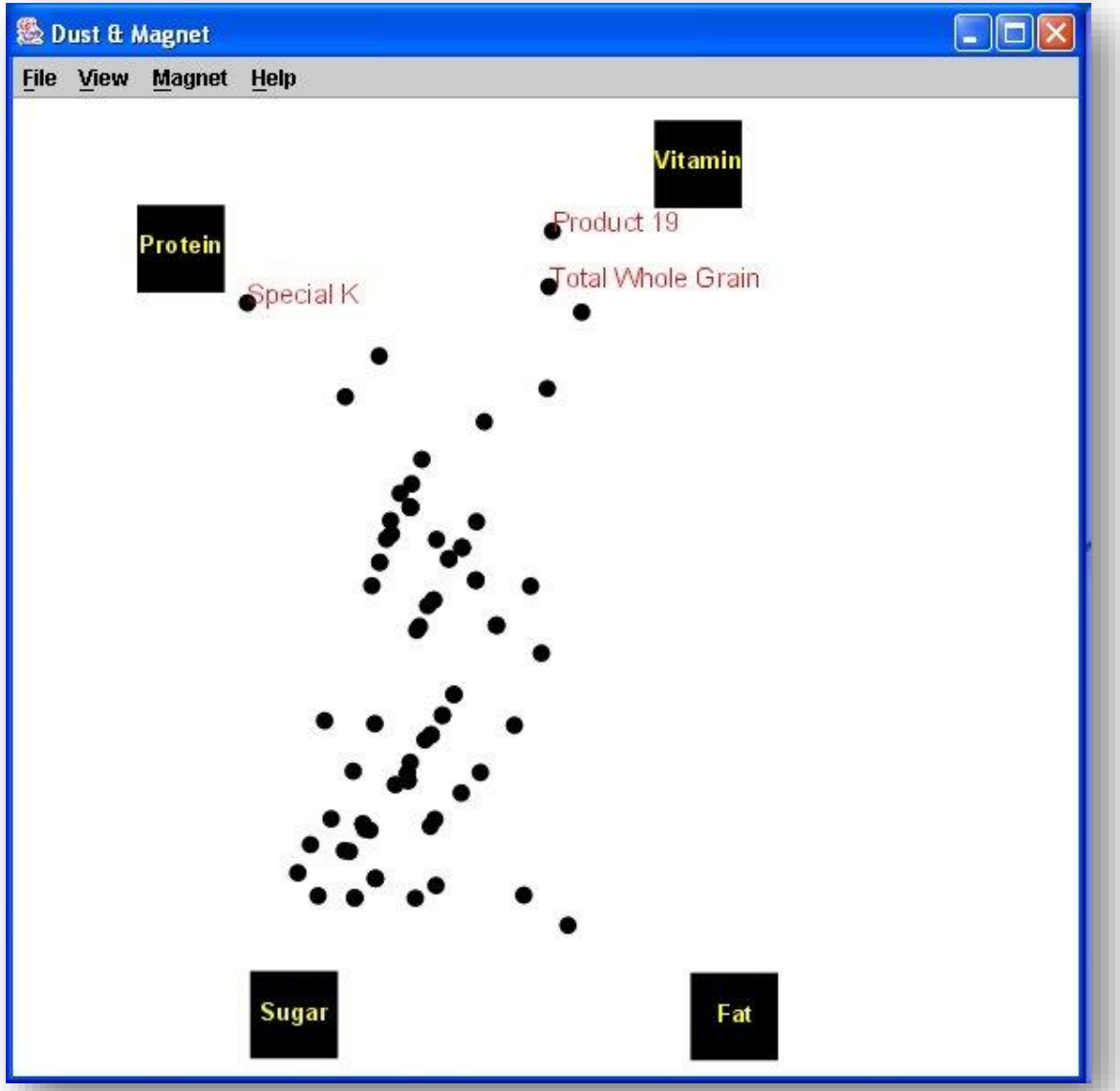
# Reconfigure

- Show a different arrangement
  - Provide different perspective by changing the spatial arrangement of representation
- Examples:
  - Sorting and rearranging columns
  - Changing attributes in scatter plot
  - Baseline adjustment in stacked histogram



http://bl.ocks.org/mbostock/3943967

# Reconfigure: Dust and Magnet




Yi, Melton, Stasko, and Jacko, (IV'05)
http://www.cc.gatech.edu/gvu/ii/dnm/

Group task: identify the pros and cons of dust and magnets.

Specifically focus on interaction techniques

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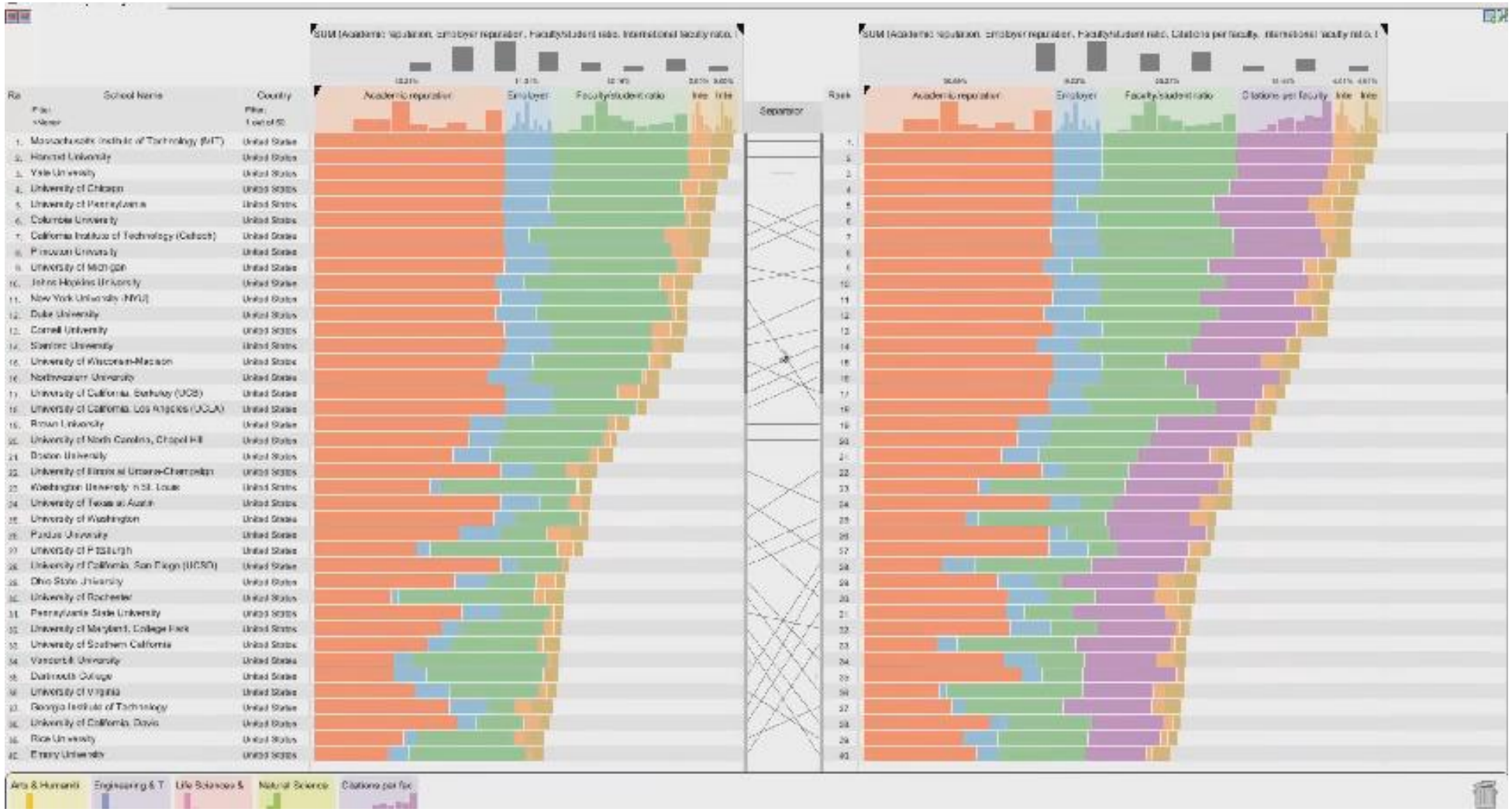
# An alternative…

