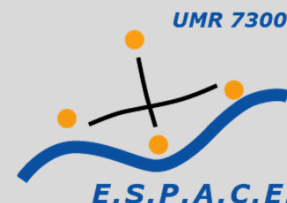


Second Symposium on Social-Ecological Urbanism: Balancing Dense and Green Urban Development

Chalmers University of Technology, SMOG, Architecture & Civil Engineering, June 18th-19th 2019

Urban form and green spaces. Towards integrated analytical models.

Giovanni Fusco
CNRS Senior Research Fellow



Overview

- **Analytical models** are meaningful only within a given **theoretical paradigm** for the city.
- This is even more true for **green spaces**, which were at the center of the **modernist paradigm**
- I propose a **new paradigm** for the city of the 21st century which wants to be reconnected with the valuable experience of **centuries of urban history**.
- Starting from a human-centred point of view, I propose a **new analytical model** (MFA) to study the urban fabrics of contemporary cities.
- The model must be able to **distinguish forms from the different paradigms**.
- Applied to the city of Brussels, the model **proved capable of integrating green spaces** which are relevant for the pedestrian experience.

The Modernist Paradigm

Le Corbusier's 3 Ingredients of Good Urbanism:

Space, Sunshine, Vegetation !

A powerful slogan, hardwired in the social representation of the city to be desired



In practice: the S-p-a-c-e-d City (Gourdon 2001)
Buildings set free from the street
Towers in the Park / residential subdivisions /
activity areas / a road system
... Functionalism

The Problem of Functionalism

Form Follows Function



"It is the pervading law of all things organic and inorganic,
Of all things physical and metaphysical,
Of all things human and all things super-human,
Of all true manifestations of the head,
Of the heart, of the soul,
That the life is recognizable in its expression,
That **FORM EVER FOLLOWS FUNCTION.**
This is the law."



Louis Sullivan

Louis Sullivan (1856-1924)

In Design, Architecture, Urbanism, quest for **physical forms** that are **well adapted to a given goal**

Space, Sunshine, Vegetation, Functions !



But ... what is the goal of a city or even of an urban neighborhood?

Not a single goal + evolving needs as human societies evolve

The Problem: highly adapted forms are not adaptive forms

An alternative paradigm

Growing awareness in the Academia and in the professional world.

Rediscovery of the value of traditional forms + integration of the challenges of the contemporary city

- Urban morphology schools
- J. Jacobs, Ch. Alexander, J. Gehl
- New Urbanism
- Social-Ecological Urbanism
- ... New Urban Agenda (Habitat III)



Proximity, Time, Form !

Ecology

... the role of analytical models

Proximity

Proximity as the basis of ease of human interaction in the city

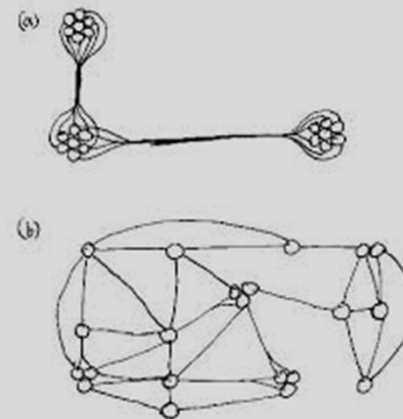


Configurational approaches (Hillier 1996): the interaction potential of street networks (to-movement, through-movement).

Analytical models: Space Syntax (Hillier 1996), Multiple Centrality Assessment (Porta et al. 2006)

The theory of the urban web (Salingaros 2005): proximity in the functioning of the pedestrian-centered city... a step towards human ecology.

Analytical models: ?



Time and the making of the physical city

The physical city: a process or an end result?

... geographers know that mountains, rivers and coastlines are better understood as processes. Shouldn't this be even truer for cities and neighborhoods?

The physical city and its generative processes.

The urban palimpsest as an end result.



Lyon, France

Time and the evaluation of the physical city



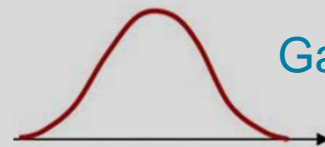
**Time = accumulation of perturbations
(often unforeseen) on artefacts**
(Mandelbrot 1982, Taleb 2012)

Physical Object



Informational Object

Life expectancy:



Gaussian



Power Law

Technologies are informational objects.

Lindy effect: a technology which proved to adapt over long time will probably survive long time still, newly arrived technologies are normally short-lived

WARNING: risk of extreme conservatism in a context of fast urban change

Disruptive changes are inevitable: looking for less fragile to such disruptive changes.

