

U.N. Smart Cities
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Selected Smart Cities Geospatial Challenges in the Big Data Era

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EMPOWERING CITIES- The real story of how citizens and businesses are driving smart cities

is a research program developed by The Economist Intelligence Unit (EIU), on behalf of Philips Lighting, to assess the progress of cities toward adopting smart technologies.

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Introduction of Empowering Cities Study

- 1. The connected city: Digital technology as a catalyst for urban transformation**
- 2. The fixable city: Near real-time feedback on urban services**
- 3. The crowdsourced city: A growing citizen interest in shaping their cities**
- 4. The collaborative city: The private sector as a partner for advancing smart cities**

Conclusion: Implications for decision-makers

1 Smart city and its application (Deren Li, 2015)

* What is a smart city?

- A smart city is built upon the infrastructure of the digital City. It integrates the real world and the digital world with the internet of things, and perceives the states of everyone and everything in the real world. Then the sensed data is transferred to the cloud computing center for computation and understanding, providing intelligent service for economic development, city management and publics.

- The smart city is a key component of the smart earth

Smart city=digital city+internet of things +cloud computing

Cyber physic space

Do everything on web

Cyber space

See everything on web

2. Third UN World Conference (U.N.DRR), March 14, 2015, Sendai, Japan

The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted

Priorities for action

Priority 1:

Understanding disaster risk.

Priority 2:

Strengthening disaster risk governance to manage disaster risk.

Priority 3:

Investing in disaster risk reduction for resilience.

Priority 4:

Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction.

Priority 1:

Understanding disaster risk. National and local level

(c) To develop, periodically update and disseminate, as appropriate, location-based disaster risk information,

including risk maps,

to decision makers, the general public and communities

at risk of exposure to disaster in an appropriate format by using, as applicable, geospatial information technology;

Global and regional levels

To achieve this, it is important:

- (a) To enhance the development and dissemination of **science-based methodologies** and tools to record and share disaster losses and relevant disaggregated **data and statistics**, as well

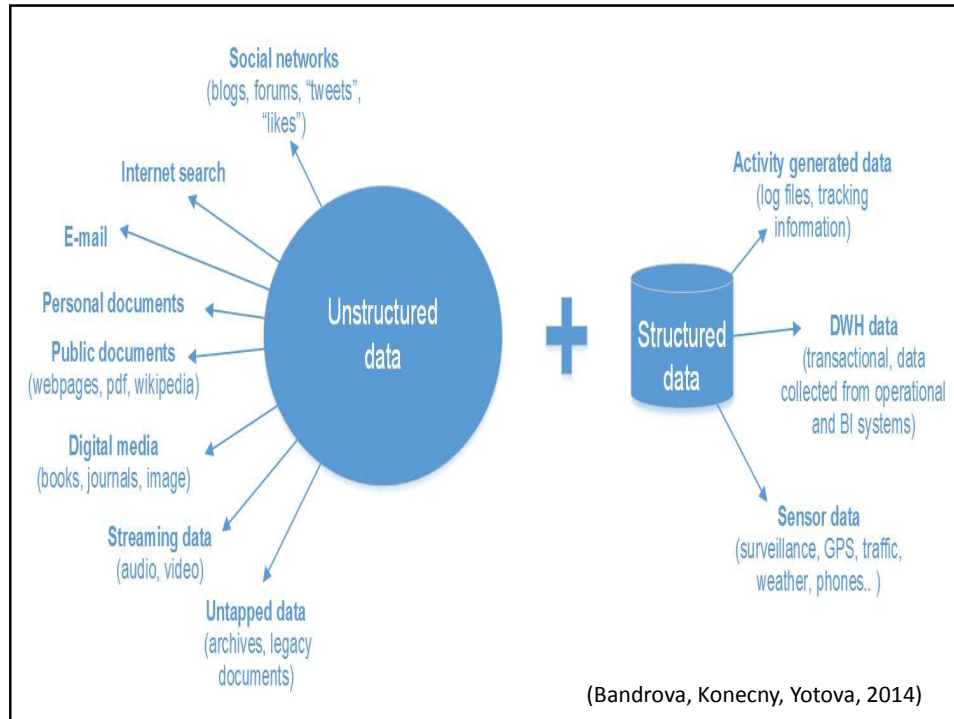
as to strengthen disaster risk modelling, assessment, **mapping**, monitoring and multi-hazard early warning systems;

2. Big Data: buzz word or reality?

Information superhighway,

SDI's,

System of Systems concepts (GEO, GEOSS,..)



