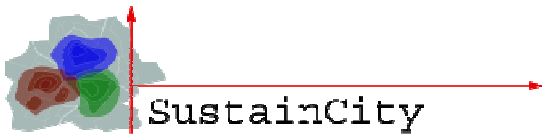

EXTERNAL CASE STUDY WITH EMPHASIS ON METHODS AND RESEARCH

SustainCity CONFERENCE, ETH, ZURICH, APRIL 18th, 2013

André de Palma, ENS Cachan

Outline of the presentation

- Background
- Individual nested decisions: moving, tenure status, housing type, residential location, job location, job type: which decisions in which order?
- Optimal housing consumption and portfolio choice with exogenous random shocks
- Couple residential location: contrasting preferences and bargaining powers
- Animal and human architecture
- Implementation: UrbanSimM

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Background

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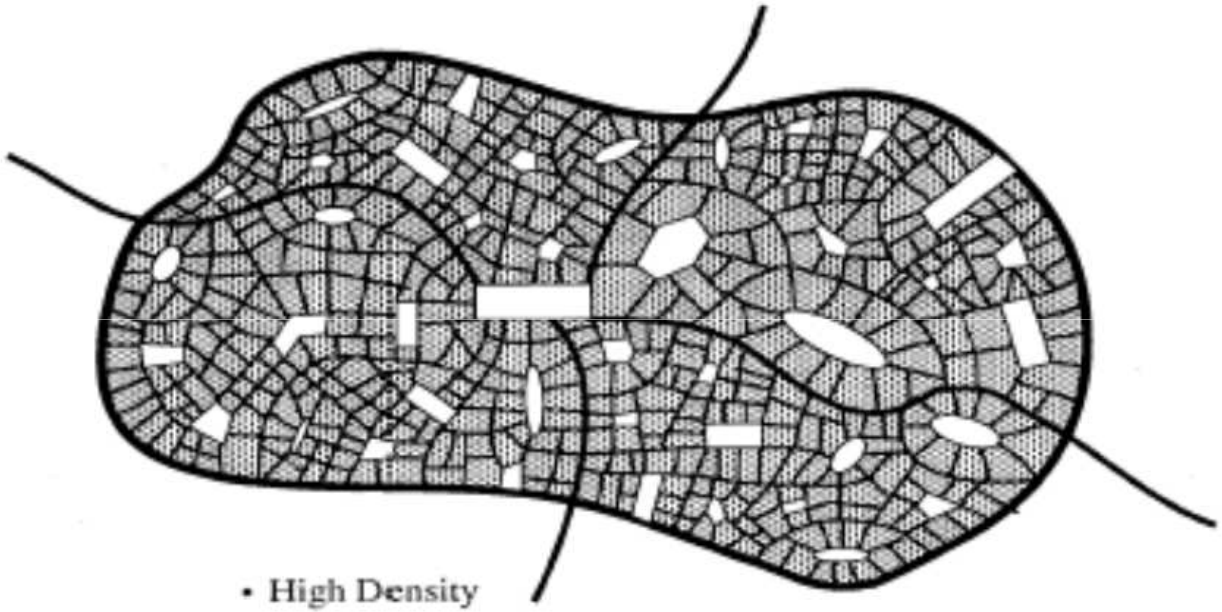
The Walking City



- High Density
- Mixed Use
- Short distance origin and destination patterns, highly dispersed throughout the city

Source : Newman (1995)

