

Professional Ethics, System Design Methods and Geospatial Data Quality

Yvan Bédard¹, Jennifer Chandler², Rodolphe Devillers³, Marc Gervais¹

¹Univ. Laval, Geomatics

²Univ. of Ottawa, Law

³Memorial Univ. of Newfoundland, Geography



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Objectives

- ◆ Geospatial data uncertainty and ethics
- ◆ Today's solutions to deal with uncertainty
- ◆ A new ethics-centered solution for system design:
 - ◆ C.A.R.E.F.U.L.
- ◆ More new solutions
 - ◆ GEOIDE Project #PIV-23
- ◆ Conclusion: impacts of geospatial data ethics
 - ◆ on education
 - ◆ on system design

Geospatial Data Uncertainty and Ethics

- ◆ There are thousands of ways to measure the position, shape, orientation and size of phenomena or objects
- ◆ Data uncertainty varies spatially and over time
 - ◆ Ambiguity of concepts (semantics, geometry)
 - ◆ Poorly known resolution and precision
 - ◆ Lack of up-to-dateness and timeliness
 - ◆ Incompleteness
 - ◆ Low level of « processability »
 - ◆ ...
- ◆ **Everytime data is reused or transformed, additional uncertainty is introduced**

Geospatial Data Uncertainty and Ethics

- ◆ **Uncertainty can be reduced**
 - Better observation technologies and methods
 - Standards
 - Training
 - ...
- ◆ There always remain **residual uncertainty**
- ◆ Residual uncertainty = risk **absorbed by**
 - data producers
 - Data brokers
 - Users
- ◆ Jurisdictions' laws, Court decisions and regulations define **who take or share that risk**

Geospatial Data Uncertainty and Ethics

- ◆ Typical users take digital data for granted, assuming their quality is high and fits the intended usage
- ◆ An increasing number of incidents and accidents result from the inappropriate use of geospatial data
- ◆ **"Erroneous, inadequately documented, or inappropriate data can have grave consequences for individuals and the environment."**

(AAG Geographic Information Ethics Session Description, 2009)

