



We need a more ethical dissemination of geographic information data and products

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PUBLIC PROTECTION AND ETHICAL GEOSPATIAL DATA DISSEMINATION
AN INITIATIVE OF GEOIDE (PROJECT IV-23)



Outline

- *The talk in short:*

The GIS world changed and is changing even more rapidly...

...but software vendors and data producers did not change their practices as fast.

This situation possibly creates more ethical problems ...

...but changes to professional practices could be adopted to make them more ethical

A simplified view of GIS history

Phases

Users

1960s

Pioneers

System developer

1970s

Early adopters

1980s

Expansion

Expert user

1990s

Democratization?

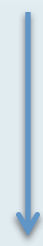
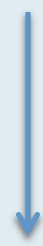
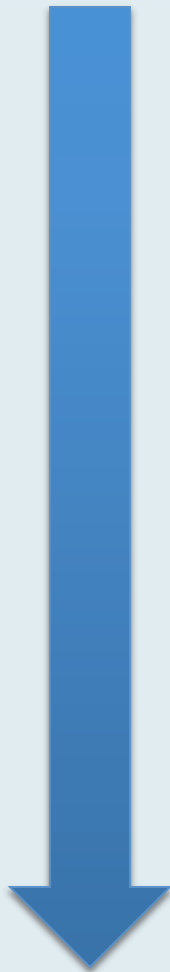
2000s

Neogeography

2010s

Real democratization?

My grand-mother





The new geospatial landscape

More data collected (e.g. earth observation, LiDAR, sensor networks, VGI)

+

More data made available (e.g. SDI/Data clearinghouse, Web services, mashups) and increasingly used in mobile devices

+

More, and more diverse, users and usages

=

Possibility of more accidents, losses of money, time and lives due to data/map errors and misuses

Misuses likely to increase with new geolocation technologies



Frequent accidents related to the (mis)use of geographic information

FILED UNDER [GPS](#)

GPS coordinates lead demolition crew to destroy wrong house


By Paul Miller  posted Jun 1 2007 2:35 PM



Tired of blaming GPS on petty mishaps like the [destruction of cars](#), a demolition crew in Georgia has managed to accidentally destroy an entirely wrong house based on GPS coordinates. Oddly enough, it wasn't even the first time they'd been by: the man who cuts the grass noticed that the power box was missing from the home and holes were punched into the walls about a month ago -- it was suspected as vandalism, but it now seems that the stealthy, directionless demolition company was to blame. The demolition company says it had "paperwork" authorizing the destruction, complete with the coordinates and a description of the home, which the owner's father had built with his own hands "brick by brick."

[Thanks, Leonard]

Driver follows GPS onto pedestrian walkway, into cherry tree

By Joshua Topolsky  posted Jul 21st 2007 5:15 PM



In another example of the evils of computer navigation, a 37-year-old trucker [followed his GPS](#) directions to their [totally illogical conclusion](#) when he drove his truck down a pedestrian walkway and wedged the delivery vehicle into a cherry tree. The driver, who was looking for a factory to drop off his cargo, blindly followed the female voice of his navigation system, apparently ignoring several no-entry signs and turning onto the walkway in broad daylight. The motorist then attempted to reverse out, damaging two lamp posts, a hedge, and of course the cherry tree, which Swiss workers later had to take a chainsaw to. The tucker was fined 650 Swiss francs (about \$540), and his GPS was given a firmware update and a copy of Google Maps.

[Thanks, pork_musket]



Wrong map leads to Timor border skirmish

October 10 1999 at 05:31PM



Get IOL on your mobile at m.iol.co.za

Dili, East Timor - Confusion over the exact location of the border between the two halves of Timor island triggered a clash involving a United Nations interven said on Sunday.

"The incident occurred 500m insid according to a 1992 Indonesian m The Indonesians were using a 19 which showed the village to be ins said on condition of anonymity.

Asked whether the contact had bee Indonesian security forces, he said say."

Interfet earlier said that the clash o travelling near the border came un militias. It said two militiamen mig **Continues Below ↓**



Google map part of Central America dispute

Last Updated: Monday, November 8, 2010 | 12:04 PM ET [Comments 14](#)[Recommend 14](#)
[CBC News](#)



Costa Rica alleges Nicaraguan soldiers, shown here near the San Juan River on Nov. 4, recently crossed over into Costa Rica. However, Nicaraguan commander Eden Pastora told the Costa Rican newspaper La Nacion on Nov. 2 that a Google map shows that Nicaraguan troops were on their own side of the border. (Bismar Picado/La Prensa/Reuters)

A Google map cited by Nicaragua after an alleged military incursion into Costa Rica had an error in it that is being fixed, Google says.

