Visualization
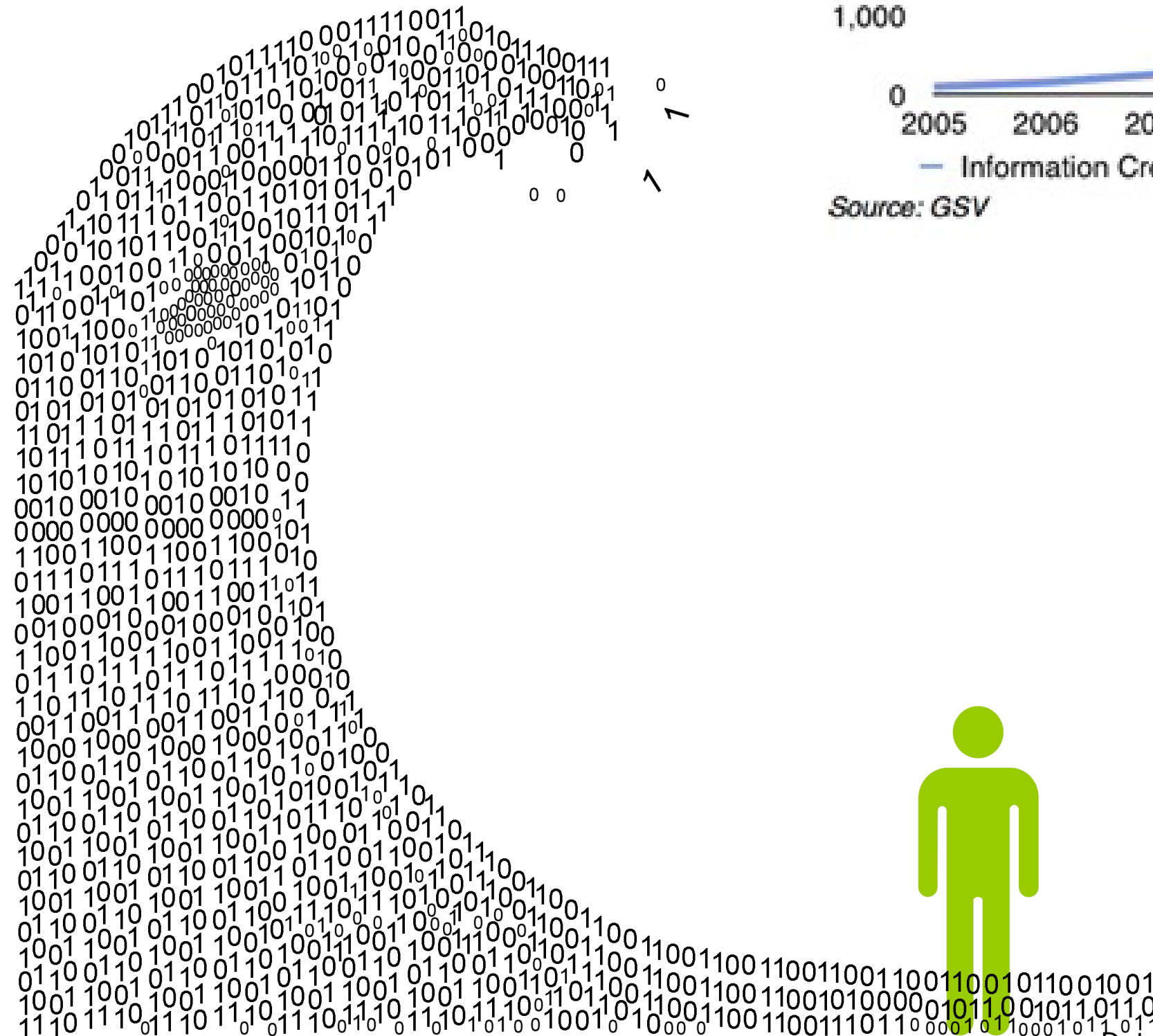
Forms. Functions. Uses.

