

Interactive Exploration of Multi-granularity, Spatial and Temporal Datacubes: *Providing Computer-Assisted Geovisualization Support*



Presented by Véronique Beaulieu

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Context

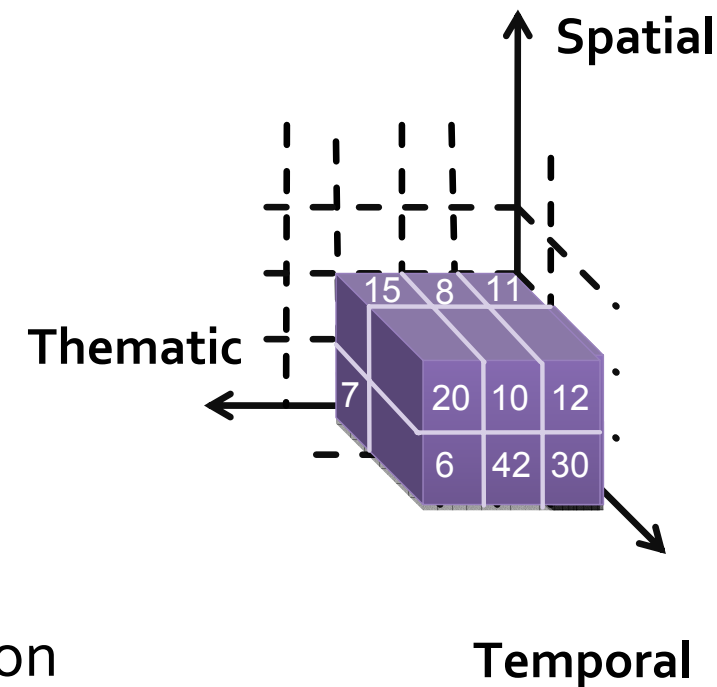
SOLAP

- Business Intelligence (BI)
- Analysis –oriented database structure
- Operators
 - Drill-down, roll-up, drill-across, swap, slice
- Different display modes: maps, tables, diagrams
- High interactivity
 - to explore
 - to cross-tabulate
- Missing a certain control on geovisualization of data



Complexity of geovisualization with SOLAP

- SOLAP allows dynamic queries
 - The user changes on-the-fly:
 - the **dimensions**,
 - the **measures**,
 - the **levels of granularity** of the analysis.
 - The user can do :
 - Uni-, bi-, or **multivariate** analysis
 - Depending on one.. two... or several **dimensions**.
- SOLAP should allow dynamic geovisualization
 - The user should benefit easily of
 - **different points of view** of the analysis...
 - only **appropriate views** of the data...
- All these manipulations are done **simultaneously** and in an **free manner!!!**



Complexity of geovisualization with SOLAP

- SOLAP allows dynamic queries
 - The user changes on-the-fly:
 - the **dimensions** of the analysis,



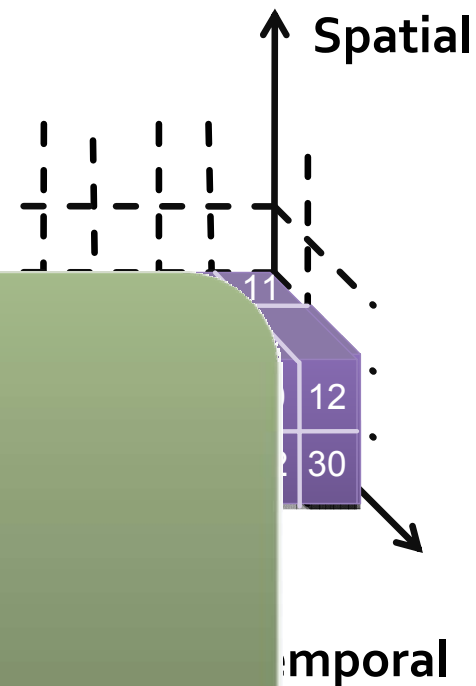
«~~How~~» to **obtain** the result

«How» to **see** the result

Facilitating GKD ?

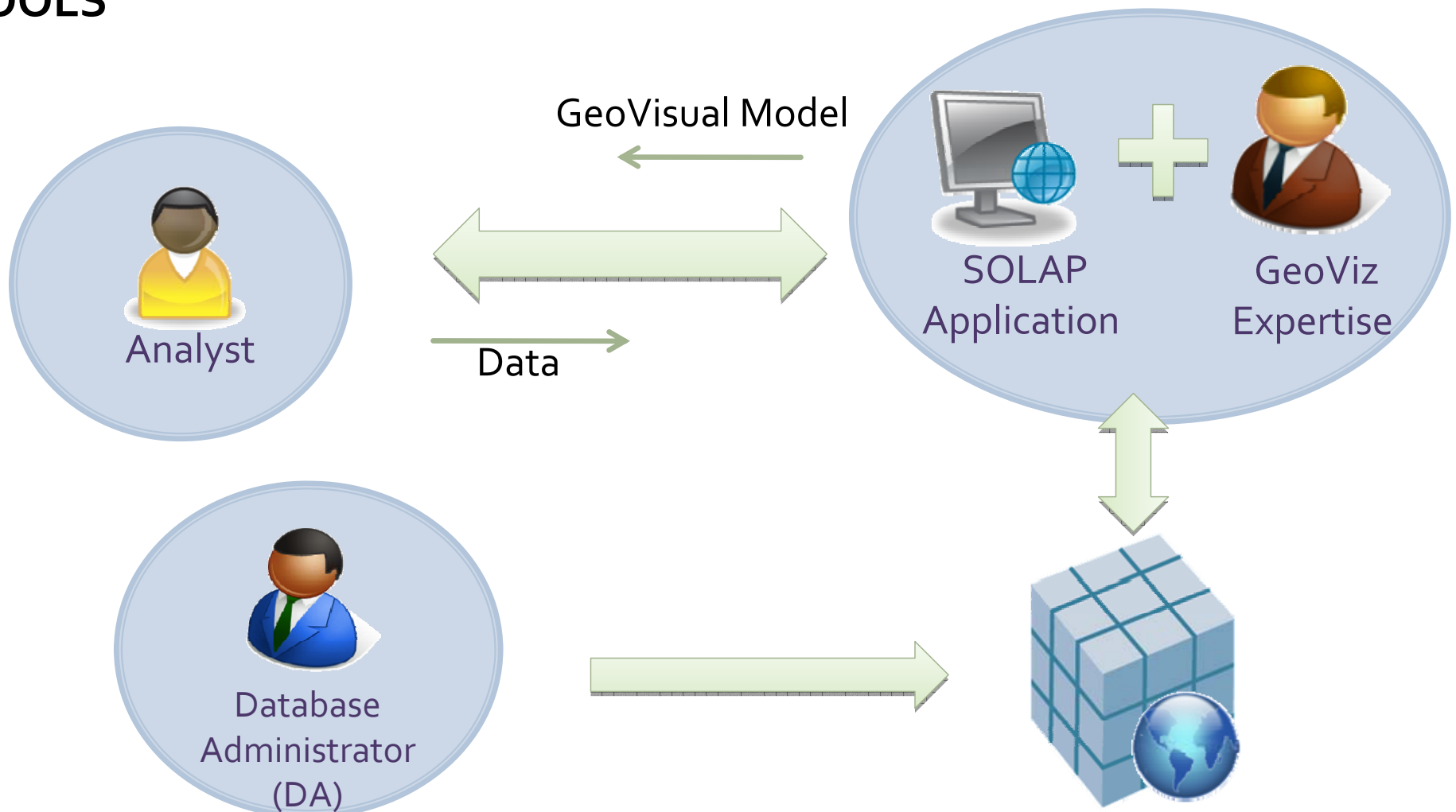
- different points or view of the analysis...

- All these manipulations are done **simultaneously** and in an **free manner!!!**



