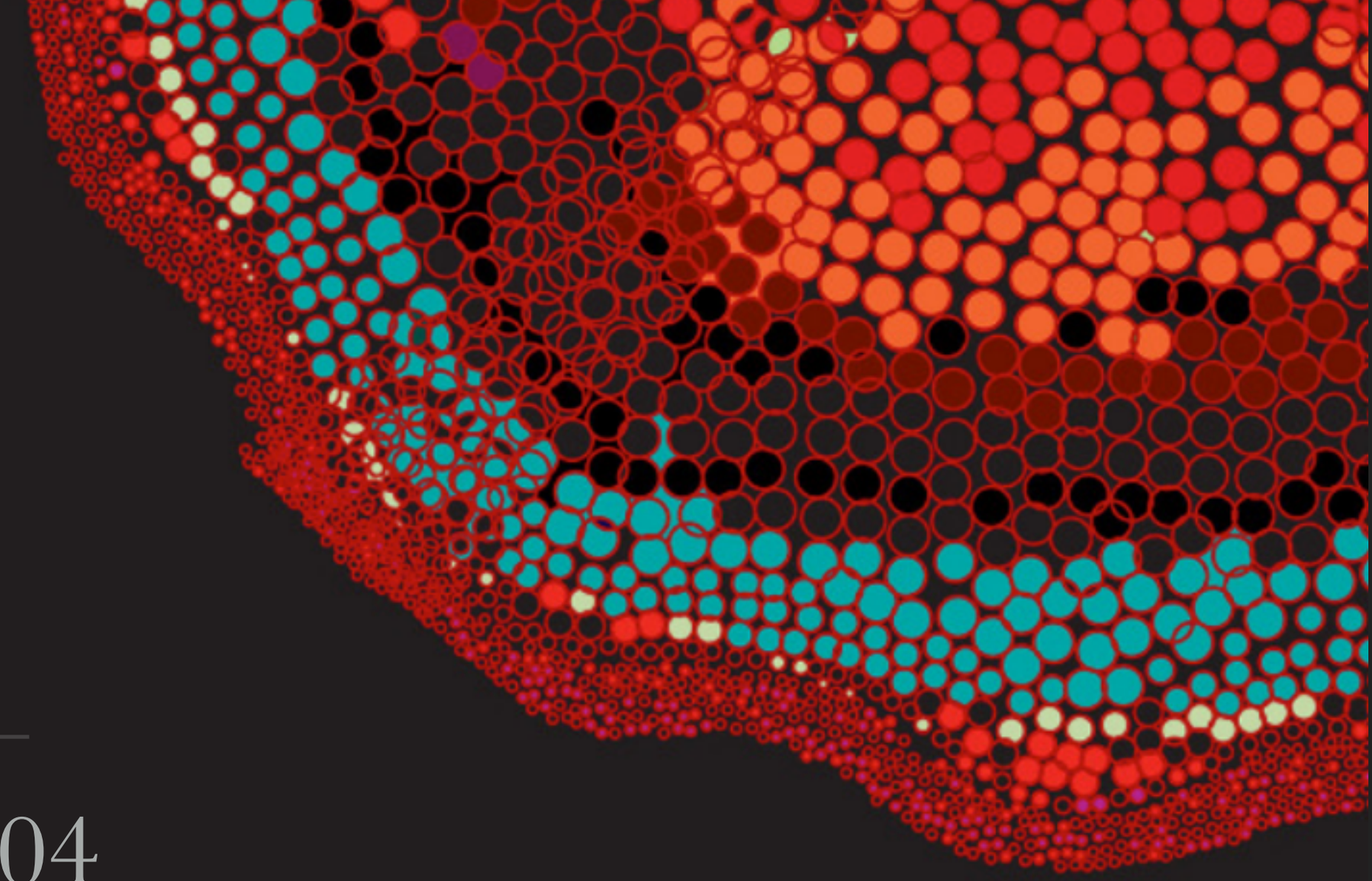


LECTURE 04

Interactive Data Visualizations

The Problem: Too Much Data

- Displays are getting smaller (smart phones)
- Datasets are getting larger
- Our cognitive abilities are limited
- Analysis is a process, often iterative

