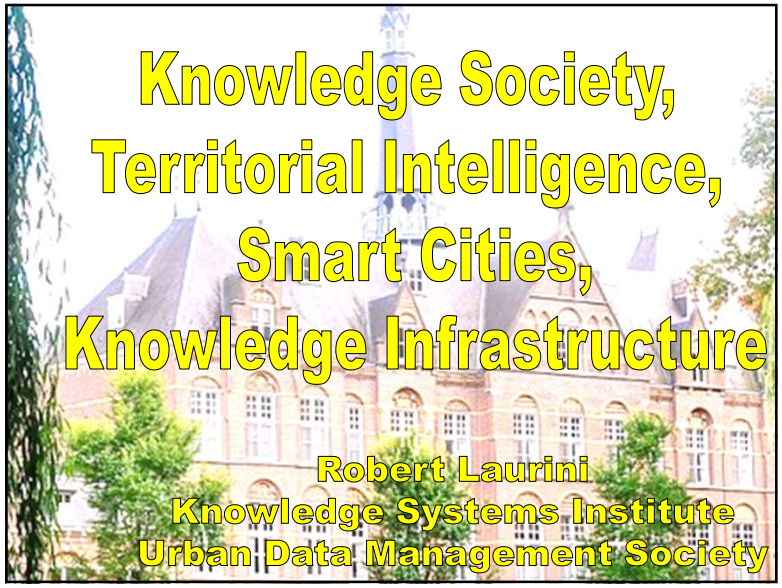


Knowledge Society, Territorial Intelligence, Smart Cities, Knowledge Infrastructure

1 – About knowledge and the knowledge society

2 – Smart cities and territorial intelligence

3 – Geographic knowledge for smart cities

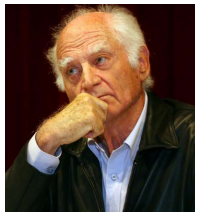
4 – About geospatial rules

5 – Geographic Knowledge Infrastructure

6 – Conclusion and research agenda

Michel Serres

"*Knowledge is now the infrastructure*"

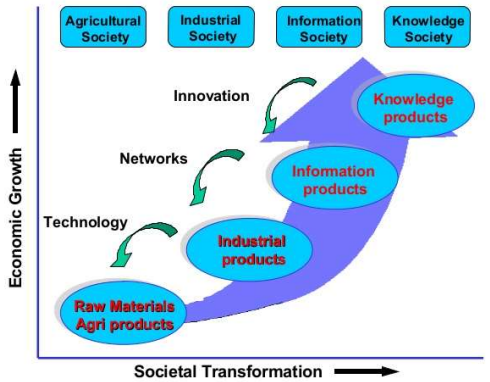


1 – About knowledge and the knowledge society

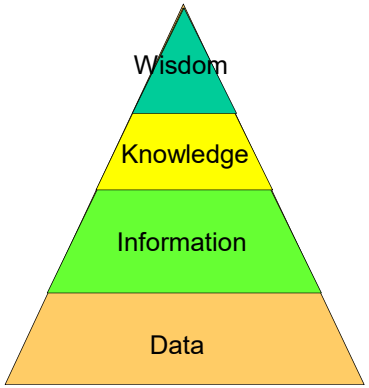
What is knowledge?

How can knowledge be an infrastructure for smart cities and territories?

Societal Transformation



Data, information, knowledge



Applica-tion	I do stop
Context	If the traffic light is red, I do stop
Meaning	Traffic light of George Washington Avenue is red
Raw data	« Red », 234, 10.34, « George Washington »

Cake metaphor (Gurteen)

Data: molecular components

Information: ingredients

Knowledge: recipe (know-how)

Wisdom: choose to whom to make the cake (know-why)

Definition of Geographic Knowledge

Geographic knowledge corresponds to information potentially useful to

- explain,
- manage,
- monitor
- plan a territory
- and to innovate from another territory

2 – Smart cities and territorial intelligence

Dozens of definitions

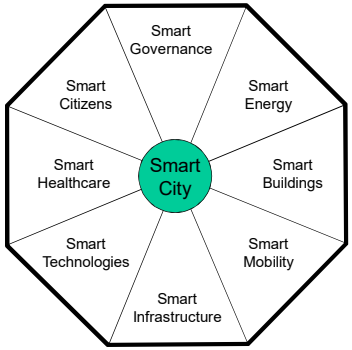
Only a few

Carlo Ratti's Definition

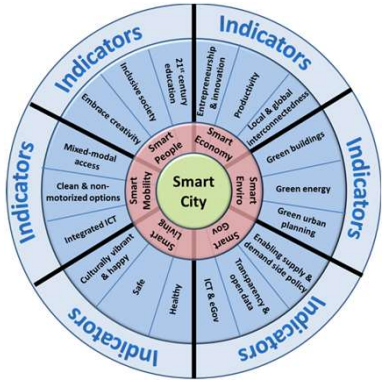
Dr. Carlo Ratti, director of the MIT Senseable City Lab, claims that an intelligent or smart city is

- technological,
- interconnected,
- clean,
- attractive,
- comforting,
- efficient,
- open,
- collaborative,
- creative,
- digital and green.

