Visualising Symbolic Objects

VSTAR

Monique Noirhomme-Fraiture

Institut d'Informatique
FUNDP
(université de Namur)
mno@info.fundp.ac.be

ASSO Workshop, Lisbon, 26 January 2004

Plan

- Visualising SO
- VSTAR
- Demo

ASSO Workshop, Lisbon, 26 January 2004

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

Existing solutions for multi-variate data visualisation (1/2)

- Cartesian representation

two by two

inside a matrix : Hyperslice, Hyperbox

hierarchically : Hierarchical Axis, Dimension Stacking, Worlds within World

Existing solutions for multi-variate data visualisation (2/2)

• Non cartesian representation

Parallel Coordinates Method (Inselberg) :

allow visualisation of correlation beetween 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

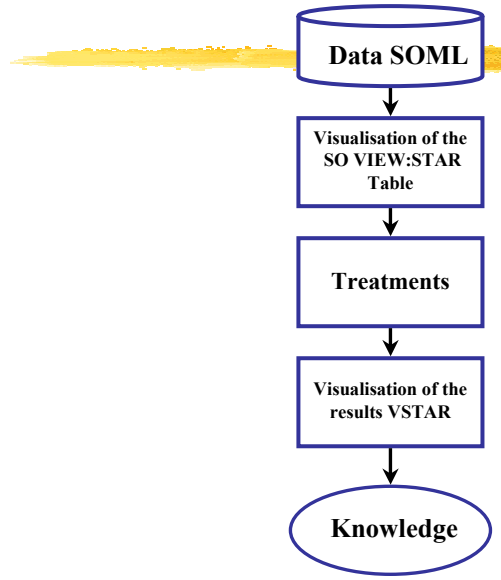
Meet the need: Zoom Star, Symbolic Cube

Visualisation

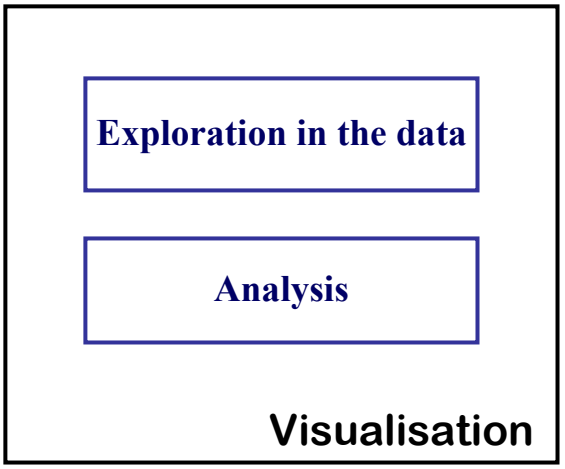
Visualisation of the input

Visualisation of the output

Visualisation



Visualisation



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

Graphical convention for the axes

Variable type	*Axis description*
Quantitative	Graduated axis
Categorical	Dots equally distributed on the axis
Categ.: Not Weighted	Axis drawn in one colour
Categ.: Weighted	Axis drawn in another colour
Missing value	Axis drawn in grey

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

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

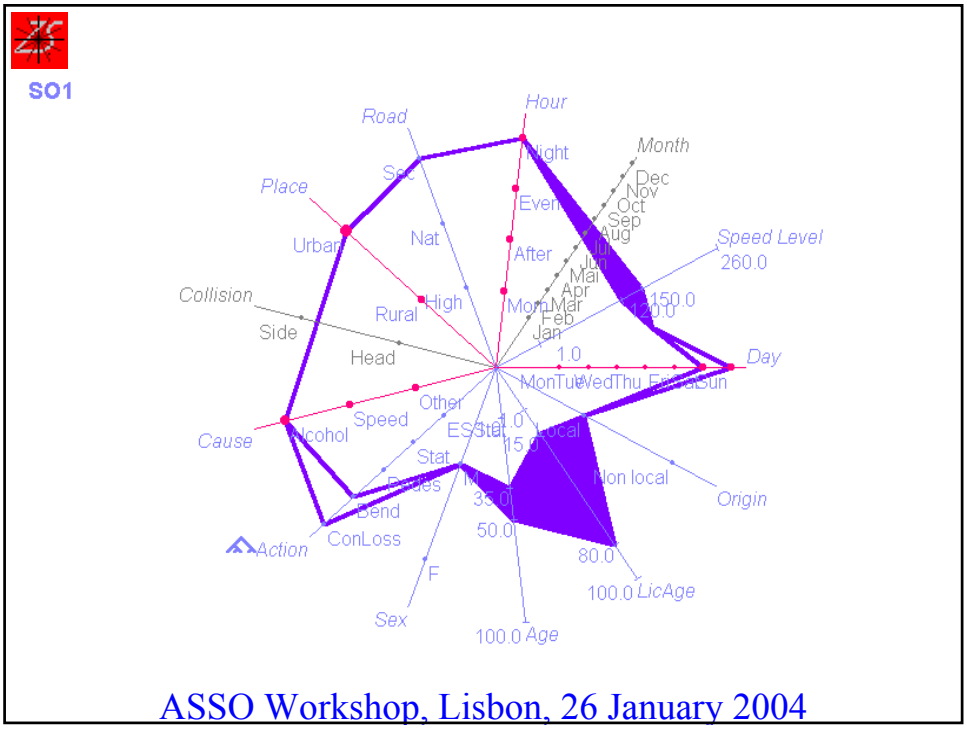
And Place = Rural (0.30), Urban (0.70)

And Road = Sec

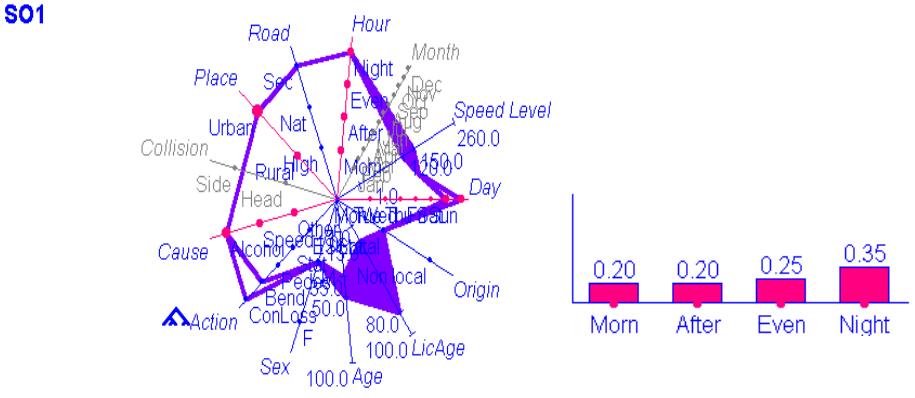
And Hour = Morn (0.20), After (0.20), Even (0.25), Night (0.35)

And Month = Not Applicable

And Speed Level = [120.00 : 150.00]



Histogram for Zoom Star in 2D

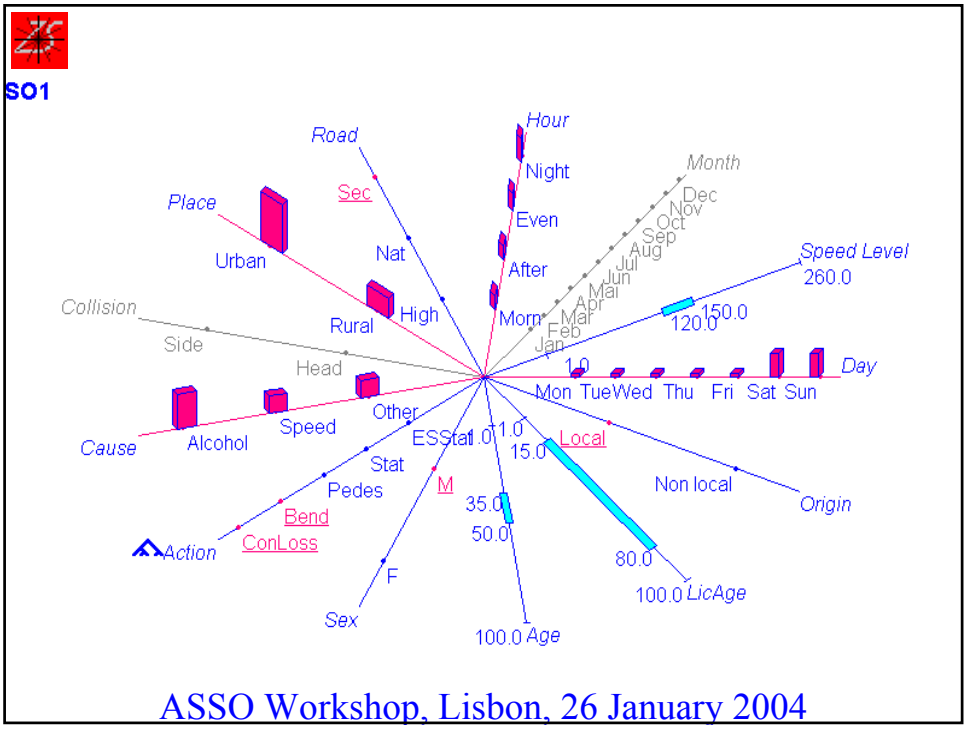


Convention chosen to link axes

Variable value	*Link type*
Single	The current value is linked
Multiple	All values are linked
Interval	The limits are both linked and the whole surface is filled
Weighted values	The value with the hightest weight is the only one to be linked