Form

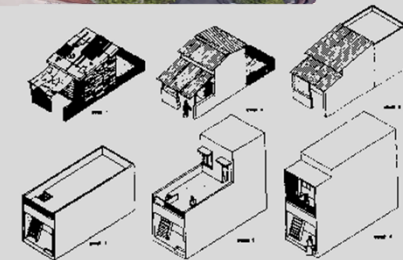
The form of the physical city: a question of scale



The whole urban layout



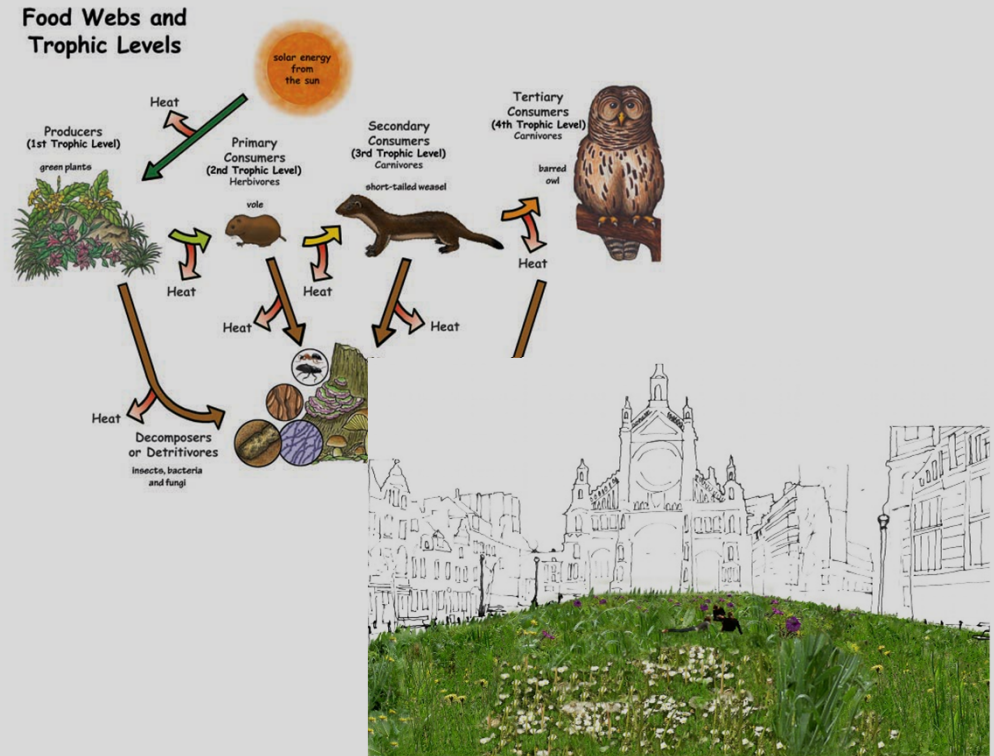
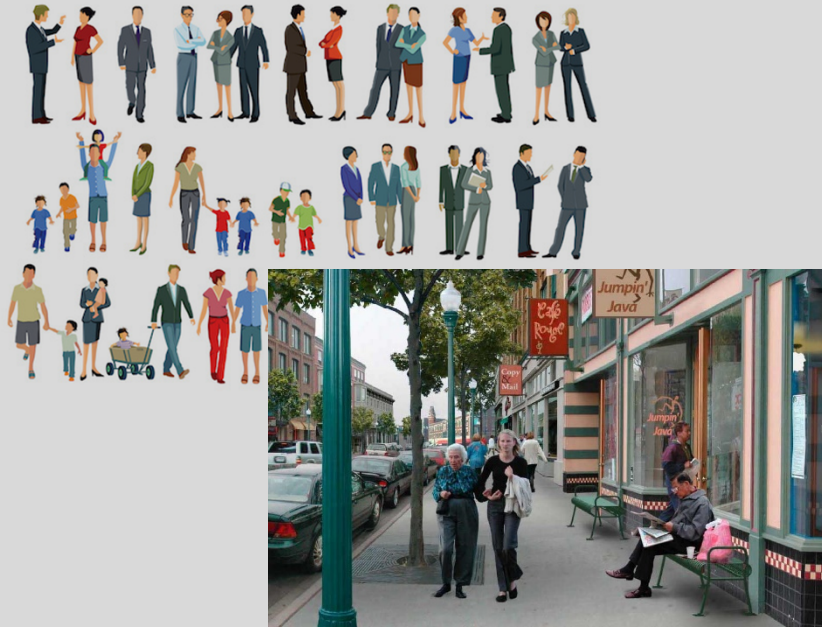
The urban fabric



The building type, the block, the streetscape

New analytical models: SpaceMatrix (Berghauser-Pont and Haupt 2010), Multiple Fabric Assessment (Araldi and Fusco 2017), ...

Ecology



Human ecology



The natural ecosystems within a man-made environment

A nexus at the centre of Social-Ecological Urbanism

Analytical models from Environmental Psychology, Landscape Ecology, Urban Metabolism models, etc.

Focus on Urban Form

Given the action of time (urban palimpsest), what are the forms of the contemporary city?