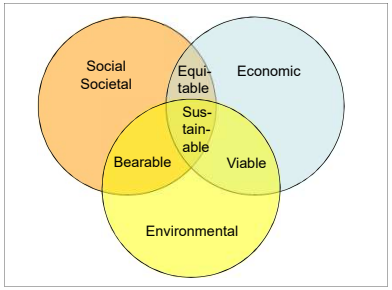
Mathew's diamond



Boyd Cohen's wheel



Pillars for territorial intelligence



Territorial Intelligence

Territorial Intelligence
=
(Territory
+
Collective Human Intelligence
+
Artificial Intelligence)

➔ Sustainable development)

3 – Geographic knowledge for smart cities

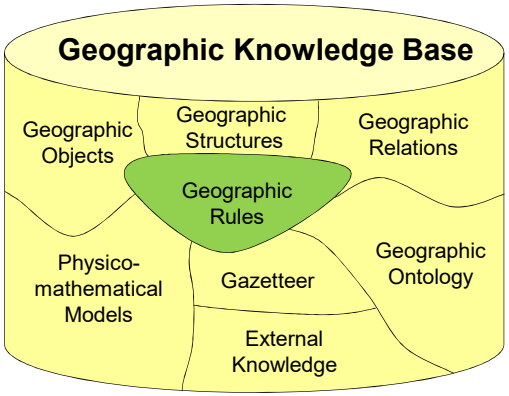
Description of the territory

Description of its dynamics

Description of projects

➔ Projections for the future

GKB Components



Geographic Projects

Where to put a new airport, a new hospital, a new stadium, etc.?

Is this new construction project compliant with planning rules?

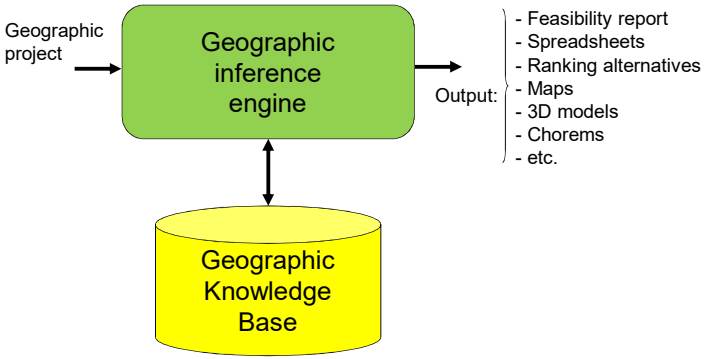
What is the best mode or the best way to get from *A* to *B*?

How to organize a plan for green spaces in a city?

How to reorganize common transportation?

etc.

Usage



4 – About geospatial rules

Rules must be considered as first-class citizens in IT (Graham, Morgan, Ross, etc.)

Generally, in business intelligence:

IF-THEN-fact

IF-THEN-Action

Encoded by means of logic

But for geospatial rules: geometry, topology, etc.

Examples of geospatial rules (1/2)

If a lane is narrow, make it one-way, except if it is a cul-de-sac (dead end);

When planning a metro, move underground networks;

No parking, no business;

Each building must be connected to utility networks (water, electricity, gaz, telephone, internet, etc.);

Council flats must be connected to urban heating systems;

If a cross-road is dangerous, install traffic lights;

In city centers, transform streets into pedestrian precincts;

When a commercial mall is planned in the neighborhood of a city, shops located in the city center will be in jeopardy;

If the number of car parking lots is insufficient, encourage using buses or bikes;

At the vicinity of an airport, limit building heights

Examples of geospatial rules (2/2)

When a big plant is closing, unemployment will increase;

At the vicinity of an historic building, no modifications of building are allowed

Every lamppost can be considered as holder of sensors (temperature, pollution, noise, etc.);

When defining a new industrial area, unemployment will diminish;

When a road is wide and buses are running, provide a bus lane;

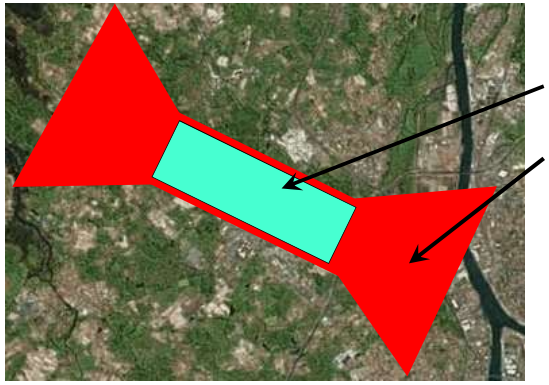
If a recreational park is inside a city, provide bike lanes coming to this park;