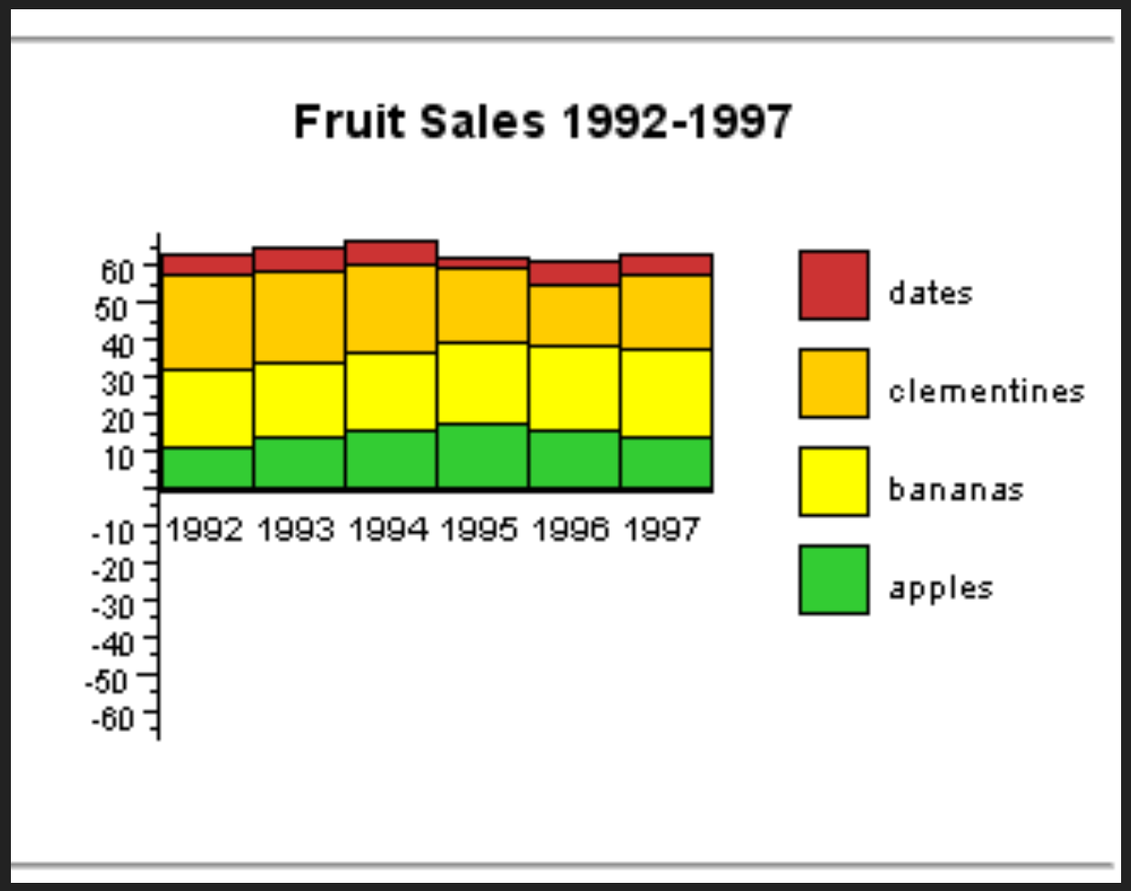
Solution: Interaction Techniques

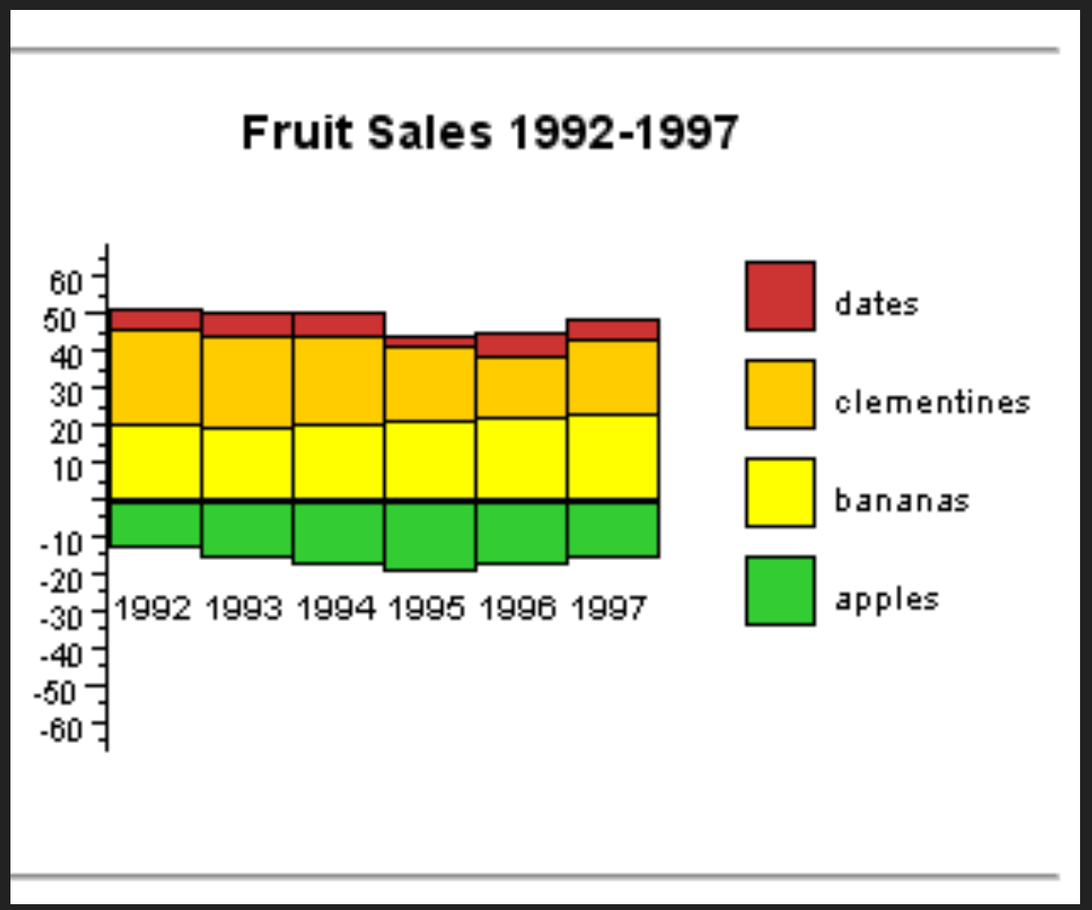
- Interaction techniques allow the user to work with a much larger dataset than possible to be presented on the screen at once.
- By drilling down, animating, adjusting the data model and more, the user can explore the data space.
- Interaction also enables removing data from the display, By slicing, filtering, zooming, and querying the data, the user can narrow and search the information

Schneiderman's Mantra

- Overview first, zoom and filter, then details on demand

Interactive Stacked Histogram





http://www.meandeviation.com/dancing-histograms/hist.html

Interaction Operators

Inbox (7) - joel.lani | Google Calendar | TextArc: Read Alic | Google Image Res | Visualizing cultural | Picasa Web Album | Taylor & Francis O | Data - Gapminder | ben schneiderman | ynet אחרונות | haifa - Google Ma | fisheyemenu-dem

https://maps.google.com

GCalendar | GReader | Gmail | NBA | NBA | Weather | del.icio.us | post to del.icio.us | ynet | ACM DL: Proceedings | Morfix | Post to CiteULike | Google Scholar | Other bookmarks

+Joel | Search | Images | Maps | Play | YouTube | News | Gmail | Documents | Calendar | More

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Haifa
Israel

Directions | Search nearby | Save to map | more

Explore this area »

