Duration: 15 min

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A Task by Data Type Taxonomy for Information Visualizations

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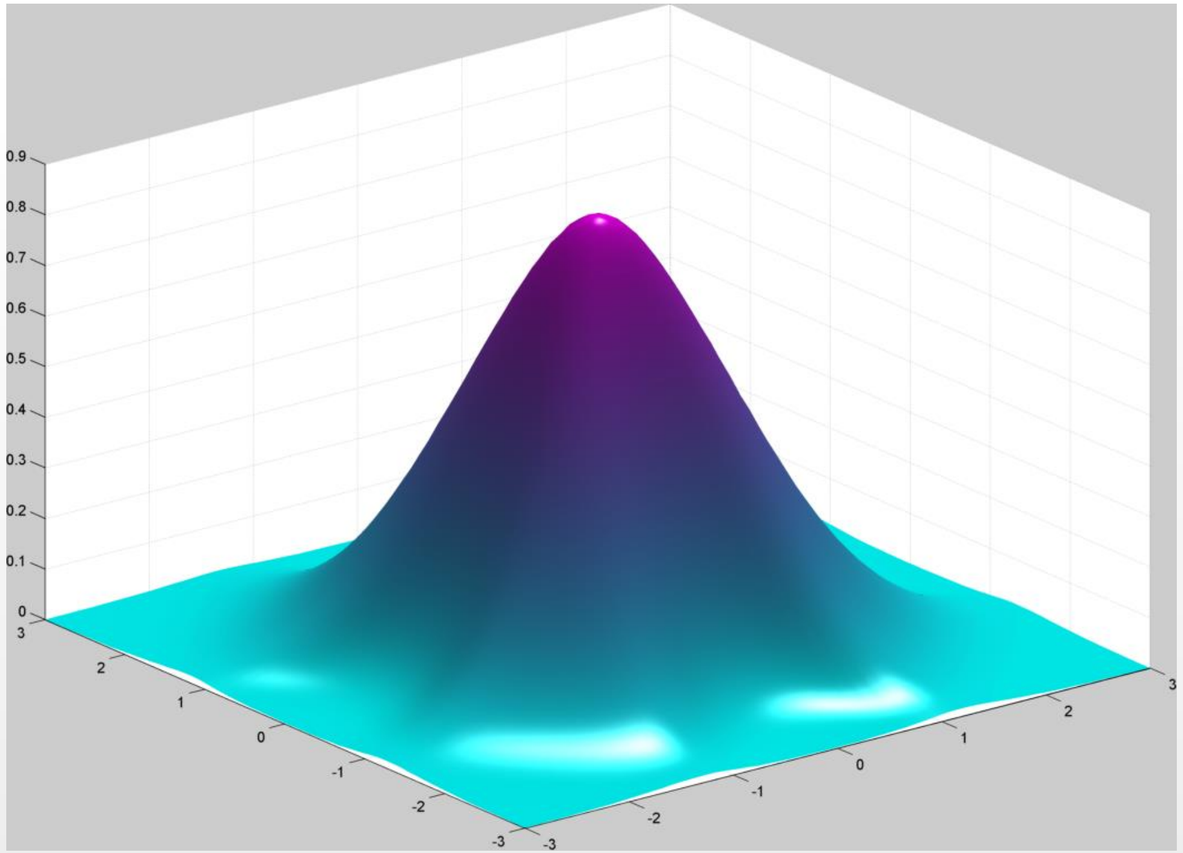
Polytech Nantes 12 November 2019



Out Lines

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Structure of our Presentation

- Journal & Author
- Structure of the Paper
- Summary of key points
  - Introduction
  - Visual Information Seeking Mantra
  - Task by Data Type Taxonomy
  - Advanced filtering
  - Summary
- Personal remarks

Publication Information

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Title:

The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations

Author:

Ben Shneiderman

Affiliation:

Professor, Computer Science, UMIACS

Publication:

Published in 1996 IEEE Symposium on Visual Languages, Boulder, Colorado, US.

About Author

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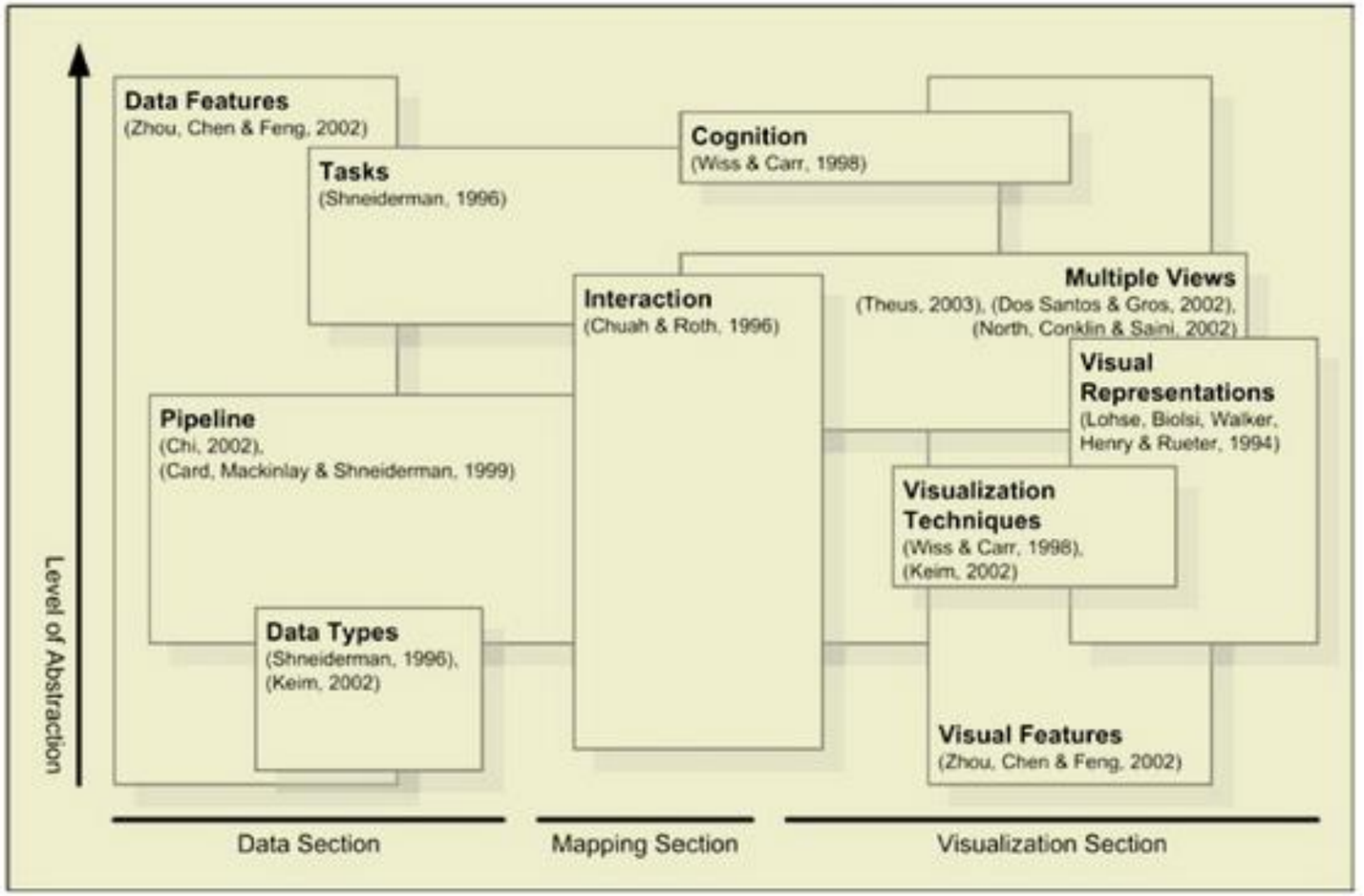
- Prof. Ben Shneiderman worked as Founding Director: Human Computer Interaction Lab (1983-2000)
- Professor: Computer Science, University of Maryland, USA
- Ph.D SUNY at Stony Brook 1973
- ACM SIGCHI Life time achievement award in 2001

Research Work

- Human Computer Interaction
- User Interface Design
- Information Visualization
- Social Media



As of November 2018, following are Prof. Ben Shneiderman's articles in Refereed Journals(174), Refereed Conferences(157), Unrefereed Publications(92) and Chapters in Books(29)

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This paper offers a task by data type taxonomy with seven data types (one-, two-, three-dimensional data, temporal and multi-dimensional data, and tree and network data) and seven tasks (Overview, Zoom, filter, details-on-demand, relate, history, and extracts).

