July 2, 2017, ICC,
Washington, USA

Disaster Risk Reduction Agenda in Big Data Era: the Role of Cartography

Milan KONECNY

Masaryk University, Brno, Czech Rep.

Chair of ICA Commission CEW&CM

Content

1. U.N. Disaster Risk Reduction Concept

2. Big Data and Smart Data Era

3. What we have for disposition?

4. Data Driven Geography

5. Neogeography, Volunteer GI and Social Media Geographic Information (SMGI)

6. VGE- Virtual Geographical Environments

7. Cartographical Trends for DRR

1. U.N. DISASTER RISK REDUCTION CONCEPT

The Sendai Framework for Disaster Risk Reduction 2015-2030

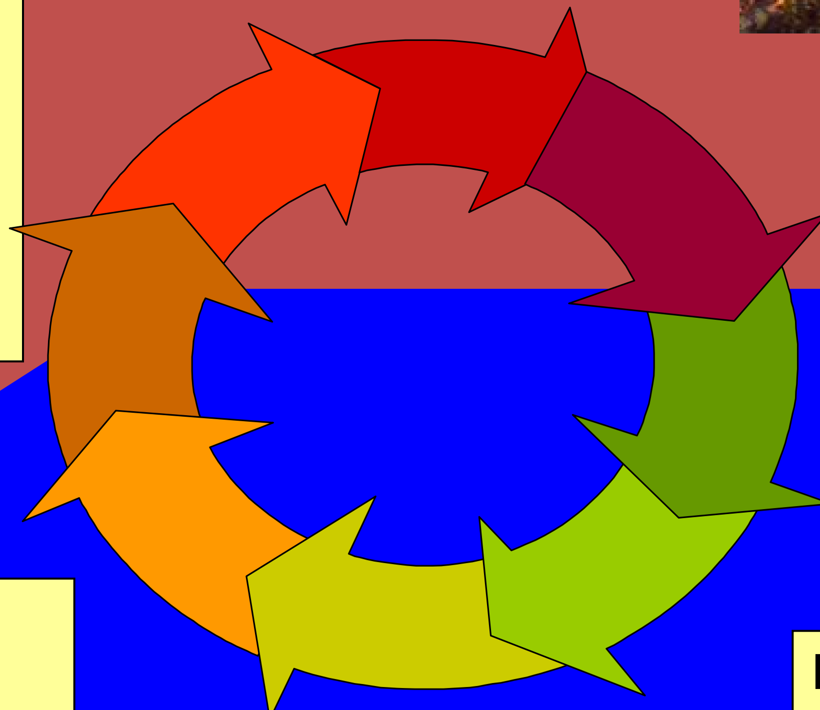
was adopted at the

Third UN World Conference in Sendai, Japan, on March 18, 2015

Disaster Management Cycle

Preparedness
- Scenarios development
- Emergency Planning
- Training

Prevention and Mitigation
- Hazard prediction and modeling
- Risk assessment and mapping
- Spatial Planning
- Structural & non structural measures
- Public Awareness & Education..



Alert
- Real time monitoring & forecasting
- Early warning
- Secure &dependable telecom
- Scenario identification
- all media alarm

Post Disaster
- Lessons learnt
- Scenario update
- Socio-economic and environmental impact assessment
- Spatial (re)planning

Recovery
- Early damage assessment
- Re-establishing life-lines transport &communication infrastructure

Response
- Dispatching of resources
- Emergency telecom
- Situational awareness
- Command control coordination
- Information dissemination
- Emergency healthcare

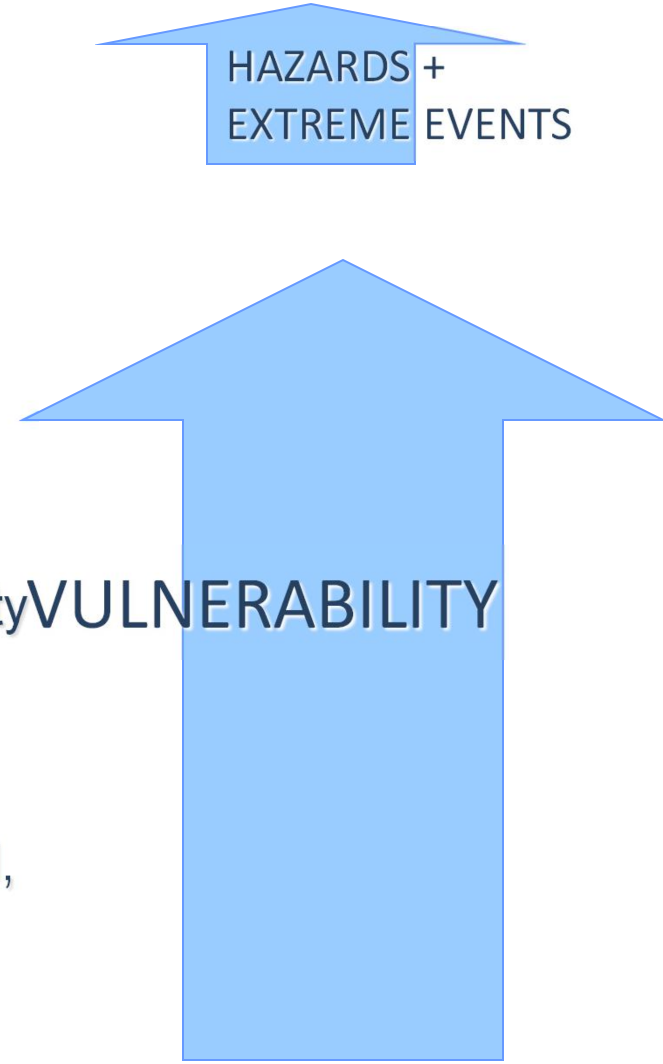
Global Trends - Disasters are NOT natural

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

Main concept:

disasters are not natural but the result of socially built vulnerabilities…

Paradigm shift, focus so far on the emergency and the disaster itself, urgency to refocus on the managing risk and reducing vulnerabilities

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

Natural hazard + Exposure x Vulnerability - Capacity = Disaster Risk

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

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;

(f) To promote real time access to reliable data, make use of **space and in situ information**,

including geographic information systems **(GIS),** and use information and communications technology innovations

to enhance measurement tools and the collection, analysis and dissemination of data;

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;

(b) To promote the conduct of comprehensive surveys on multi-hazard disaster risks and

the development of regional disaster risk assessments and **maps**, including climate change scenarios;

(c) To promote and enhance, through international cooperation, including technology transfer, access to and the sharing and use of non-sensitive data and information, as appropriate, communications and **geospatial and space-based technologies and related services;** maintain and strengthen in situ and remotely-sensed earth and climate observations; and strengthen the utilization of media, including **social media**, traditional media, **big data and mobile phone networks**, to support national measures for successful disaster risk communication, as appropriate and **in accordance with national laws;**

Role of stakeholders

Children and youth are agents of change and should be given the space and modalities to contribute to disaster risk reduction, in accordance with legislation, national practice and **educational curricula;**

Older persons have years of knowledge, skills and wisdom, which are invaluable assets to reduce disaster risk, and they should be included in the design of policies, plans and mechanisms, including for early warning;

Academia, scientific and research entities and networks to focus on the **disaster risk factors and scenarios,** including emerging disaster risks, in the medium and long term;

Increase research for regional, national and local application; support action by local communities and authorities; and **support the interface between policy and science for decision-making;**

2. Big Data and Smart Data Era

BIG DATA

A REVOLUTION THAT WILL TRANSFORM HOW WE LIVE, WORK, AND THINK

大数据时代

生活、工作与思维的大变革

Big Data: buzz word or reality?