Photos

Places
University of Haifa
Lev HaMifratz Mall
Grand Canyon

Maps Labs - Help

Satellite | Traffic

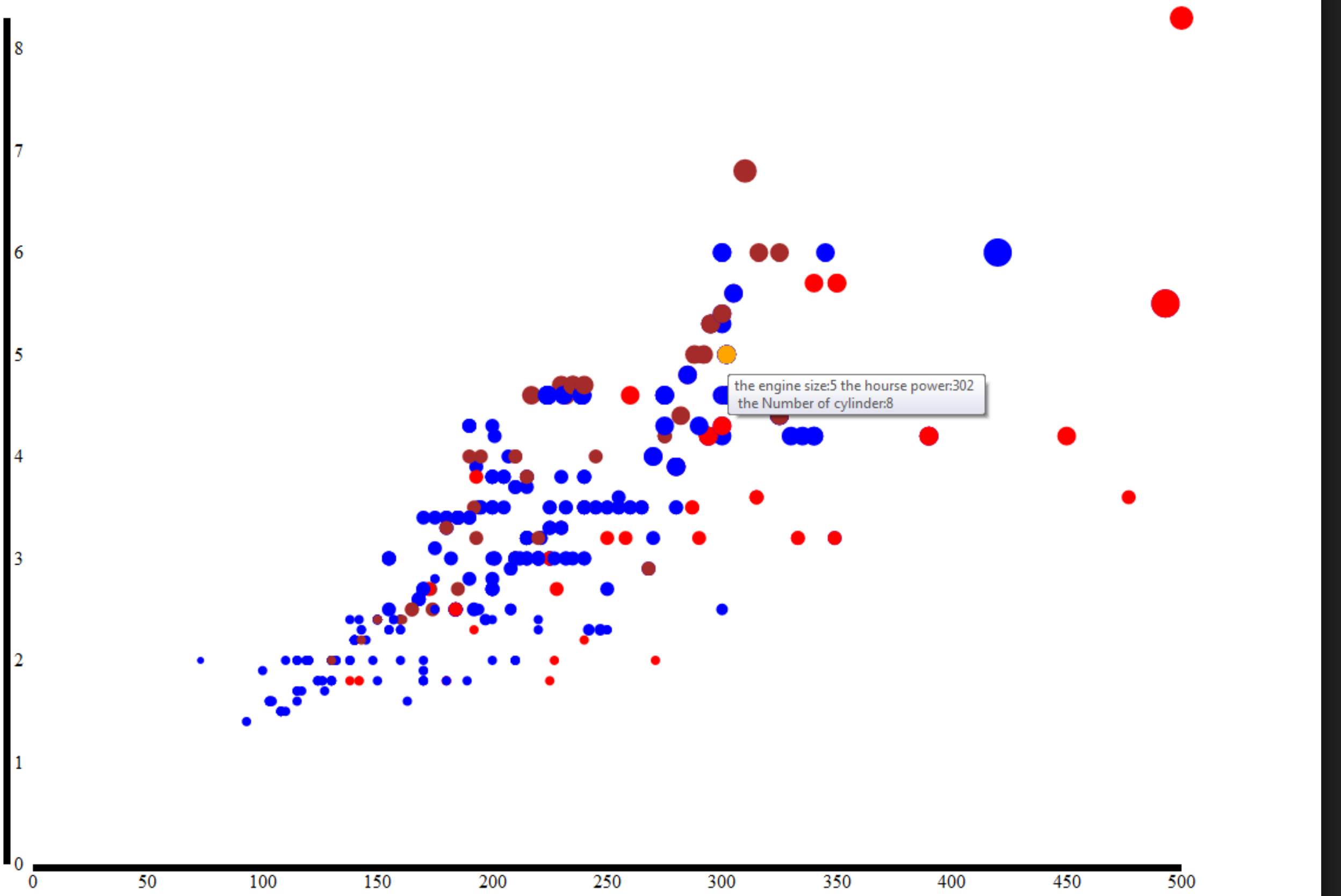
Mediterranean Sea | Bat Galim | Allenbi Interchange | Haifa | Kiryat Eli'ezer | Military Cemetery | Kiryat Eliyahu | San Francisco Observation Point | Ein HaYam | Ramat Shaul | Kiryat Shprintsak | Alex Garden | HaMoshava HaGermanit | The Lower City | Kiryat Rabin | Wadi Nisnas | Sha'ar HaAliya | Ramat HaTishbi | Mt. Karmel North | Herzliya | Ramat Haviv | Neve David | Wadi Salib | Hadar HaKarmel | Nahala | Kababir | Sede Yehoshua Cemetery (Kfar Samir) | Merkaz HaKarmel | Ge'ula | Ramat Hadar | al-Khalisa | Kfar Samir | Karmeliya | Haifa Mahane David Cemetery | Yitshak Moda'i Garden | Gdud 21 Interchange | Vardiya | Ruppin Interchange | Shambur | Romema | HaBanim Grove | Yizre'eliya | Nave Sha'anan | Neve Yosef | Kishon Junction | HaKishon Park | HaTehni Interchange (under construction) | Netivei HaMifratz | Derech Yulius Simon | Derech Moshe Dayan | Tuvim

2000 ft
1 km

Navigation Operators

- Searching a subset of data to be viewed
- Refining the level of detail
- In a 3D or 2D plane, this means changing the camera orientation, Pan + zoom
- In multi-resolution visualizations this means drilling down or up hierarchical representations of the data

Navigate without loosing Context!


