Infovis: Single views

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Overview

- Context
- Challenges
- Single view examples

Context

Infovis vs Scivis

- Abstract Data
- *n*-dimensional

- Very important:
  - visual metaphor
  - user interaction
  - **exploration**, analysis (visual analytics), presentation

- Spatial data
- 1, 2- or 3-dimensional, time-dependent
- Very important:
  - 3D rendering
  - fast rendering
  - **analysis**, exploration, presentation

Two important goals

An intuitive visual metaphor:

- How can abstract information be represented visually?
- How can high-dimensional data be depicted?
- 2D or 3D visualization?
- How can we position or place the data in space?
- Integration of Focus and Context?

A proper interaction scheme:

- Modification of visual parameters and metaphors
- Change of focus

Special challenges

Often large amounts of data. How to do visualization and:

- selection of data subsets
- aggregation of data
- extraction of meta data

Extended data structures, complex data inter-dependencies

- deep hierarchies, large graphs,
  multi-modal data
- different kinds of inter-dependencies, i.e., relationships
- *pattern finding capabilities are very important*

Dealing with large amounts of data

Subsampling/Subsetting techniques

- sampling
- querying

Segmentation techniques

- segmentation: separation into subsets

Aggregation techniques

- aggregation:
  sum, count, minimum, maximum, average...
- frequency-based techniques

