

Interaction

What is Interaction?

- From Google: Reciprocal action between a human and a computer
- One of the two main components in infovis
 - Representation
 - Interaction
- Interaction is what distinguishes infovis from static visual representations on paper

Interaction

- How do you define “interactive”?

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Response Time

- 0.1 sec
 - animation, visual continuity, sliders
- 1 sec
 - system response, conversation break
- 10 sec
 - cognitive response

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Interaction Types

- Keim's taxonomy (TVCG '02) includes
 - Projection
 - Filtering
 - Zooming
 - Distortion
 - Linking and brushing

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Interaction Types

- Dix and Ellis (AVI '98) propose
 - Highlighting and focus
 - Accessing extra info – drill down and hyperlinks
 - Overview and context – zooming and fisheyes
 - Same representation, changing parameters
 - Linking representations – temporal fusion

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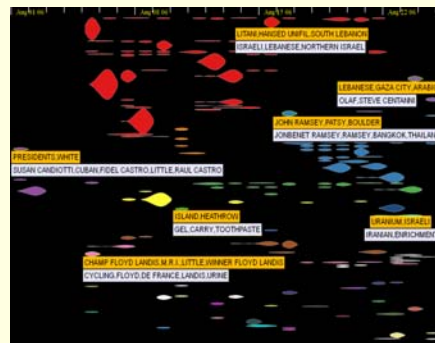
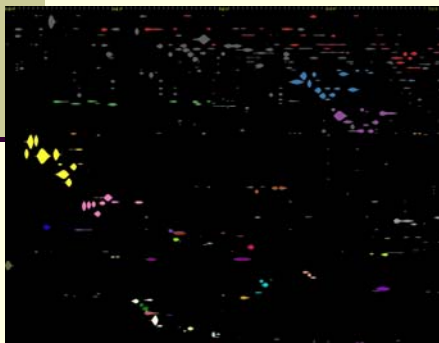
In this class

- Interactions for browsing a large amount of data
 - **Labeling**, overlap reduction techniques
- Interactions for selecting data of interest
 - Brushing, filtering, dynamic query
- Interactions for examining data of interest
 - Zooming, distortion, roll up/drill down

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Labeling

- Why labels are needed in visualizations?
 - To associate visualization with data
 - To display semantics
 - To explain data, visualization, and relationships



Excentric Labeling

“Excentric Labeling: Dynamic Neighborhood Labeling for Data Visualization”

Jean-Daniel Fekete, Catherine Plaisant

SIGCHI conference on Human Factors in Computing systems in 1999

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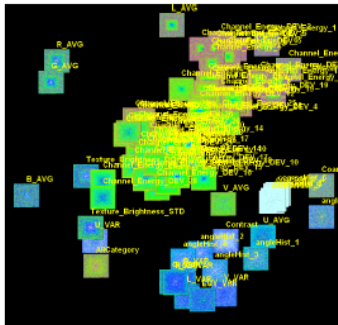
In this paper....

- Labeling challenges in Information abundant InfoVis applications.
- Informal Taxonomy of Labeling Techniques
- Excentric Labeling method

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Labeling Challenges...

- Readable
- Non-ambiguously related to its graphical object
- Does not hide any pertinent information.



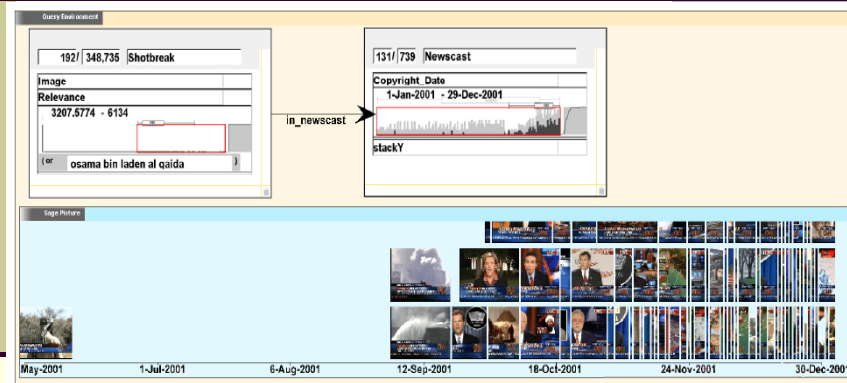
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Taxonomy of labeling...

