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Data representation and visual forms: from static to dynamic

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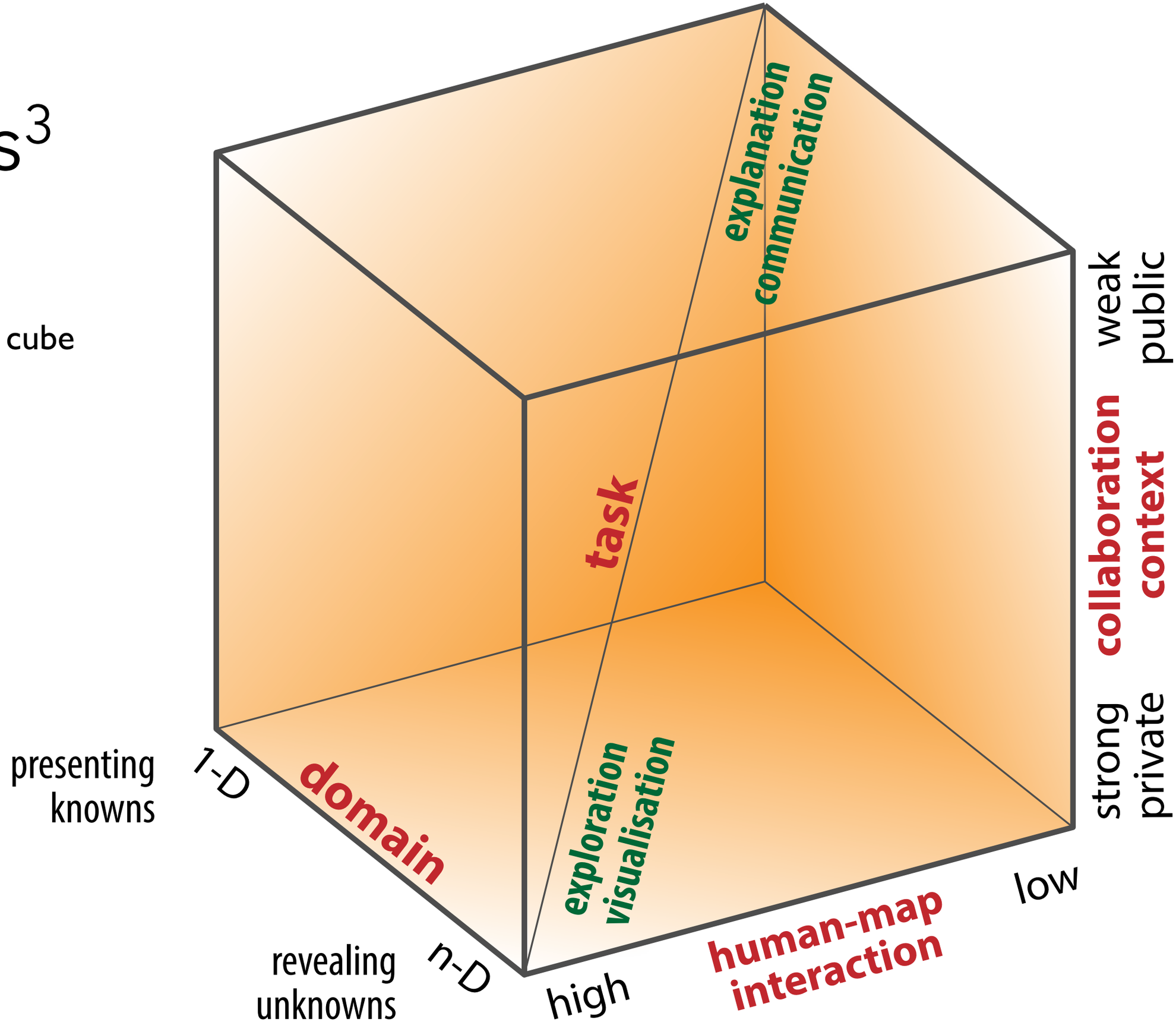
Concepts de base en géovisualisation

Overview

- Geovis^3
- Data representation and visual forms
- From static to dynamic: levels of interactivity