Data tsunami !
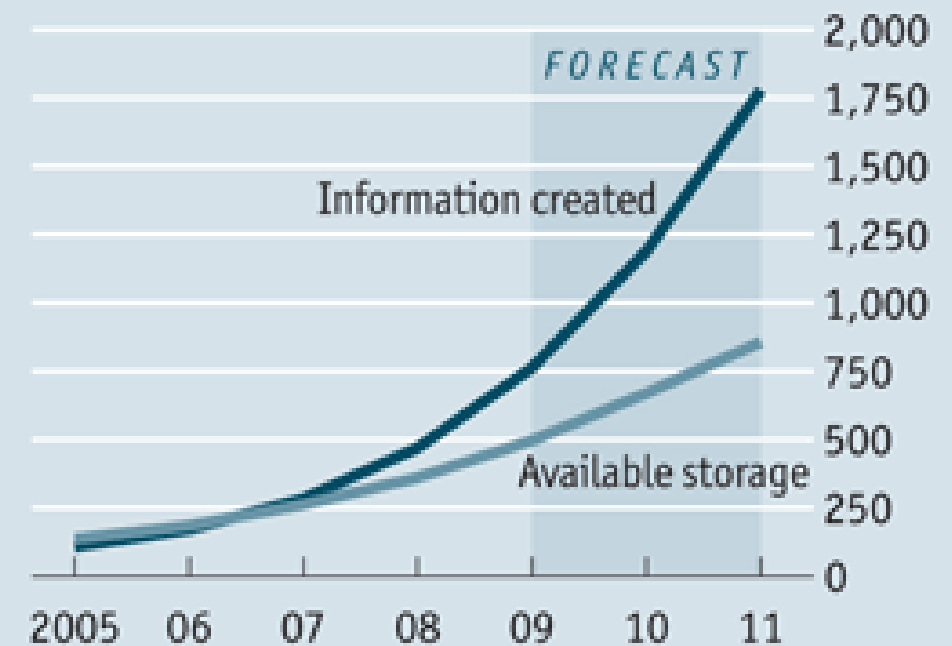

Information Created versus Total Available Storage

- Information Created (Exabytes)
- Available Storage (Exabytes)
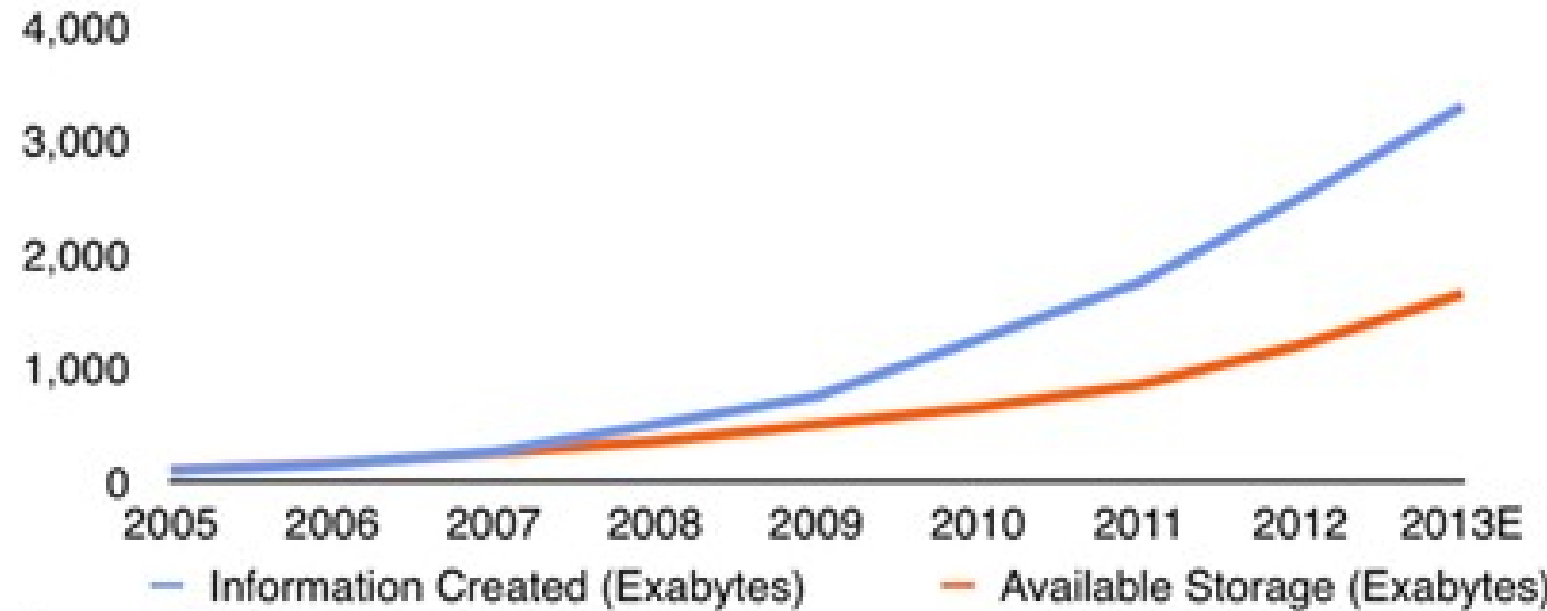
Source: GSV

Overload

Global information created and available storage
Exabytes

FORECAST

Information created

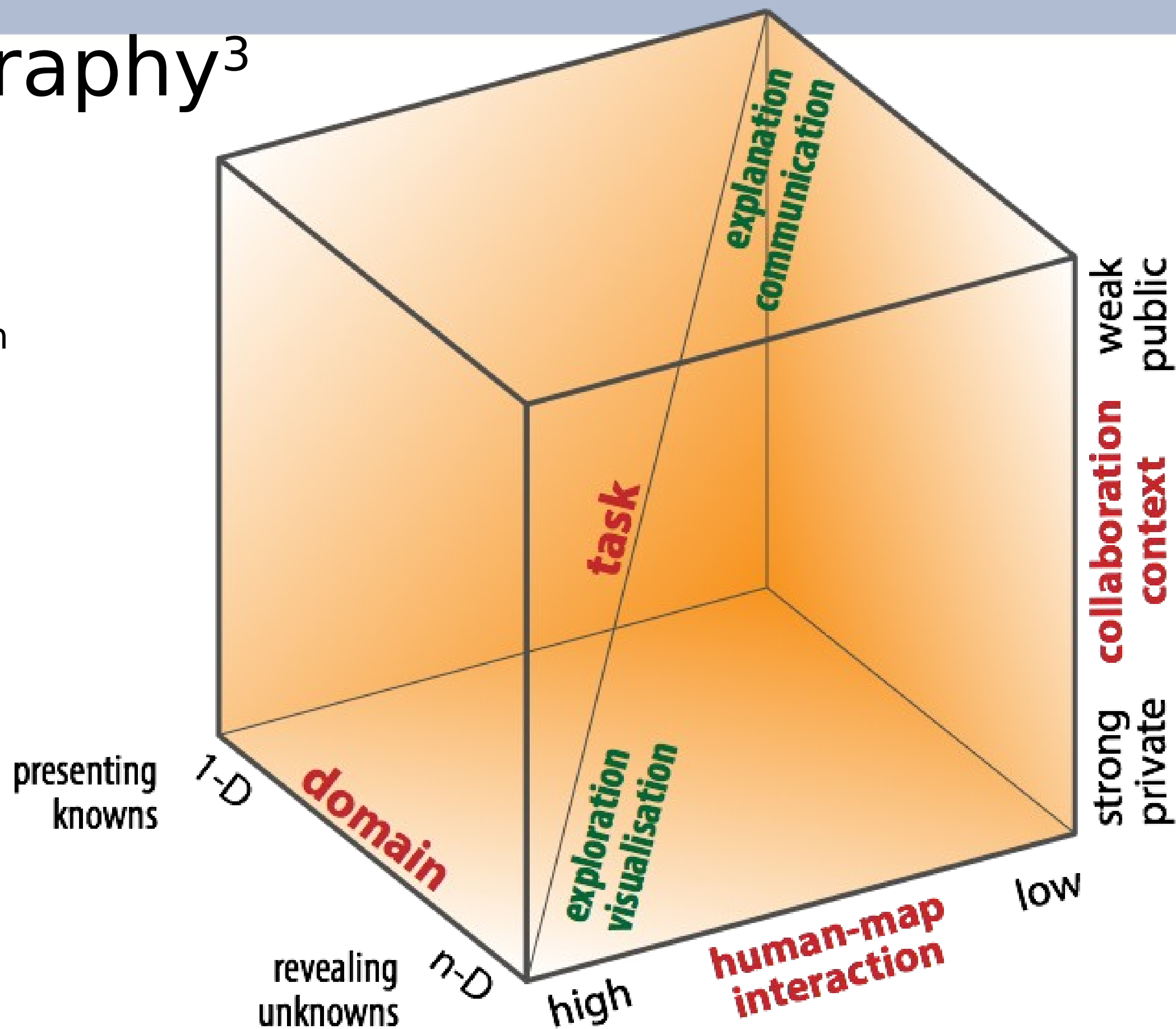Available storage

Source: IDC

Data, data everywhere

Geovisualization and big data

- Find patterns and relationships in complex geospatial data

- Discovery of patterns and knowledge creation might be difficult, patterns might stay hidden

