Visualising Symbolic Objects

VSTAR
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Plan

* Visualising SO
* VSTAR
* Demo

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**Zoom Star Representation**

*Need to represent*

- multivariate (or hypervariate data)
- mix of qualitative/quantitative variables
  - quantitative: in interval
  - categorical: weighted or multivariate values
  +
- hierarchical taxonomy of value
- logical dependencies

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**Existing solutions for multivariate data visualisation (1/2)**

- **Cartesian representation**
  
two by two

  inside a matrix: Hyperslice, Hyperbox
  hierarchically: Hierarchical Axis, Dimension Stacking, Worlds within World

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Existing solutions for multivariate data visualisation (2/2)

• Non cartesian representation
  Parallel Coordinates Method (Inselberg):
  allow visualisation of correlation between quantitative variables.
  Circle Segment Method (Ankerst, Keim & Kriegel):
  over time, large number of observations

Iconic techniques
  stick figure icon, autoglyph, colour icon,
  variables of the same type

Meet the need: Zoom Star, Symbolic Cube

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Visualisation

Visualisation of the input

Visualisation of the output

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**Zoom Star**

*Principles*

- One graphic for each SO
- Radial graph (Kiviat diagram)
- Global information first
- More information given interactively
- Complete description if required
- All types of variables
- 2D/3D

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**Graphical convention for the axes**

<table>
<thead>
<tr>
<th>Variable type</th>
<th>Axis description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative</td>
<td>Graduated axis</td>
</tr>
<tr>
<td>Categorical</td>
<td>Dots equally distributed on the axis</td>
</tr>
<tr>
<td>Categ.: Not Weighted</td>
<td>Axis drawn in one colour</td>
</tr>
<tr>
<td>Categ.: Weighted</td>
<td>Axis drawn in another colour</td>
</tr>
<tr>
<td>Missing value</td>
<td>Axis drawn in grey</td>
</tr>
</tbody>
</table>

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**2D Zoom Star**

**quantitative variable**
- limits of the interval

**categorical variable**
- not weighted: equal dots for different values
- weighted: with size proportional to the weight

- To join extremities of interval or dot of higher weight
- To colour the internal surface
- Complete distribution given when clicking on the axis

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**Example**

SO1 =

- Day = Mon (0.06), Tue (0.06), Wed (0.06), Thu (0.06), Fri (0.06), Sat (0.35), Sun (0.35)
- And Origin = Local
- And LicAge = [15.00 : 80.00]
- And Age = [35.00 : 50.00]
- And Sex = M
- And Action = Bend, ConLoss
- And Cause = Other (0.25), Speed (0.25), Alcohol (0.50)
- And Collision = Not Applicable
- And Place = Rural (0.30), Urban (0.70)
- And Road = Sec
- And Hour = Morn (0.20), After (0.20), Even (0.25), Night (0.35)
- And Month = Not Applicable
- And Speed Level = [120.00 : 150.00]

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Histogram for Zoom Star in 2D
### Convention chosen to link axes

<table>
<thead>
<tr>
<th>Variable value</th>
<th>Link type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>The current value is linked</td>
</tr>
<tr>
<td>Multiple</td>
<td>All values are linked</td>
</tr>
<tr>
<td>Interval</td>
<td>The limits are both linked and the whole surface is filled</td>
</tr>
<tr>
<td>Weighted values</td>
<td>The value with the highest weight is the only one to be linked</td>
</tr>
</tbody>
</table>

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### 3D Zoom Star

- histograms on the axes
- animation features: the star can turn around a vertical axis or an horizontal one
- Example

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Dependencies and taxonomies representation

Information only at demand

Dependencies: supplementary linked axis

Taxonomy: in a separate window

exp: NACE

Example
Example of professional careers of retired persons in Luxembourg in 1991 who have complete 40 years of work.

### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthdate</td>
<td>Categorical with weights</td>
<td>Birth date</td>
</tr>
<tr>
<td>Salary51</td>
<td>Quantitative with intervals</td>
<td>Salary received in 1951</td>
</tr>
<tr>
<td>Salary60</td>
<td>Quantitative with intervals</td>
<td>Salary received in 1960</td>
</tr>
<tr>
<td>Salary70</td>
<td>Quantitative with intervals</td>
<td>Salary received in 1970</td>
</tr>
<tr>
<td>Salary80</td>
<td>Quantitative with intervals</td>
<td>Salary received in 1980</td>
</tr>
<tr>
<td>Salary90</td>
<td>Quantitative with intervals</td>
<td>Salary received in 1990</td>
</tr>
<tr>
<td>Alloc90</td>
<td>Quantitative with intervals</td>
<td>Sickness Allocation received in 1990</td>
</tr>
<tr>
<td>Pension</td>
<td>Quantitative with intervals</td>
<td>Monthly pension allocation</td>
</tr>
<tr>
<td>FUND</td>
<td>Categorical with weights</td>
<td>Pension fund</td>
</tr>
<tr>
<td>Gender</td>
<td>Categorical with weights</td>
<td>Sex</td>
</tr>
</tbody>
</table>

