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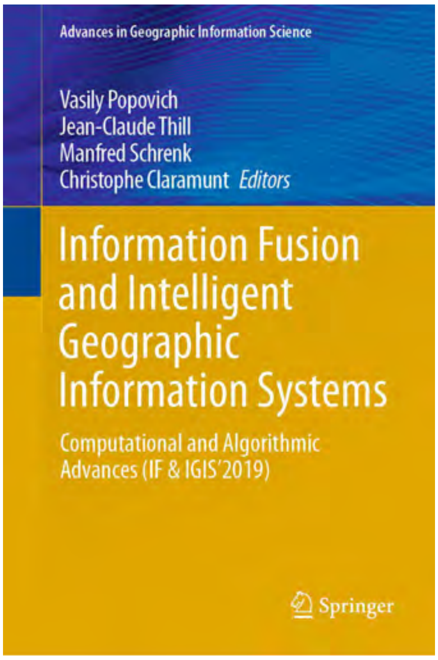

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V. Popovich, J.-C. Thill, M. Schrenk, C. Claramunt (Eds.)

Information Fusion and Intelligent Geographic Information Systems

Computational and Algorithmic Advances (IF & IGIS'2019)

Series: Advances in Geographic Information Science

- Gathers the proceedings of the 9th International Symposium "Information Fusion and Intelligent Geographic Information Systems 2019," held in St. Petersburg, Russia
- Highlights cutting-edge research on cloud computing, deep learning, visual analytics, and large-scale optimization
- Discusses information fusion and intelligent GIS applications in surface and sub-surface maritime activities, land-based trip and travel planning, smart cities, emergency management, and environmental monitoring

This book gathers the proceedings of the 9th International Symposium "Information Fusion and Intelligent Geographic Information Systems 2019" (IF&IGIS'2019), which was held in St. Petersburg, Russia from May 22 to 24, 2019. The goal of the symposium was to provide a forum for exchange among leading international scholars in the fields of spatial data, information integration and Intelligent Geographic Information Systems (IGIS). The symposium was an opportunity to discuss sound and effective lines of modeling in the fusion of spatial data and information within the broader scope of intelligent GIS. The topics of the 2019 Symposium essentially fall into three broad categories of developments aimed at leveraging the power of spatial information, namely: artificial intelligence; algorithmic and computations processes; and data-informed simulation models. All papers collected here present compelling, cutting-edge research on cloud computing, deep learning, visual analytics, and large-scale optimization. They discuss information fusion and intelligent GIS research in the context of surface and sub-surface maritime activities, port asset management, land-based trip and travel planning, smart city and e-government, emergency management, and environmental monitoring.

From Information-Communication City to Human-Focused City

Pierre Laconte

Abstract Smart cities are using information and communications technologies—ICTs—to connect urban activities hitherto unconnected. ICTs can help connect activities within buildings, neighbourhoods or cities and help linking such activities as land use, heritage conservation, energy savings, telecommunications, commerce/banking and mobility. This functional concept can serve multiple aims and objectives, among others the production of knowledge-based services making use of "big data" collecting. Cities can appeal to their citizens and visitors by their quality of life. Beyond the gross development product statistics, quality of life includes perceived quality of air, water and health. The continuity of their urban landscapes invites to leisure activities ("green and blue" trails). It offers diversity of visual experiences by users of the public spaces ("views from the street" rather than "views from the road"). It offers squares, trees and gardens, fountains and canopies, all designed for both walking and sitting users, clean air and an overall urban density propitious to informal contacts between persons and generations. It encourages non-motorised mobility, for the sake of health and fossil fuel energy saving. That enhances availability of urban services, safety and security for all citizens, and on the other hand, the quest for "human well-being", a qualitative appeal to their citizens and users. This is perhaps a key to urban sustainability and adaptation to unavoidable economic, social and disruptive technical changes affecting cities.

Keywords Sustainability · Functional · Data · Quality of life · Urban services · Human · Emotional · Platforms · Circularity

1 "Smart Cities" as Functional Concept

"Smart cities" are using information and communications technologies—ICTs—to connect urban functions and activities hitherto unconnected.

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Information and communication technology can help connect activities within buildings, neighbourhoods or cities such as land use, heritage conservation, energy savings, telecommunications, commerce/banking and mobility.