3D Zoom Star

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



Dependencies and taxonomies representation

Information only at demand

Dependencies : supplementary linked axis

Taxonomy : in a separate window
exp: NACE

Example

Analysis with SO Visualisation

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

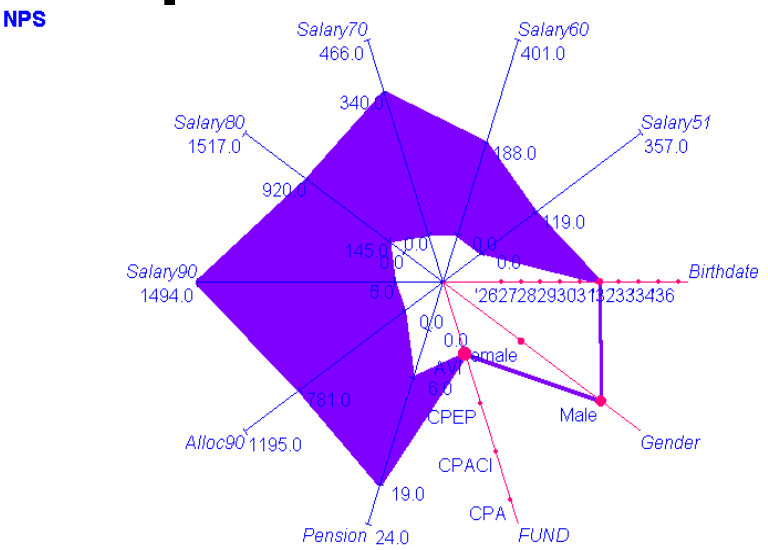
Variables

Name	*Type*	*Description*
Birthdate	Categorical with weights	Birth date
Salary51	Quantitative with intervals	Salary received in 1951
Salary60	Quantitative with intervals	Salary received in 1960
Salary70	Quantitative with intervals	Salary received in 1970
Salary80	Quantitative with intervals	Salary received in 1980
Salary90	Quantitative with intervals	Salary received in 1990
Alloc90	Quantitative with intervals	Sickness Allocation received in 1990
Pension	Quantitative with intervals	Monthly pension allocation
FUND	Categorical with weights	Pension fund
Gender	Categorical with weights	Sex

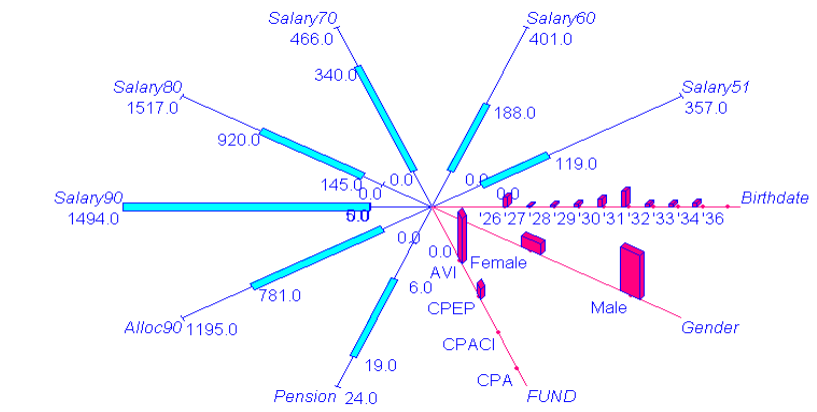
Carrier data

NPS =
Birthdate = '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)
And Gender = Female (0.21), Male (0.79)
And FUND = AVI (0.81), CPEP (0.19)
And Pension = [6.00 : 19.00]
And Alloc90 = [0.00 : 781.00]
And Salary90 = [5.00 : 1494.00]
And Salary80 = [145.00 : 920.00]
And Salary70 = [0.00 : 340.00]
And Salary60 = [0.00 : 188.00]
And Salary51 = [0.00 : 119.00]