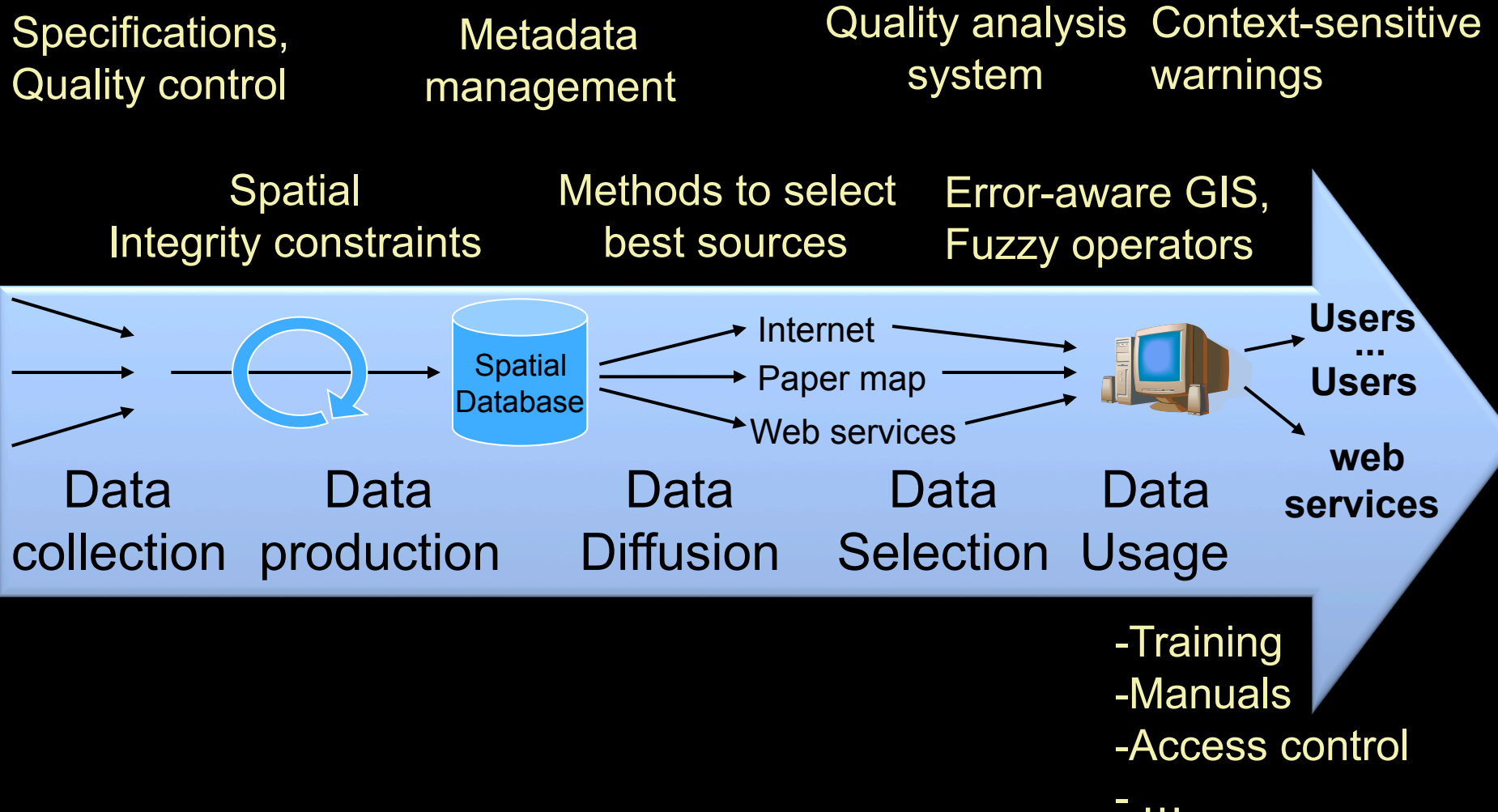
Geospatial Data Uncertainty and Ethics

- ◆ From an ethics point of view:
 - ◆ Poor quality data should not be used for sensitive applications where it poses a risk of harm
 - ◆ If it is to be used, then it will be necessary to build in appropriate safeguards to avoid the harm, and to provide effective warnings

Geospatial Data Uncertainty and Ethics

- ◆ From an ethics point of view:
 - ◆ It is always possible, however, that a court might find that the sensitive application ought not to have been designed at all if the risks posed by the poor data are too serious
 - ◆ It is not enough just to anticipate the intended uses and data quality requirements of a system. It is also important to anticipate the possible misuses of the system as well

Data Uncertainty: today's approaches



Data Uncertainty: today's approaches

Victims' approaches and reactions

Don't follow



Data Uncertainty: today's approaches

Ethics-related issue

- ◆ Professional self-regulatory bodies have Codes of ethics contained in regulations
- ◆ These regulations are enacted by governments
- ◆ Professionals' primary duty is to the public welfare

Data Uncertainty: today's approaches

Ethics-related issue

- ◆ Codes of ethics influence « Good Practices »
 - ◆ Ex. professionals must care about individuals and environment
- ◆ « Professional misconduct » is typically set out in regulations
 - ◆ Ex. Negligence, failure to report or remedy to a danger, to protect people
- ◆ In case of lawsuits, Codes of ethics have impacts

Data Uncertainty: today's approaches

Ethics-related issue

- ◆ Data uncertainty issues end up in the hands of legal systems, but they begin in the hands of systems designers
- ◆ Software engineering methods based on formal models are recognized as the most rigorous approaches to develop quality systems
- ◆ Good practices require to understand clearly data quality requirements and fitness-for-use
- ◆ It is a duty for the expert to care about users and to inform them about inappropriate usages of spatial data