This functional concept can serve multiple objectives and business interests, among others, the production of knowledge-based services making use of “big data” collecting. This will be illustrated by five examples.

1.1 Using Individual Data for Money Transfers: Mobile Phones as Banks

A kiosk displays M-Pesa advertising in a slum area of Nairobi, Kenya (2012) (Fig. 1). M-Pesa (Mformobile, Pesa is Swahili formoney) is amobile phone-basedmoney transfer, financing and microfinancing service, launched in 2007 by Vodafone in Kenya and Tanzania. The service allows users to deposit money into an account stored on their own cell phones, to send balances using PIN-secured SMS text messages to other users, including sellers of goods and services, and to redeem deposits for regular cash money.

M-Pesa is thus a “smart” branchless banking service.

Fig. 1 Kiosk displaying M-Pesa advertising

M-Pesa has spread quickly and by 2010 had become the most successful mobile phone-based financial service in the developing world. An estimated total of 17 million M-Pesa accounts have been opened in Kenya, and the service has expanded to Tanzania, Ghana, Afghanistan, South Africa, India and Eastern Europe.

The service has been lauded for giving millions of people access to the formal financial system and thus for reducing urban crime for cash in largely cash-based societies. This case was referred at in Bisello [3, page 4].

1.2 Big Data Collective Exchange Platforms Between Users and Between Users and Rulers

Data exchanges have been multiplying the traditional merchant exchange added value by getting to know the profile of the buyers. Big data collection generates value-added information of electronic platforms in fields such as accommodation (Airbnb), mobility (Uber), auctions (eBay) and collection of personal data (Facebook). The profiles so collected are a highly saleable product. This high value creation gives them easy access to international funding ("uberisation" of services). The data made available on each citizen also multiply the potential of citizen alienation by the masters of Big data collection, including governments (Fig. 2).

Beyond Huxley's "Brave New World" and Orwell's "1984", the Government of China is using big data for imposing its "Conformity policy" to all citizens. It is an "unbridled" toy for "unbridled" governments.

More modestly, smart platforms can be owned by independent cooperatives, a modern extension of the nineteenth-century cooperative movement (initiated by Manchester Rochdale cooperative pioneers). These new cooperatives are reported in the "Platform Co-operativism Consortium"—PCC (Scholz [10]).

Their profits in that case flow back to their members, instead of shareholders.

1.3 Smart Buildings as Power Plants and Resource Savers

Smart buildings aim at optimising air, water, energy production (solar energy generated from both roofs and windows), batteries charging, etc., within a centralised system. A "Smart Building" integrates major building systems on a common network and shares information and functionality between systems to improve energy efficiency, operational effectiveness, and occupant satisfaction.

The multinational contractor BESIX [2] sees its Dutch headquarter "smart building" as an encyclopaedia of smart building features (Fig. 3).

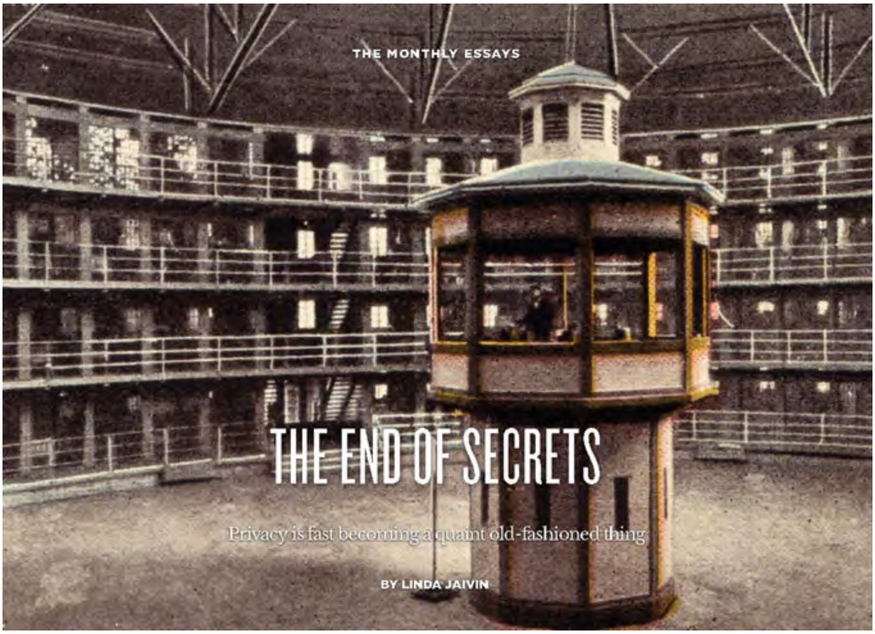

Fig. 2 A postcard showing the interior of Stateville Correctional Centre, Illinois, modelled on Bentham's Panopticon [1, 5]