Zucker, S., (2014) :

"a popular **term** used to describe the exponential growth and availability of data, both structured and unstructured" .

"There is no rigorous definition of big data.

Initially the idea was that the volume of information had grown so large that the quantity being examined no longer fit into the memory that computers use for processing, so engineers needed to revamp the tools they used for analyzing it all" (Mayer-Schönberger V., Cukier K., 2013).



“Big Data” BD:

It is the **ability of society to harness information in novel ways to produce useful insights or goods** and services of significant value .

The **bridge between BD and the society cannot be done only by the existing technologies and computers.**

The presence of professionals should be more active in the process of transforming BD in useable variant to users and society.

BD needs to establish teams with people coming from branches which did not work together to now.

Design new complex approaches.

Geographers (physical and human and economical ones), cartographers and geoinformatics + RS want to add their knowledge to enhance such linkages and **develop paradigm for and supportive approaches of higher level usage of BD** in everyday decision making, solving problems and improvement of life of inhabitants.

4. Where we are now?

- Global Mapping
- UN-GGIM
- GMES and INSPIRE: step ahead than GOOGLE, offering data (not only showing)
- GEO, GEOSS
- Digital Earth (Annoni and JRC)
- Concepts and strategies (Spatial-Enabled Society, e-Government,)
- VGI, VGE.....

UN-GGIM

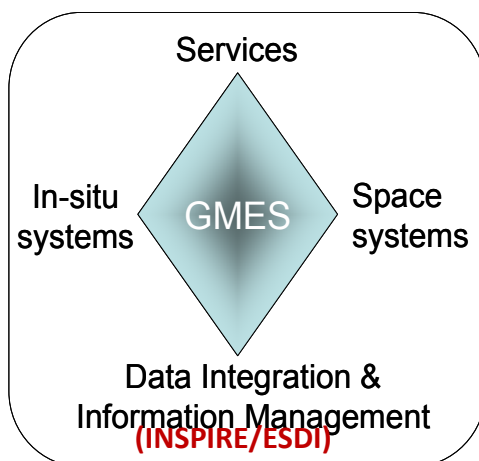
AIMS AND OBJECTIVES

The United Nations initiative on Global Geospatial Information Management (UN-GGIM) aims at playing a leading role in setting the agenda for the development of global geospatial information and to promote its **use to address key global challenges**. It provides a forum to liaise and coordinate among Member States, and between Member States and international organizations.



Former GMES – Global
Monitoring of Environment and
Security)

COPERNICUS
Global Monitoring for Environment and Security



ERCS 1st priority

Rapid mapping on demand in case of humanitarian crises, natural disasters, and man-made emergency situations within & outside Europe

- **Reference maps** available within 6 hours over crisis area
- **Damage assessment maps** available within 24 hours & daily updated
- **Situation maps and forecasts** of evolution of situations within the few days-weeks after crisis



IGC , August 22 2016, Beijing, P.R. China



5. From Big to Smart Spatial Big Data with Support of VGEs

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Brno, Czech Republic

Smart versus „Stupid“ or better saying less smart?

Approach in Administration to make documents smart

Business approaches (fast, etc...)

In Geography, Geoinformatics, Remote Sensing: very strong development line of Smart Cities academician (Deren Li)

6. DATA DRIVEN GEOGRAPHY

H.J. Miller and M.F. Goodchild (2014) Data-driven geography. GeoJournal. DOI: 10.1007/s10708-014-9602-6.

„The context for geographic research has shifted **from a data-scarce to a data-rich environment**,

in which the most fundamental changes are not just the volume of data, but the **variety and the velocity** at which we can capture georeferenced data;

Trends often associated with the **concept of Big Data**.

A data-driven geography may be emerging in response to the wealth of georeferenced data

flowing from **sensors and people** in the environment.