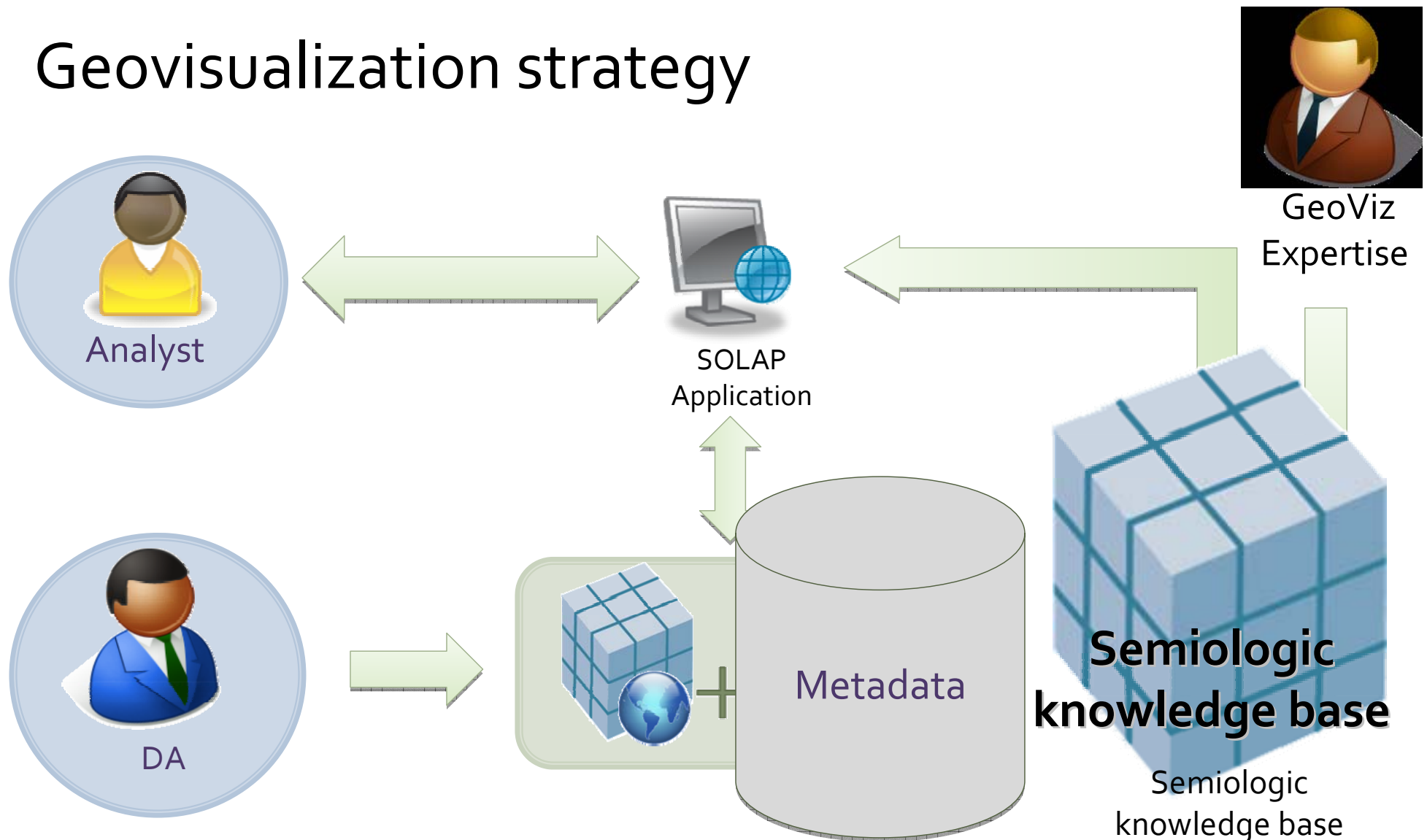
Our Solution

INTEGRATING A SEMIOLOGIC KNOWLEDGE BASE WITH SOLAP TOOLS



Our Solution

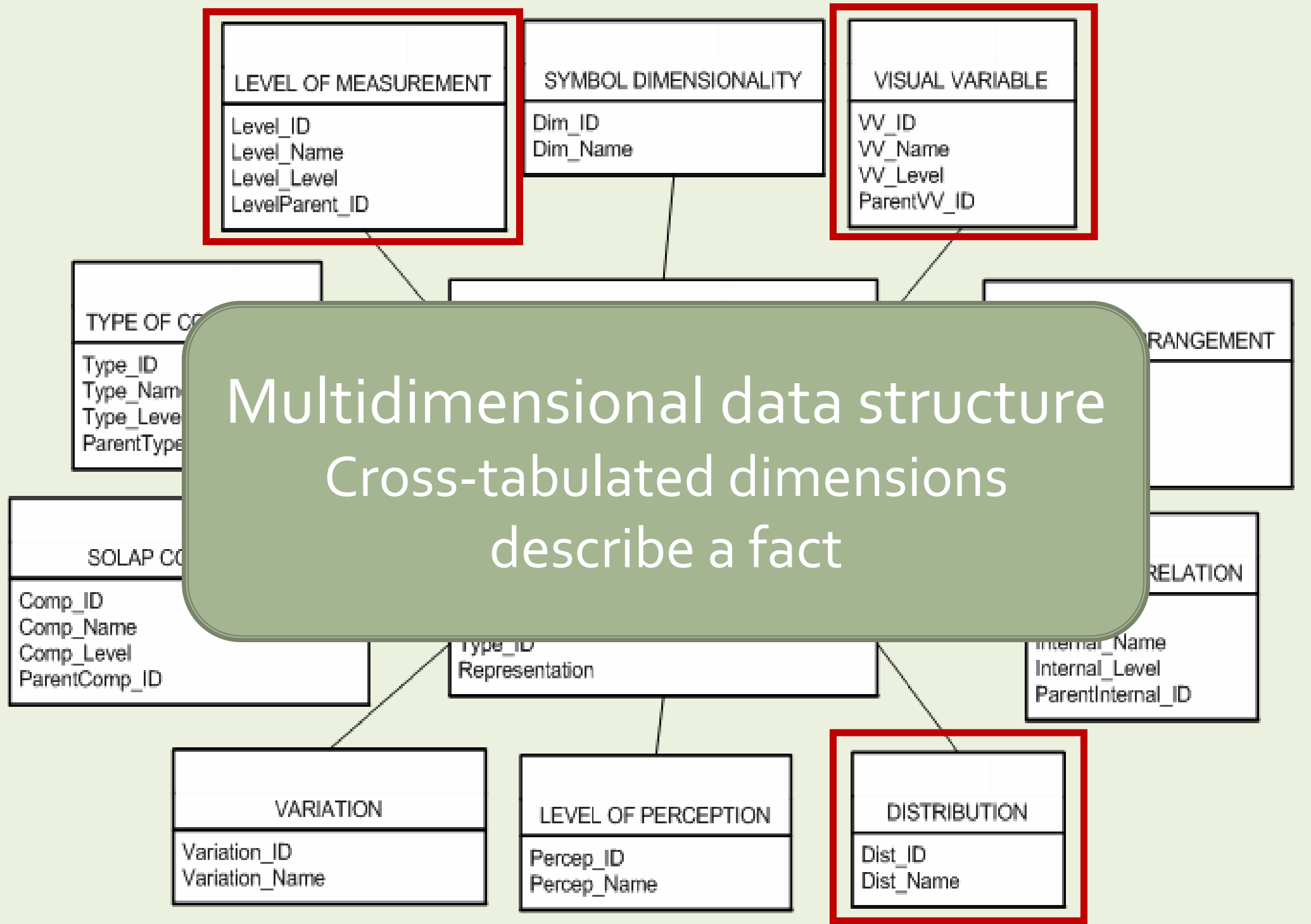
Geovisualization strategy



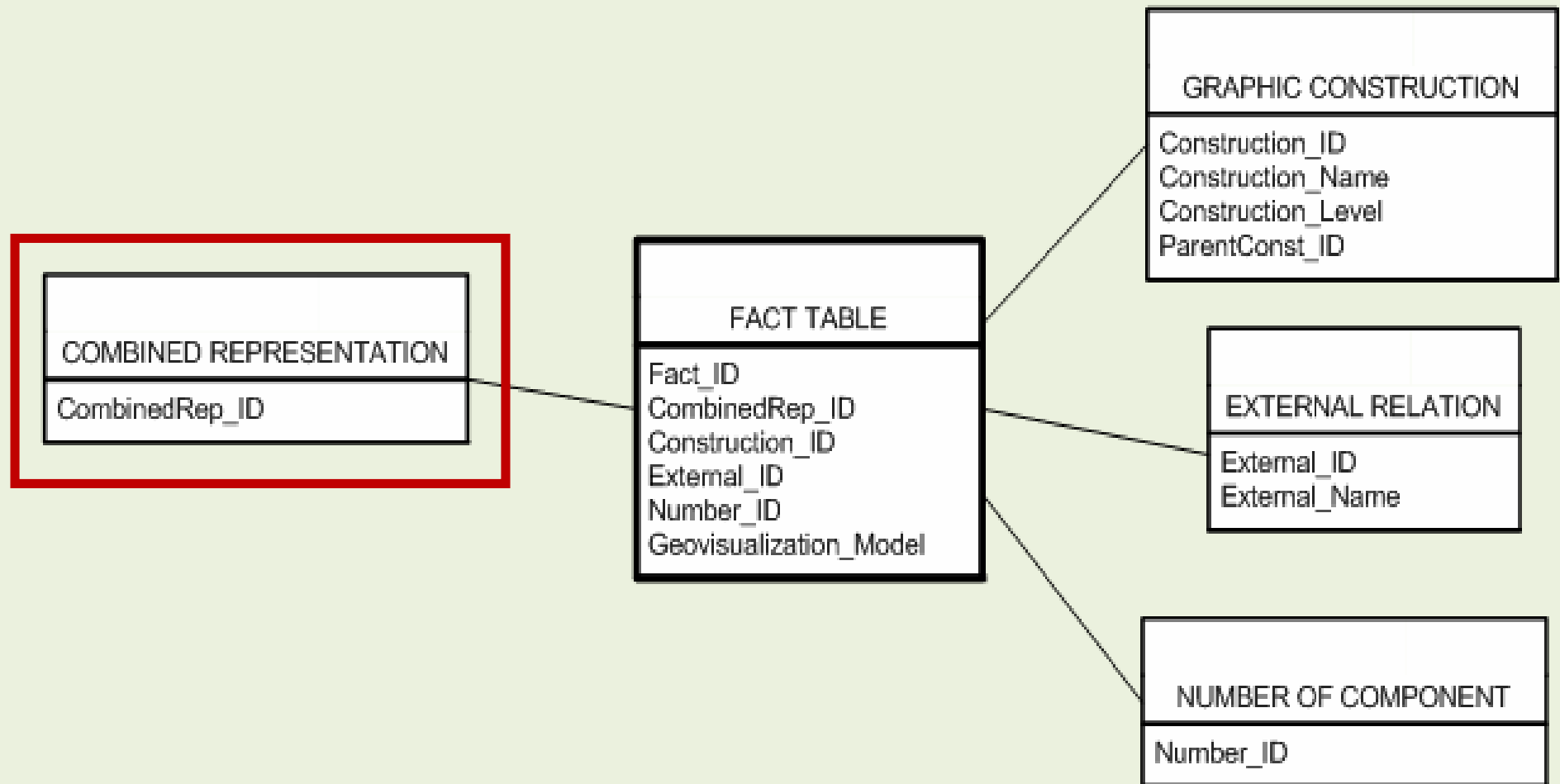
Semiologic knowledge base

- Two levels of semiologic knowledge
 - Representation of one component
 - Representation of all components together





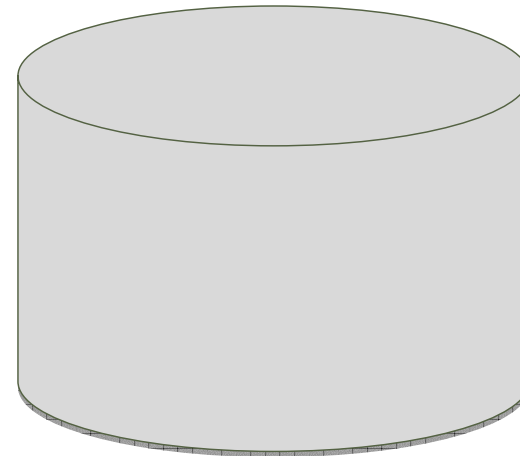
ALL COMPONENTS REPRESENTATION



Geovisualization Metadata

DEFINITION OF

- Level of measurement
- Distribution
- Variation
- Internal relation
- External relation



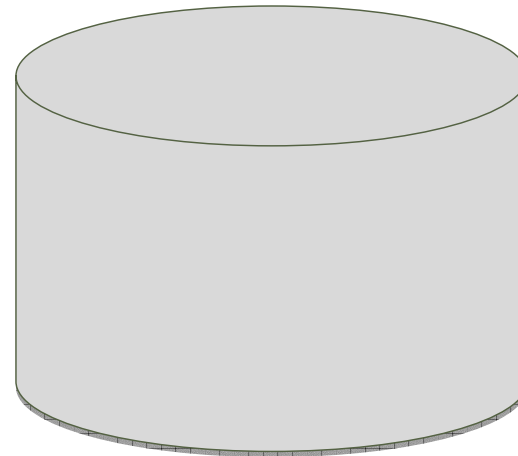
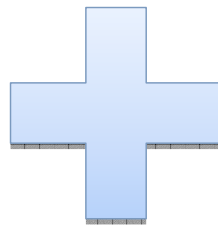
Geovisualization
Metadata

The other dimensions are derived from the knowledge base and the SOLAP application.