Research stance:

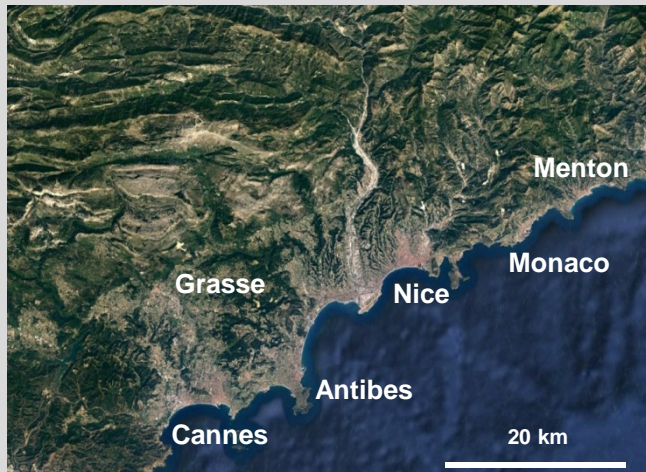
- The meso-scale form (urban fabric)
- Based on theory of urban morphology
- Support of analytical methods to investigate large-scale real cities
- A human-centered form
- Through form, integrate other aspects (space, sunshine, vegetation, function) which, without form, are pointless for humans.

Goals:

- Understand and evaluate the forms of the contemporary city
- Support urban planning and design

... to do so analytical methods must **discriminate forms** coming from **different paradigms**

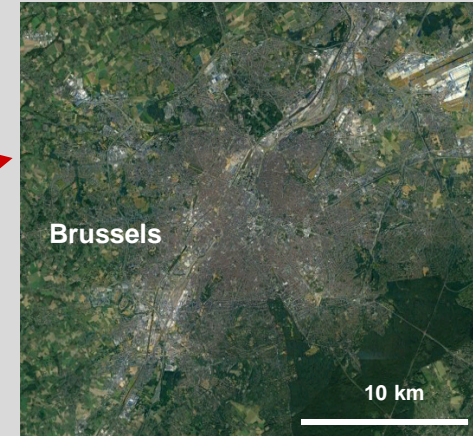
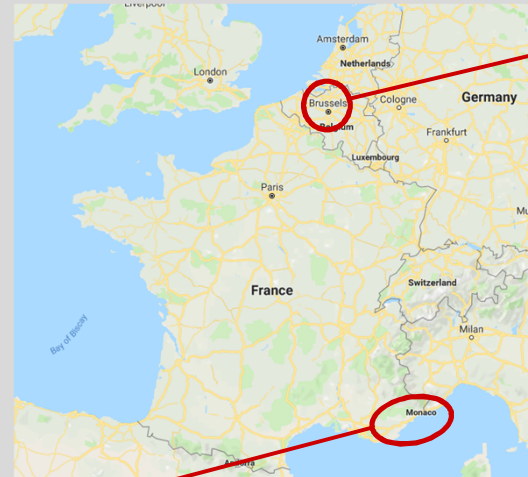
Case Studies



The French Riviera

(Fusco and Araldi 2017)

1510 km² - 1.1 million inhabitants



Brussels Capital Region

(Guyot, Araldi and Fusco 2018)

161 km²

1.2 million inhabitants

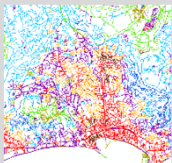
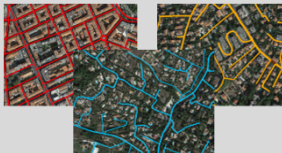
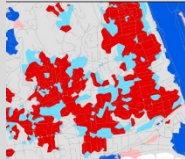
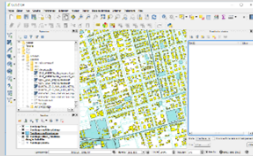
Questions:

What are the typical fabrics on the French Riviera and Brussels?

How can we integrate vegetation and topography in urban fabrics?

How can we project urban fabrics in space and time?

Multiple Fabric Assessment



Spatial Unit Definition

Computation of Morphological Indicators

Identification of Spatial Patterns
Through Local Indicators of Spatial Association