Data Uncertainty: today's approaches

Ethics-related issue

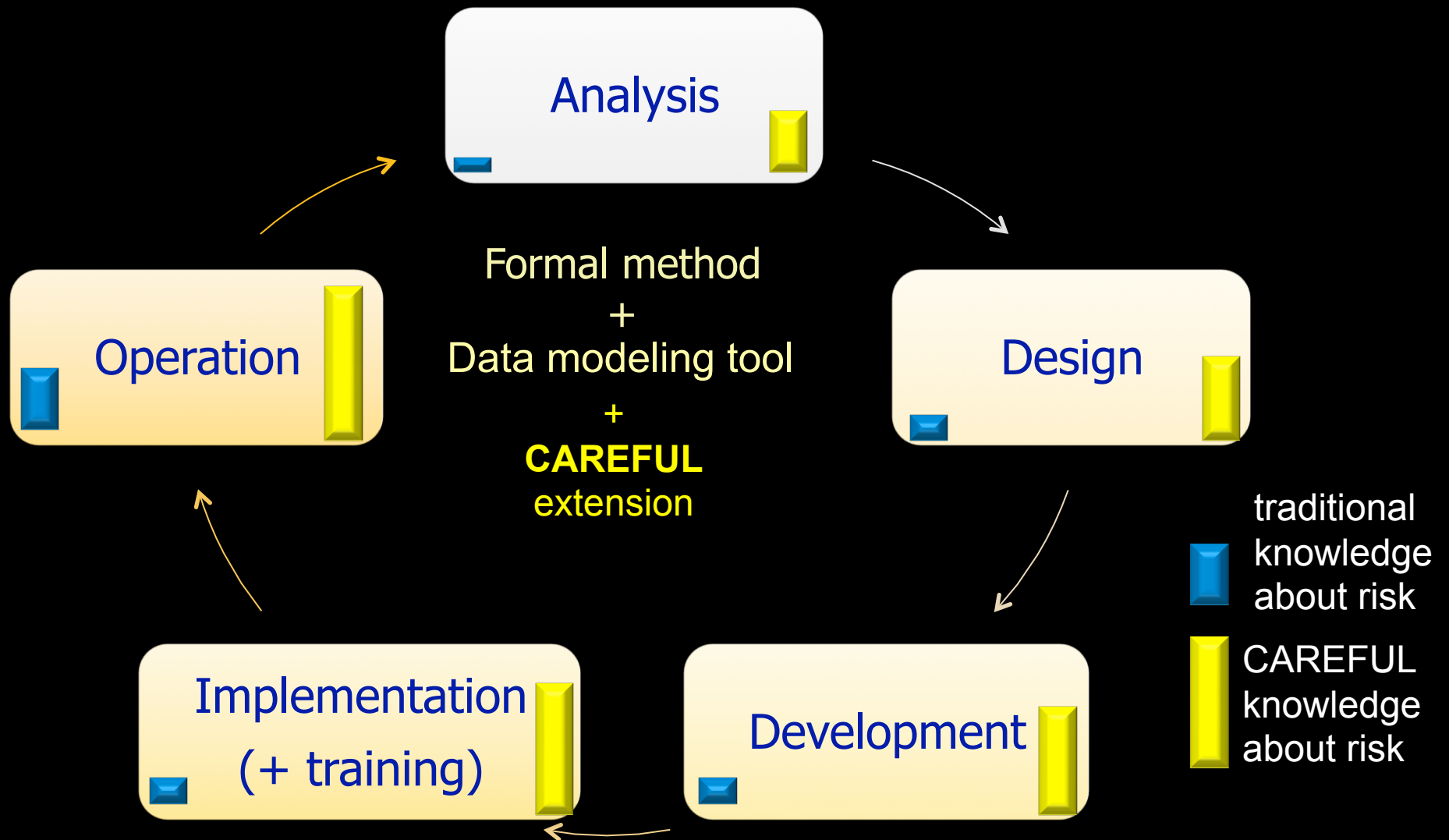
- ◆ It is a duty for the expert to involve his client during every phase of a system development method
- ◆ This involvement must include decisions about the risks related to spatial data definition, selection, production, dissemination and potential reuse (intended or not)
 - ◆ Risk-related decisions must be understood and approved by the client