Fig. 3 View of BESIX new Netherlands Headquarters, Dordrecht

Fig. 4 Small van fleets in service in Lyon (Photo Keolis, 2017)

1.4 Smart Mobility, Tool for Management of Autonomous Connected Vehicles

Autonomous vehicles (AVs), or zero-occupancy vehicles, have been described as a liberation from the driving chores.

However, according to the International Transport Forum [4] report, trucks without drivers should increase road congestion.

The reduction of the employment costs may indeed encourage fleet owners to put more—half empty—trucks on highways.

As to cars, AVs may in effect result in users acquiring greater tolerance for long-distance commuting and therefore increase urban spread, unless collective transport AV small van fleets are in service for short-distance links to access mass public transport, using the street network (Keolis 2017) (Fig. 4).

1.5 Saving Resources through Circularity

The principle is to replace the linear production chain (produce, use and throw away) by a circular production chain (produce, use and reuse into a secondary product). This can apply to many types of goods, including entire buildings.

A recent example of building recycling is the Amsterdam CIRCL pavilion (Fig. 5).

Fig. 5 "CIRCL", Amsterdam multi-purpose circular pavilion (ABN AMRO Bank 2017)

Every resource used in the building can be recycled. All parts of the building are dismountable.

One may remember that the Eiffel Tower was to be dismantled after the Paris World.

Exhibition was however kept ever since, by popular demand (Fig. 6).

Recycling in a wider context is only made possible by linking supply and demand for secondary products and certifying them. This may include recycling of CO_2 emissions instead of trying to store them underground.

2 "Human-Focused" Cities

Cities may well combine on the one hand the "smart cities" functionalities that enhance availability of urban services, safety and security and, on the other hand, the "emotional" qualitative appeal to their citizens and users.

2.1 Emphasis on Quality of Life, Leisure Activities and Education

"Medellin Ciudad Inteligente" encourages popular IT education, including a network of large and small libraries, even in metro stations (Fig. 7).

Fig. 6 Inside view of the same building

Fig. 7 España Library of Medellin. A strong statement in favour of “knowledge city”. *Photo* by Municipality of Medellín. (Source: https://healthymedellin.weebly.com)

Fig. 8 New York City Times Square (before and after pedestrianisation). Photo source: https://voyagesmicheline.com

2.2 Enhancement of Citizen Satisfaction through Making Places Available for Informal Contacts

New York's Times Square was ever clogged by traffic. Mayor Bloomberg made pedestrianisation acceptable by introducing a trial period, during which traffic flows were analysed. This analysis showed it took less time for taxis to take alternative routes.

This was a smart combination of smart data and enhancement of citizen satisfaction (Figs. 8 and 9).

Rome's Piazza Navona may be seen as a human-focused urban place. It is not only an attraction but also as a form of urban theatre, as the God Neptune of Bernini's fountain is spewing towards the facade of his rival Borromini's Sant Agnese Church (Fig. 10).

2.3 Emotional Citizen Involvement through Community Events (Festivals, Cultural Events, Folklore, Supporter Sports)

See Figs. 11 and 12.

Fig. 9 Same view after pedestrianisation. Photo © New York Department of Transportation

Fig. 10 Rome's Piazza Navona. *Source* Port of Rome, Portale turistico del Porto di Roma (Source: http://www.portofrome.it)

Fig. 11 Oktoberfest, Munich, is the top yearly event of this 1.5 M inhabitant's city. Source: muenchen.de, Das offizielle Stadtportal (https://www.muenchen.de)

Fig. 12 "Carnaval des Gilles de Binche"—on UNESCO's World Heritage List—involves the entire population of Binche, a Belgian town of 30,000 inhabitants. Source: *Le Soir*, 28/02/2017. Photo © EPA

2.4 Human Focus in a Changing Climate Context

At a planetary level, greenhouse gases (GHGs) emissions are affecting climate. In cities, the focus could rather be put on the role of reduced fossil fuel energy pollutions affecting human health as a quality of life indicator. In other words, is a GHG reduction a correct indicator of citizen-focused quality of life in a climate change context?