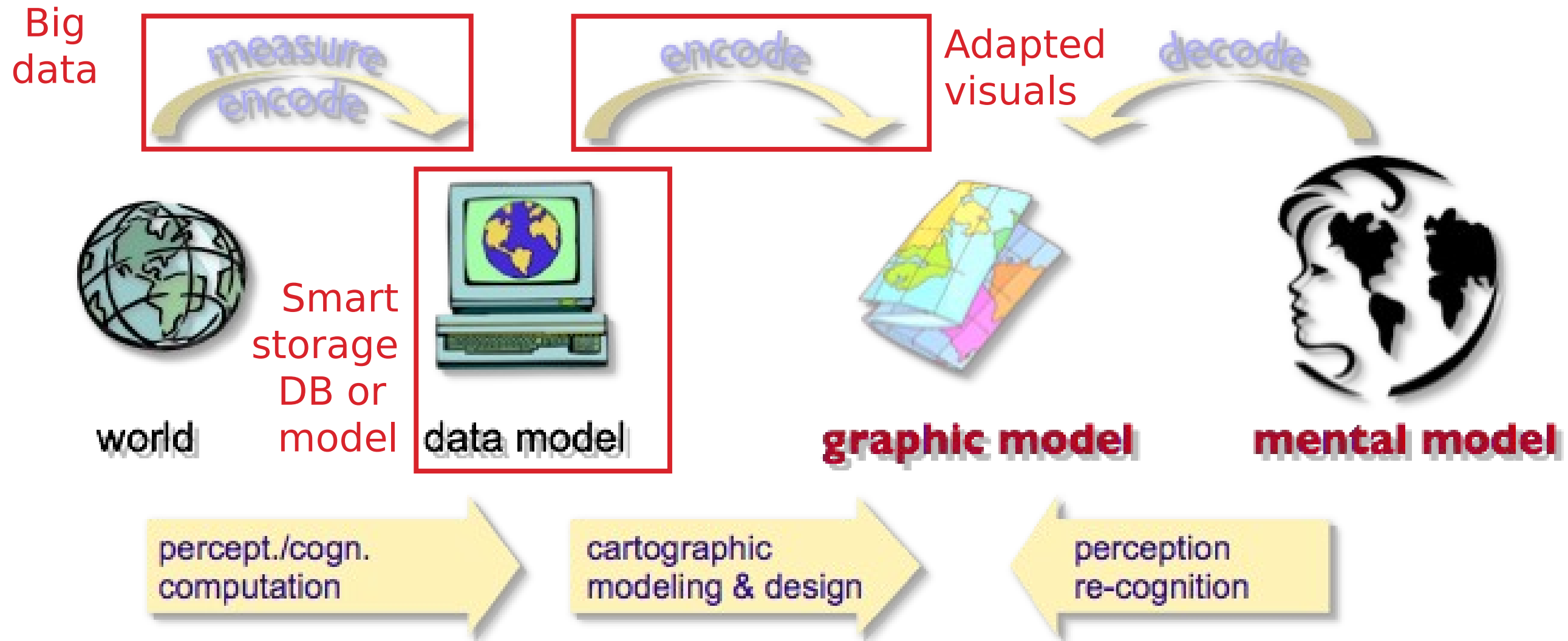- Visuals stimulate pattern recognition and hypothesis generation

Cartography³

MacEachren's geovisualisation cube

Big data in Geovis

Putting big data in visual form…
Raw data > data model > visual form > mental model

Big data

Adapted visuals

measure encode

encode

decode

Smart storage DB or model

world

data model

graphic model

mental model

percept./cogn. computation

cartographic modeling & design

perception re-cognition

Framework for visual forms

- **Systematically** organise visual domain

- Understand **functions and uses** for different visual forms

- Informed decisions on **why, when and where** to apply which visual

- Based on the **aims / task / problem**

Range of visual forms

Visual forms can be classified :

- By type : photography, graph, diagramm, map

- By production type / display : printed, digital, 2D/3D...

- Realistic <> Abstract

- Discrete <> Continuous

- Static <> Interactive

- Pre-defined <> Dynamic (on-demand)
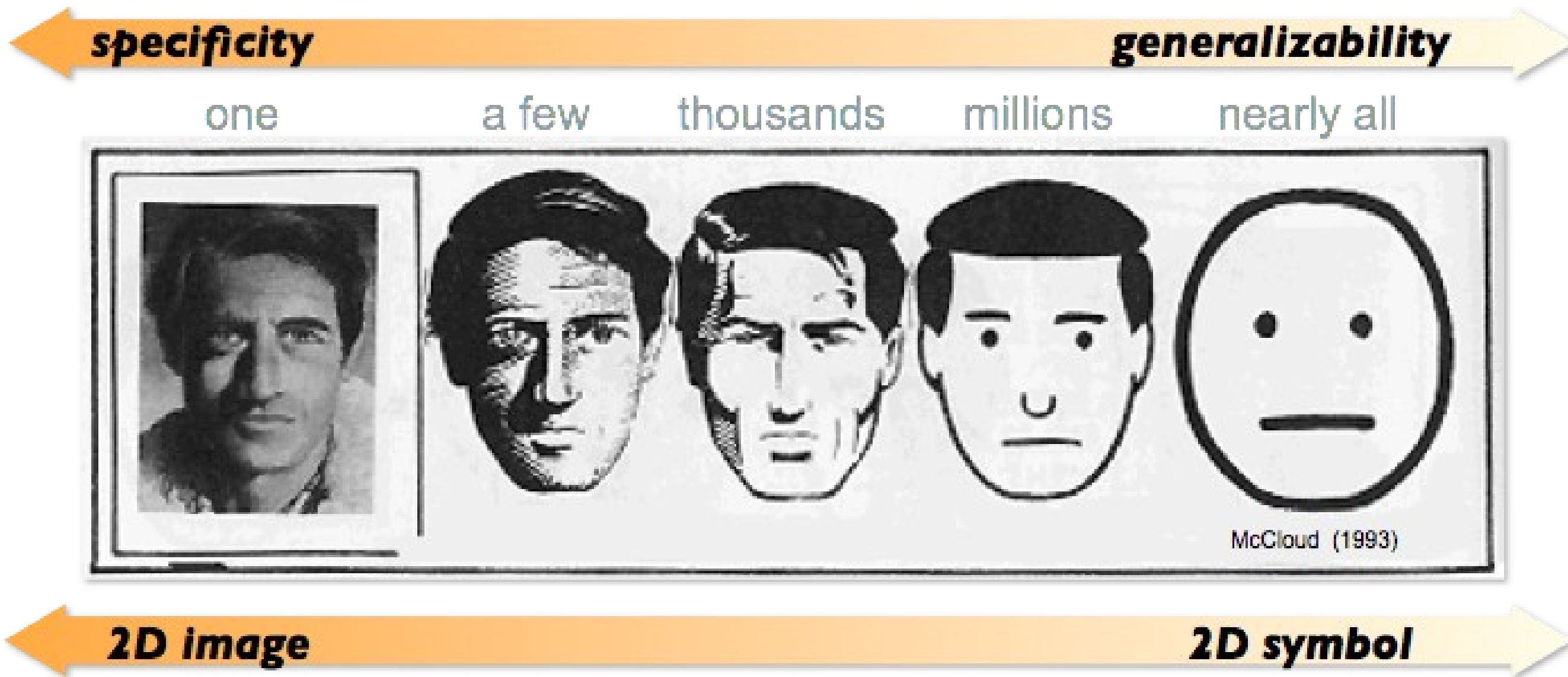
Functions of visual forms

- **Demonstrate**

  > photography, video, virtual environment

- **Give a context**

  > map, system scheme

- **Help to mental construction** (concept, structure, links)

