

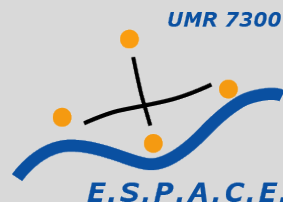
Spatial Big Data in urban environments What do they unveil (and hide) in the case of Brussels?

Friday March 1st 2019 - Louvain-la-Neuve (Belgium)



**The contemporary city mirrored by its form.
A research agenda for geographers and
planners.**

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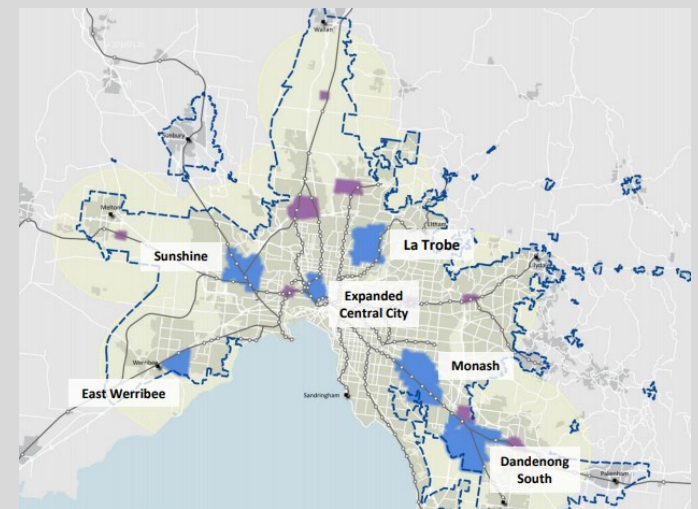
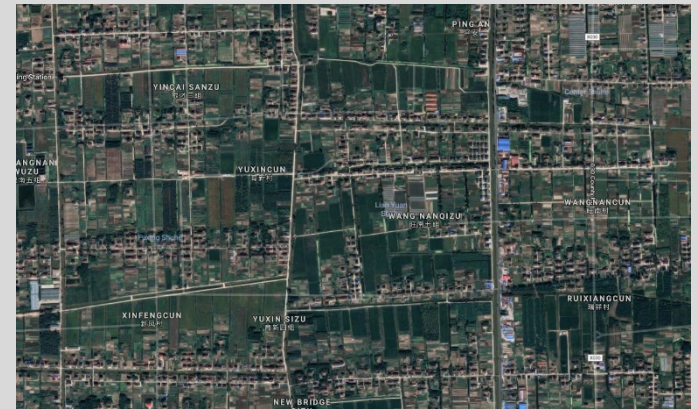
Cities are undergoing accelerated change

Under combined effect of **metropolization** and **socio-technical change** (Ascher 1995, Newman et Kenworthy 1998, Wiel 1999, Bunting et Filion 2006, Bourdin 2014).

New objects, new diffusion processes, new centralities, new standardized techno-eco-districts vs. selective urban blight.

Classical sustainability issues (resources, pollution, socioeconomic dev.) + **more existential ones** (place identity, heritage vs. globalization, spatial solidarity, early obsolescence of new urban objects in the face of disruptive change).

... **form** is the **mirror** of these **changes**, the study of urban form can reveal ways of dealing with them.



Scientific paradigms are changing, too.

Traditionally :

