

What is special about geospatial ? or A discipline in constant transition

Marinos Kavouras
NTUA

“Ensuring the Rapid Response to Change,
Ensuring the Surveyor of Tomorrow” FIG 2015

Several paradigm shifts

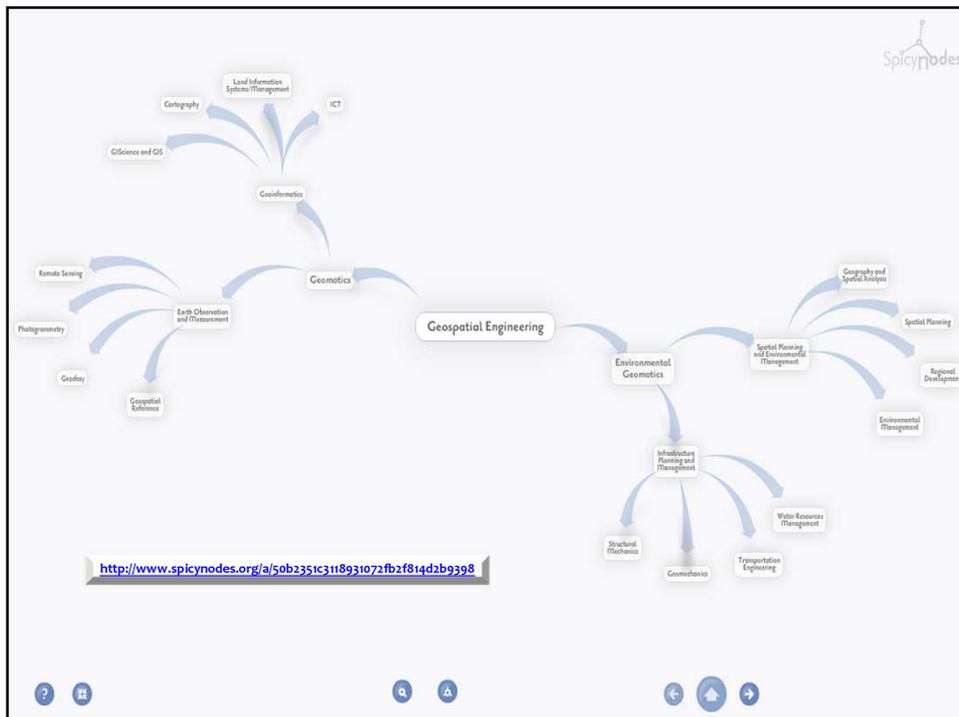
The **Atlantic Institute Think Tank Series**
held in Berlin, Campobello Island, Vienna,
Québec City, Paris and Boston (2005).

Several paradigm shifts

"We are the only profession with the necessary knowledge of science and technology to address (design and engineer) society's needs for geo-spatial information, including the full range of acquisition, integration, geo-referencing and quality control, management, analysis and interpretation in selected application areas, while assisting all users with the appropriate use and a successful application".

Prepare the new engineers

- Acquire knowledge and skills from application development and problem solving.
- Follow up the developments in enabling technologies but develop a technology-independent expertise.
- Focus less on technology-driven approaches, more on concepts, problem definition, design, solving, strategies.
- Realise that spatial problems are complex, while technology is often simple minded.
- Do not abandon good theory and concepts but develop them further. They suit any technology.
- Promote interdisciplinary understanding and cooperation.
- Develop a professional and business perspective.
- Prepare for a strong competition.



TECHNOLOGY ASPECTS



- ADCPs - Acoustic Doppler Current Profilers
- Airborne Laser Scanning
- AUVs - Autonomous Underwater Vehicles
- Digital Aerial Cameras
- GNSS Receivers
- HR Satellite Imagery
- Imaging Sonar
- Inertial Navigation System
- Magnetometers
- Marine Navigation Systems
- Mobile GIS Systems - Hardware & Software
- Mobile Mappers
- Photogrammetric Imagery Processing Software
- Point Cloud Processing Software
- Remote Sensing Image Processing Software
- ROVs - Remotely Operated Underwater Vehicles
- Side Scan Sonar
- Singlebeam Echosounders
- Sub-bottom Profilers
- Terrestrial Laser Scanners
- UAS for Mapping and 3D Modelling
- USVs - Unmanned Surface Vehicles