  > text, map, scheme, abstract animation

- **Motivate** (catch attention, mindfullness)

  > animation, video, interactive application
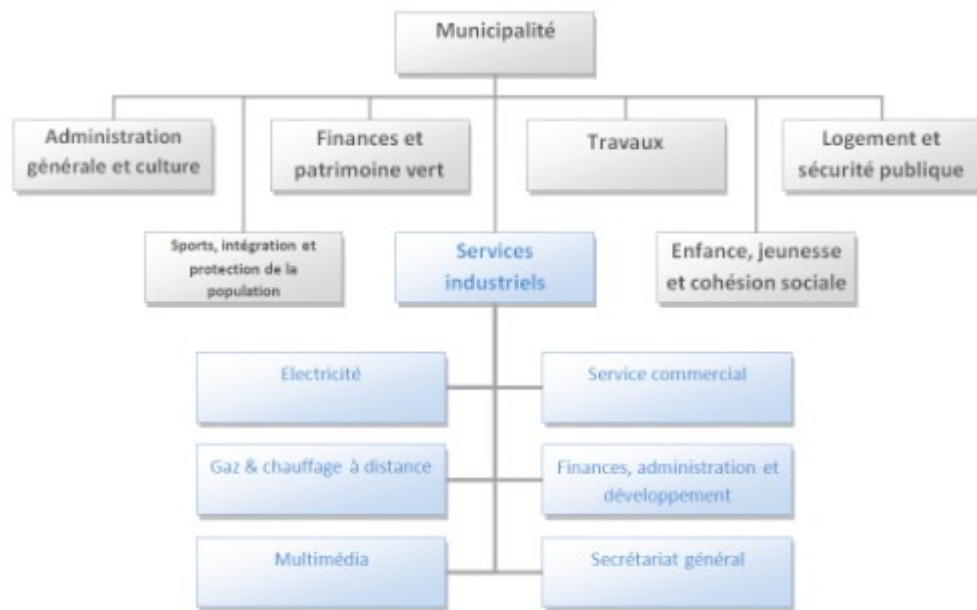
Range of visual forms

Visual forms can be classified :

- By type : photography, graph, diagramm, map

- By production type / display : printed, digital, 2D/3D...

- Realistic <> Abstract

- Discrete <> Continuous

- Static <> Interactive

- Pre-defined <> dynamic (on-demand)

•Realistic <> Abstract

specificity — generalizability

one — a few — thousands — millions — nearly all

2D image — 2D symbol

McCloud (1993)

Realistic <> Abstract

www.larousse.fr

Schéma d'une presse offset à une couleur.
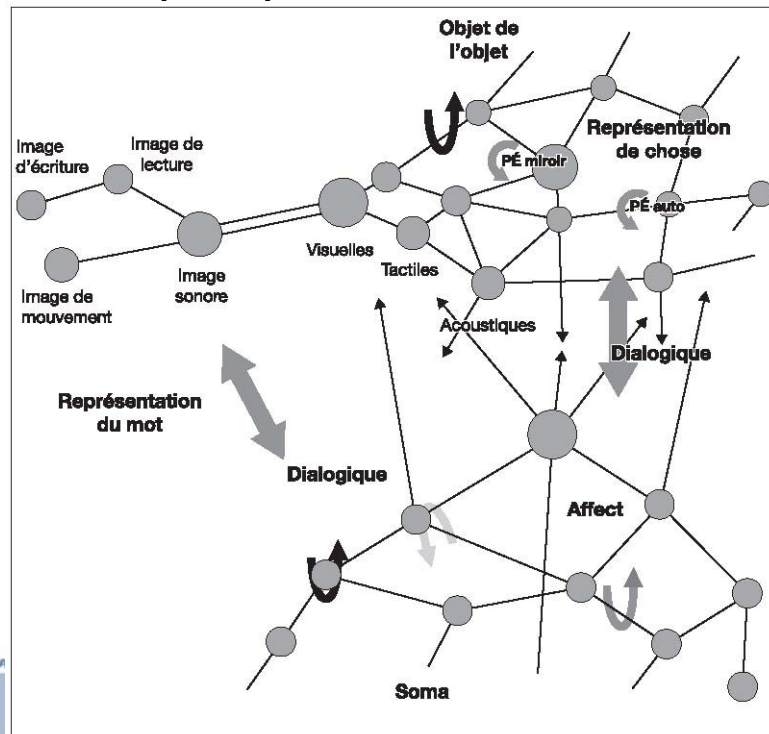