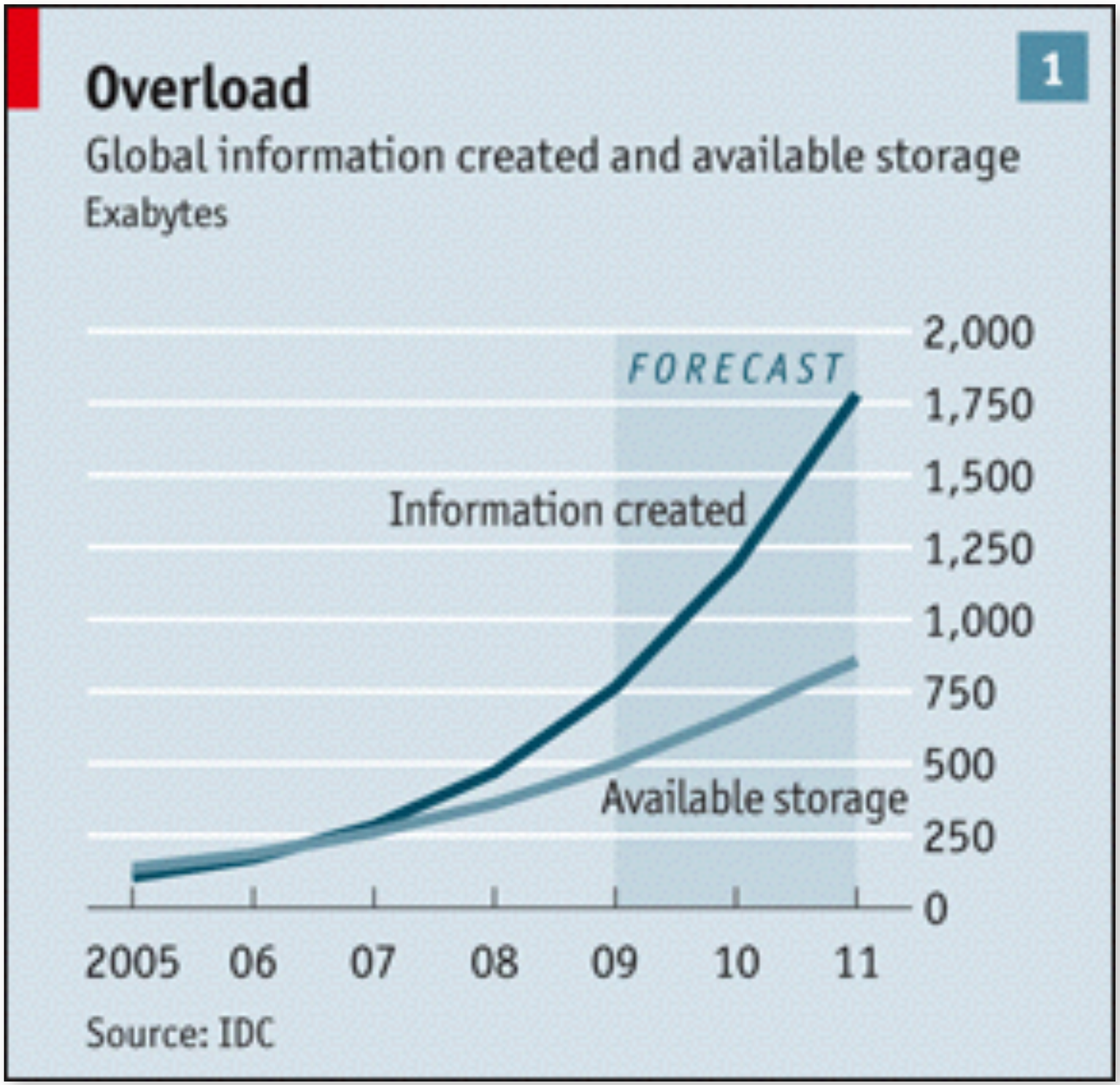
Geovis^3

MacEachren's
geovisualisation cube



Data representation and visual forms

Data tsunami!



http://www.economist.com/node/15557443

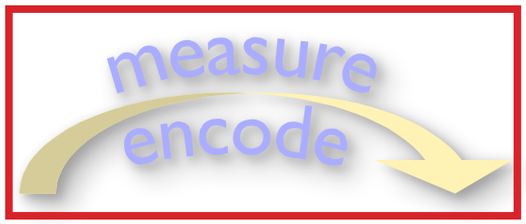
Big data in Geovis

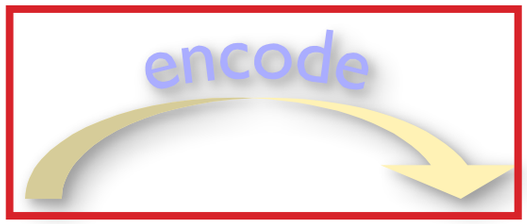
- Find patterns and relationships in complex geospatial data
- Discovery of patterns and knowledge creation might be difficult, patterns might stay hidden
- Visuals stimulate pattern recognition and hypothesis generation

Geovis workflow

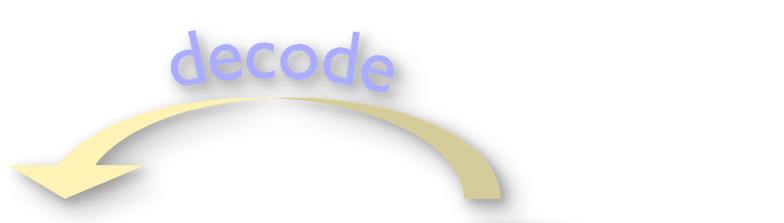
Putting big data in visual form…

Big data!





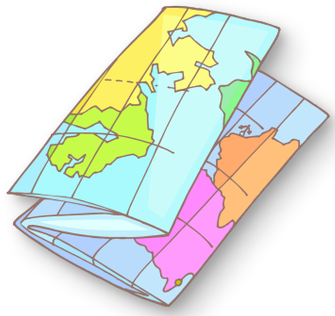
Adapted visuals!



world

Smart storage: DB or model!

data model



graphic model

mental model

percept./cogn. computation

cartographic modeling & design

perception re-cognition

Framework for visual forms

- Systematically organise visual domain
- Understand roles and uses for different visual forms
- Informed decisions on why, when and where to apply which visual
- Based on the task / problem at hand

Range of visual forms…

- Many different classification schemes exist!
- Realistic vs. **abstract**
- **Discrete** vs. continuous
- By type: photographs, graphs, diagrams, maps, …
- By production type / display
- **Static** vs. interactive
- Predefined vs. dynamic

Range of visual forms

specificity ***generalizability***

one a few thousands millions nearly all

McCloud (1993)