A survey of GHG-emissions accounting methods has been done in a comparative study by Baader and Bleidschwitz (2009). While the measurement of GNP is made by public agencies according to internationally agreed methods, there is no such agreement about the six GHGs identified by the IPCC.

Who is entrusted with measuring?

GHGs measurement is done by independent institutions, e.g.:

1. CO_2 Grobbilanz/EMSIG (Climate Alliance Austria, Energy Agency of the Regions)
2. ECO_2 Region (Climate Alliance, Ecospeed)
3. GRIP (Tyndall Centre, UK Environment Agency)
4. Bilan-Carbone (ADEME, France)
5. CO_2 Calculator (Danish Environmental Research Institute)
6. Project 2 Degrees (ICLEI, Clinton Climate Initiative, Microsoft).

What emissions are measured and how?

1. The measurement covers either all of the IPCC GHGs or only some of them, mainly carbon dioxide and methane.
2. Different potential global warming estimates are obtained according to whether the second, third or fourth IPCC report is used.
3. The reporting standards are different.
4. The scope of measurement either only includes direct emissions or also includes indirect and life cycle emissions.

Measuring energy production and consumption as an alternative to direct measuring of CO_2 emissions?

Considering the political impossibility of a world agreement on the calculation of CO_2 and other greenhouse gases, the second best could be to analyse in depth the origin, production and use of fossil fuels, which according to Nicholas Stern [11] constitute the largest of the GHG emissions.

3 Global Urban Sustainability Includes both Functional and Human-focused Features

Hereafter we have been selecting three award winning cities/neighbourhoods within the list of European practices referenced in the literature assessing the sustainability performance of cities. These three awards are referred at in the book "Sustainable cities—Assessing the Performance and Practice of urban Environments" [6] (Fig. 13).

3.1 Zurich

Zurich may be considered as a smart mix of land use and mobility policies aimed at improved quality of life (1985–).

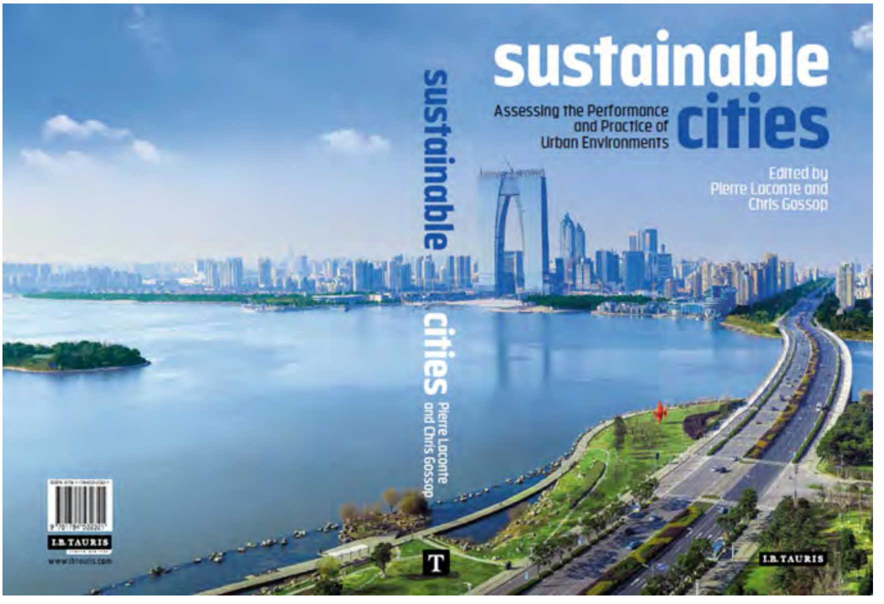

Fig. 13 Title page of the book "Sustainable Cities - Assessing the Performance and Practice of urban Environments"

Zurich's traffic management

In Zurich, trams and buses enjoy absolute priority on-street. When approaching a traffic light, the sensor (seen on the lower left) ensures they have a green light at any time of the day. The reliability of timetables makes public transport the city's fastest mode of transport. Modal split is around 80% in favour of public transport.