CONTINUOUS INFORMATION FLOW

- Earth observation and monitoring
- SDIs
- UBIQUITOUS computing/mapping
- CROWDSOURCING, UGC, VGI
- Navigation - Wireless location
- LBS – Location based services
- Geosensor networks

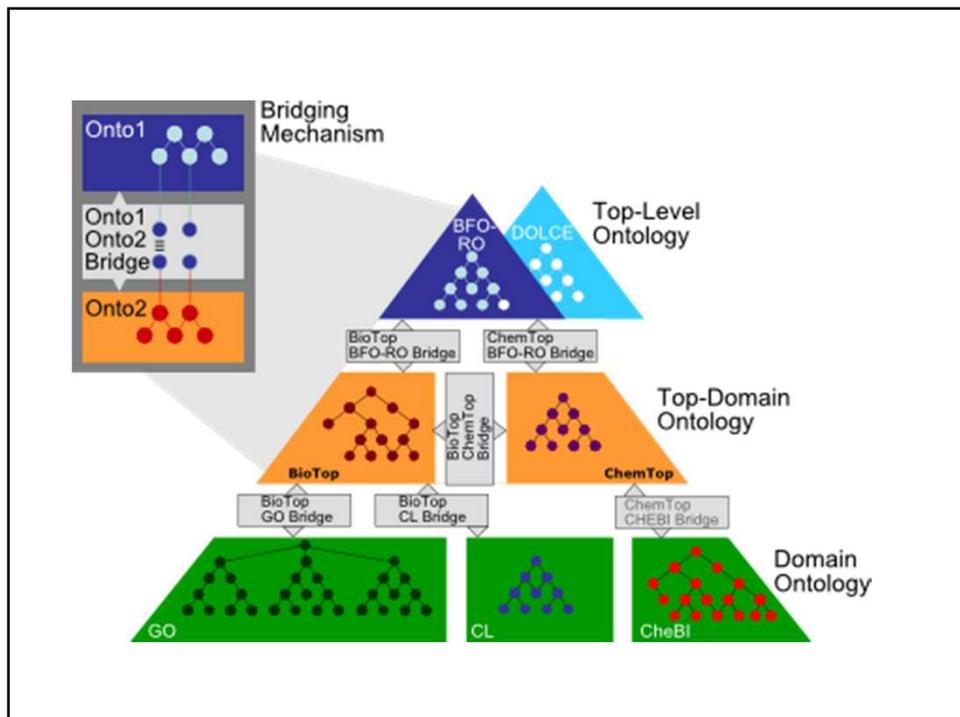
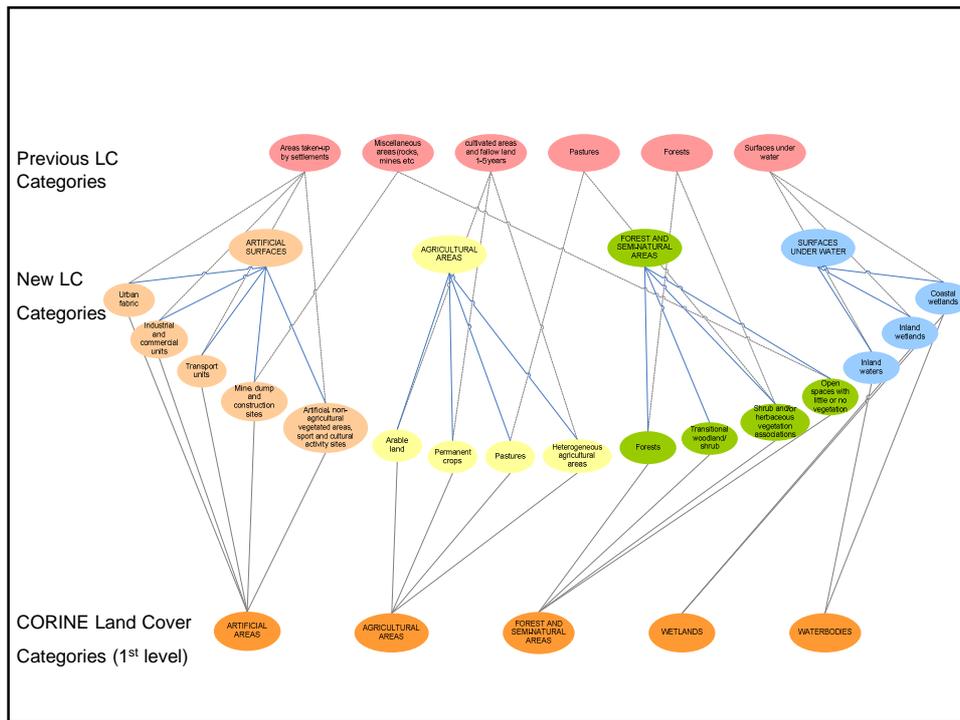