2D image ***2D symbol***

Abstract vs. realistic

http://www.bbc.co.uk/london/travel/downloads/tube_map.gif

Discrete vs. continuous

Sunday, 28 November 2009 at 4PM in the Centre of Dublin

Interactivity & dynamic maps

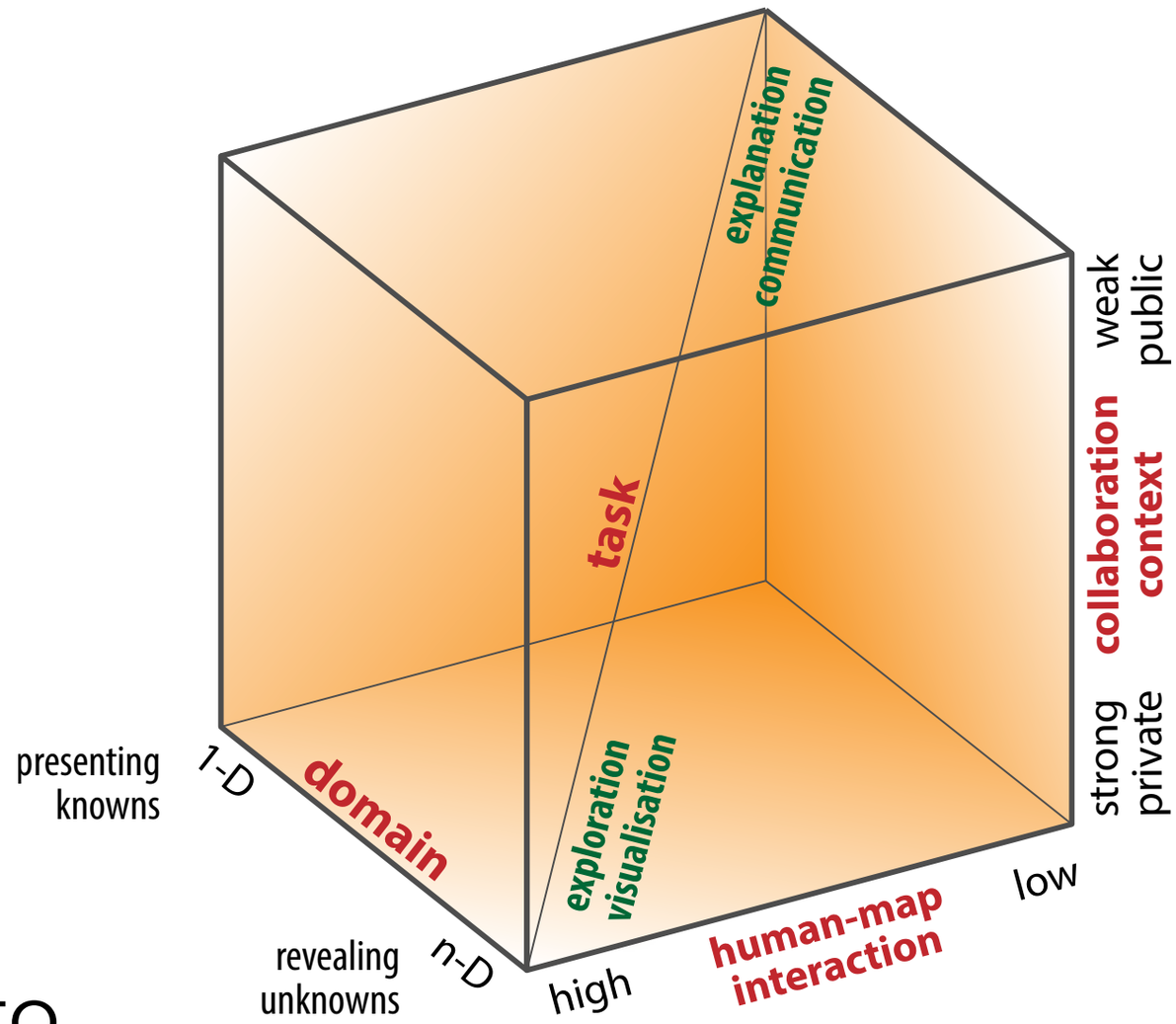
Typology of interactivity

- Interaction with the data representation
  - Zoom, pan, changing view point (camera), changing orientation of the data, change of scale
- Interacting with the temporal dimension
  - Navigation, fly-by or fly-throughs, toggling, sorting
- Interaction with the data
  - Database querying, data mining; geographic, statistical and temporal brushing; filtering, highlighting
- Contextualising interaction
  - Multiple views, combining data layers, window juxtaposition, linking

(J. Crampton. Interactivity Types in Geographic Visualization, Cartography and Geographic Information .Science 29(2) 2002, p.85-98)

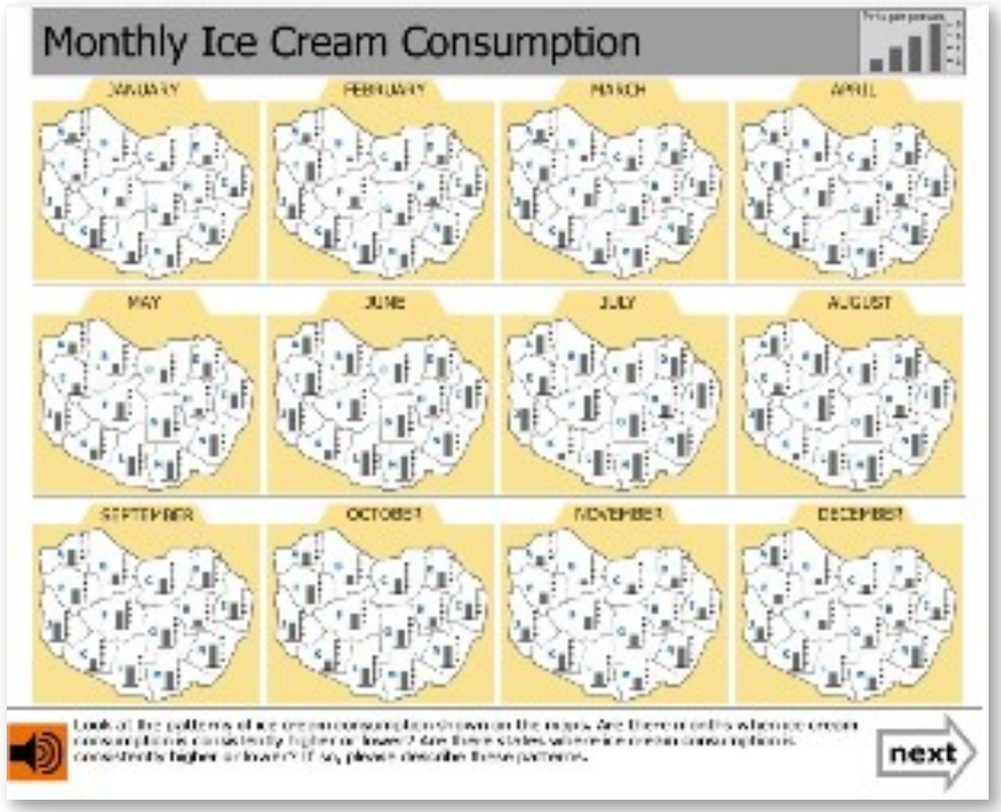
Levels of interactivity

- 5 levels of interactivity
- Continuum along one side of the map cube
- Which, when, where most appropriate?
  - Depends on purpose and audience!
- Goal: you should be able to select the appropriate level!