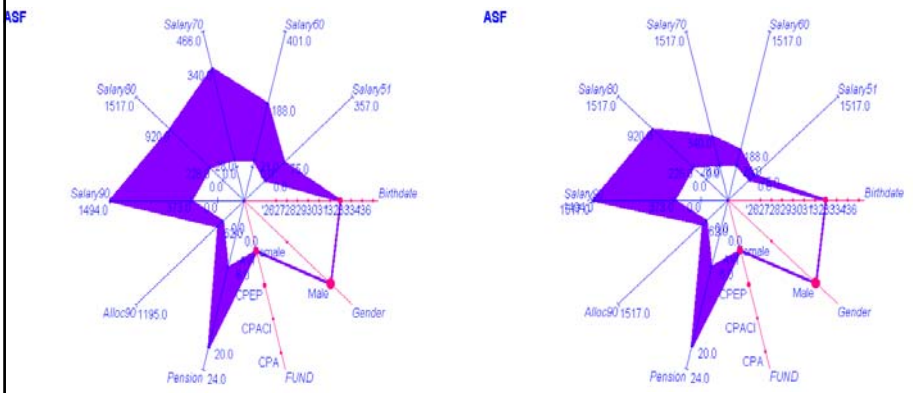
Non profit sector 2D



Non profit sector 3D



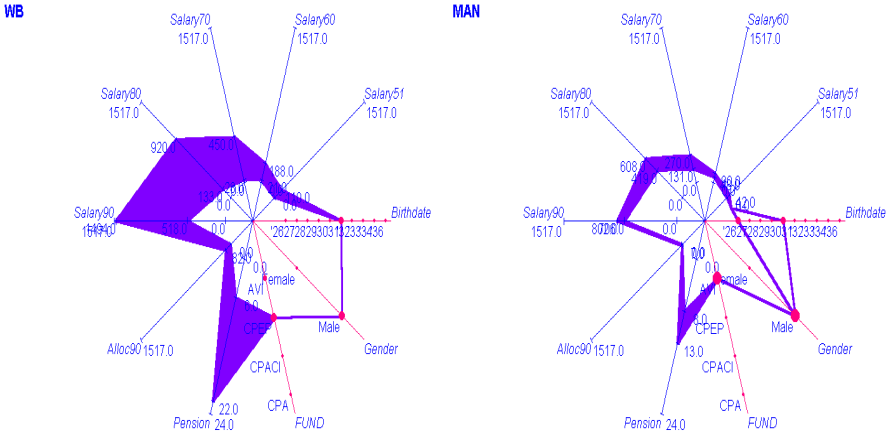
Agriculture with different scale 2D



Comparison of several SO

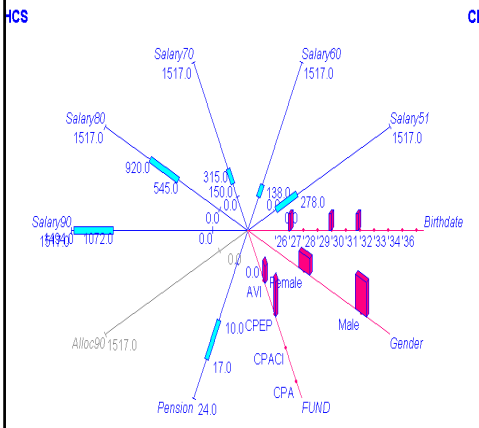
Wholesale business sector

Manufacturing industries sector

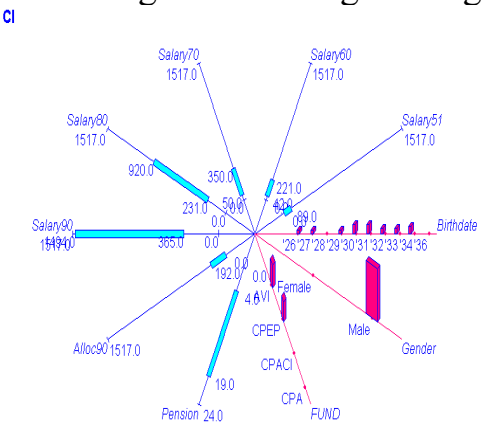


Comparison of several SO

Health care

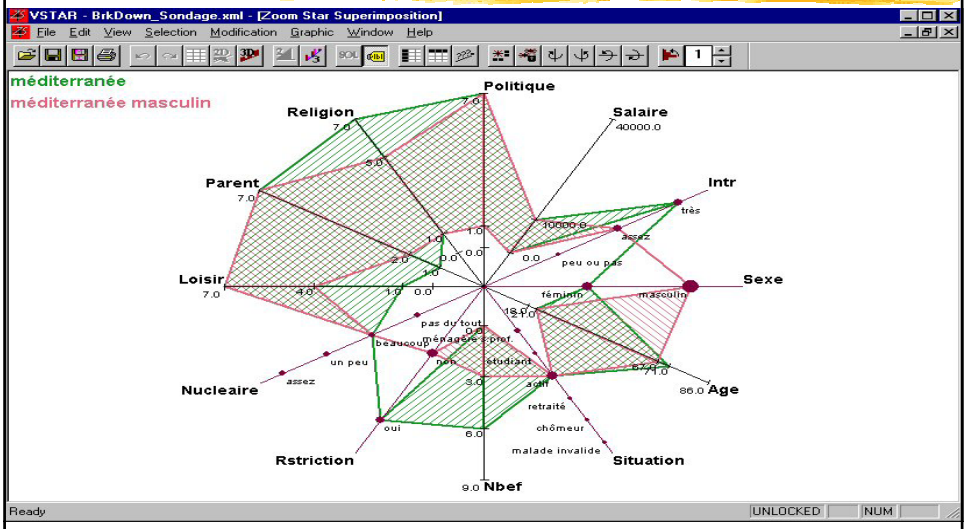


Building and civil engineering

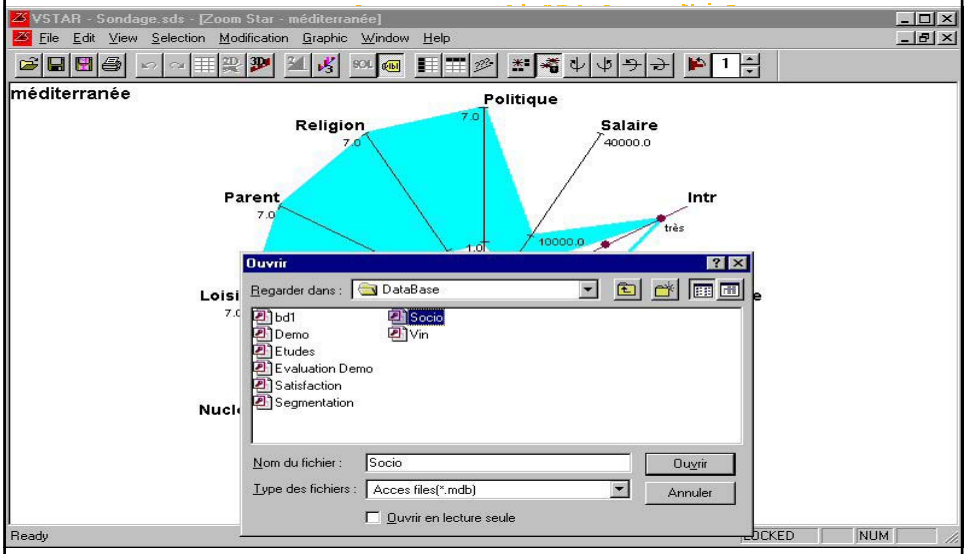


ASSO Workshop, Lisbon, 26 January 2004

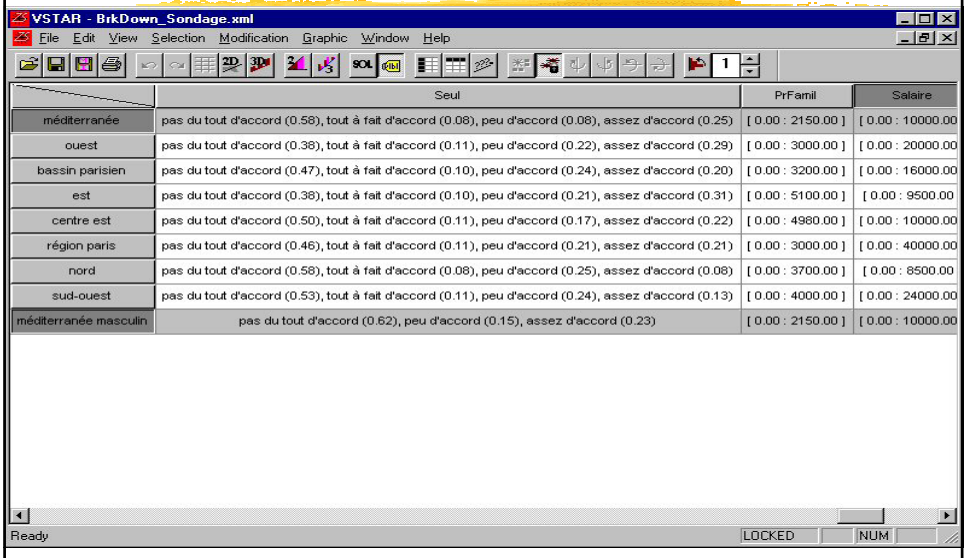
Superimposition



Breakdown

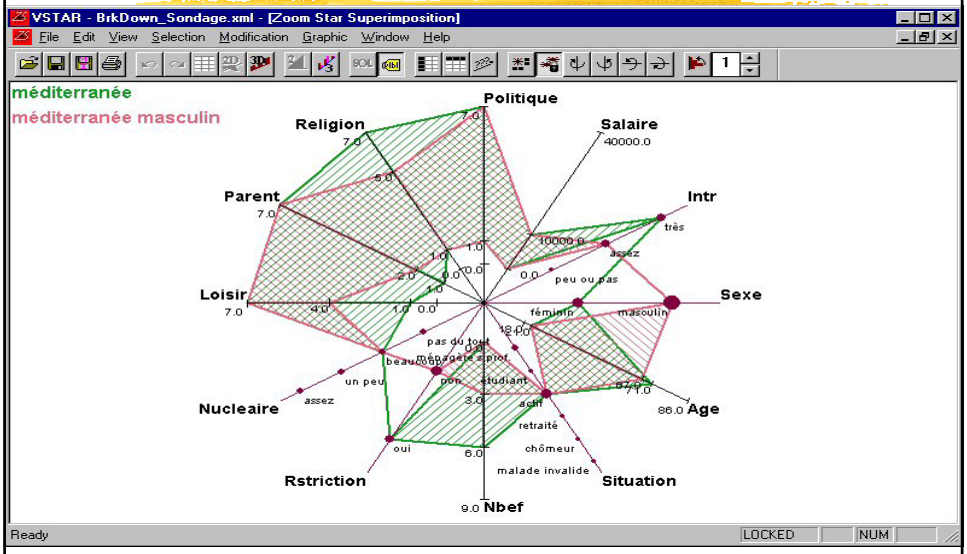


Breakdown



	Seul	PrFamil	Salaire
méditerranée	pas du tout d'accord (0.58), tout à fait d'accord (0.08), peu d'accord (0.08), assez d'accord (0.25)	[0.00 : 2150.00]	[0.00 : 10000.00
ouest	pas du tout d'accord (0.38), tout à fait d'accord (0.11), peu d'accord (0.22), assez d'accord (0.29)	[0.00 : 3000.00]	[0.00 : 20000.00
bassin parisien	pas du tout d'accord (0.47), tout à fait d'accord (0.10), peu d'accord (0.24), assez d'accord (0.20)	[0.00 : 3200.00]	[0.00 : 16000.00
est	pas du tout d'accord (0.38), tout à fait d'accord (0.10), peu d'accord (0.21), assez d'accord (0.31)	[0.00 : 5100.00]	[0.00 : 9500.00
centre est	pas du tout d'accord (0.50), tout à fait d'accord (0.11), peu d'accord (0.17), assez d'accord (0.22)	[0.00 : 4980.00]	[0.00 : 10000.00
région paris	pas du tout d'accord (0.46), tout à fait d'accord (0.11), peu d'accord (0.21), assez d'accord (0.21)	[0.00 : 3000.00]	[0.00 : 40000.00
nord	pas du tout d'accord (0.58), tout à fait d'accord (0.08), peu d'accord (0.25), assez d'accord (0.08)	[0.00 : 3700.00]	[0.00 : 8500.00
sud-ouest	pas du tout d'accord (0.53), tout à fait d'accord (0.11), peu d'accord (0.24), assez d'accord (0.13)	[0.00 : 4000.00]	[0.00 : 24000.00
méditerranée masculin	pas du tout d'accord (0.62), peu d'accord (0.15), assez d'accord (0.23)	[0.00 : 2150.00]	[0.00 : 10000.00

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)