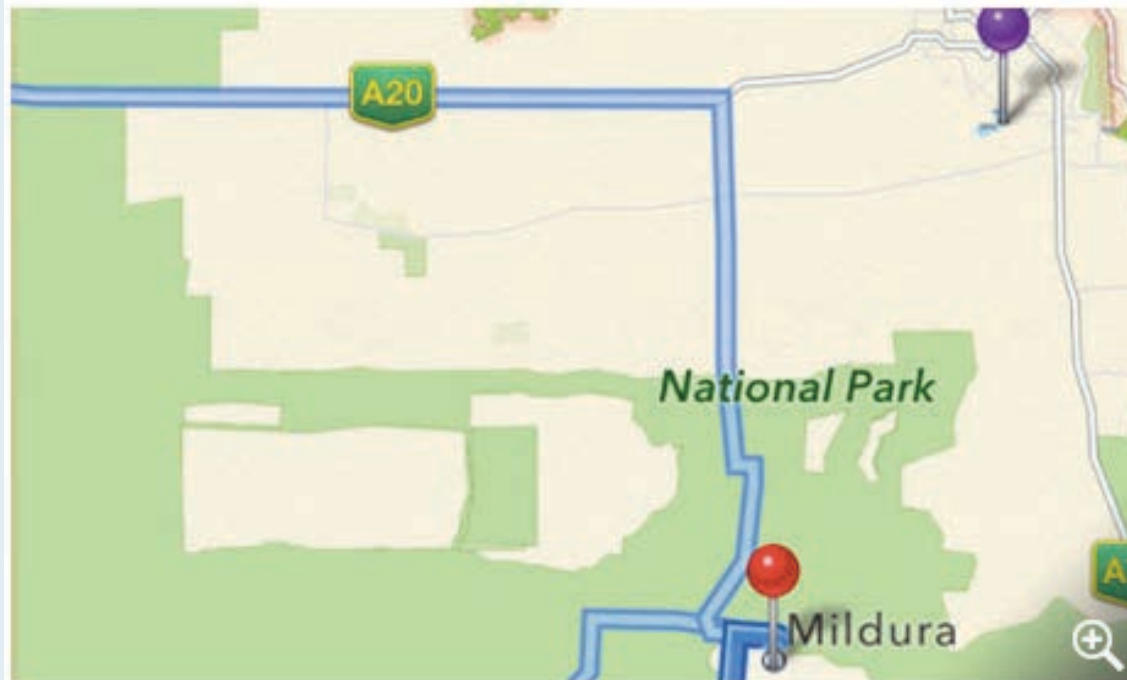
Apple redraws maps after Australian drivers led astray in the bush

Mildura police issue warning after motorists lose way in scorching temperatures because town misplaced on Apple Maps

Charles Arthur

guardian.co.uk, Monday 10 December 2012 08.02 GMT

 Jump to comments (157)



Apple Maps: the red pin shows where the map service has marked Mildura. The purple pin shows the actual location of the town. Photograph: Google Maps





Can GIS can be “dangerous” ?

- A famous court decision in the US described charts as **dangerous products** as they are not only used for simple reading but could also lead to action - "product in a defective condition unreasonably dangerous to the user" (Brocklesby v. United States & Jeppesen and Co., 1985)

Dangerous products

CAUTION
HYDROCHLORIC
ACID



NO Dangerous Goods on aircraft



Are you carrying them in your luggage or on your person?

If you have any Dangerous Goods, **declare them!**
Carrying these substances may be an offence and may result in prosecution.

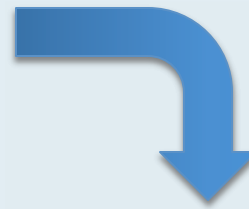


?

