Hypervariate Information Visualization

Hauptseminar “Information Visualization" – Wintersemester 2008/2009

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Gliederung

- Definition
- Application Domains
- Traditional Hypervariate Visualization Techniques
  - Attribute Visible Techniques
  - Object Visible Techniques
- Extensive Hypervariate Visualization Techniques
- Integrating the User
  - Brushing
  - User-Driven Dimension Reduction
  - Store and Share Informations with other users
- Discussion

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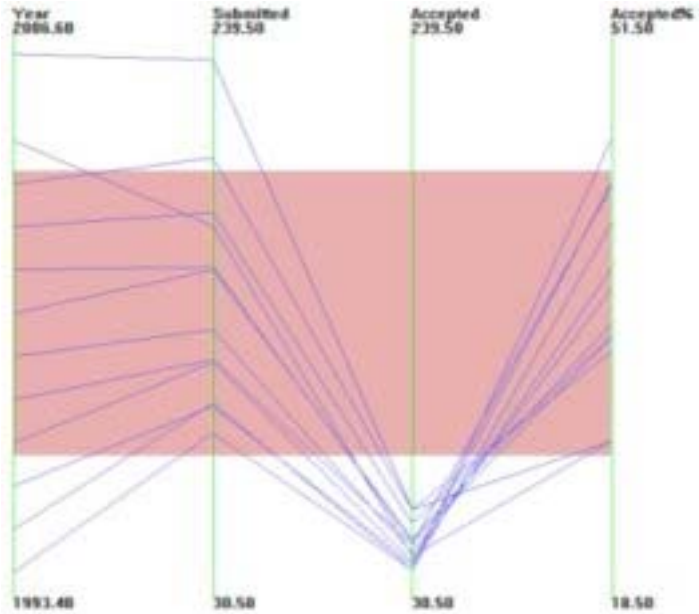
Definition

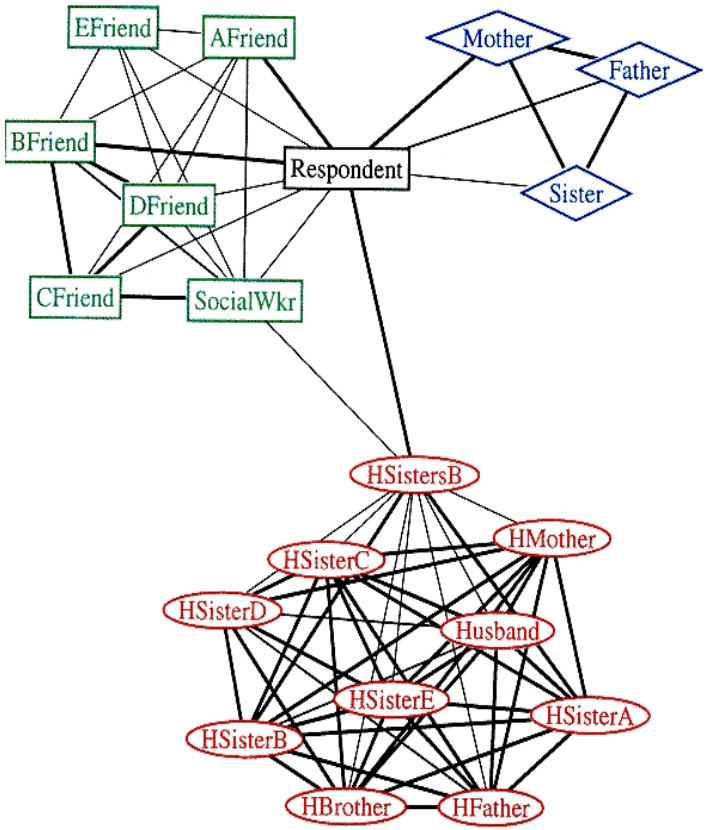
- Visualizing data with more than three attributes
- Difficulty to map hypervariate data in normal cartesian plots or scatterplots
- High importance of intuitive and understandable visual patterns