Bayesian Clustering of Combinations of Spatial Patterns

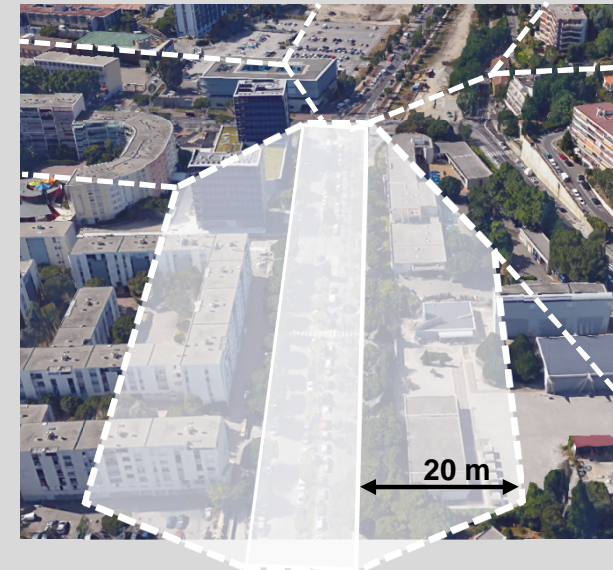
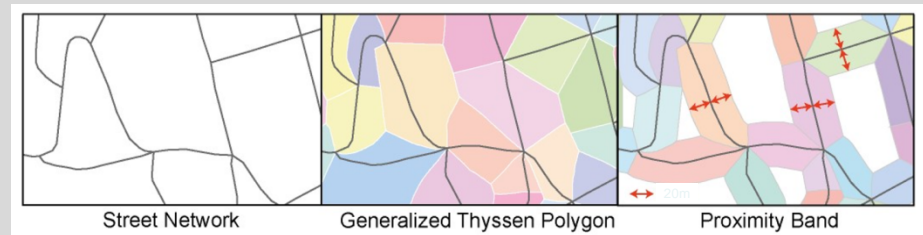
Identification of Families of Urban Fabrics

Spatial Organization of the Urban Landscape

Spatial Unit Definition

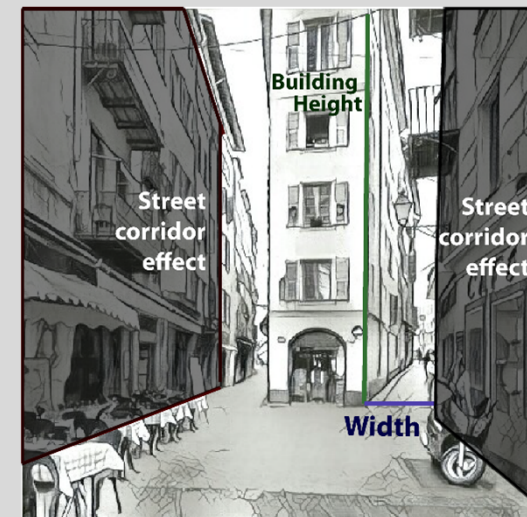
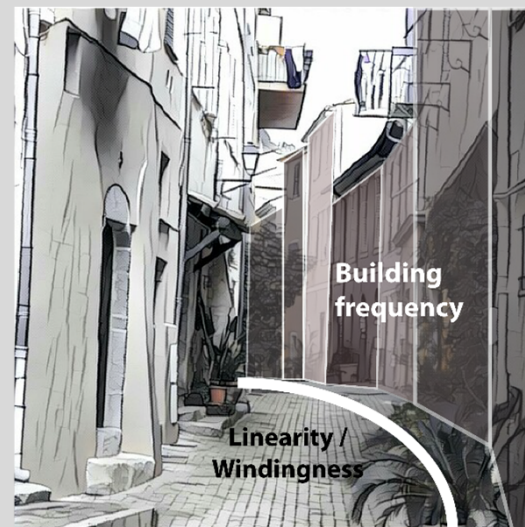
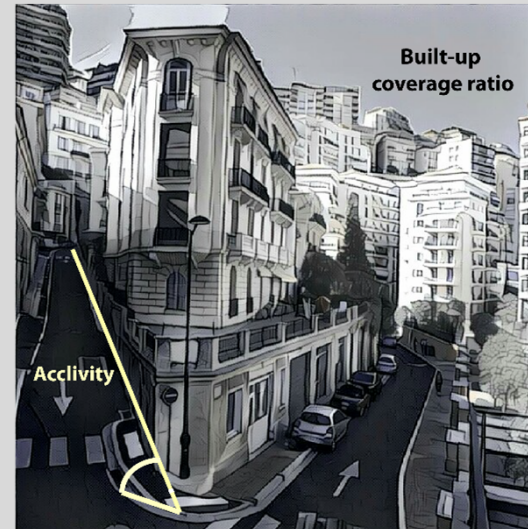
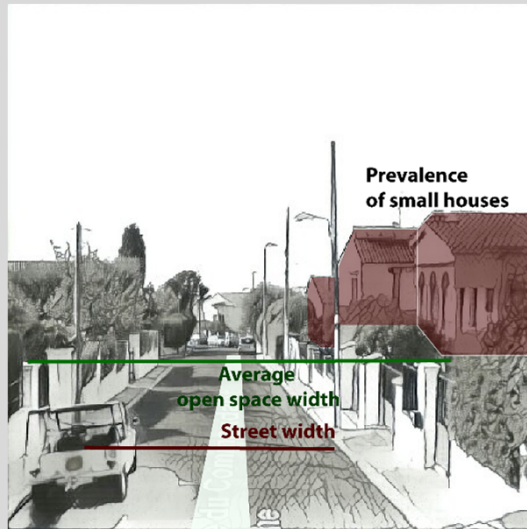
Street proximity bands: the pedestrian point of view on urban fabric.