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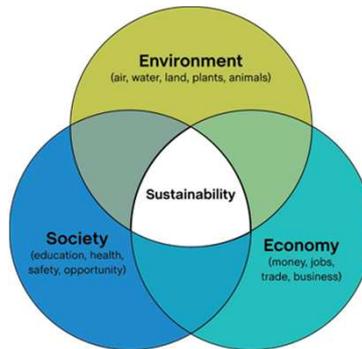
- **Big Data, Linked Data**
- **Web 2.0 – Semantic Web**
- **Neogeography – crowd sourcing**
- **Knowledge engineering**
- **Geovisualization**
- **Robotics**
- **Geoeconomy**

KNOWLEDGE ENGINEERING





SOCIETAL-ECONOMIC ASPECTS



GEOECONOMY-GEOSERVICES

What is their economic impact ?

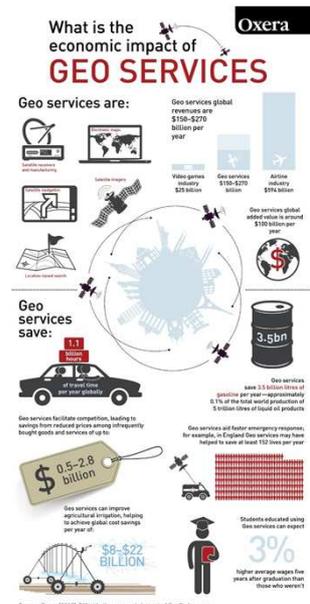
Prepared for Google 2013

<http://www.oxera.com/Oxera/media/Oxera/images/Oxera-Geo-Services.jpg>

\$150 billion to \$270 billion per year

The industry encompasses all digital mapping and location-based services, electronic maps, satellite navigation and imaging.

'Geo technologies are changing the way people, corporations and governments interact with the world, making them more efficient and enabling cost savings.'



Economic Value of Geospatial Data: The great enabler

(Geospatial World May 2013)

<http://www.geospatialworld.net/paper/business/ArticleView.aspx?aid=30534>

- **Geospatial technology, information, and services are addressing some of the major priorities of our nations, adding value to productivity, reducing costs and enabling GDP growth in the process**
- GEOMATICS SECTOR - HUMAN RESOURCES STUDY
http://www.gov.mb.ca/conservation/survey_services/pdf/HR-study-geomatics-sector.pdf
- European LBS revenue forecast.(GEOMATICS INDUSTRY UPDATE)