Answer to geovisualization needs



Semiotic
Knowledge base



Geovisualization
Metadata

**We can provide appropriate
geovisualization support.**

Change the dimensions of the analysis from space...

BPEI 2000-2006

Measures

Origin

Time 2000

Gender

Age Class

University program

Institutional Origin

Language

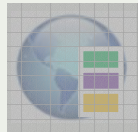
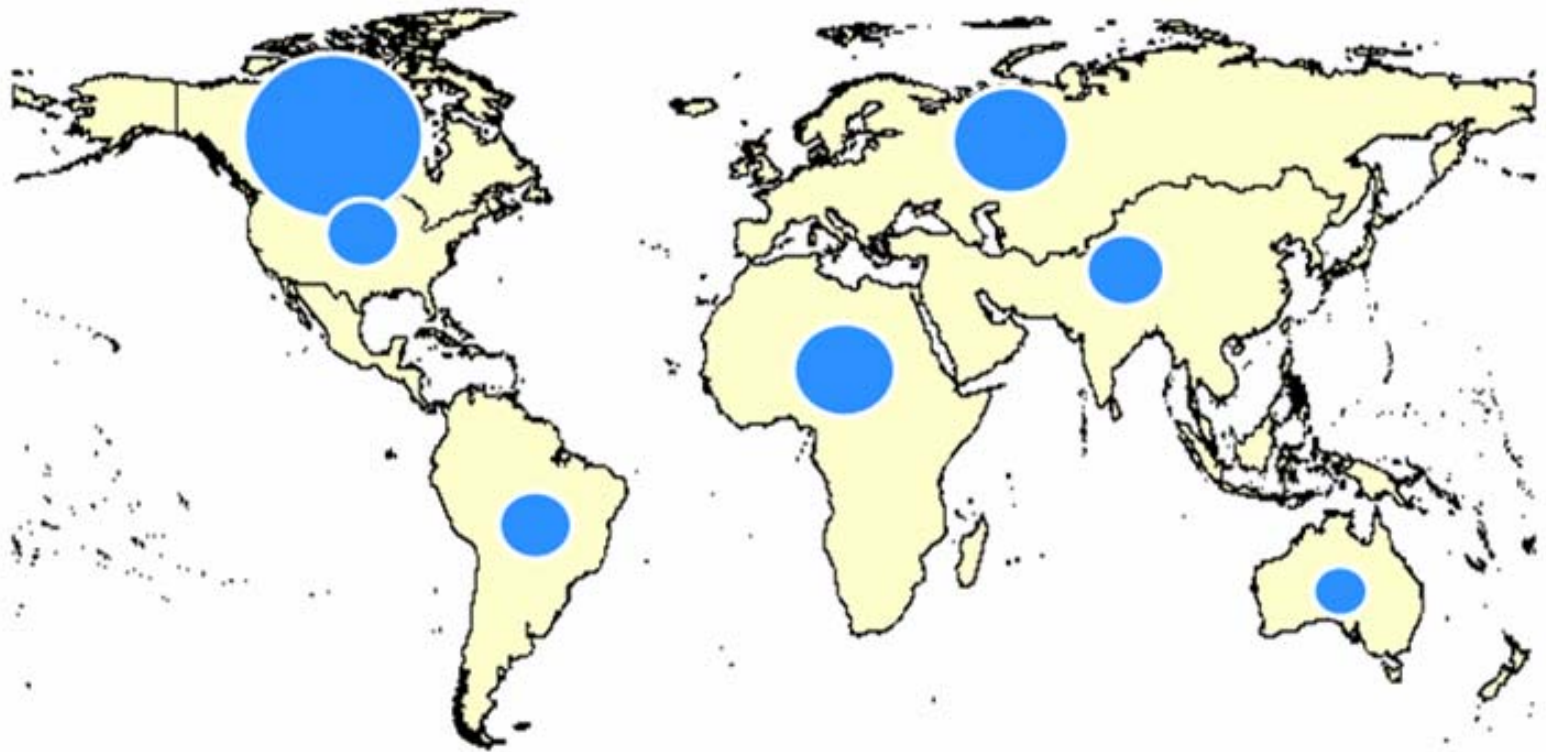
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



....to gender

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

Collegial Program

Program Grade

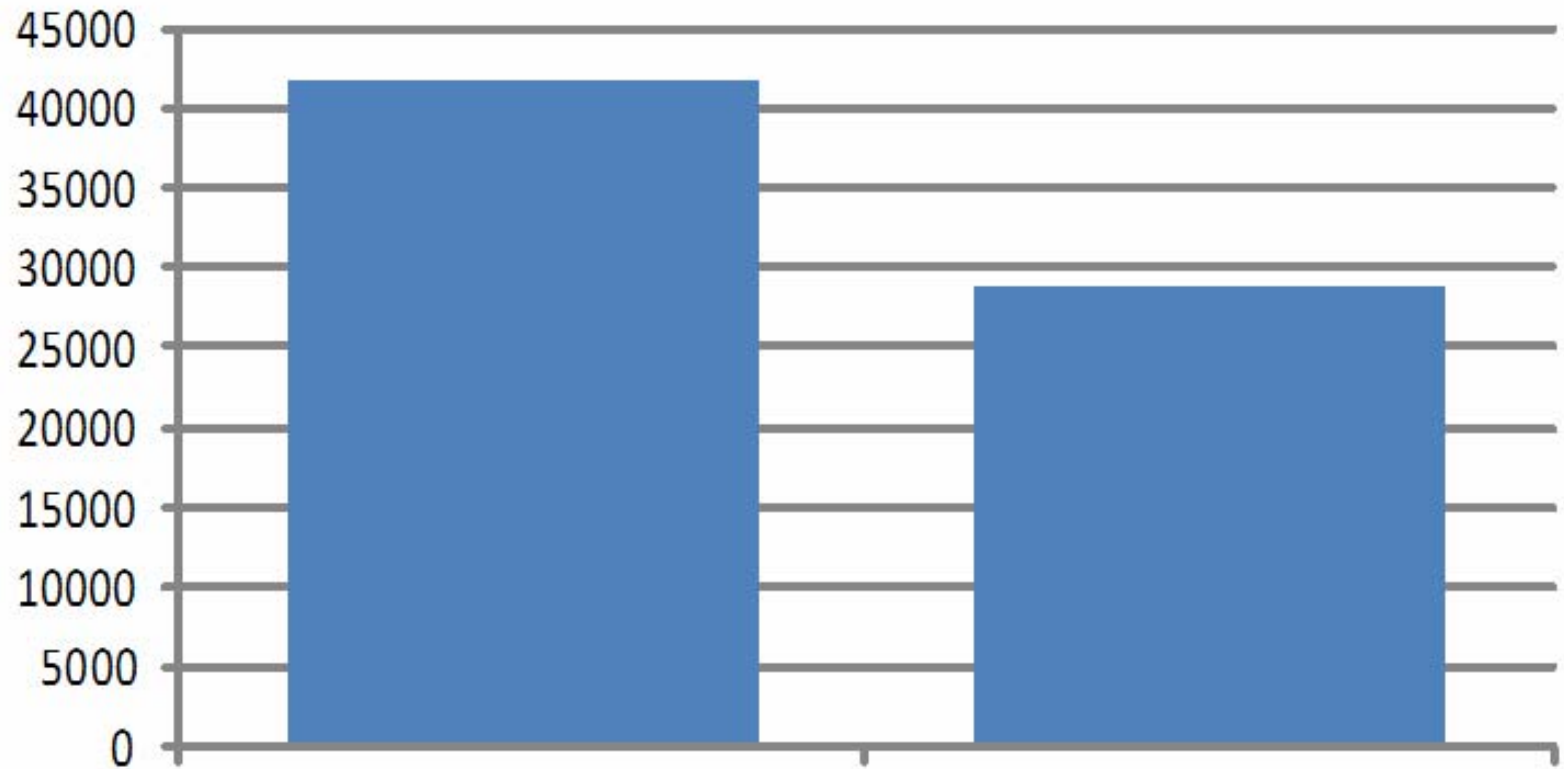
Status

Nb registration

Confidential cote
Amount of Scholarships

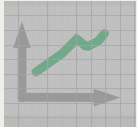


NB of registration



Women

Men



Change the measure of the analysis... from nb of registration ...

BPEI 2000-2006

Measures

Origin

Time 2000

Gender

Age Class

University program

Institutional Origin

Language

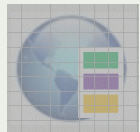
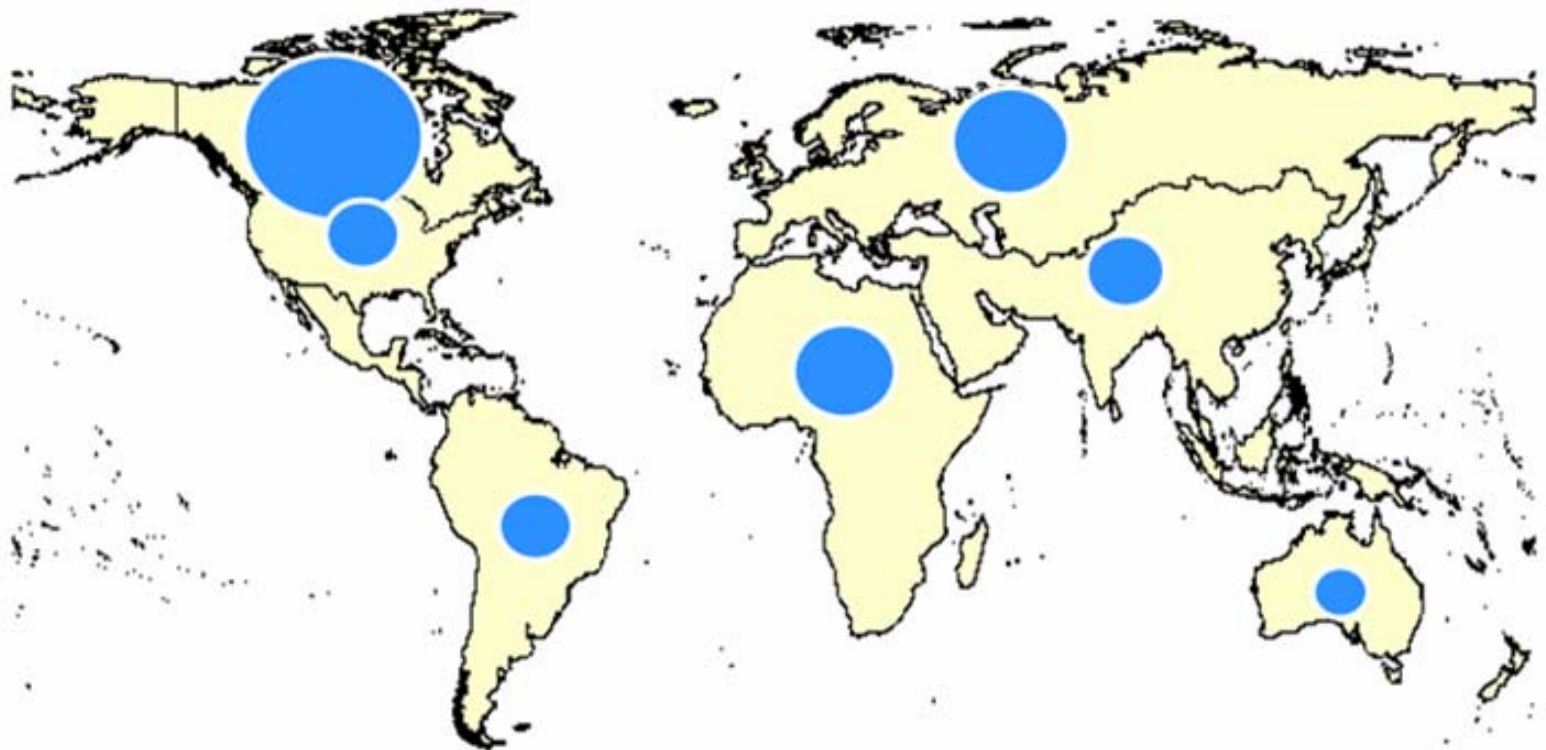
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