The sensors (lower left) trigger the traffic light priority in favour or trams and buses, not taxis (Fig. 14).

The political ingenuity, however, lies in the parking policy favouring local voters: the KISS Principle ("Keep it Smart Simple").

Zurich's parking management

Unrestricted on-street parking is exclusively reserved for Zurich-registered residents (the voters), while cars entering the city from other municipalities have a max. 90' free parking time. This measure has triggered a large-scale return of inhabitants to the city, has benefited the off-street car parks and has been politically very rewarding for the city fathers, while suburban rail travel patronage has been improved. This system could be applied in any city where commuters come from other electoral districts (Fig. 15).

Emotional attachment to the city's way of life is embodied by its attitude to mobility and relation between centre and periphery, e.g. Limmat Valley [9]. The inclusionary approach to mobility is illustrated by the Nissan automobile poster (Fig. 16).

Fig. 14 Zurich's traffic management

3.2 Bilbao

Bilbao is a smart mix of urban regeneration and multimodal transport, putting emphasis on culture, quality of life and public meeting places (1989–2012).

The long-time prosperous steel industry was wiped out by the 1989 steel crisis. Industrial land was re-used for new activities, based on services and culture, while preserving architectural heritage (Fig. 17).

The derelict industrial area along the Ría was owned by several public bodies, from local to national. This ownership was unified by a public–public partnership embodied in a public redevelopment corporation: Ría 2000. The two planned anchors for new development, at each end of the site, were the new Guggenheim museum and the congress and concerts centre (Fig. 18).

The valuable land situated between the two anchors and very close to the central business district was redeveloped by Ría 2000, with an obligation to invest all of the proceeds in new public infrastructure along the same canal.

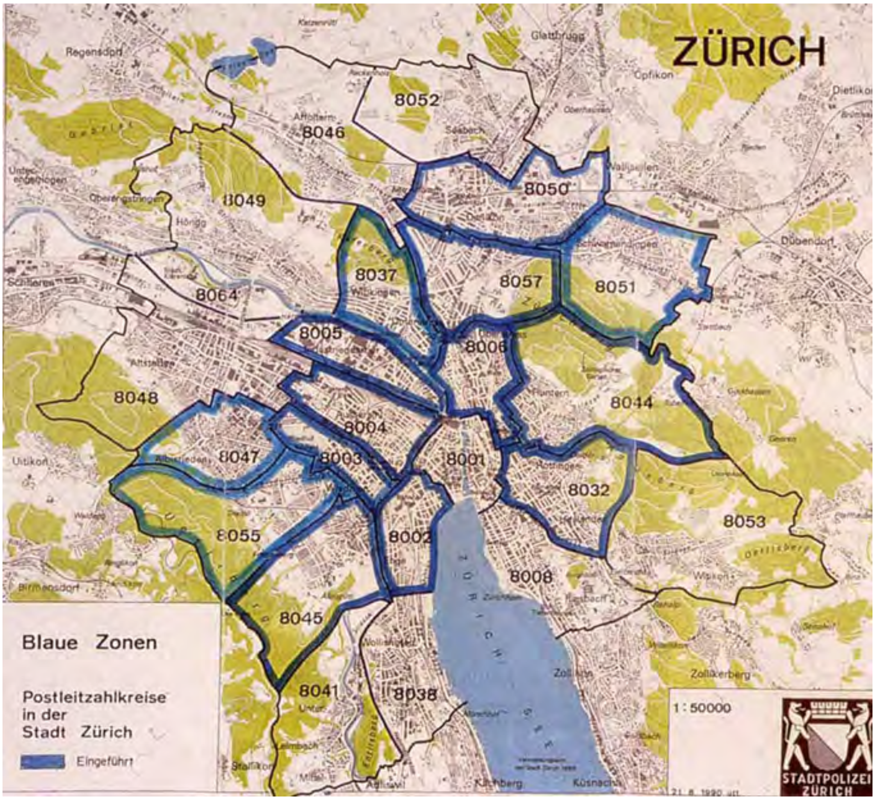

Fig. 15 City map showing the areas for unlimited parking by residents (90 minutes for non-residents). Source: Stadtpolizei Zurich

Fig. 16 Nissan automobile poster

Fig. 17 View of Bilbao's Ría industrial landscape prior to the 1989 steel crisis. Source: Archivo Municipal de Bilbao

The huge surplus generated by the land sales was to be used exclusively to enhance connectivity and further urban regeneration.