Type	Technique	Comments/Problems
STATIC	No label	No labels!
	Label-only-when-you-can (i.e. after filtering objects)	Need effective filters. Labels are rarely visible.
	Rapid Label-All	High risk of overlaps or ambiguous linking to objects
	Optimized Label-All	Often slow - may not be possible
	Optimized Label-All with aggregation and sampling	Effective but application dependant- may not be possible

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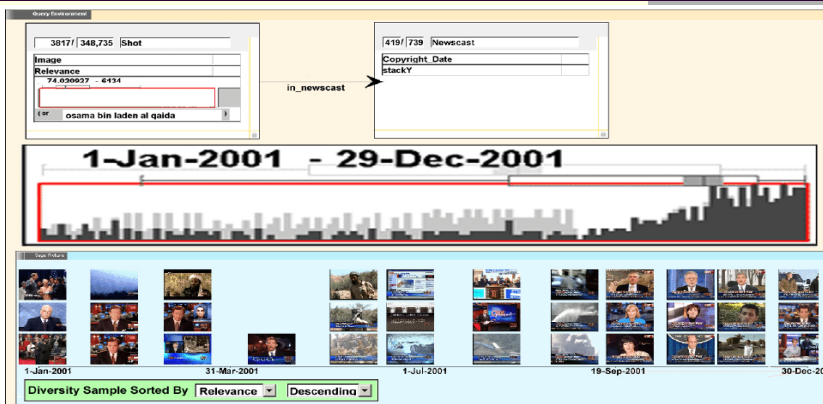
Optimized Labeling with Sampling (1)



Example: query results to a video library are represented using a collage of representative key frames [DCHW03]. Occlusion happens in this display. This figure is used without authors' permission.

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Optimized Labeling with Sampling (2)



Sampling is used to reduce the number of key frames shown in the display to make sure that there is no occlusion [DCHW03]. This figure is used without authors' permission.

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Taxonomy of labeling...

■ Dynamic

One at a time	Cursor sensitive balloon label	Requires series of precise selection to explore space (slow), cannot reach overlapped objects.
	Cursor Sensitive label in side-window	Same as above. Constant eye movement can be a problem, but avoids occlusion of other objects.
	Temporal brushing (Cleveland)	More labels visible at a time, but overlapping problem.

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Taxonomy of labeling...

■ Dynamic

Global display change	Zoom until labels appear	May require extensive navigation to see many labels (can be effectively combined with semantic zooming, e.g., Pad++)
	Filter until labels appear	May require several filtering to see labels (can be effectively combined with Zooming, e.g., starfields)

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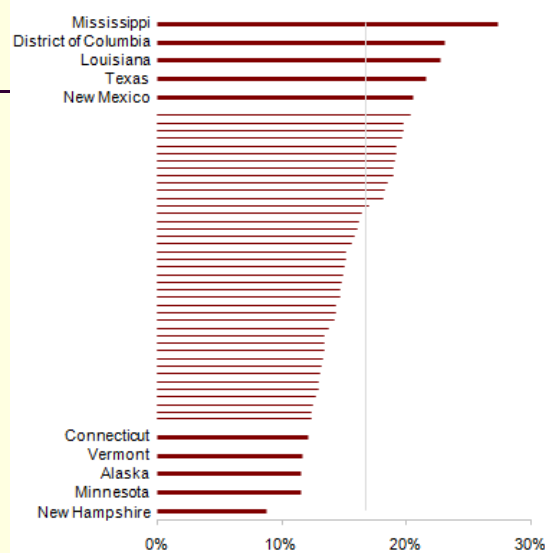
Taxonomy of labeling...

■ Dynamic

Focus + context		
	Overview and detail view without deformation	Effective when objects are separated enough in the detail view to allow labels to fit (not guaranteed.)
	Overview and detail with deformation/ transformation (i.e. fisheye or magic lenses)	Deformation might allow enough room for labels to fit. (not guaranteed). May require tool or mode to be selected.
	Global deformation of space (e.g., Hyperbolic Browser)	Requires intensive navigation and dexterity to rapidly deform the space and reveal all labels (e.g., by fanning the space).