Partition of the planar urban space into regions based on proximity to each network segment within a certain distance from the segment (10 m, 20 m, 50 m)

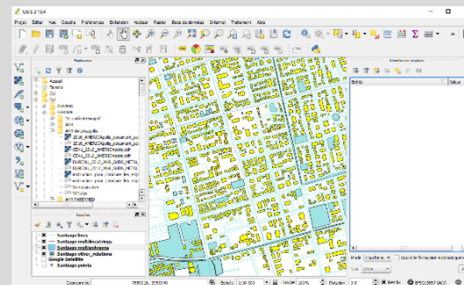


street segments: 100 000 (French Riviera), 12 500 (Brussels)

Morphological indicators for pedestrians



Geographical Information System (GIS)



Computation of morphological indicators through automated geo-processing

Urban Fabric Component	Indicator	Definition
Network Morphology	Street Length	Network length of the street segments between two intersections [m]
	Linearity/ Windingness	Ratio between Euclidean distance and segment length
	Local connectivity	Average presence nodes of degree 1
		Average presence nodes of degree 4
Average presence nodes of degree 3, 5 or more		
Built-up Morphology	Prevalence of Building type	Ratio between 0-125 m ² building surf. and total built-up surf. in 50 m PB
		Ratio betw. 125-250 m ² building surf. and total built-up surf. in 50 m PB
		Ratio betw. 250-1000 m ² building surf. and total built-up surf. in 50 m PB
		Ratio betw. 1000-4000 m ² building surf. and total built-up surf. in 50 m PB
		Ratio between >4000 m ² building surf. and total built-up surf. in 50 m PB
	Proximity band coverage ratio	Building coverage ratio on the 50 m proximity band
	Building Contiguity	Weighted average of buildings frequency on built-up units
Specialization of Building Types	Ratio between specialized building footprint and 50m PB surf.	
Network-Building Relationship	Street corridor effect	Ratio between parallel façades and street length in 10 m PB
	Proximity band building height	Ratio between building vol. and surf. inside 20 m proximity band
	Open Space Width	Ratio between open space within 20m PB and street length
	Height/Width Ratio	Ration between average building height and average open space width within the 20m PB
	Building frequency along street network	Ratio between number of buildings in 20m PB and street length
Network-Parcels Relationship	Plot fragmentation along street network	Ratio between number of parcels in 20m PB and street length
Site Morphology	Surface slope	Ratio between high sloped ($S > 30^\circ$) and total space-unit in 50m PB
Network-Site Relationship	Street acclivity	Computed as segment average of $\arctan(\text{slope})$

The Brussels Case: Integrating Vegetation

Vegetation from a pedestrian point of view



Tree alignments
on the street
(linear density of trees)



Vegetized setbacks
(10m proximity band)



“buildings in the park”
(50m proximity band)



Public space for pedestrians
(as % of street surface)

9 Urban Fabrics on the French Riviera

Old constrained urban fabrics of town-houses



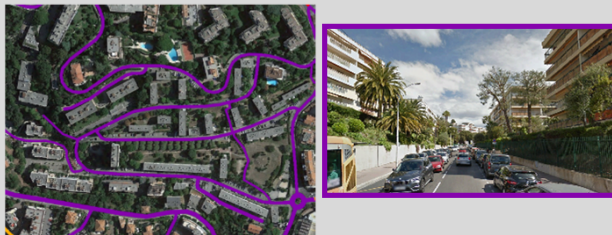
Traditional urban fabrics with adjoining buildings



Discontinuous and irregular urban fabrics with houses and buildings



Modern discontinuous urban fabrics with big and mid-sized buildings



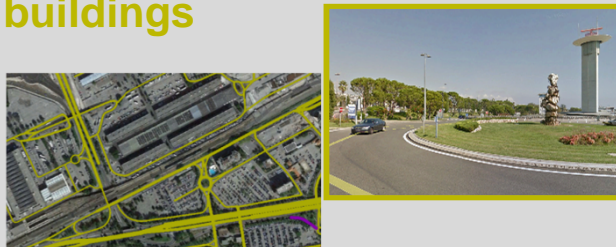
Suburban residential fabrics in hills or plain



Small house constrained suburban fabrics



Connective artificial fabrics with sparse specialized big buildings



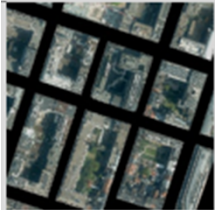
Non urbanized space in hills or plain with sparse homes and buildings



Mountain natural space with sparse houses



12 Urban Fabrics in Brussels



UF1. Continuous Modern Planned Non-Residential Fabric

- Absence of vegetation
- High and big building, absence of narrow buildings
- "Canyon" street
- Quarter of the European institutions and CBD



UF2. Continuous Traditional Fabric

- Absence of vegetation
- Many regular medium size buildings
- "Corridor" street
- Presence of pedestrian space
- Historical center