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

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

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

VIEW + VSTAR

DEMO

VSTAR Module

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

Menus and menu Items

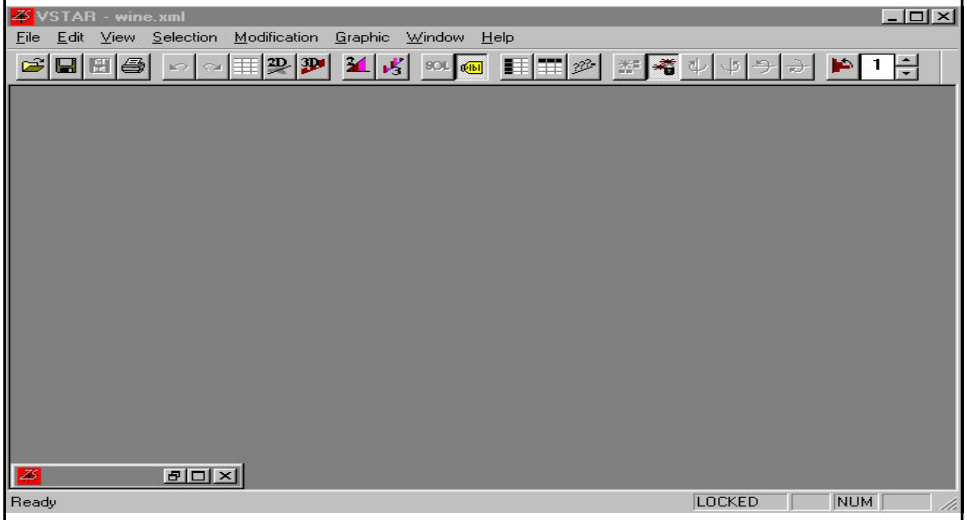


Figure1: The main window

ASSO Worshop, Lisbon, 26 January 2004

Menus and menu Items

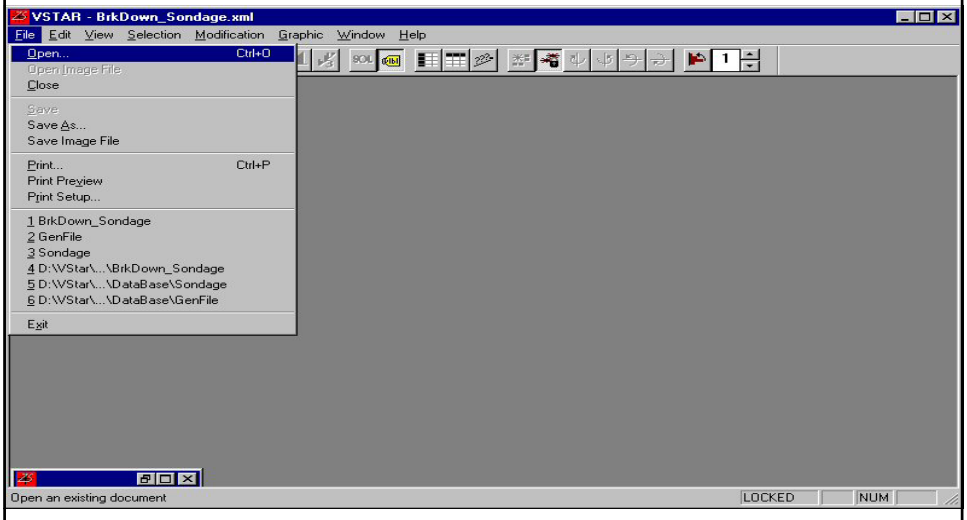


Figure2: The *File* menu

ASSO Worshop, Lisbon, 26 January 2004

Menus and menu Items

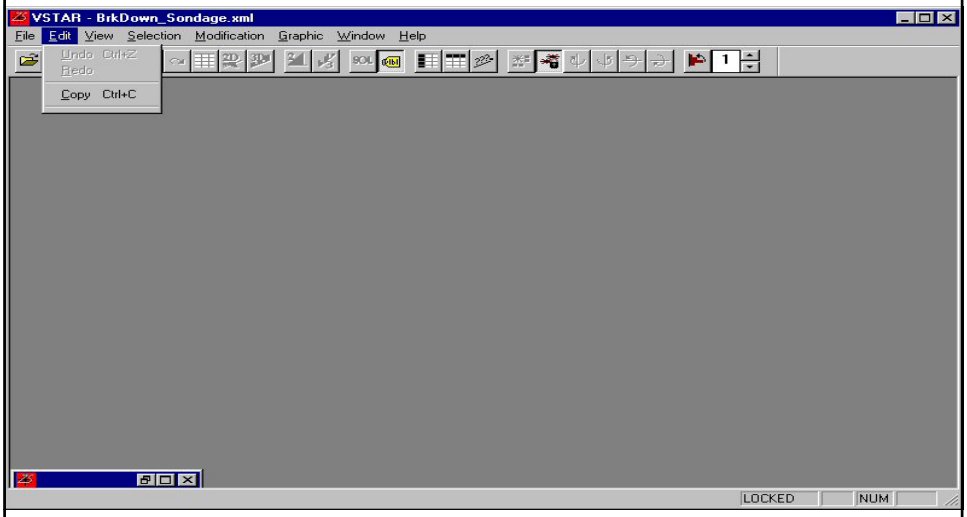


Figure3: The *Edit* menu

Menus and menu Items

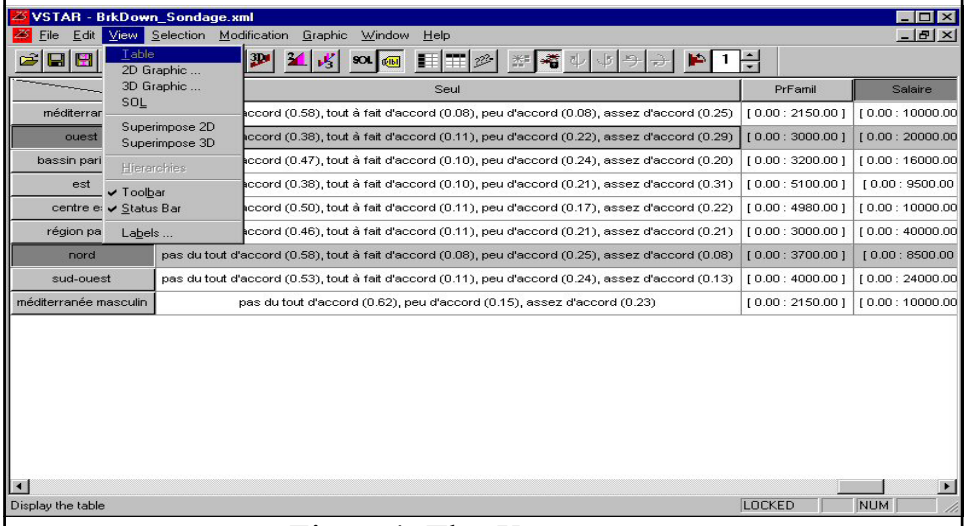


Figure4: The *View* menu

Menus and menu Items

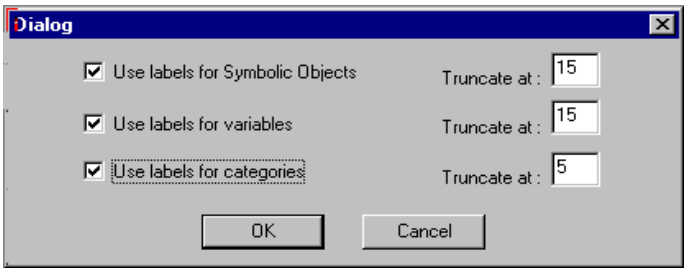


Figure5: The *Labels* dialog box

Menus and menu Items

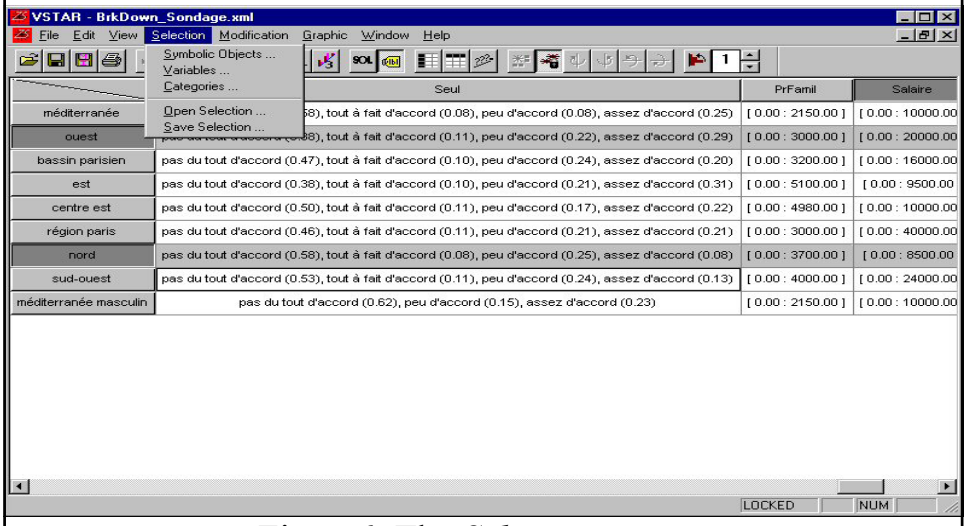


Figure6: The *Selection* menu

Menus and menu Items

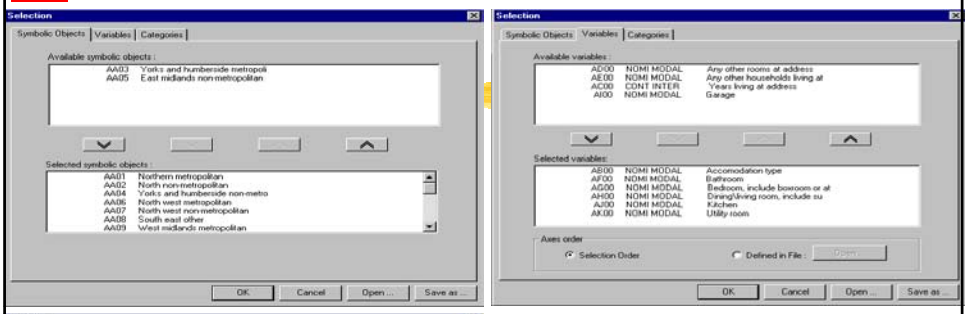


Figure7: The *Symbolic objects, Variables,* and *Categories* Selection

Menus and menu Items

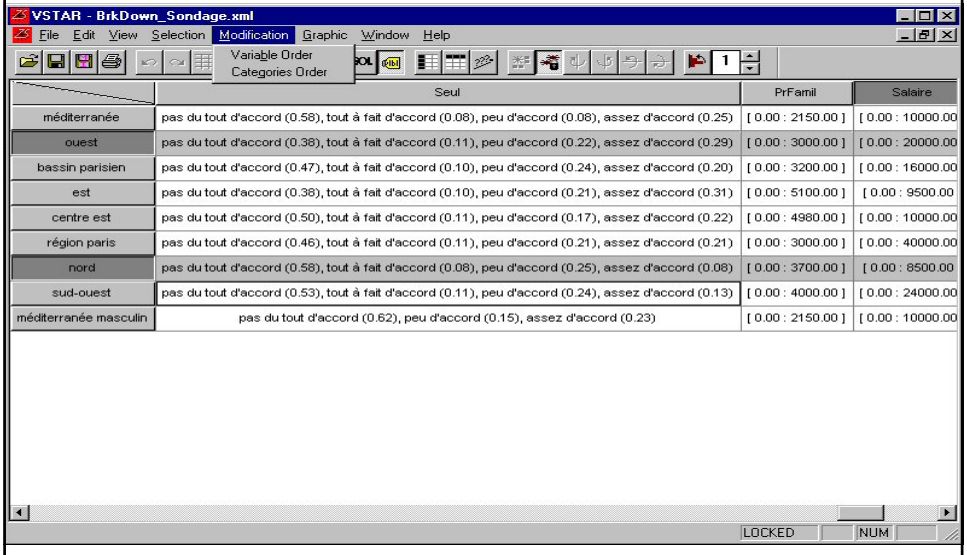