Data Uncertainty: today's approaches

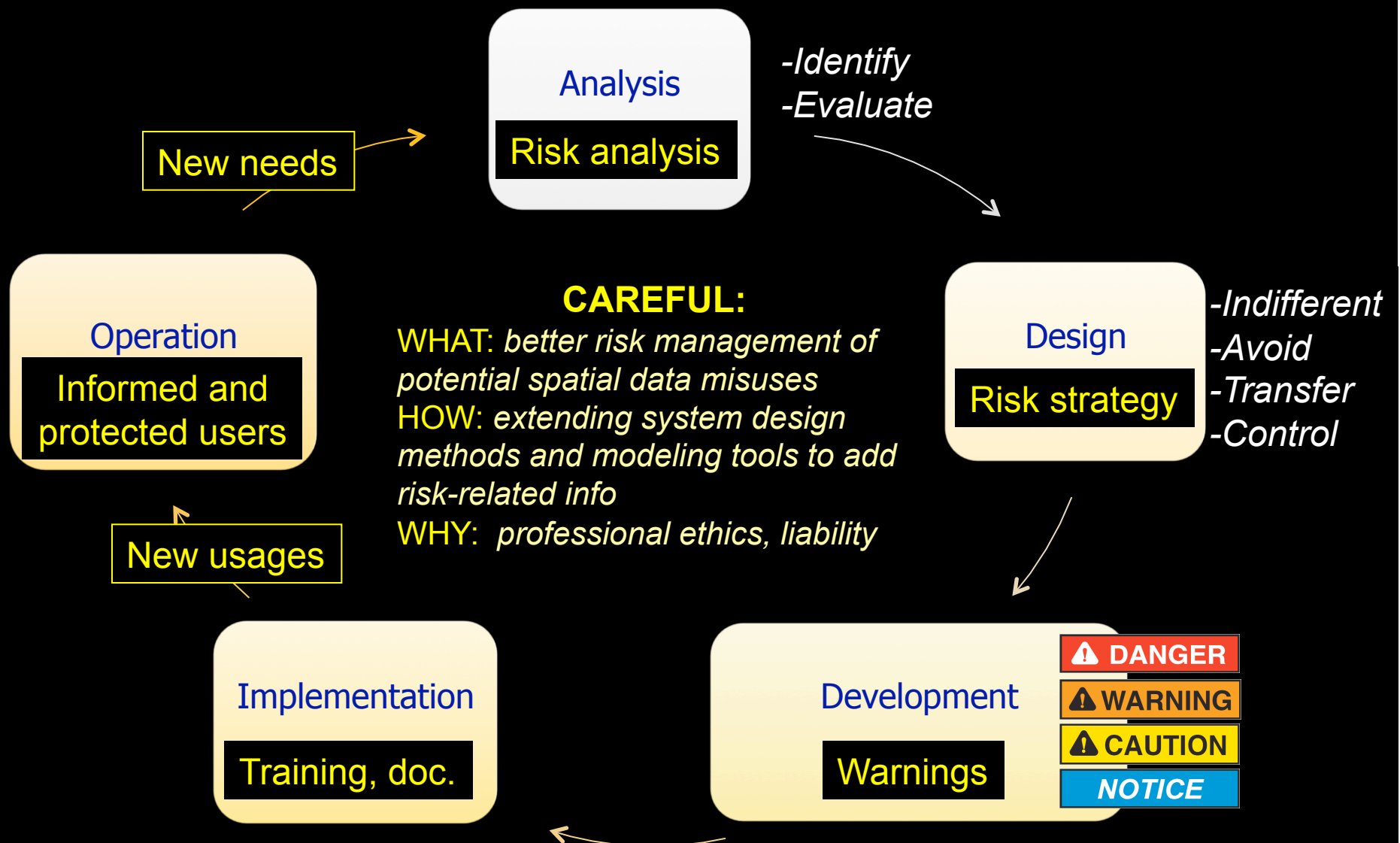
Ethics-related issue

- ◆ This is the basis for a proposed new ethics-centered approach that integrates good practices into geospatial system development.
- ◆ It adds more ethics into Software Engineering, Geomatics Engineering, and Risk Management with regard to geospatial data usage
- ◆ *This new approach is called **C.A.R.E.F.U.L.***
 - ◆ *(Computer-Assisted Risk Evaluation For Usage Limitation)*

A New Approach called « C.A.R.E.F.U.L. »



A New Approach called « C.A.R.E.F.U.L. »



A New Approach called « C.A.R.E.F.U.L. »

modele_reseau_routier_v2.vsd - Microsoft Visio

File Edit View Insert Format Tools Shape Window Perceptory Help

Type a question for help

Class (anglaisGDF)

Stereotype name: << >>

Class Name: road segment

Implementation name: seg_routier

☐ Abstract class

Semantics | Spatial definition | Temporal definition | Attribute definition | Operation definition | **Risk description**

Definition: A linear Section of the earth which is designed for

Derivation rules:

Aliases:

Code:

Visibility:

Package name: Road network

RISK DESCRIPTION NO RISK008

1. RISK IDENTIFICATION

Title: Road segmentation

OFFICIAL REPORT DESCRIPTION: It's important to know how the data you will use are segmented. Are there segmented when a road segment passes over another one, at administrative area boundaries, when a road segment crosses a railroad track?

IDENTIFIED BY: Yvan Bécard Date (JJ/MM/AAAA): 26.03.2007

PROJECT PHASE: Database Design

POTENTIAL RISK 7: ☒ Oui ☐ Non

Risk description: It is more difficult to build a network when data are segmented at unreal intersection like when a road passes over another.

Risk MINIMUM: Transactional data source

CATÉGORIE DU RISQUE: Qualité interne des données sources

NOM DU QUES TOUCHÉ: Aléas - établissements

LIEN POTENTIEL AVEC D'AUTRES RISQUES: ☐ Oui ☒ Non Si Oui, donnez le(s) numéro(s):

2. RISK ANALYSIS

CRITÈRES D'ANALYSE: Probabilité d'occurrence: Moyen Gravité des conséquences: Moyen Niveau de dangerosité globale: Moyen

JUSTIFICATION: Probabilité: Étant donné que les utilisateurs du cube ne proviennent pas du milieu de l'éducation et conséquemment, ne connaissent pas de façon approfondie la répartition des écoles sur le territoire, la probabilité qu'ils considèrent que les données soient complètes est relativement importante.

Gravité: Nous savons qu'environ 2% des immeubles scolaires de la province de Québec n'étaient pas compris dans le jeu de données qui nous a été transmis pour cartographier les écoles. Il est cependant impossible de déterminer la proportion d'immeubles qui sont absents du territoire couvert par le prototype. Vu l'ignorance de cette proportion et l'importance du besoin de connaître la répartition et le nombre d'école sur le territoire à l'étude, la gravité des conséquences négatives possibles est donc jugée à "moyen".