Year	Submitted	Accepted	Accepted (%)
1994	91	41	45.1
1995	102	41	40.2
1996	101	43	42.6
1997	117	44	37.6
1998	118	50	42.4
1999	129	47	36.4
2000	151	52	34.4
2001	152	51	33.6
2002	172	58	33.7
2003	192	63	32.8
2004	167	46	27.6
2005	268	88	32.8
2006	228	63	27.6

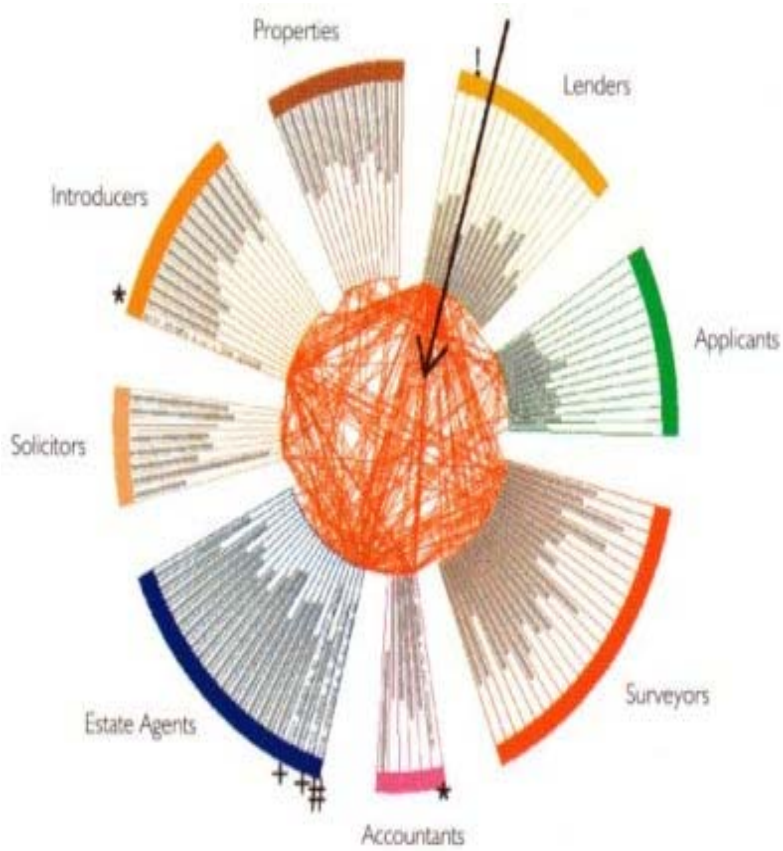


Application Domains

- Visualizing social choices(Fig. 3)



- Visualizing cheating delicts(Fig. 4)



Traditional Techniques

- Basic possibilities to encode the dimension's relationships
  - Lines
  - Color
  - Intersection of plains ---> e.g. Venn-Diagramm
- Development of special techniques which are fitted to the HyperInfoVis problems
- Subdivided in two categories:
  - Techniques supporting attribute visibility
  - Techniques supporting object visibility

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Object vs. Attribute visibility

- Attribute visible techniques point out the apportionment of given object's attribute values in each dimension
- Examples:
  - Parallel Plot
  - Scatterplot Matrix
  - Linked Histograms
  - Mosaic Plot

- Object visible techniques display the objects as single glyphs on the screen
- Examples:
  - Star Plot
  - Metaphorical Icons
  - Infocrystals
  - Cone tree
  - Treemaps
  - Hyperbolic Browser