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POVERTY RATIOS, TOTAL POPULATION



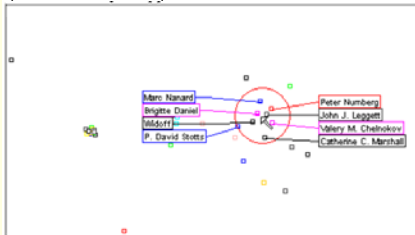
<http://www.excelcharts.com/blog/focus-context-bar-chart-skyscraper/>

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Taxonomy of labeling...

■ Dynamic

Sampling	Dynamic sampling (Chalmers et al.)	Few labels are visible.
NEW	Excentric labeling	Fast, no tool or special skill needed. Spread overlapping labels, and align them for ease of reading.



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Demo

<http://www.cs.umd.edu/hcil/excentric/#prototypes>

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Excentric Labeling

- Comparison of excentric with virtual instantaneous zoom.
 - a 60% speed advantage for the excentric
 - Easily learnable after a little practice.
 - No of operations in zoom was much more



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Algorithm

1. Extract each label and position for interesting graphic objects in the focus region.
2. Compute an initial position.
3. Compute an ordering.
4. Assign the labels to either a right or left set.
5. Stack the left and right labels according to their order.
6. Minimize the vertical distance of each set from the computed initial position.
7. Add lines to connect the labels to their related graphic object.

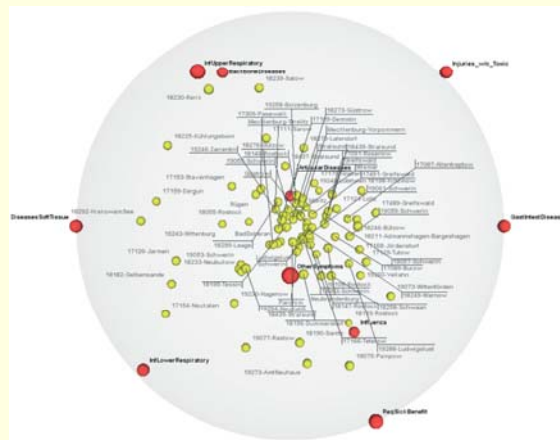
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Particle-Based Labeling

- A recent approach
- Optimized label all
- Martin Luboschik, Heidrun Schumann, Hilko Cords: [Particle-Based Labeling: Fast Point-Feature Labeling without Obscuring Other Visual Features](#), InfoVis 2008
- Video

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Use the technique carefully



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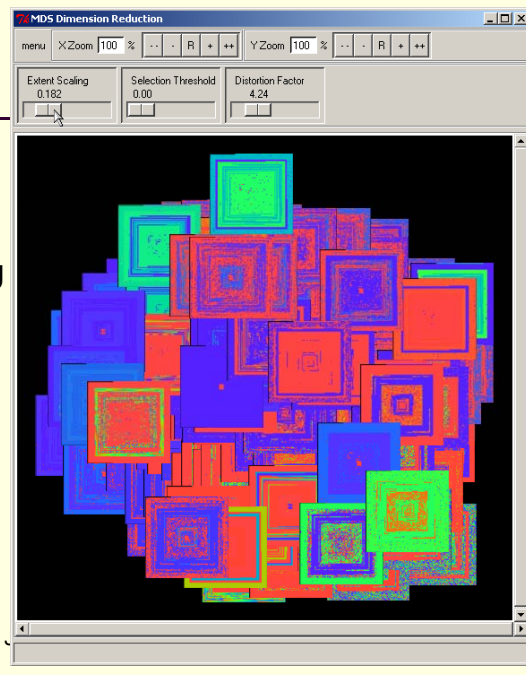
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Overlap Reduction

- Extent Scaling
- Dynamic Masking
- Zooming and Panning
- Showing Names
- Layer Reordering
- Manual Relocation
- Automatic Shifting



Value and Relation Display for Interactive Exploration of High Dimensional Datasets, Yang et al. InfoVis 2004