Est-ce que le risque est tolérable? ☐ Oui ☒ Non

JUSTIFICATION: Puisque le niveau de dangerosité du risque est moyen, il serait préférable de tenter de le réduire.

3. RISK MITIGATION PLANNING

OPTION(S) DE TRAITEMENT DU RISQUE: ☒ Incrimination ☐ Événement ☐ Contrôle ☐ Transfert

JUSTIFICATION: Puisque le risque n'est pas suffisamment important pour justifier le retrait complet des données relatives aux bâtiments de type "école", il serait préférable de tenter de contrôler celui-ci.

CONCEPTEUR: ☒ Prévention intrinsèque ☐ Formation

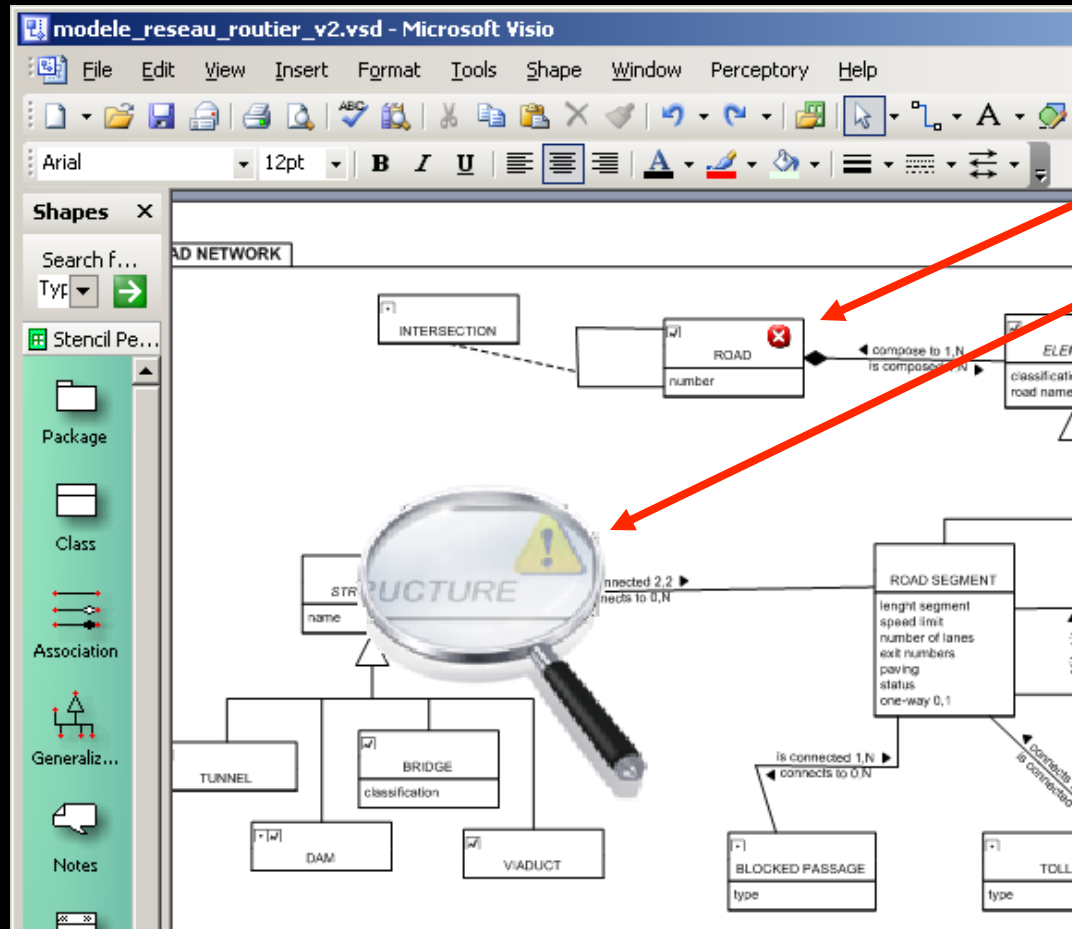
UTILISATEUR: ☐ Mesures supplémentaires ☐ Autre

Mesure(s) de prévention: ☒ Information pour la sécurité ☐ Autre

Si l'information pour la sécurité, veuillez remplir le formulaire « Informations relatives à une mise en garde » et spécifiez son numéro: 008