Summary

- Big Data is relevant to GIS:
 - in the soft stages of science
 - in solving time-critical problems
 - in spatial prediction
- Big Data requires a change of scientific perspective
 - science driven by data rather than theory
 - *all* the data, not just the best data
 - prediction as a legitimate activity(M. Goodchild, Brno, 2016)

Summary (2)

- We need to develop ways to harden Big Data
 - at electronic speed
- Synthesis may be the most important activity in GIScience in the future
- GIS is becoming a platform
 - an integrated set of Cloud services
 - ubiquitous access across all devices
 - making it easy to develop new applications
 - but with many open questions about privacy, data management(M. Goodchild, Brno, 2016)

7. VGE – VIRTUAL GEOGRAPHIC ENVIRONMENTS

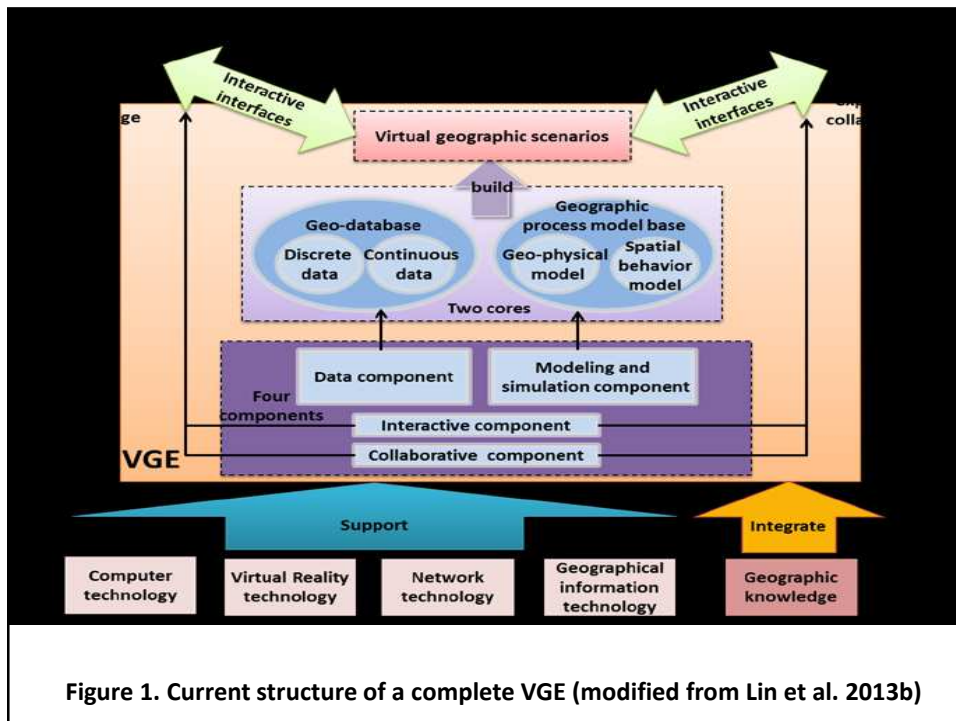


Figure 1. Current structure of a complete VGE (modified from Lin et al. 2013b)

**8. NEOGEOGRAPHY, VOLUNTEER GI
AND
SOCIAL MEDIA GEOGRAPHIC
INFORMATION (SMGI)**

Volunteer geographic information **VGI**:

"The terms, "*crowdsourcing*" and "*collective intelligence*" draw attention to the notion that the collective contribution of a number of individuals may be more reliable than those of any one individual.

The term VGI refers specifically to geographic information and to the contrast between the actions of amateurs and those of authoritative agencies." Goodchild (2009, p. 18)

Traditional SDI versus VGI

(podle McDougall, GSDI 12, Singapore)

	Government-centric SDI	User-centric VGI
SDI Structure	Highly structured	Ad-hoc and simplistic
Standards	Close adherence to standards	Loose based on communication standards
Maturity of data holdings	Highly mature	New and current but variable
Spatial Accuracy	Complying with mapping standards	Variable
Metadata	Contain detailed metadata	Few standards – ICT based
Openness	Highly controlled	Often new data sets
Data Update	Often slow and overly bureaucratic	Fast and flexible
Potential data maintenance and collection base	Limited to the budget and staffing	Potentially a huge user and contributor base
Adaptability	Low – retrained by mandate, resources and bureaucracy	High

Michele Campagna, Cagliari, Italy:

Social Media Geographic Information (SMGI)

the opportunities offered by the *analysis of social media data* for *knowledge building and decision-making* support in Geodesign.