Information superhighway,

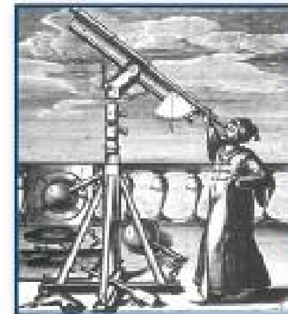
SDI´s,

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

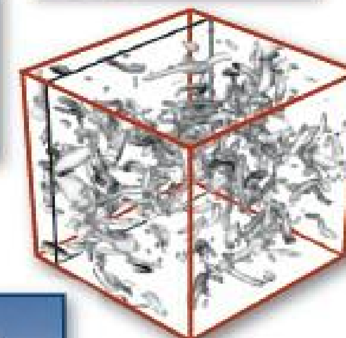
Jim Gray: the 4th Paradigm

Science Paradigms

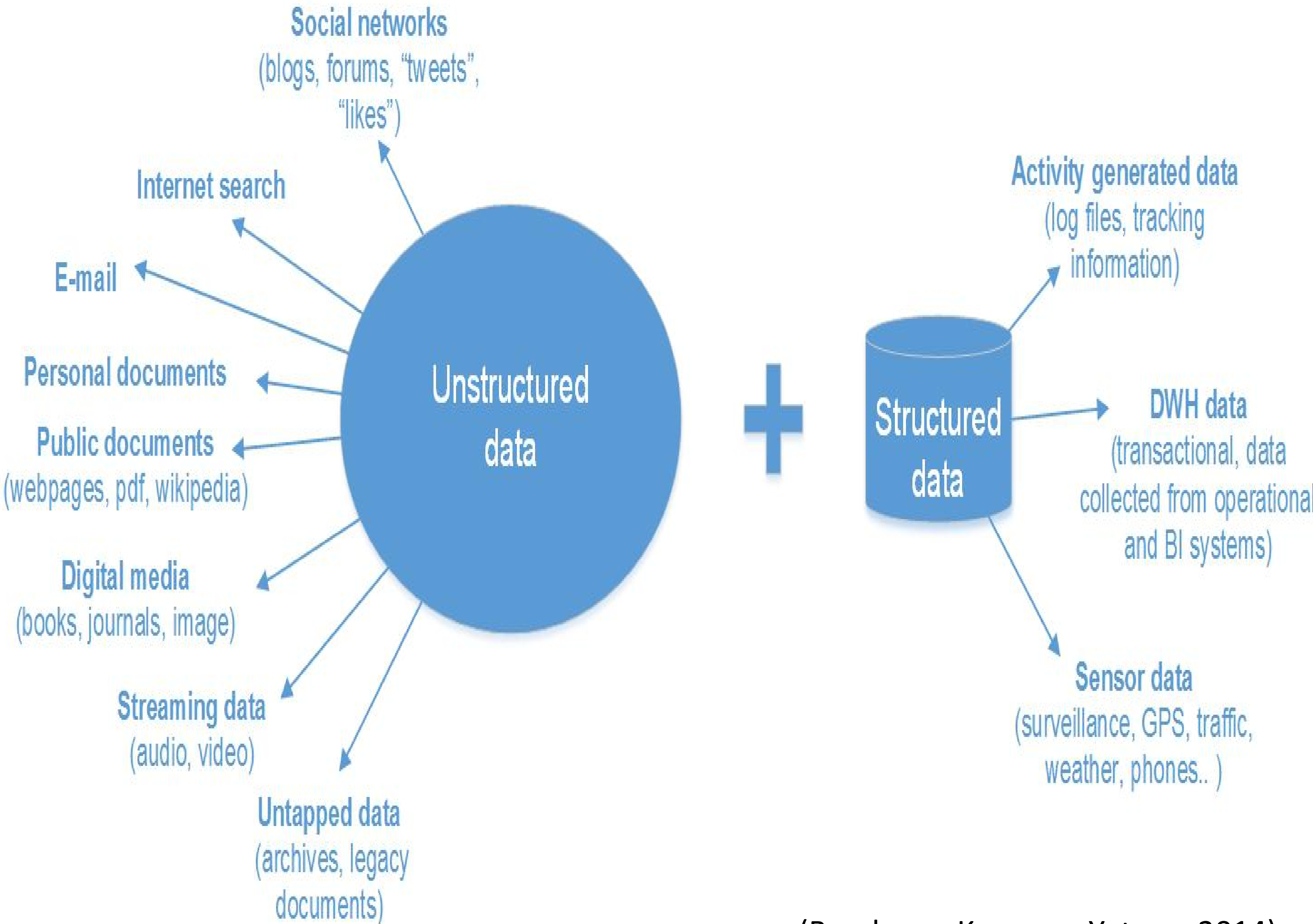
- Thousand years ago:
  science was **empirical**
  describing natural phenomena
- Last few hundred years:
  theoretical branch
  using models, generalizations
- Last few decades:
  a **computational** branch
  simulating complex phenomena
- Today: **data exploration** (eScience)
  unify theory, experiment, and simulation
  – Data captured by instruments
    or generated by simulator
  – Processed by software
  – Information/knowledge stored in computer
  – Scientist analyzes database/files
    using data management and statistics



$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{4\pi G\rho}{3} - K\frac{c^2}{a^2}$$



Big Data Concepts and Policies



(Bandrova, Konecny, Yotova, 2014)

BD: Definitions

Zucker, S., (2014) :

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

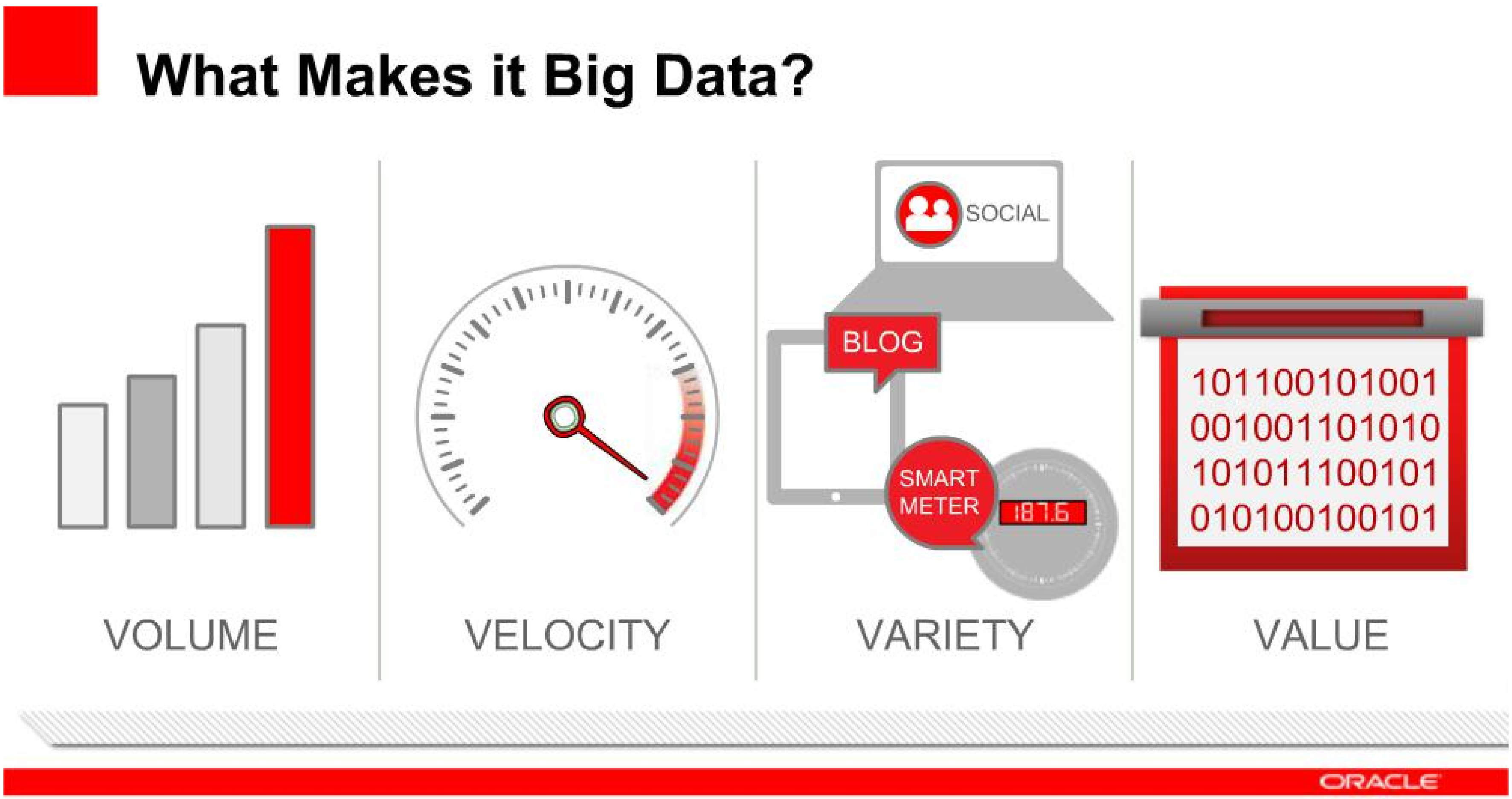
″**There is no rigorous definition of big data**. Initially the idea was that the volume of information had grown so large that the quantity being examined no longer fit into the memory that computers use for processing, so engineers needed to revamp the tools they used for analyzing it all” (Mayer-Schönberger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

Next-generation GIS are required to store, process and visualize many structured, unstructured and semi-structured data in different formats: vector, raster, video, audio, text, etc. However, the more interesting question is about user involvement into data collection and GIS development.