Exploring information collections becomes increasingly difficult as the volume grows. Designers only figure out how to use and render a large number of high –resolution color screens information in a systematic and use controlled manner. In this paper author express his views that humans have a remarkable perceptual abilities to identify the image, colors, sizes, shape, movement and textures.

2. Visual Information Seeking Mantra

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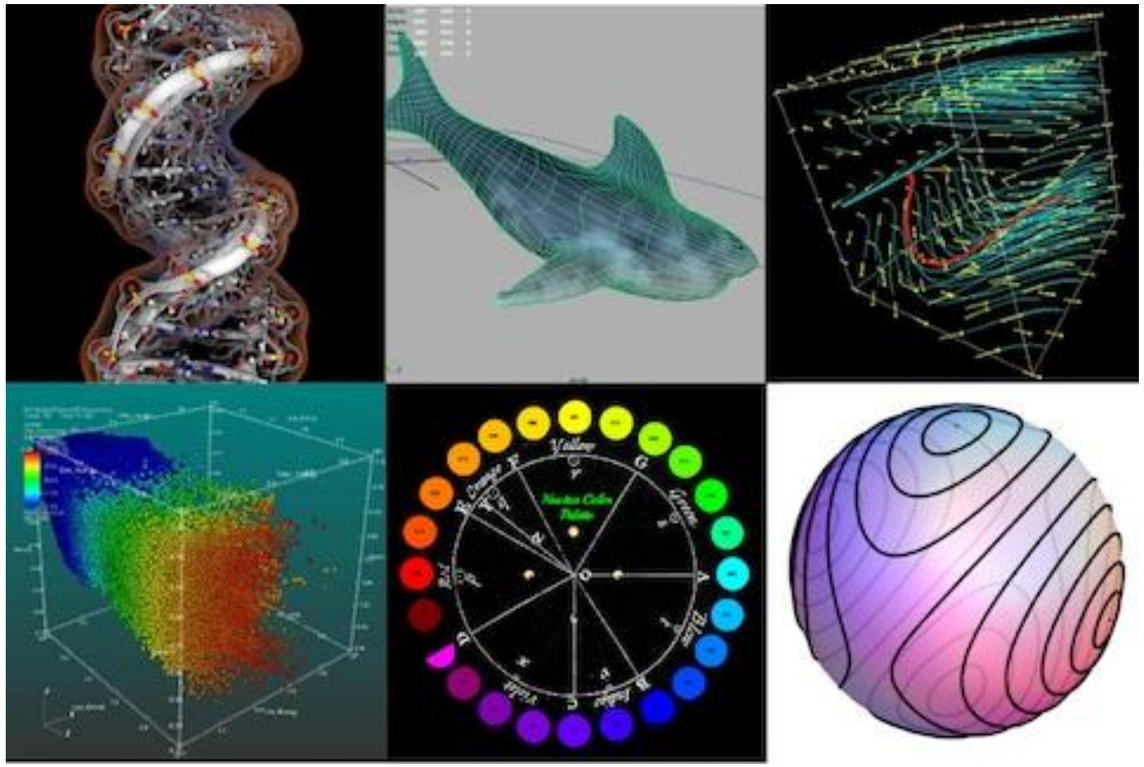
The success of direct-manipulation interfaces is indicative of the power of using computers in a more visual or graphic manner. **Visual displays: It** becomes even more attractive to provide orientation or context, to enable selection of regions, and to provide dynamic feedback for identifying changes

2(1). Scientific Visualization

It has power to make atomic, cosmic and common 3D phenomena(like heat conductions in engines, airflow over wings)



2(2). Abstract Information Visualization

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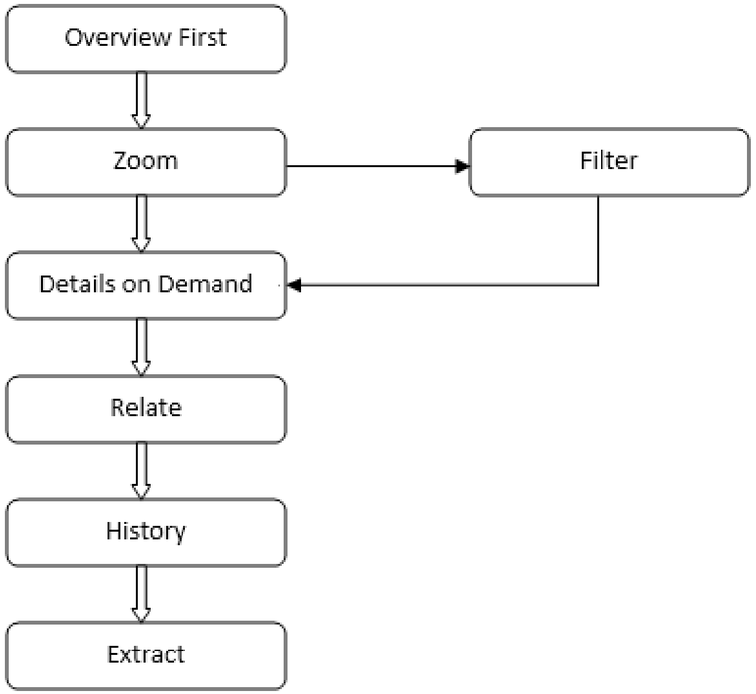
It has power to reveal patterns, clusters, gaps or outliers in statically data, stock market trades, computer directories and document collections.

2(3). Visual Information Seeking Mantra



Seven Tasks for all Data Types

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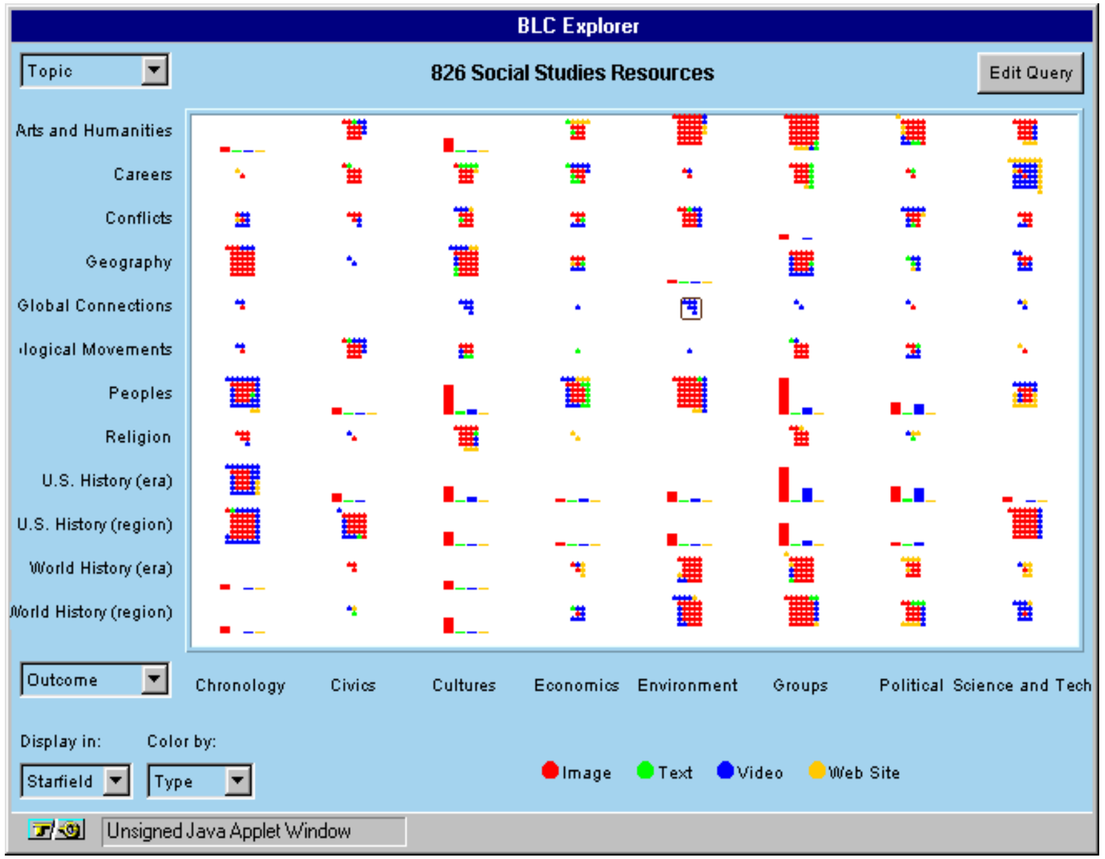
(1). Overview