# LineUp



Gratzl et al., 2013
https://www.youtube.com/watch?v=iFqCBI4T8ks

Group task: Compare LineUp to Dust and Magnets.

How do they implement reconfiguration?  What works?

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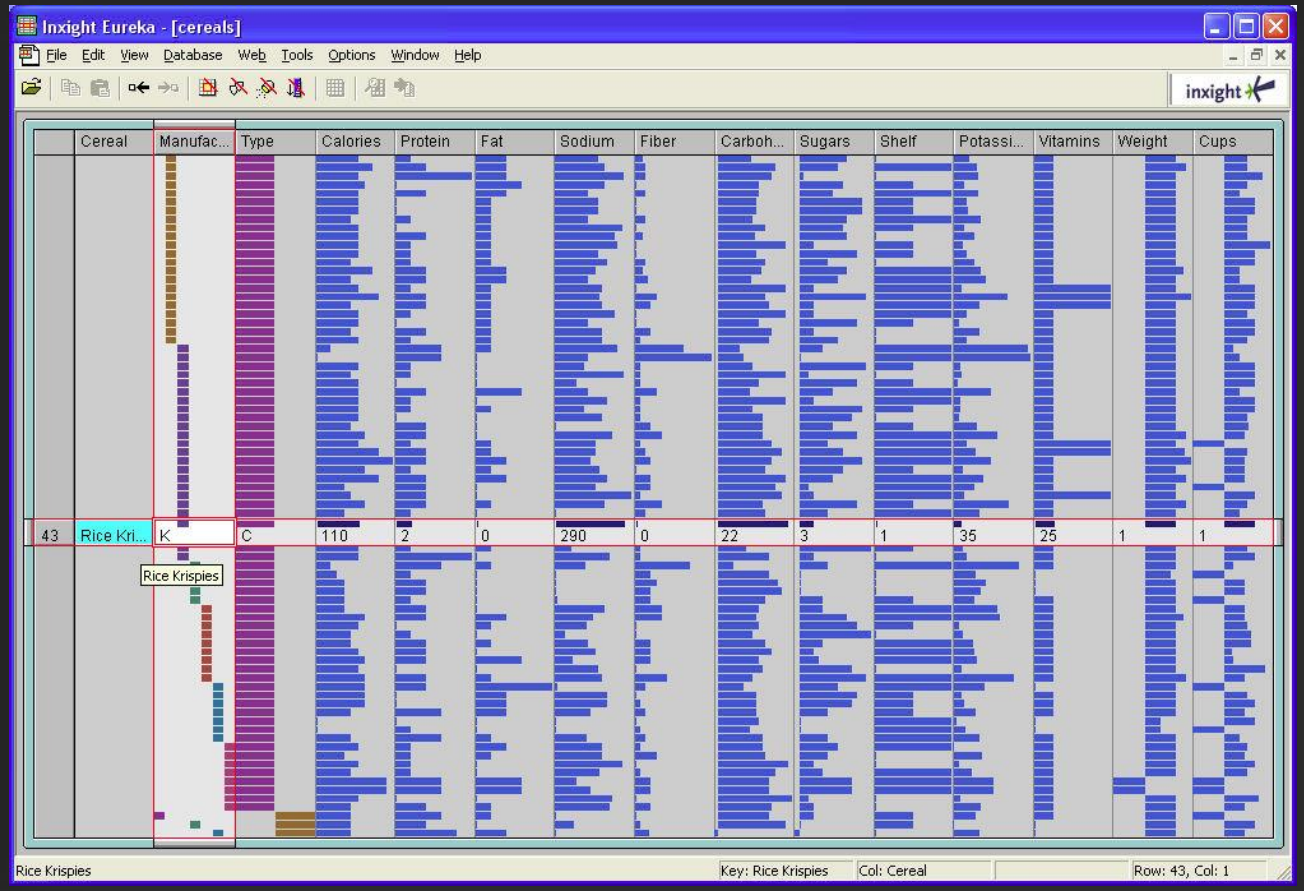
# Encode