Single views

Characteristics

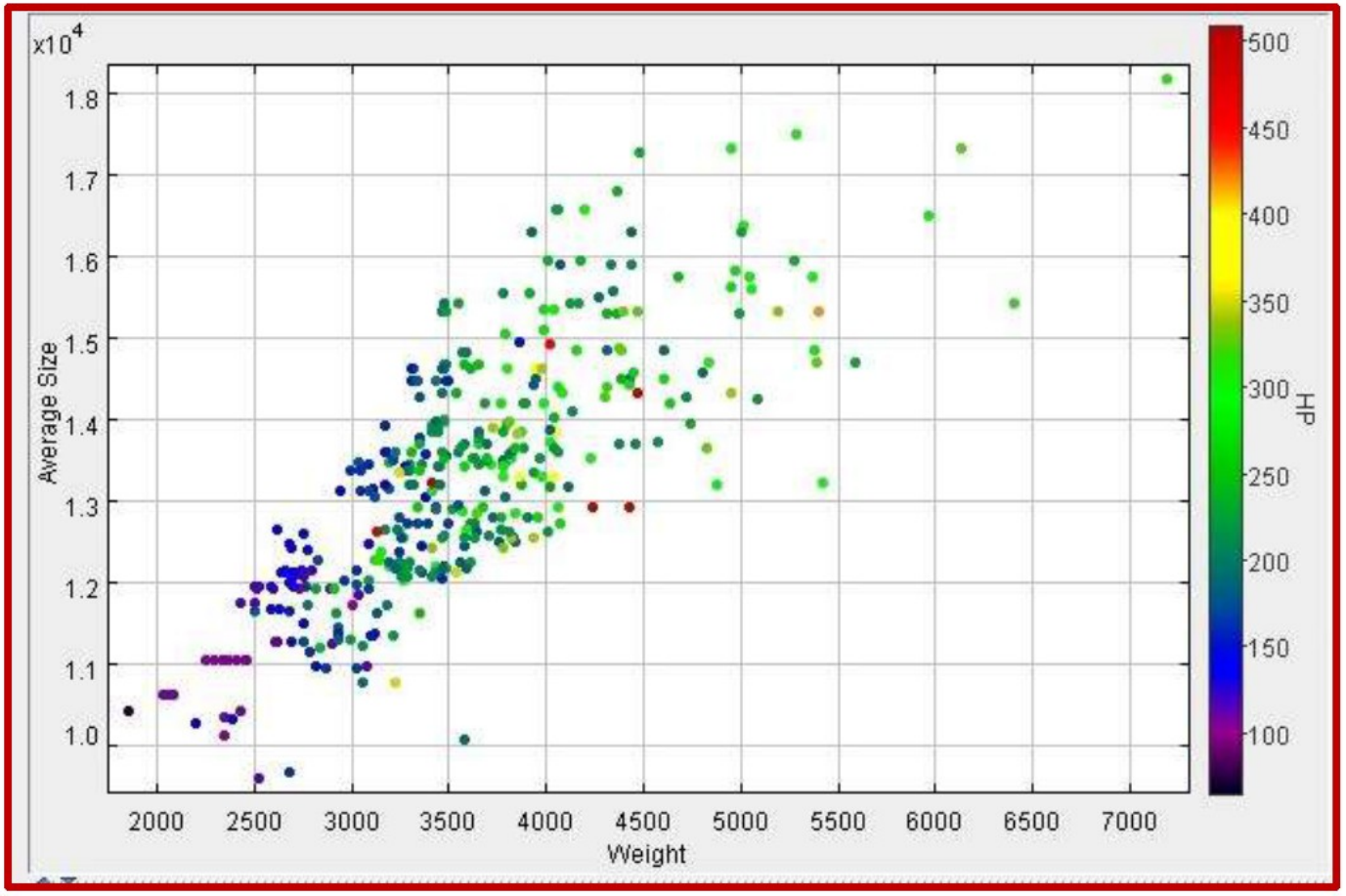
Data : often tabular

Users : general public, inexperienced

Tasks : exploration, supplementary figures

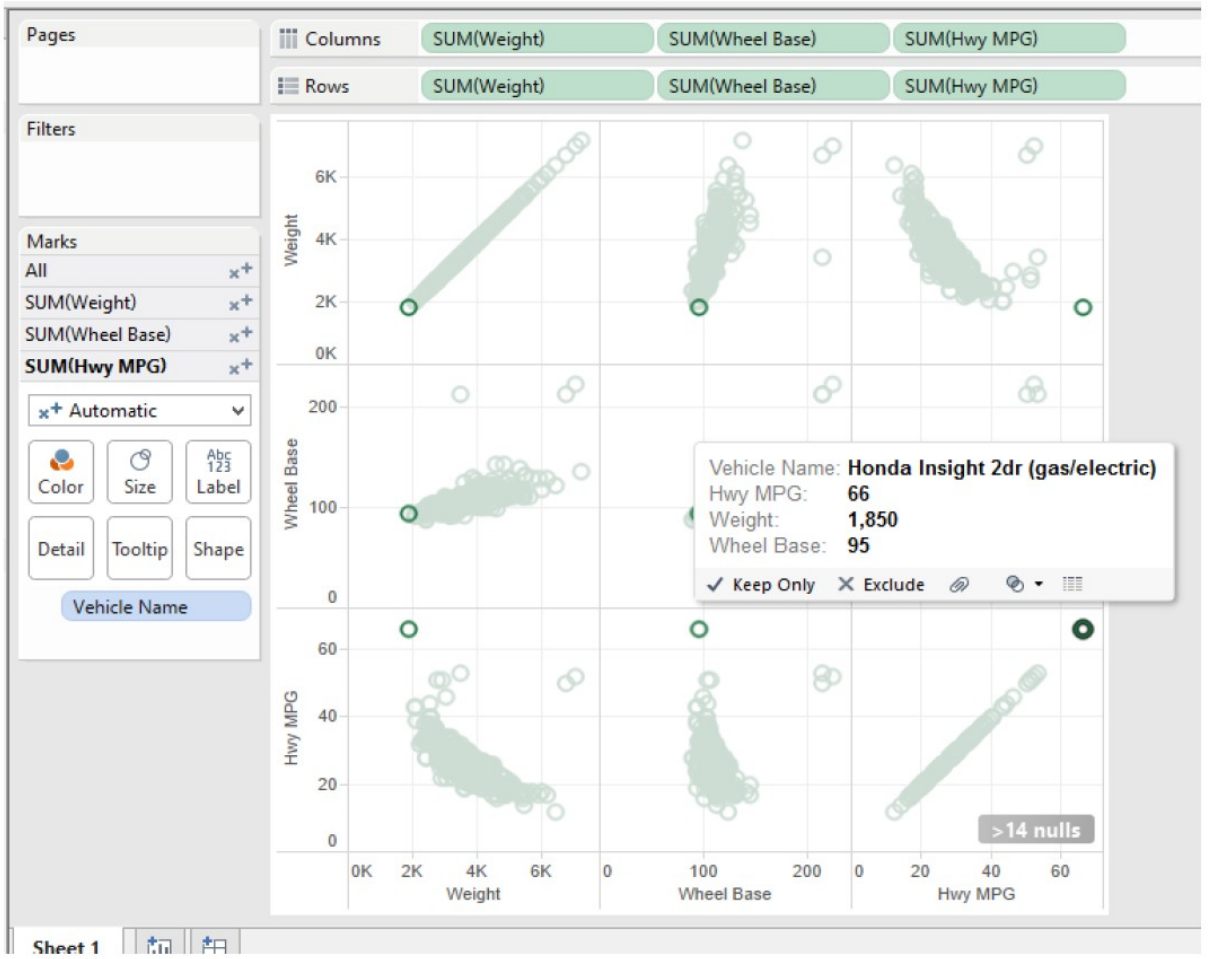
Scatterplot

2-3 variables, one ellipse per data item

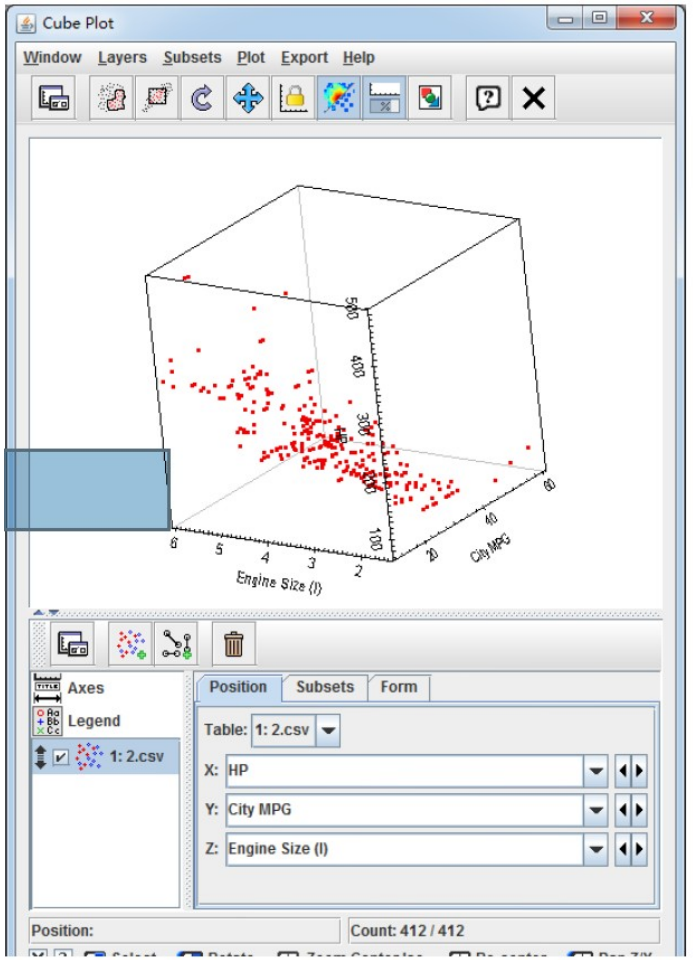


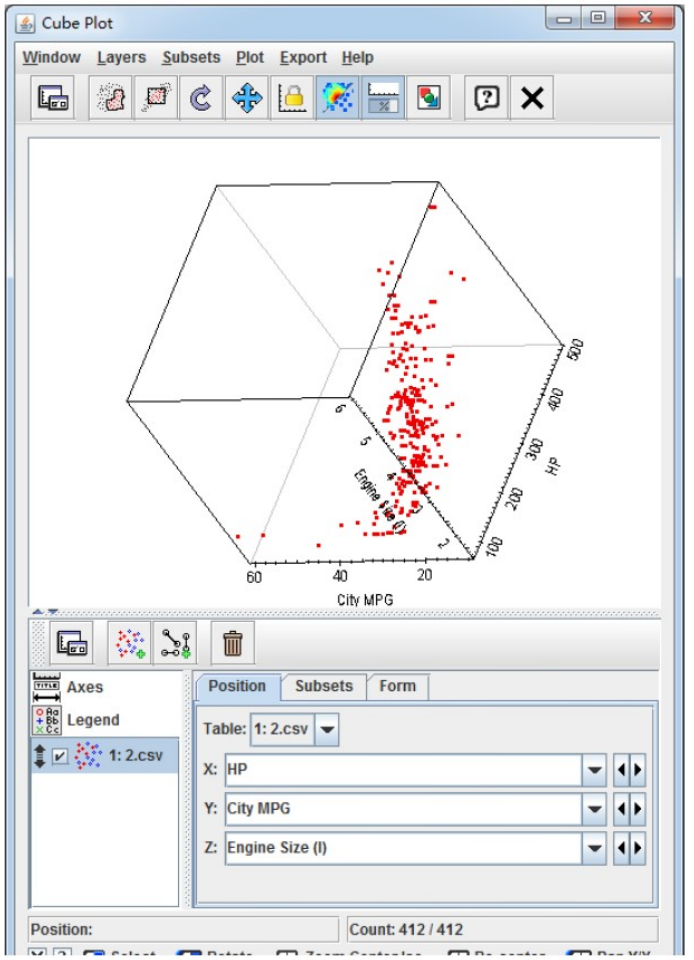