Safe products can also be dangerous in some contexts



Experts know how to safely handle dangerous products



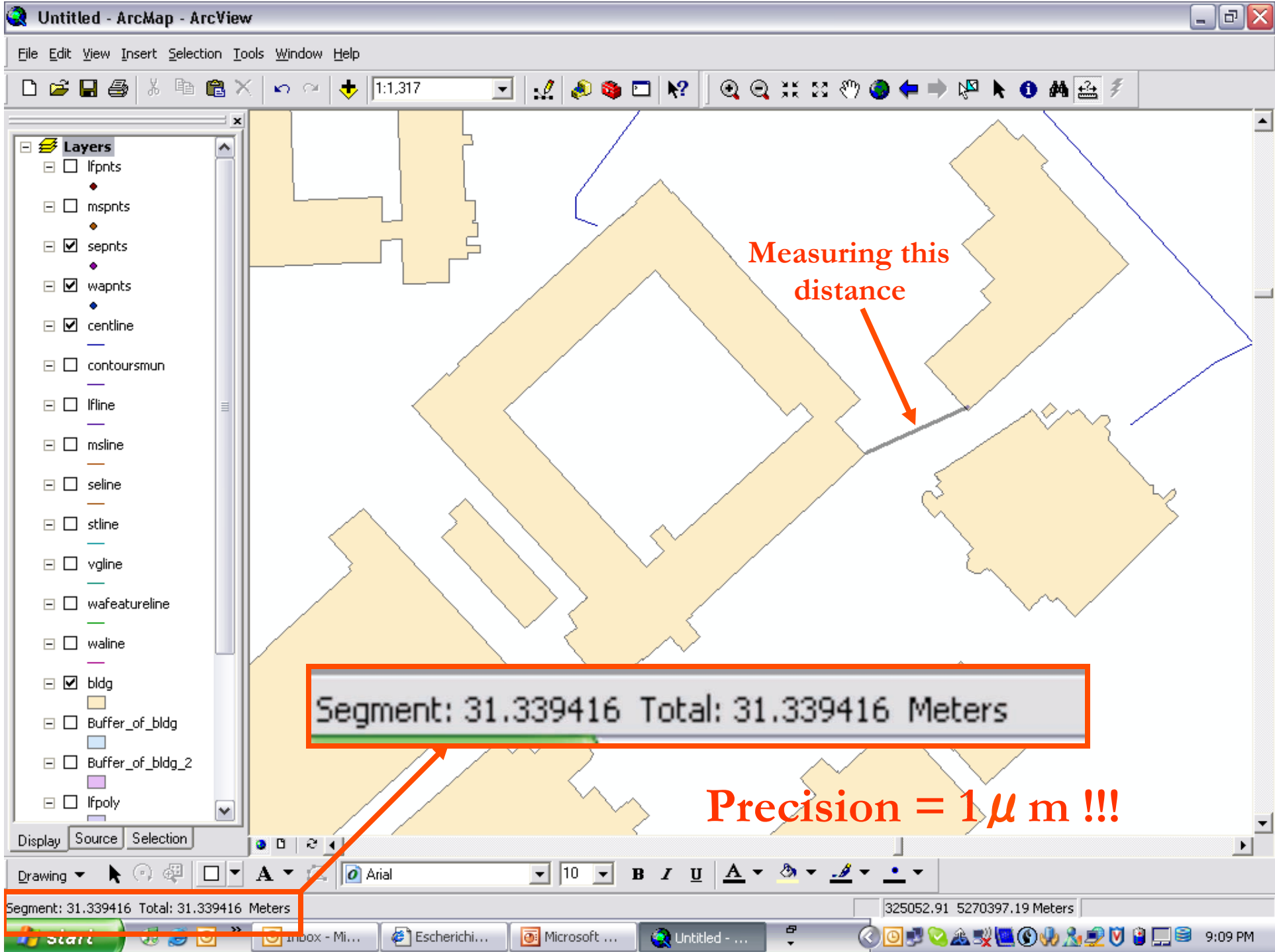
Should this be the
geospatial
(r)evolution?