Level 1: Static

- No explicit interactivity at all
- Look → decode → (hopefully) understand!
- Implicit interactivity
- Look at symbols and use legend to understand symbols
- Little to no manipulation
- When / why static level could be useful?



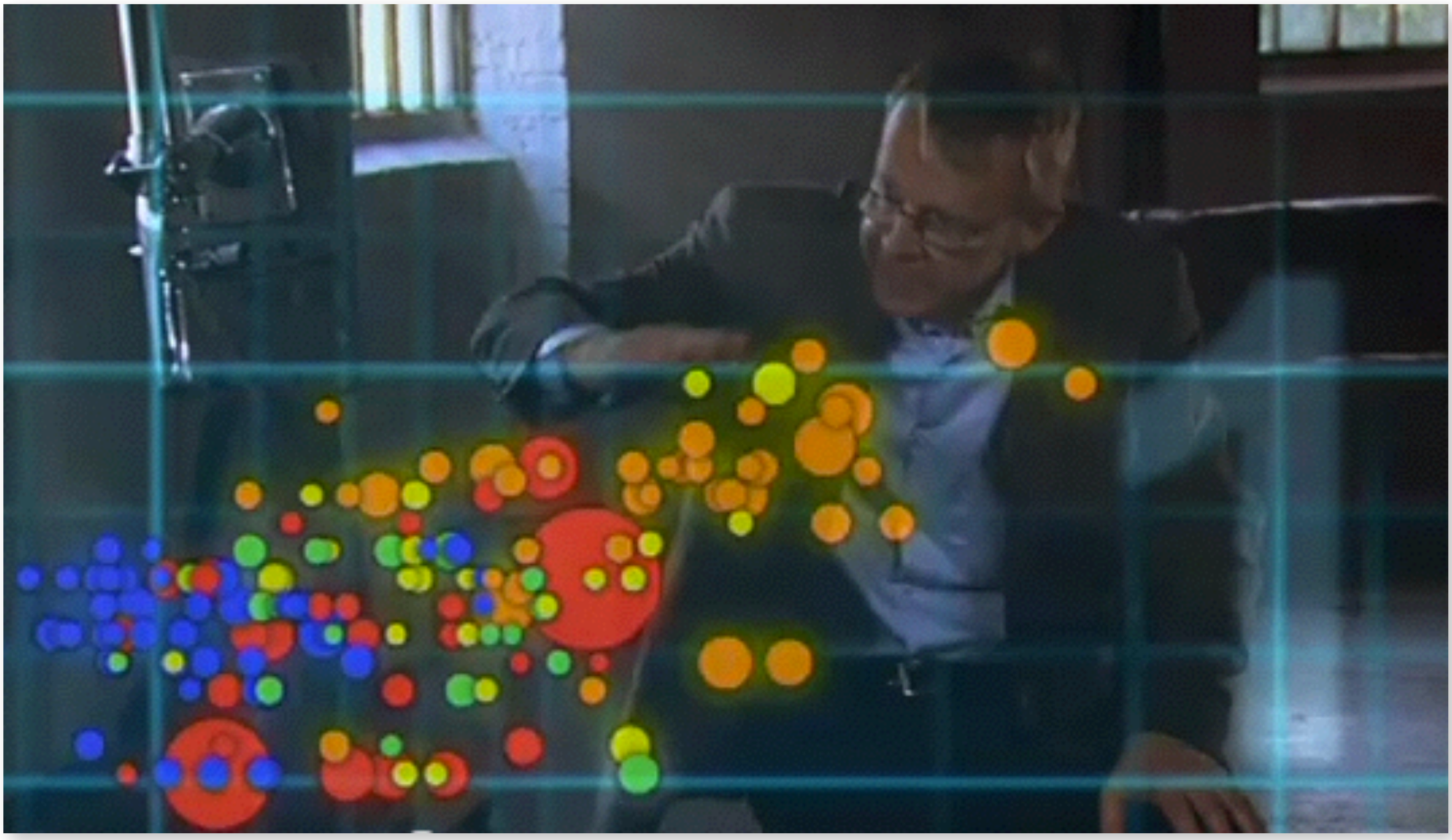
Level 2: Animation

- Illustrative animation can tell a story
- Limited to pre-built sequence
  - Low interaction level: play, stop, loop, rewind
- Passive monitoring of a model
- Animation ≠ Interactivity
- When / why animation could be useful?

Animation: example…

http://www.youtube.com/watch?v=Qz3BF3Njx-k

Animation: example...