Urban geography and urban economics “strong” theories



Rational Comprehensive Planning

- Focus on land-use allocation
- Does not address urban form

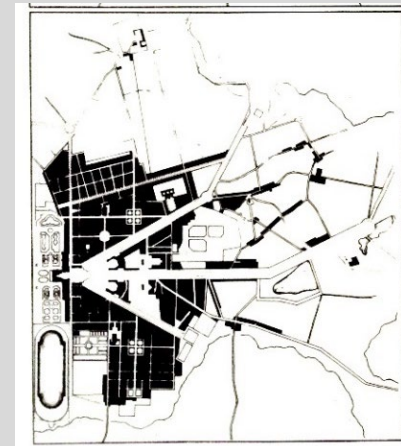
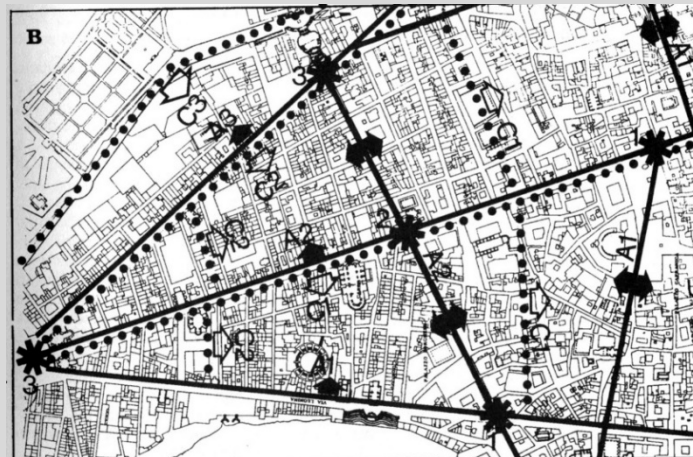
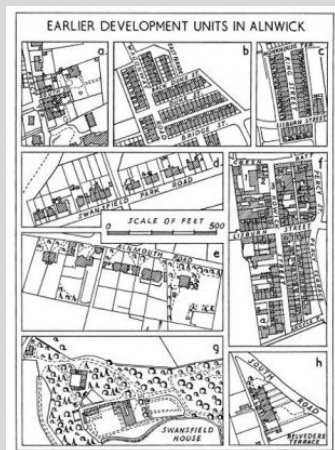
‘70s-‘80s : Failure of RCP, failure of modernist forms...

Urban Morphology (Muratori, Conzen, Caniggia, Panerai)

- First reaction to RCP’s indifference to form
- Create a phenomenological knowledge on historical urban forms
- Fail to produce an operative theory for the changing city (new functions, new forms ?)



Pruitt-Igoe, Saint Louis, 1972



Complex cities make rational comprehensive planning impossible

Cities are complex systems characterized by the interplay between self-organization and attempts of (incomplete) control



Hayek (1967, 1978): we cannot achieve detailed, specific knowledge for complex social systems, but only knowledge in principle

Taleb (2007): this knowledge could be challenged by the occurrence of black swans



Planning the complex city in a changing complex world is one of the main challenges for the coming decades.

An extreme position: give up planning

Moroni (2015), Alfasi & Portugali (2007):
renounce to patterning instruments and limit
system control to **framework instruments**
defining the rules of market-like interaction



... and its criticism

- How can coordination between actors be achieved?
- An underlying urban knowledge is always injected in a system of rules... and how about the morphological infrastructure?
- What is a collectively desirable solution?
- the blindness of market prices to future urban malfunctioning

Urban Strategic Foresight to coordinate the Complex City

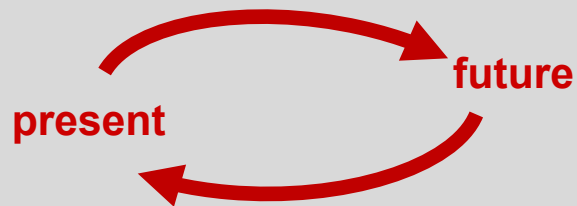
Shared projects produced within urban strategic foresight (Loinger & Spohr 2005, Blečić & Cecchini 2016).

Self-organization is not denied, but steered by a common vision.

Uncertainty an unavoidable epistemic condition and a positive resource.

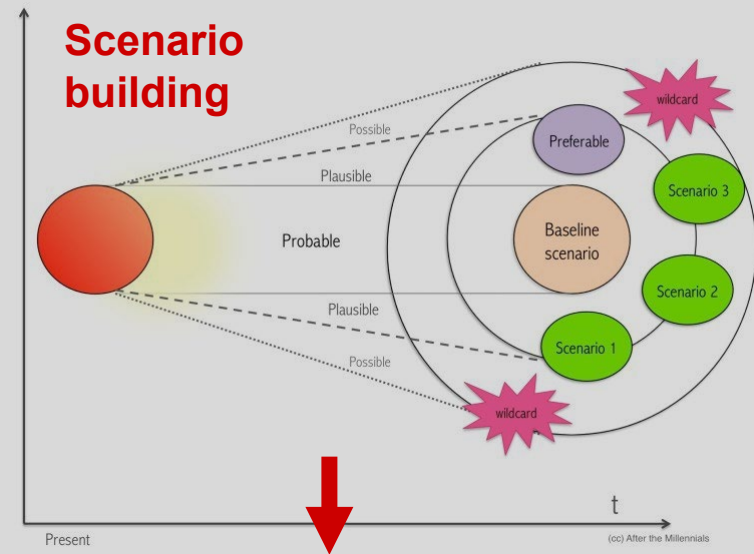
Socio-technical systems

(Dupuy 1992, 2012):