.... to confidential cote

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

Collegial Program

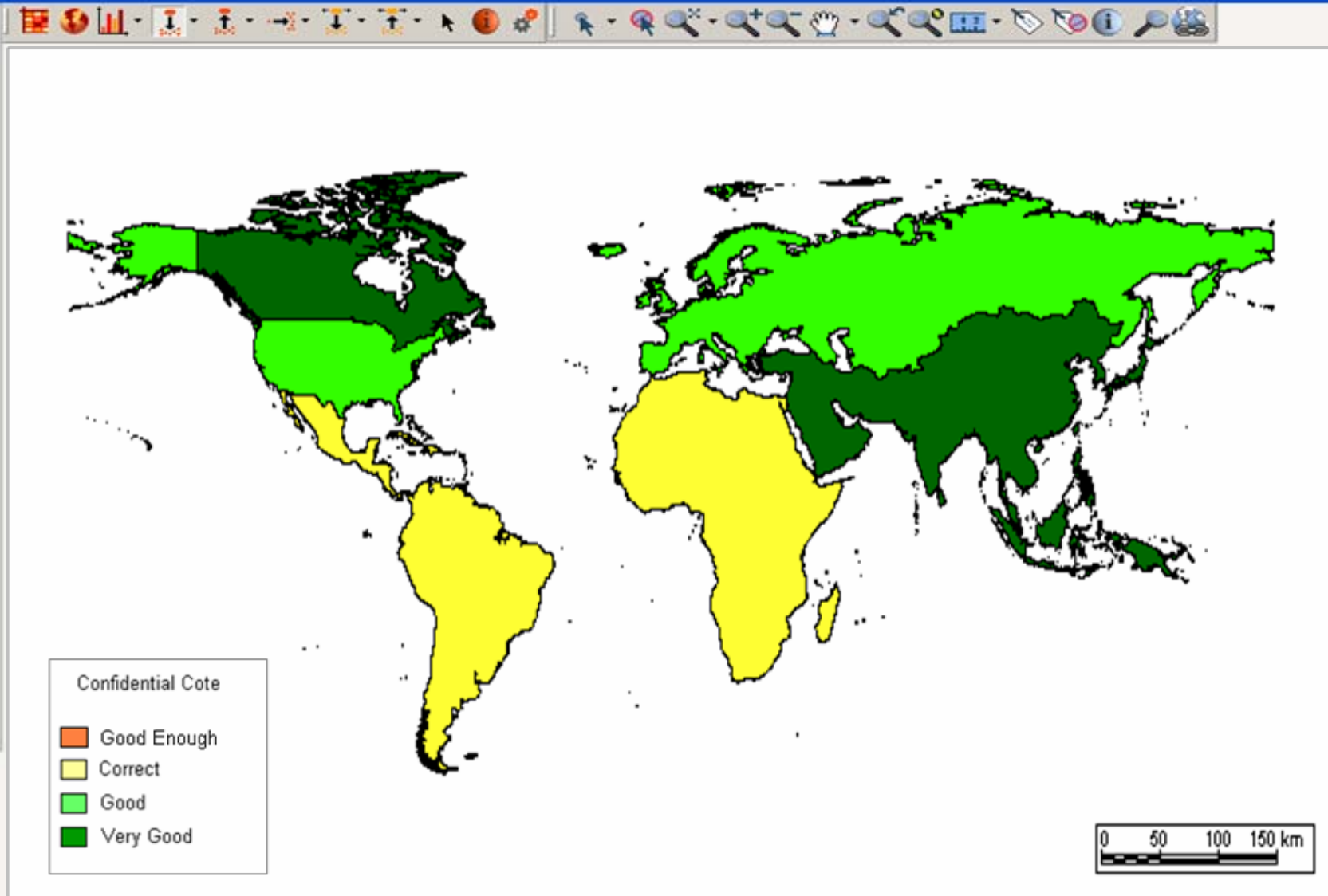
Program Grade

Status

Nb registration

Confidential cote

Amount of Scholarships



Change the level of granularity... from countries...

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

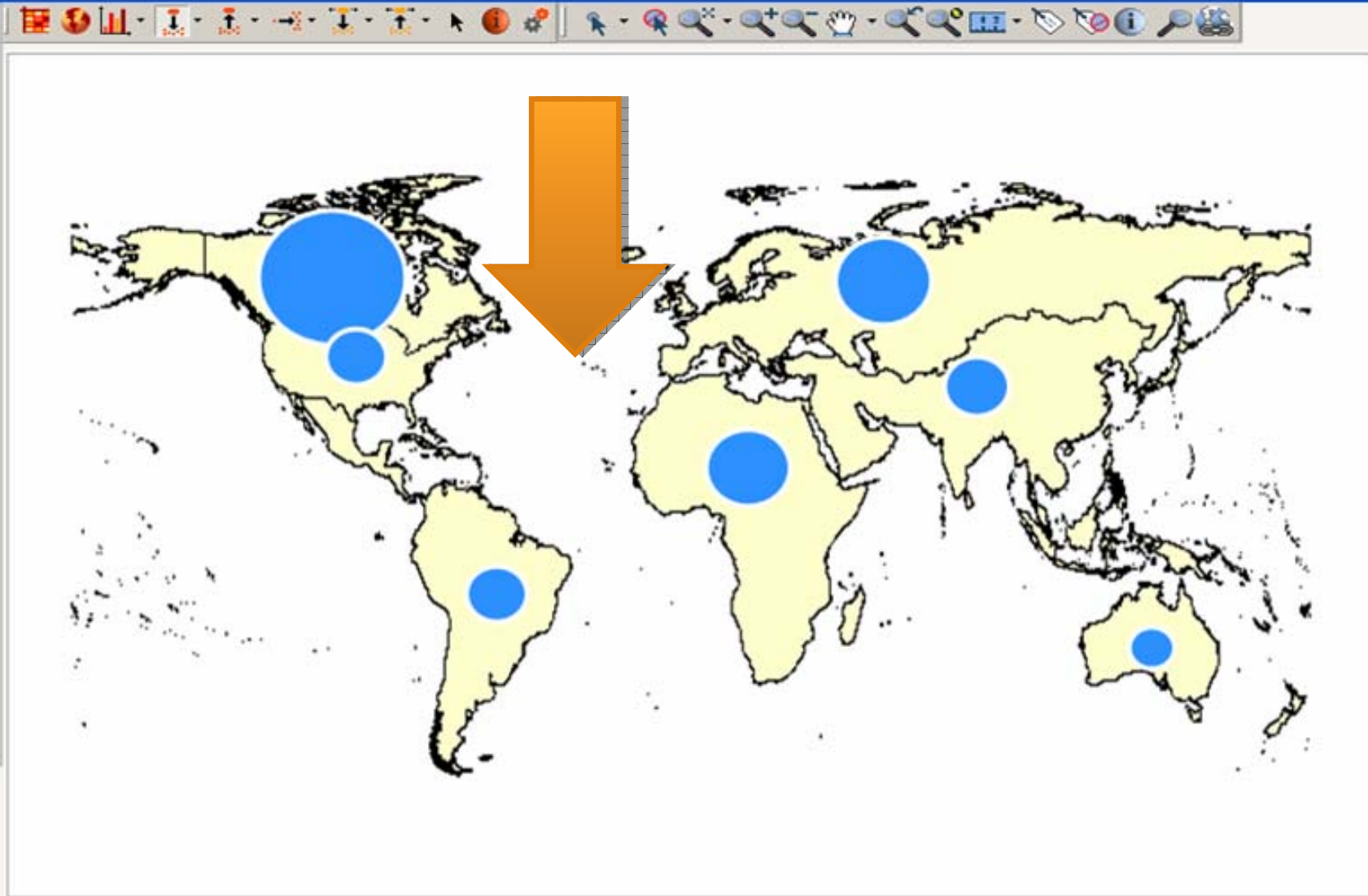
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



... to provinces...