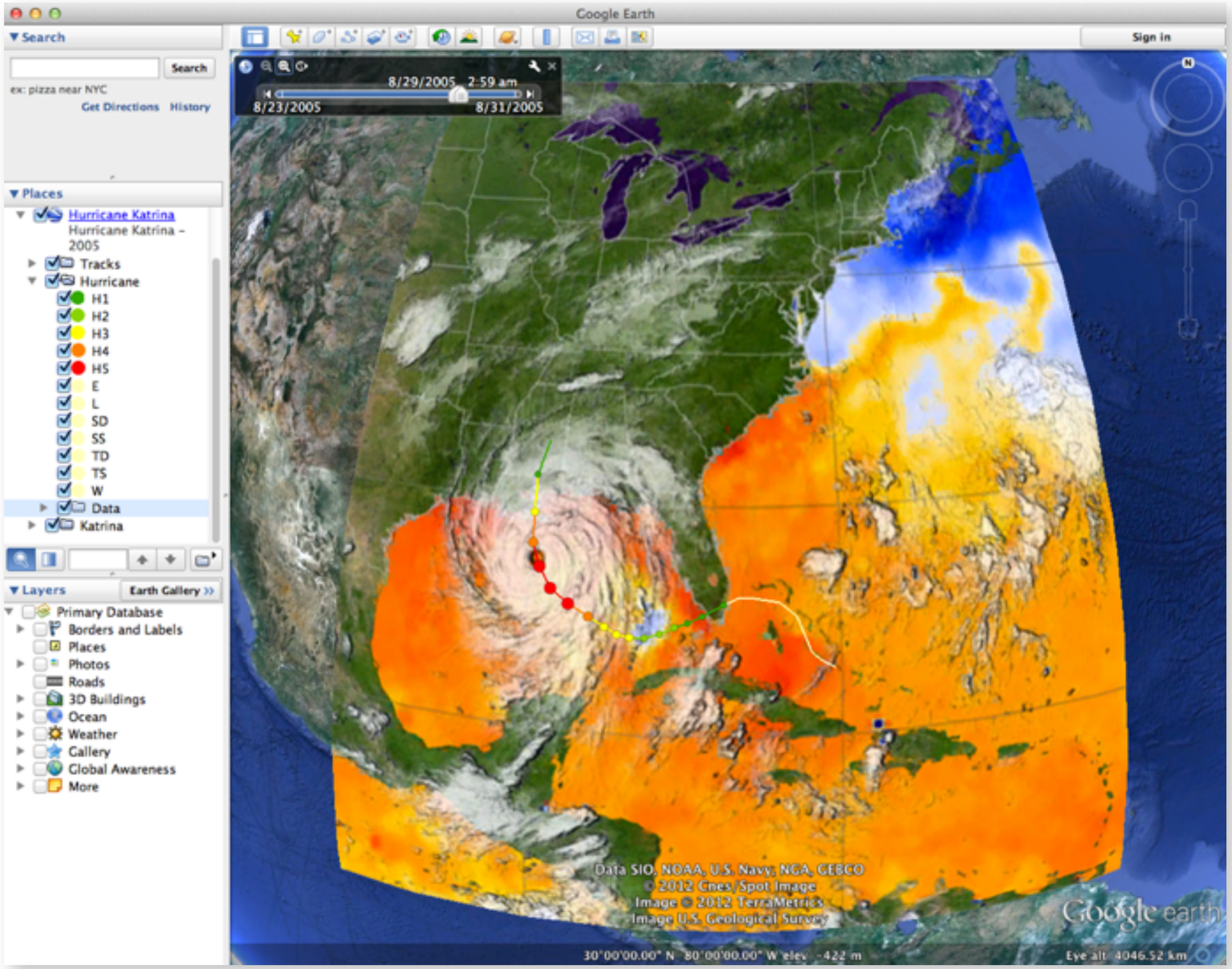


http://www.youtube.com/watch?v=jbkSRLYSojo

Level 3: Sequencing

- Controlled interaction of linear sequence
  - Modify speed and direction of animation
- Buttons provide some interactivity
  - Zoom in and out, select other view
- Geographic visualisation / ESDA
  - e.g. sequencing of choropleth maps (Slocum)

Sequencing: example…



«The amazing things about Google Earth…»

Hurricane Katrina

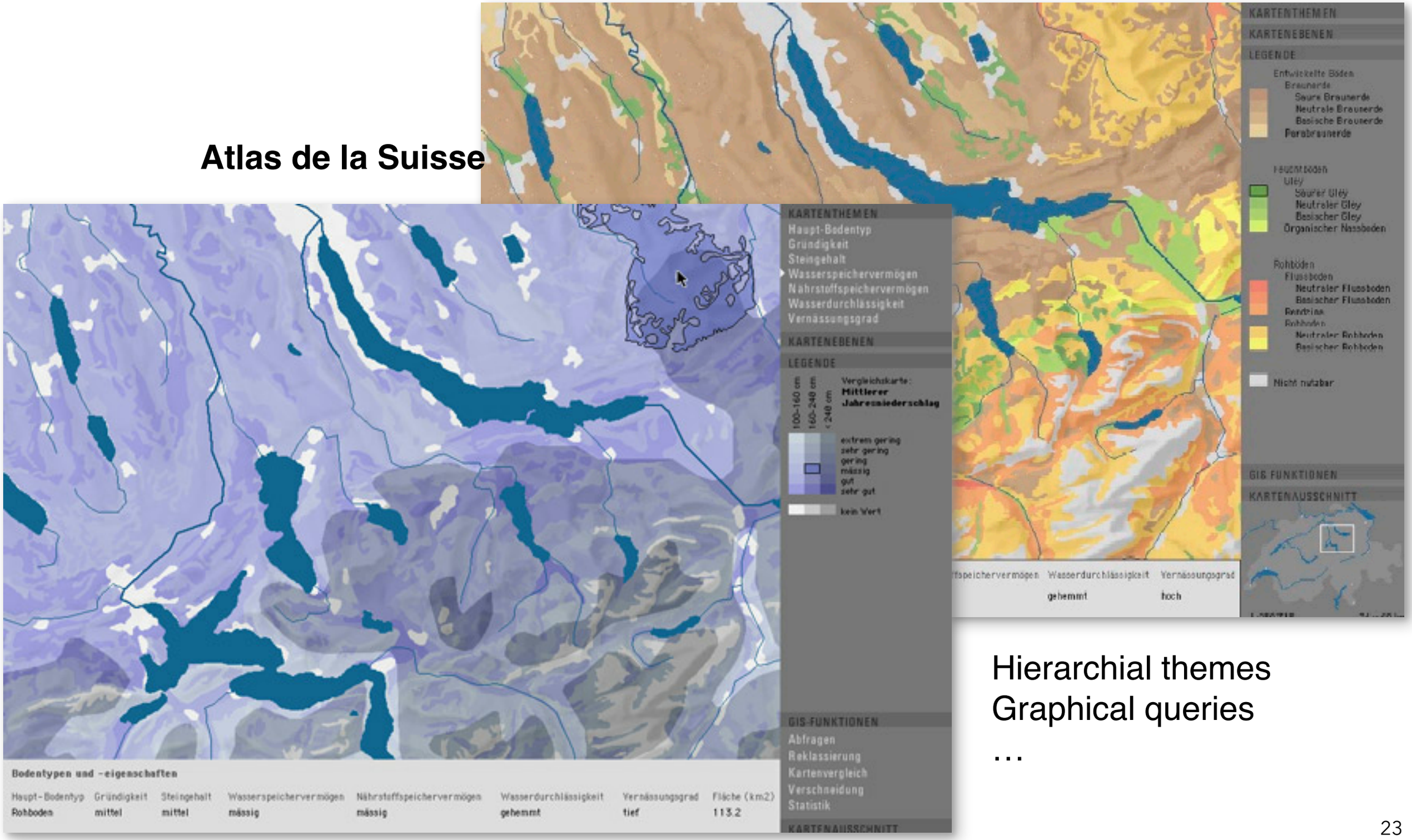
http://www.gearthblog.com/blog/archives/2006/12/top_10_time_animatio.html