Scatterplot matrix

With details on demand

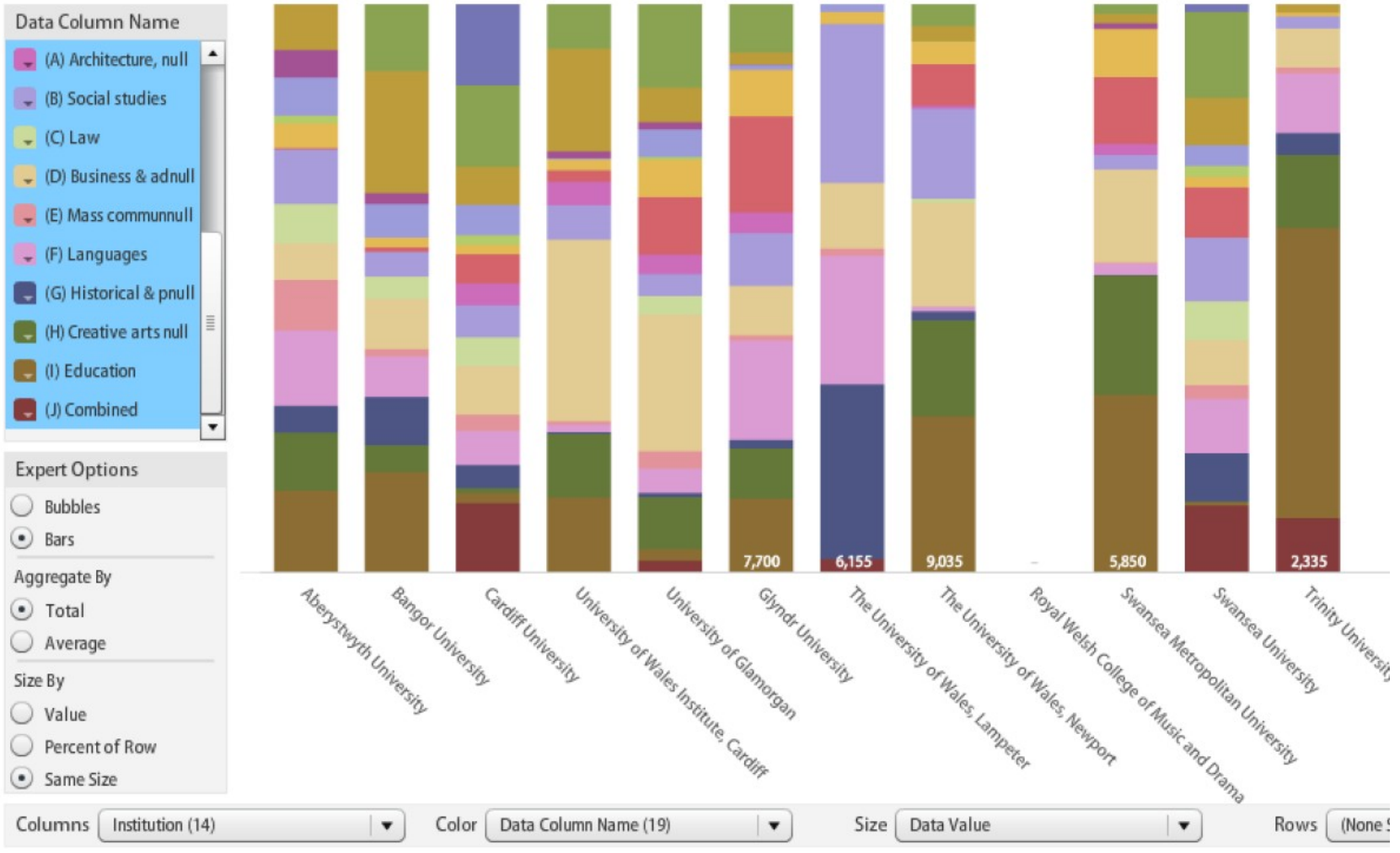


3D scatterplot matrix

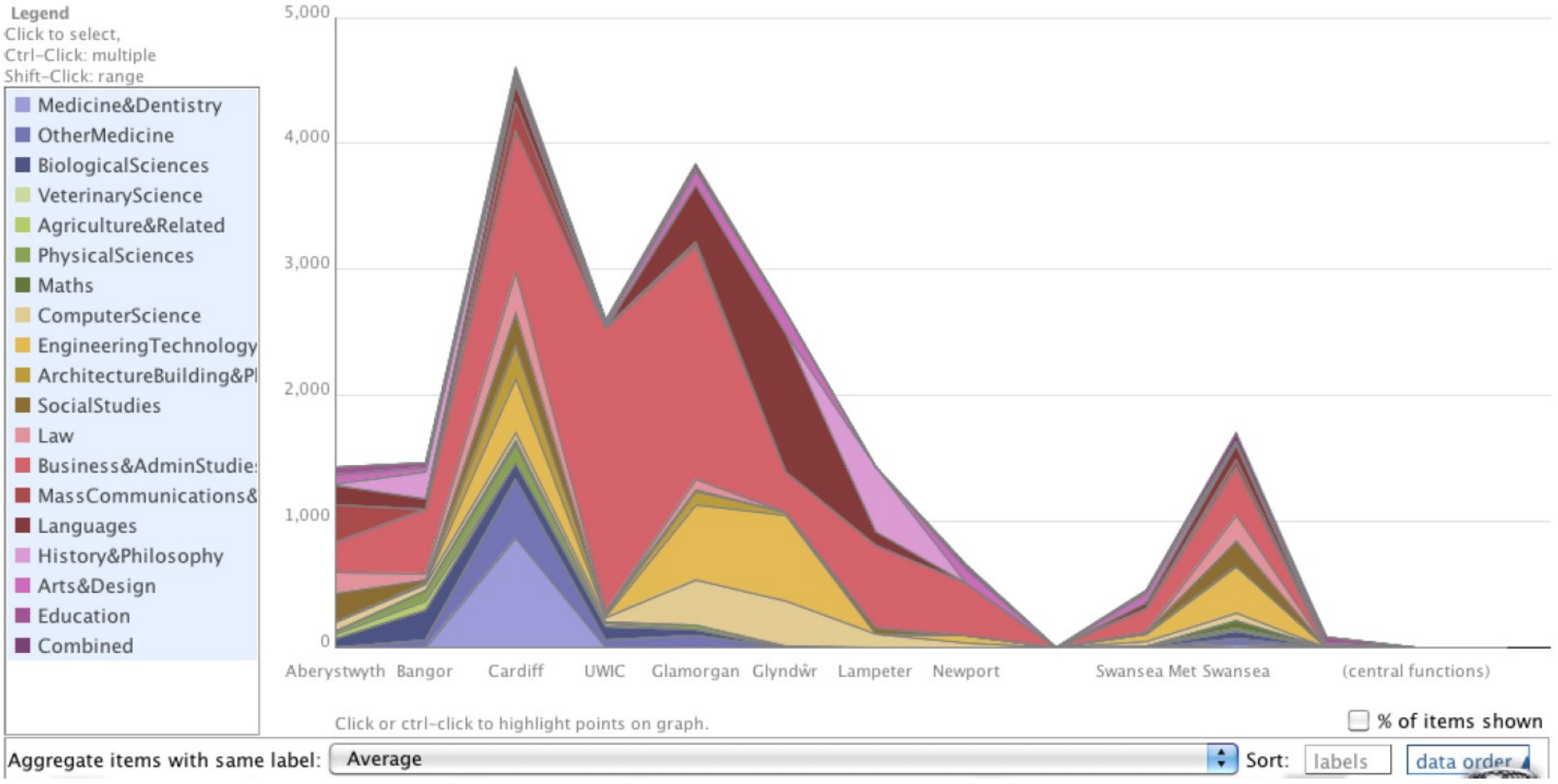




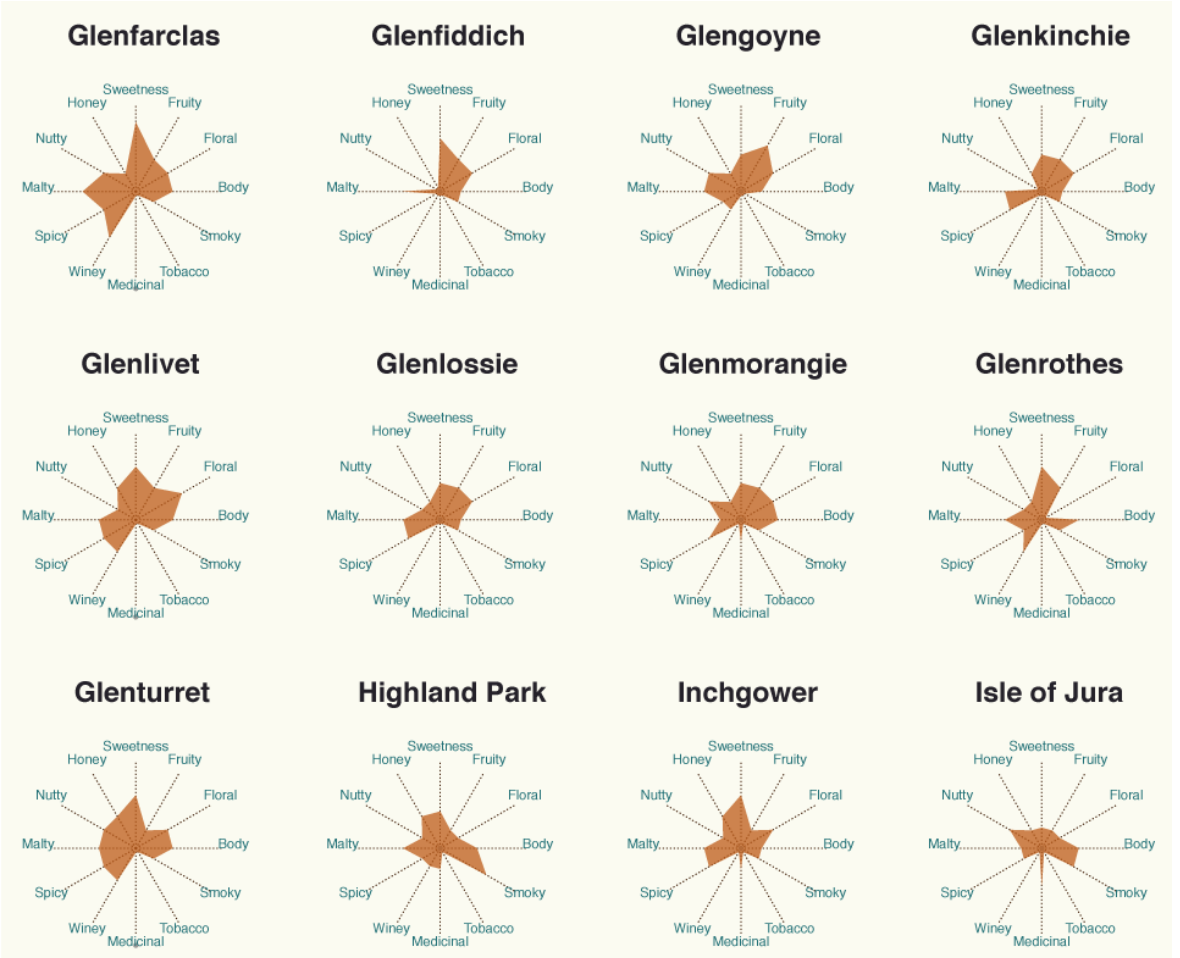
Stacked bar chart



Stacked area chart



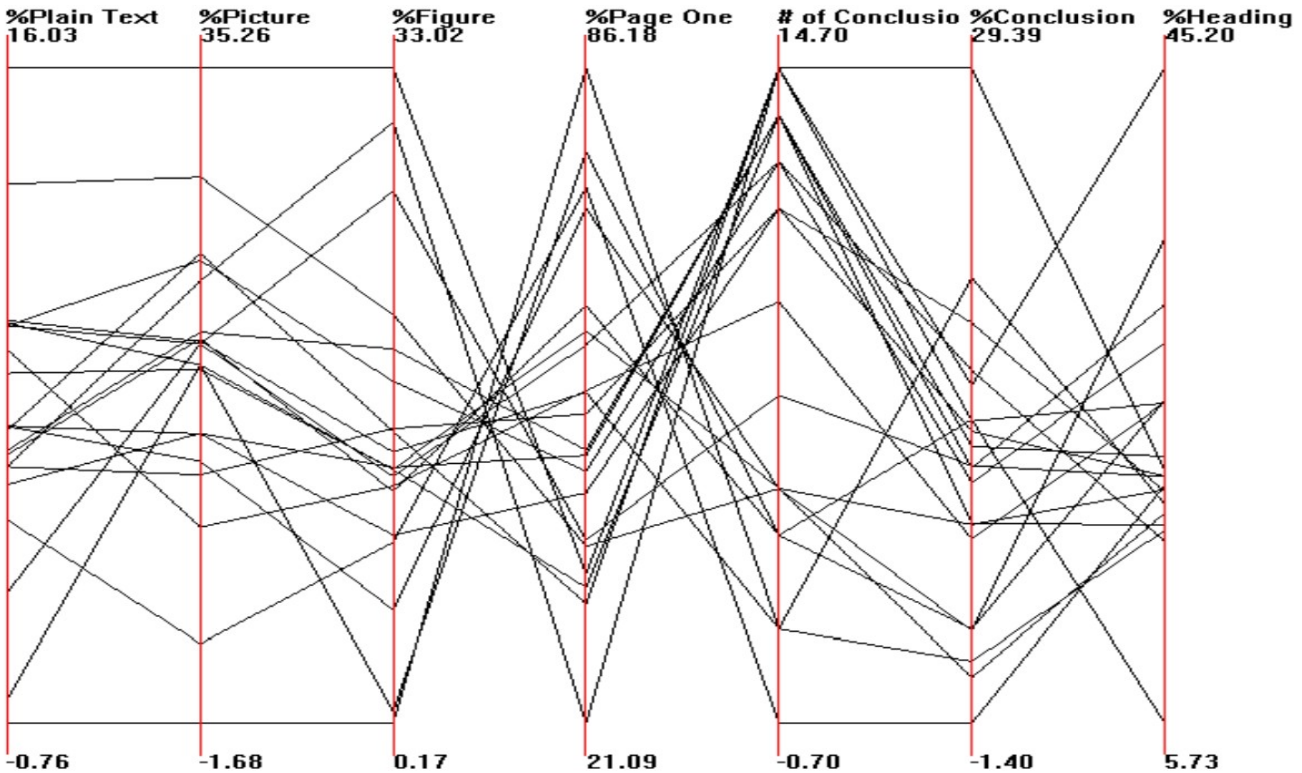
Star glyphs



https://www.reddit.com/r/Infographics/comments/1ueveb/whiskey_flavor_profiles_86_scotch_whiskies_12/