Organigramme des Services industriels de

Schéma de la représentation de chose dans ses dialogiques avec la représentation de mot et l'affect.
In Roussillon (2007)
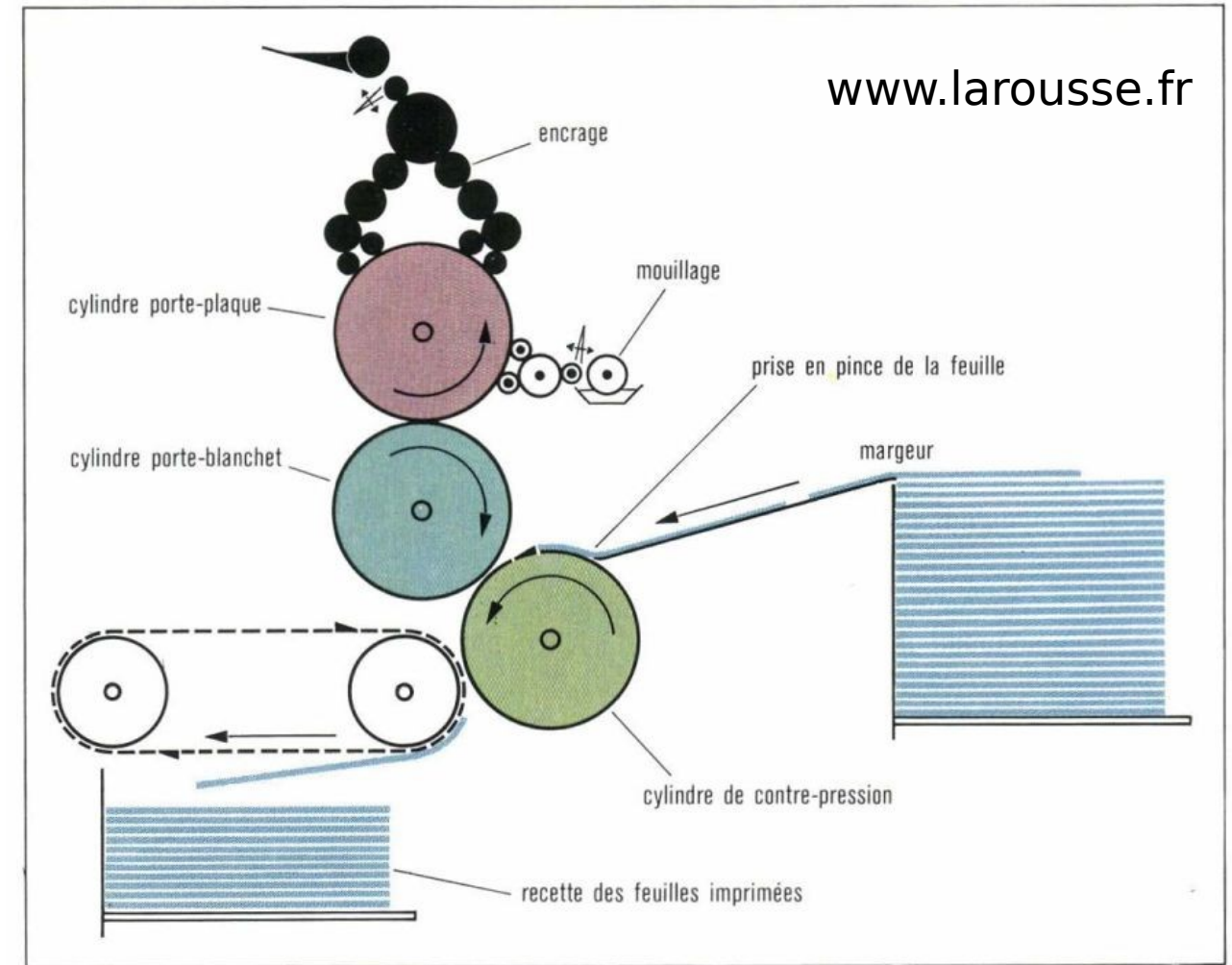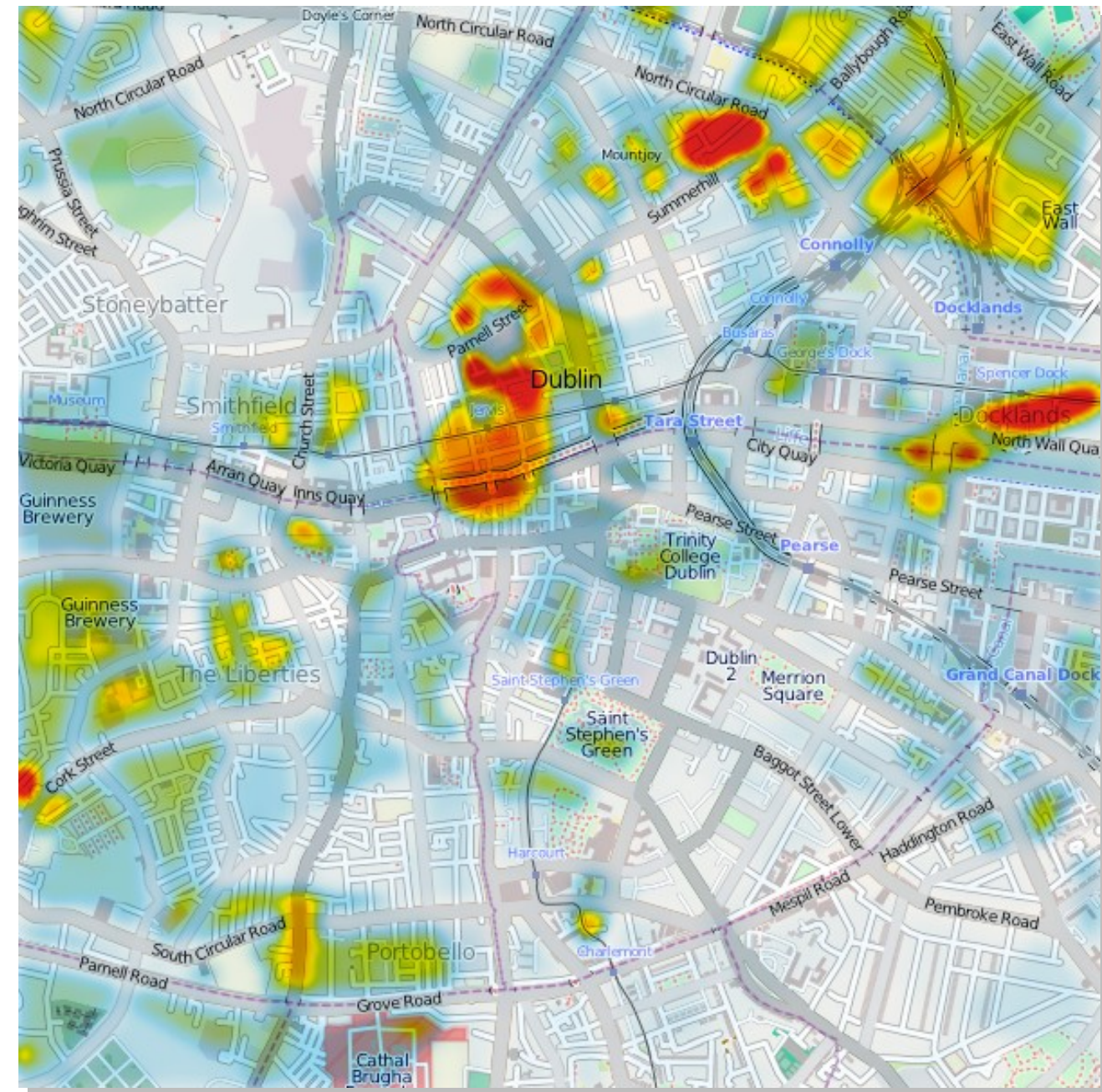La représentance et l'actualisation pulsionnelle.

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

Realistic <> Abstract

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

Static <> **Interactive**
Pre-defined <> **Dynamic** (on-demand)

Typology of interactivity in Geovisualization

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)

14

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!