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Brushing

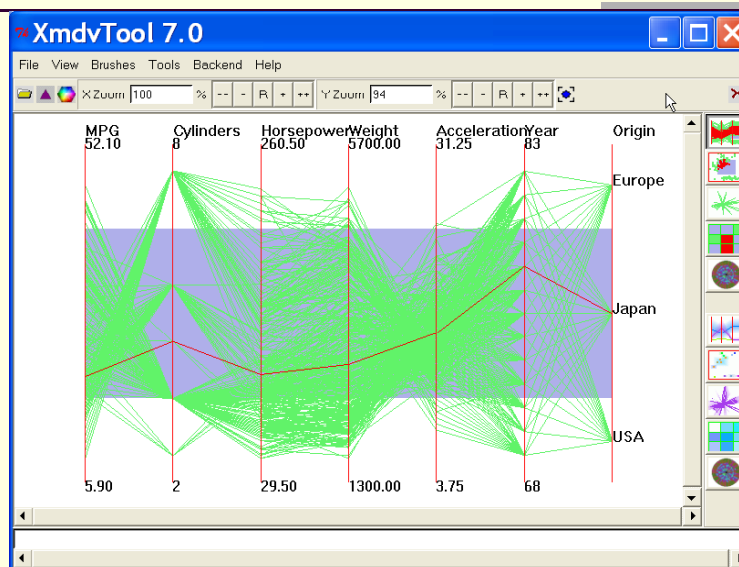
- Brushing - Selecting or highlighting a case in one view generates highlighting the case in the other views
- Often used when there are multiple views of the same data – **coordinated views**
 - Viewer may wish to examine different attributes of a data case simultaneously
 - Alternatively, viewer may wish to view data case under different perspectives or representations
 - But need to keep straight where the data case is

Changing Representation

- May interactively change entire data representation
 - Looking for new perspective
 - Limited real estate may force change

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Changing Representation



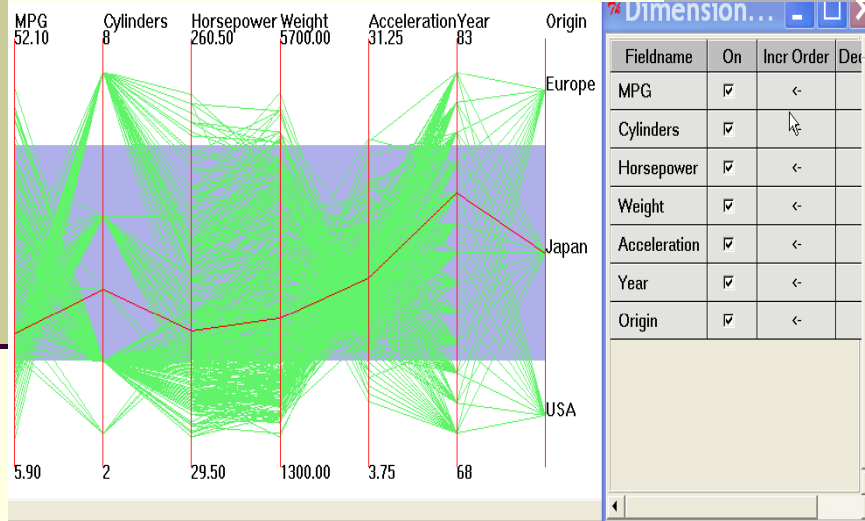
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Rearrange View

- Keep same fundamental representation and what data is being shown, but rearrange elements
 - Alter positioning
 - Sort

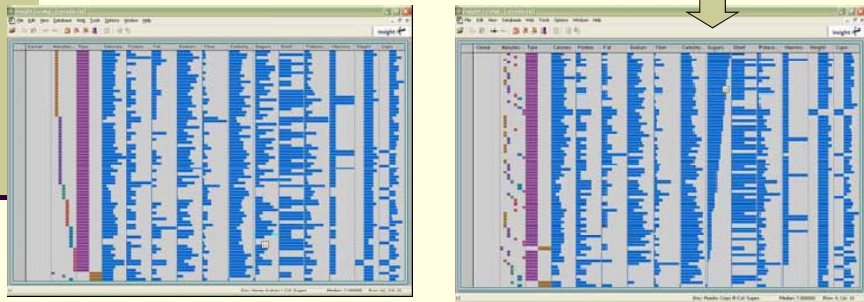
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Rearrange