- Gain overview of entire collection
- It includes zoomed out views.
- It contains a movable field of view box to control the content of detail view
- Use fish eye strategy.

(2). Zoom

- Zoom in on items of interest.
- Use starfield displays, 2 dimension scatter plots to structure result sets and



Seven Tasks for all Data Types

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(3). Filter

- Filter out uninteresting items
- Sliders, buttons or other control widgets.

(4). Details-on Demand

- Select an item or group and get details when needed.
- The usual approach is to simply click on an item to get a pop-up window with values of each of the attributes

(5). Relate

- View relationship among items
- Example FilmFinder (Ahlberg and Shneiderman, 1994).

Seven Tasks for all Data Types

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(6). History

- Keep a history of actions to support Undo, replay and progressive refinement
- It keeps sequence of searches.

(7). Extract

- Allow extraction of sub collections and of query parameters.
- Retrieve desire information then store it for further use in file

Model Demo

- file:///C:/Users/Sunil/Desktop/model/html/horizontal/map-demo.html
- file:///C:/Users/Sunil/Desktop/model/html/horizontal/pie-chart-demo.html

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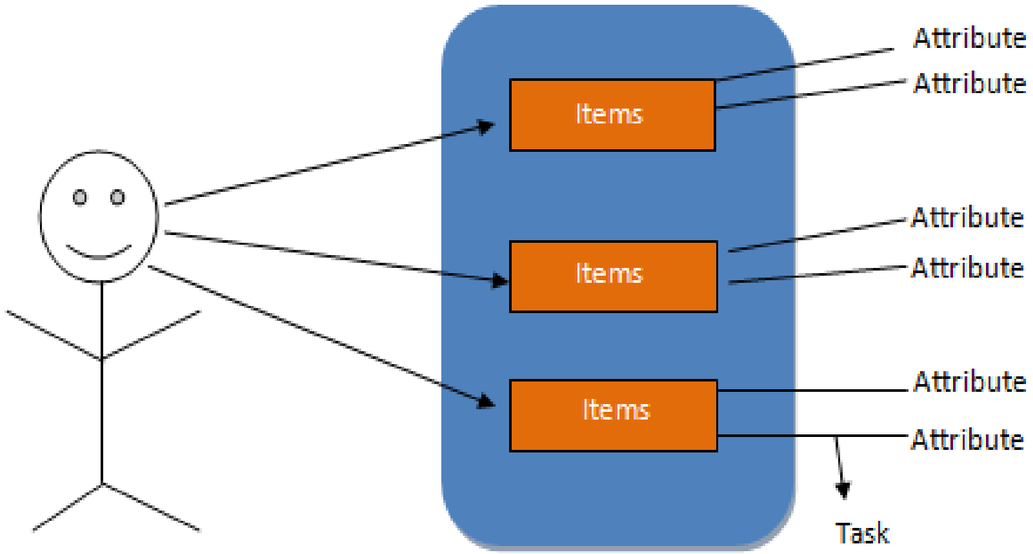
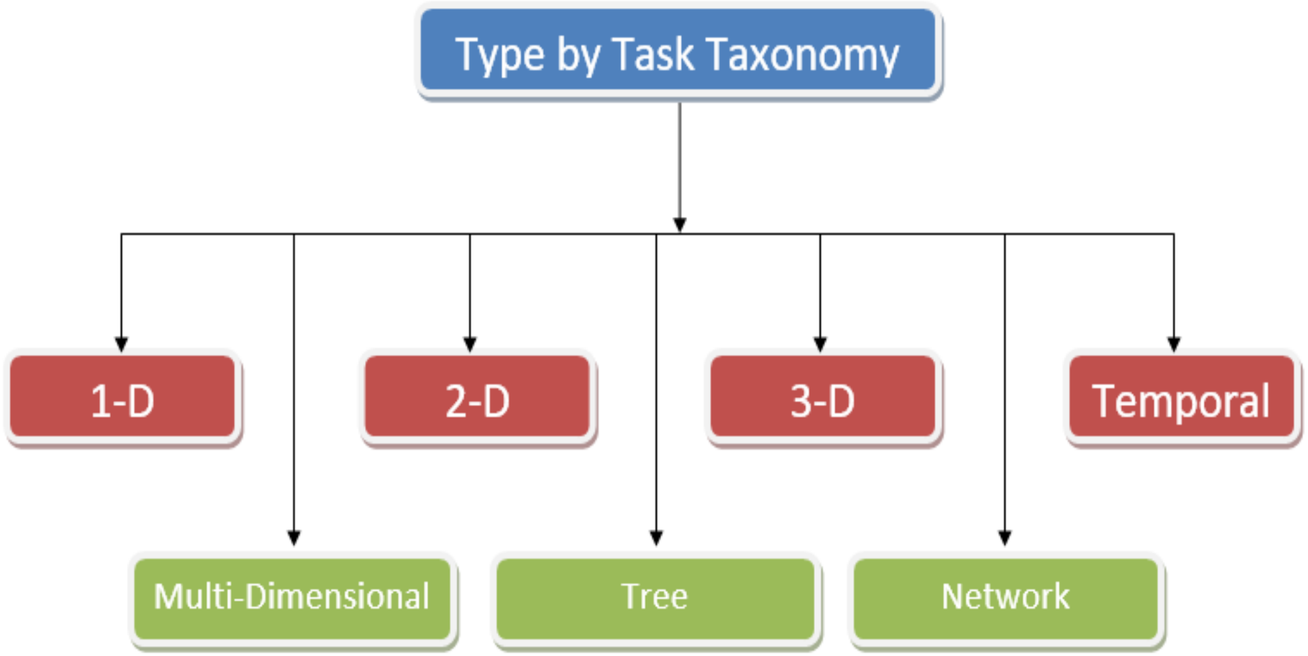
Type by Task Taxonomy (TTT): Data Type & Task (1996: Shneiderman)





1-Dimensional Data Type (Linear Data Type)