A project to rally actors:

- Shared
- Good enough to be desirable
- Credible enough not to be dismissed as unrealistic



Deep Uncertainty (Walker 2013)

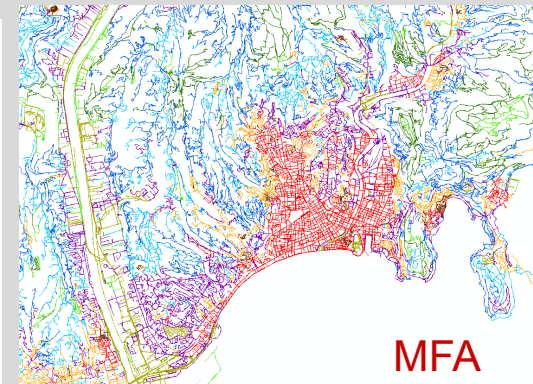
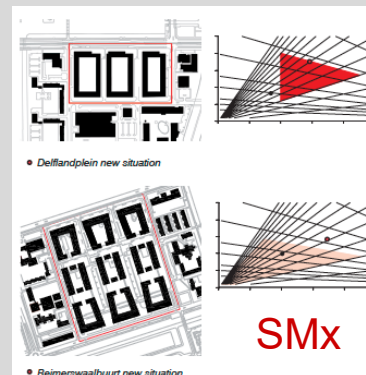
- Arouse demand for uncertain urban knowledge
- Provide expertise on complex cities based on spatial organization
- 3 directions of scientific research

Morpho-Dynamic Research

Recognize **structural complexity** of urban form :

1. Form has many definitions endowed with social meaning: city layout, urban fabrics, streetscapes (Lévy 2005)
2. Configuration as a new approach to urban form: from geometric description to analysis of properties within systems of spatial relations (Hillier, Peponis, Porta, Cutini)

Plenty of new methods:



Morpho-Dynamic Research

3. Investigate the complex relations between urban form and urban dynamics (socio-economic functionings, mobilities, morphogenetic processes)
4. Test first morpho-dynamic theories for the complex city (Salingaros) with real-world data

New perspectives from new sources of data : VGI, SMGI, etc.

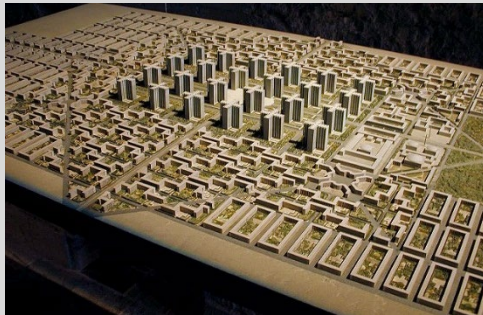


New concepts, new approaches in the analysis of the relations

5. Accept various degrees of uncertain and incomplete knowledge on these issues

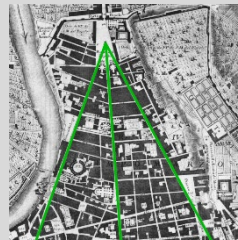
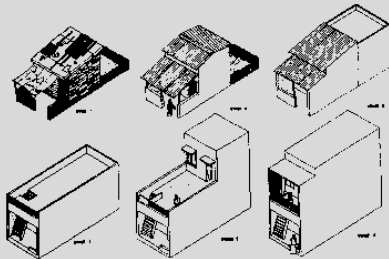
Morpho-Prospective Research. Good urban form in face of an uncertain future

The culturalist approach
(Sittte 1889, Howard 1902)



The modernist approach
(Cerdà 1867, Loos 1913,
Le Corbusier 1924, 1943)

Post-war rediscovery of traditional solutions



urban morphology (Muratori, Caniggia, Conzen)

urban complexity (Alexander, Hillier, Salingaros)