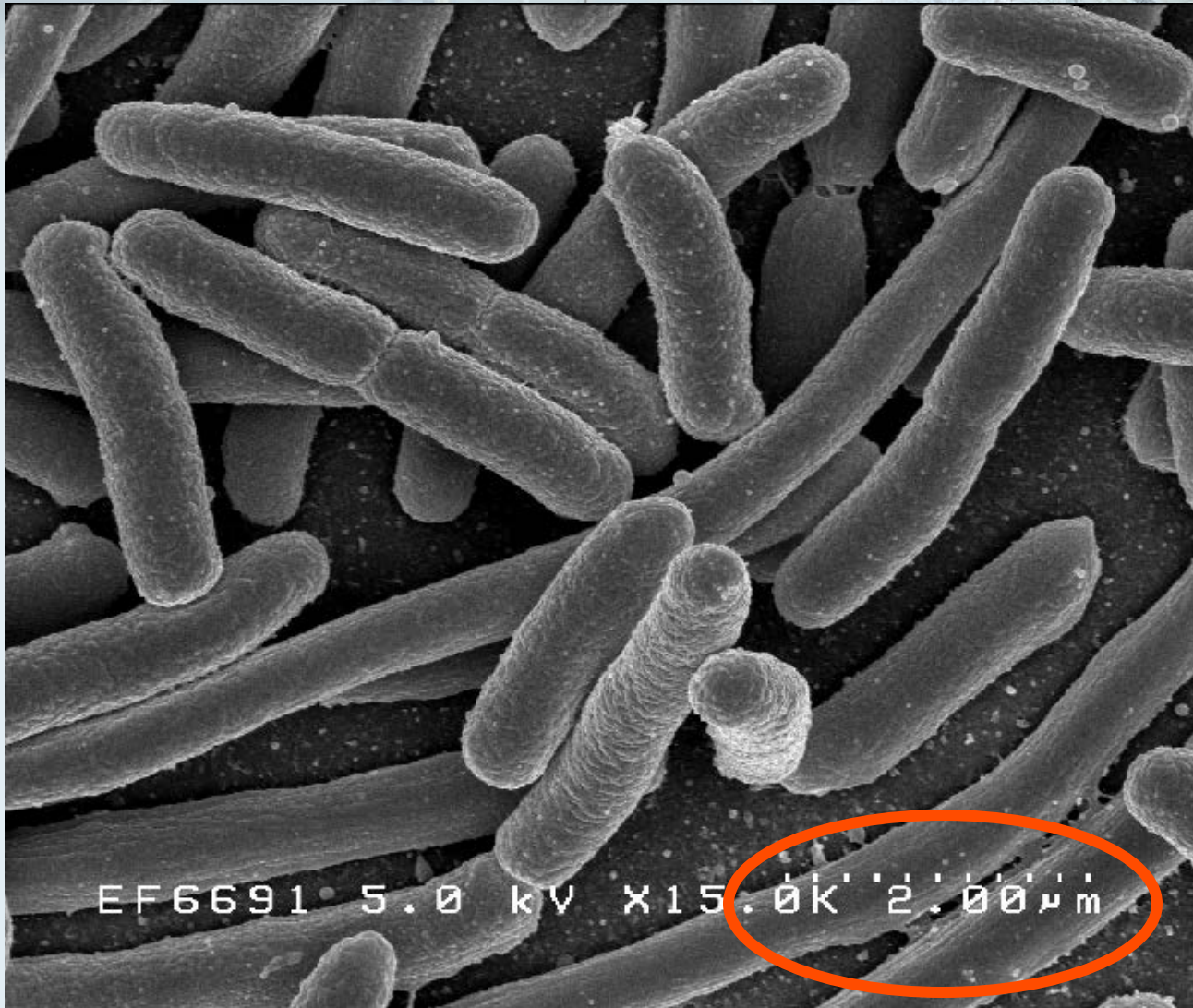
The background of the slide is a composite image. On the left, there is a satellite in orbit. In the center, there is a map with a grid overlay. On the right, there is a scale of justice. The text is overlaid on this background.

Simple geospatial applications have hidden complexities

- “The power and imperfections of emerging GIS technology invite misuse” (Goodchild and Kemp, 1992)
 - Reinforced with more recent geospatial applications
- Modern geospatial applications have an underlying complexity that can require an expert understanding to be used properly
- Even simple geospatial applications (e.g. Google Map) can require understanding complex concepts to be used without risk



Are we misleading users on the results they can expect ?



Escherichia coli



How did data producers and software vendors adapt?

While well-established methods exist for data producers to measure the quality of the data...

... producers too rarely do it (expensive, time consuming)

While international standards exist for describing and storing metadata that could inform users...

... only few geospatial applications allow this or looked for alternatives to metadata

While a large literature proposed methods to visualize/communicate data quality in GIS...

... software vendors do not use any (not a priority)



What users do not always understand

- Accident implying geographic information indicate that map/GIS users often do not understand that:
 - Data can be **out of date** (e.g. Canadian topographic maps are on average 30 years old)
 - Data can be **incomplete** (by accident, or by design)
 - Data can be **inaccurate** (e.g. topographic maps often around 10-20 meters accuracy and generalized)
 - Data may not **represent** the world as they would like to see it (different abstractions/models)
 - **Analysis** (e.g. shortest route) based on imperfect data can in turn be imperfect
 - Etc.