UF3. Continuous and Dense Residential Fabric with regular small houses

- Absence of vegetation
- Many regular narrow buildings
- "Corridor" street
- Typical Brussels houses



UF4. Continuous Residential Fabric with houses and small buildings

- Many medium adjoining buildings and some large building
- Some street trees
- Absence of large green space
- Typical Brussels houses



UF5. Continuous Residential Fabric with regular small houses and wider street space

- "Corridor" streets
- Some street trees
- Presence of large green spaces
- Garden neighborhoods



UF6. Semi-continuous Mixed Use/Form Fabric

- Residential/specialized small/large buildings
- Regular/irregular street grid
- Intermediate space



UF7. Semi-continuous Residential Fabric with small houses and small buildings

- Many narrow isolated building
- Presence of vegetation
- Garden neighborhoods



UF8. Semi-continuous Residential Fabric with houses and average buildings

- Low coverage and large streets
- Presence of vegetation
- Medium size isolated building
- Garden neighborhoods



UF9. Semi-continuous Specialized Fabrics

- Large concentrated specialized building
- Absence of narrow buildings
- Industrial zones



UF10. Open Specialized Fabrics

- Low coverage
- Few Isolated specialized large buildings
- Vegetation
- Industrial zones and Business parks



UF11. Open Suburban Residential Fabric

- Much vegetation
- Some isolated medium sized buildings
- Large streets
- Villa



UF12. Open Natural and Artificial Non-Urbanized Areas

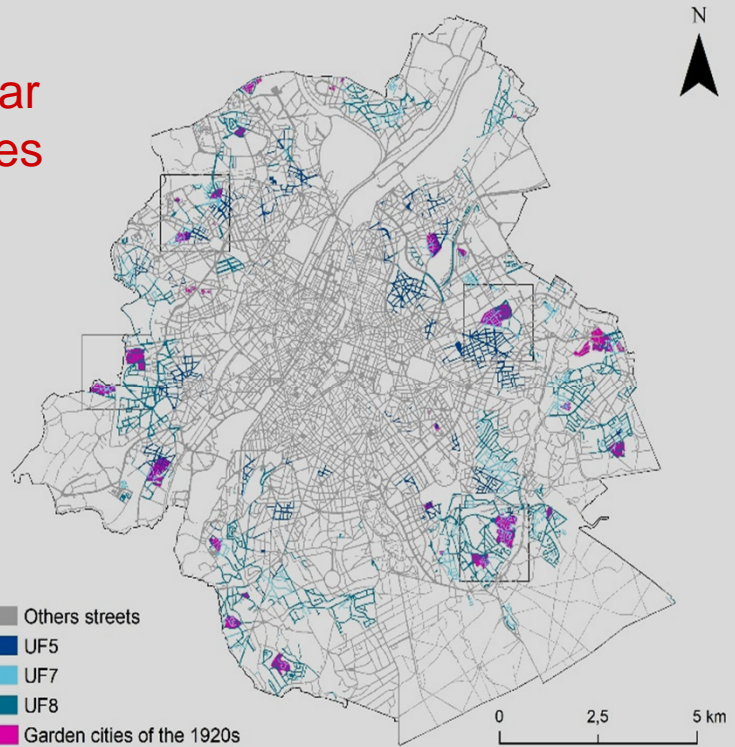
- Much vegetation
- No building
- Natural spaces

200

— m

Projecting Urban Fabrics in Space: Brussels Garden Cities

Between-War
Garden Cities



Sources: Urbis, Inventaire du Patrimoine architectural bruxellois, Christian Dessouroux 2008



Ch. Bastin & J. Eyraud © SPRB, Centre de Documentation BDU - GOB, Documentatiecentrum BSO



Schmitt-GlobalView © SPRB, Centre de Documentation BDU - GOB, Documentatiecentrum BSO