- Show a different representation
  - Change visual/retinal variables

- Examples:
  - Colors
  - Sizes
  - Orientation
  - Font
  - Shape

# Abstract/Elaborate

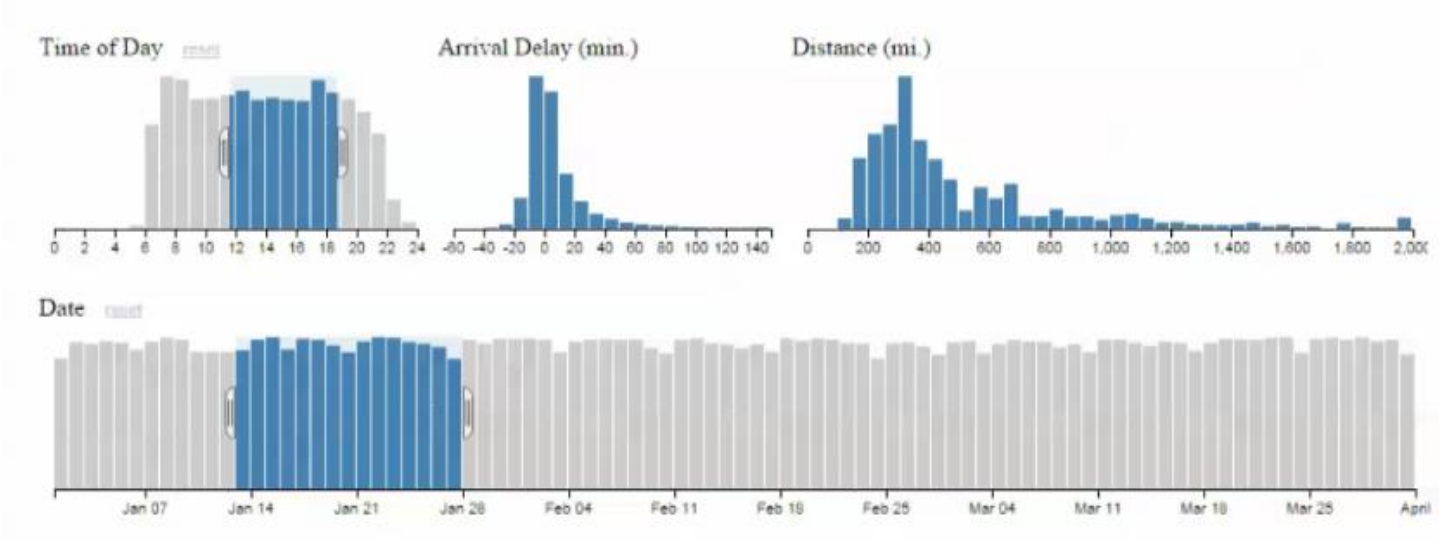
- Show more or less detail
  - Adjust level of abstraction
- Examples:
  - Unfolding sub-categories
  - Drill-down in treemaps
  - Zooming



# Connect

- Show related items
  - High associations and relationships
  - Show hidden data items that are relevant to specified items

- Examples:
  - Highlighting connections in Vizster
  - Linked brushing

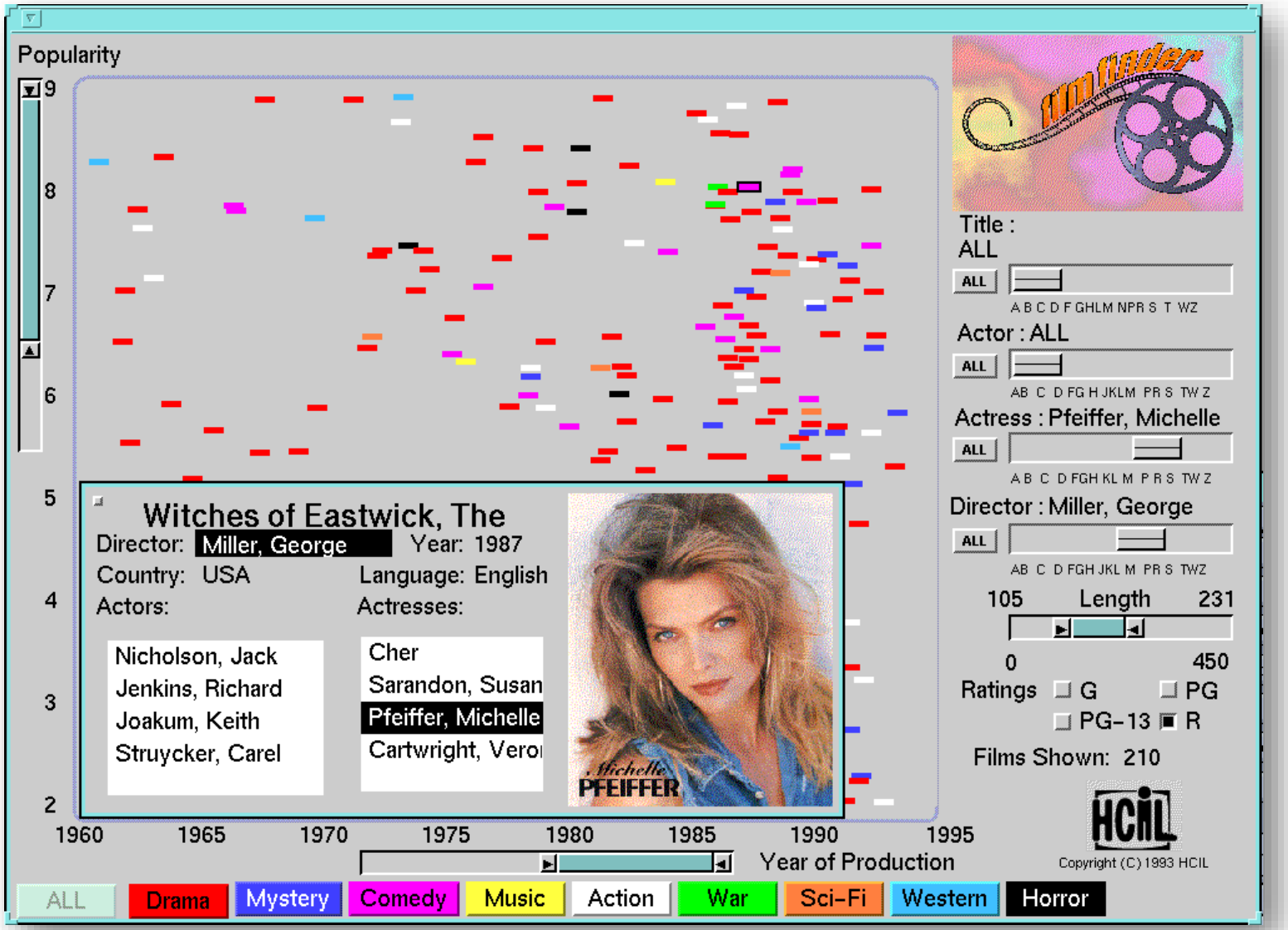


# Filter

- Show something conditionally
  - Change the set of data items presented based on some condition

- Examples:
  - Dynamic Queries
  - FilmFinder
  - Keystroke filtering in NameVoyager
  - Basically any flight search engine

# Filter: FilmFinder




Ahlberg & Shneiderman, ‘94

Group task: What are the limits of dynamic queries.