Fact Check

\$155-210 mn

benefits for
agriculture in
Australia



\$482 mn

gain from horticulture
development in
wastelands in India

50%

Larger area handled
by forest managers in
Australia with g-tech



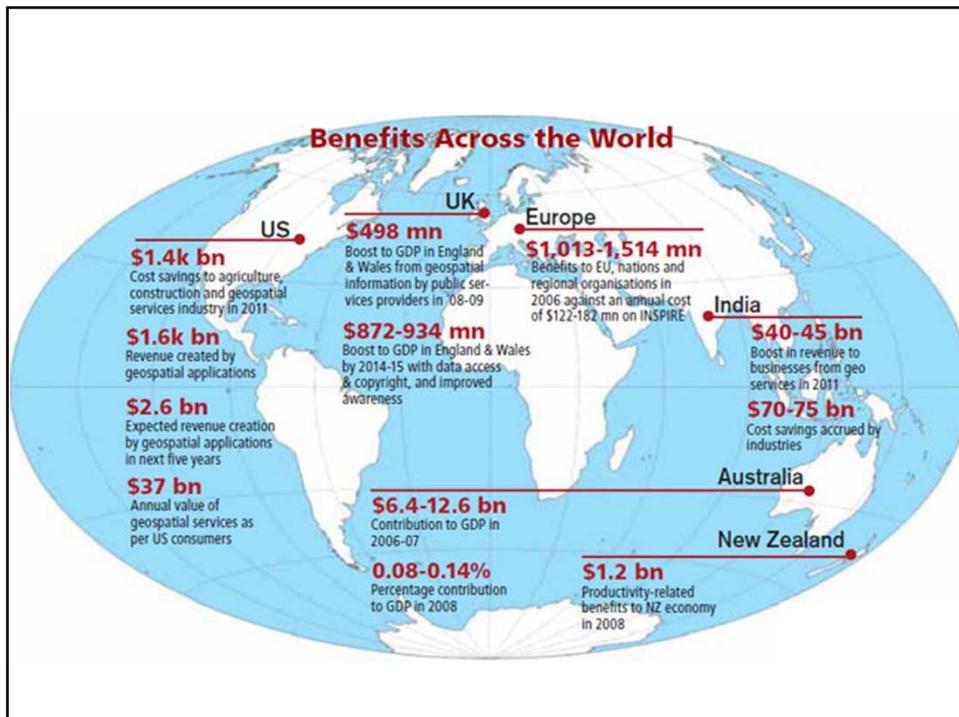
\$220 mn

cost saving in India
from improved
mapping for forest
work plans

4%

productivity
gain in fisheries
in Australia

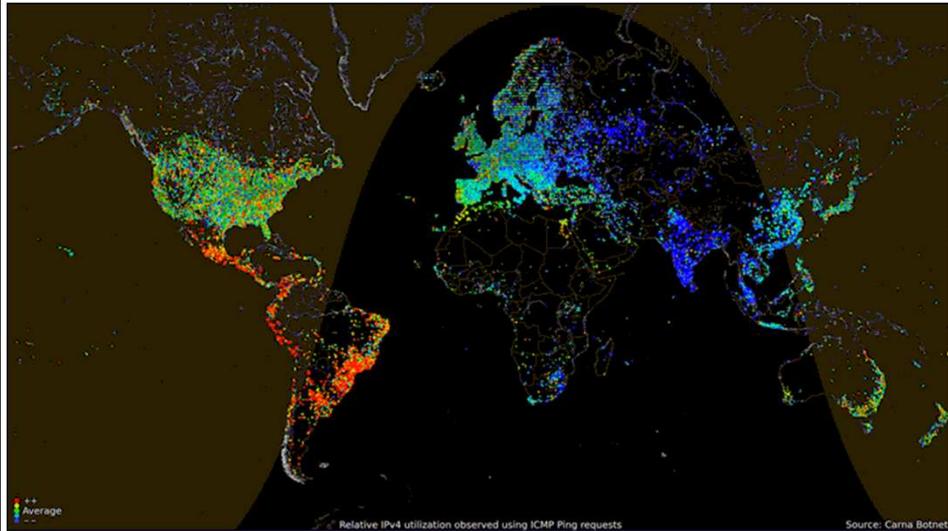




The power of geovisualization

Map by ChartsBin.com

Global Internet Usage Based on Time of Day



Map by [Carna Botnet](#) via [Reddit](#)

Visualizing Global Population Density



Map by [valeriepieris on Reddit](#)

The Longest Straight Line You Can Sail on Earth (Pakistan to Kamchatka Peninsula, Russia – 20000 miles)



Map by [kepleronlyknows on Reddit](#)