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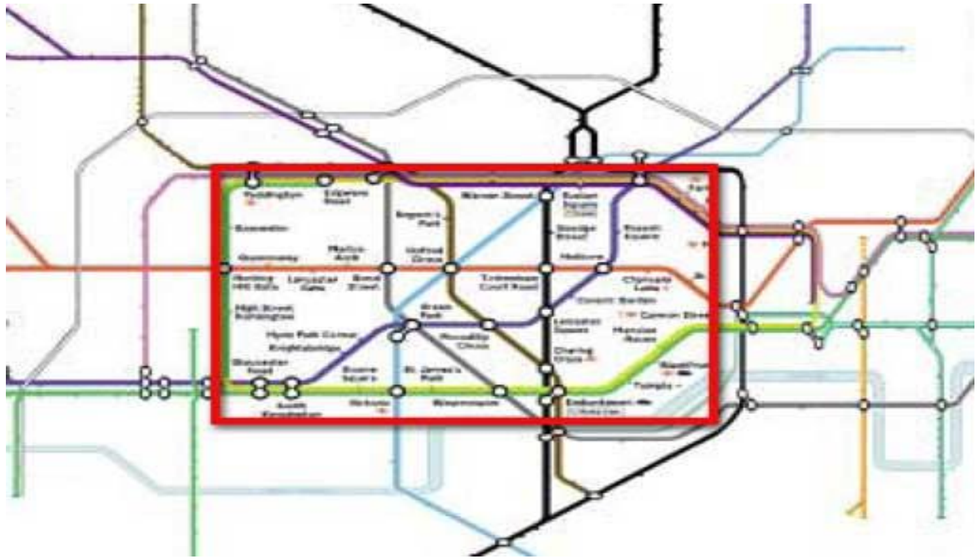
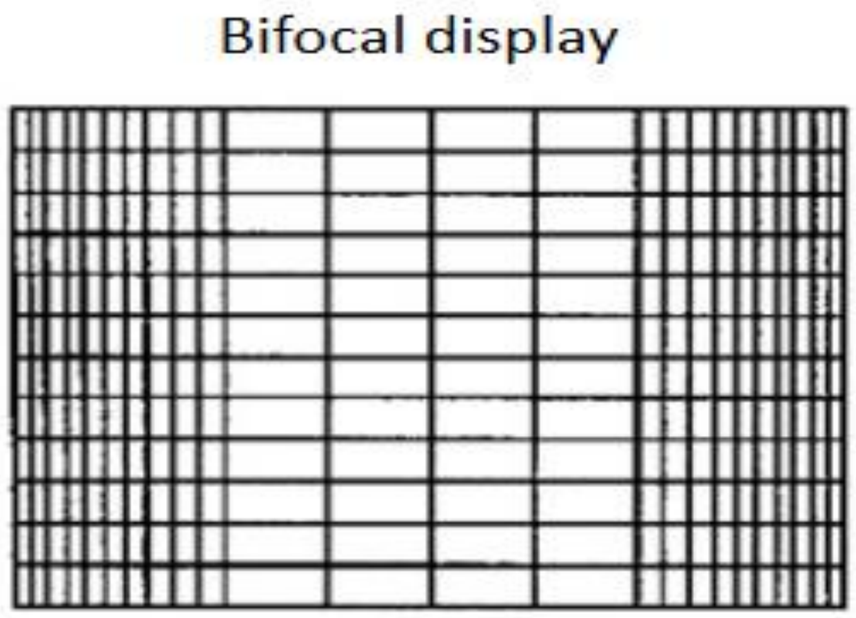
- It includes textual documents, program source code and alphabetical list of names that are organized in sequential manner.

- Bifocal Display (Spence and Apperley, 1980) Value Bars (scroll bar like features, Chimera 1992), Document Lens





2-Dimensional Data Type (Planer or Map Data Type)

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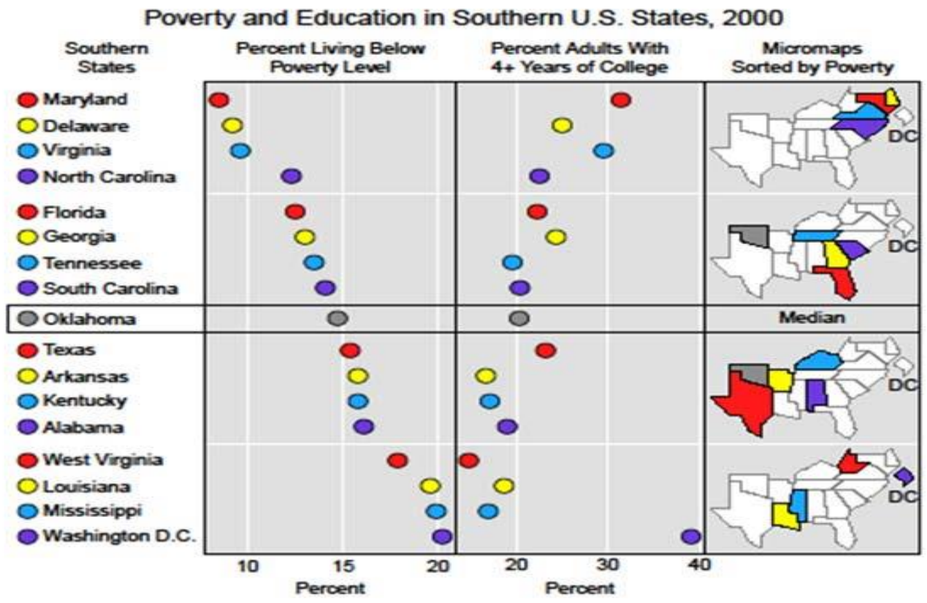
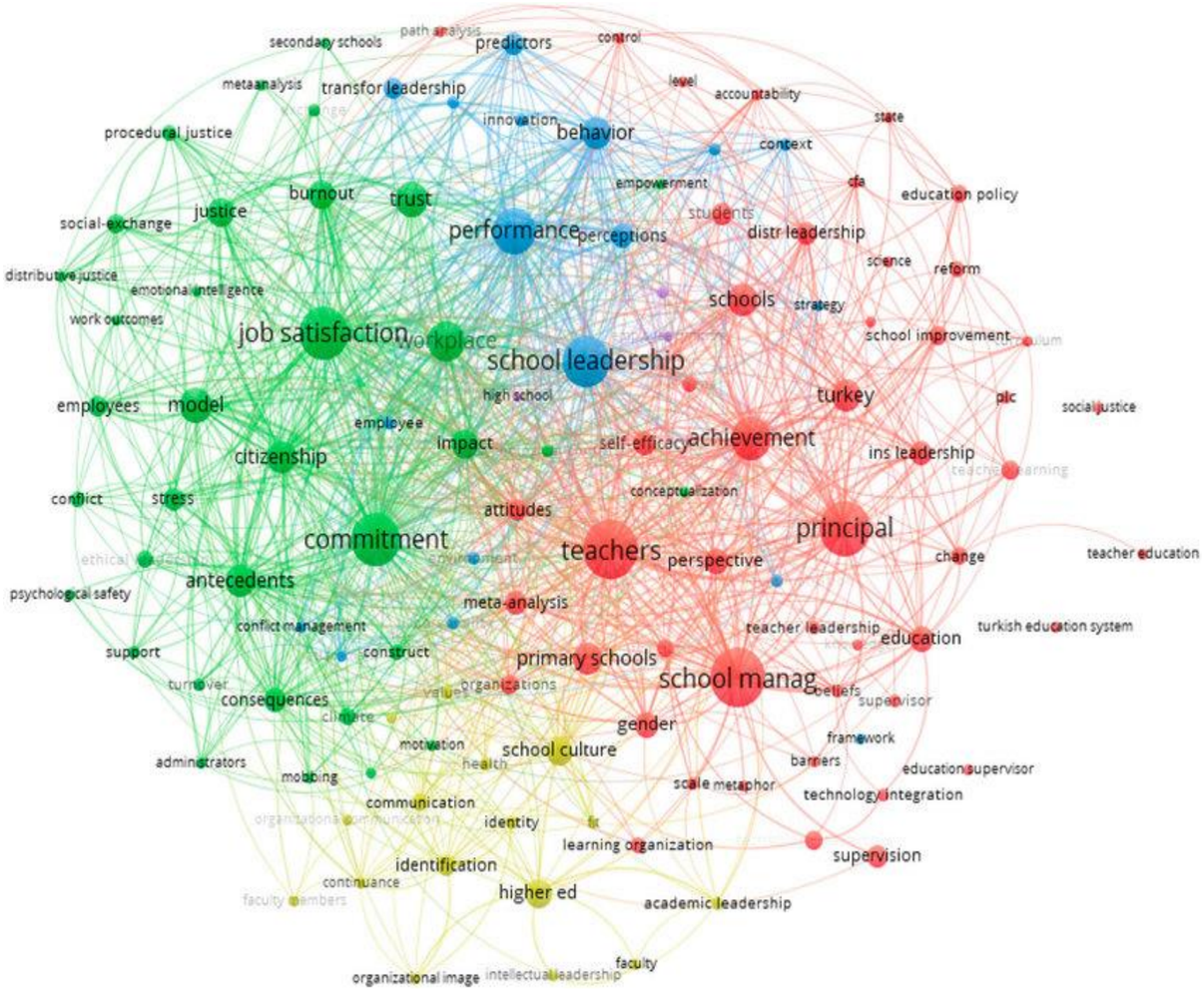
- It includes geographical maps, floorplans or newspaper layouts.
- Each item has task domain attributes (name, owner, vale).
- Co- occurrences display used.