Hint: think of the constraints the UI imposes on the kinds of queries (in the DB sense) that can be expressed

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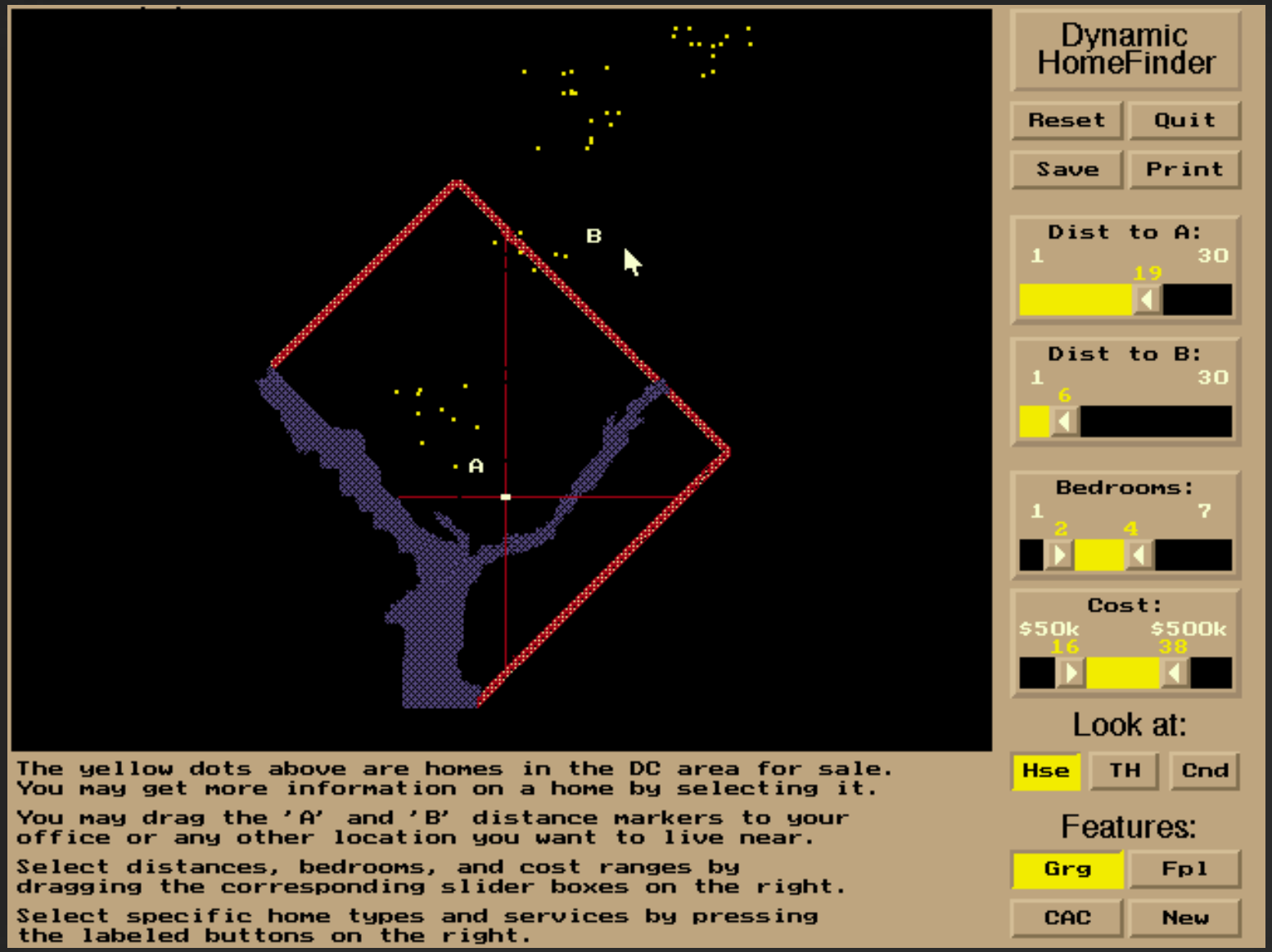
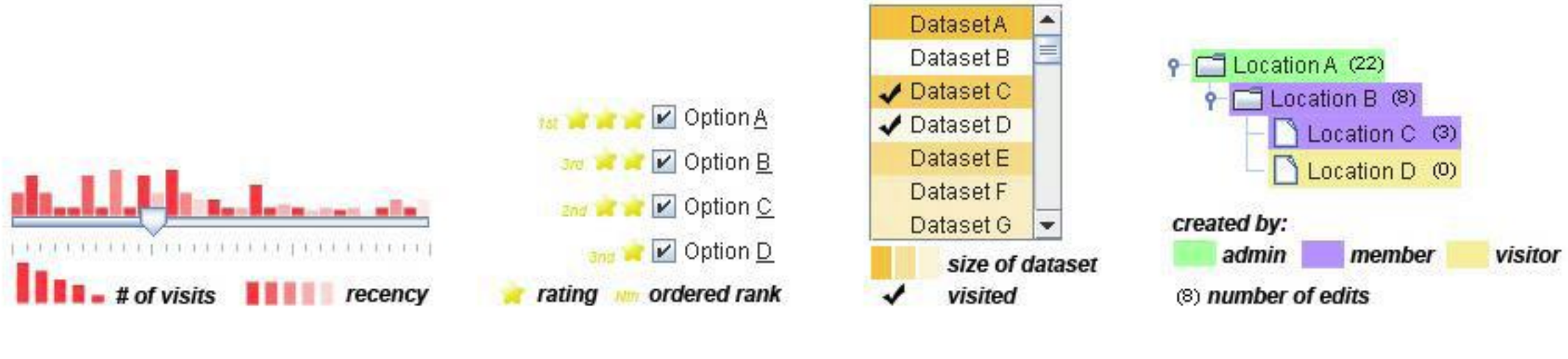