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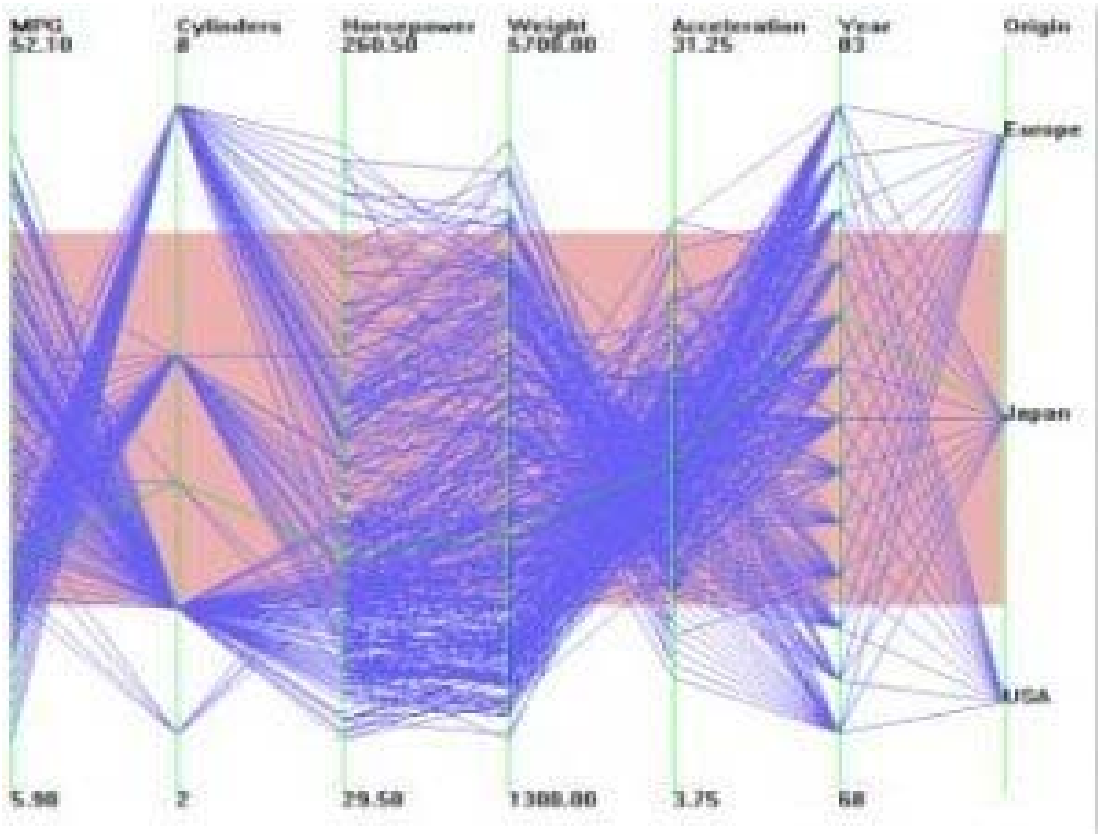
Example: Attribute visibility