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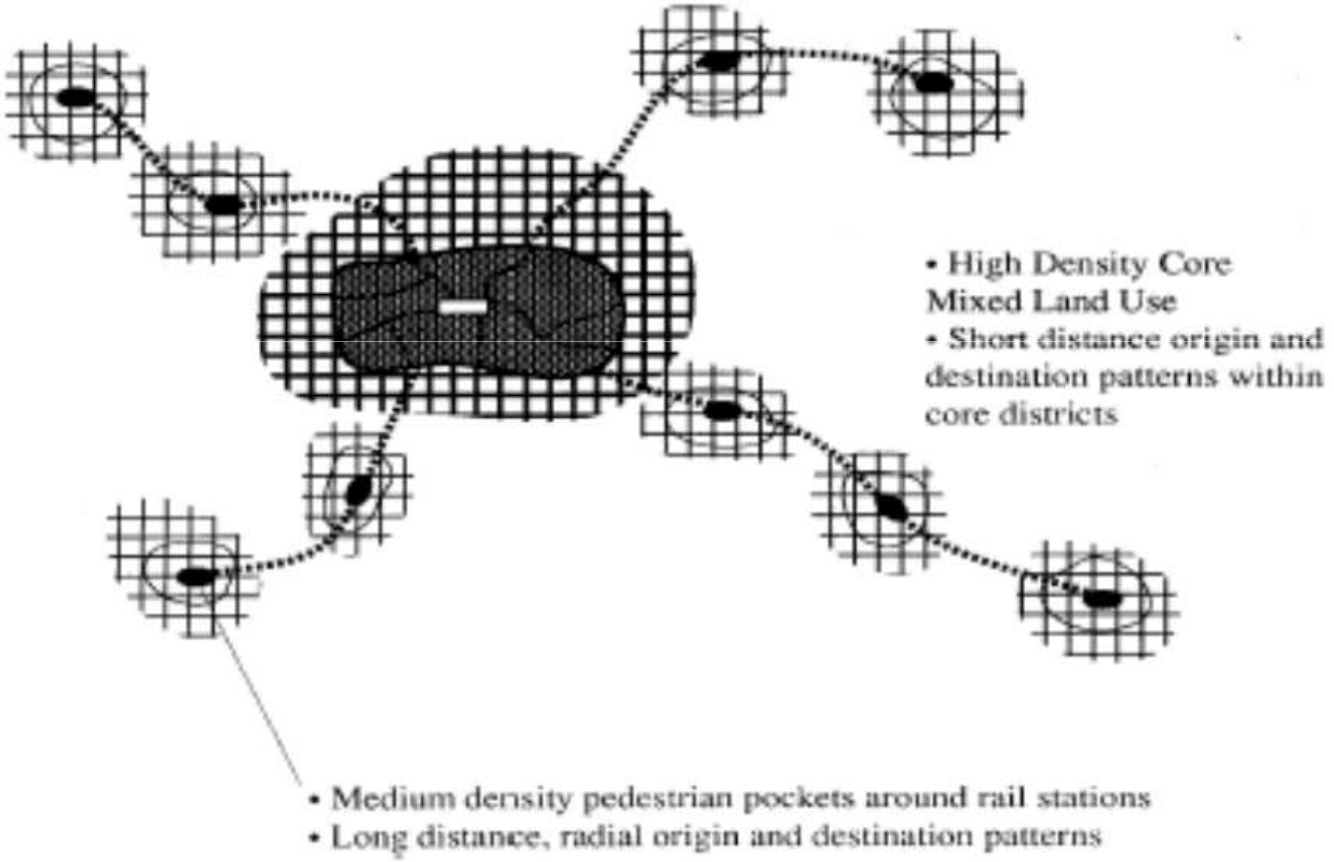
The Public Transport City



Source : Newman (1995)

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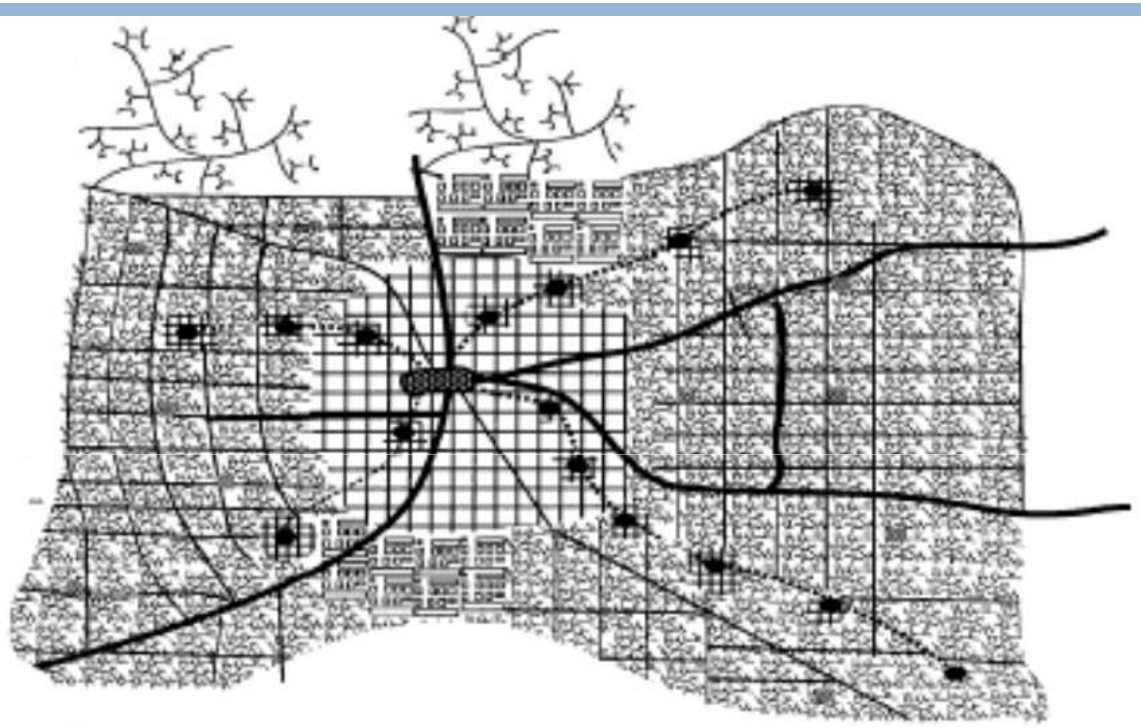
The Automobile City