Figure8: The *Graphic* menu

Menus and menu Items

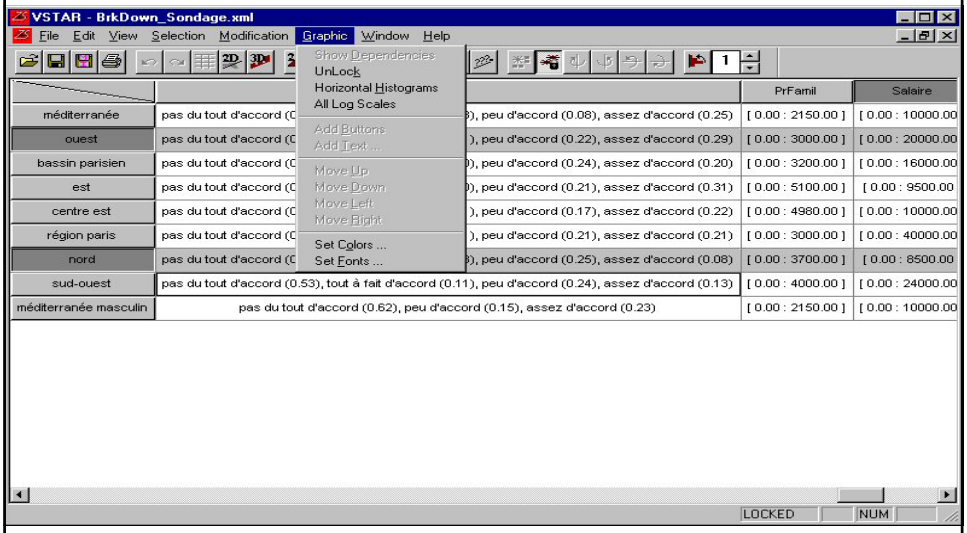


Figure9: The *Graphic* menu

ASSO Worshop, Lisbon, 26 January 2004

Menus and menu Items

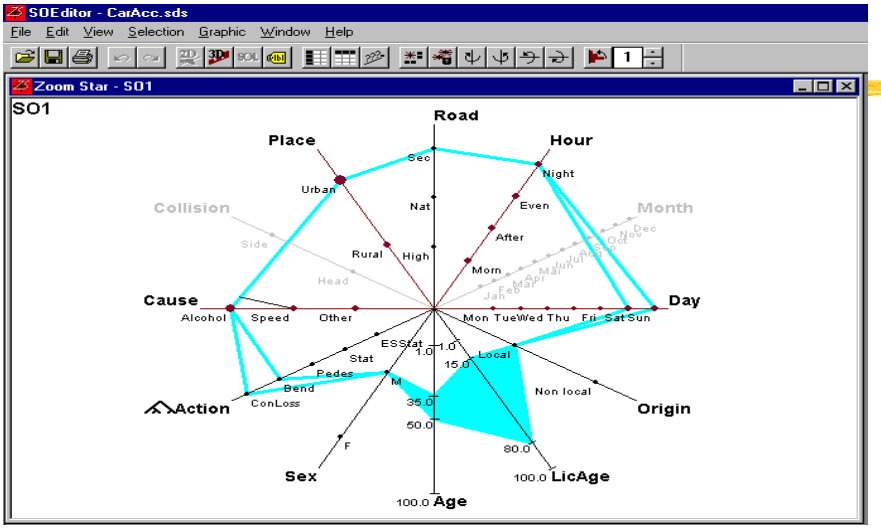


Figure9: An example of Zoom Star with a *dependency*

ASSO Worshop, Lisbon, 26 January 2004

Menus and menu Items

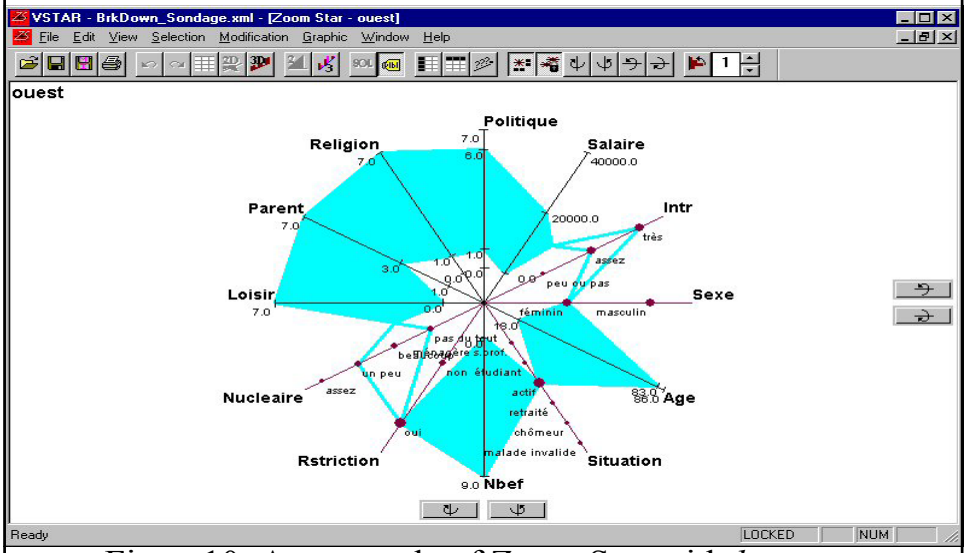


Figure10: An example of Zoom Star with *buttons*

Menus and menu Items

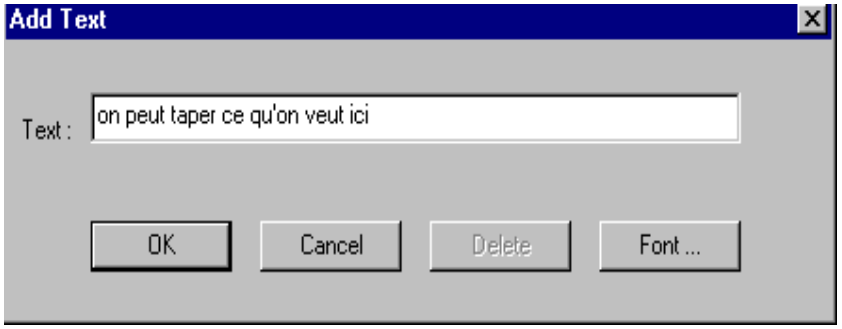


Figure11: The *Add Text* dialogue box

Menus and menu Items

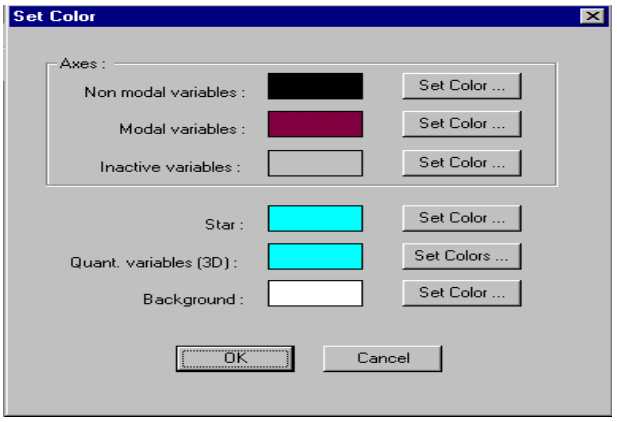


Figure12: The *Set Color* dialogue box

Menus and menu Items

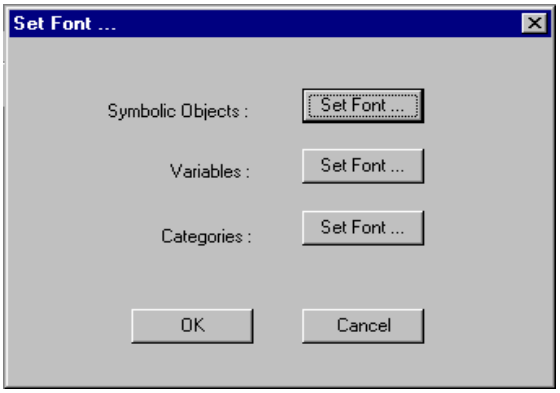


Figure13: The *Set Font* dialogue box

Menus and menu Items

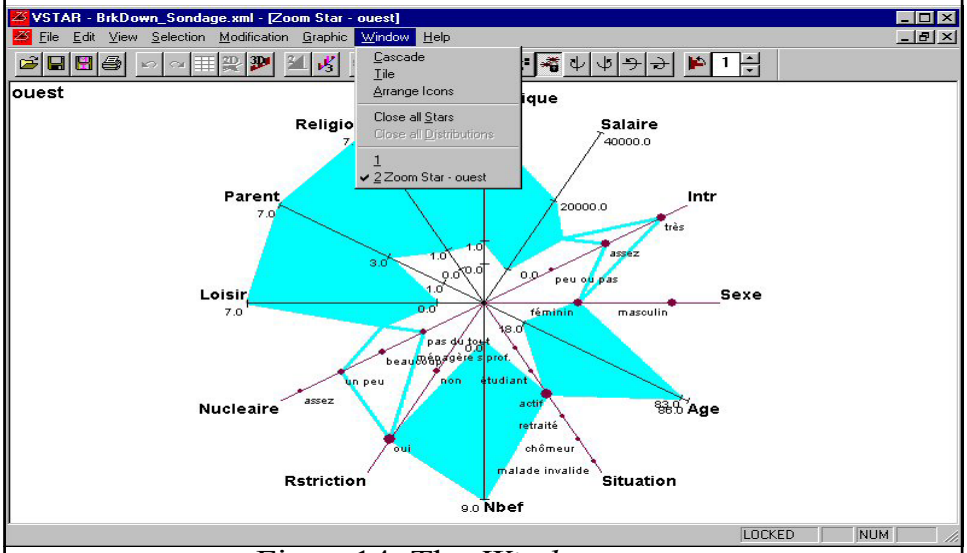


Figure14: The *Window* menu

Menus and menu Items

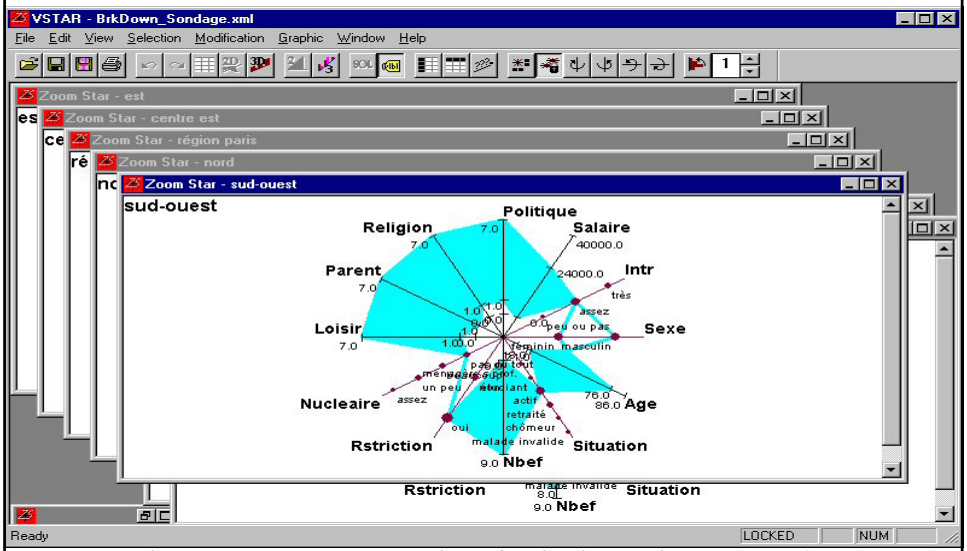
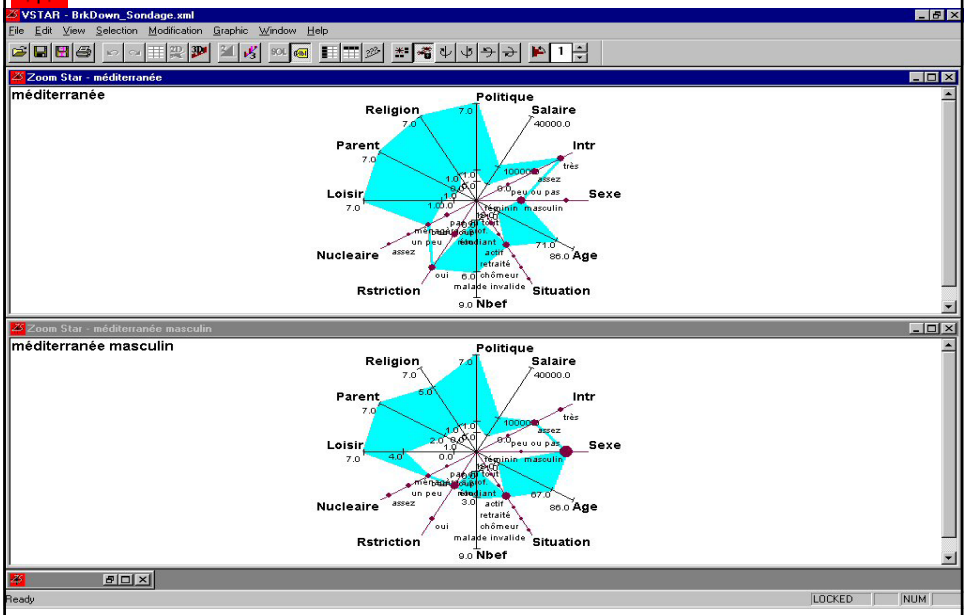


Figure15: An example of windows in *Cascade*

Menus and menu Items



Menus and menu Items

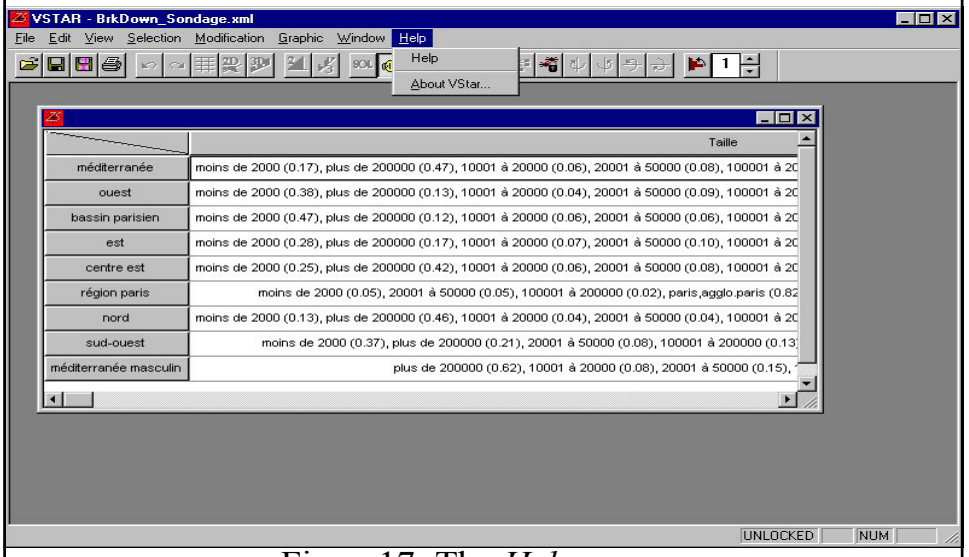