# Filter: DQ Negatives

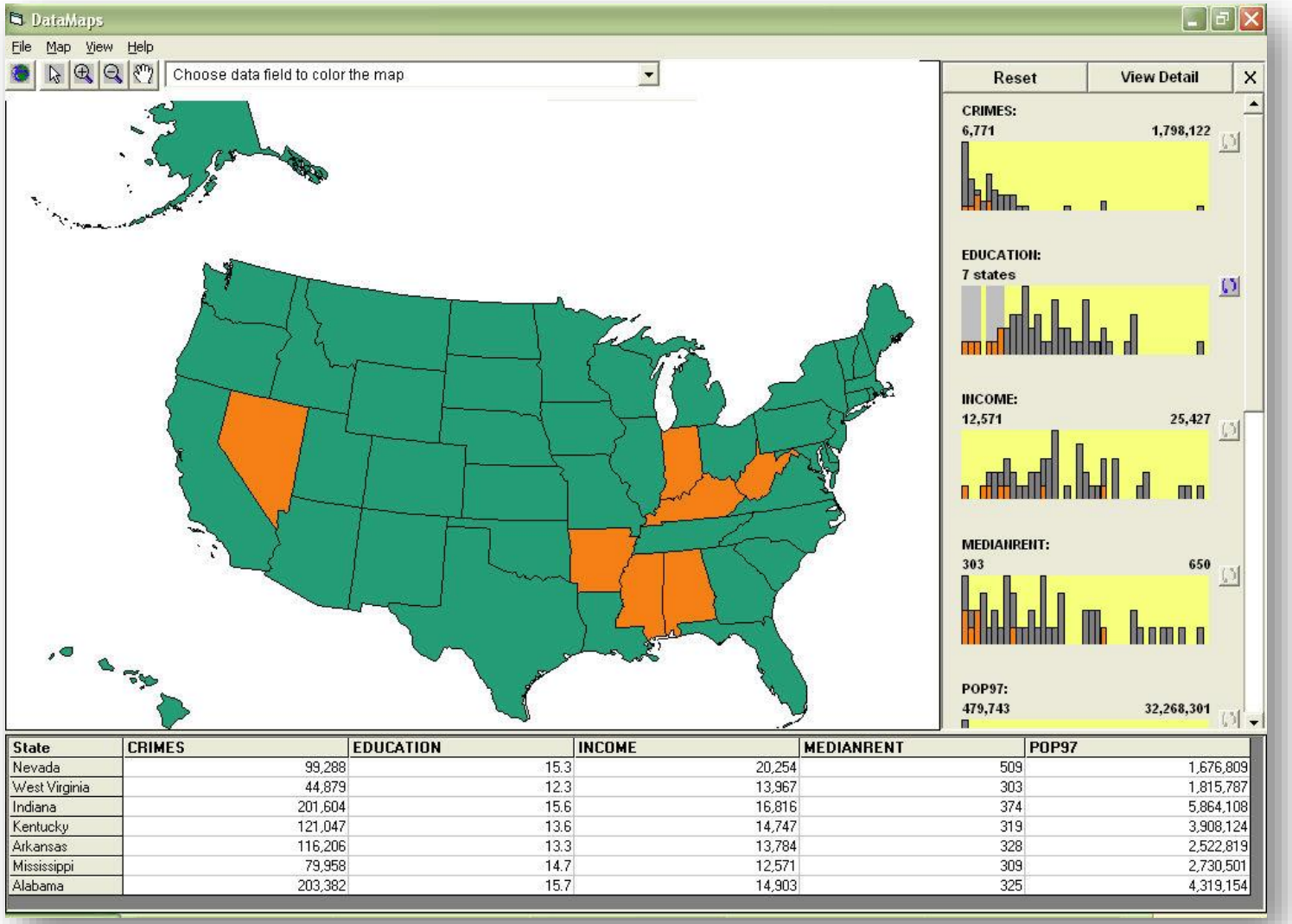
- Operations conjunctive (no ORs)
  - Do we care?
- Controls are global
  - Affect everything
- Controls fixed in advance
  - Possibly lots of real estate
- Hard to maintain interactivity with lots of data
  - Fancy data structures

# Filter: Data in controls

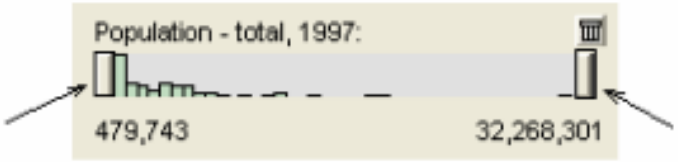



Scented Widgets, Wesley Willett, Jeffrey Heer, and Maneesh Agrawala , TCVG ‘07

# Filter: DataMaps (an alternative)




| State | CRIMES | EDUCATION | INCOME | MEDIANRENT | POP97 |
|---|---|---|---|---|---|
| Nevada | 99,288 | 15.3 | 20,254 | 509 | 1,676,809 |
| West Virginia | 44,879 | 12.3 | 13,967 | 303 | 1,815,787 |
| Indiana | 201,604 | 15.6 | 16,816 | 374 | 5,864,108 |
| Kentucky | 121,047 | 13.6 | 14,747 | 319 | 3,908,124 |
| Arkansas | 116,206 | 13.3 | 13,784 | 328 | 2,522,819 |
| Mississippi | 79,958 | 14.7 | 12,571 | 309 | 2,730,501 |
| Alabama | 203,382 | 15.7 | 14,903 | 325 | 4,319,154 |




DataMaps, VA Tech, https://web.archive.org/web/20031010001417/http://infovis.cs.vt.edu/census/Datamaps.htm

# Filter: Brushing Histograms

- Data values in histograms can be clicked on and selected (controls regions)
- Items selected in histogram cause corresponding  item(s) to be highlighted in main view

# Group Question

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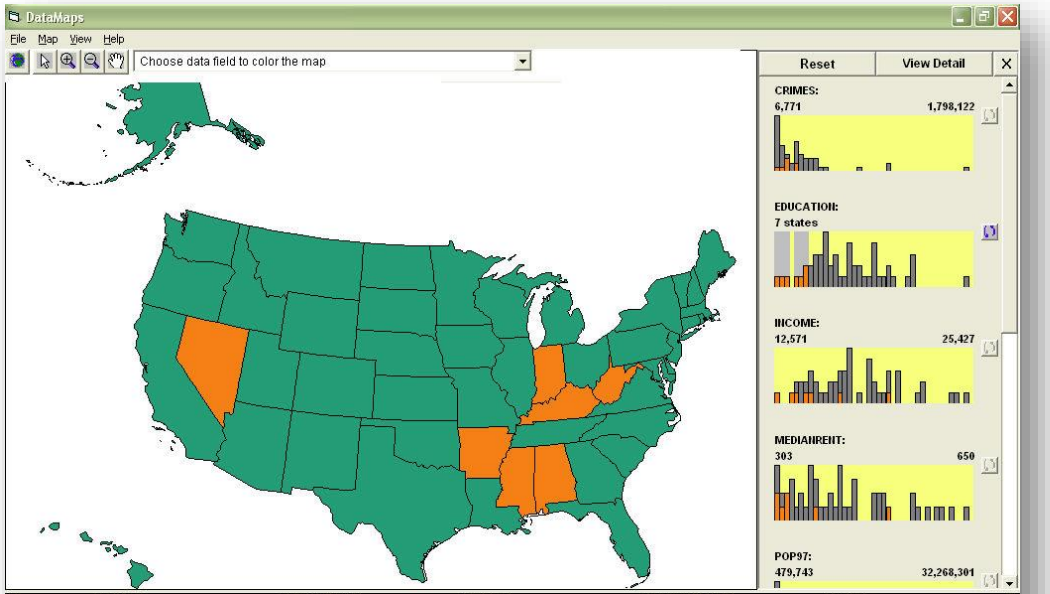
- Where do you think Brushing Histograms (DataMaps), will do better than Dynamic Queries? (and vice versa)