8
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100
150
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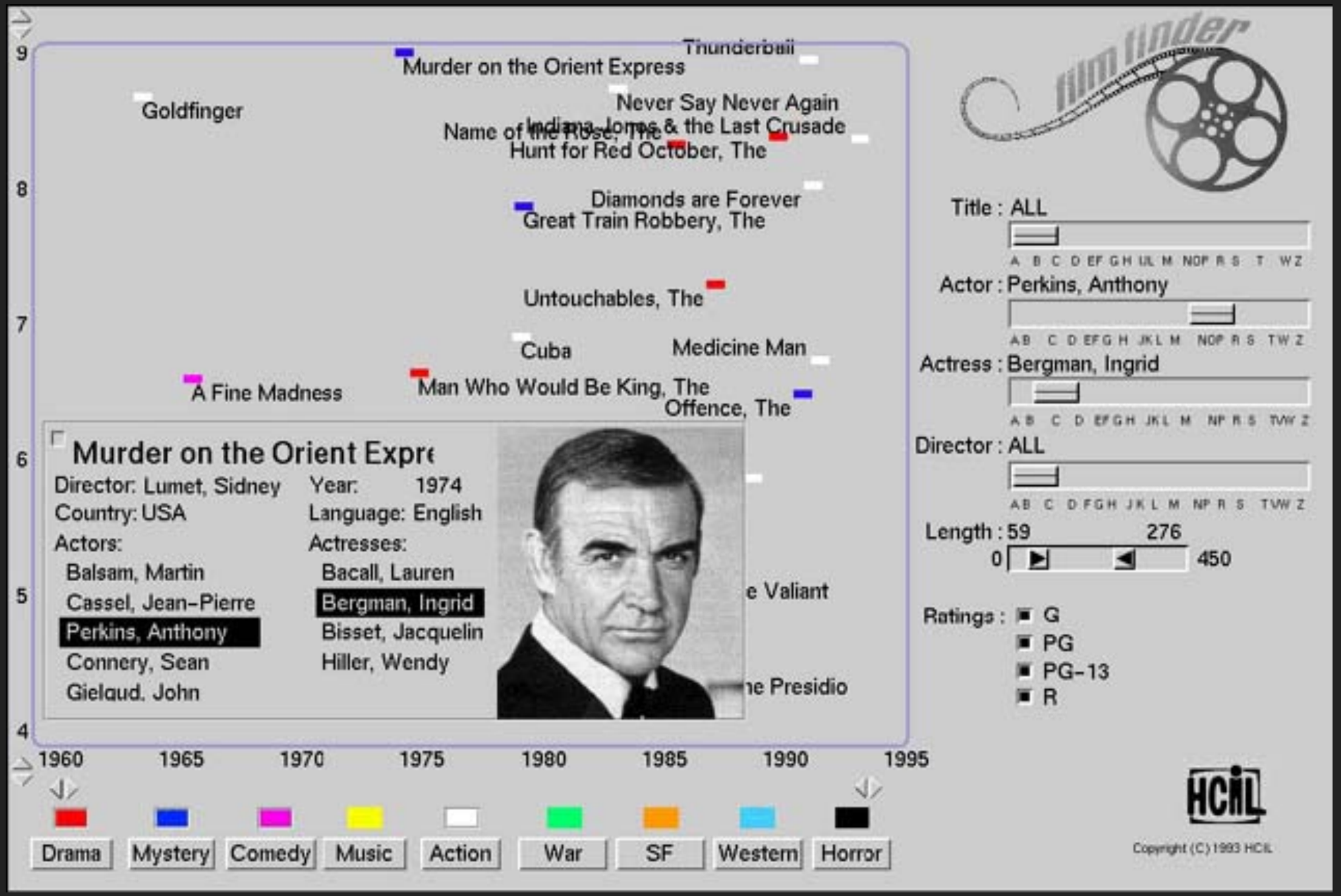
250
300
350
400
450
500
the engine size:5 the hourse power:302
the Number of cylinder:8

Selection Operators

- Isolating a subset of the display component to be subjected to some other operation (highlighting, deleting, moving)
- Many techniques for selection
  - Click on entity
  - Paint over a selection of entities
  - Bounding box, lassoing
  - Matching input or constraints

Should a new selection replace or supplement a previous selection?


9
8
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Thunderball
Murder on the Orient Express
Goldfinger
Never Say Never Again
Indiana Jones & the Last Crusade
Name of the Rose, The
Hunt for Red October, The
Diamonds are Forever
Great Train Robbery, The
Untouchables, The
Cuba
Medicine Man
A Fine Madness
Man Who Would Be King, The
Offence, The
Murder on the Orient Expre
Director: Lumet, Sidney
Year: 1974
Country: USA
Language: English
Actors:
Actresses:
Balsam, Martin
Bacall, Lauren
Cassel, Jean-Pierre
Bergman, Ingrid
Perkins, Anthony
Bisset, Jacquelin
Connery, Sean
Hiller, Wendy
Gielgud, John
e Valiant
ne Presidio
1960
1965
1970
1975
1980
1985
1990
1995
Drama
Mystery
Comedy
Music
Action
War
SF
Western
Horror
film finder
Title : ALL
A B C D EF G H IJL M NOP R S T WZ
Actor : Perkins, Anthony
AB C D EFG H JKL M NOP R S TW Z
Actress : Bergman, Ingrid
A B C D EF G H JK L M NP R S TW Z
Director : ALL
AB C D FGH JK L M NP R S TW Z
Length : 59 276
0 450
Ratings :
G
PG
PG-13
R
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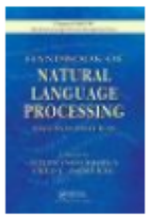
1. **The handbook of computational linguistics and natural language processing**
   Published: 2010.
   Format: Book
   D.H. Hill Library
   Stacks (5th floor) P98 .H346 2010 Available
   Add to List

2. **Handbook of natural language processing [electronic resource]**
   Published: c2010.
   Format: eBook
   Online
   View resource online (NCSU only)
   Add to List