### Carrier data

\[
\text{NPS} = \text{Birthday} = '26 (0.19), '27 (0.03), '28 (0.05), '29 (0.06), '30 (0.15), '31 (0.30), '32 (0.07), '33 (0.07), '34 (0.08) \\
\text{Gender} = \text{Female} (0.21), \text{Male} (0.79) \\
\text{FUND} = \text{AVI} (0.81), \text{CPEP} (0.19) \\
\text{Pension} = [ 6.00 : 19.00 ] \\
\text{Alloc90} = [ 0.00 : 781.00 ] \\
\text{Salary90} = [ 5.00 : 1494.00 ] \\
\text{Salary80} = [ 145.00 : 920.00 ] \\
\text{Salary70} = [ 0.00 : 340.00 ] \\
\text{Salary60} = [ 0.00 : 188.00 ] \\
\text{Salary51} = [ 0.00 : 119.00 ]
\]
Non profit sector 2D

Non profit sector 3D

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Agriculture with different scale 2D

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Comparison of several SO

Wholesale business sector  Manufacturing industries sector

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Comparison of several SO

Health care  Building and civil engineering

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Superimposition
# Breakdown

## Table

<table>
<thead>
<tr>
<th>Soil</th>
<th>RF-Parent</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>littorale</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>desert</td>
<td>2100.00</td>
<td>0.00</td>
</tr>
<tr>
<td>basalt</td>
<td>0.00</td>
<td>20000.00</td>
</tr>
<tr>
<td>eri</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>nubata</td>
<td>5000.00</td>
<td>0.00</td>
</tr>
<tr>
<td>rupia</td>
<td>0.00</td>
<td>10000.00</td>
</tr>
<tr>
<td>soliset</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>solagri</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>solidom</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>sololi</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>solincis</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>solagric</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

## Diagram

[Diagram showing various factors affecting breakdown]
Breakdown

An example: Environmental Attitudes Survey 2000

From Statistics Finland

Sampling survey

Sample size: 2500

Non response: 30 %

Response size: 1 746

Cross classification: gender - age group - collapsed education level (2)

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Socio-demographic variables

Gender: 1 = Male, 2 = Female

Age group: 15-24, 25-34, 35-44, 45-54, 55-64, 65-74

Education level: 2 = Primary, 3 = Lower Secondary, 4 = Higher Secondary, 5 = Lower University, 6 = University

Development of the region: 1 = Low, 2 = Low Medium, 3 = High Medium, 4 = High

Earning - Earning level: 1 = very low (often children), 2 = low, 3 = Medium, 4 = High, 5 = Very high

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Socio-demographic variables

GRID - 1km x 1 km Grid

1 = 1-199 people living, no manufacturing industries
2 = 2000-2999 people living, no manufacturing
3 = 1-199 people living, 1-99 manufacturing jobs
4 = 200-2999 people living, 1-99 manufacturing jobs
5 = 1-2999 people living, 100+ manufacturing jobs
6 = 3000+ people living

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**Attitude factors**

**Control:** believe to the use of control mechanisms

**Satisfactory:** generally satisfactory to the state of environment

**Individual:** believe that the role of an individual is essential

**Welfare:** environmental care is part of welfare

**Human:** believe that a human being may influence on the decision making etc.

**Politician:** politicians are responsible, especially

**Fear factors**

**Load:** fear on the load of environment and impact on the welfare of humans

**Noise:** fear on noise and construction

**Nature:** anxiety on the nature of Finland

**Sea:** anxiety on the future of seas and oceans

**Diversity:** fear on the decrease of the diversity of the nature

**Waste:** fear on waste and bad water

**Vehicle:** fear on the problems due to vehicles

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VIEW + VSTAR

DEMO

VSTAR Module

- Menus and menu Items
- Operations available in a Table Window
- Operations available in a Graphic Window (2D or 3D)

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Menus and menu Items

Figure 1: The main window

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Figure 2: The File menu

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Figure 3: The Edit menu

Figure 4: The View menu

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Menus and menu Items

Figure 5: The Labels dialog box

Figure 6: The Selection menu
Figure 7: The Symbolic objects, Variables, and Categories Selection

Figure 8: The Graphic menu
Menus and menu Items

Figure 9: The Graphic menu

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Menus and menu Items

Figure 9: An example of Zoom Star with a dependency

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Figure 10: An example of Zoom Star with *buttons*

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Figure 11: The *Add Text* dialogue box

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Menus and menu Items

Figure 12: The *Set Color* dialogue box

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Menus and menu Items

Figure 13: The *Set Font* dialogue box

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Figure 14: The *Window* menu

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Figure 15: An example of windows in *Cascade*

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Menus and menu Items

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Figure 17: The Help menu

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Operations available in a Table Window

Figure 20: The Selection of Lines and Columns

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VSTAR Module

Operations available in a Graphic Window

Figure 21: Examples of 2D and 3D Zoom Stars

The object name and the variables names can be moved

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Operations available in a Graphic Window

Figure 22: Visualisation of distributions
Left button click on a weighted variable axis

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Operations available in a Graphic Window

Figure 23: Visualisation of dependencies
Right button click on a dependency line

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Figure 24: Visualisation of Taxonomies
Left button click on a taxonomy icon

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Operations available in a Graphic Window

Figure 25: Scales modification
Left button click on a quantitative variable axis

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