THE WORLD'S POPULATION, CONCENTRATED

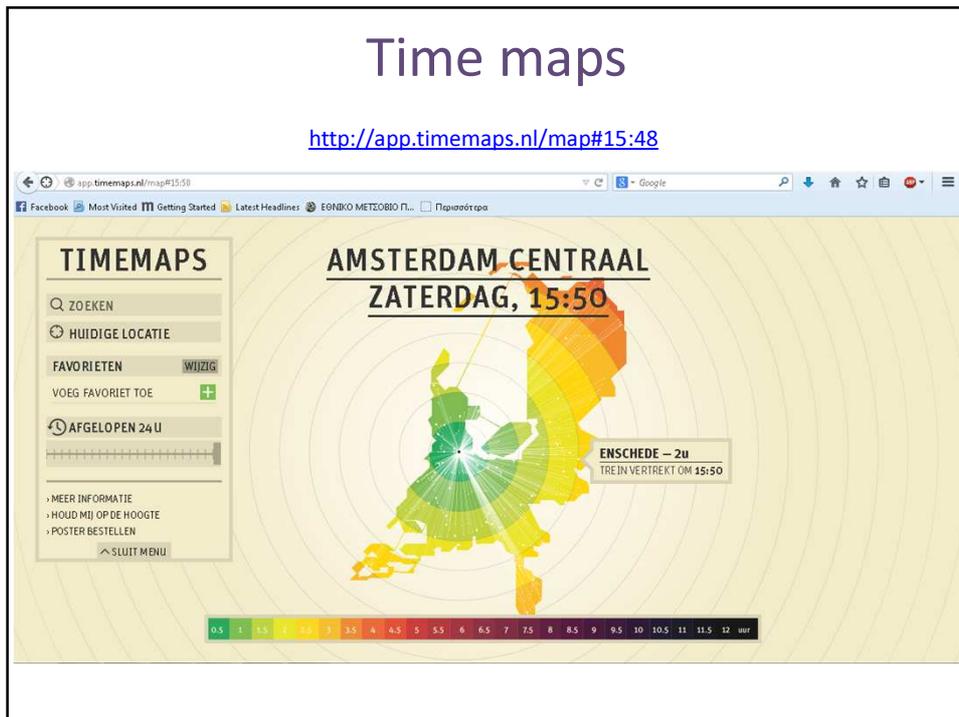
If the world's 6.9 billion people lived in one city, how large would that city be if it were as dense as...



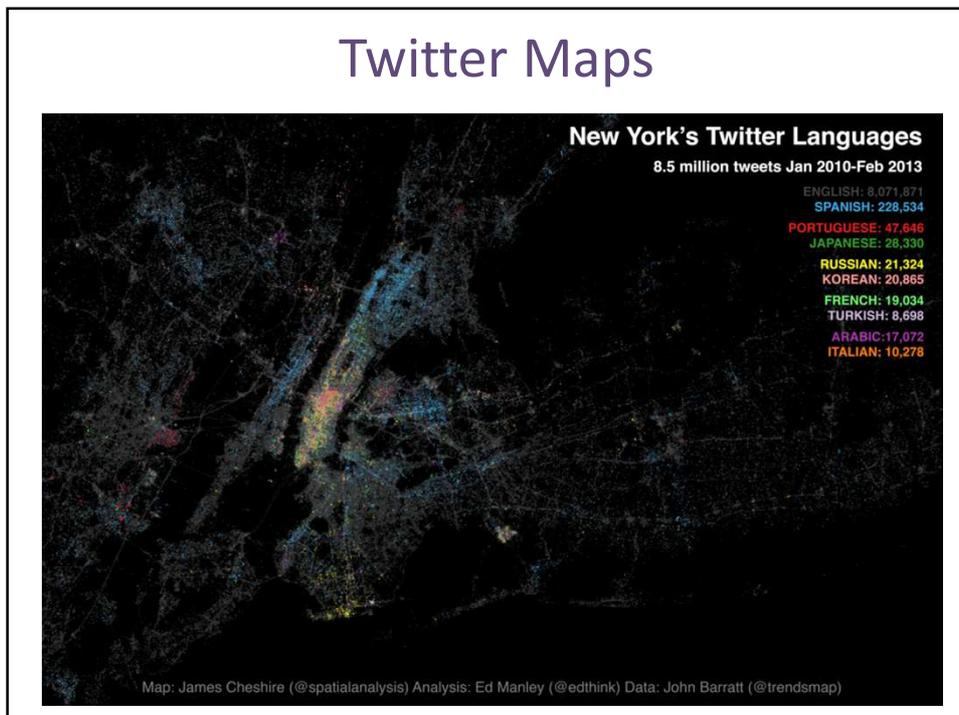
Maps by
Tim De Chant @ [persquaremile.com](#)