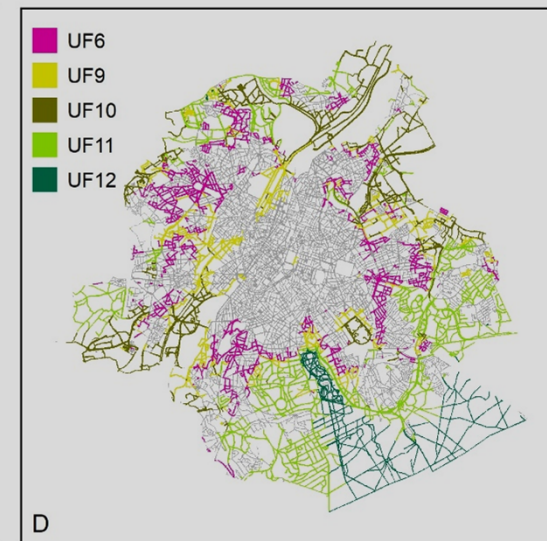
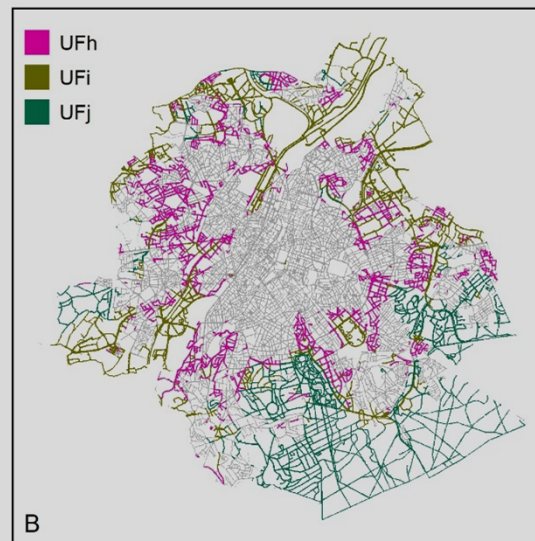
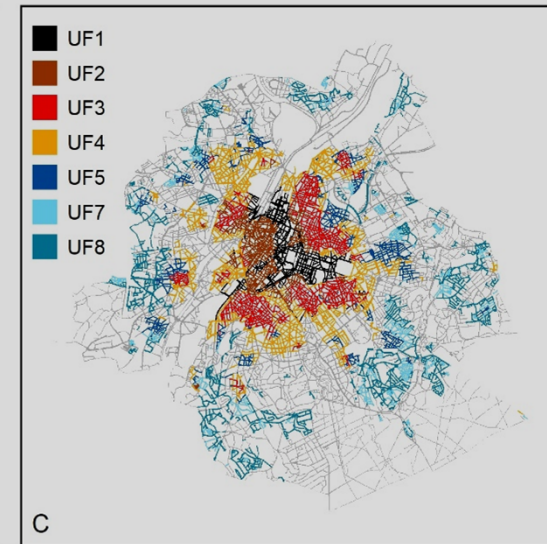
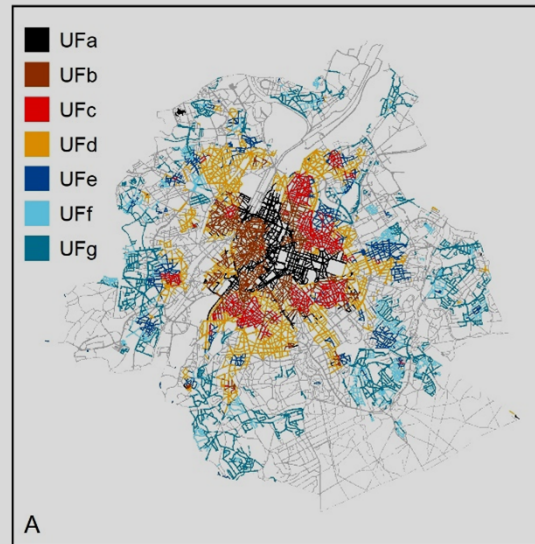
Floréal

The effect of introducing vegetation

Garden-city fabrics detected even without vegetation.

Differences in modern specialized fabrics and in suburban dispersed forms.

Identification <> characterization



10 km

Projecting urban fabrics in time: the physical city of the next century

Which are the most fragile urban fabrics of today's city?

Fragile urban forms



Pruitt-Igoe, Saint Louis, 1972

Assessment through the Lindy effect (the proof of time)



Irregular highly connected fabrics of adjoining townhouses and small, mixed-use buildings.

- oldest urban fabrics still to be found in contemporary cities
- an accounted history of several millennia,
- have adapted to new urban functions and new urban populations



Continuous urban fabrics of adjoining buildings forming relatively regular urban grids, with some specialized large blocks

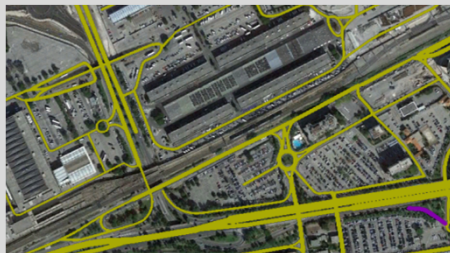
- a history of at least 2-3 centuries
- absorbed the arrival of the industrial revolution, with its streetcars and railways, and later the automobile system.
- Can accommodate revegetation of public space.

Prospecting the physical city of the next century



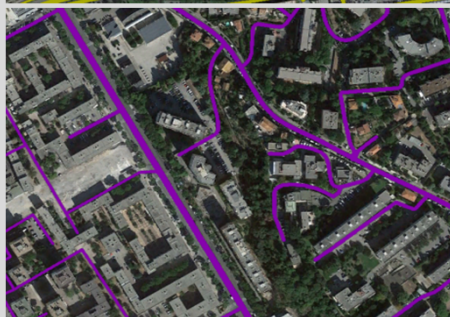
Suburban residential fabric with tree-like street network.