➤ revisit this debate in the light of uncertain knowledge

The effect of time on human artefacts



**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.

Towards resilient and antifragile cities

Traditionally:

fragile



resistant



Hazard-resistant solutions a classical strategy of intervention in risk-systems. In open complex systems characterized by deep uncertainties and black swans, **an impossible task.**

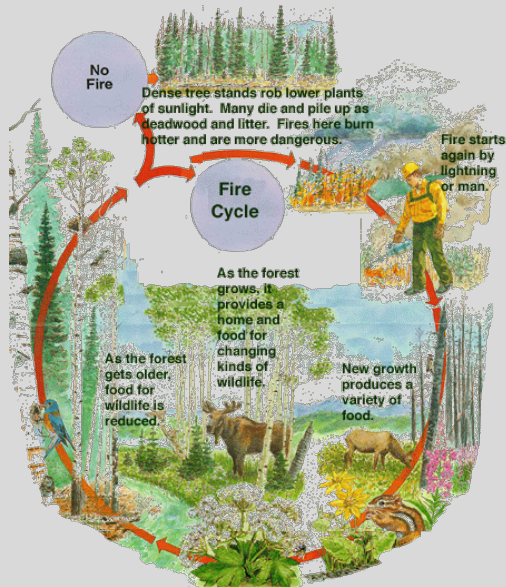
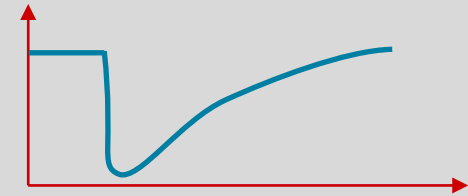
Two new concepts: **resilience** and **antifragility**.

General goals for planning in self-organized complex systems.

What do these concepts mean? What precise meaning do they take in the context of the planning of the physical city?

Engineering Resilience, General Resilience, Antifragility

Engineering resilience = capacity of a system to recover normal functioning state after perturbation



General resilience (Holling 1973) = capacity of an ecosystem to absorb change and perturbation and to assure persistence of key relations

3 key properties of general resilience in ecosystems:

- Persistence
- Adaptability
- Transformability

Spatial dimension in general ecosystem resilience (Cumming 2011).

Taleb's triad:

fragile



resistant



antifragile

Antifragility = capacity of self-organized and adaptive systems to improve when exposed to perturbations.

Concepts of resilience and antifragility are not opposed, but overlap.

Resilience and antifragility for the physical city

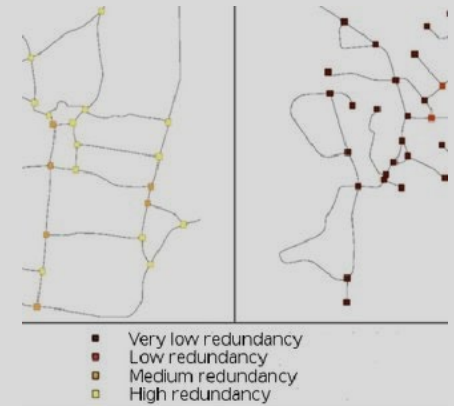
Resilience of urban ecosystems and urban metabolisms (Newmann & Jennings 2009, Ernstson 2010, Biggs 2015). Focus on external perturbations (natural catastrophes, climate change).

After Albert (2000): **resilience of urban networks** after a natural or man-made catastrophe (Lhomme 2012, Toubin 2012).

Configurational resilience of street networks using Space Syntax to debilitating perturbations (Cutini 2014, Cutini & Di Pinto 2015, Esposito & Di Pinto 2015, Koch & Miranda 2013, Marcus & Colding 2014, Abshirini & Koch 2017). **Analysis for the first time morphological.**

Pumain (2012): the proper of the city is to produce innovation endogenously

Voiron (2014): interest to study city **resilience to urban change**



Urban morphological resilience



Mehaffy and Salingaros (2013) key to resilient ecosystems is their complexity:

- 1) *inter-connected network structure*
- 2) *diversity and redundancy*
- 3) *wide distribution of structures across scales*
- 4) *capacity to self-adapt and self-organize*

Morphology of resilient cities:

- 1) *Inter-connected networks of pathways and relationships*
- 2) *Diversity and redundancy of activities, types, objectives, and populations*
- 3) *Wide distribution of scales of structure*
- 4) *Cities and their components can adapt and organize in response to changing needs on different spatial and temporal scales, and in response to each other*
- 5) *Resilient cities retain and build upon older patterns or information. They are “structure-preserving” even as they make deep structural transformations.*



Making cities resilient ant antifragile

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.**

This theory could guide decision making in urban strategic foresight.