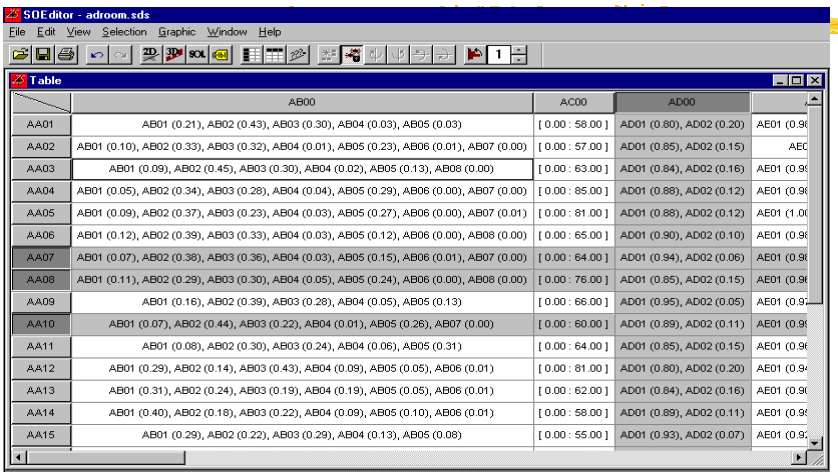


Figure17: The *Help* menu

Operations available in a Table Window



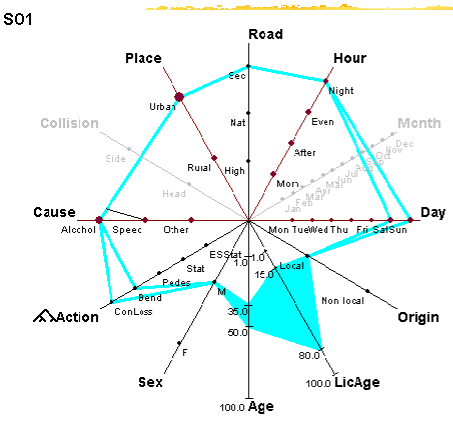
	AB00	AC00	AD00	
AA01	AB01 (0.21), AB02 (0.43), AB03 (0.30), AB04 (0.03), AB05 (0.03)	[0.00 : 58.00]	AD01 (0.80), AD02 (0.20)	AE01 (0.9
AA02	AB01 (0.10), AB02 (0.33), AB03 (0.32), AB04 (0.01), AB05 (0.23), AB06 (0.01), AB07 (0.00)	[0.00 : 57.00]	AD01 (0.85), AD02 (0.15)	AE0
AA03	AB01 (0.09), AB02 (0.45), AB03 (0.30), AB04 (0.02), AB05 (0.13), AB08 (0.00)	[0.00 : 63.00]	AD01 (0.84), AD02 (0.16)	AE01 (0.9
AA04	AB01 (0.05), AB02 (0.34), AB03 (0.28), AB04 (0.04), AB05 (0.29), AB06 (0.00), AB07 (0.00)	[0.00 : 85.00]	AD01 (0.88), AD02 (0.12)	AE01 (0.9
AA05	AB01 (0.09), AB02 (0.37), AB03 (0.23), AB04 (0.03), AB05 (0.27), AB06 (0.00), AB07 (0.01)	[0.00 : 81.00]	AD01 (0.88), AD02 (0.12)	AE01 (1.0
AA06	AB01 (0.12), AB02 (0.39), AB03 (0.33), AB04 (0.03), AB05 (0.12), AB06 (0.00), AB08 (0.00)	[0.00 : 65.00]	AD01 (0.90), AD02 (0.10)	AE01 (0.9
AA07	AB01 (0.07), AB02 (0.38), AB03 (0.36), AB04 (0.03), AB05 (0.15), AB06 (0.01), AB07 (0.00)	[0.00 : 64.00]	AD01 (0.94), AD02 (0.06)	AE01 (0.9