In France, it is forbidden to open a new tobacconist shop within 500 meters from an existing one;

If there is one or several rivers crossing a city, design systems to mitigate floods;

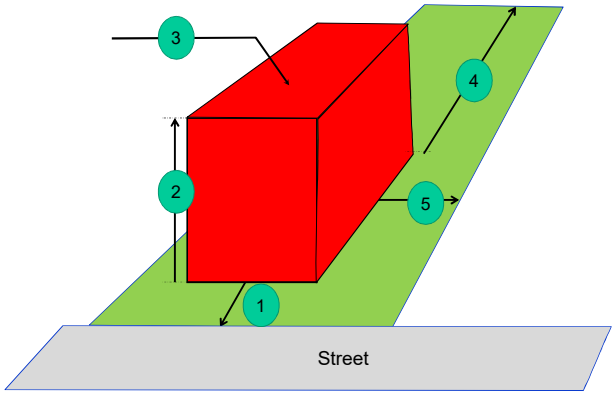
In a city with many hills, consider cable-cars linking them.

Near airport

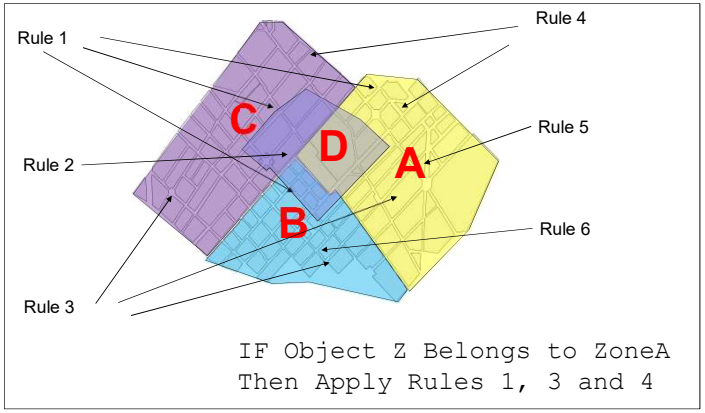


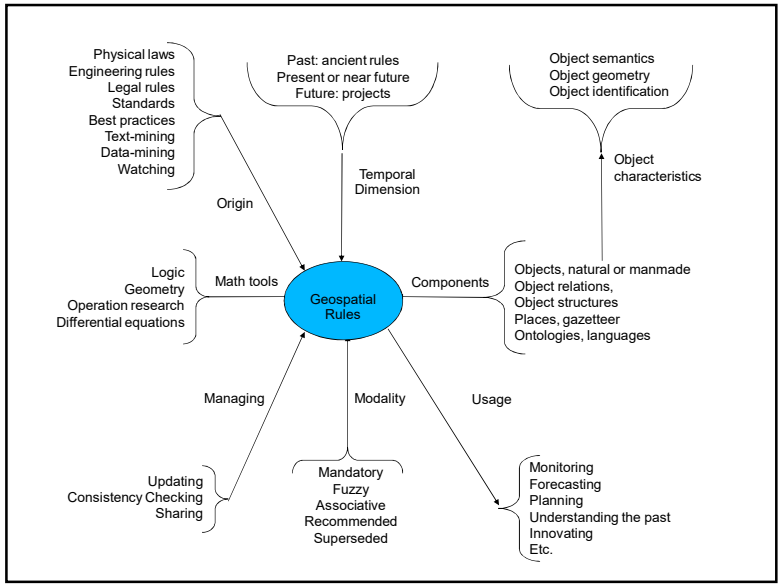
Polyg (150,2 240,151 470,268 670, 250 551,512 455,375 197,249 11,252)

Planning rules



Located rules





First typology of geospatial rules

Co-location rules: "*if something here, then another thing nearby*"

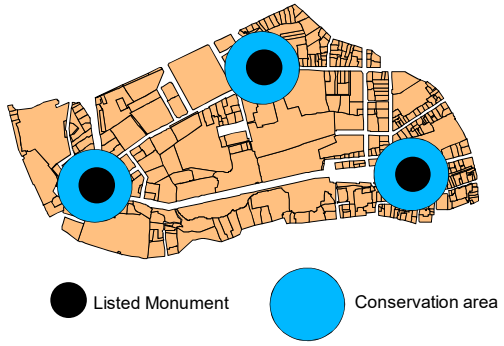
IF-THEN-Zone: for the creation of a zone