3-Dimensional Data Type (Real World)

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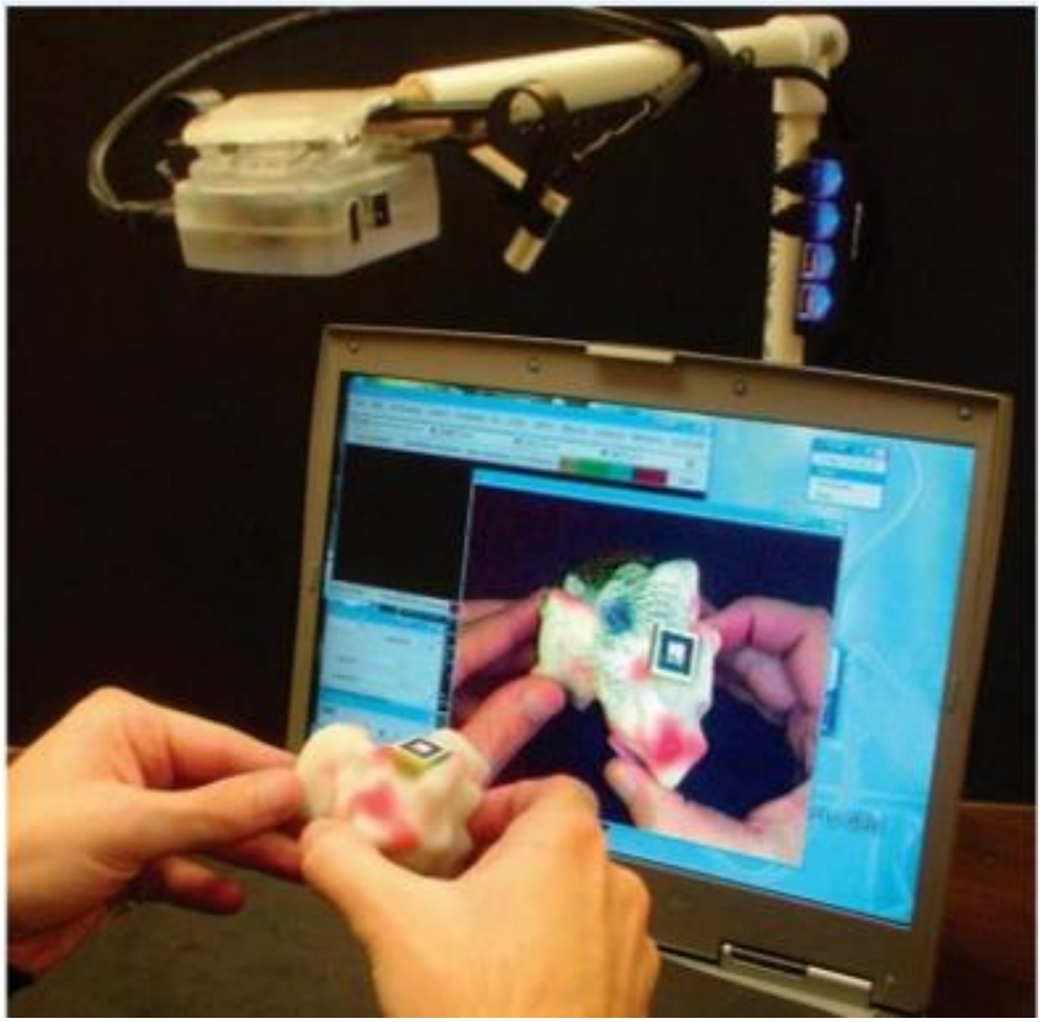
- It includes real-world objects such as molecules, the human body, and buildings have items with volume and some potentially complex relationship with other items.

- Technique used: overview, landmarks, perspective, stereo display, transparency and colour coding.



Temporal Data Type

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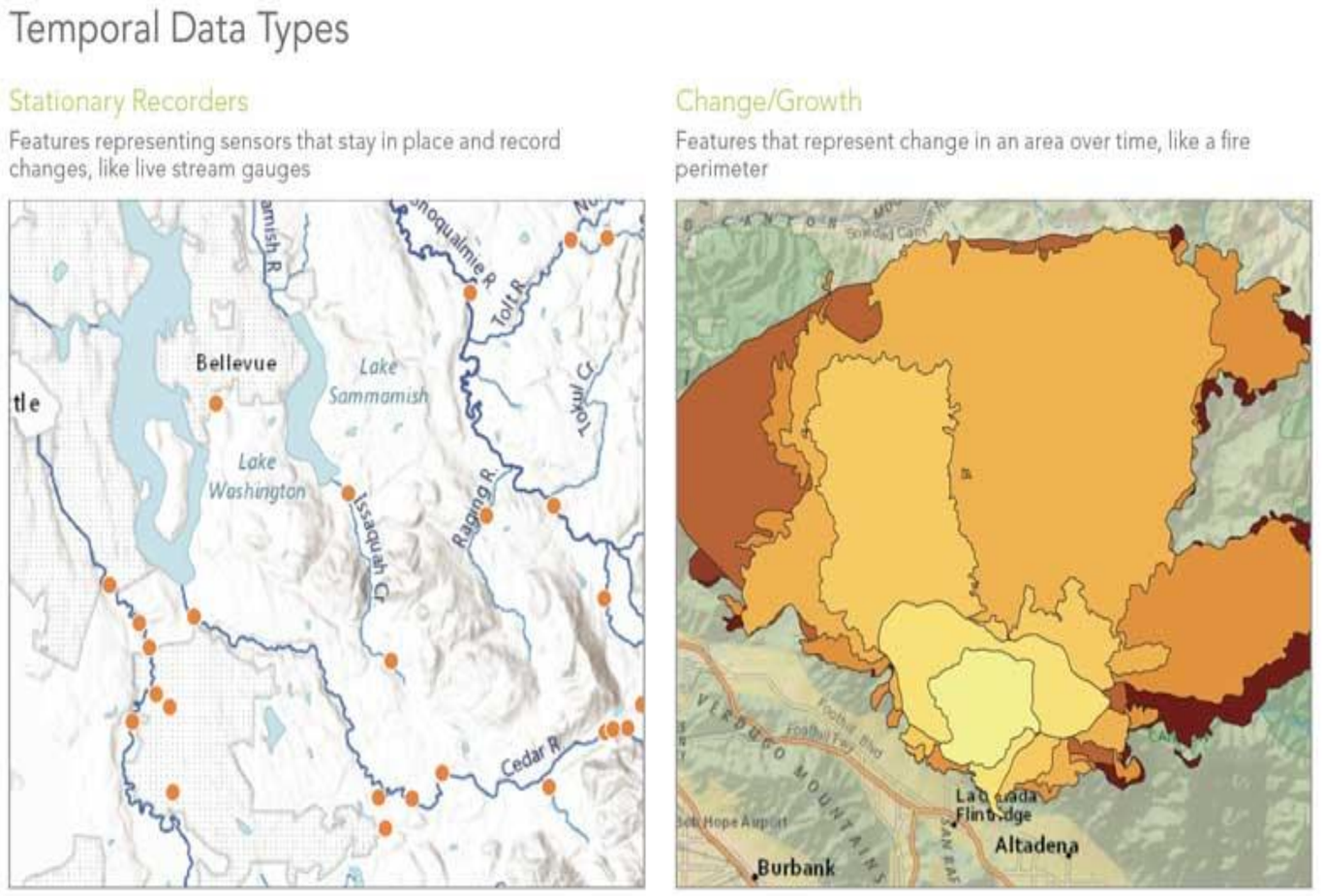
- Temporal visualization normally features lines that either stand alone or overlap with each other with a start and finish time.
- Temporal data visualization appears in system for editing video data or comparing animations.
- Scatter plot, Time series sequences, Timelines, Line Graph and Polar Diagrams.