We need new ways of protecting the public!

- We should increase our efforts to:
 - **help users access** the right **data** for the task at hand
 - **inform users of the quality** of the data **and** potential **risks** of misuse
 - **avoid misleading users** by providing precise (but inaccurate) measurements
 - **act like professionals** with the duty to protect our clients (e.g. codes of ethics of engineers, doctors, lawyers)
 - Etc.



Being more explicit in GIS Codes of ethics?

- GIS Certification Institute (GISCI) code of ethics
 - Obligations to Society
 - Do the best work possible
 - Contribute to the community
 - Speak out about issues
 - Obligations to Employers and Funders
 - Obligations to Colleagues and the Profession
 - Obligation in Individuals in Society
- No clear statement/mandate to protect customers

Geospatial clearinghouses / Geoportals

INSPIRE GEOPORTAL
Enhancing access to European spatial data

EUROPEAN COMMISSION > INSPIRE > INSPIRE GEOPORTAL > Discovery / Viewer

Find a place in: Europe

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Discover Information Geographically

Advanced Search

Active Layers: 0

Europe

Australia

GeoConnections - Discovery Portal
An Official Web Site of the United States Government

Home Search Catalogue

GEO.DATA.GOV

Search

Additional Options
Clear

WHERE
 Anywhere Intersecting Fully within

Search by geography?
 Entire Province
Or locate your area here

Search

Canada

USA

NOVA SCOTIA CANADA

HELP FAQS FEEDBACK BACK FORWARD LOGIN

Search

Search by geography?
 Entire Province
Or locate your area here

Search by subject?
Full Text Search:
Match:
 Any word
 Exact phrase
 All words

Search by date?
 Anytime
 Time Period for Data (yyyymmdd)
From:
To:
 Last published date (yyyymmdd)
After:

Nova Scotia Geographic Catalogue Version 2.0 (2009-May)
The contents of this site are best viewed with an enhanced browser such as Microsoft Internet Explorer 7.x

This page and all contents Crown copyright: 2008
Government of Nova Scotia Internet Privacy Statement
Comments to: geonova@gov.ns.ca /2004-Feb.

Nova Scotia (Canada)

Tested ways to help users select more suitable geospatial data

The screenshot shows a web interface titled "Personalized Fuzzy Logic Retrieval Portal". It is divided into three main sections: Search, User Profile, and Search Results. Brackets on the left side of the image group these sections under the labels "Search criteria", "User profile", and "Search results".

Search criteria

Search

Search Terms:

*Please separate search terms with spaces.

User profile

User Profile

Search results

Search Results

Number of records retrieved: 99

1	Canada Land Inventory (1:250,000) - Land Capability for Waterfowl
2	Canada Land Inventory (1:250,000) - Land Capability for Waterfowl
3	Canada Land Inventory - 1:1,000,000
4	Sand Dune and Climate Change Studies in the Prairie Provinces in Canada
5	National Harvest Survey - Information on hunting activity and migratory game bird harvest in Canada
6	Ecosystem Modelling in the Northwest Atlantic (CDEENA Program)
7	North American Bird Banding and Encounter Database
8	ABMI Web GIS Application
9	Species and Plant Community Database, Manitoba, Canada

(Wilson *et al.*, 2013)

Starting at the data production stage...











The screenshot shows the Microsoft Visio interface for a class diagram. The class is named 'road segment' (Class Name) and 'seg_routier' (Implementation name). The 'Risk description' tab is active, displaying a form with the following sections:

- RISK DESCRIPTION** (No RISK008)
- 1. RISK IDENTIFICATION**
 - Title: Road segmentation
 - OFFICIAL REPORT: It's important to know how the data you will use are segmented. Are they segmented when a road segment passes over another one, at administrative area boundaries, when a road segment crosses a railroad track?
 - IDENTIFIED BY: Yvan Bédard
 - PROJECT PHASE: Database Design
 - POTENTIAL RISK?: 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 MINIMAL?: Oui Non
 - CATÉGORIE DU RISQUE: Transactions, data source
 - NOM DU QUÉBEC TOUCHÉ: Qualité interne des données sources
 - LIEN POTENTIEL AVEC D'AUTRES RISQUES: Oui Non
- 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 scores 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 connus 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 assés 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 étudier, 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 ou risque est moyen, il serait préférable de tenter de le réduire.
- 3. RISK MITIGATION PLANNING**
 - OPTION(S) DE TRAITEMENT DU RISQUE: Incompétence; Convoitise; Événement; 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; Mesures supplémentaires; Information pour la sécurité; Autre
 - UTILISATEUR: Formation; Autre
 - MESURE(S) DE PRÉVENTION: Autre