The idea of virtual GIS is considered in this regard. Virtual GIS development is encouraged by the idea of Virtual Geographic Environment which may have enormous potential in BD usage and manipulation.

The Intel Science and Technology Center for Big Data
http://istc-bigdata.org/#&panel1-4

Characteristics of BD



Features of big data

- **Volume:** TB, PB, EB level of data waiting to be processed.
- **Velocity:** The data stream waiting to be response should be processed in seconds or even milliseconds is continuously generated.
- **Variety:** Data sources and types are various. Text, pictures, videos and other structured and unstructured data are exist;
- **Veracity:** Because of the noise, loss, inconsistency and ambiguity, the uncertainty should be taken into consideration.
- **Value:** Big data contains great values. It offers an unprecedented possibility to quantify and understand the world. The ultimate goal of big data is to find the great values within them.

This "5V" also translated as: volume, speed, diversity, authenticity and value.

“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 paradigma for and supportive approaches of higher level usage of BD** in everyday decision making, solving problems and improvement of life of inhabitants.

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

From Big to Smart Spatial Big Data with Support of VGEs

Yaochen QIN, Fun QIN, Milan Konecny

Henan University, College of Environment & Planning, Kaifeng, China

Masaryk University, Institute of Geography, Laboratory on Geoinformatics and Cartography, Brno, Czech Republic

2. Many faces of

SMART

Meanings?

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)

Business example:

BD is a broad term including complex challenges which must be prioritized and addressed – such as **"Fast Data" and "Smart Data."**

"Smart Data"(SD) means information that actually **makes sense.** ***SD is data from which signals and patterns have been extracted by intelligent algorithms. Collecting large amounts of statistics and numbers bring little benefit if there is no layer of added intelligence.***

By "Fast Data" we're talking about as-it-happens information enabling real-time decision-making (Alissa Lorentz, AUGIFY).

The development of the smart city

Informational-ized city → Digital city → Intelligent city

1993

The "information superhighway" starts the information era of the cities

1998

"The build of the digital comfortable community" marks the construction of the digital city and digital earth

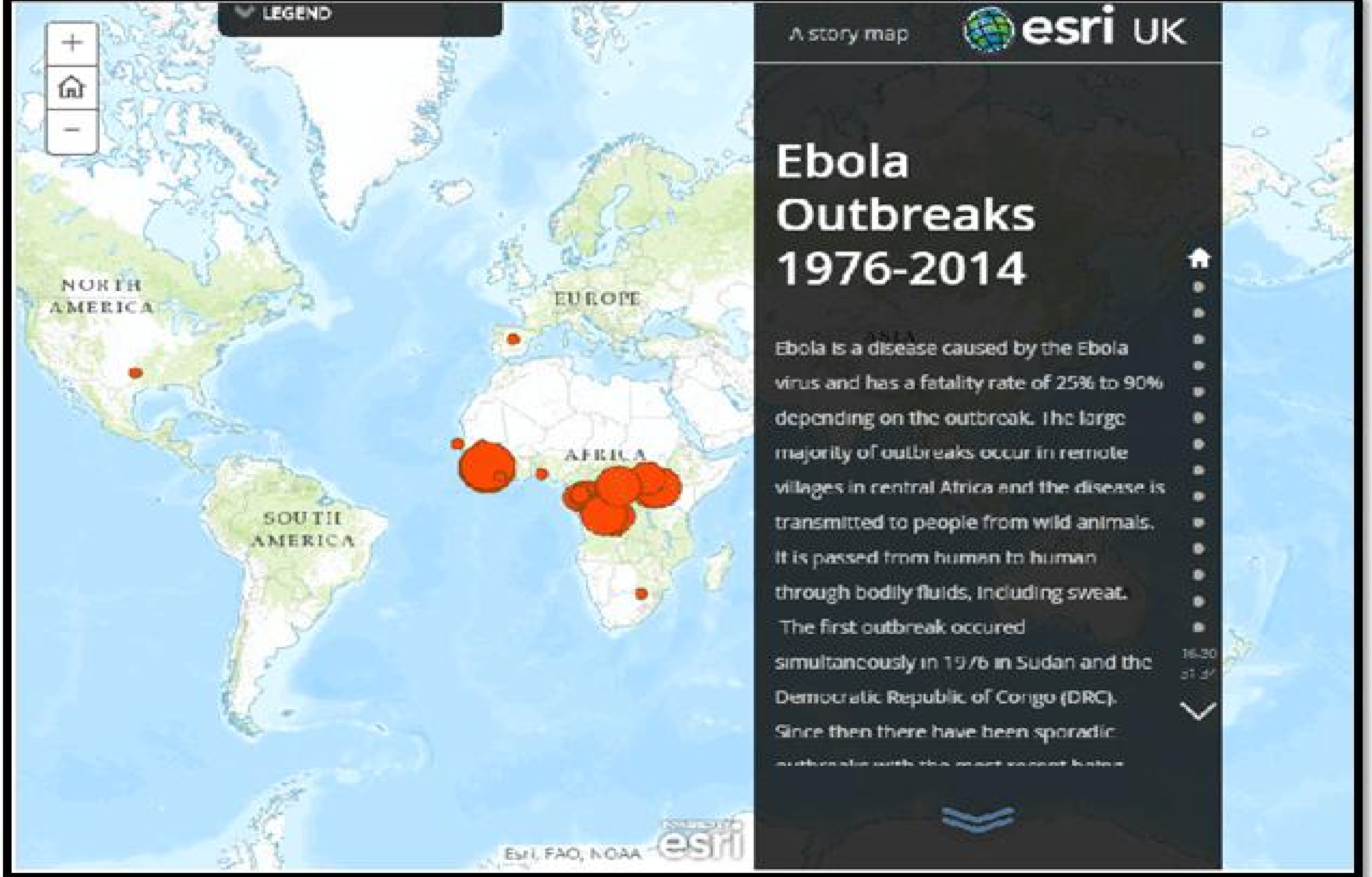
2006

The new information technologies such as internet of things and cloud computing integrates the digital city system.

2009

IBM proposed a new concept: "smart city", marking the digital city into a new stage.

The smart city is based on the information infrastructure and the digital city, It pays more attention on the integration of the digital city with the real city through ubiquitous sensor networks, puts more emphasis on the intelligent control and the automatic feedback. It is a more advanced stage of the digital city, and a high-degree integration of the industrialization and information technology.



The IBM Ebola tracker. [IBM's Ebola heat map] uses Big Data technology in combination with a GPS app to track and fight Ebola.