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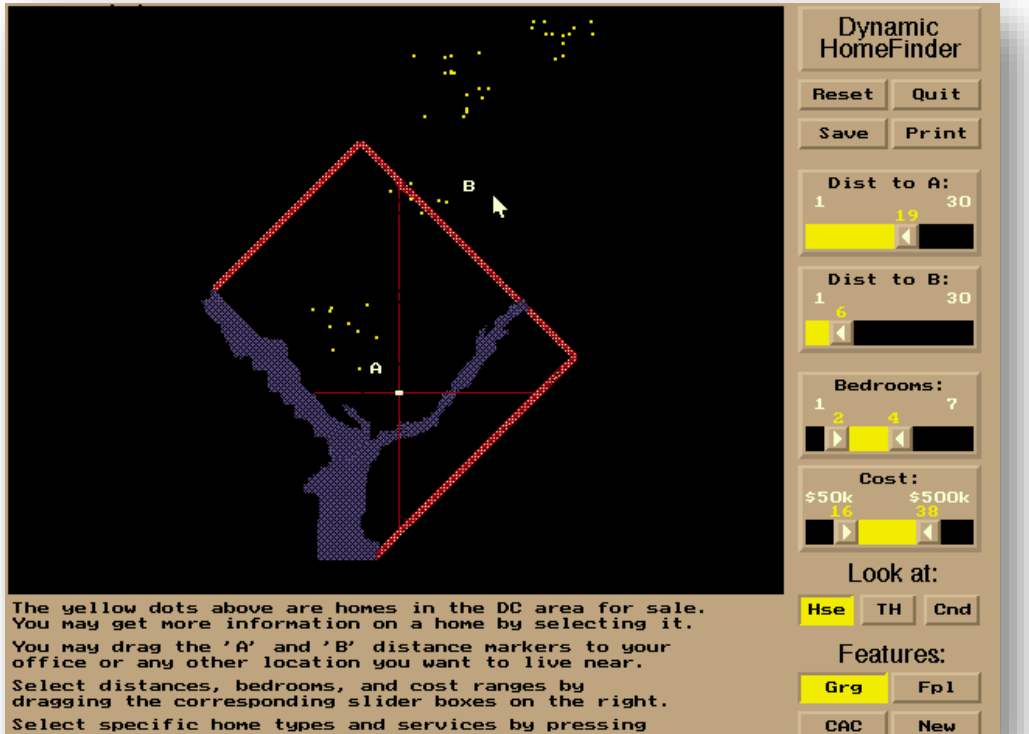


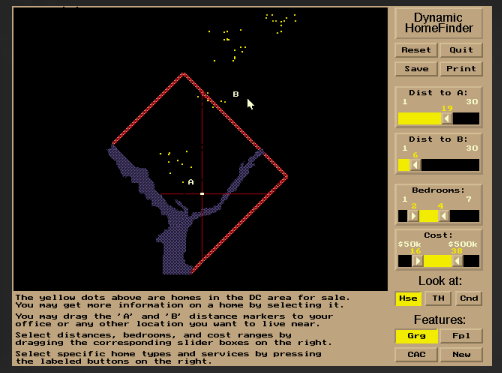
# Filter: DQ vs BH

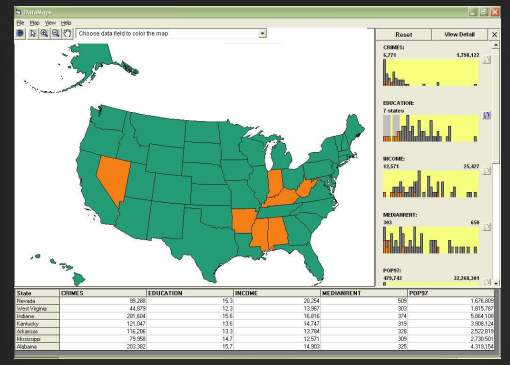
- Study on census data
- Different tasks with both methods
  - How many states with pop between x and y in 1970
  - Given 3 states, what's the lowest median?
  - …