Multi- Dimensional Data Type

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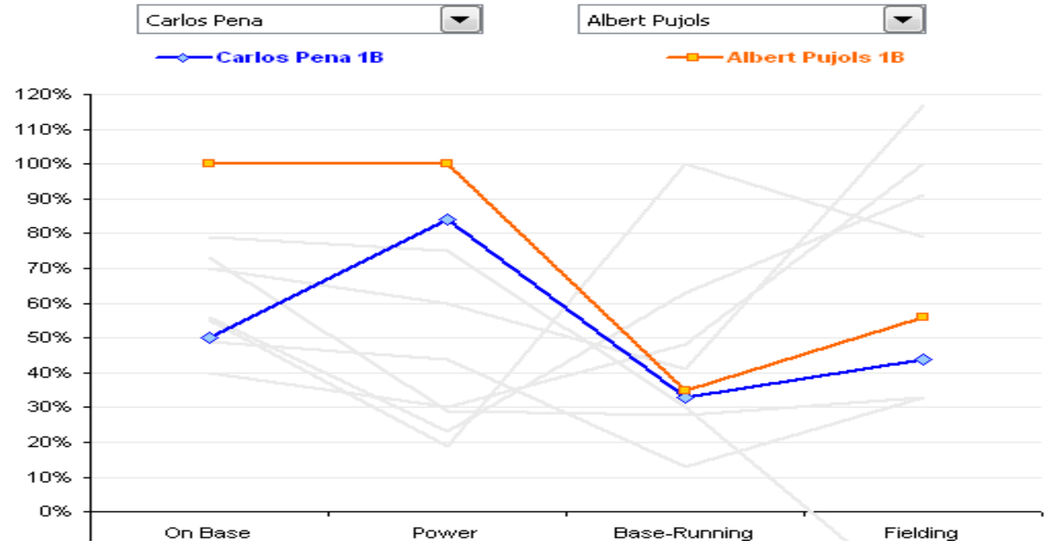
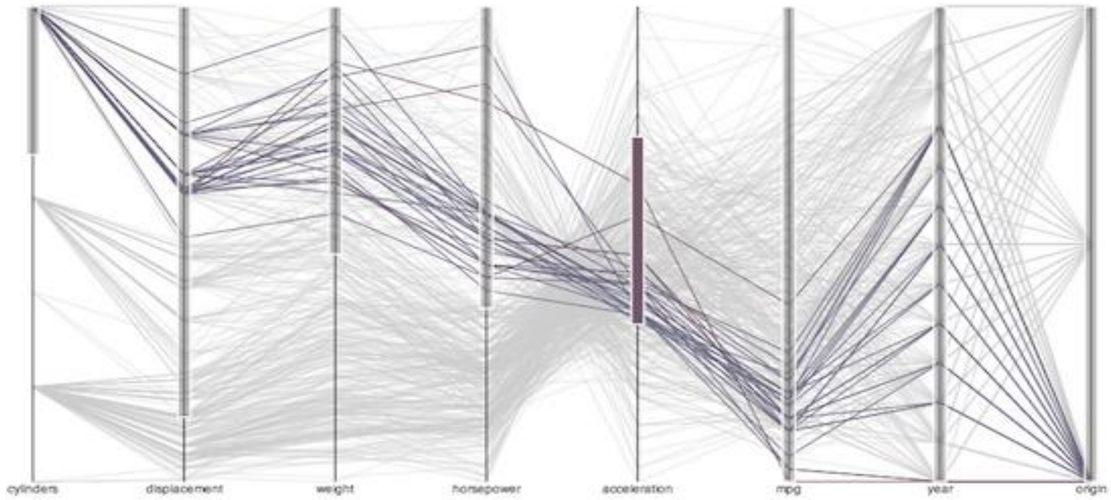
- Most relational and statistical databases are conveniently manipulated as multidimensional data in which items with n attributes become points in an n-dimensional space.

- Parallel Coordinates technique used as solution. It is used to plot individual data elements across many dimensions.

- Issue: Large data sets create a lot of visual clutter, as the axes get closer to each other it becomes more difficult.

Parallel Coordinate Technique





Multi- Dimensional Data Type..

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HomeFinder (Williamson and Shneiderman,1992)

Multi- Dimensional Data Type..

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Influence Explorer (Tweedie et al., 1996)

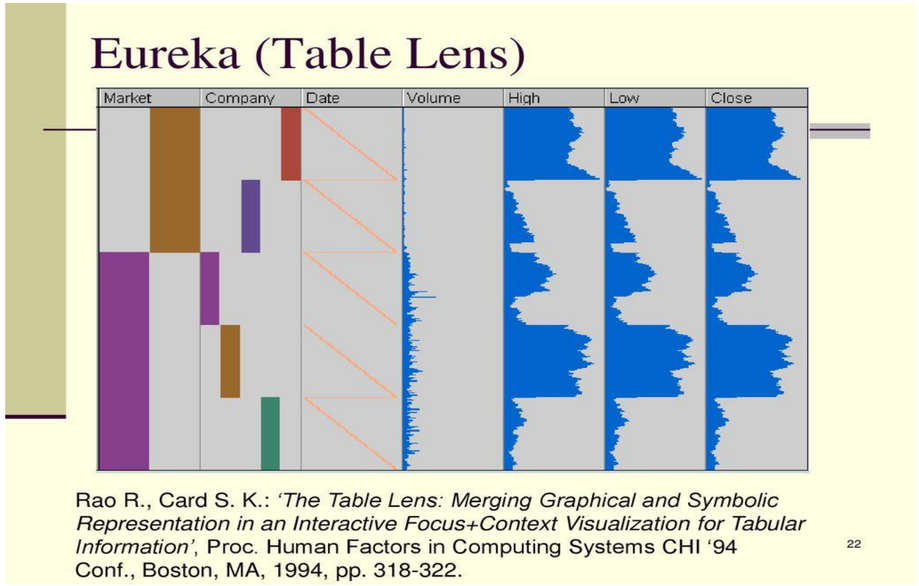

Table Lens (Rao and Card, 1994)