3. What we have for disposition?

- 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

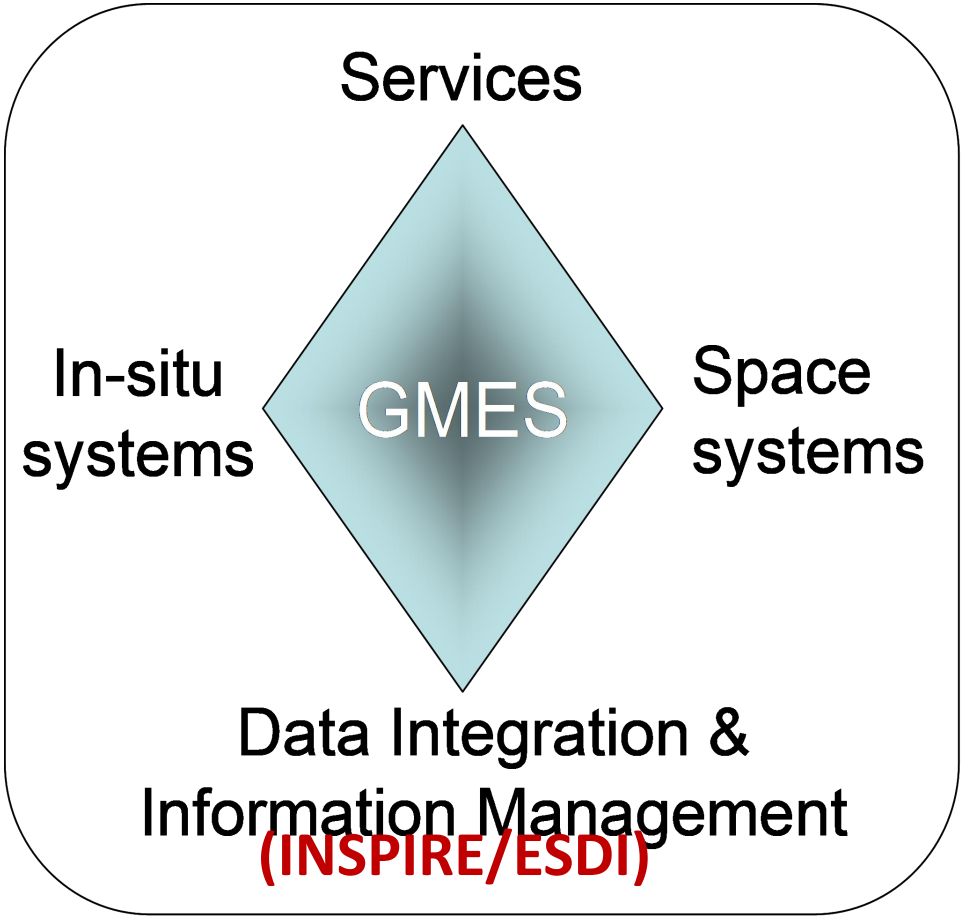
The United Nations initiative on Global Geospatial Information Management (UN-GGIM) aims at playing a leading role in setting the agenda for the development of global geospatial information and to promote its **use to address key global challenges**.

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

4. 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.

Data-driven geography: challenges

In Big Data: A Revolution That Will Transform How We Live, Work, and Think, Mayer-Schonberger and Cukier (2013) identify ***three main challenges*** of Big Data in science:

((1))populations, not samples;
((2))messy, not clean data, and;
(3) correlations, not causality.

Ad. 1. Populations, not samples;

….. dealing with large volumes of
data was impractical.

Instead, researchers developed methods for collecting representative samples and for
generalizing to inferences about the population from which they were drawn. Random sampling was thus a strategy for dealing with information overload ing an earlier era.

Ad. 2. messy, not clean data

The new data sources are often messy, consisting of data that are ***unstructured,*** collected with no quality control, and frequently accompanied by no documentation or metadata.

Goodchild and Li (2012) identify ***three strategies for cleaning and verifying messy data:***
((1))the crowd solution;
(2) the social solution; and
(3) the knowledge solution.

Ad. 3 Correlations, not causality

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

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

5. NEOGEOGRAPHY, VOLUNTEER GI

AND

SOCIAL MEDIA GEOGRAPHIC INFORMATION (SMGI)

Neogeography

- Citizens as both users and producers of geospatial data
  - volunteered geographic information
  - crowdsourcing
  - multiple sources, little quality control, not rigorously sampled
- Maps for the individual
  - user-centered
  - transitory
  - the view from the ground
  - delivered on small devices

VGI Volunteer Geographic Information

How to manage volunteer geographic information? Chaos or help?

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

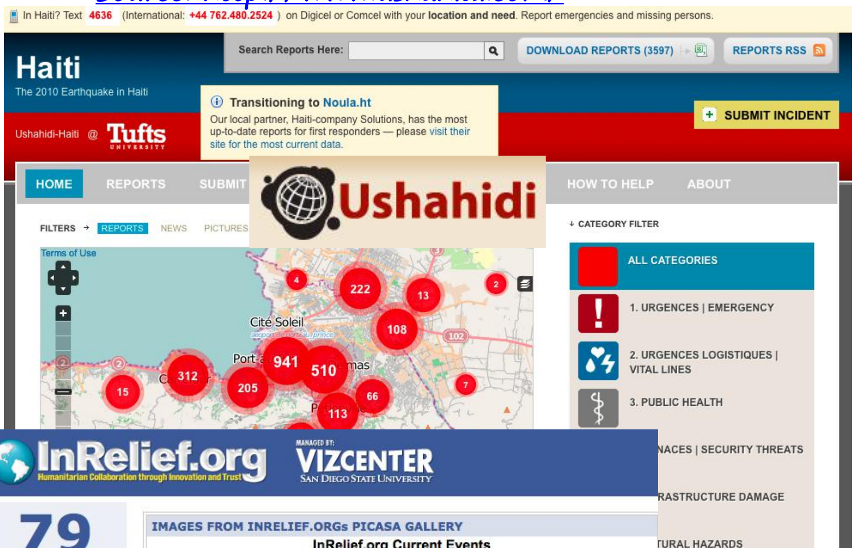
(podle McDougall, GSDI 12, Singapore)

	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

UGC for crisis mapping

- Ushahidi
- InRelief
- OpenStreetMap
- Sahana
- CrisisCommons

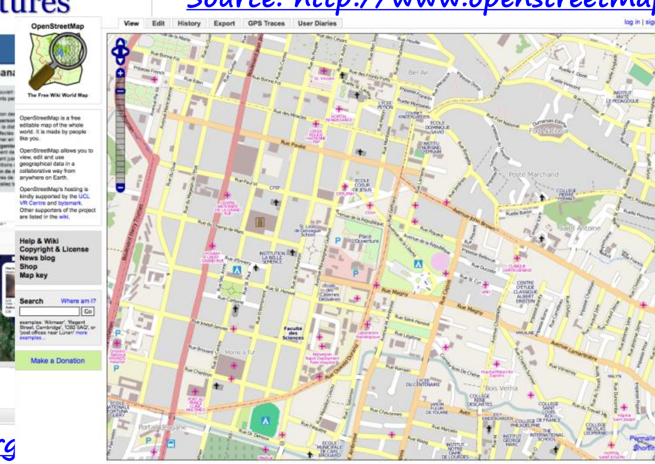
Source: http://www.ushahidi.com/



Source: www.inrelief.org

Source: http://www.sahanafoundation.org

Source: http://www.openstreetmap.org/



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.