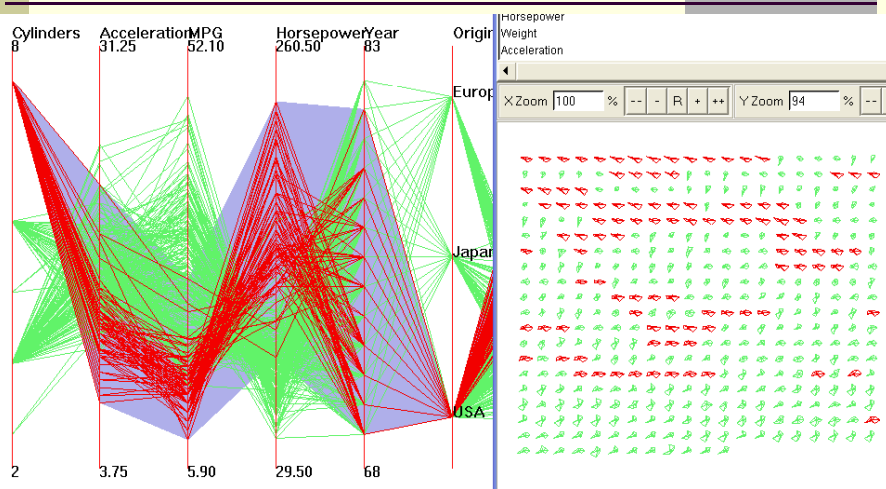
Sorting

- Can sort data with respect to a particular attribute in Table Lens



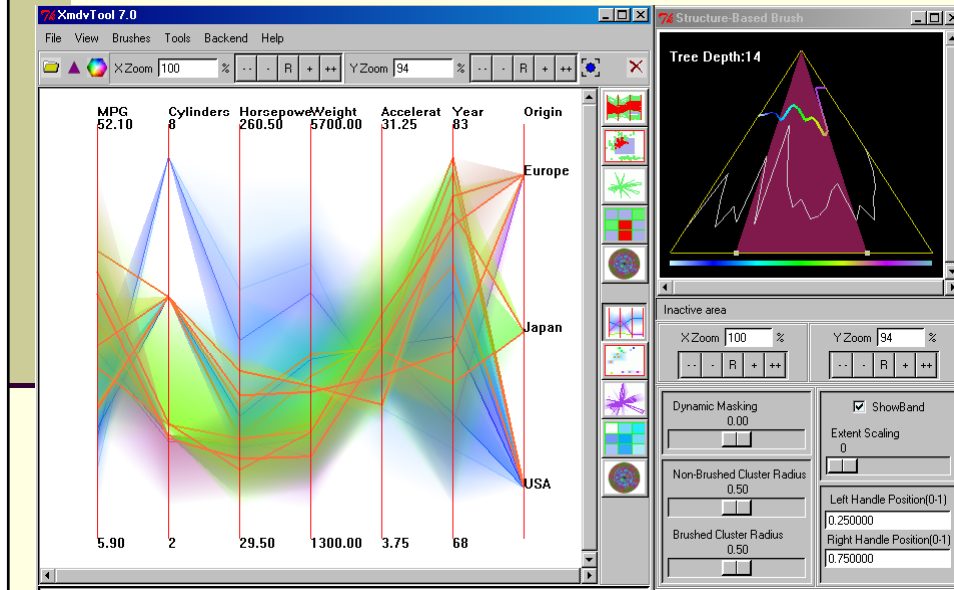
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N-D Brushing (demo)



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Structure-Based Brushing (demo)



Overview + Detail View

- Example: Visible Human Explorer - video



http://www.nlm.nih.gov/research/visible/vhp_conf/north/vhedemo.htm

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More on Coordinated Views

- Jigsaw video

<http://www.cc.gatech.edu/gvu/ii/jigsaw/>

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Filtering/Limiting

- Changing the set of data cases/dimensions being presented
 - Focusing
 - Narrowing/widening

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Video

- Filter for Boolean variables

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