Tree Data Type

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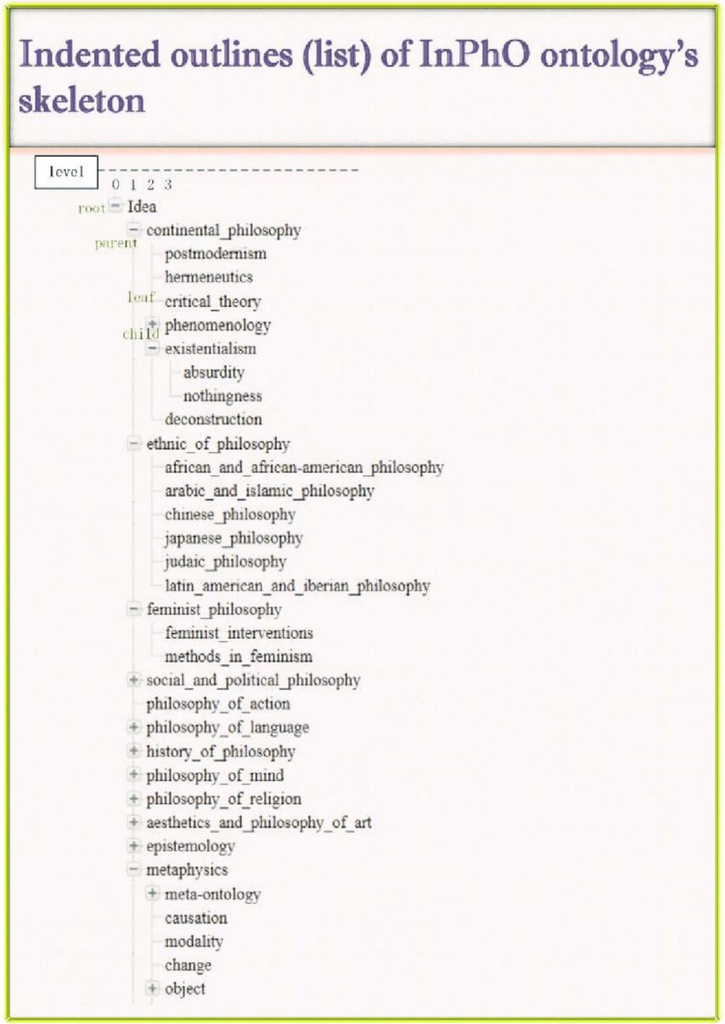
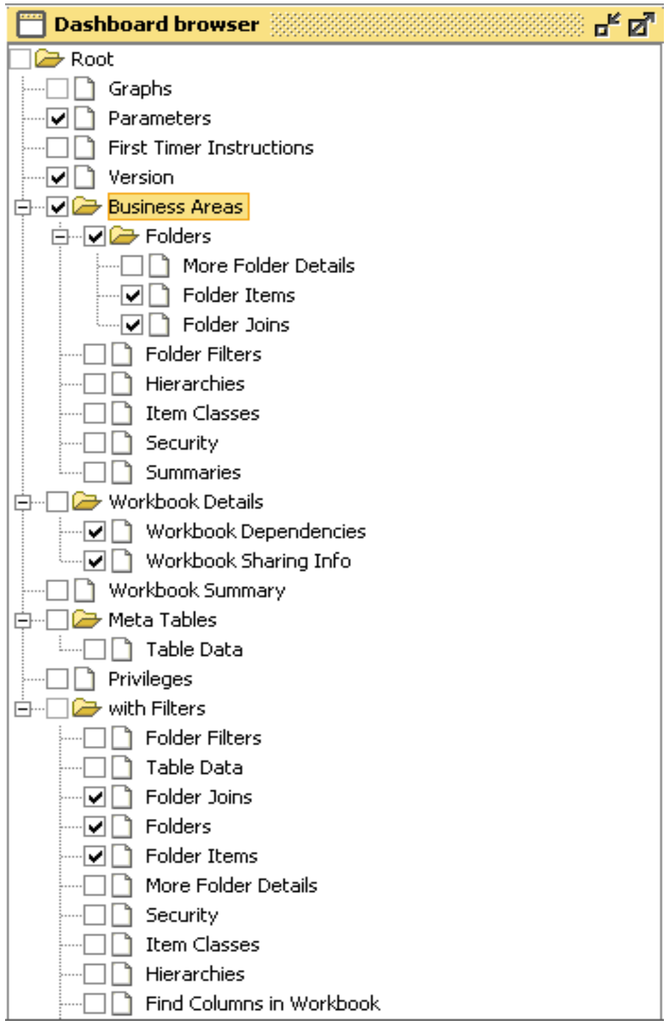
- Hierarchies of tree structure are collections of items with each item having a link to one parent item (except root).
- Tree structure data displayed with indented outlines.
- Outliners, degree-of-interest trees, hyperbolic tree, Space tree, Treemap, Tree Browser.





Tree Data Type..

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- Treemap: It shows quantities of each categories via area size, each category is assigned a rectangle area with their subcategory rectangles nested inside of it.
- Ben Sheniderman developed it.
- Down side, it does not show the hierarchal level as clearly as other charts.

Network Data Type

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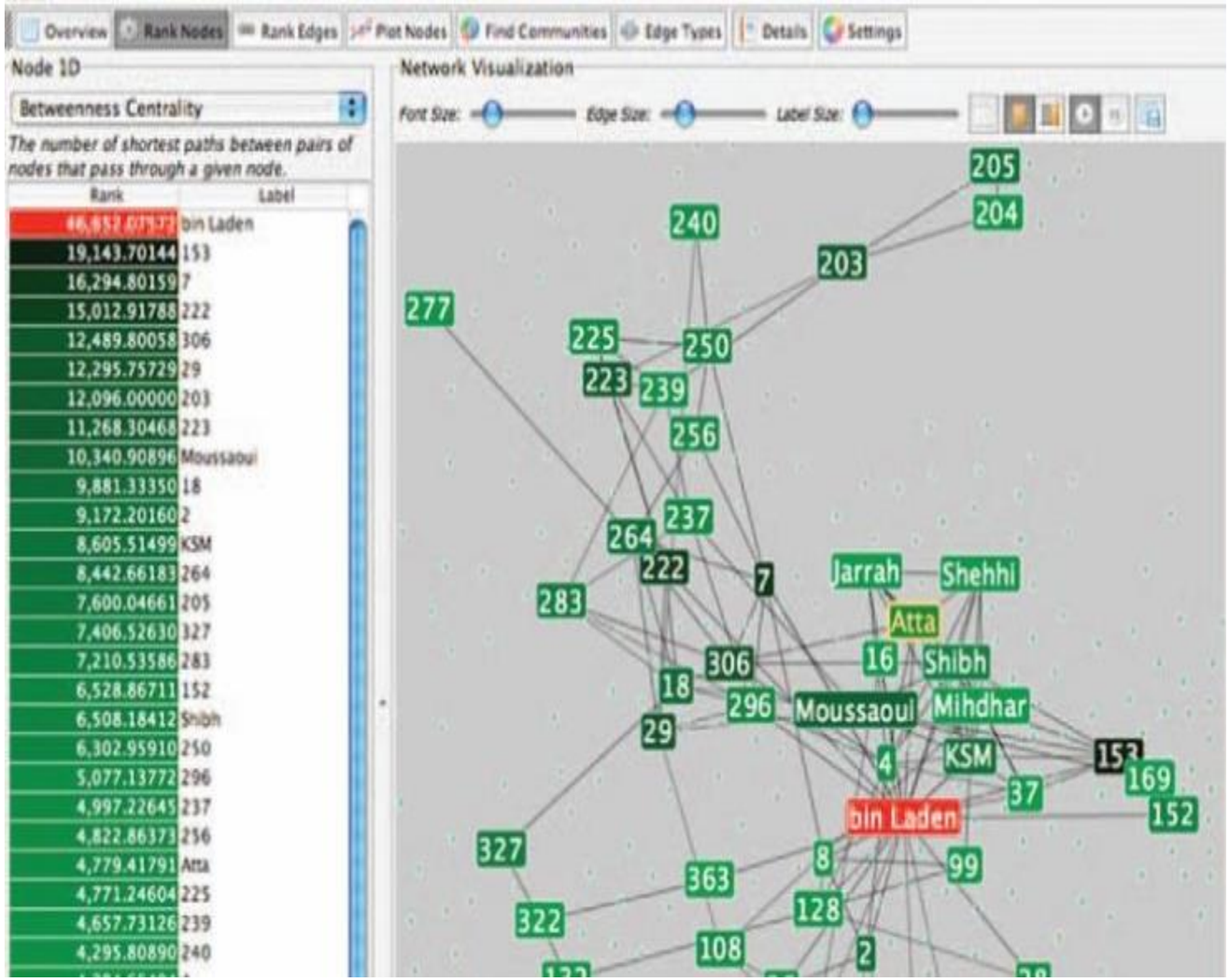
- Data sets connect deeply with other data sets.
- Network data visualization show how they relate to one another within a network.
- Demonstrating relationships between datasets without explanations.
- Many special cases of networks exist like acyclic, lattices, Rooted vs. Unrooted, Directed vs. Undirected.
- NetMap, netViz, JUNG, NetDraw, TouchGraph, NodeXL.