BPEI 2000-2006

Measures

Origin

Time 2000

Gender

Age Class

University program

Institutional Origin

Language

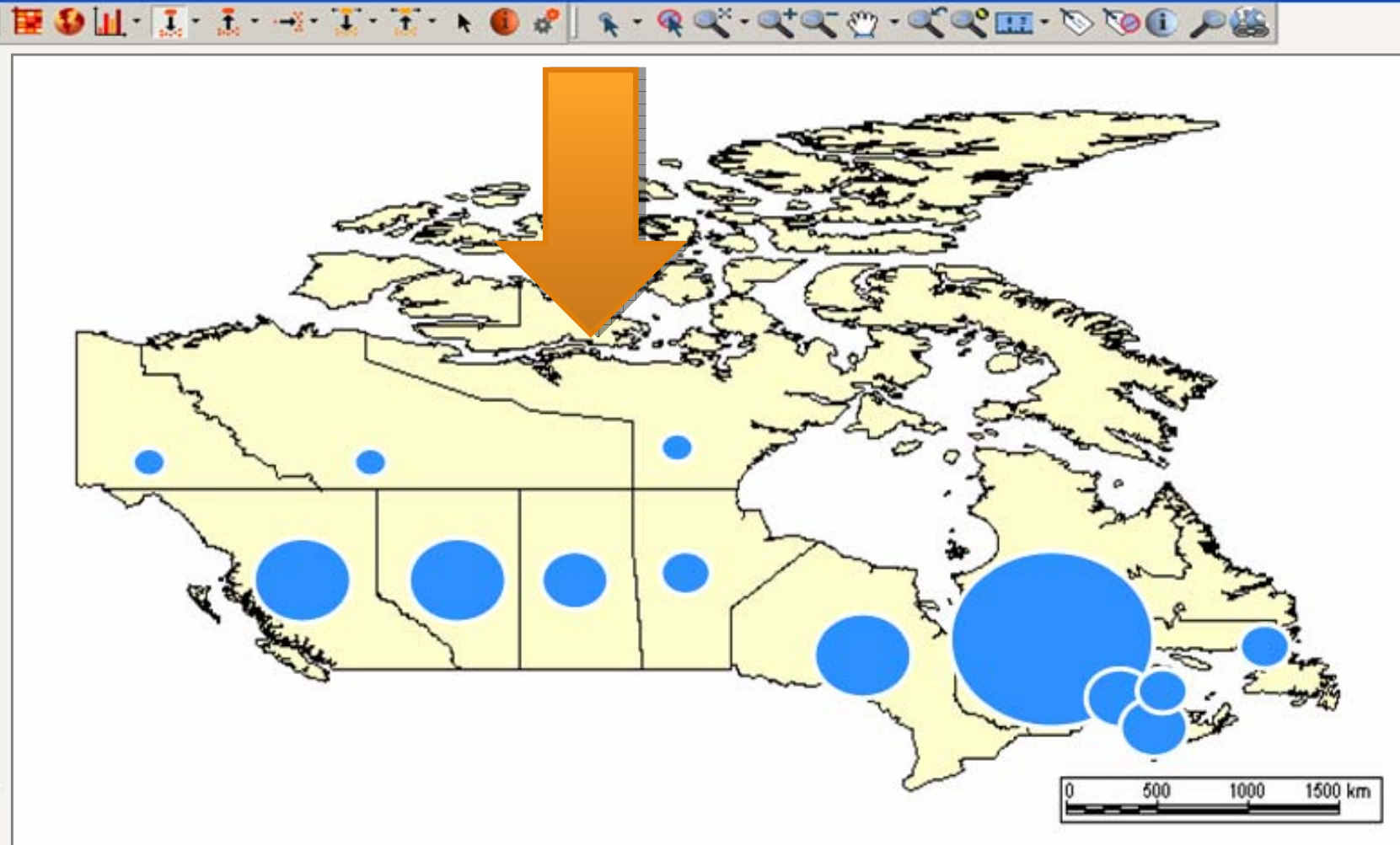
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



... to administrative regions.

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

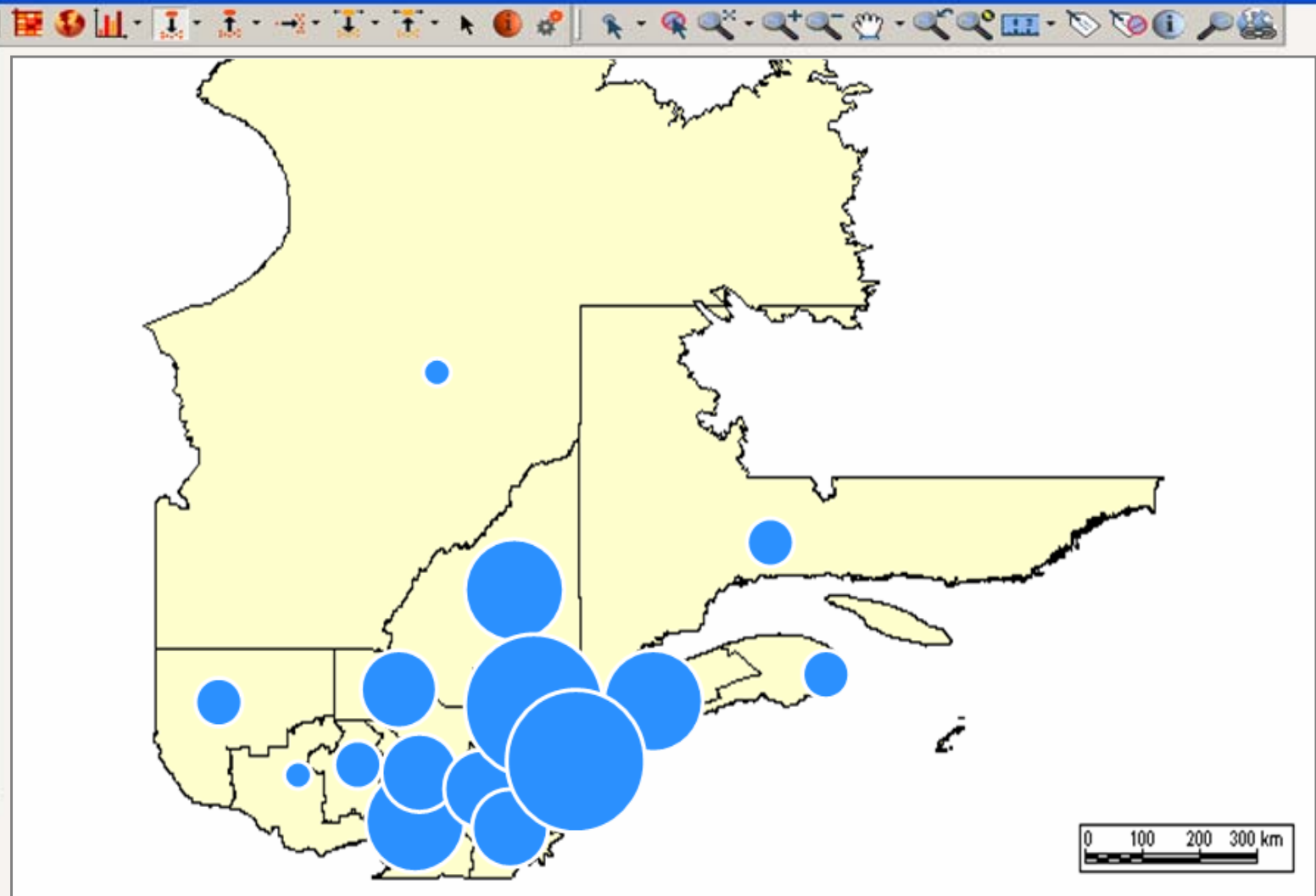
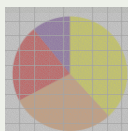
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



From univariate... to bivariate... to multivariate

Risk of Erosion

Measures

Land parcels

Time

Land use

Type of bank

Mean slope

Route

Bank height

Stream

Dist. Road-bank

Dist. 5 depth

Risk (bank)

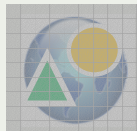
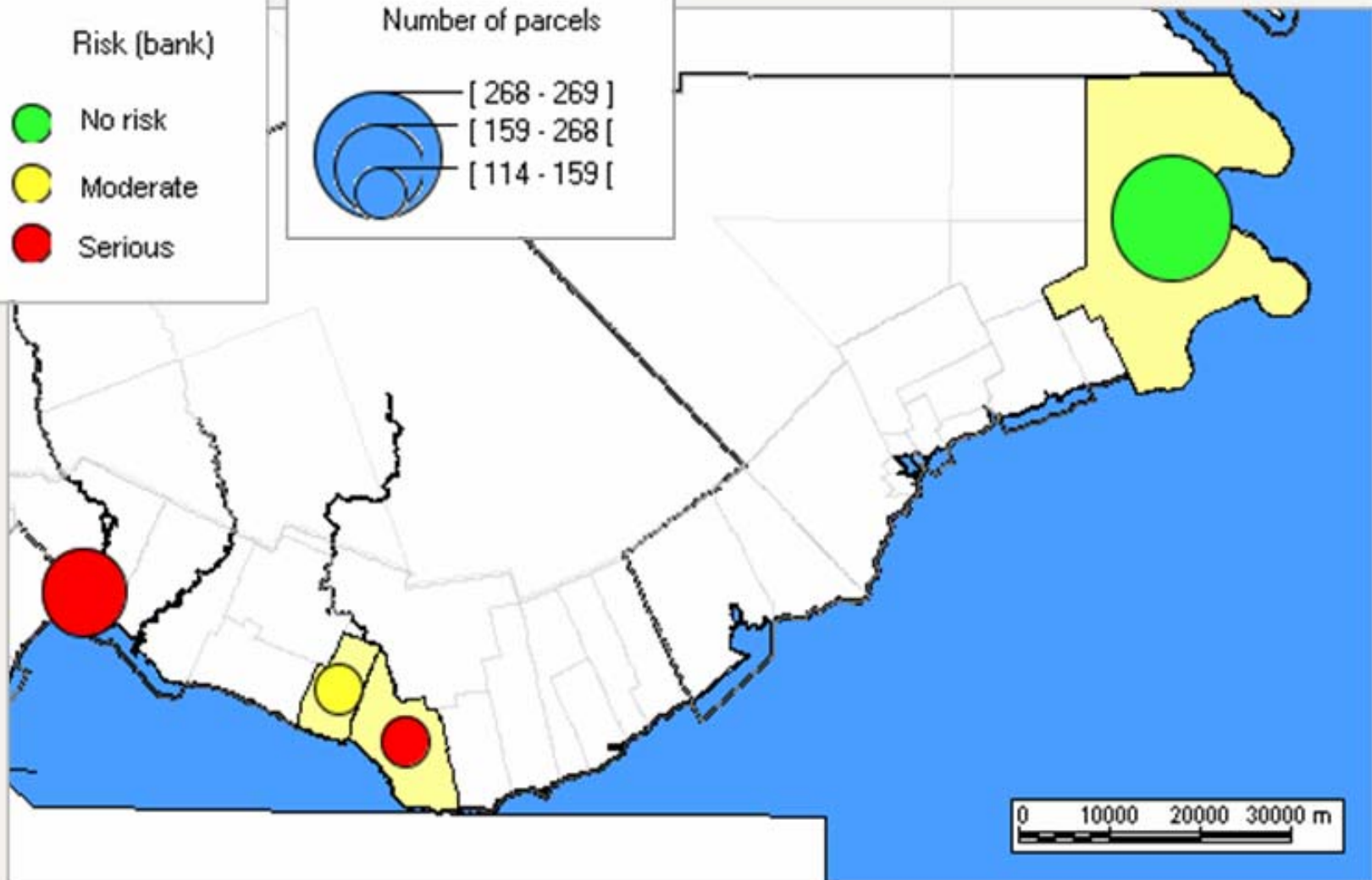
Nb parcels
Affected Road len



Risk (bank)

- No risk
- Moderate
- Serious

Number of parcels



As multiple dimensions are cross-tabulated from one...