Level 4: Hierarchical interactivity

- Non-linear organisation principle of information
  - Still pre-defined by designer
- Information trees with links and nodes
  - E.g. library catalogs, file systems
- Interaction along links and nodes of hierarchy
  - E.g. hypermedia
- Interrogate depth and detail of information
- Reveal hierarchical connections and relationships

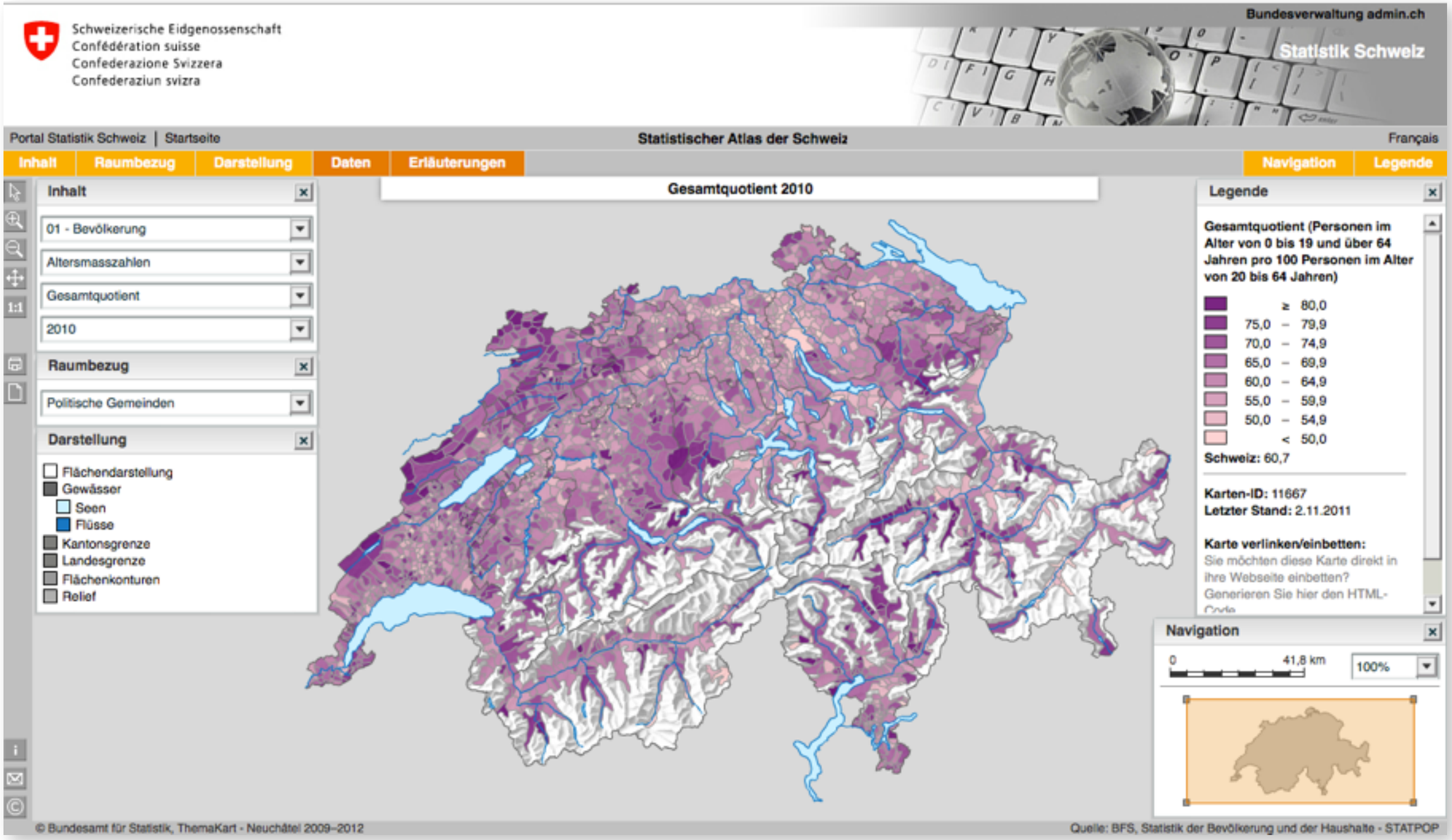
Hierarchical interactivity: example…

Atlas de la Suisse



Hierarchial themes
Graphical queries
…

Hierarchical interactivity: example…