3. **Natural Language Processing and Information Systems [electronic resource]: 15th International Conference on Applicat...**
   Author: Hopfe, Christina J.
   Published: June 2010
   Format: eBook
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   View resource online (NCSU only) - Springer-Verlag
   View resource online (NCSU only) - Springer-Verlag
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4. **Introduction to Chinese natural language processing [electronic resource]**
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   Online
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5. **Introduction to Chinese natural language processing [electronic resource]**
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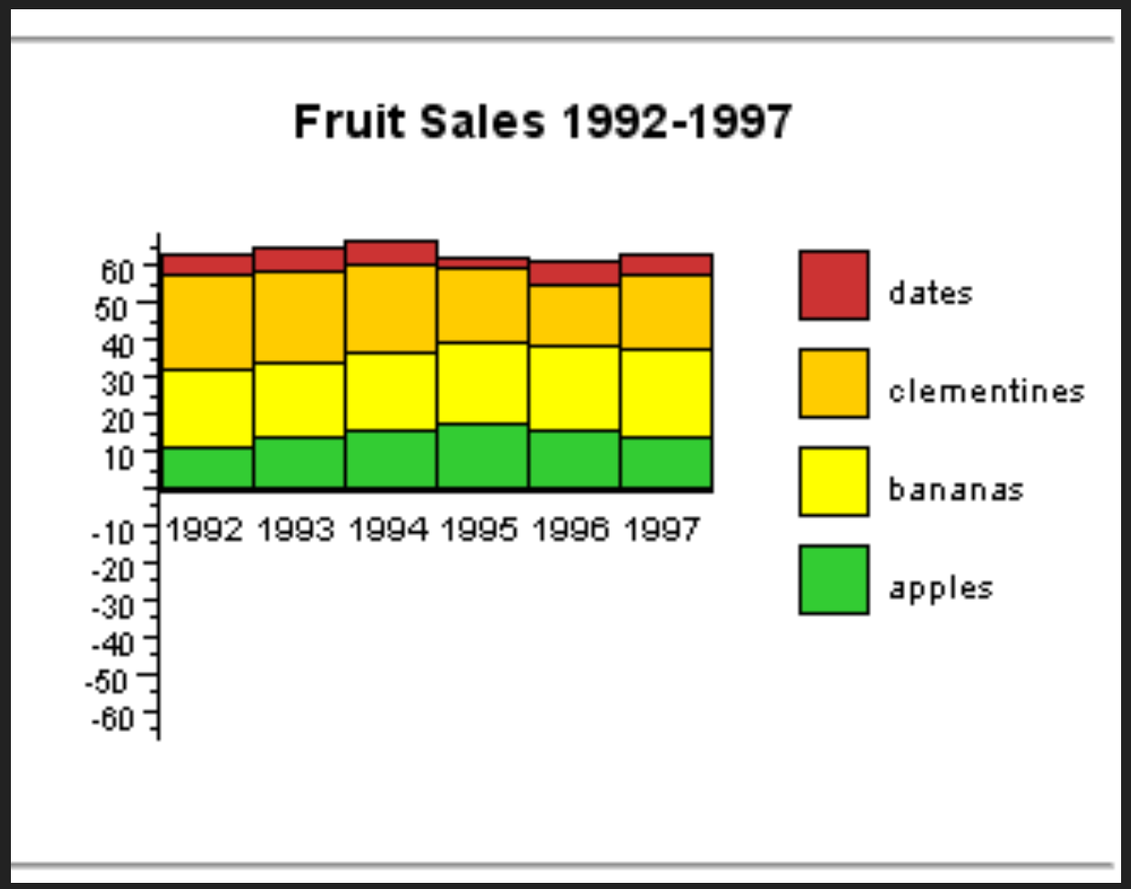
6. **Natural language processing and information systems [electronic resource] : 14th international conference on applica...**
   Author: International Conference on Applications of Natural Language to Information Systems (14th : 2009 : Saarbrücken, Germany)
   Published: c2010.
   Format: eBook
   Online
   urce online (NCSU only) - Springer-Verlag
   Add to List

Filtering Operators

- Reduce the volume of data by setting constraints
- Filtering is often indirect (vs. selection which is direct)


Fruit Sales 1992-1997
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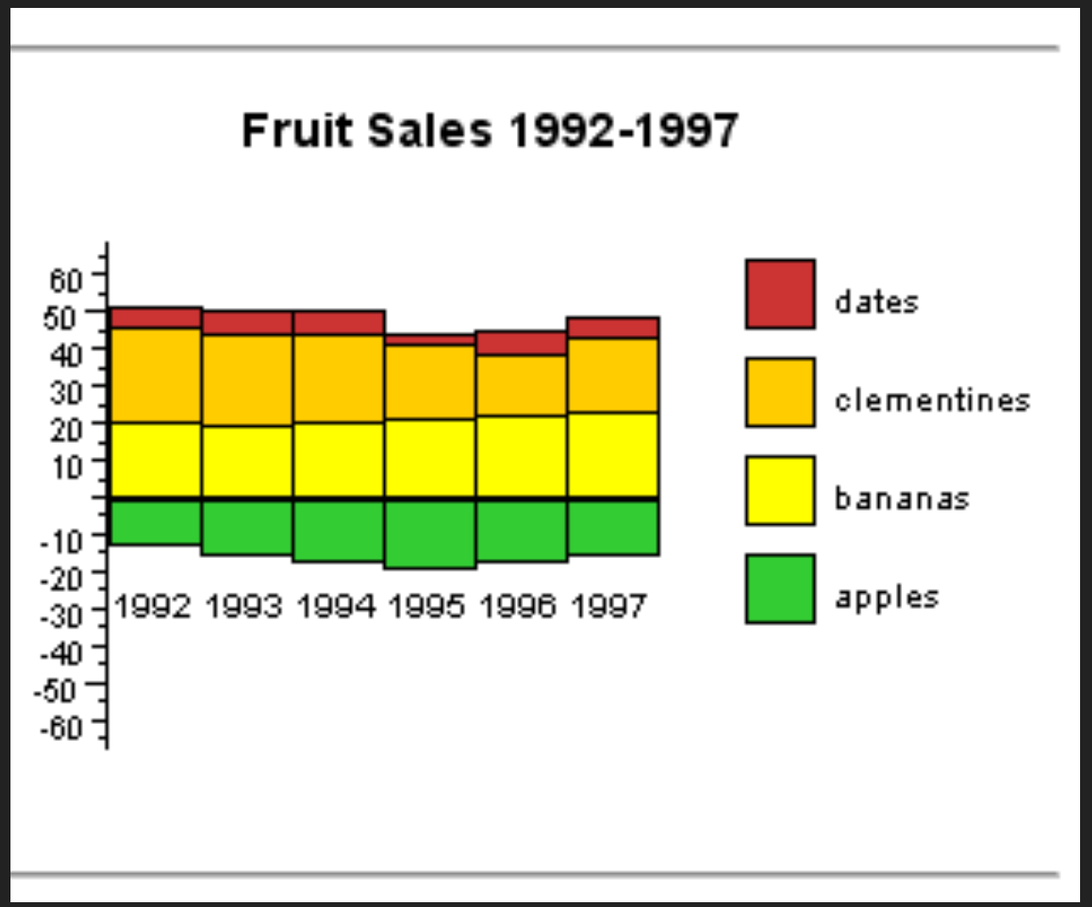
-50
-60
1992 1993 1994 1995 1996 1997
dates
clementines
bananas
apples