BPEI 2000-2006

Measures

Origin

Time 2000-2

Gender

Age Class

University program

Institutional Origin

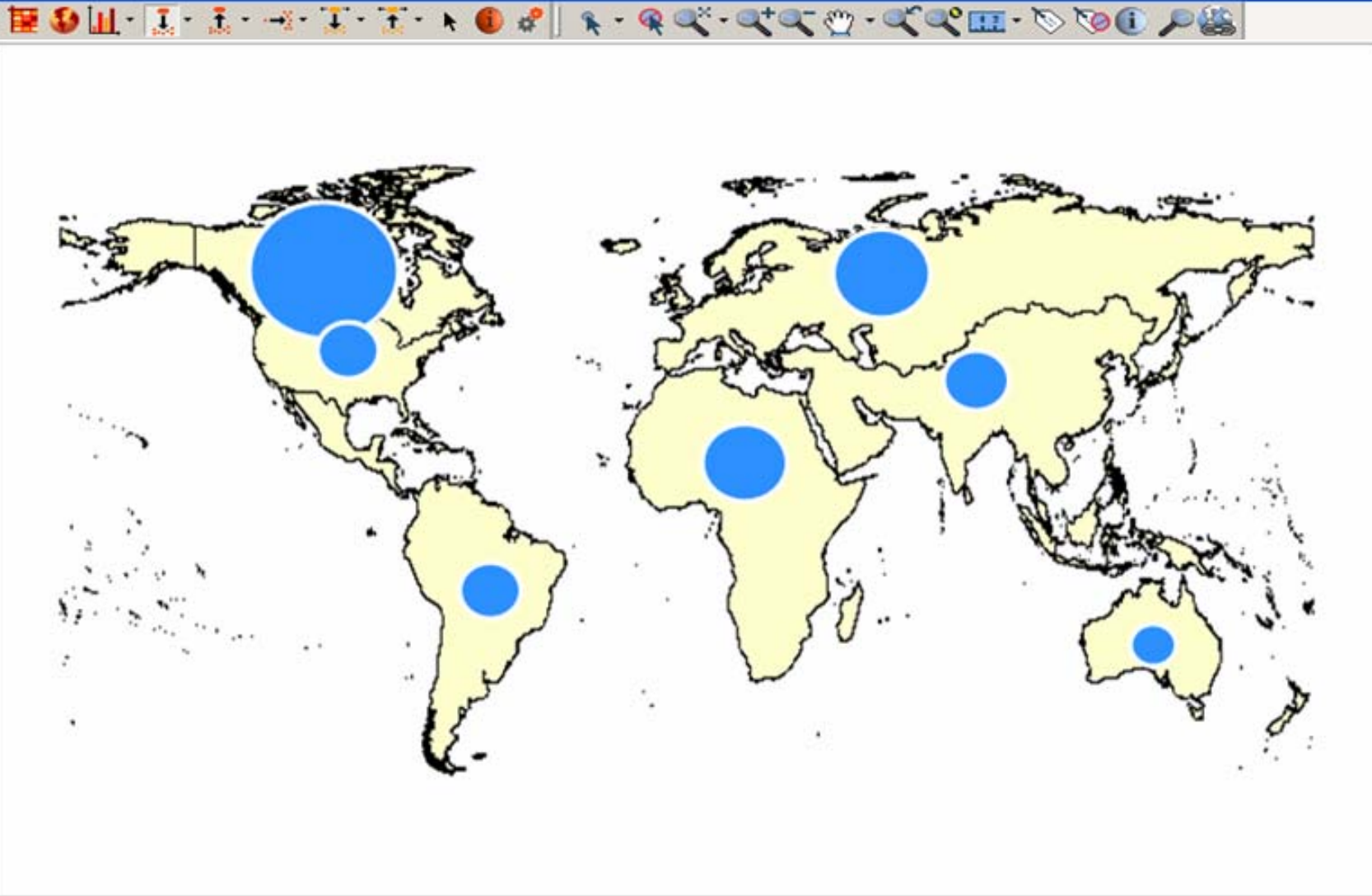
Language

Collegial Program

Program Grade

Status

Nb registration
Confidential code
Amount of Scholarships



As multiple dimensions are cross-tabulated from one... two...

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

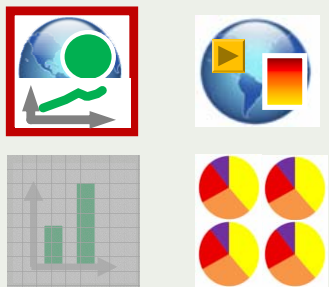
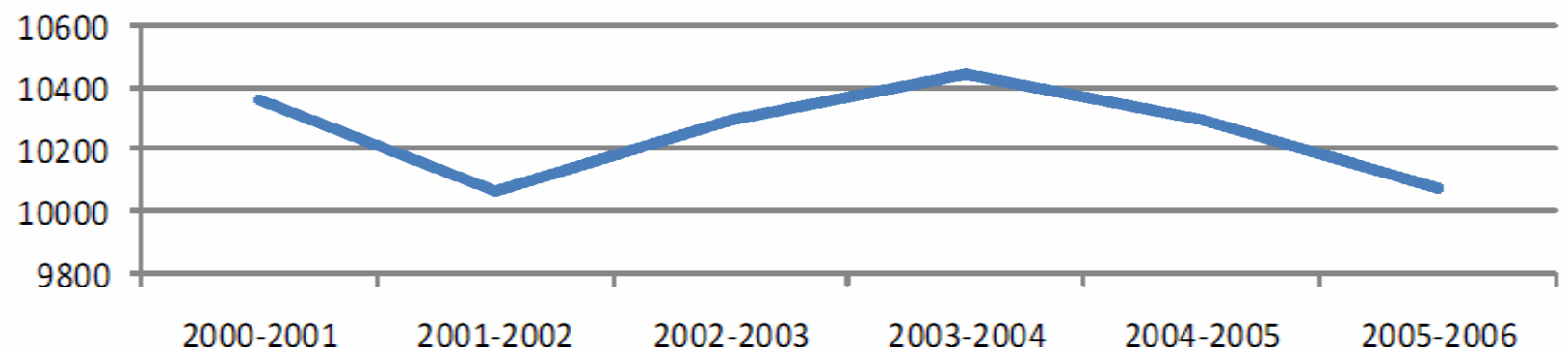
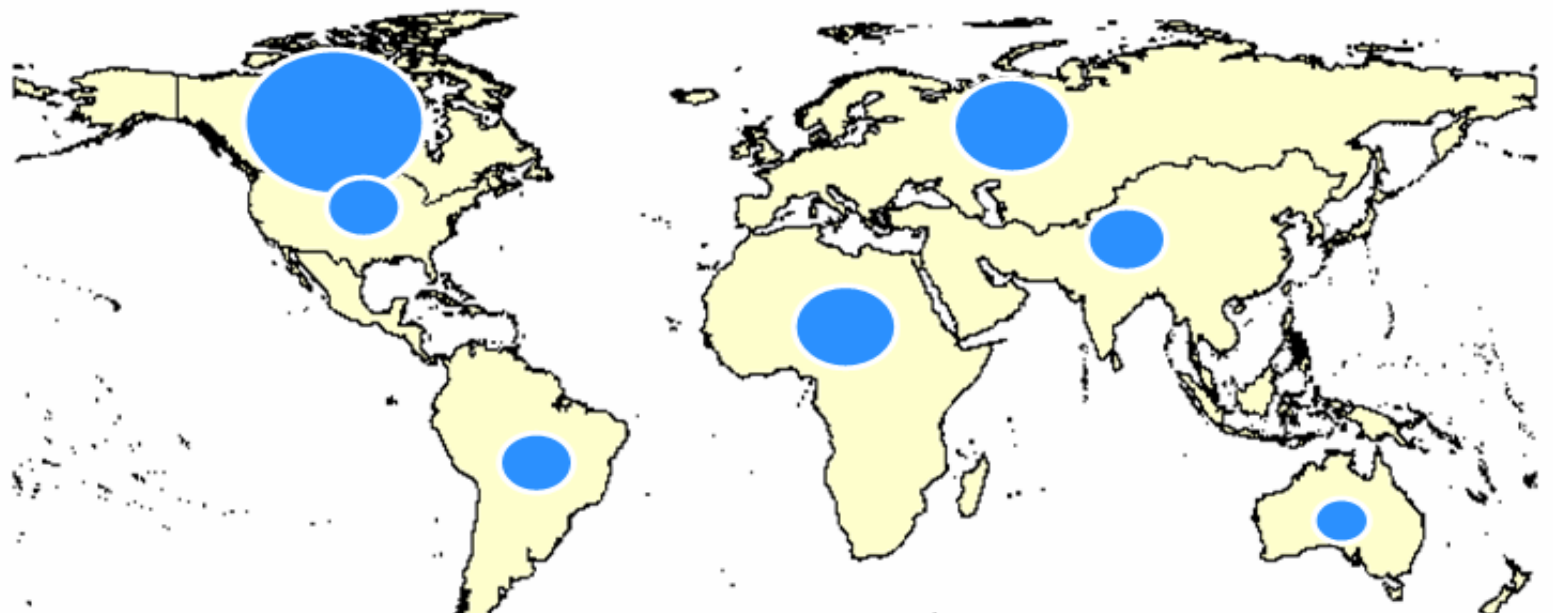
Language