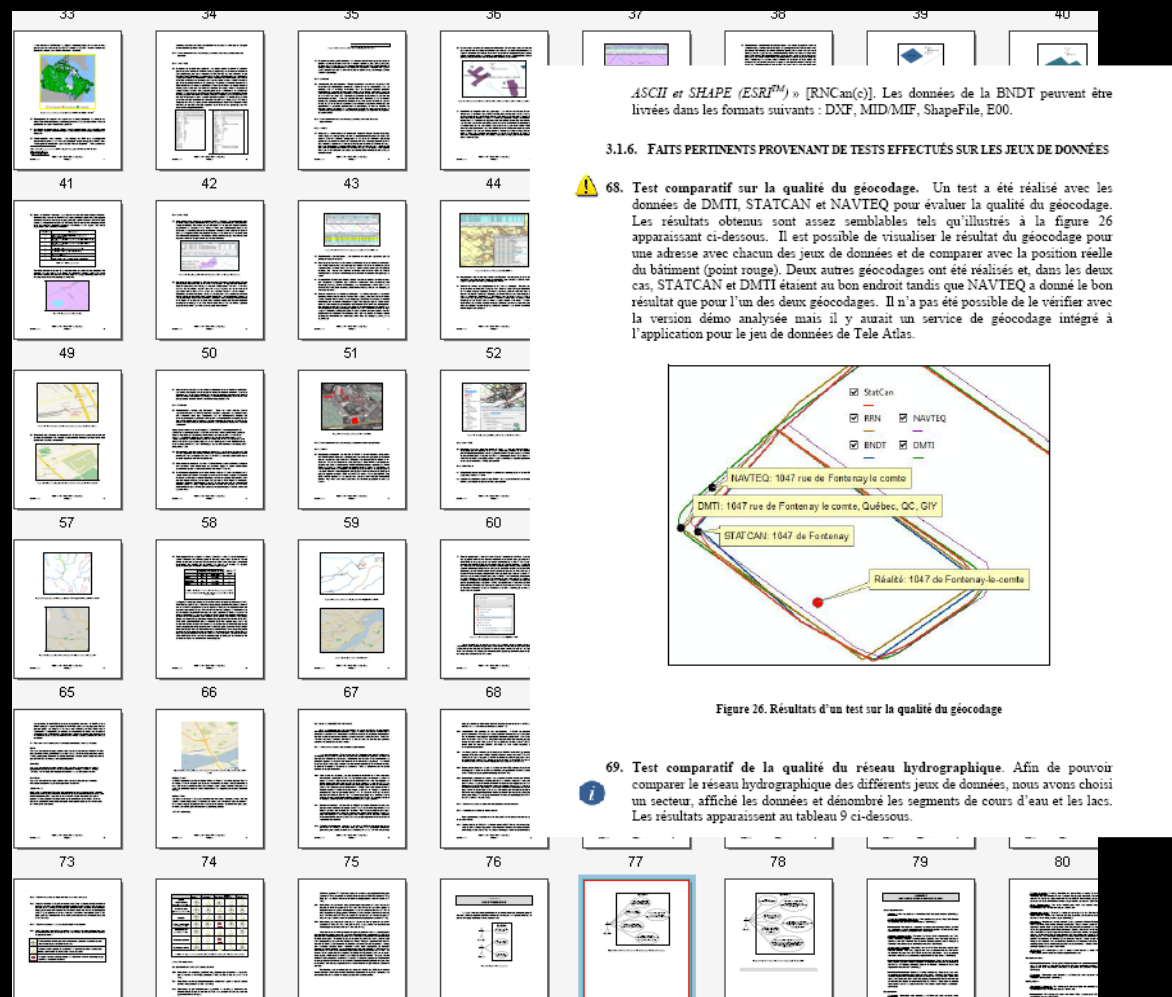
Risk-related
metadata
in
Data modeling
tool

A New Approach called « C.A.R.E.F.U.L. »