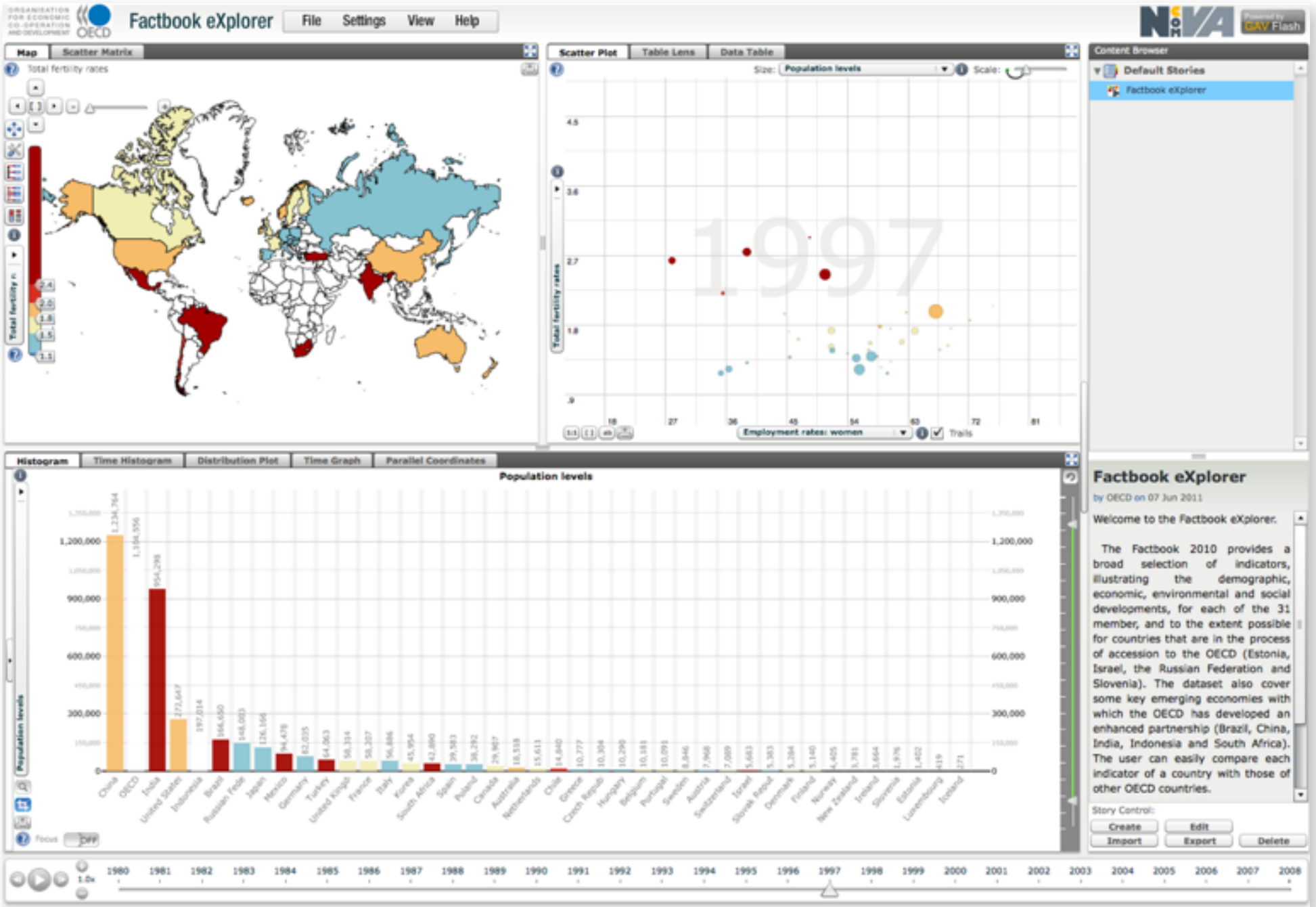


http://www.bfs.admin.ch/bfs/portal/de/index/regionen/thematische_karten/02.html

Level 5: Conditional interactivity

- As good as it get's until now!
- Real-time graphic solutions based on predefined rules
  - E.g. brushing, linked windows
- Event based
  - Unexpected outcomes possible based on starting conditions
  - E.g. geo-simulation, dynamic models, …
- Real-time simulation or «what-if» modelling (scenarii)
  - Pro-active graphics (GViz: Buttenfield, 1993)
  - Steering, flow modelling (ViSc: Rosenblum, 1990)