Collegial Program

Program Grade

Status

Nb registration
Confidential code
Amount of Scholarships



As multiple dimensions are cross-tabulated from one... two... three dimensions

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

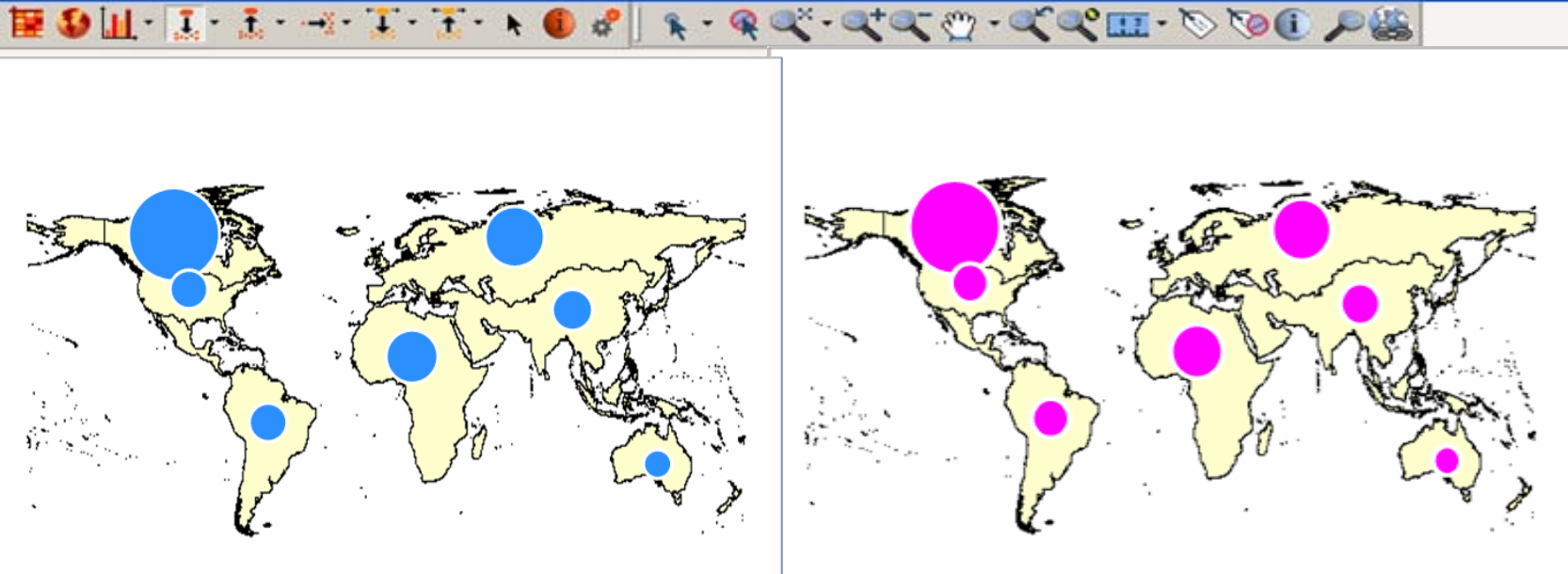
Collegial Program

Program Grade

Status

Nb registration

Confidential code
Amount of Scholarships



Different points of view of the same data... from one...

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

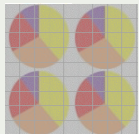
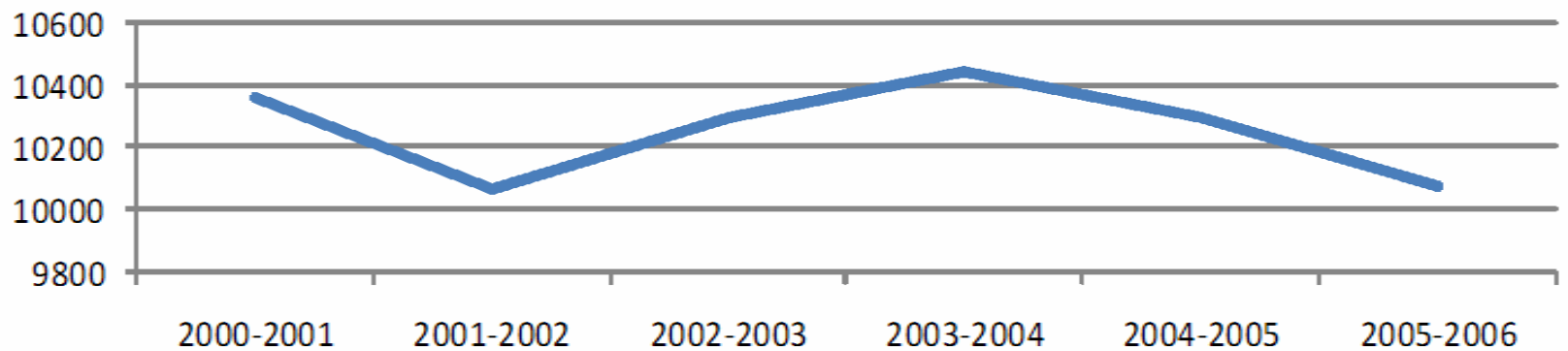
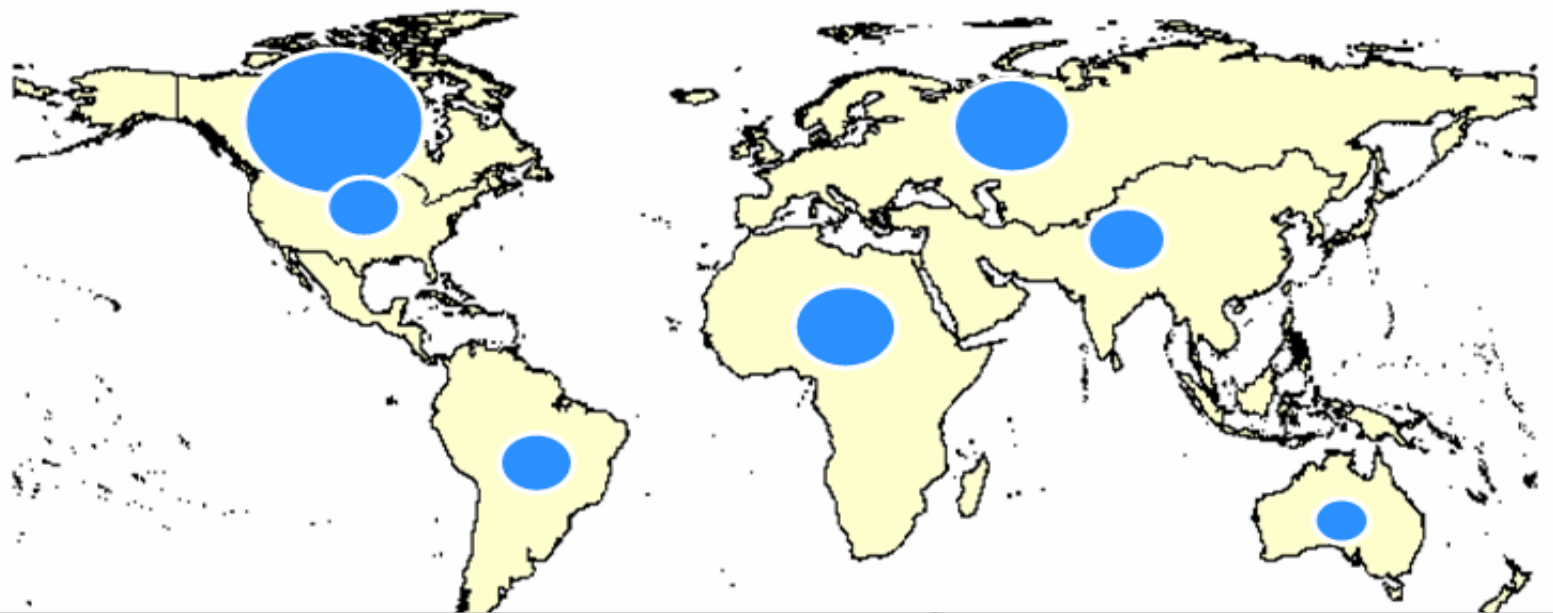
Language

Collegial Program

Program Grade

Status

Nb registration
Confidential cote
Amount of Scholarships



Different points of view of the same data... from one... two...

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

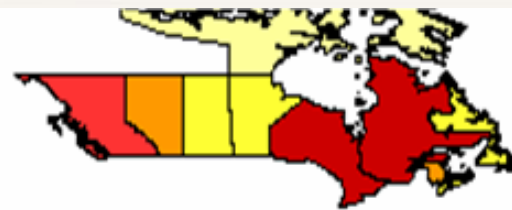
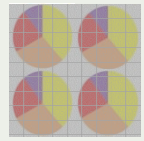
Collegial Program

Program Grade

Status

Nb registration

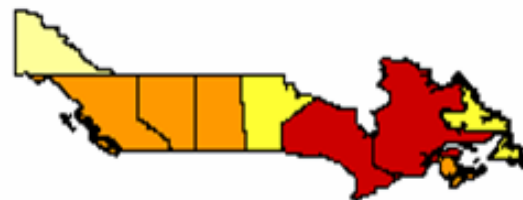
Confidential cote
Amount of Scholarships



2000-2001



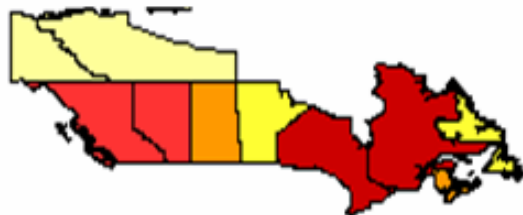
2001-2002



2002-2003



2003-2004



2004-2005



2005-2006

Different points of view of the same data... from one... two... three... points of view.

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

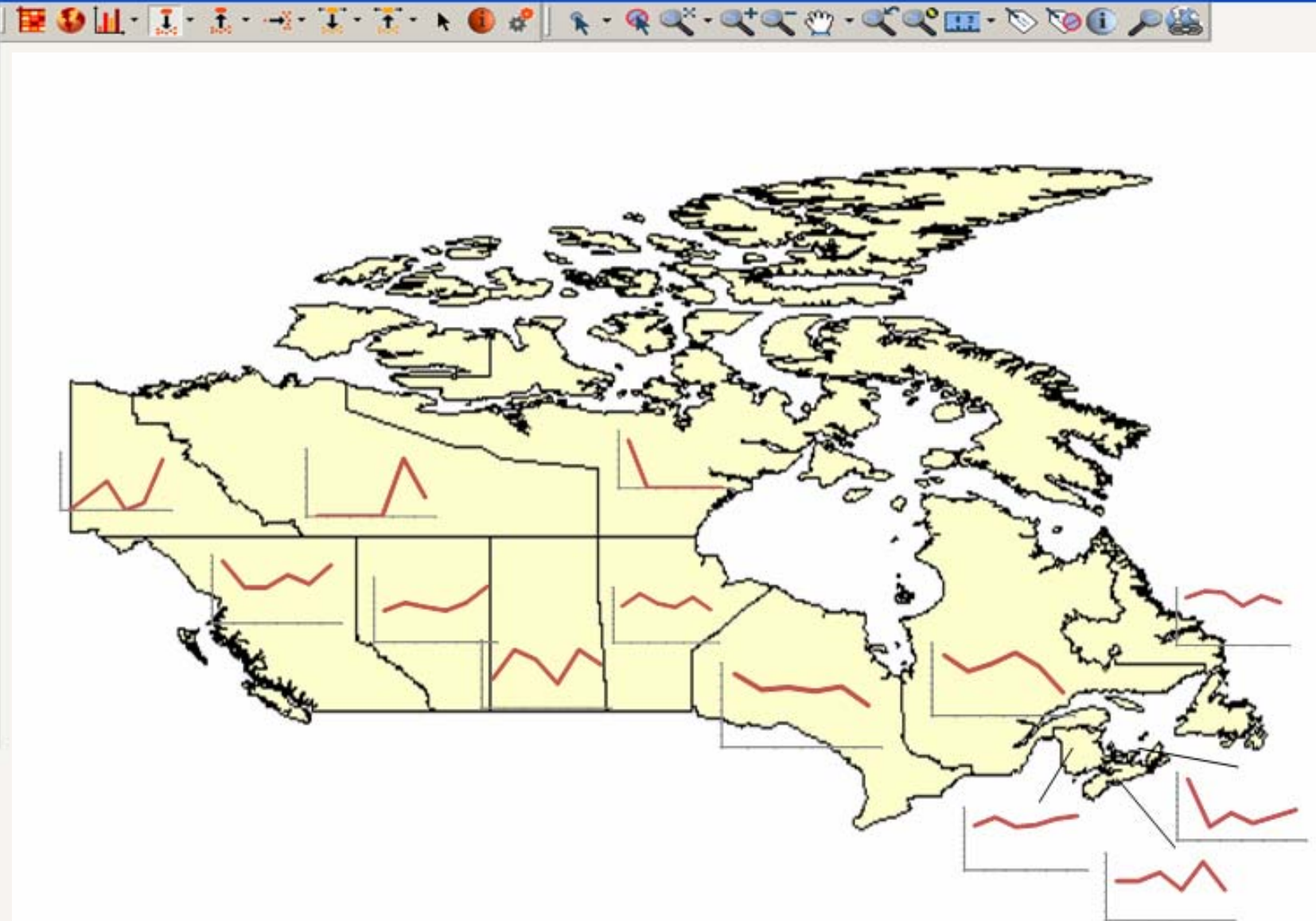
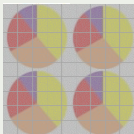
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