Metarule: "*IF some conditions hold, THEN apply RuleA*"

Located rule: "*IF in a place B , THEN apply RuleB*";

Bi-location rule: "*IF something holds in place P, then something else in place Q*"

Listed historic monuments



Encoding

$\forall$ *T* $\in$ Earth, $\forall$ *B* $\in$ PROJECT, $\exists$ *M* $\in$ Geo-Objects,
Ω-Type (*B*) = "Building",
Ω-Type (*M*) = "Listed_Monument",
Inside (Geom (*B*), *T*), Inside (Geom (*M*), *T*):
Disjoint (Geom(*B*), Union (Buffer (Geom (*M*), 100)))
$\Rightarrow$
State (B) = "LM_Approuved"

5 – Geographic knowledge infrastructure

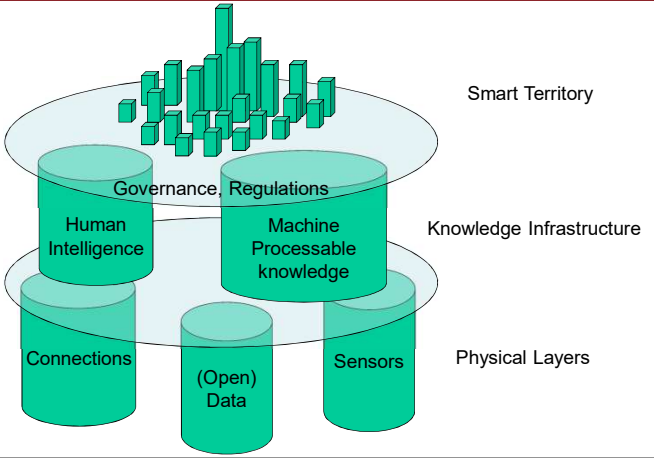
Existing Spatial Data Infrastructure (e. g. INSPIRE)

- Data, metadata, information
- Collected once
- Seamless combination of various sources
- Availability
- Conditions for acquisition/use

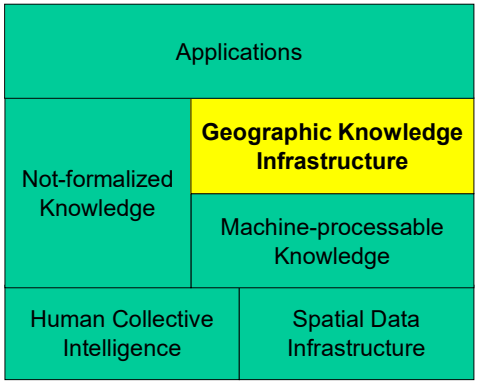
Knowledge infrastructure

- Methodologies

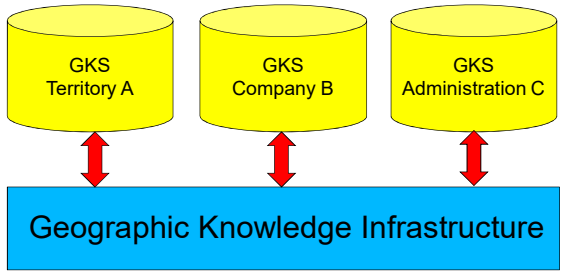
Role of knowledge infrastructure



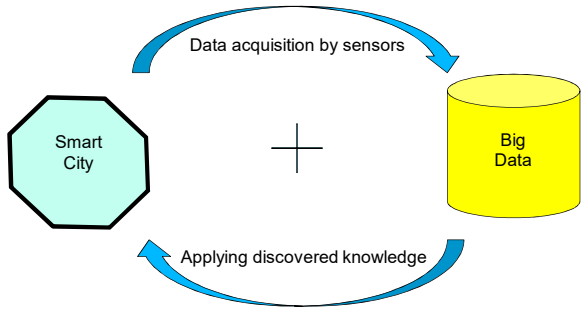
Geographic Knowledge Infrastructure



Sharing Knowledge Infrastructure



Virtual Circle



6 – Conclusion and research agenda (1/2)

1 – identification of knowledge chunks, including rules, and their characteristics,

2 – identification of rule semantics (2D, 3D, 3D+T),

3 – identifying a collection of examples for prototyping,

4 – definition of a language for geospatial rules,

5 – structuring and populating knowledge bases,

6 – design of a language for modeling projects and scenarios as input,

Conclusion and research agenda (2/2)

7 – identifying output representations suitable for all stakeholders,

8 – primary specifications of a geographic inference engine,

9 – implementation and execution of the engine,

10 – integration of narrative and visual knowledge,

11 – assessment of the result and possible modifications of the language or the engine,

12 – definition of real-life examples,

13 – acceptability by stakeholders.

Main book

Thanks for your attention!

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