Taleb: planning and decision making in complexity

Blecic and Cecchini: planning for complexity.

“Soft planning”: not a rigid project to implement

- A relatively stable and shared, but highly qualitative, common vision
- Plans/rules/interventions on highly resilient morphological infrastructure to foster the self-organization

Only qualitative urban knowledge injected

No naïve assumption that simple market-like interaction among actors can produce an antifragile city. Other kind of coordination is needed.



What is to be done?

A different heuristic: *Via Negativa*

Via Negativa: if we know what is not, we already know a lot.

In planning, we can more confidently identify what not to do than what is definitely the right thing to do.

Avoid:

- functional specialization
- hierarchical, tree-like street networks
- rules hindering self-organization and coordination
- urban projects focusing only on a precise scale
- Optimization.

Beyond *Via Negativa*:

Coordination between individual actions capable of producing “urban forms with high resilience potential” at different scales.

Where could this coordination come from?

Shared Urban Culture and Pattern Language

Coordination through shared urban culture.

Lindy effect: Antifragility of vernacular solutions.

Alexander (1977, 1987): a pattern language

Pattern = a general operational solution developed in the course of time to solve a typical class of problems. It encodes collective intelligence.

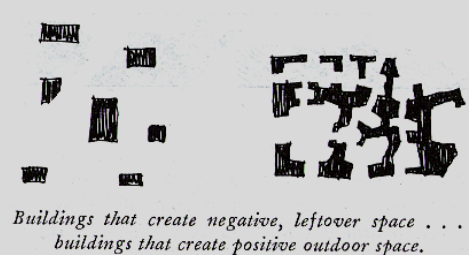
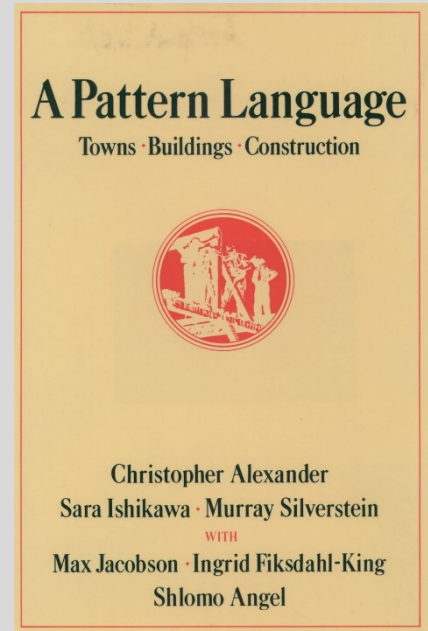
Patterns are pre-scientific

A pattern language = a system of interconnected patterns

An approach developed in several domains (computer science, medicine, pharmacology or psychology)

Alexander et al. (1977): a language of 253 patterns for architecture, urban design and urban planning

Research on traditional urban morphologies and pattern language could converge to create operational protocols based on a shared urban culture.



Morpho-Cultural Research

A potential convergence:



- Urban Form is linked to Urban Culture (practical know-how, with associated social meaning, producing urban forms)
- Culture as a coordinator within urban self-organization
- Culture as a new perspective in urban structural complexity

The ultimate mirror imaging: nature vs culture.

- Salingaros, Alexander: vernacular complex urban forms are “natural”, modern culture walks away from biophilia
- Urban morphologists: vernacular urban forms are linked to precise cultural contexts
- The question is thus: how and why urban cultural codes shift from catalyzing self-organized complexity to hindering it?

Prospecting the physical city of the next century

An exercise in deep uncertainty



Via Negativa

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

Fragile
urban
forms



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.

Prospecting the physical city of the next century



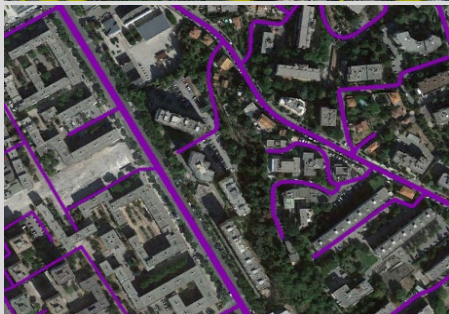
Suburban residential fabric with tree-like street network.