- Parallel Plot



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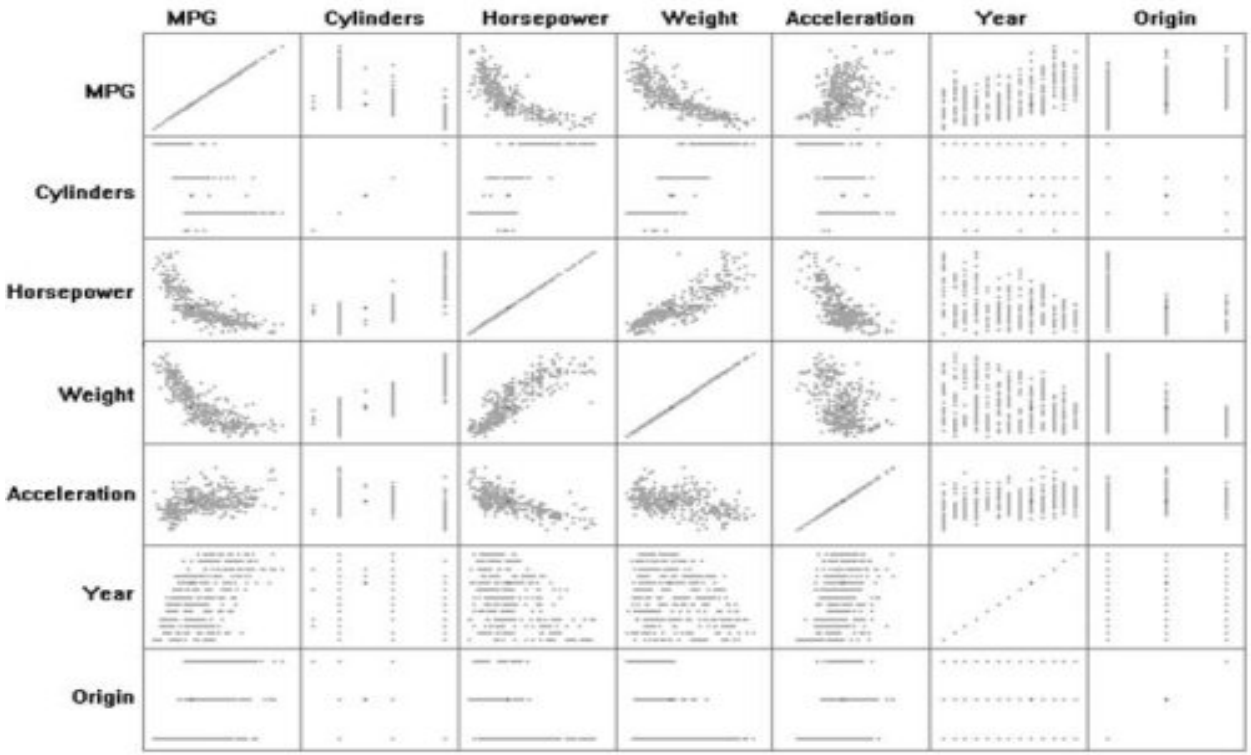
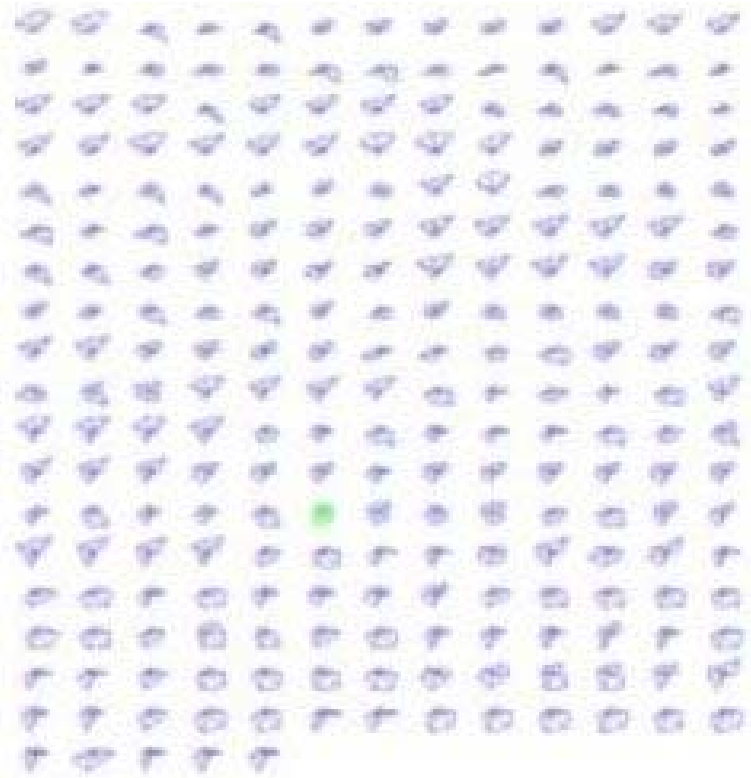
Example: Attribute visibility

- Scatterplot Matrix(Fig. 6)



Example: object visibility

- Star Plot



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Example: Object visibility

- Metaphorical Icons: Chernoff Faces(Fig. 8)