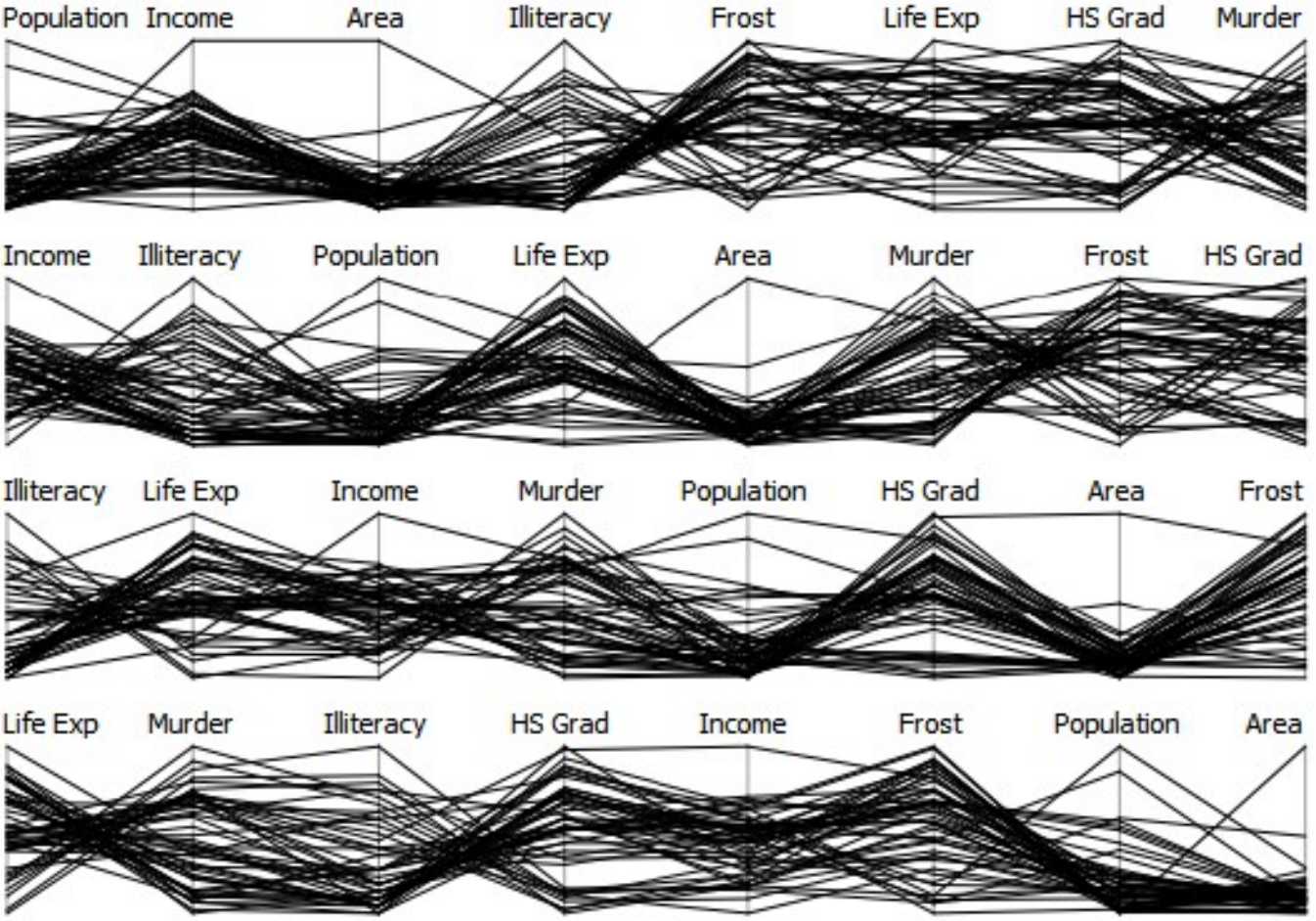
Parallel coordinates

- layout: n parallel axes
- one axis per data-attribute
- axes scaled to min/max-interval



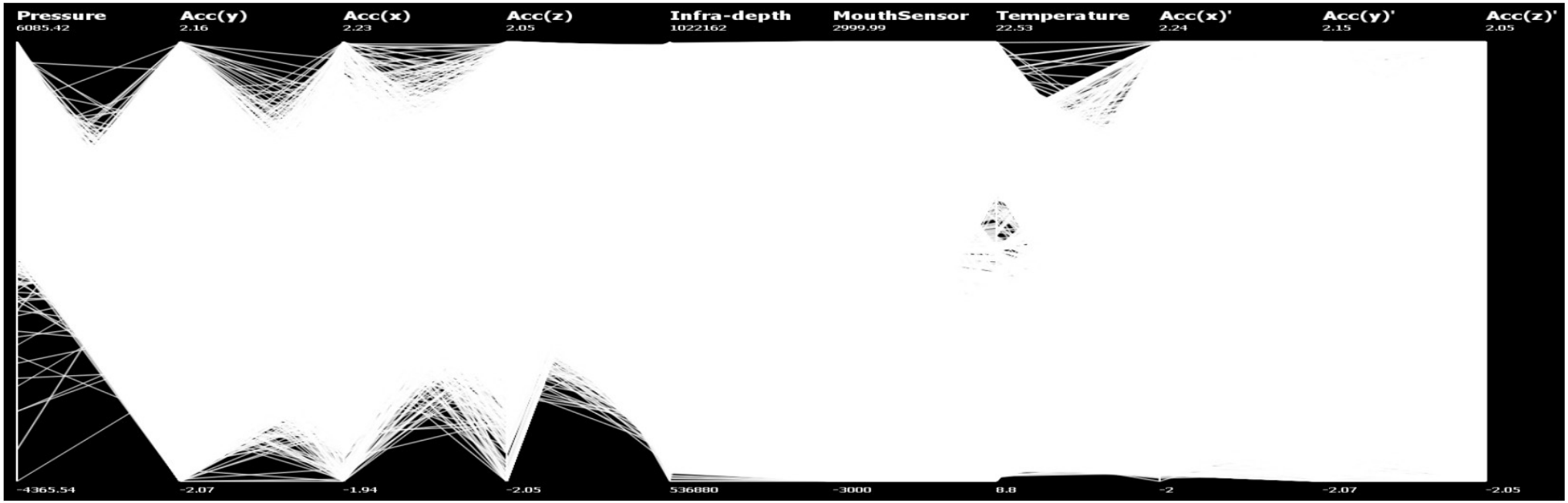
Inselberg, Alfred. "The Plane with Parallel Coordinates." The Visual Computer 1, no. 2 (August 1985): 69–91. https://doi.org/10.1007/BF01898350.