Li & North, InfoVis'03

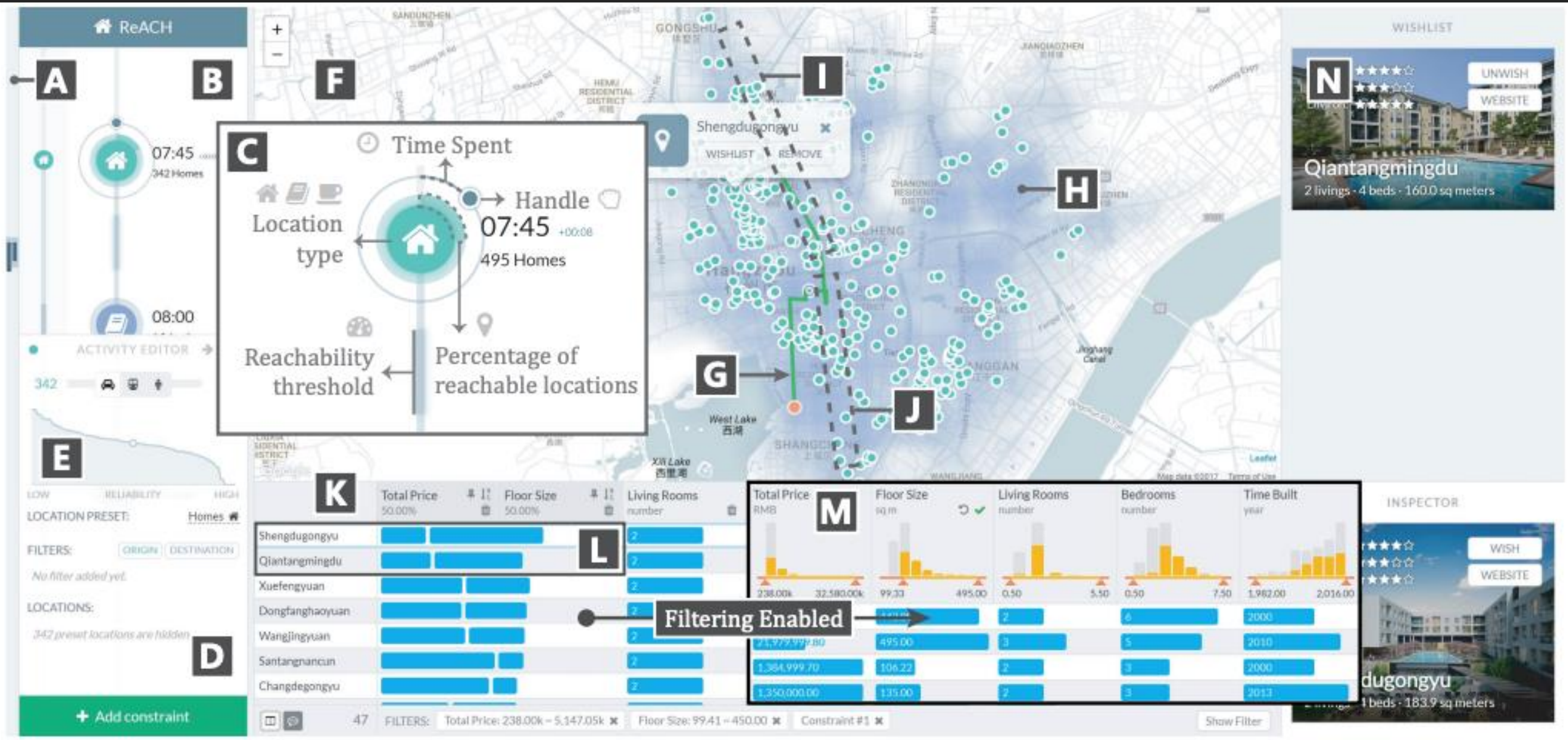
# Filter: DQ vs BH

- Fundamental differences (DQ+)
  - DQ filters unwanted data out
  - DQ does single range query
  - DQ users interact with the query
- Fundamental differences (BH+)
  - BH highlights data of interest
  - BH allows multiple ranges
  - BH users interact with the data



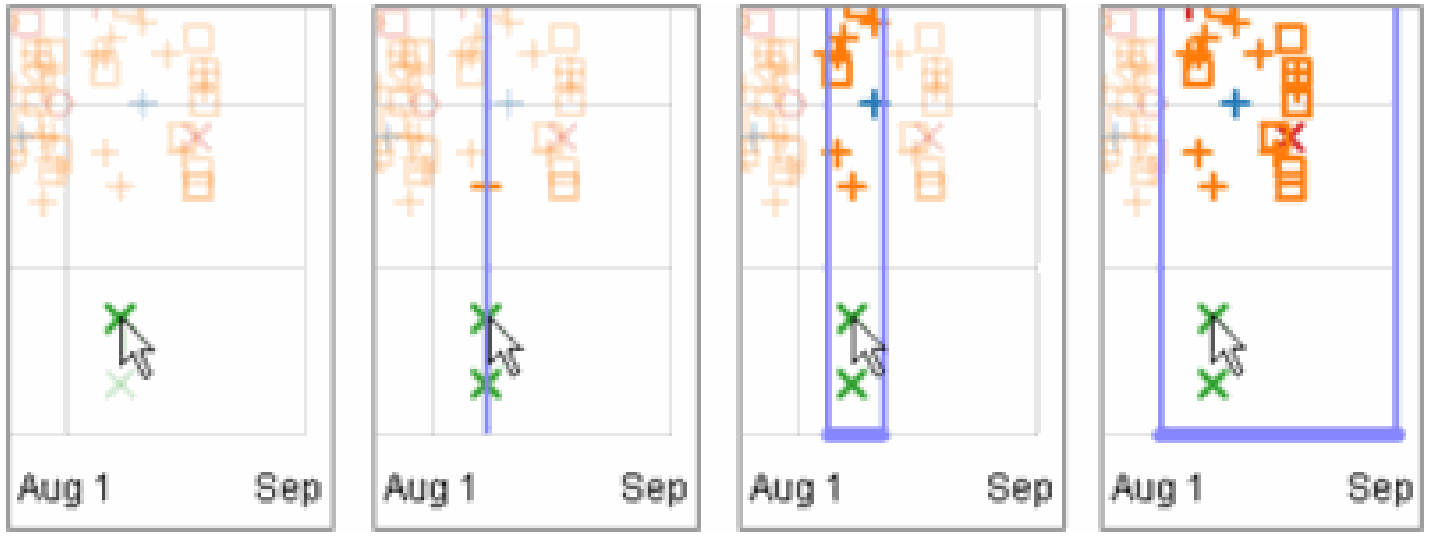



Li & North, InfoVis'03




HomeFinder Revisted, CHI'18, Weng et al.