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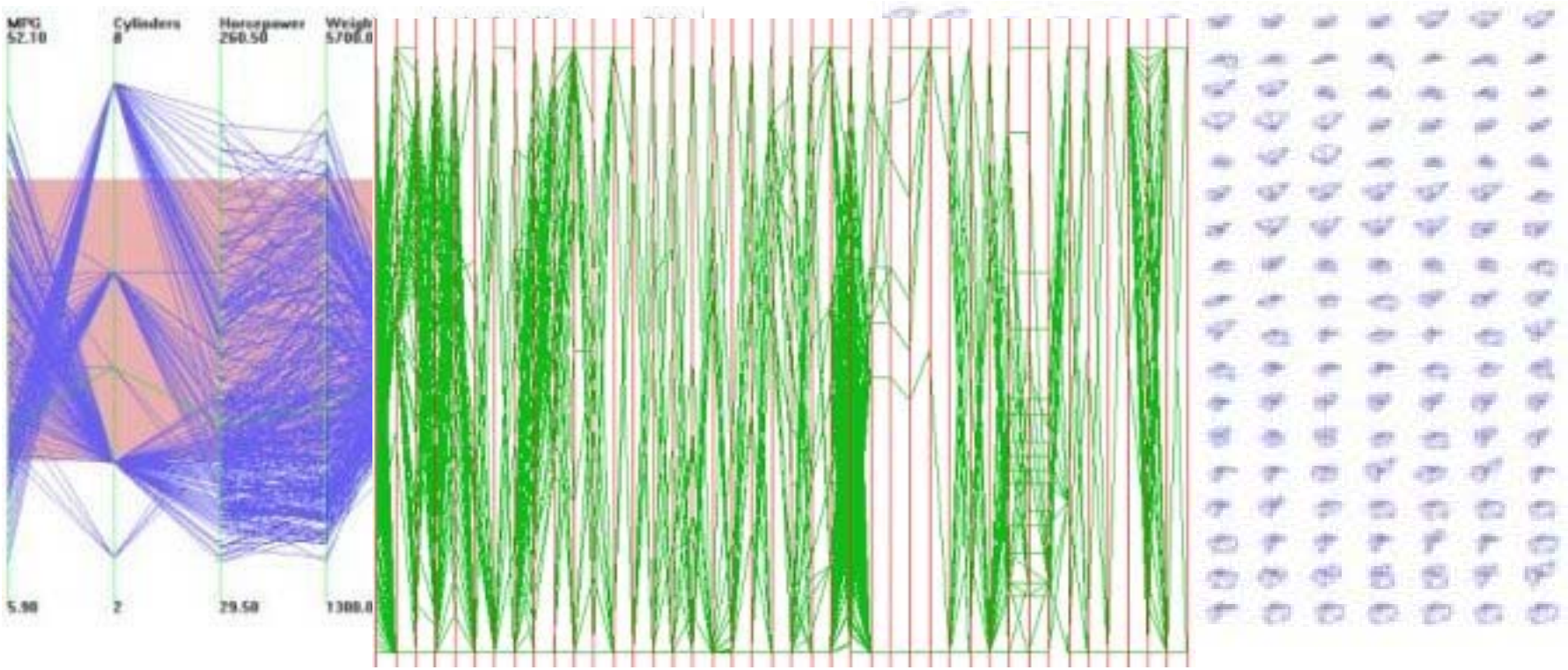
Object vs. Attribute visibility



Extensive Techniques

- Necessary Improvements: Dimension Reduction and introduction of interactive elements
- Three categories of Dimension Reduction
  - ***System-Driven Dimension Reduction***
  - ***User-Driven Dimension Reduction***
  - ***Combination of both Approaches***
- ***Examples for Techniques using System-Driven methods:***
  - ***Pure System-Driven (Multidimensional Scaling, Self-Organizing Maps)***
  - ***Visual Hierarchical Methods***
  - ***Glyph representations***
  - ***Information Nuggets***