The plan's implementation was completed in 2011 by an office tower by Architect C. Pelli (Fig. 19).

A new tram line serves (Fig. 20) the canal side in the urban centre, saving traffic and parking space and adding to the citizens' health and quality of life.

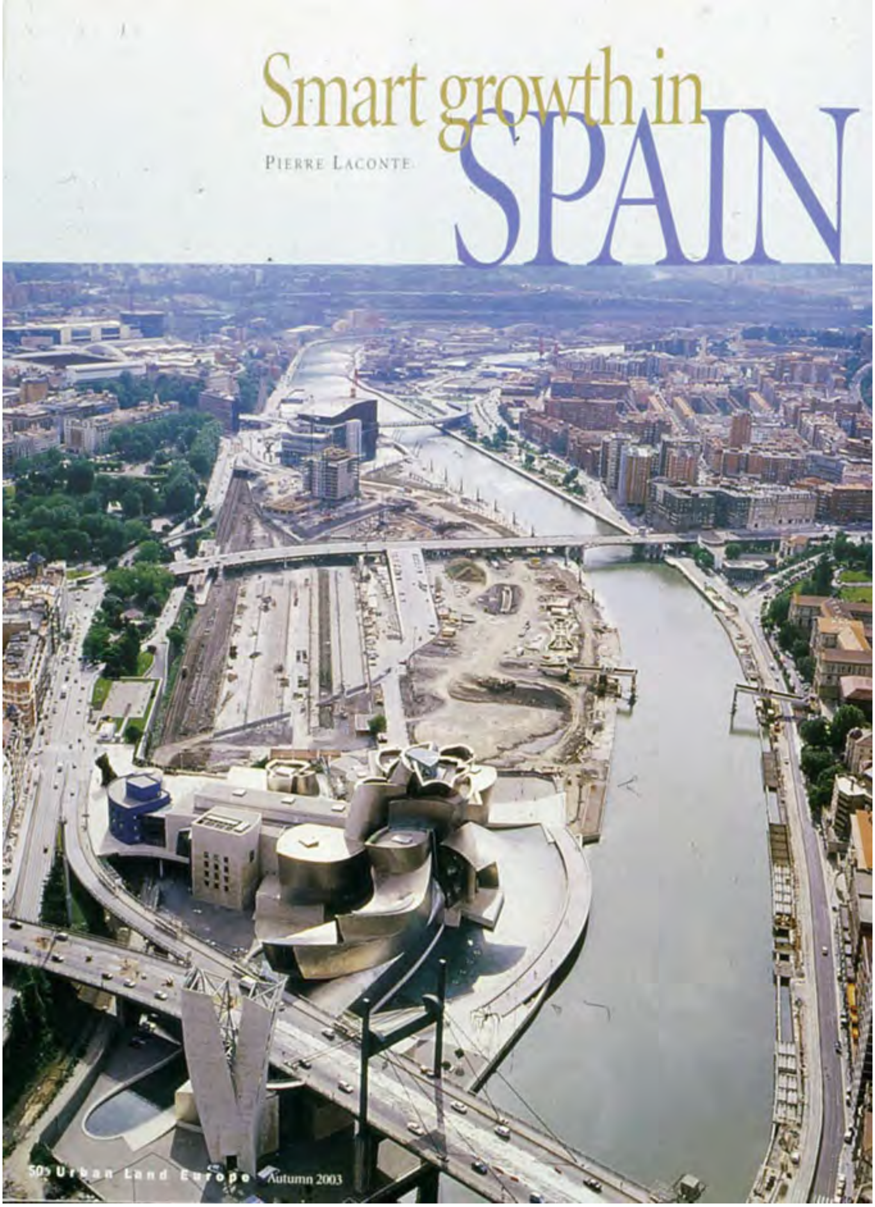

Fig. 18 Cover page of Urban Land Europe, Autumn 2003 [7]

Fig. 19 Office tower. *Photo* P. Laconte

Fig. 20 New tram line in Bilbao

Bilbao Metro (Fig. 21) partly new (stations designed by Norman Foster) and partly reusing old industrial railways, it enhanced connectivity throughout the city and its region and attracted energy saving public transport.