Time maps

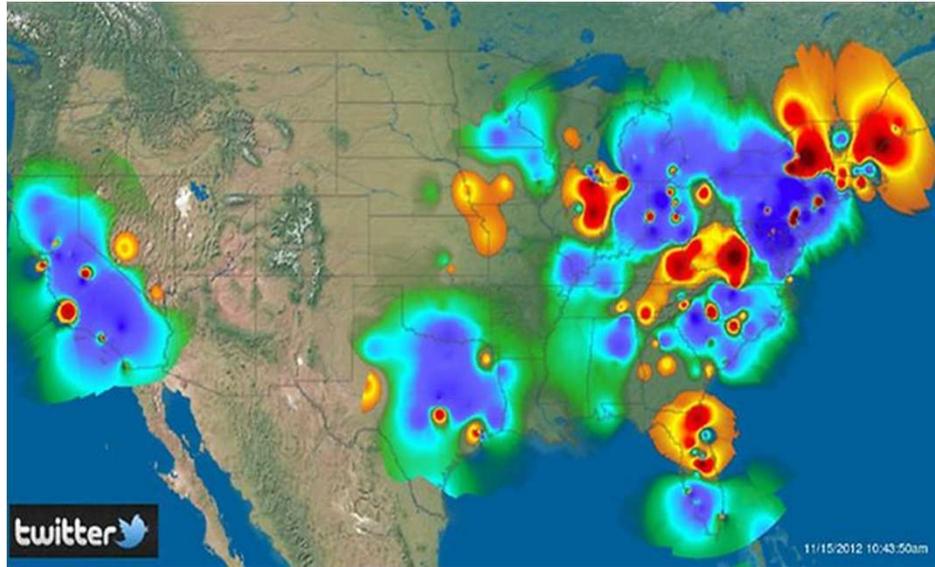
<http://app.timemaps.nl/map#15:48>



Twitter Maps

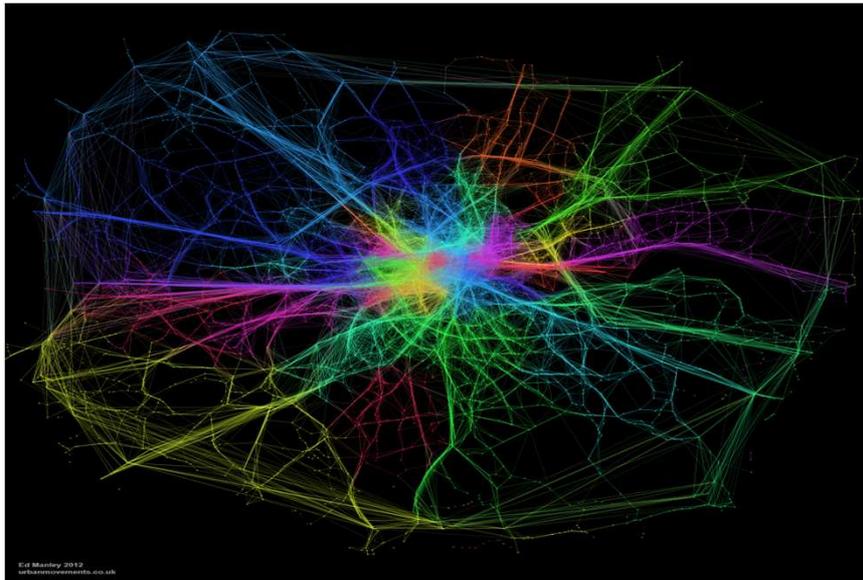


Twitter sentiment heat maps



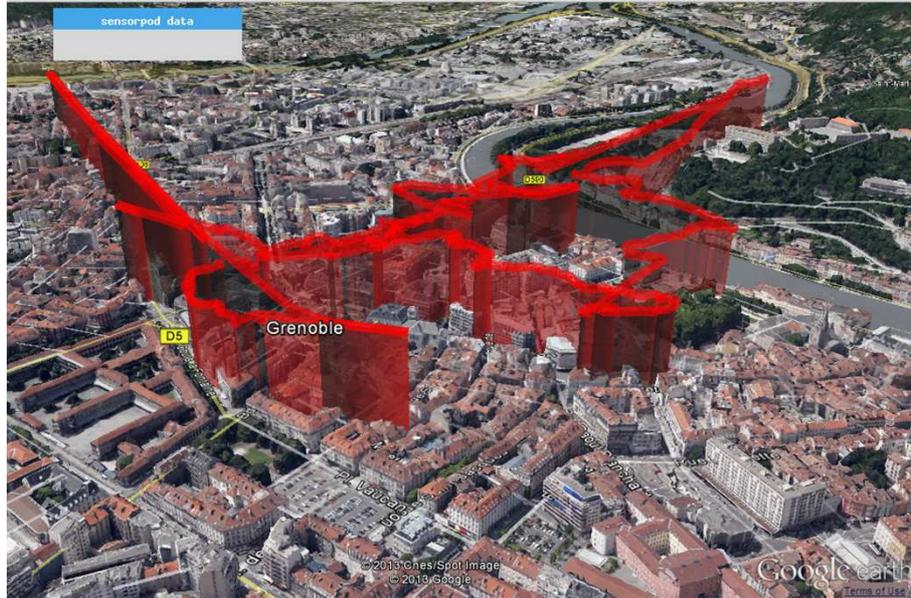
Picture: SGI Source

Traffic flows



© 4 Manby 2012
www.manby.com.au

Landscape of Information: Mapping the Invisibles



DEVELOPING A SPATIALLY-THINKING SOCIETY



What is Geospatial Thinking?

(National Research Council's *Learning to Think Spatially*)

- **Knowledge, skills, and habits of mind**



To use

Concepts of space
Tools of representation
Processes of reasoning

To structure problems, find answers, and express solutions to these problems.

Why Geospatial Thinking?

(National Research Council's *Learning to Think Spatially*)

(Committee on Support for Thinking Spatially 2006, 55) argues that spatial thinking is essential in science:



“Spatial thinking is deeply implicated in the conduct of science...[M]any classic discoveries and everyday procedures of science draw extensively on the processes of spatial thinking.”