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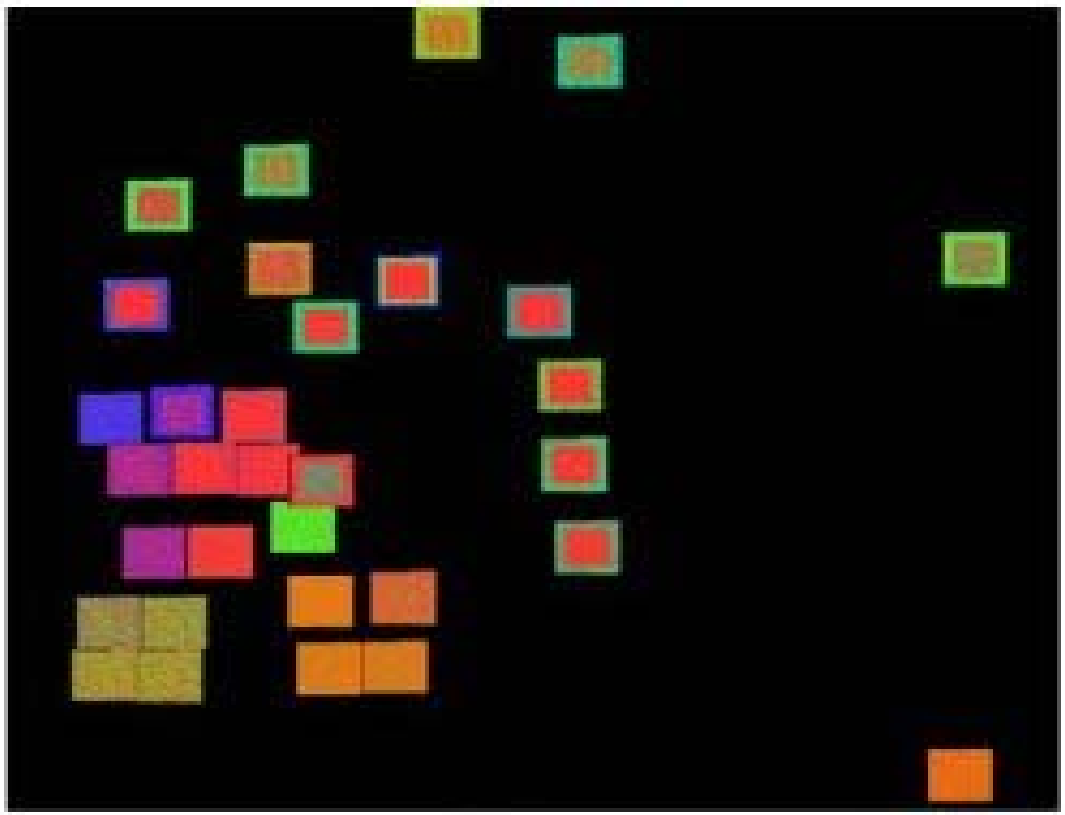
Examples

- Glyph representation(Fig. 10)



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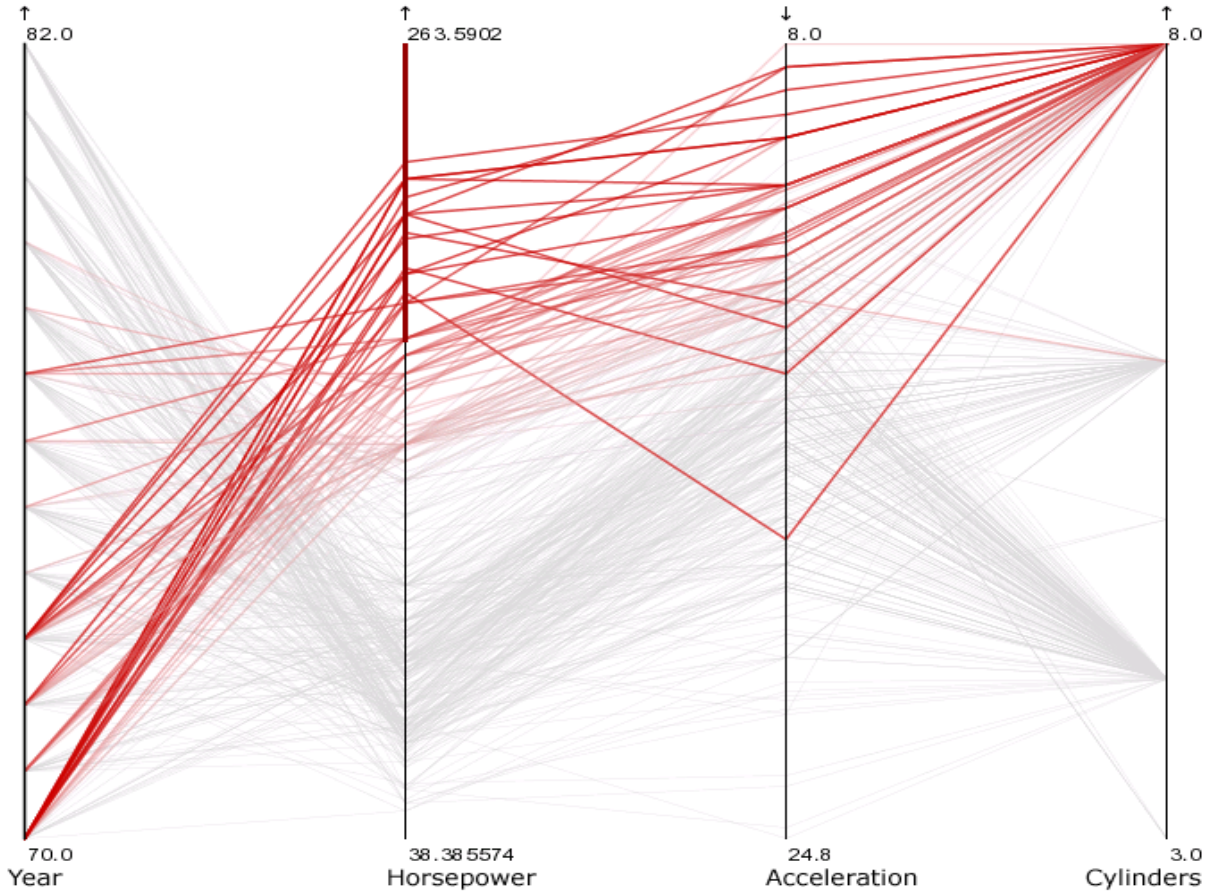
Integrating the User