15
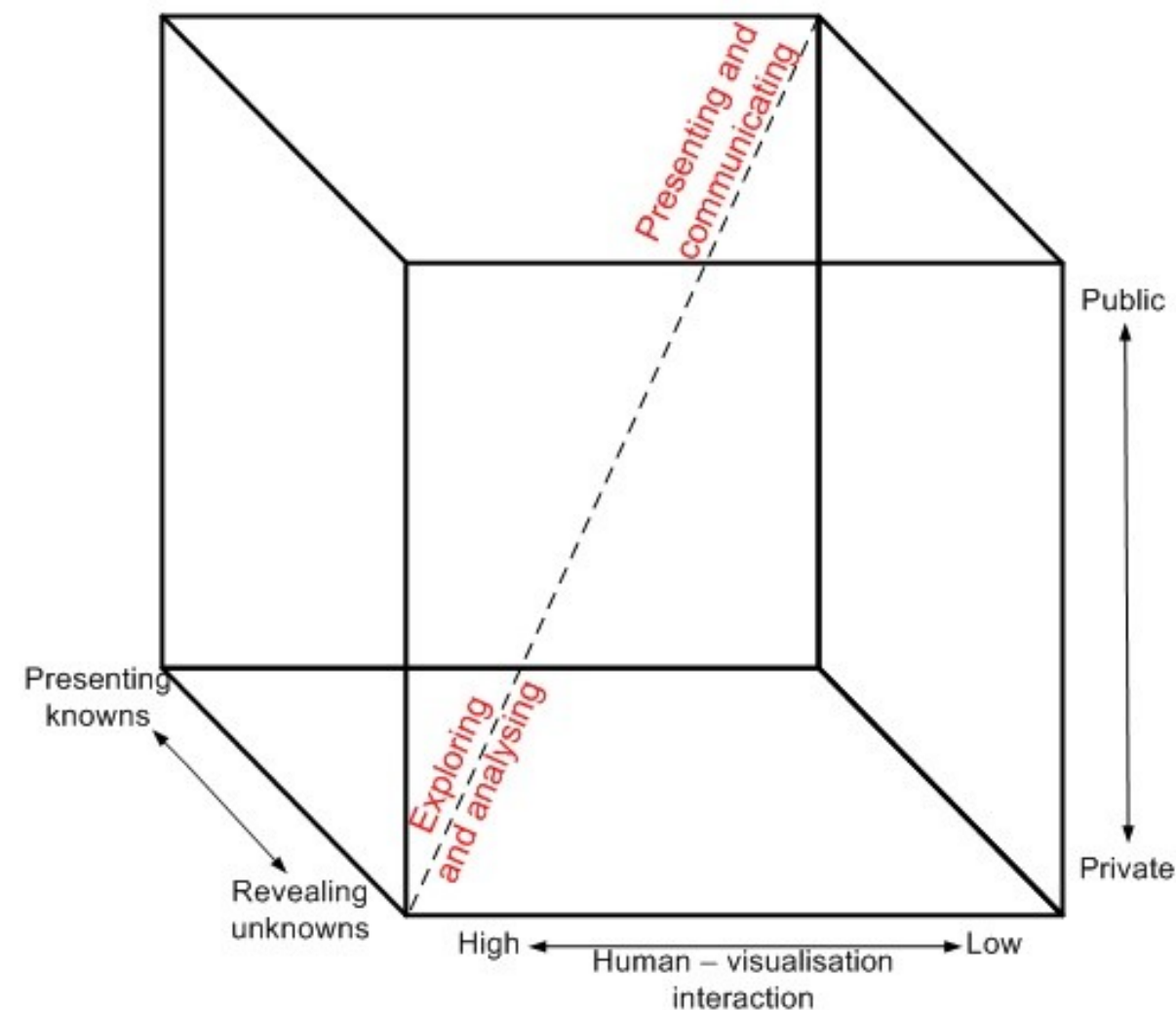
Level 1: Static

- 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 is useful?**
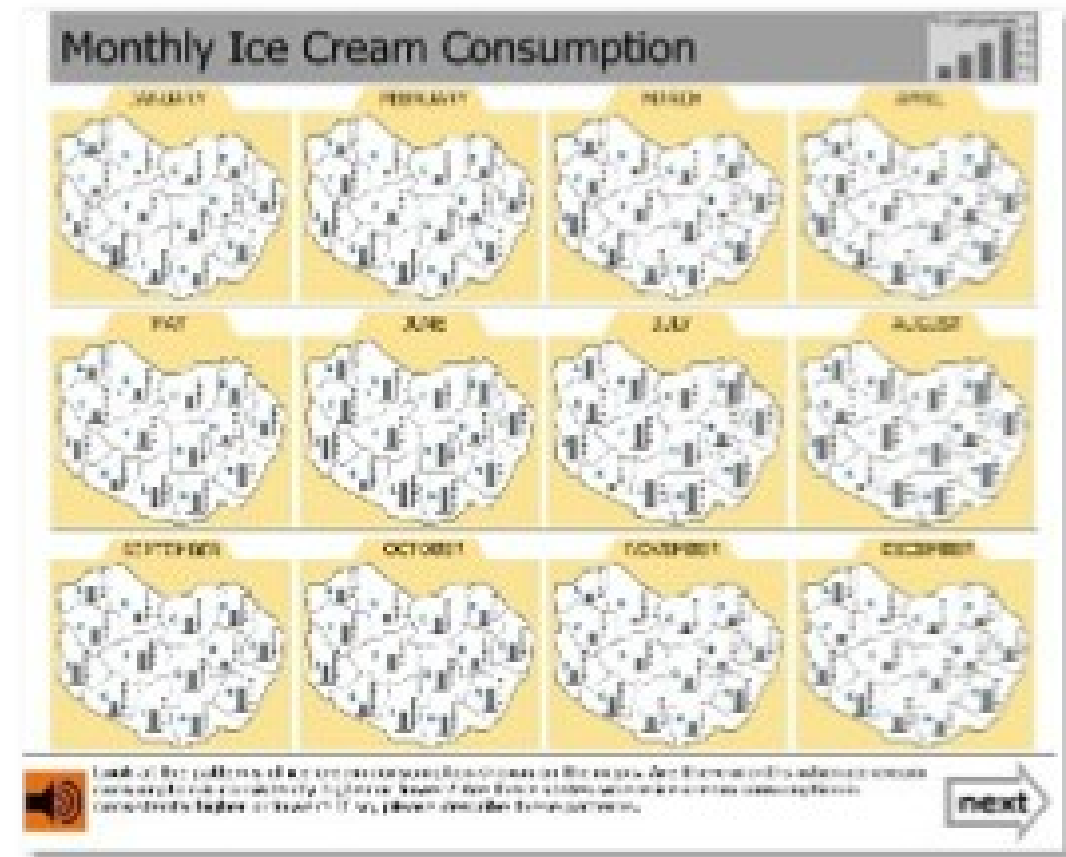
Level 2: Animation

- 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?