Fruit Sales 1992-1997
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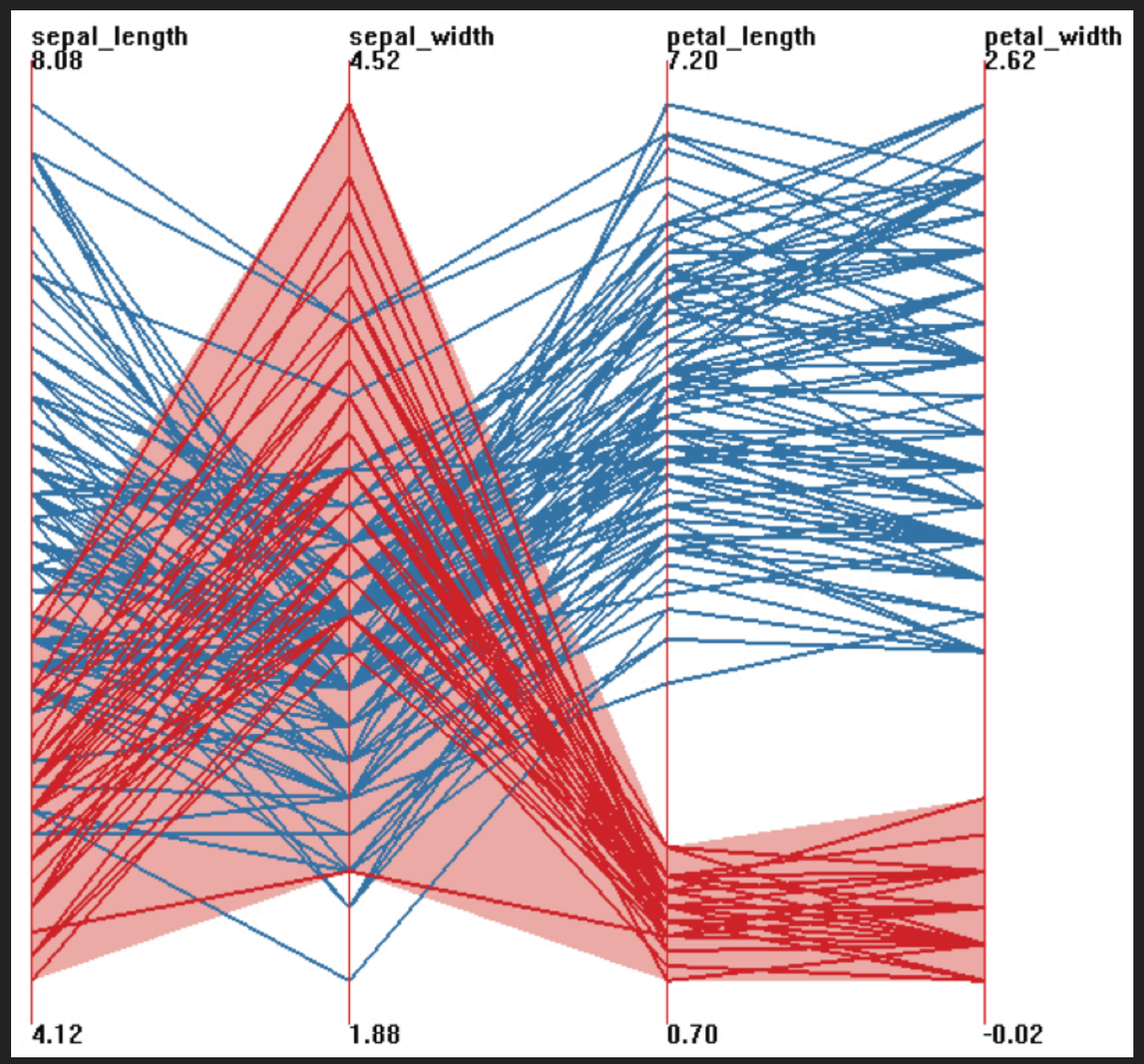
-50
-60
1992 1993 1994 1995 1996 1997
dates
clementines
bananas
apples

Reconfiguring Operators

- Reorganizing the data to cope with complexity or scale
- Often comes together with filtering
  - For example, sorting rows or columns in table visualizations.
- Change the dimensions of x- and y- coordinates