Adding metadata on possible risks in database modeling tools

(Levesque *et al.*, 2007)

... to provide users with recommendations

Qualité globale du jeu de données : 	
Définition des données : 	 Il n'est pas précisé si les maisons incluent les maisons mobiles.
Couverture : 	 La couverture des données convient à vos besoins.
Généalogie : 	 Seulement les informations sur les traitements des données sont disponibles
Précision : 	 Les méta données sont insuffisantes pour évaluer ce critère.
Accessibilité : 	

Data coverage fits users' needs

Metadata are not sufficient to assess spatial accuracy

(Bédard *et al.*, 2012)

Aiming for Quality-Aware GIS

The screenshot displays a GIS application window with a map and a 'Quality Report for Operation: MEASURE' dialog box. The map shows a measured distance of 3908.89 meters between points A and B. The dialog box provides a detailed quality assessment.

Data layer

Quality element

Quality information

Quality Report for Operation: MEASURE

The measured distance: 3908.89 Meters can be subject to inaccuracies. Please consult the quality information below:

Elements of data quality:

- Positional Accuracy
 - Positional Accuracy
- Completeness
 - Omission
- Logical Consistency
 - Format Consistency

Layers

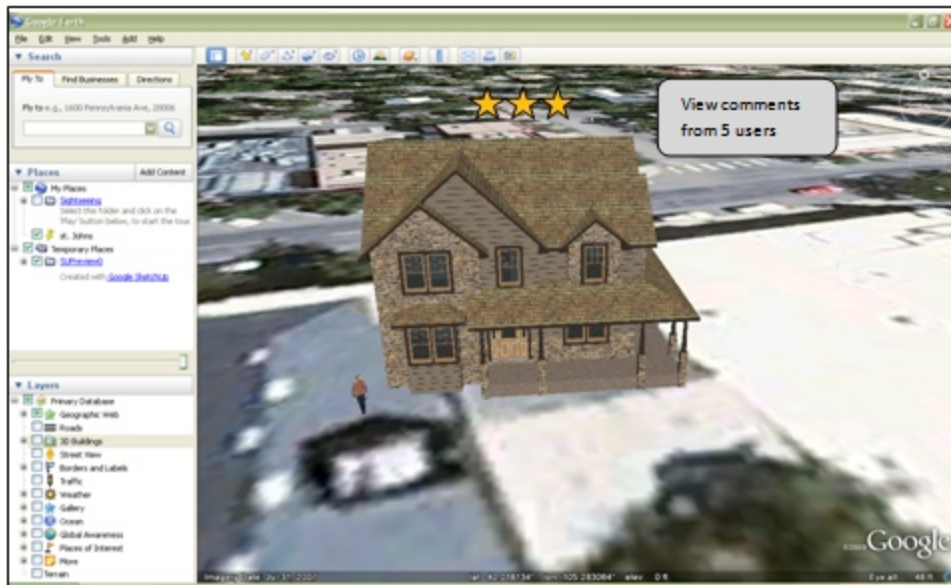
Layers	Metadata description
1 Bridges	The accuracy of geometric representation data is given by the difference between the position of the geometric
2 Camp	The accuracy of geometric representation data is given by the difference between the position of the geometric
3 Road	The accuracy of geometric representation data is given by the difference between the position of the geometric

Hide empty metadata classes

View entire metadata for layer: [dropdown]

(Zargar *et al.*, 2009)

Better communicating the quality of user-generated geographic information



(Jones *et al.*, 2013)

The background of the slide is a composite image. On the left, there is a satellite in orbit. In the center, there is a map with white lines representing data or roads. On the right, there is a scale of justice, symbolizing ethics and law. The overall theme is the intersection of technology, geography, and ethics.

Conclusions / Recommendations

- GIS software and data producers should:
 - Feel more concerned about their **ethical responsibility** to protect the users of their products
 - Adopt more **consumer protection** approaches
 - **Help users** find the best available data
 - **Provide tools** to document and communicate potential risks that could arise from using their products/data
- The professional and academic communities should more clearly include the **protection of customers** in their codes of ethics/conduct

Thank you – questions?



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