ISO-3864-2
Symbols
for Warnings
in
Data
Modeling Tool

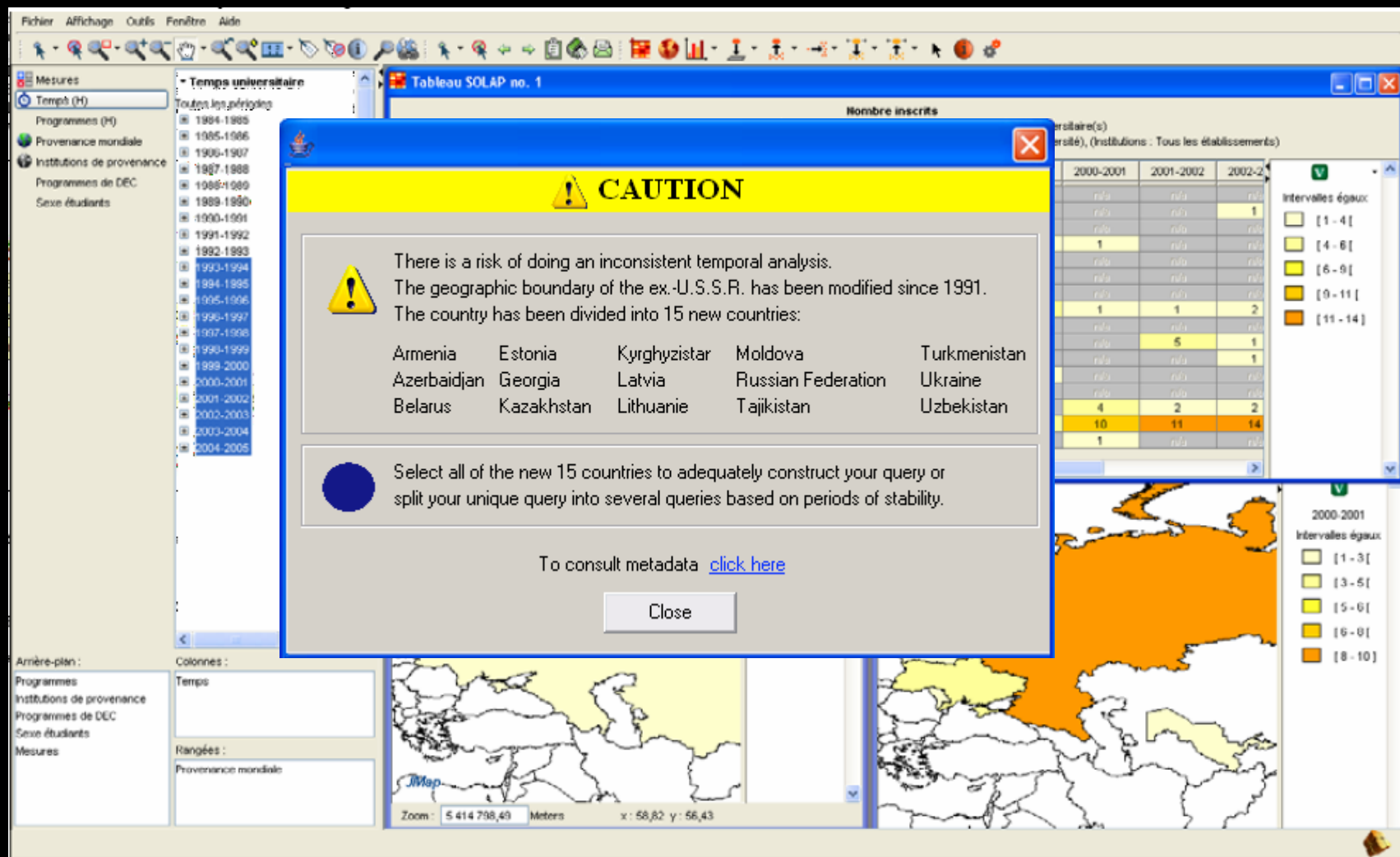
A New Approach called « C.A.R.E.F.U.L. »



Risk-Related
Reporting
with the help of
Data Modeling
Tool

- user manual
- training material
- fitness-for-use report
- ...

A New Approach called « C.A.R.E.F.U.L. »



Context-sensitive Warnings Generated from Data Modeling Tool

More New Solutions

- ◆ A group of researchers have started a new project involving Ethics among several elements of solutions
 - ◆ GEOIDE Project #PIV-23



Geomatics
Engineering



Faculty
of Law



Geography



Geomatics
Engineering

GEOIDE Project #PIV-23

- ◆ 7 Canadian researchers
 - ◆ Geomatics, Law, Geography
- ◆ 4 international researchers
 - ◆ USA, France, UK, Holland
- ◆ 10 governmental and industrial partners