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

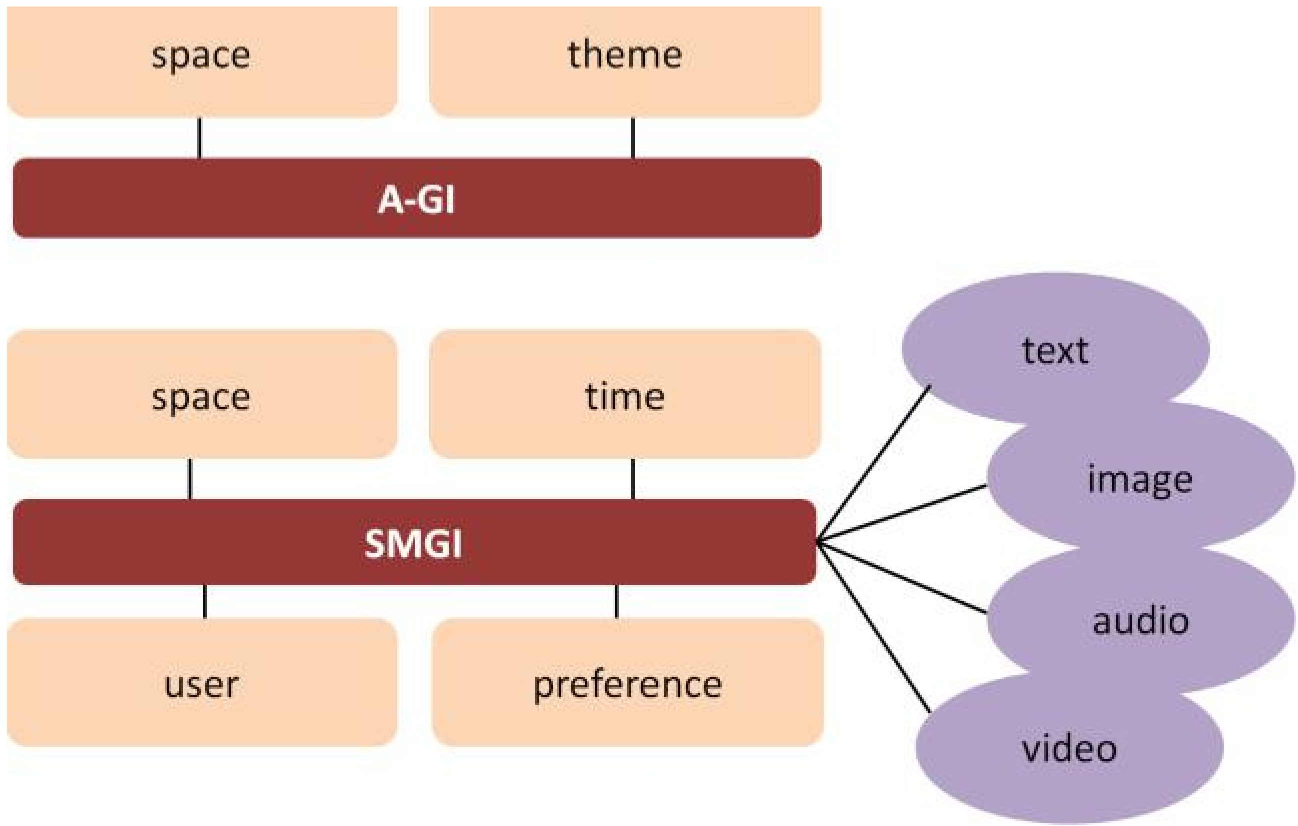
spatial **User Generated Contents (UGC),** commonly referred
to **as Volunteered Geographic Information (VGI)** (GOODCHILD 2007).

A subset of VGI are:

Social Media Geographic Information (SMGI), which is the information ***produced and shared through social media platforms***, might enhance the opportunities to collect ***not only geographic information*** representing the current conditions of the study area but *also the* ***perceptions of users about spatial phenomena.***

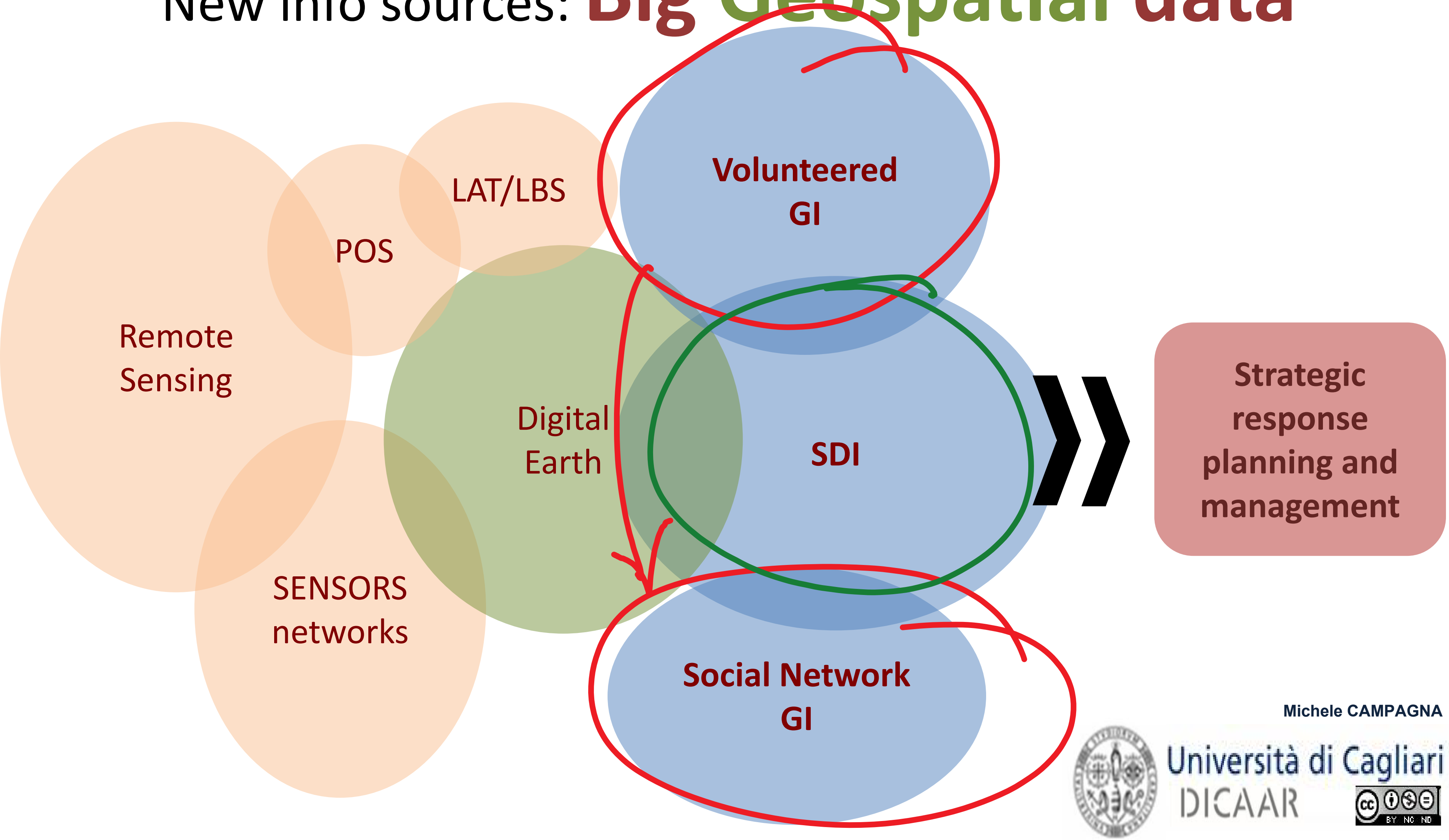
The ICTs, the Internet, and more recently, Web 2.0 technologies are
affecting diverse domains of interest, increasingly channeling digital Geographic Information
(GI) into daily life of a wider public.

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

New info sources: Big Geospatial data



Michele CAMPAGNA
Università di Cagliari
DICAAR

SM-GI: a definition

Social Media Geographic Information (**SMGI**) can be defined as

any piece or collection of multimedia data or information

with explicit (i.e. coordinates) or implicit (i.e. place names or toponyms) geographic reference