Challenge: Axis ordering

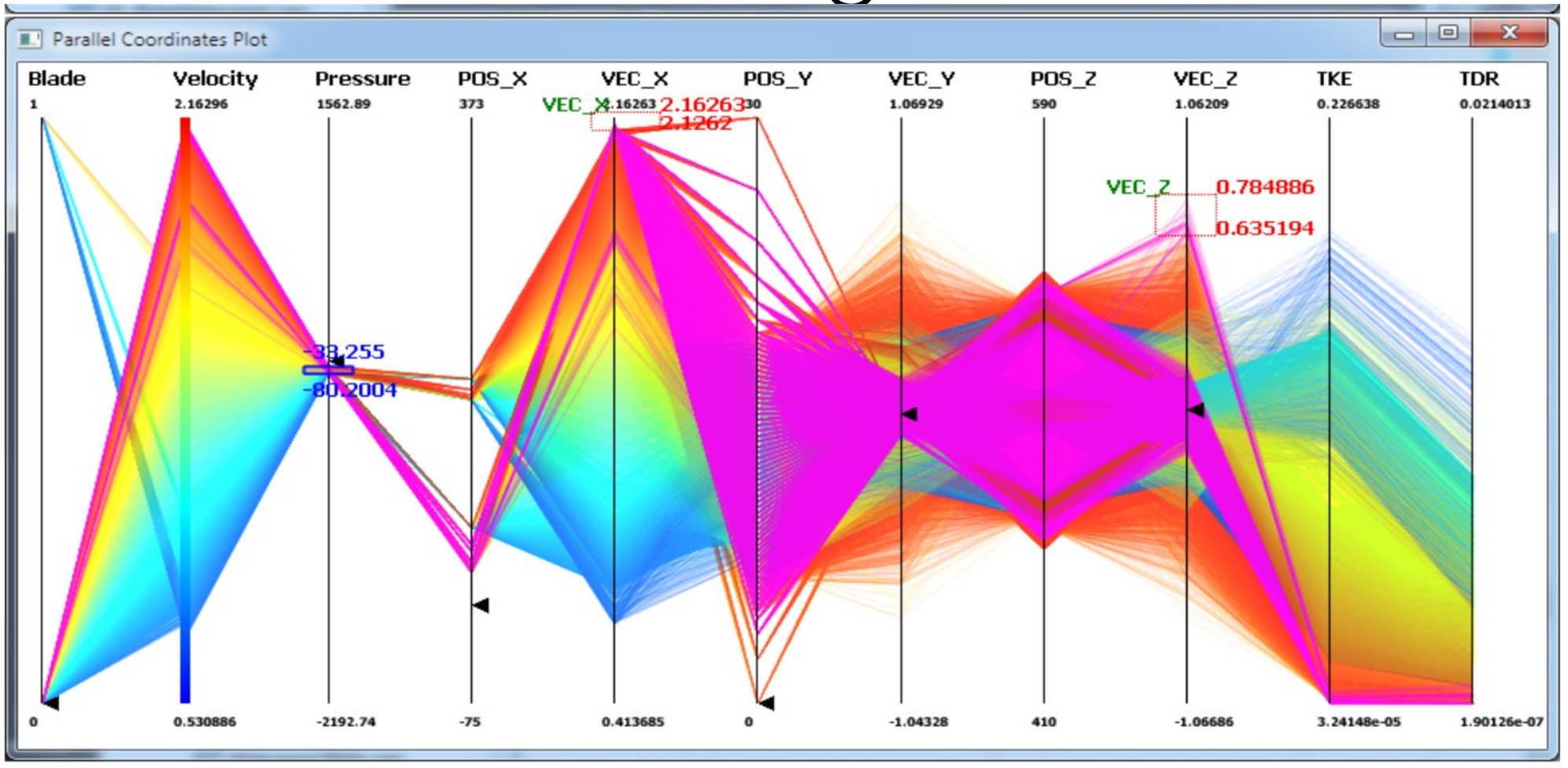


Heinrich, Julian, and Daniel Weiskopf. "State of the Art of Parallel Coordinates," 2013. http://dx.doi.org/10.2312/conf/EG2013/stars/095-116.