Fig. 21 Bilbao metro

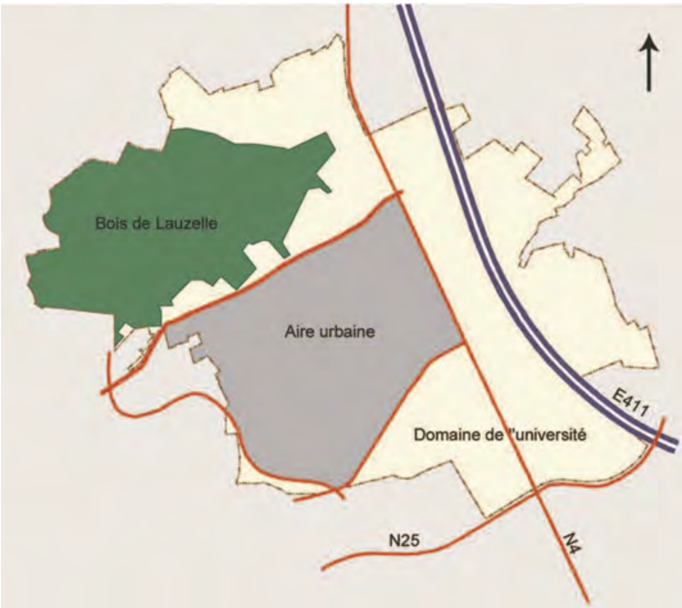

Fig. 22 Location of the new university town

3.3 Louvain-la-Neuve (Brussels Conurbation)

High density-low rise land-use—Planning for resource saving—is a key feature of the Louvain-la-Neuve new university town (conceived from 1968) [8] (Fig. 22).

The university bought 920 ha of agricultural and forest land in a rural area close to Brussels—Namur road (N4): the central part was set aside for urban development; forest land in the North was preserved. The overall master plan and architectural coordination—starting in 1968—was entrusted to the Groupe Urbanisme—architecture (R. Lemaire, J.-P. Blondel and P. Laconte) (Fig. 23).

The only connection point of the site to existing road infrastructure is the Brussels–Namur trunk road. Development started from there along an East–West pedestrian spine. Automobile access to buildings is ensured through side alleys (Epstein 2008).

Planning for uncertainty (stop and go)

As the project could be suspended at any time by political decisions development took place according to a linear pedestrian central spine, this allowed a step-by-step mixed urban development. Automobile access to buildings and parking are located outside of the spine, with occasional underpasses.

The pedestrian option allowed a reduction of heavy infrastructure costs and enhanced air quality and citizens' health (Fig. 24).

It was implemented from 1972 as the main street's first phase. It started from the existing road east of the site (right part of the picture), It was later extended to