- Only 60 years of history
- Optimizes residential comfort for motorized families
- Probably won't adapt to some future change
- Potential resilience of single houses
- Intervention strategy: increase network connectivity, foster functional mix, create network of public spaces



Modern functional concentrations

- Very short history
- Optimized for a single function
- Most fragile to future change
- Intervention strategy: allow functional and typological mix, plot fractioning, increase network connectivity and public space



Morphological resilience is also strengthened by the spatial arrangement of morphological regions

Evaluating processes or end-results ?

Additive Self-Constructed City



Domaine du Pin de la Lègue, Fréjus

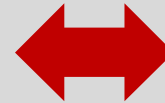


Södermalm, Stockholm

Designed and Controlled City



Haut-du-Vaugrenier Subdivision



What are the advantages and the shortcomings of the two processes?

Which one is more resilient?

What space is left for self-organizing processes in developed countries?

Urban Morphological Resilience

Beyond the qualitative evaluation through the proof of time, Morphological Resilience is an open research question.

Feliciotti, Romice & Porta (2016, 2017): first attempts to operationalize morphological resilience concepts using proxies.

But:

Complete theory of urban morphological resilience still to be developed.

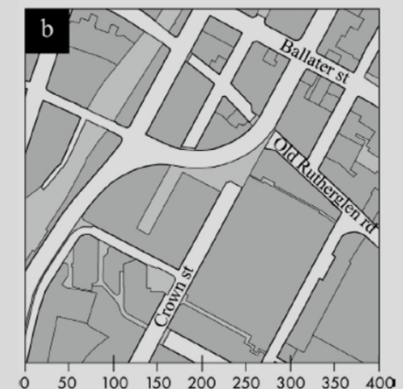
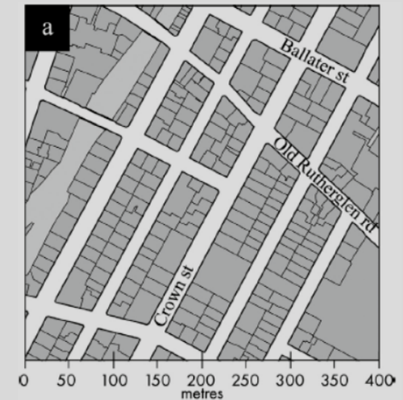
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Analytical models to evaluate urban morphological resilience still in early stage

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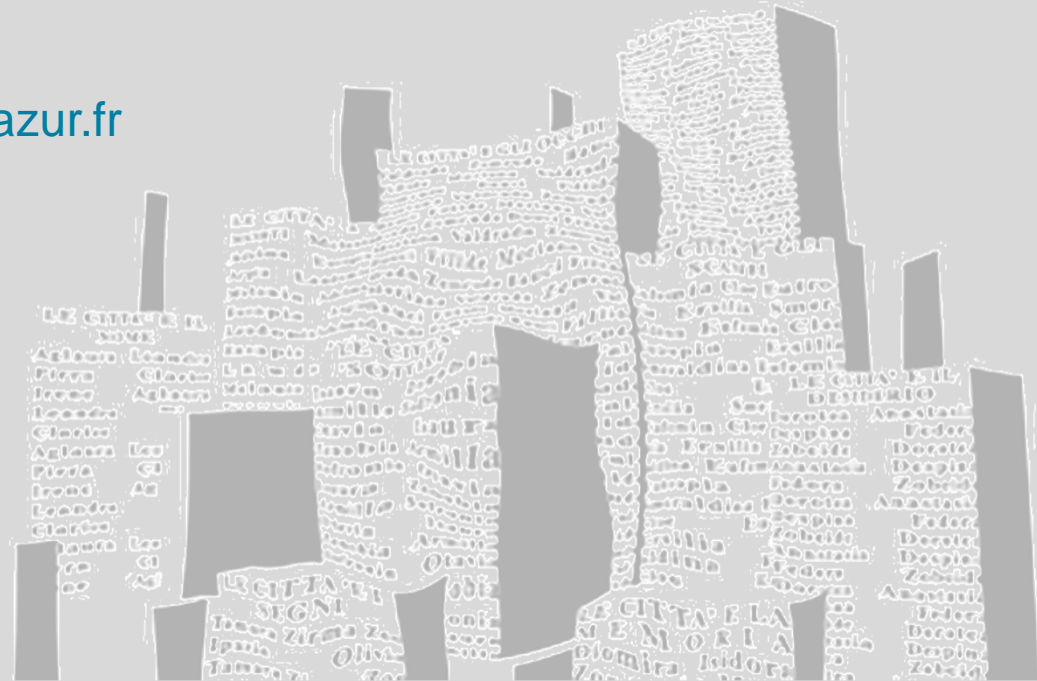
Coupling morphological resilience from a human perspective to ecological resilience a non-trivial question.

A challenge for Social-Ecological Urbanism.



Thanks for your kind attention

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