Challenge: overlapping lines

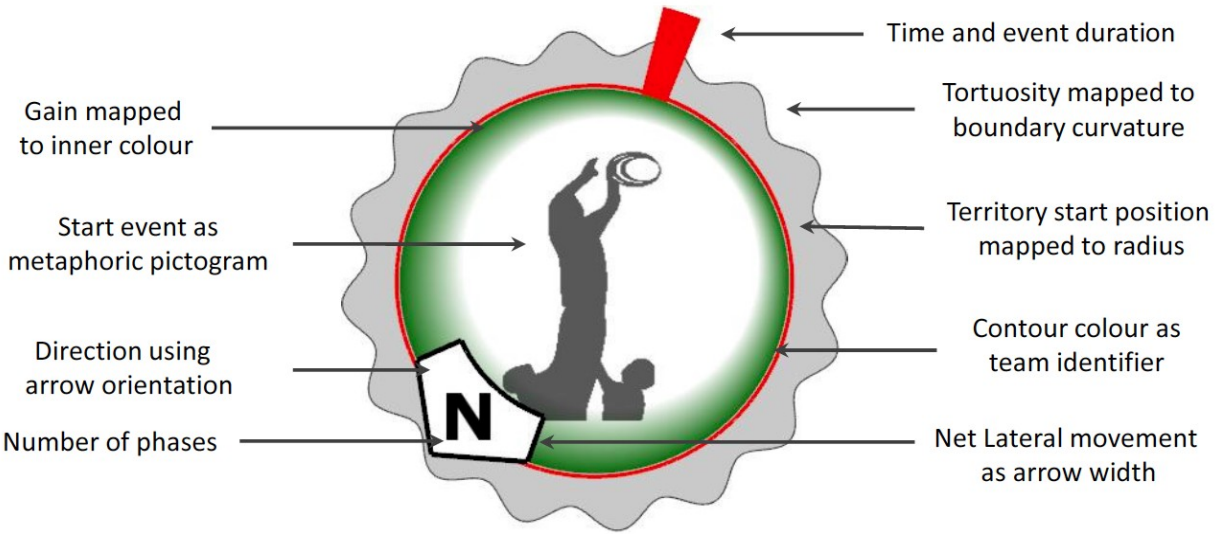


Color and brushing



Glyphs

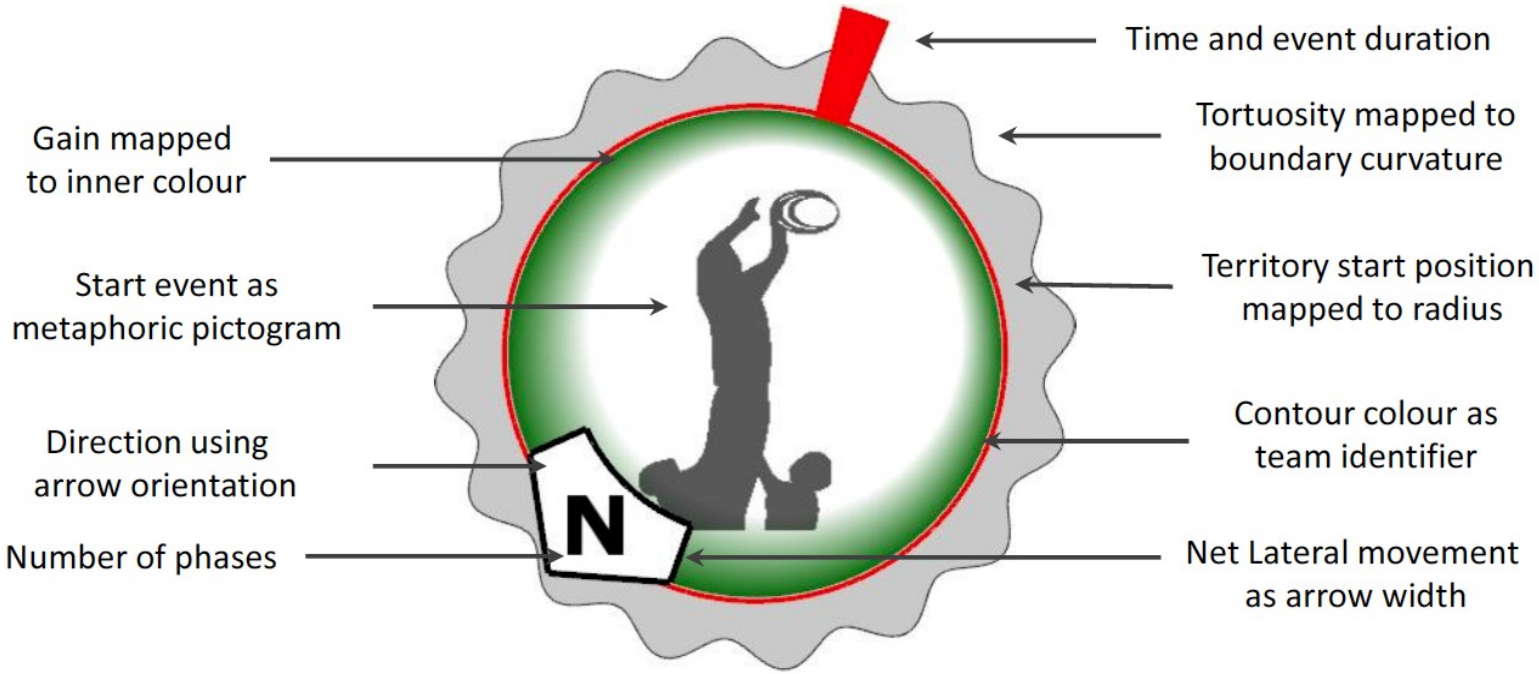
- Iconic representation of multiple attributes
- Methods:
  - Rugby glyphs
  - Vector glyphs
  - Chernoff faces
  - Star glyphs



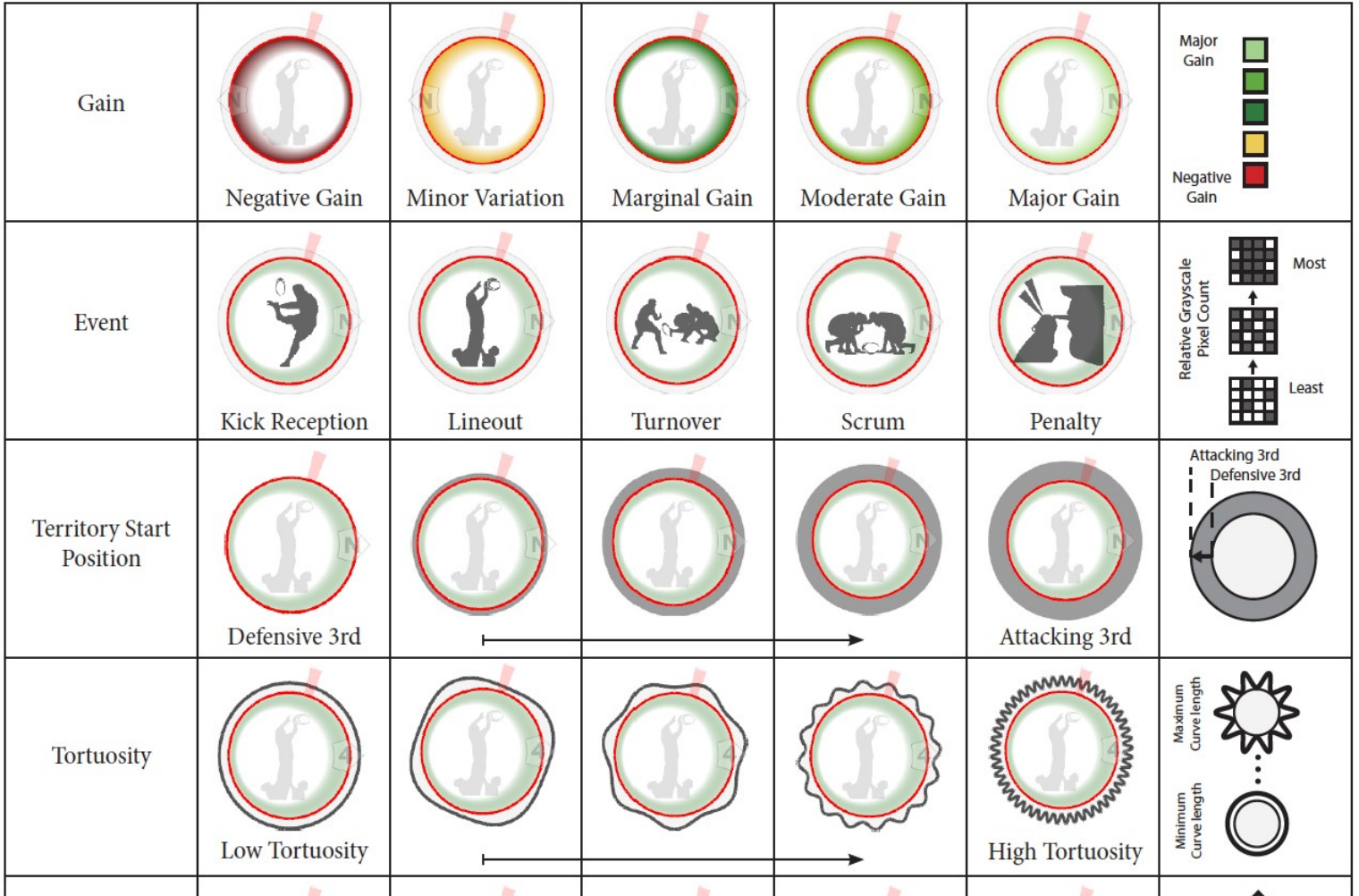
Sample glyph

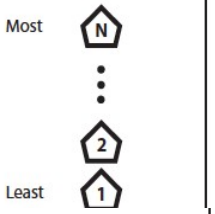
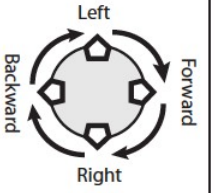
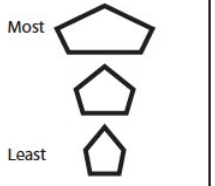
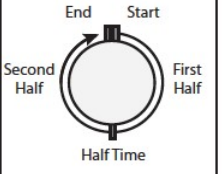
10 dimensions

Sort Key	Typedness	Visual Channel
Gain	Ordinal	Colour
Event	Nominal	Pictogram
Territory Start Position	Interval	Size
Tortuosity	Ratio	Shape
Number of Phases	Ratio	Enumerate
Direction	Direction	Orientation
Net Lateral Movement	Ratio	Length
Time	Ratio	Location
Phase Duration	Ratio	Length
Team Identifier	Nominal	Colour