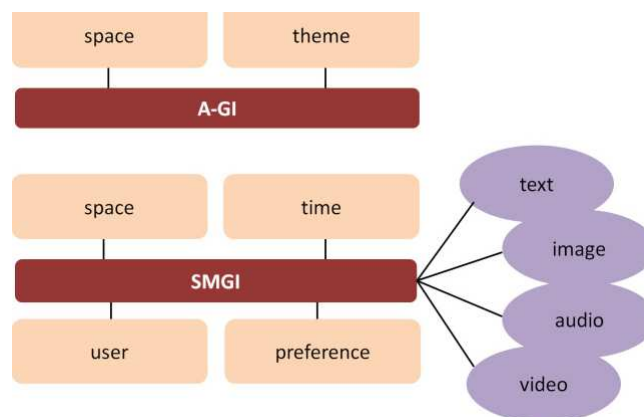
Geodesign: term identifying an approach to planning and design deeply rooted in geographic analysis and able to inform collaborative decision-making.
(in GWF, Hyderabad, 2017)

Currently, two major categories of spatial data resources may be considered suitable for Geodesign approaches, namely

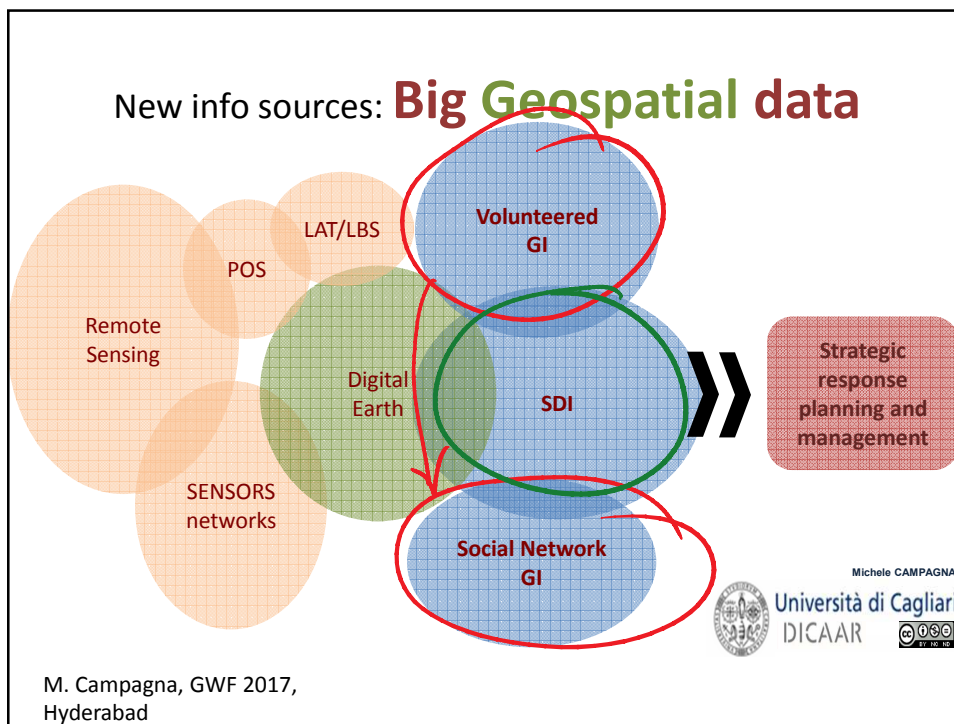
Authoritative Geographic Information (A-GI) from Spatial Data Infrastructures (NEBERT 2004) and

spatial **User Generated Contents (UGC)**, commonly referred to as **Volunteered Geographic Information (VGI)** (GOODCHILD 2007).

Fig. 1: Differences between A-GI (up) and SMGI (down) data models



Michele Campagna, Pierangelo Massa, Roberta Floris, The Role of Social Media Geographic Information (SMGI) in Geodesign.
p. 164, 2016





9. How in Smart Cities with EW and Disasters?

Global Trends - Disasters are NOT natural

Greater exposure to natural and human-induced hazards, climate change and variability

Socio-economic: poverty & unsustainable development styles, unplanned urban growth and migrations, lack of risk awareness & risk governance institutions & accountability...

Physical: insufficient land use planning and safety awareness, housing & critical infrastructure in hazard prone areas...

Ecosystem & natural resource depletion (coastal, - coral reefs, mangroves...-; mountains; watersheds; wetlands; forests...)

According to Salvano Briceno, Nanjing, 2016



Negative developments:

Increasing threats from war and lack of common understanding among most powerful governments to address global challenges...

Increasing ignorance on relevance of democratic values and human rights, in particular women rights...

Positive developments:

Increasing transparency of international financial management, including gradual reduction of fiscal paradises and greater participation of multinationals in development needs...