- 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

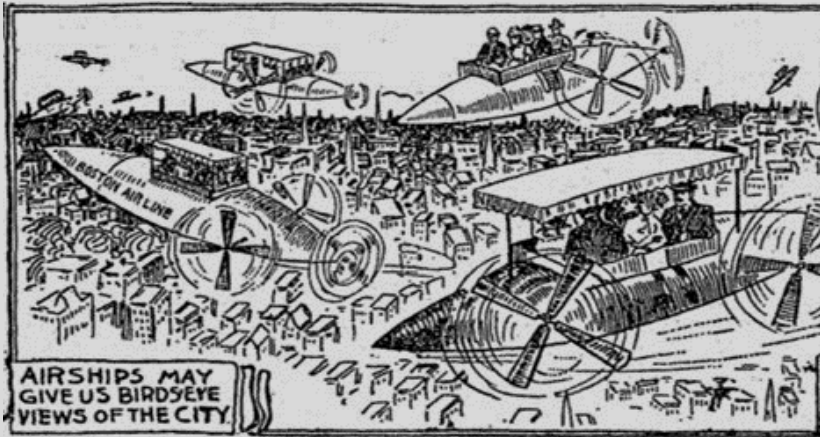
- Very short history
- Optimized for a single function
- Most fragile to future change
- Intervention strategy: allow functional and typological mix, plot fractioning, increase network connectivity and public space



Antifragility is also strengthened by the spatial arrangement of morphological regions

Prospecting the mobility system in city of the next century

Classical future analysts will speculate on the impact of technologies presently under development



The city of year 2000
(Boston Globe 1900)

How can we avoid the same trap? ...Lindy effect + *via negativa*

Over millennia, cities have developed connected networks of pathways for walking.

Investments in walking infrastructure today are the most antifragile to urban change and will complement any transportation technology.

For the rest:

- Precautionary principle
- Programmed redundancy
- Avoid optimization

Exercise appraisal

In front of Smart City neomania, an intellectual purge.

Beyond morphology, other resilience domains must be assessed.

Urban strategic foresight needs inputs from local actors and must be case specific.

Urban actors have to agree on what level of coordination they are ready to accept.

As scientists, we will be requested for both empirical and theoretical research backing (or possibly rejecting) practical and procedural knowledge.

Need of epistemic modesty. Complex system scientific knowledge is inherently uncertain, often only qualitative and we don't have the pretention to consider as invalid practical or procedural knowledge,.

Conclusions

In the face of the easy attractiveness of high-tech solutions central role that urban form can play in urban antifragility and resilience.

The surprising modernity of traditional spatial arrangements.

Open research questions:

- better understanding of the complex system properties of traditional urban forms
- limits of traditional spatial arrangements to integrate new urban objects
- possibility to combine qualitative knowledge of complex morphologies, inputs from participatory processes and quantitative spatial analysis.

These questions should be tackled by a new research agenda on highly resilient urban morphologies in the face of urban change.

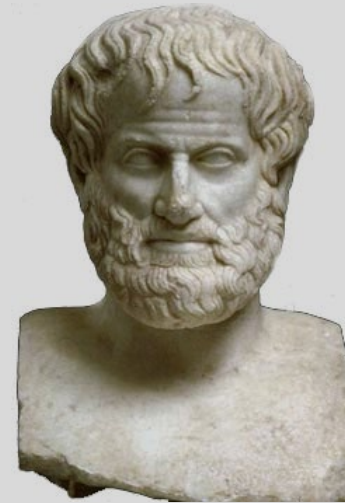
Knowledge, self-conscience and urban resilience

Aristote's 3 kinds of knowledge:

Episteme

Techne

Phronesis



Positivist approach: *episteme* must found *techne* et *phronesis*

Today, we recognize the limits of *episteme* for complex systems

... reevaluation of vernacular solutions and quest for antifragile procedures: a new role for *techne* and *phronesis*?

Epistemic modesty: a new equilibrium between scientific, practical and procedural knowledge.

Cities are open, non-teleologic systems, it is precisely through the self-consciousness of projects and culture, that actions can, at least partially, be coordinated.

Thanks for your kind attention

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