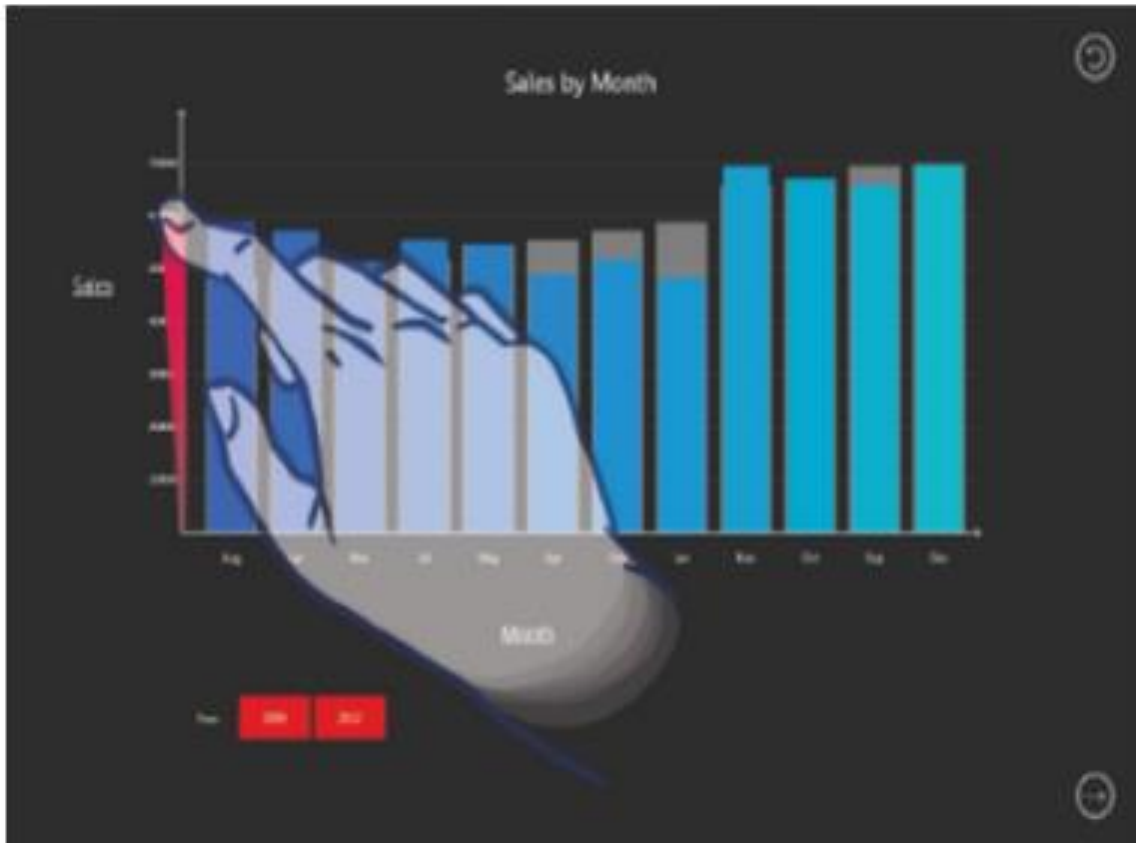
# Filter: More like this (Generalized Selection)




Jeffrey Heer, Maneesh Agrawala, Wesley Willett, CHI'08
http://vis.berkeley.edu/papers/generalized_selection/

# New ways of interacting (not just mouse)

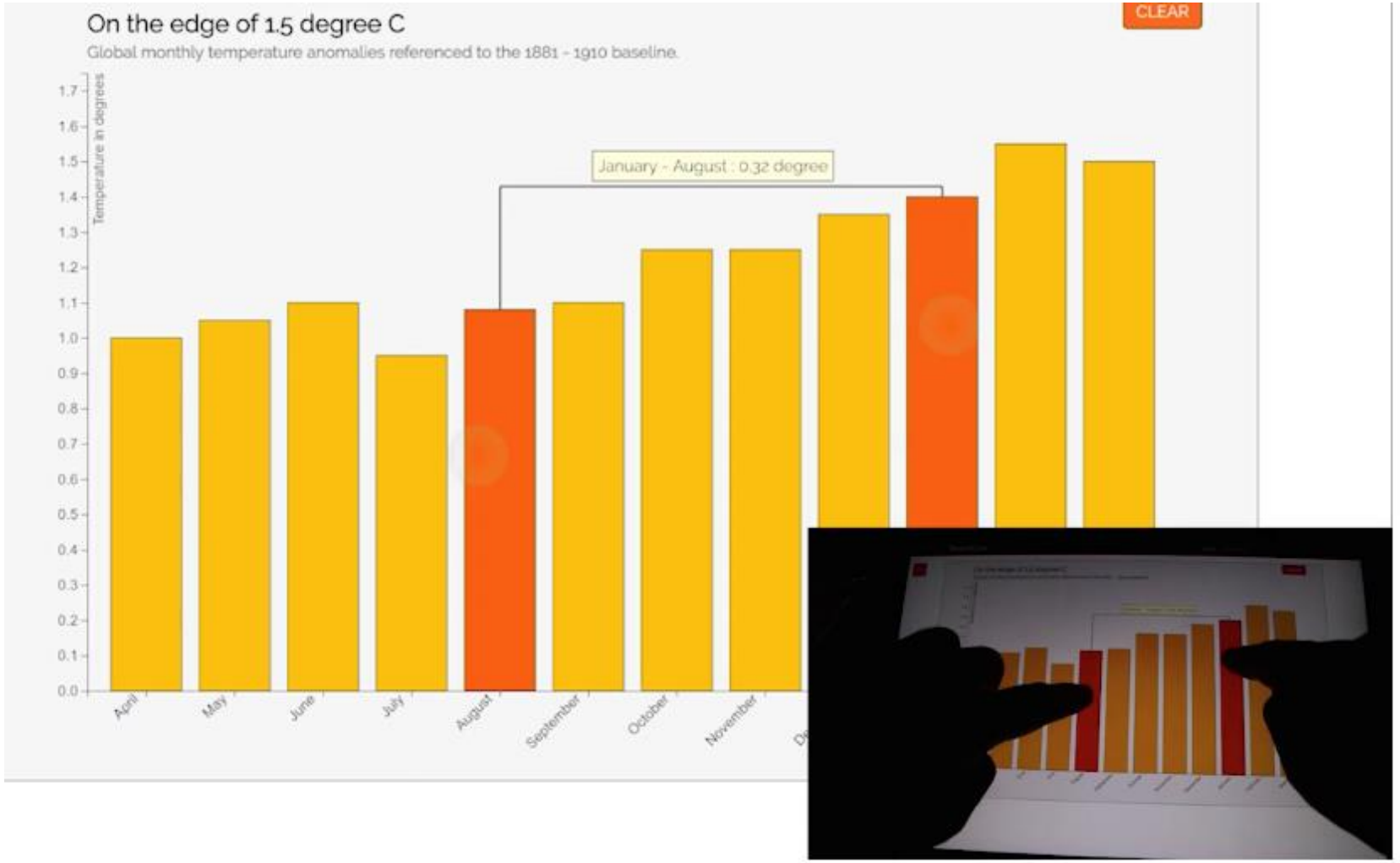
# TouchViz




Drucker et al., 2013

https://www.microsoft.com/en-us/research/video/touchviz-a-case-study-comparing-two-interfaces-for-data-analytics-on-tablets-2/

# Smartcues




Subramonyam, 2018

# 7 Categories

- Select
- Explore
- Reconfigure
- Encode
- Abstract/Elaborate
- Connect
- Filter

# Summary

- Interaction key for lots of infovis applications
- Static representations don’t scale, aren’t easy to explore, etc.
- Multiple views amplify importance of interactivity
- Interaction facilitates dialog between user and visualization system