collected through social networking (web or mobile) apps

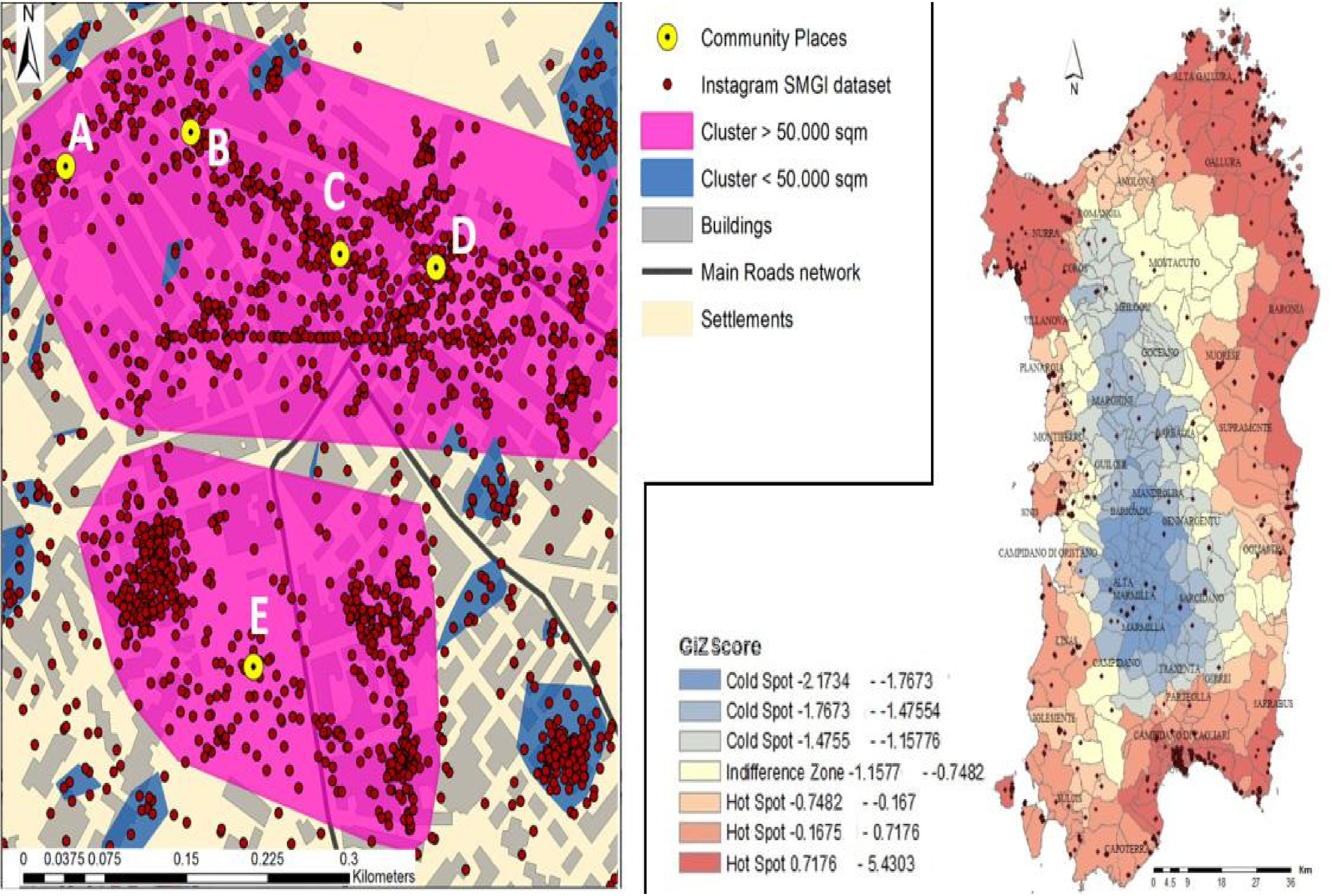
Michele CAMPAGNA

Università di Cagliari
DICAAR

The **SMGI Analytics framework** developed so far consists of the following methods:

1. **Spatial analysis of users' interest:** SMGI and its comments may enable to investigate the patterns of users' interest in space by density and clustering functions.

The overlay with A-GI such as administrative boundaries, transport infrastructure, buildings or land
uses, may offer useful hints to public authorities to understand which places are important
to the local communities and how those areas are perceived by them.


N
A
B
C
D
E
0 0.0375 0.075 0.15 0.225 0.3
Kilometers
Community Places
Instagram SMGI dataset
Cluster > 50.000 sqm
Cluster < 50.000 sqm
Buildings
Main Roads network
Settlements
GiZ Score
Cold Spot -2.1734 - -1.7673
Cold Spot -1.7673 - -1.47554
Cold Spot -1.4755 - -1.15776
Indifference Zone -1.1577 - -0.7482
Hot Spot -0.7482 - -0.167
Hot Spot -0.1675 - 0.7176
Hot Spot 0.7176 - 5.4303
N
ALTA GALLURA
GALLURA
ANGLONA
NURRA
MONTACUTO
BARONIA
NUORESE
PLANARGIA
SUPRAMONTE
CAMPIDANO DI ORISTANO
OGLIASTRA
SARRABUS
CAMPIDANO DI CAGLIARI
0 4.5 9 18 27 36
Km

2. Multimedia content analysis on texts, images, audios, or videos

this typology of analysis relies on simple or advanced texts analytics to extract useful information from texts (currently it is more difficult to automatically extract useful information from images, video or audio).

3. Temporal analysis of users' interests:

time reference is usually available for SMGI,
enabling to study when specific regional destinations,
urban districts, public spaces, or
other services are used during different time periods.
An example is shown in Figure 3,
where the temporal trends of Instagram SMGI
contributions are depicted in the Iglesias
(Italy) to investigate the municipal temporal patterns.

4. User behavioral analysis:

querying SMGI by user enables to study users' behavior in space and time. This information can be also used to analyze, for example, if a public space is visited by tourists or by local people. Furthermore, this attribute can be used to apply user profiling techniques.

5. **Combination of two or more of the previous analyses:**

such combination may enable to elicit ***what people discuss in space and time, their behaviors and movements.***

Tightly coupling different analytics may ease the elicitation of further knowledge that may be proficiently used ***for spatial planning analysis.***

6. VGE – VIRTUAL GEOGRAPHIC ENVIRONMENTS

Michael Batty first used the term **'virtual geography' in 1997 (Batty 1997),** the term **'Virtual Geographic Environments' (VGEs) was formally proposed by Lin and Gong** as a concrete study object of the discipline of virtual geography (Lin and Gong, 2001).

Combined with the two terms above, a VGE can be regarded as a typical virtual-based geographic environment that allows users **to 'feel the geographic scenarios in person' and 'know the geographic laws beyond reality'** (Lin et al. 2013b).

New branch of Geographic Information Science (**GIScience)**

Although the main concept remains the same, the development process indicates that **VGEs** have experienced a **gradual evolution in terms of their content and functions.** Overall, three primary stages are apparent.
(1) The period from 1998 to 2002 can be regarded as the **embryonic period** of VGEs. BTW **Five types of space (i.e. internet space, data space, 3D geographic space, personal perceptual and cognitive space, and social space)** are defined to characterize VGEs.

The authors also mentioned the ‘georeferenced virtual environment’
…. **A gap** still existed between **VGEs and geography.**

(2) The following 6 years (until the year 2008) - continuous exploration stage. To detect the **relationship between VGEs and geography**, scholars interpreted VGEs from the perspective **of geographic language**, which is a basic tool to represent geo-spatial information.
…**multi-dimension expression and multi-channel interaction** as typical characteristics.

(3) The most recent five years (2009-2013) are regarded as the **explosive stage of VGEs**.
These five years clearly clarified and concentrated the conception of VGEs.
Lin et al. (2013a, 2013b) re-described their proposed **VGEs** as **a new generation of geographic analysis and computer-aided geographic experiment tools.**

VGEs are **'a type of typical web- and computer-based geographic environment'** built 'by merging geographic knowledge, computer technology, virtual reality technology, network technology, and geographic information technology', ...

…. and ‘with the objective of **providing open, digital windows into geographic environments** in the physical world,
to allow users to **‘feel it in person’** by a means for **augmenting the senses** and to **‘know it beyond reality’** through geographic phenomena **simulation** and **collaborative** geographic experiments’.

VGE will **‘contribute to human understanding of the geographic world and assist in solving geographic problems at a deeper level’** (Lin et al. 2013b). ….. definition of a VGE has a closer relationship to geography.