AA08	AB01 (0.11), AB02 (0.29), AB03 (0.30), AB04 (0.05), AB05 (0.24), AB06 (0.00), AB08 (0.00)	[0.00 : 76.00]	AD01 (0.85), AD02 (0.15)	AE01 (0.9
AA09	AB01 (0.16), AB02 (0.39), AB03 (0.28), AB04 (0.05), AB05 (0.13)	[0.00 : 66.00]	AD01 (0.95), AD02 (0.05)	AE01 (0.9
AA10	AB01 (0.07), AB02 (0.44), AB03 (0.22), AB04 (0.01), AB05 (0.26), AB07 (0.00)	[0.00 : 60.00]	AD01 (0.89), AD02 (0.11)	AE01 (0.9
AA11	AB01 (0.08), AB02 (0.30), AB03 (0.24), AB04 (0.06), AB05 (0.31)	[0.00 : 64.00]	AD01 (0.85), AD02 (0.15)	AE01 (0.9
AA12	AB01 (0.29), AB02 (0.14), AB03 (0.43), AB04 (0.09), AB05 (0.05), AB06 (0.01)	[0.00 : 81.00]	AD01 (0.80), AD02 (0.20)	AE01 (0.9
AA13	AB01 (0.31), AB02 (0.24), AB03 (0.19), AB04 (0.19), AB05 (0.05), AB06 (0.01)	[0.00 : 62.00]	AD01 (0.84), AD02 (0.16)	AE01 (0.9
AA14	AB01 (0.40), AB02 (0.18), AB03 (0.22), AB04 (0.09), AB05 (0.10), AB06 (0.01)	[0.00 : 58.00]	AD01 (0.89), AD02 (0.11)	AE01 (0.9
AA15	AB01 (0.29), AB02 (0.22), AB03 (0.29), AB04 (0.13), AB05 (0.08)	[0.00 : 55.00]	AD01 (0.93), AD02 (0.07)	AE01 (0.9