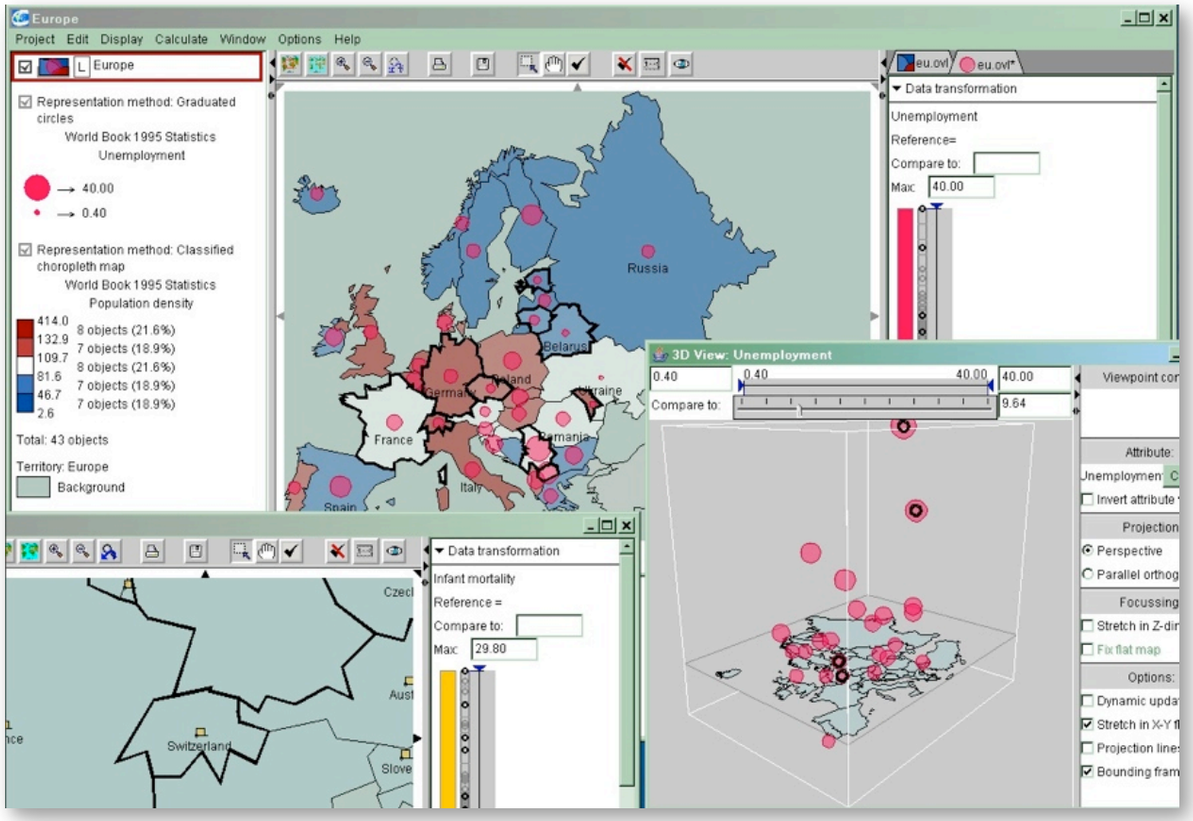
Conditional interactivity: example…



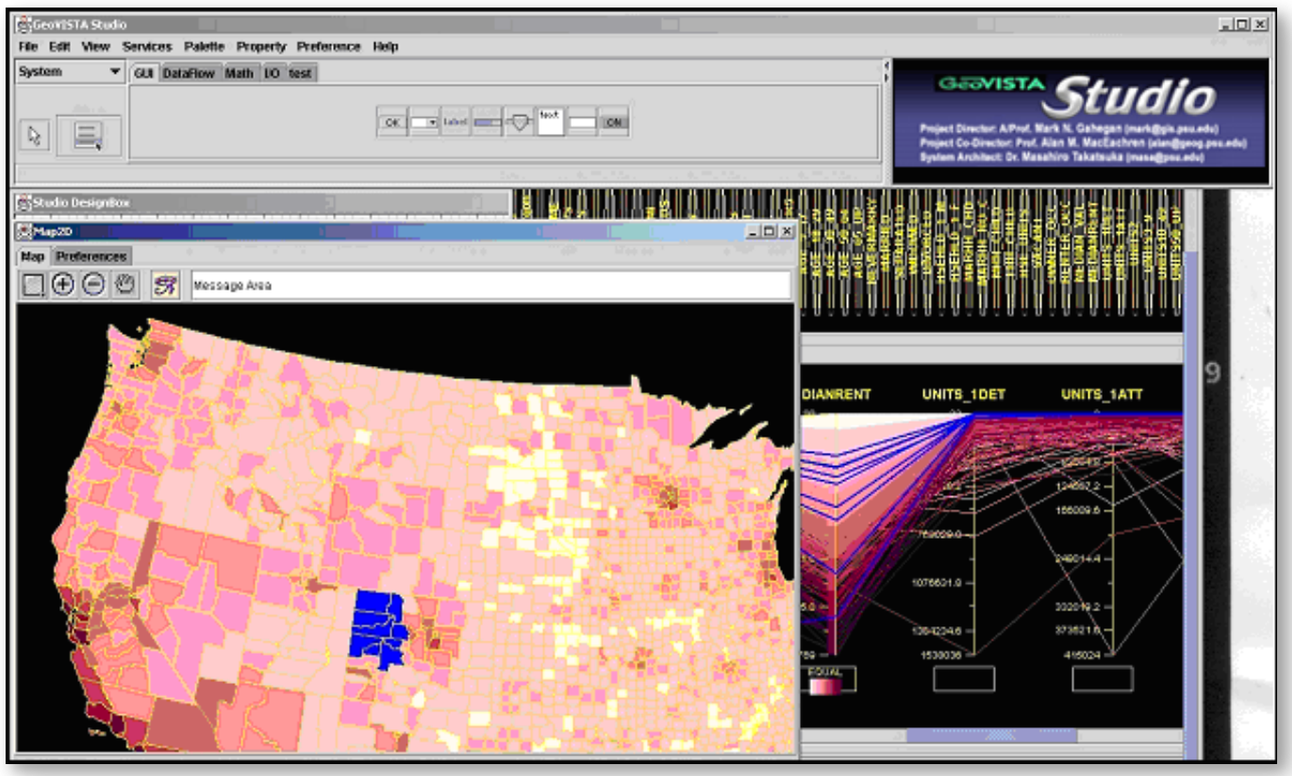
OECD Factbook eXplorer

http://stats.oecd.org/oecdfactbook/

Conditional interactivity: example…



G. & N. Andrienko, CommonGIS



Gahegan et al., GeoVISTA Studio

Interactivity: wrap up

- Interactivity in GeoVis is …
  - What/how users can manipulate what they see
  - What/how users can manipulate to make visible what they do not see
- Five levels …
  - static → animated → sequential → hierarchical → conditional
- Determining appropriate interactivity level for context …
  - Task / problem at hand; Theme, Audience

Questions?