http://www.youtube.com/watch?v=Oz3BF3Njx-k

Animation: example…

Animation: example…

http://www.youtube.com/watch?v=jbkSRLYSojo
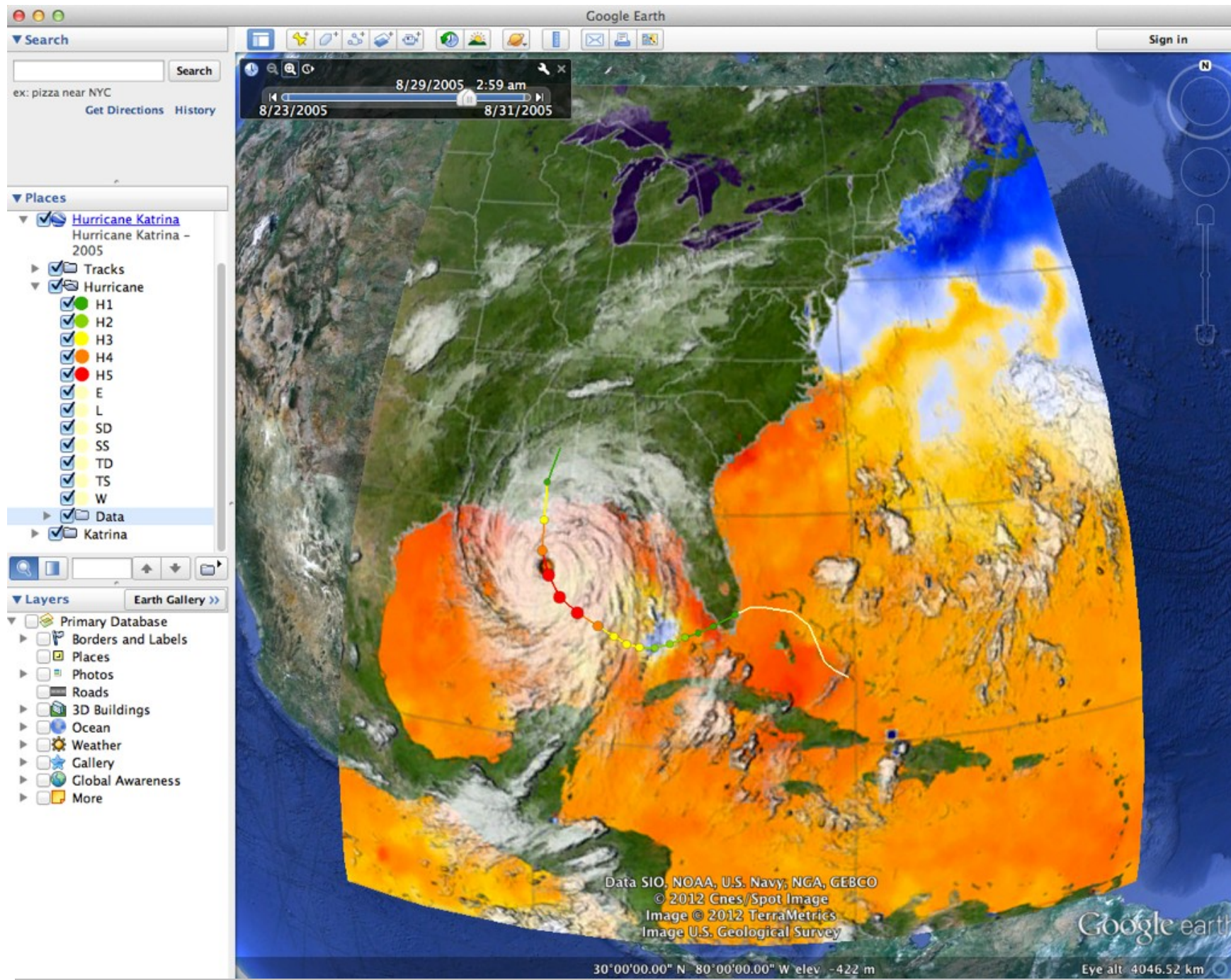
Level 3: Sequencing

- 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)

20

Animation: example…

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

Level 3: Sequencing

«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
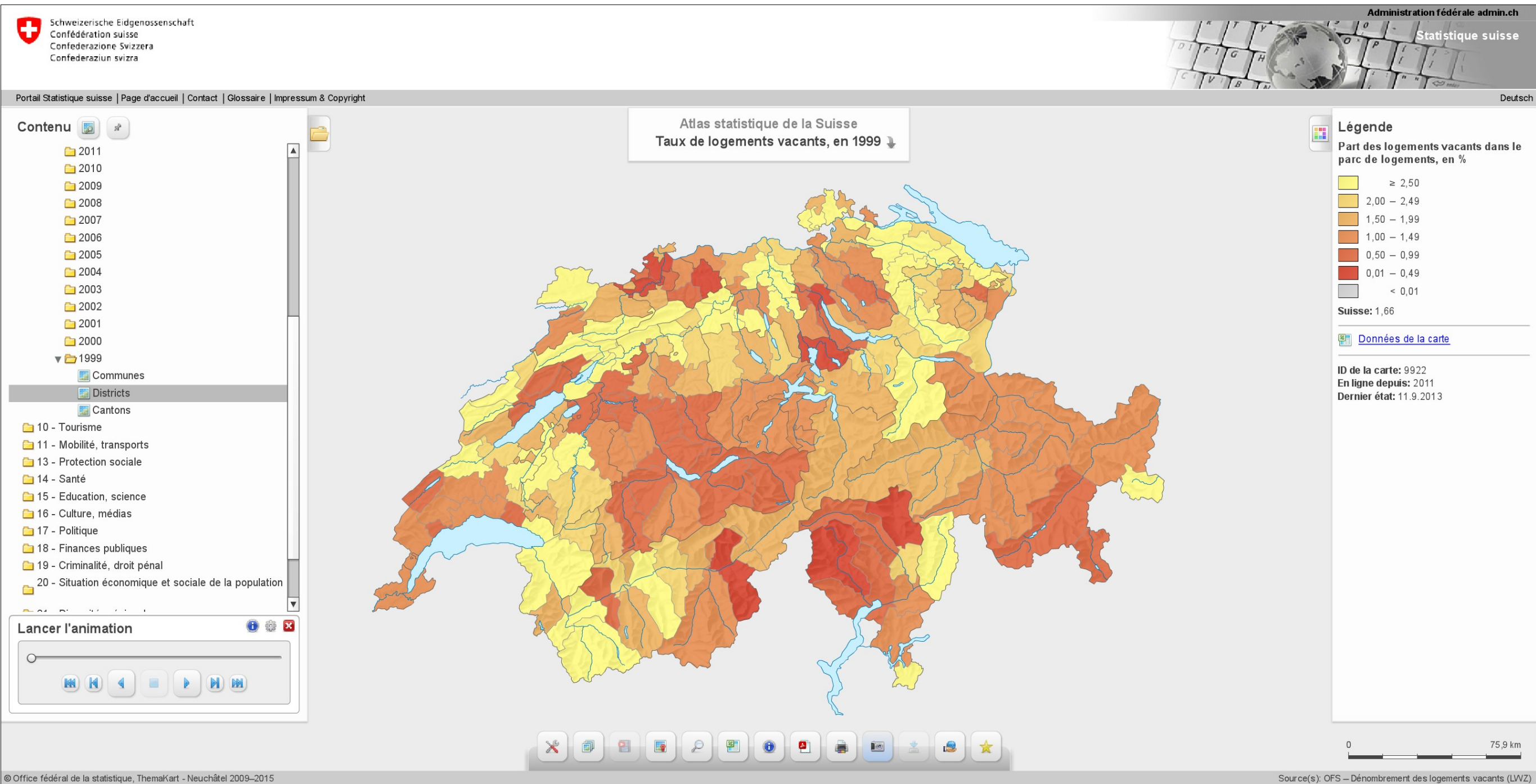
23