- Reasons:
  - ***Clutter problem***
  - ***Unintuitive views***
  - ***Lack of accuracy***
  - ***No specific management discovery system***
- ***Introduction of basic navigation :***
  - ***Zooming and panning, showing names, extent scaling, selection possibilities...***
- ***Complex interaction Methods:***
  - ***Brushing***
  - ***User-driven dimension reduction***
  - ***Sharing extracted informations***

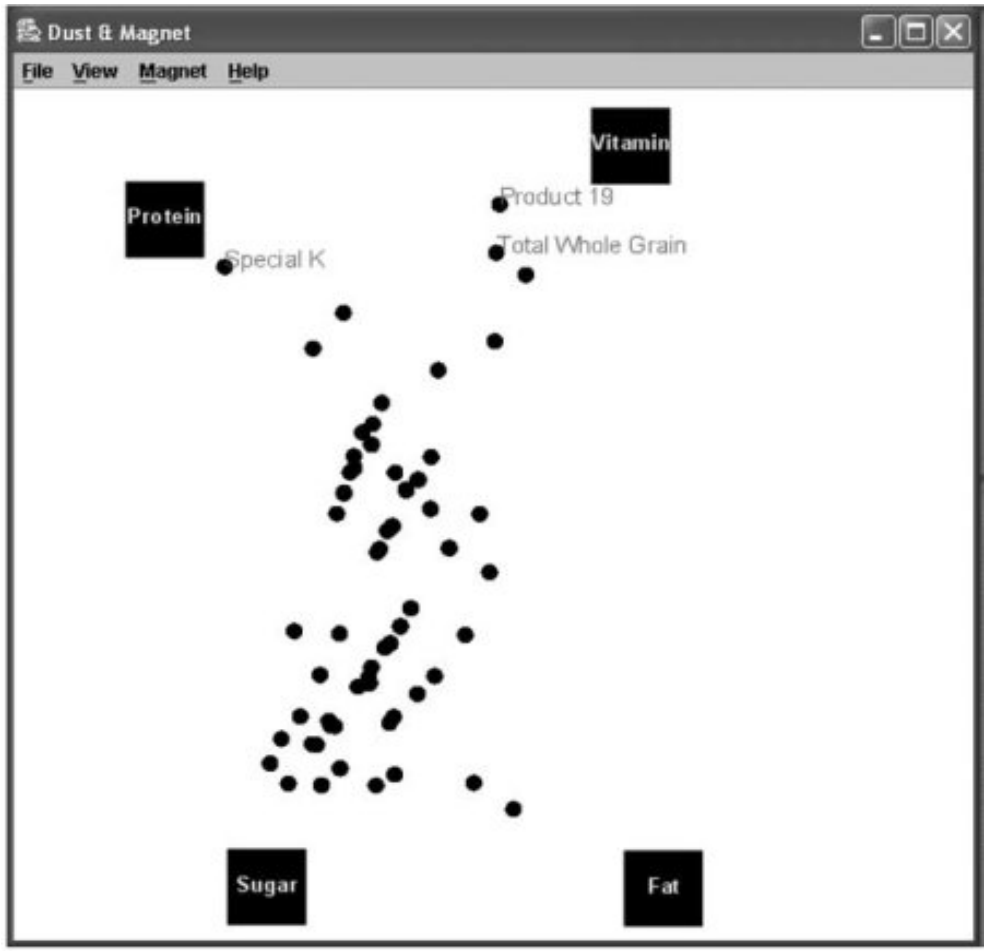
Brushing

- Parallel Plot with Brushing(Fig. 11)