Increasing awareness, although not yet action, of relevance of inequality for sustainable development

What is Disaster Risk Reduction (DRR)?

- A conceptual framework consisting of ways and means:
 - To minimize disaster risks (hence, loss of lives, livelihoods and property) by reducing the degree of vulnerability and increasing resilience capacity
 - To avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of natural phenomena, as an essential requirement for sustainable development

$$\begin{array}{|c|} \hline \text{Natural hazard} \\ \hline \text{+ Exposure} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Vulnerability} \\ \hline \text{- Capacity} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Disaster Risk} \\ \hline \end{array}$$

According to Briceno 2016

The vision of disaster risk reduction:

building resilience into sustainable development

The six principles of sustainability

www.colorado.edu/hazards/publications/informer/infrmr3/informer3c.htm



Some Questions from Many Others:

Are Priorities of U.N. DRR and concepts of Smart Cities complimentary? What is necessary to improve and develop?

VGI and Social Networks Challenges. Believings and doubts.

How communicate with people and society? Are differences between cities and rural lands?

How enrich geographical language and maps to be closer to people?

Are concepts and terminologies of EW and CM same as civil protection ones? Or some kind of dichotomy?

10. New trends inside cartography:

Context and adaptive cartography

The subject-matter of adaptive cartography is **automatic creation of correct geodata visualization with regard to situation, purpose and the user.**

Adaptive maps are still maps in the conventional sense – they are correct and well-readable medium for transfer of spatial information. The user controls map modifications ***indirectly via modification of context.***

Traditional vs. adaptive map

- Traditional map
 - Static
 - Universal
 - As much information as possible (level of legibility)
 - Demand on high level of user knowledge
- Adaptive map
 - As little information as needed for interpretation
 - No redundancy of information
 - Individual

Personality of map users

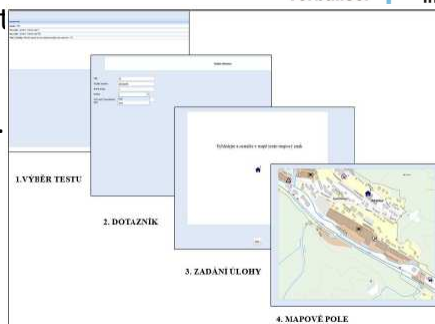
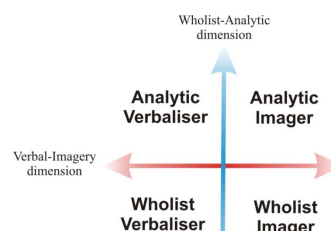
Cognitive style

Cognitive style or "thinking style" is a term used in cognitive psychology to describe the way individuals think, perceive and remember information, or their preferred approach to using such information to solve problems. Cognitive style differs from cognitive ability...

(Konecny et al., 2011 Usability of selected base maps for crises management – users perspectives. Applied Geomatics, DOI 10.1007/s12518-011-0053-1. Springer JW. 2011, pp. 1-10. ISSN 1866-9298.)

Cognitive Aspects of Geovisualization

- Interdisciplinary research.
- Theory of cognitive styles.
- Concept and design of test environment (MuTeP).
- International cooperation.



Obr. 11.7: Postupnost jednotlivých snímků testu v programu MUTEP – výběr testu, dotazník, zadání úlohy (upraveno podle ŠTĚŘBA et al., 2011)

COMMUNICATION WITH PEOPLE

And

SOCIETY



How do *people* think about space?

- Not in terms of latitude, longitude, polygons, precise distances and directions
 - not as GIS does
 - GIS is difficult to learn because it requires a change of thinking
 - Places
 - often vaguely defined, without precise boundaries
 - often context-dependent
 - with imprecise distances, directions
 - places identified by name
- (Goodchild M., Brno, May 2016)

Next ICA Commission Cartography for EW and CM events:

July 2nd, 2017: ICC Washington, Commission Workshop
(Fugate, Ryan, UNO, others)

October, 2017, Brno, Czech Republic

January 2016, GWF, Hyderabad, India

April 2018, Inter Geo and Geosiberia, Novosibirsk,
Russia

November 2018, Shenzhen, China

Xie, Xie!!!!

THANK YOU

Chvala

Muchas Gracias

Terima KasimO Brigada

Kammsa Hamida

Aligator

SHUKRAN

BLAGODARJA

DĚKUJI (in Czech)