International Civil
Aviation
Organization



Natural Resources
Canada



Transports
Canada



Infrastructure
Canada

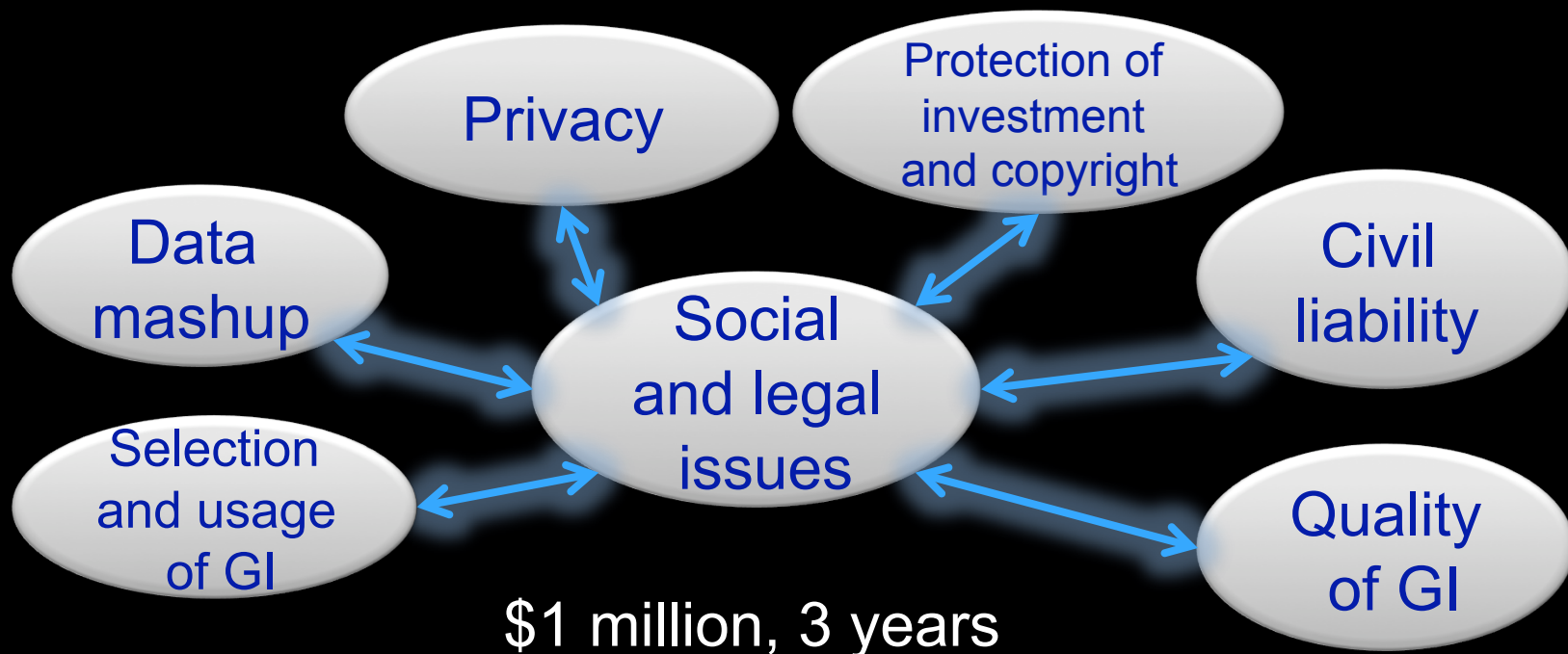


Office of the
Privacy Commissioner
of Canada



GEOIDE Project #PIV-23

Objective: to develop innovative solutions to evaluate GI quality and contribute to its responsible commercialization and hence achieve an healthy protection of the public



<http://dataquality.scg.ulaval.ca>

PUBLIC PROTECTION AND ETHICAL GEOSPATIAL DATA DISSEMINATION

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Stakeholders



Examples of insufficient protection

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Bibliography



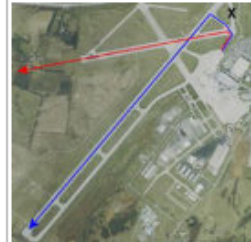
Private Section

Informations:

[6th International Symposium on Spatial Data Quality Quality: From Process to Decisions](#)
[Dates: July 6th-8th, 2009](#)

EXAMPLES OF INSUFFICIENT PROTECTION

Plane took off on a wrong runway and crashed in flames



Date: 2006-08-00

Place: Lexington, Kentucky

Country: USA

Description: Plane took off on a wrong runway and crashed in flames because the Pilot used an outdated airport map. IMPACT: 49 persons were killed

A Polish bus falls and crush on a road of the Alps



Date: 2007-07-00

Place: Laffrey (Isère)

Country: France

Description: A Polish bus falls and crush on a road of the Alps because the driver followed the GPS's instructions. However, according to the road signs, the road is prohibited for bus IMPACT: 26 dead

Conclusion: Impacts on Education

- ◆ Maturing market => Increased interest into ethics
- ◆ More PhD and MSc projects in this field
- ◆ New courses and new content in curricula
 - ◆ Ex. Laval graduate course « Geospatial Data Quality »
 - ◆ Ex. U. Ottawa graduate course « Geospatial Data and Law »
 - ◆ Ex. MUN new material within GIS course
- ◆ Continuing Education
 - ◆ Ex. training for future lawyers at Univ. Ottawa
 - ◆ Ex. Laval 2-day course on Spatial Data Quality

Conclusion: Impacts on Professional System Designers

- ◆ Ethics leads to protecting users against harm
 - ◆ Several approaches exist to reduce risks
- ◆ Ethics leads to manage the risks related to uncertain data or inappropriate uses of data
 - ◆ including unintended uses
- ◆ CAREFUL is a new ethics-centered approach extending formally proven software engineering methods
- ◆ Other projects are going on in our GEOIDE team