Hierarchical interactivity: example…

Atlas de la Suisse
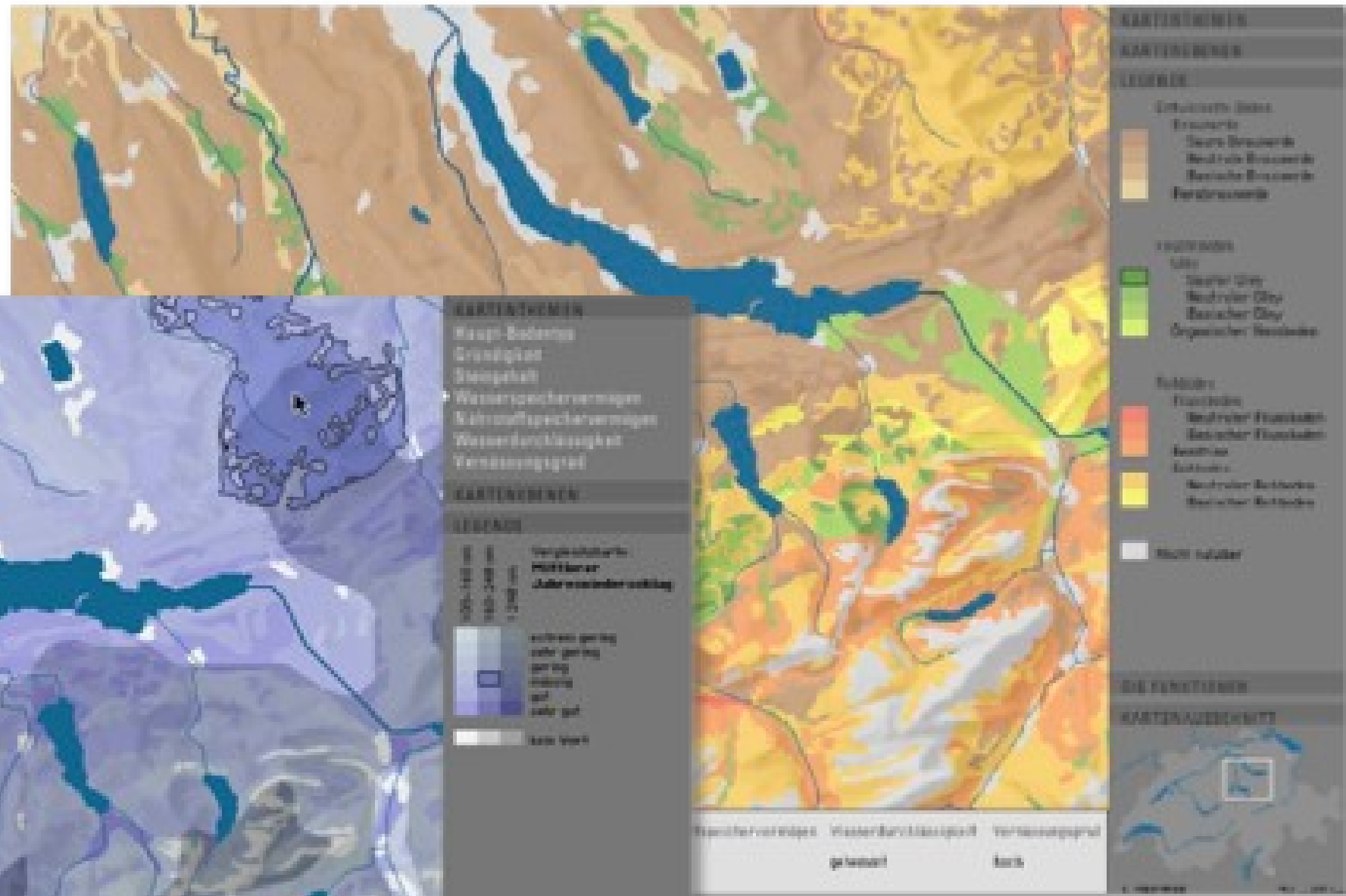
Hierarchial themes
Graphical queries
…

Hierarchical interactivity: example…

http://www.atlas.bfs.admin.ch/maps/13/fr/5772_178_175_169/9922.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)
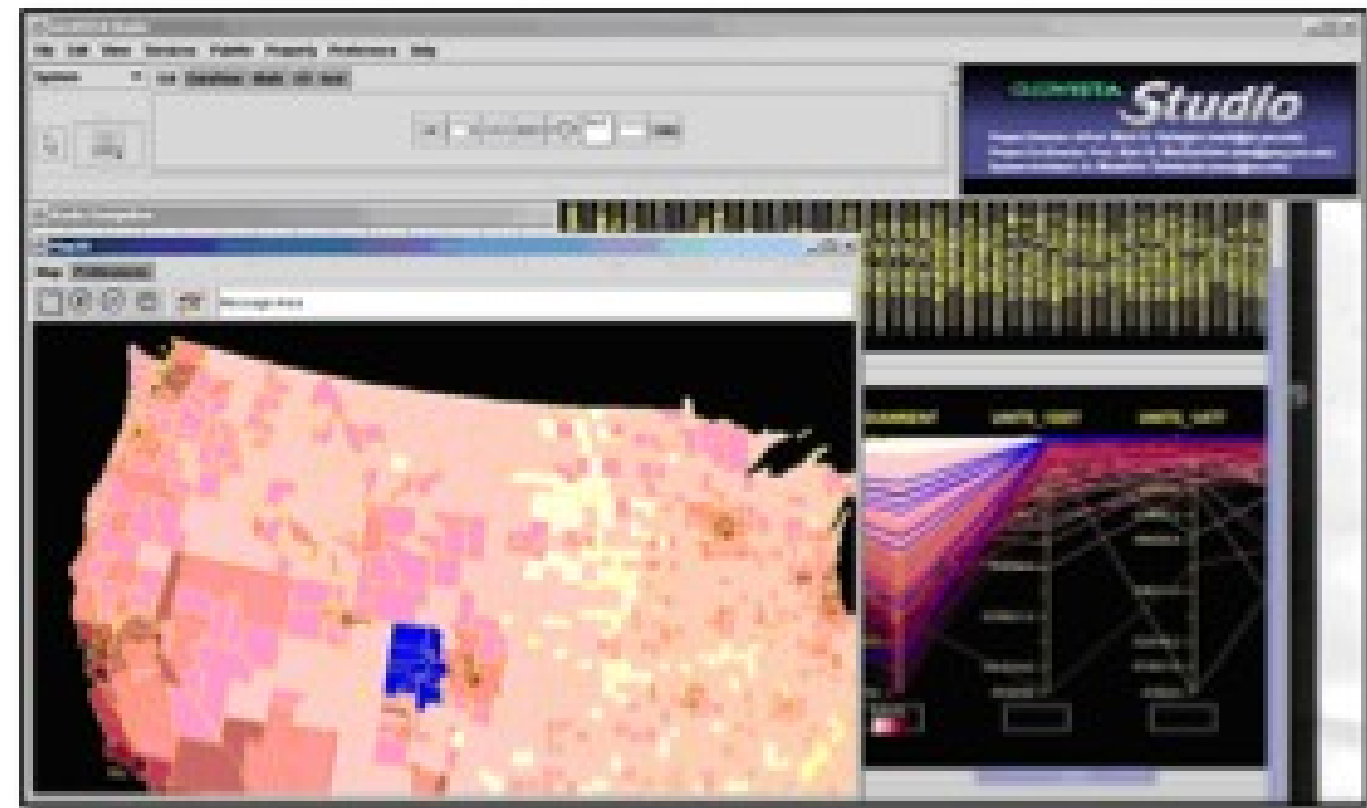
Conditional interactivity: example…

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