Multiple views readily available from one...

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

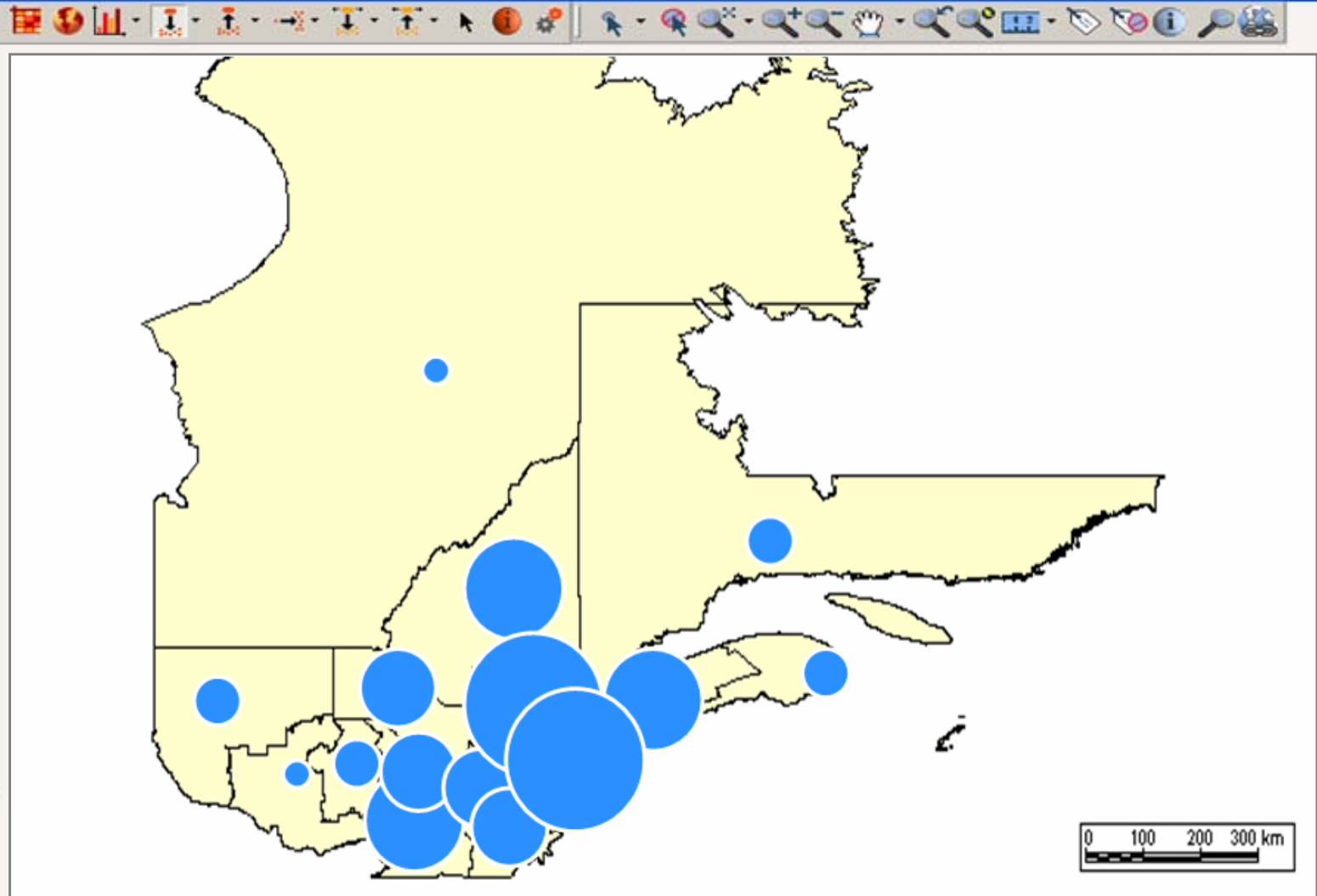
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



Multiple views readily available from one... two

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

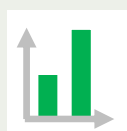
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



Multiple views readily available from one... two... three... views.

BPEI 2000-2006

Measures

Origin

Time 2000-2006

Gender

Age Class

University program

Institutional Origin

Language

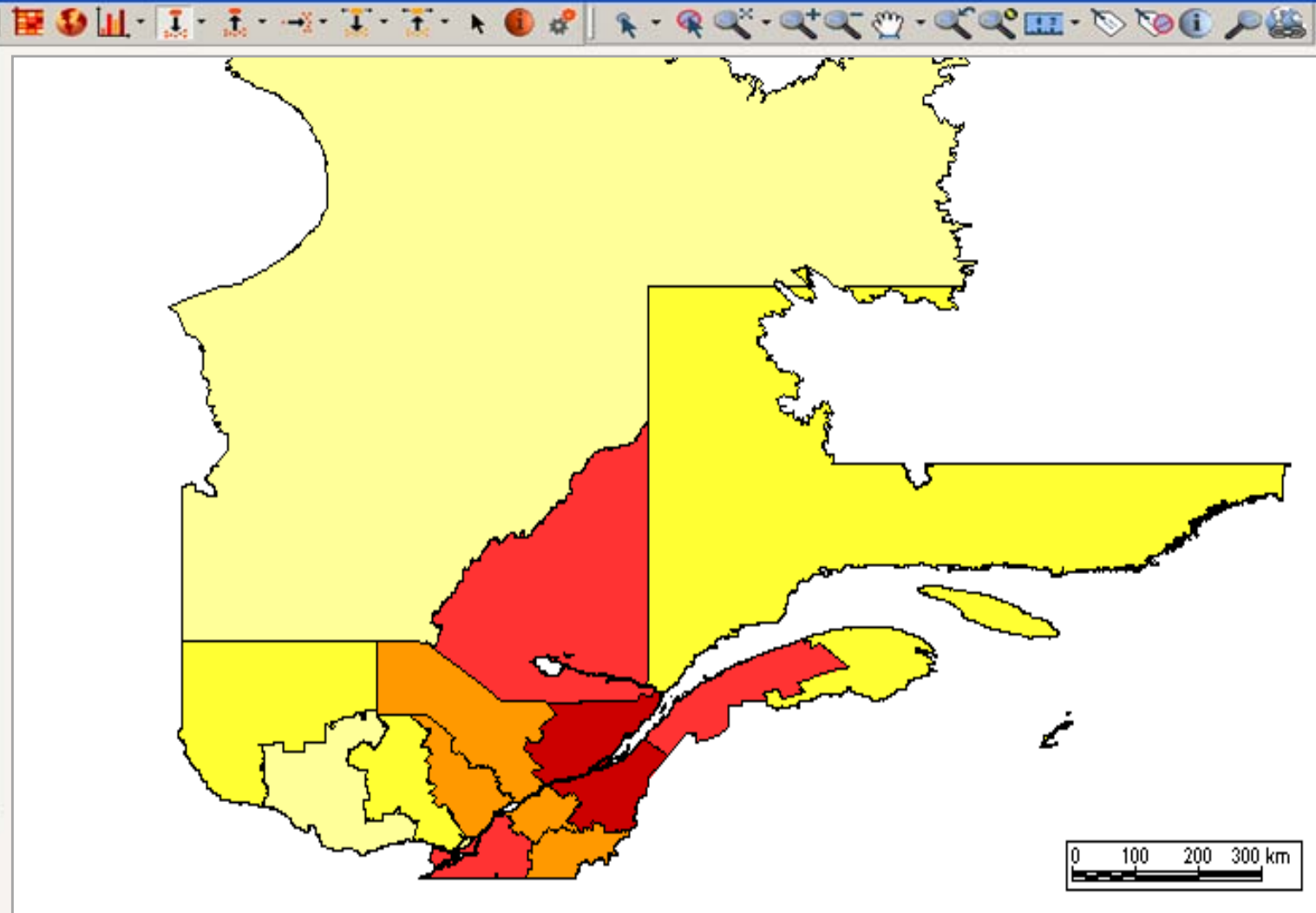
Collegial Program

Program Grade

Status

Nb registration

Confidential cote
Amount of Scholarships



Advances for GeoVisual Analytics

- Spatial OLAP for analytical needs
- Geovisualization + SOLAP
- Natural interaction with the data as well as with their geovisualization
- Support and increase the visual thinking



«How» to ~~obtain~~ the result

«How» to ~~see~~ the result

Facilitating GKD

Acknowledgements

- NSERC Industrial Research Chair in Geospatial Databases for Decision Support.
- Natural Sciences and Engineering Research Council of Canada (NSERC)
- Geovisual Analytics Workshop's organizers





Thanks for your attention

Strenghts and limits

■ Strenghts

- Respects the data manipulation
- Respects the exploration philosophy
- Gives the flexibility to the geoViz expert to add new model to the system
- Integrates a part of the semiologic knowledge

■ Limits

- Doesn't address the ART part of geovisualization
- Still need a context definition by the DA
- Still need a way to order the appropriate models with the context