Encoding Operators

- Changing the type of visualization from one to another
- Modifying the color map, size or shape used
- Changing opacity, texture, line of fill style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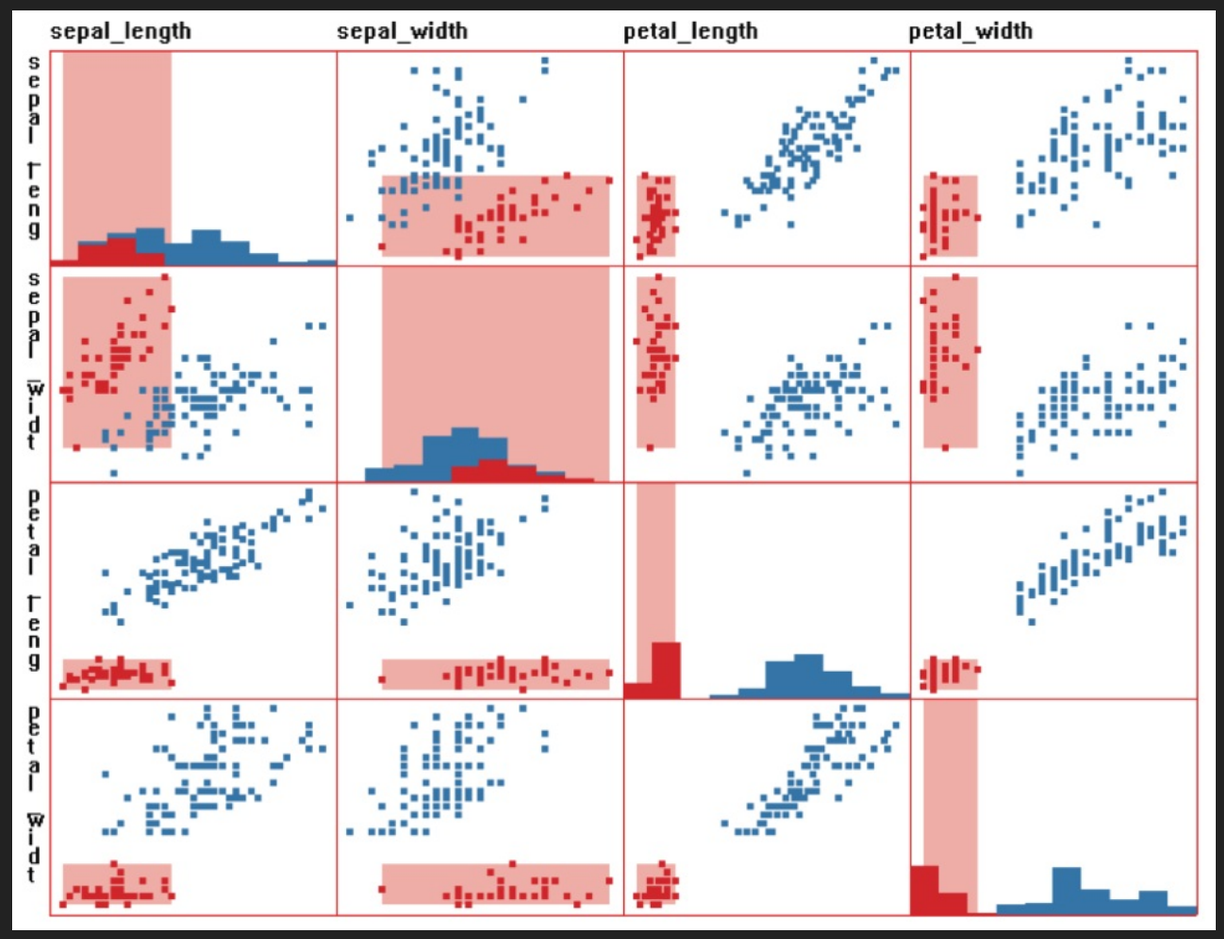
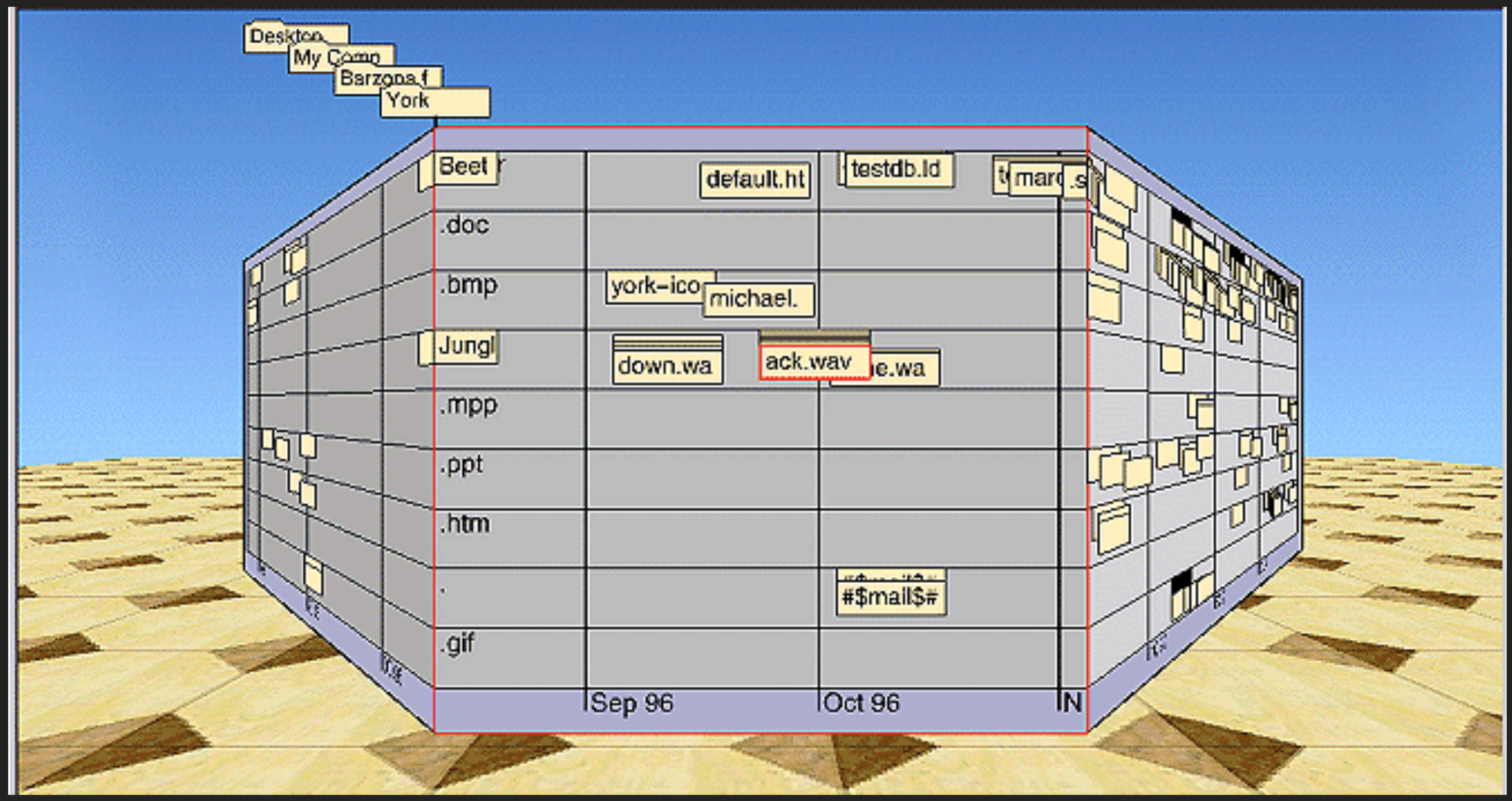
sepal_width
4.52
petal_length
7.20
petal_width
2.62
4.12
1.88
0.70
-0.02