Figure20: The *Selection* of *Lines* and *Columns*

ASSO Worshop, Lisbon, 26 January 2004

VSTAR Module

Operations available in a Graphic Window



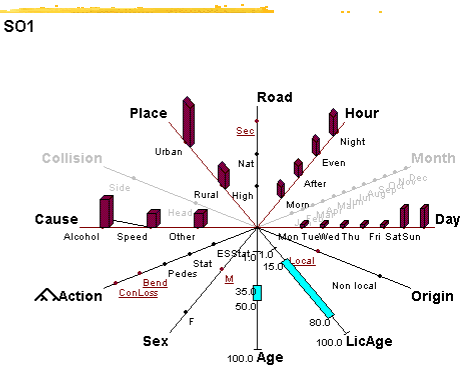


Figure21: Examples of *2D* and *3D Zoom Stars*

The object name and the variables names can be moved

ASSO Worshop, Lisbon, 26 January 2004

Operations available in a Graphic Window

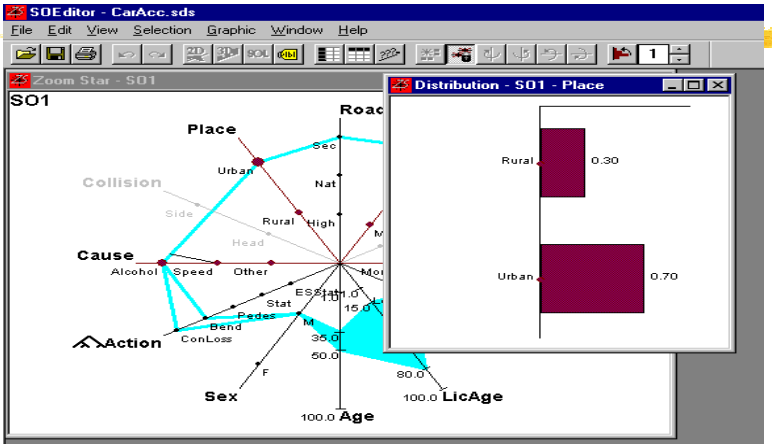


Figure22: Visualisation of *distributions*
Left button click on a weighted variable axis

Operations available in a Graphic Window

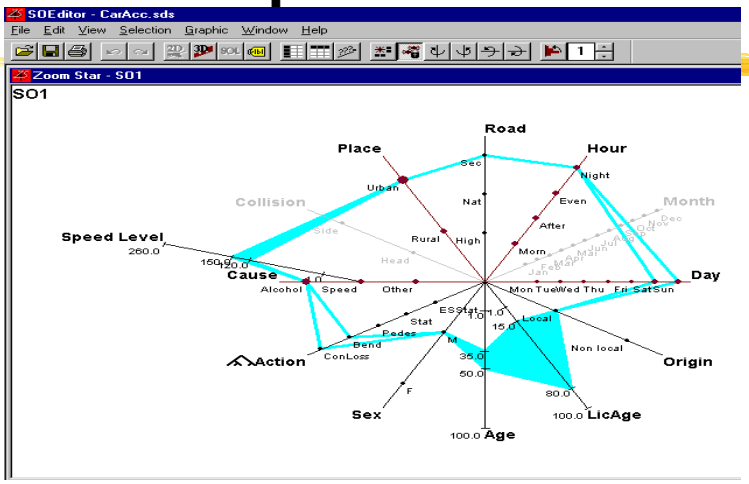


Figure23: Visualisation of *dependencies*
Right button click on a dependency line

Operations available in a Graphic Window

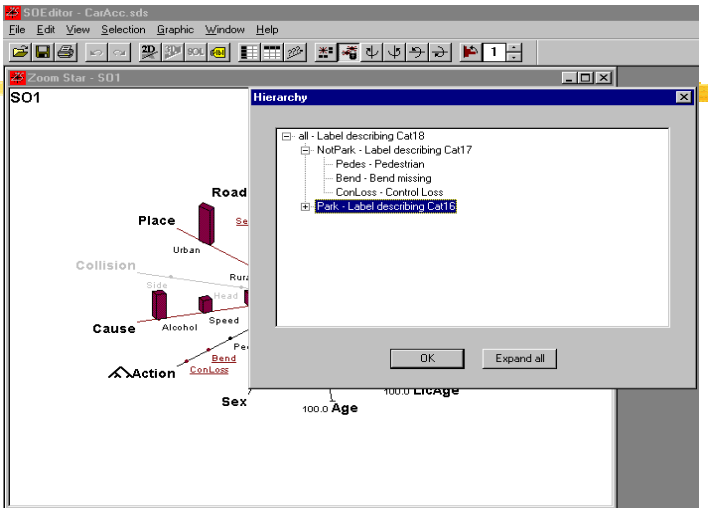


Figure24: Visualisation of *Taxonomies*
Left button click on a taxonomy icon

Operations available in a Graphic Window

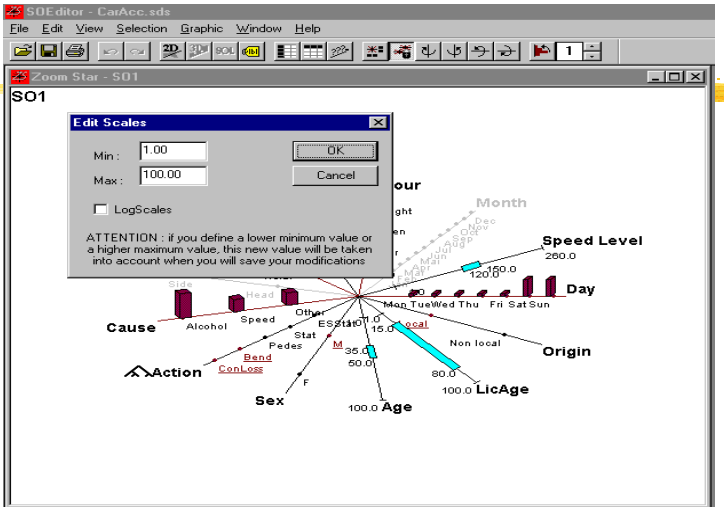


Figure25: *Scales* modification
Left button click on a quantitative variable axis