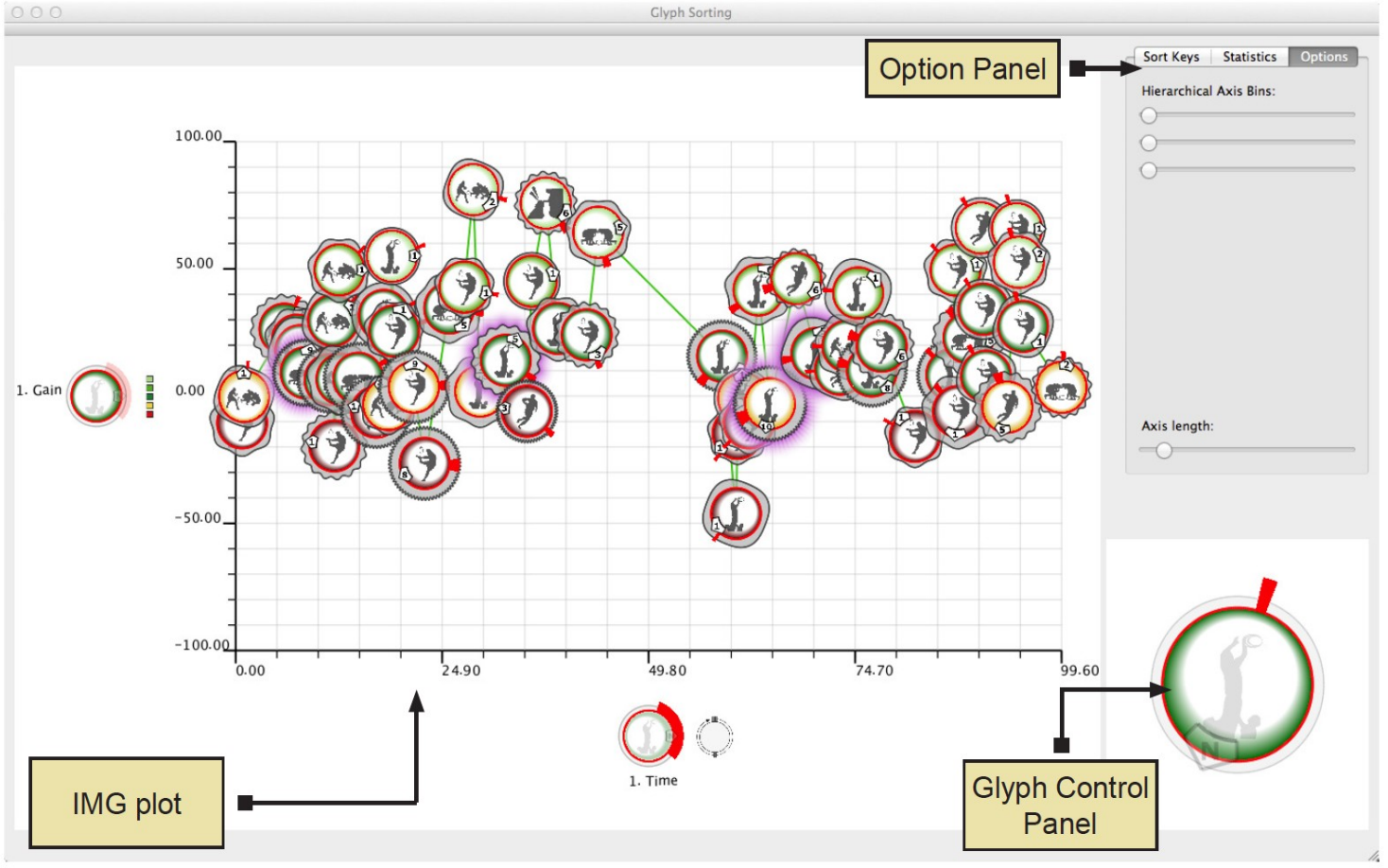


Glyphs for visualizing rugby events



Number of Phases	 1	 2	 3	 4	 N	
Direction	 Backward				 Forward	
Net Lateral Movement	 Least				 Most	
Time	 Start				 End	
Phase Duration	 Min				 Max	

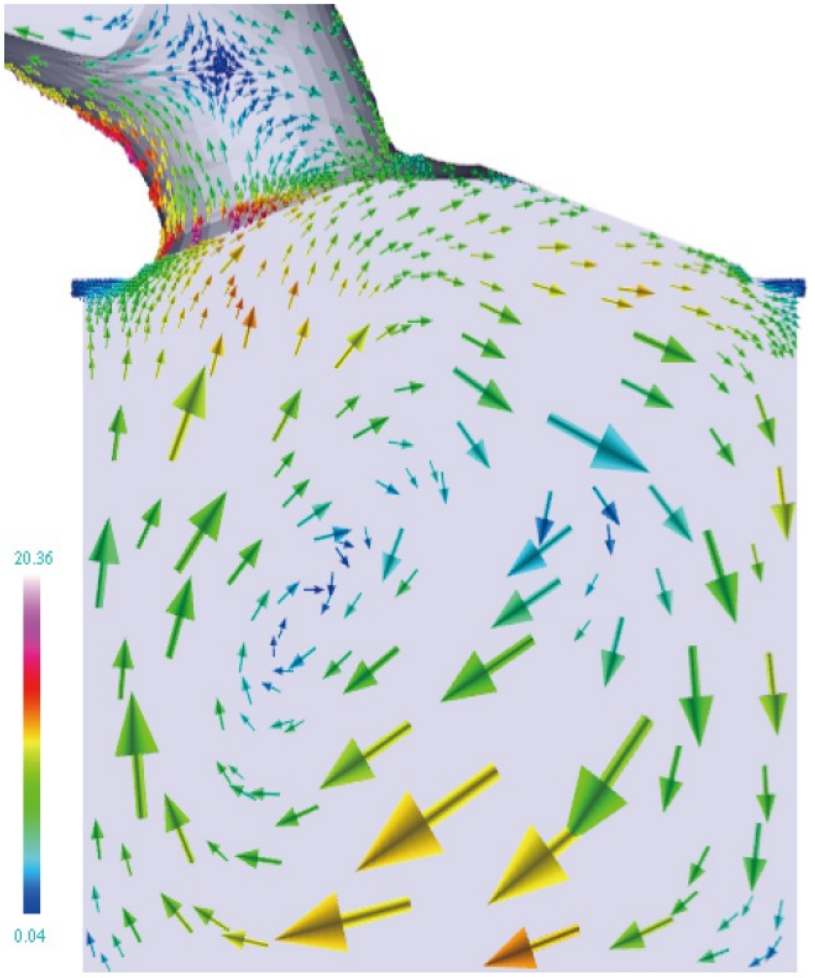
Glyphs for rugby events



Chung, David HS, Philip A. Legg, Matthew L. Parry, Rhodri Bown, Iwan W. Griffiths, Robert S. Laramee, and Min Chen. "Glyph Sorting: Interactive Visualization for Multi-Dimensional Data:" Information Visualization, November 29, 2013. https://doi.org/10.1177/1473871613511959.

Vector glyphs

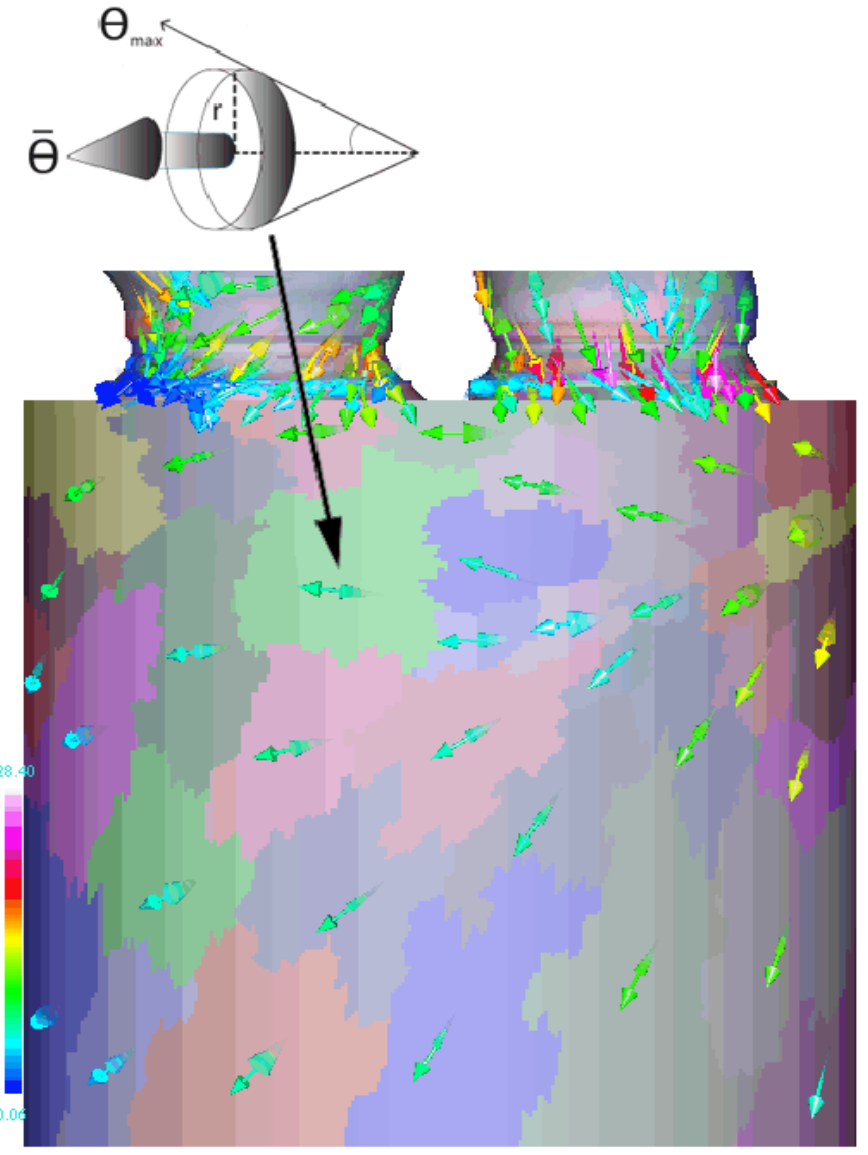
- Vector glyphs for visualization of fluid flow
- 7 variates visualized:
  - Position (x,y,z)
  - velocity(x,y,z)
  - magnitude



Peng, Zhenmin, Zhao Geng, Michael Nicholas, Robert S. Laramee, Nick Croft, Rami Malki, Ian Masters, and Chuck Hansen. “Visualization of Flow Past a Marine Turbine: The Information-Assisted Search for Sustainable Energy.” Computing and Visualization in Science 16, no. 3 (June 1, 2013): 89–103. https://doi.org/10.1007/s00791-014-0229-4.