sepal_length
sepal_width
petal_length
petal_width

Connection Operators

- linked selection: Selection often links selected data in one view to the corresponding data in other views.
- When the selection data is allowed to be interactively changed this is called brushing.
- Effective when we can only specify a certain constraint in a certain view (such as time constraint in a timeline).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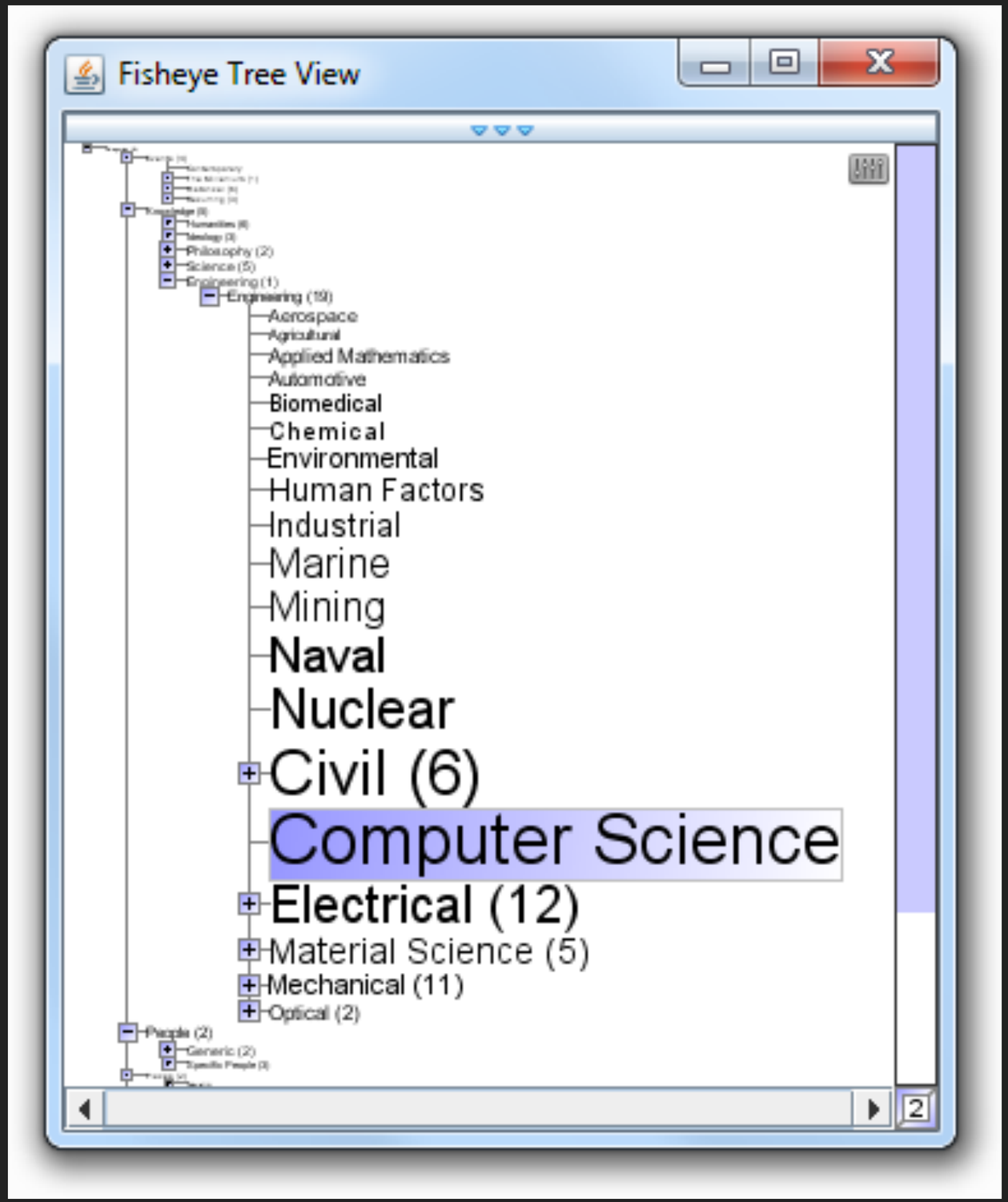
Fisheye Tree View
Philosophy (2)
Science (5)
Engineering (1)
Engineering (19)
Aerospace
Agricultural
Applied Mathematics
Automotive
Biomedical
Chemical
Environmental
Human Factors
Industrial
Marine
Mining
Naval
Nuclear
Civil (6)
Computer Science
Electrical (12)
Material Science (5)
Mechanical (11)
Optical (2)
2

Distortion Operators

- It is often desirable to focus in on a subset of the data to acquire details (elaboration)
- while reducing the level of details (abstraction) on the other part of the data.