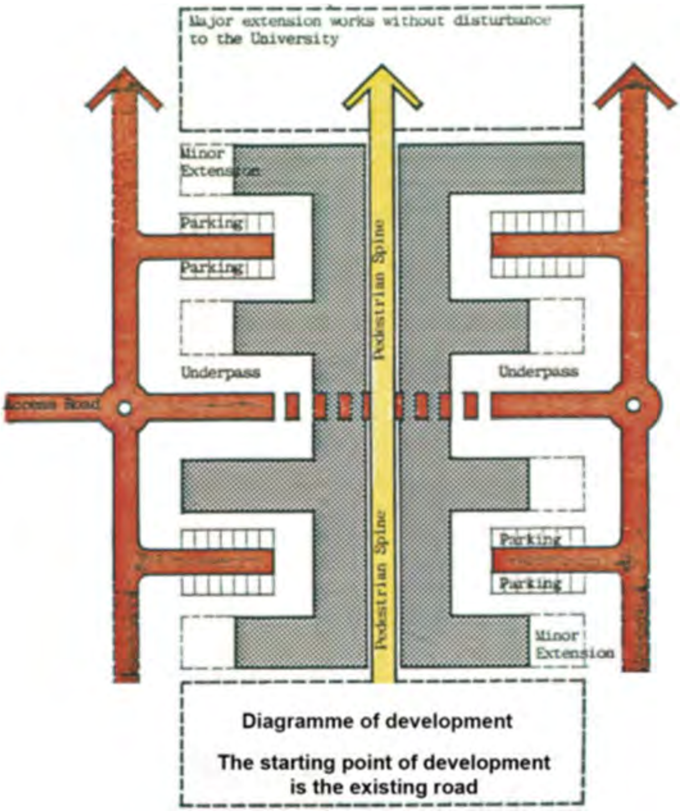

Fig. 23 Diagram of development of the central urban area of Louvain-la-Neuve

Fig. 24 Pedestrian place-making

Fig. 25 A string a public spaces alternating tranquility and animation. *Photo* P. Laconte and Koen Raeyemaekers

the railway station opened in 1975 (left part), the centre of the city, and its extension towards the western part of the site. Car access to buildings and parking takes place outside the spine, with some underpasses. Property development of the whole university-owned site (920 ha) is by long-term leases (75–99 years).

The centre of the first phase (1972) was the Science Library (Fig. 25), a huge concrete building seen as the cathedral of a university town with its plaza, above an automobile underpass. It is a social gathering place with university buildings, shops and restaurants (arch. A. Jacqmain). Built 45 years ago, it has consistently been a place alternating tranquillity and animation (Fig. 26).

All streets are pedestrian and combine university buildings, housing, retail and cultural services. Land remains the property of the University and is leased to investors. All motorised transport is located underground.

The diagram shows how the ground below—essential for long-term connectivity—remains the property of the university. The infrastructure and buildings are leased to public and private investors. High-density, low-rise development includes no high-rise buildings (Fig. 27).

View on one of the small piazza's forming a string of public spaces along the pedestrian street network. Trees are growing on the concrete slab. Cars are parked underneath (Fig. 28).

The shopping mall adjacent to the railway station (8 million visitors/year) and the private Hergé museum (arch. de Portzamparc, Paris) are all part of its high-density, low-rise development (Fig. 29).

All storm water is led to a reservoir which is treated as a lake, which saves infrastructure costs and attracts residential investment (Fig. 30).

Louvain-la-Neuve, example of human-focused smart development

The continuity of its planning—according to the initial master plan—and its governance, over the first 50 years of the up to 99 years leases, were ensured by the

Fig. 26 Street entrance to the railway station. *Photo* P. Laconte

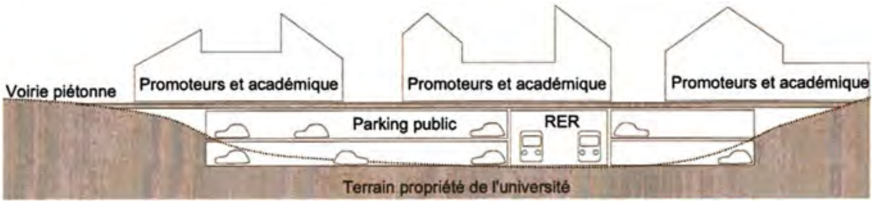

Fig. 27 Functioning of the slab. *Source* UCL Archives

combined strength of its mayors—the latest one over 18 years—and of its residents' council (Association des habitants de Louvain-la-Neuve), strong countervailing power to both the city authority and the university land lord.

Fig. 28 Numerous small piazzas. *Photo* P. Laconte

Fig. 29 Shopping development. *Photo* Hergé Museum

Fig. 30 Louvain-la-Neuve water management. *Photo* Wilco 2011

4 Conclusion

Combining, on the one hand, the "smart cities" functionalities—helped by GIS deployment—that enhance availability of urban services, safety and security for all citizens and, on the other hand, the "emotional" qualitative appeal to their citizens and users is perhaps a key to urban sustainability and adaptation to unavoidable economic, social and disruptive technical changes affecting cities.

Appendix

An artist illustration

Mobility and Liveable Cities—the transport network irrigating the city—poster by Friedensreich Hundertwasser (1928–2000) for UITP (1991).

Mobility and Liveable Cities—the compact city—poster by Friedensreich Hundertwasser for UITP (1993).

Mobility and Liveable Cities—enjoyment as a key to liveability—poster by Friedensreich Hundertwasser for UITP (1995).

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