Network Data Type..

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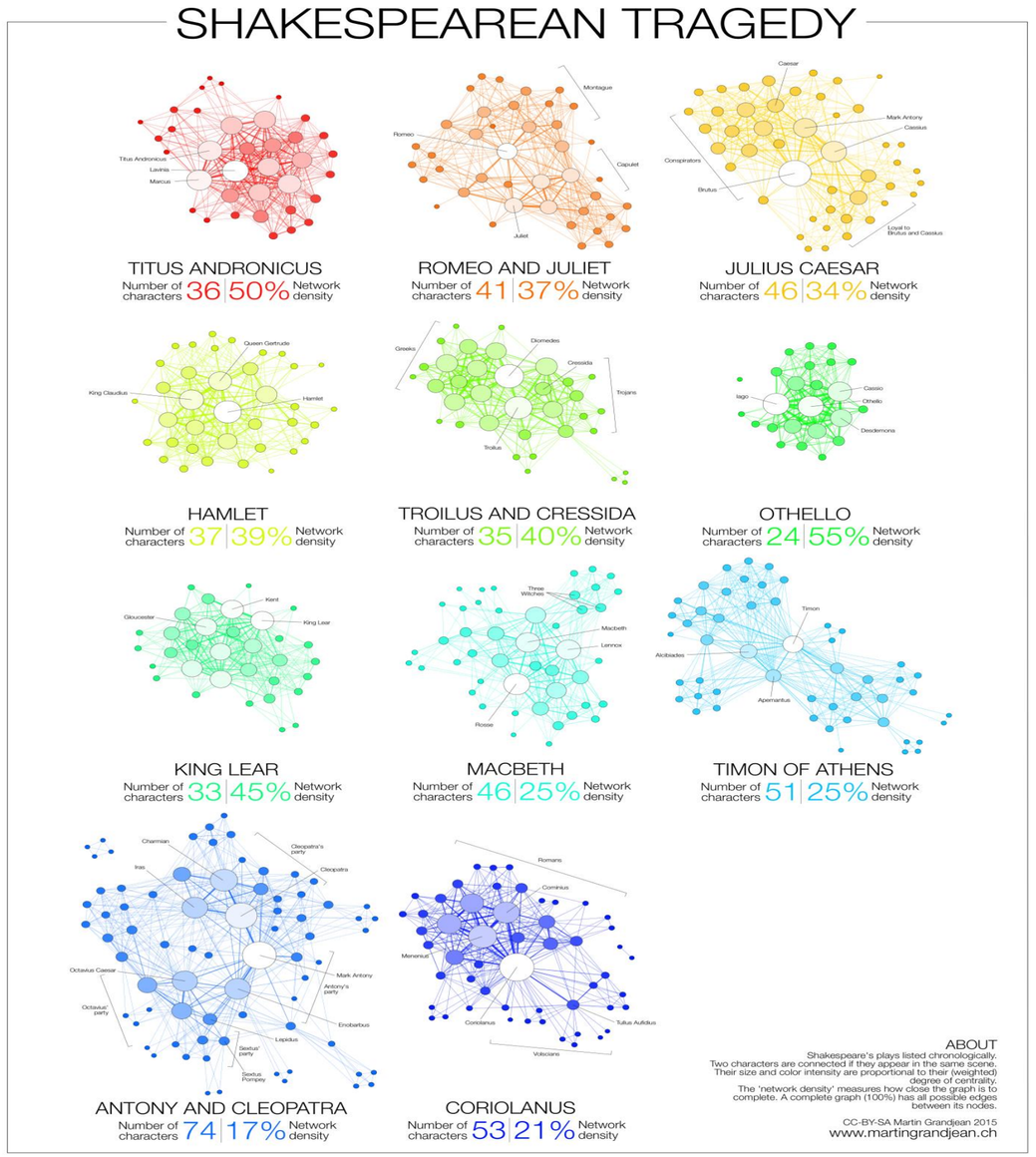

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VIS(Visual Information Seeking) Interaction method:
Dynamic query approach:- query parameter are rapidly adjusted with sliders, buttons, maps etc.

- Sliders & buttons used to reduce items in result set.
- Dynamic home finder.
- Dynamic periodic table.
- Alphaslider for selection of text items.

Dynamic queries can reveal global properties also helps users in answering specific questions. When database grows, it becomes more difficult to update display fast enough, & specialized data structures or parallel computation is required.

Dynamic query permits OR combinations within an attribute with AND combination of attributes across attributes (conjunct of disjuncts). Used to allow users to satisfy their information need.

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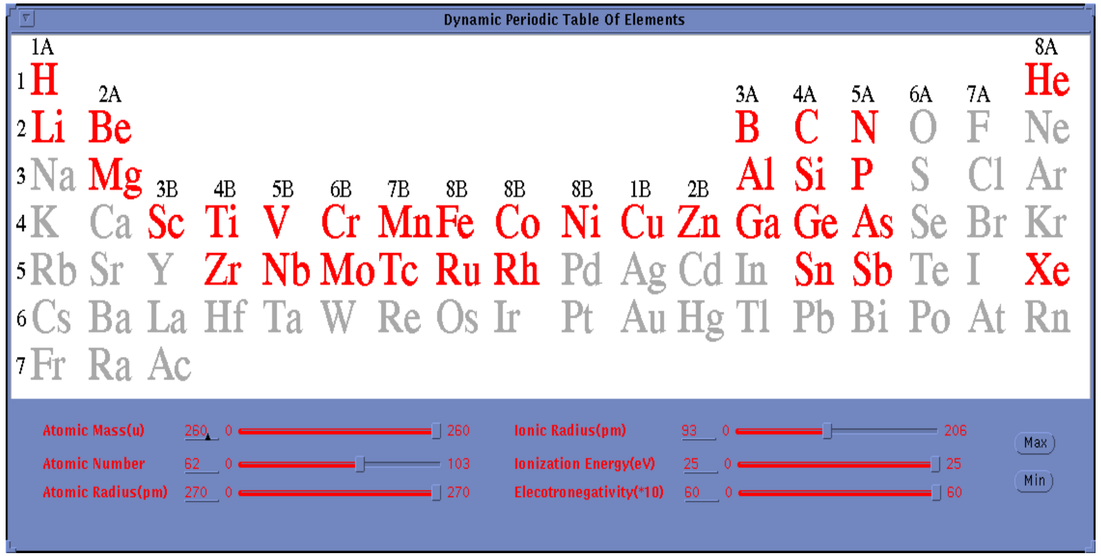
Principles of direct manipulation queries: [shneiderman 1994]

- Visual representation of the world action.
- Rapid, incremental & Reversible action.
- Selection by pointing.
- Immediate & continuous display of results.

Dynamic Periodic Table



Alpha slider for selection of text items

Summary

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- In this article novel graphical and direct query approach is used for query formulation and visualization.
- In this article a systematic and powerful visualization and easy retrieval of data from the database can be performed.
- The author has used taxonomy of 7 data types and performed the 7 tasks.
- A successful commercial product will have to accommodate several: the product will need to provide smooth integration with existing software and support the full task: i.e. 7 tasks described before.

Personal Remarks

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- Author tested his model on only 7 types of data, not on all data type.
- Dynamic query is more power tool for filtering and data visualization.
- Visual Information seeking Mantra, used on different types of model and generate good result.
- Numbers of participants(18) was low for the dynamic-query approach to the chemical table of elements.

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THANK YOU :)