Why Geospatial Thinking?

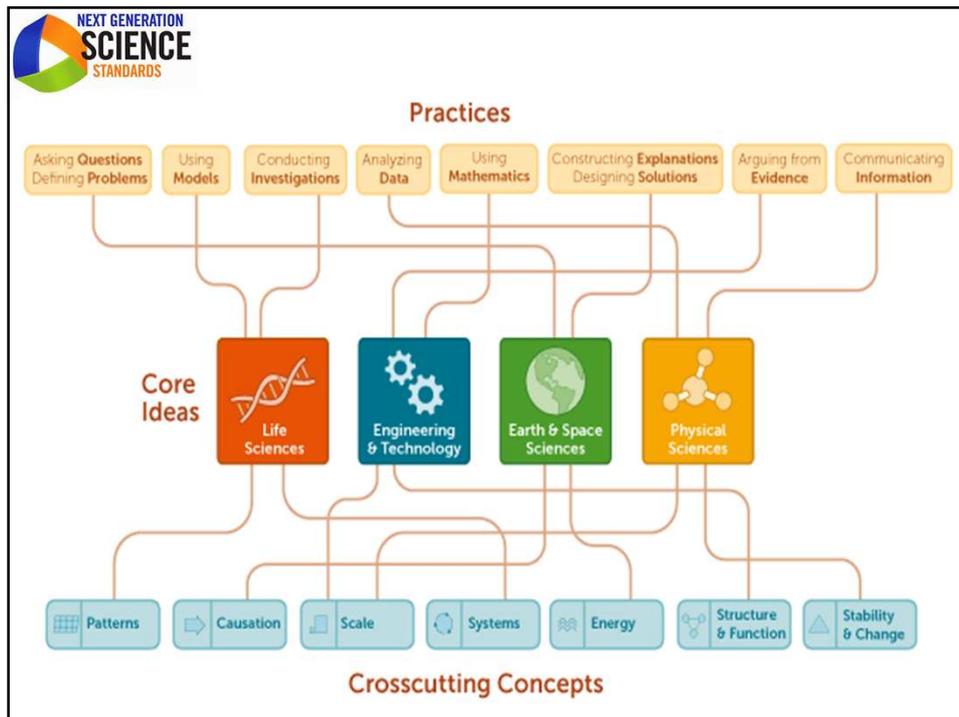
- Ability with profound and rewarding effects on numerous aspects of everyday life and **STEM** disciplines, also highly relevant to social sciences and humanities.
- Replaced, however, in education for a long period of time by other forms of thinking (verbal, metaphorical, hypothetical, and mathematical).

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The National Research Council (NRC), the National Science Teachers Association, the American Association for the Advancement of Science, and Achieve have developed the [Next Generation Science Standards](#) (NGSS) and have identified **crosscutting concepts** which apply across all domains of science.

As such, they are a way of linking the different domains of science.



- **Geospatial Science and Technology** proves to be an excellent cognitive and technological vehicle for developing the **crosscutting concepts**

**Challenges
Next turn
?**