Range glyphs

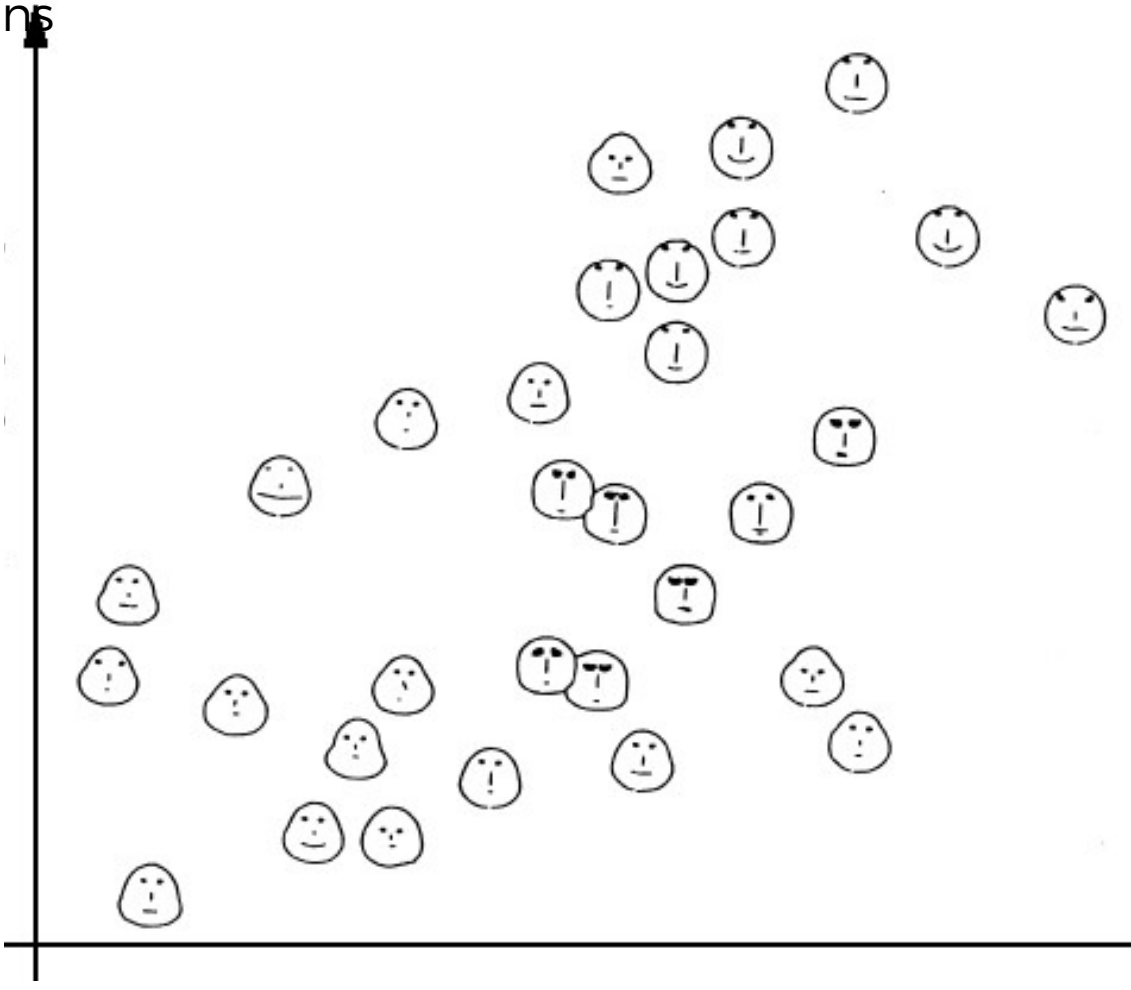
- Theta-Range glyphs for visualization of fluid flow
- 8 variates visualized:
  - Position (x,y,z)
  - Velocity (x,y,z)
  - Magnitude,
  - Angle range



Chernoff faces

Orginally used for 8-variate fossil specimens

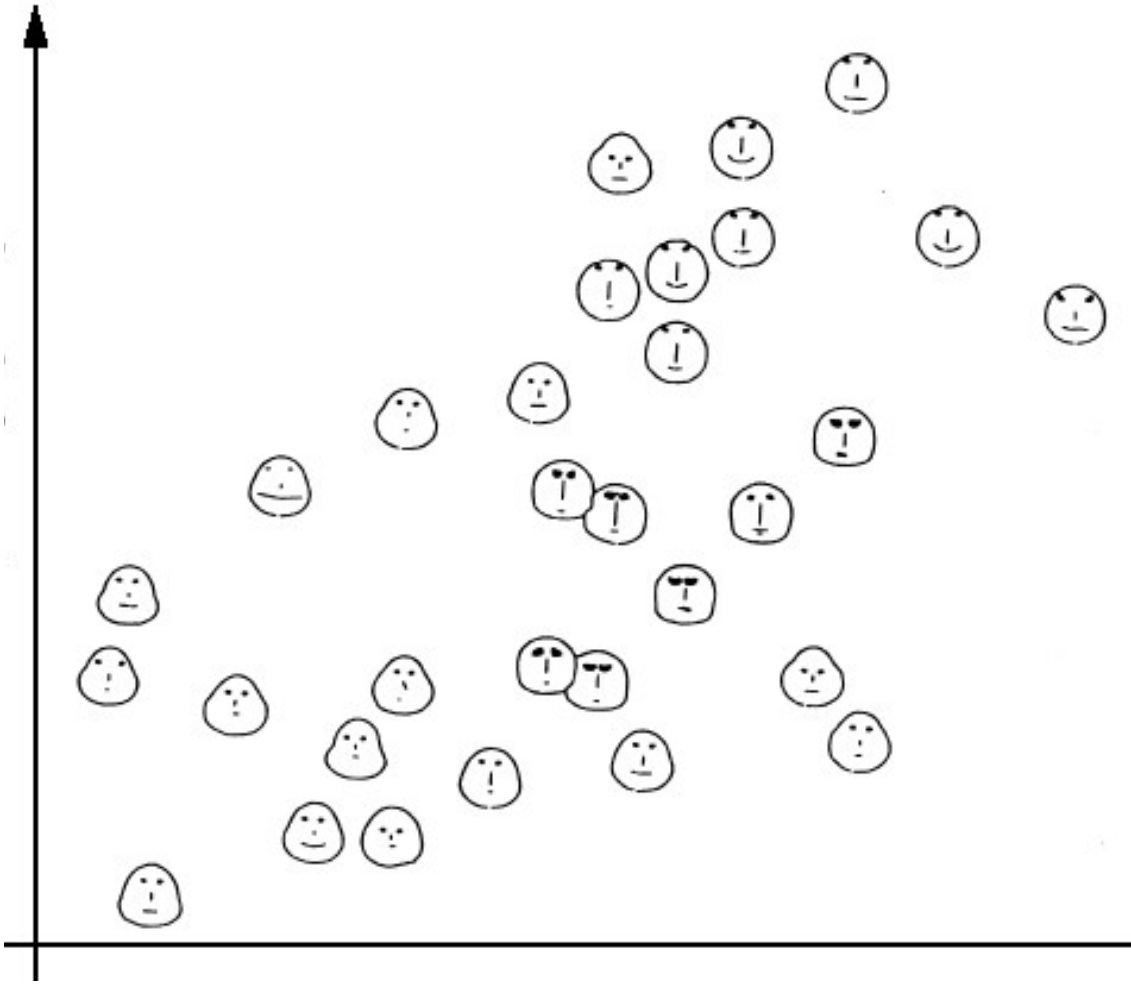
- Head shape/curvature + size
- Mouth length + curvature
- Nose length + curvature
- Eyes shape + size
- color
- x,y position



Chernoff, Herman. "The Use of Faces to Represent Points in K-Dimensional Space Graphically." Journal of the American Statistical Association 68, no. 342 (June 1, 1973): 361–68. https://doi.org/10.1080/01621459.1973.10482434.

Chernoff faces

- Do not use these
- Humans are designed around facial recognition
- Dimensions of face are not seperable



Conclusion

Summary

- Often using tabular data
- Information visualization is mapping abstract dimensions to spatial/visual
- Care needed to choose spatial mappings
- Single views form foundation of more elaborate visualizations