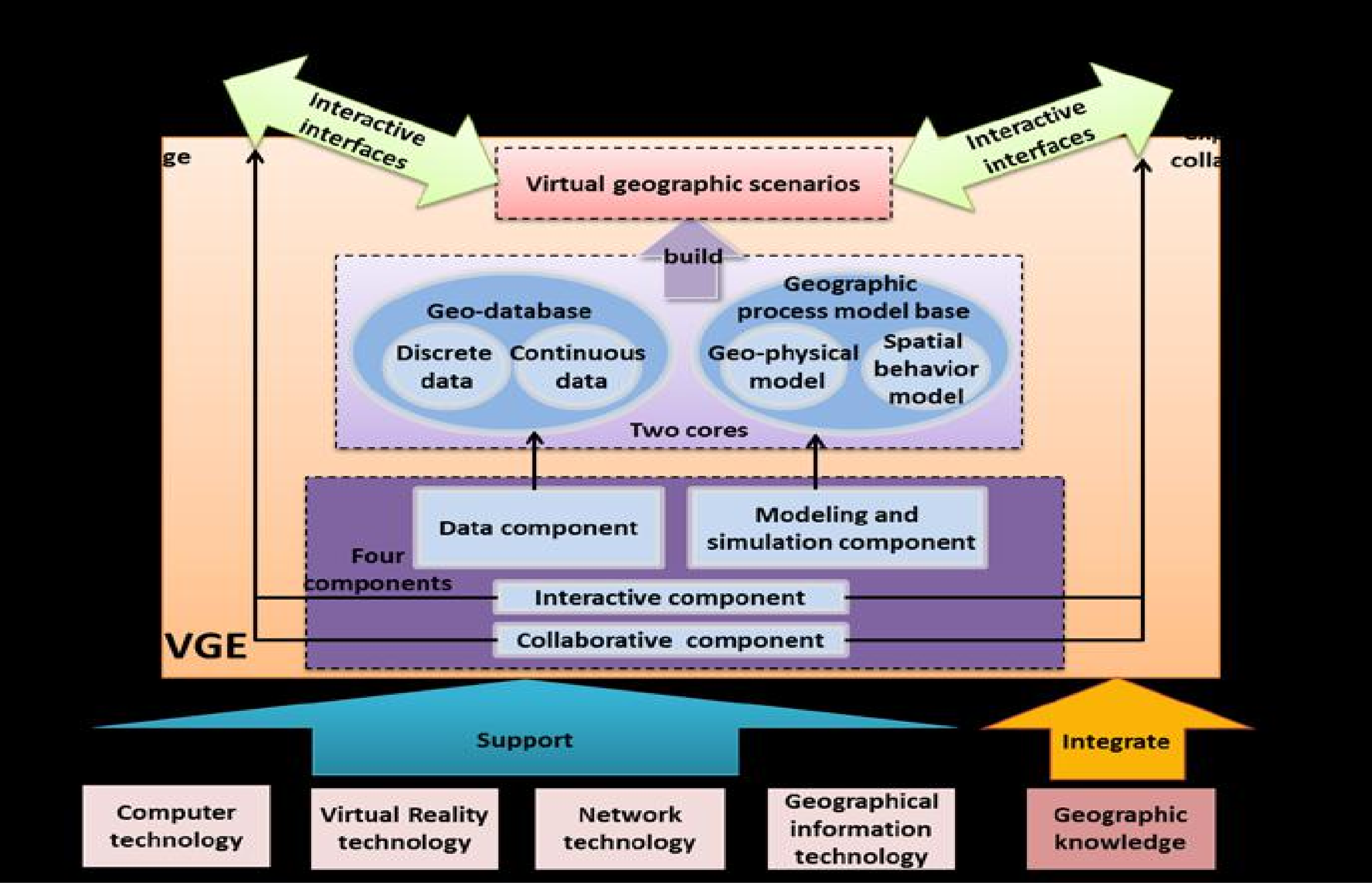


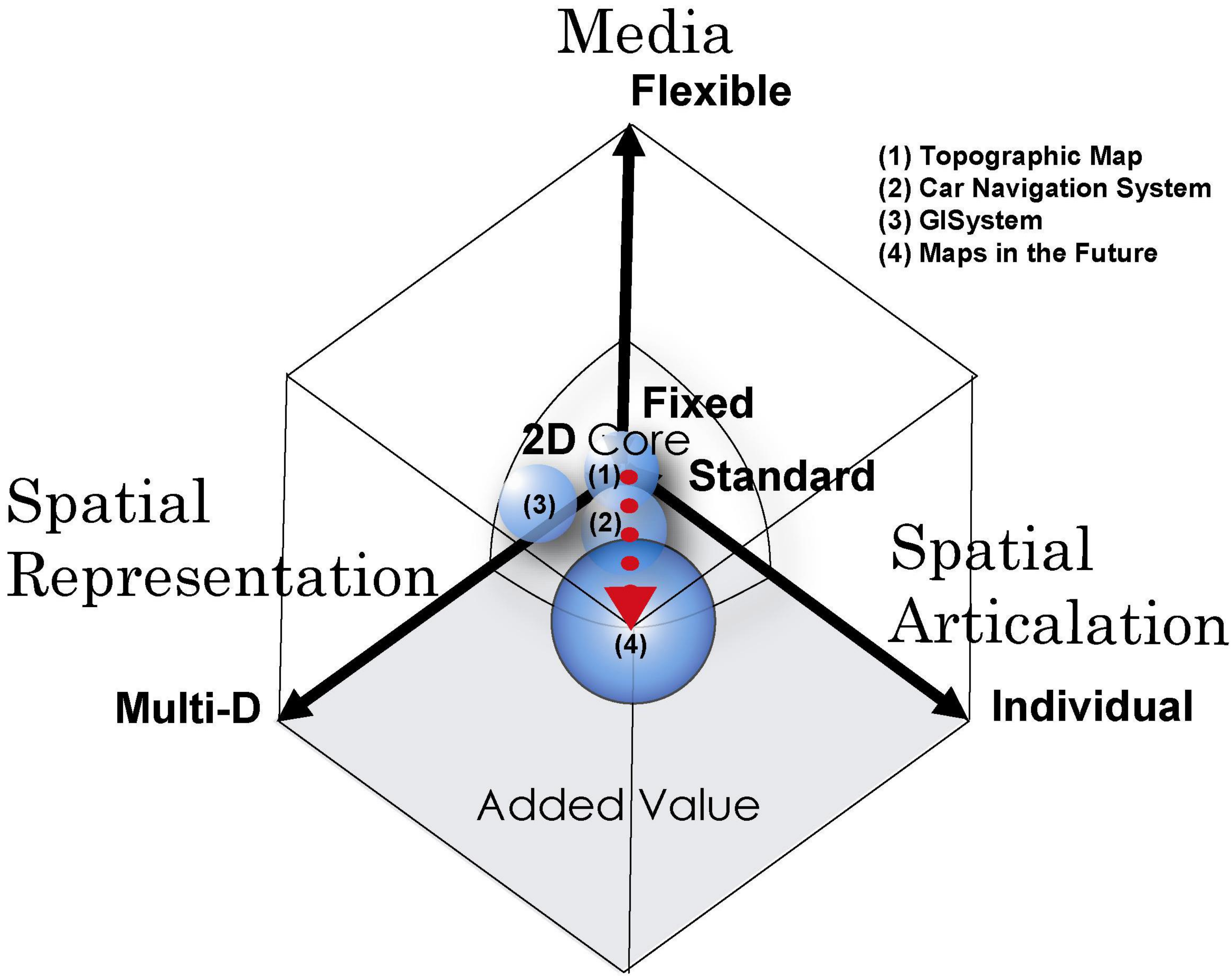
Figure 1. Current structure of a complete VGE (modified from Lin et al. 2013b)