User-Driven DR

- Dust & Magnet – Application(Fig. 12)



Sharing extracted Informations

- Organizing Informations with a discovery management mechanism
- Store discovered clusters or outliers in a special data-pool
- Store name-variable bindings

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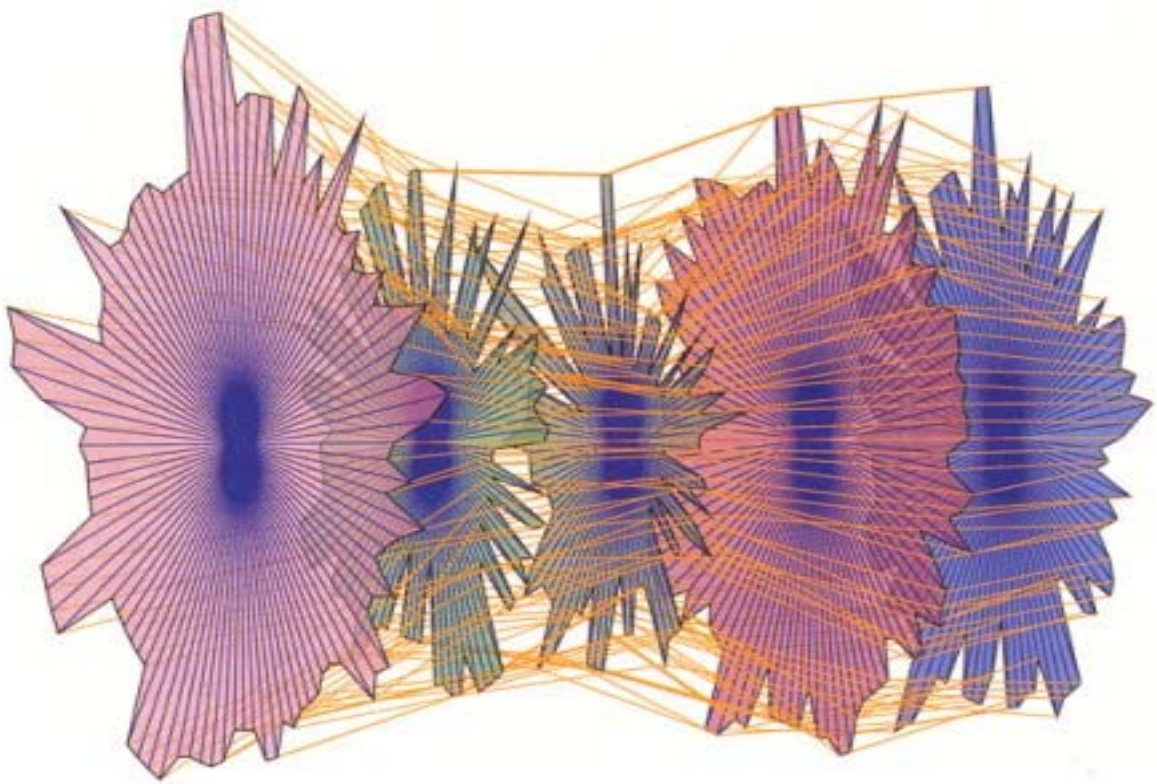
Discussion

- How can 3D-Representations support the visualization of Hypervariate data sets ?
- Parallel Glyphs(Fig. 13)



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- Fig.13: E. Fanea, S. Carpendale, and T. Isenberg. An Interactive 3D Integration of Parallel Coordinates and Star Glyphs. In Information Visualization,2005. INFO VIS 05. Proceedings of the 2005 IEEE Symposium on, pages20–20, 2005.

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