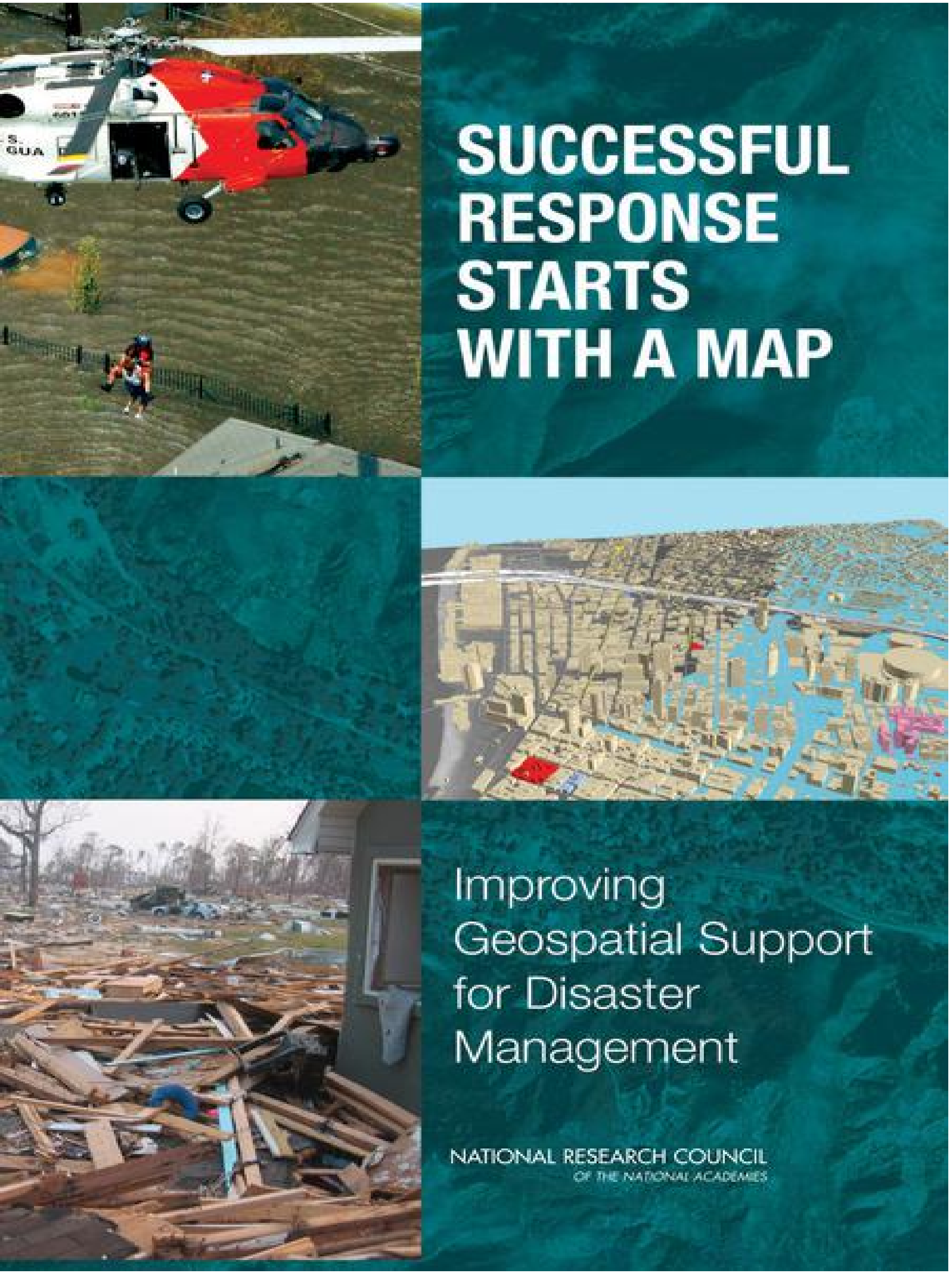
VGE based on these foundational technologies and factors,

four components (i.e., the data component, modeling and simulation component, interactive component, and collaborative component) **and two cores** (i.e., a geo-database and a geographic process model base) should be equipped within a complete VGE. Finally the virtual geographic scenarios are built for the **public immersion and providing their spatial knowledge** and for the researchers conducting collaborative geographic experiments.

7. CARTOGRAPHICAL TRENDS FOR DRR

context-based and adaptive maps, cognitive styles


Media
Flexible
(1) Topographic Map
(2) Car Navigation System
(3) GISystem
(4) Maps in the Future
Fixed
2D Core
Standard
Spatial Representation
Spatial Articalation
(1)
(2)
(3)
(4)
Multi-D
Individual
Added Value



Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management, NRC (2007)

Main contribution: ***Individualization*** of cartographics outputs, work with abilities, skills of users and prepare for them tailored outputs.

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

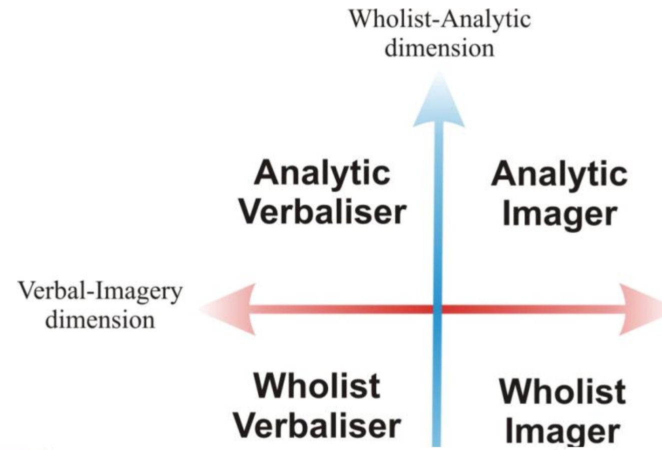
Cognitive style

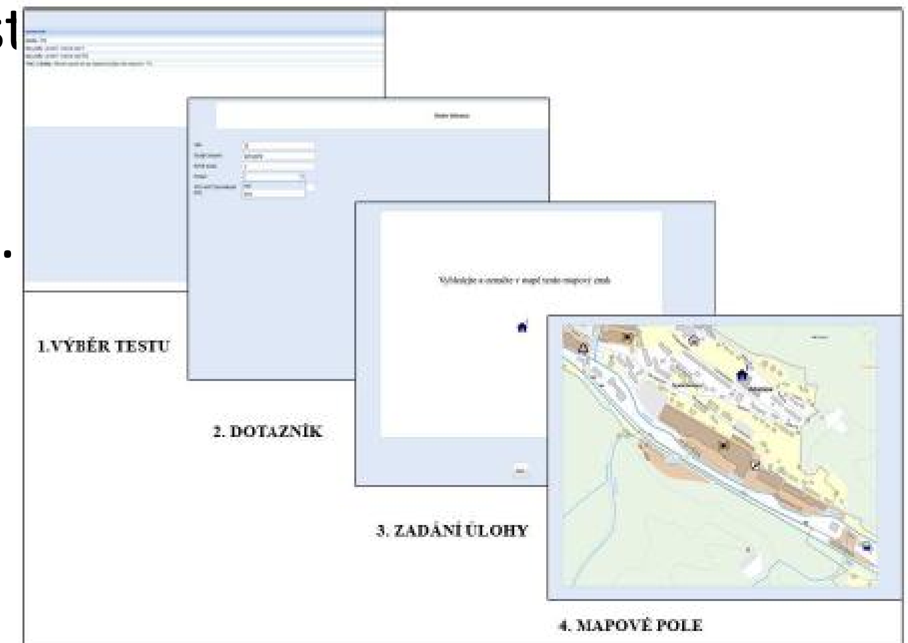
Cognitive style or "thinking style" is a term used in cognitive psychology to describe the way individuals think, perceive and remember information, or their preferred approach to using such information to solve problems. Cognitive style differs from cognitive ability….

(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: Posloupnost jednotlivých snímků testu v programu MUTEP – výbě testu, dotazník, zadání, úkol (upraveno podle ŠTĚRBA et al., 2011)

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)

Liqiu Meng (Albena 2016):

Cartography and its ***connecting role***

Confirmation that integrative approaches we need also in EW and Crises Management and
Disaster Risk Reduction approaches.

System of Systems also in EW and CM

ELIAS MESERET/AP


ZACHARIAS ABUBEKER/AFP/GETTY IMAGES

Communication with communities

Let’ s go to develop these and some new trends which will appear.

Keep geoinformatics, cartographic specifications which do our disciplines ***specific, attractive,….. and necessary.***

DRR means wider approach than DRM

- Solutions together with sustainable development and global warming;
- More economical aspects;
- Developed and developing countries; commons and specifications;
- New approaches: smart cities

- Prepare people for disaster risks with target of their **REDUCTION**

- INTEGRATION of spatially oriented efforts (GEO)
Etc.

In Cartography:

- Rapid Mapping and on-line disaster information;
- Context and adaptive cartography
- Dealing with specific social groups of inhabitants from children to seniors to understand maps to understand our information; **standardized legends**

- **VGI**

- **Social Media Geographic Information**

- Develop cartography to be able respond for detail questions, e.g. ***Will be my flat hit by storm, tsunami, fire, etc.? When? What to do?***

Next commission events:

July 2nd, 2017: ICC Washington, commission Workshop

October 17, 2017, Brno, Czech Republic

April 2018, Novosibirsk, Russia

June 18-23, 2018, Sozopol, Black Seaside, Bulgaria

November 2018, Shenzhen, P.R. China

THANK YOU

Xie, Xie!!!!!

Spasibo

Chvala

Muchas Gracias

Terima Kasim O Brigada

Kammsa Hamida

Aligator

SHUKRAN

BLAGODARJA

DĚKUJI (in Czech)

PRAGUE

BRNO