- High Density Commercial Use Core
- Commercial, Retail and Industrial Land Use separated and dispersed throughout metropolitan area
- Long distance origin and destination patterns highly dispersed throughout the metropolitan area

Source : Newman (1995)

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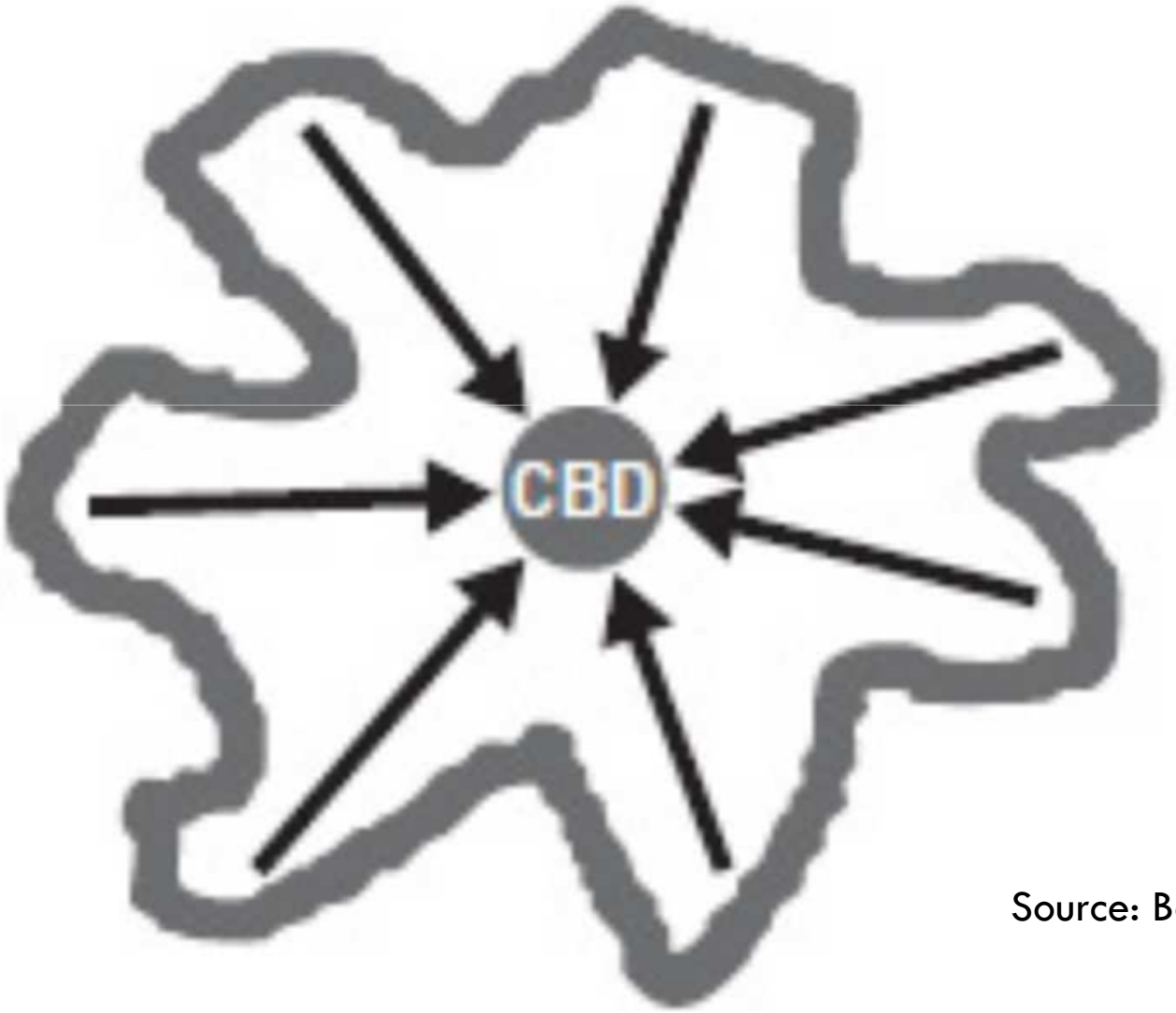
Bertaud (2001) identifies four cases in point to describe the travel spatial distribution of a city:

- the monocentric city
- the polycentric city
- the polycentric city with quasi "Brownian" type movements
- the mega-city

The Monocentric City



Source: Bertaud, 2001.

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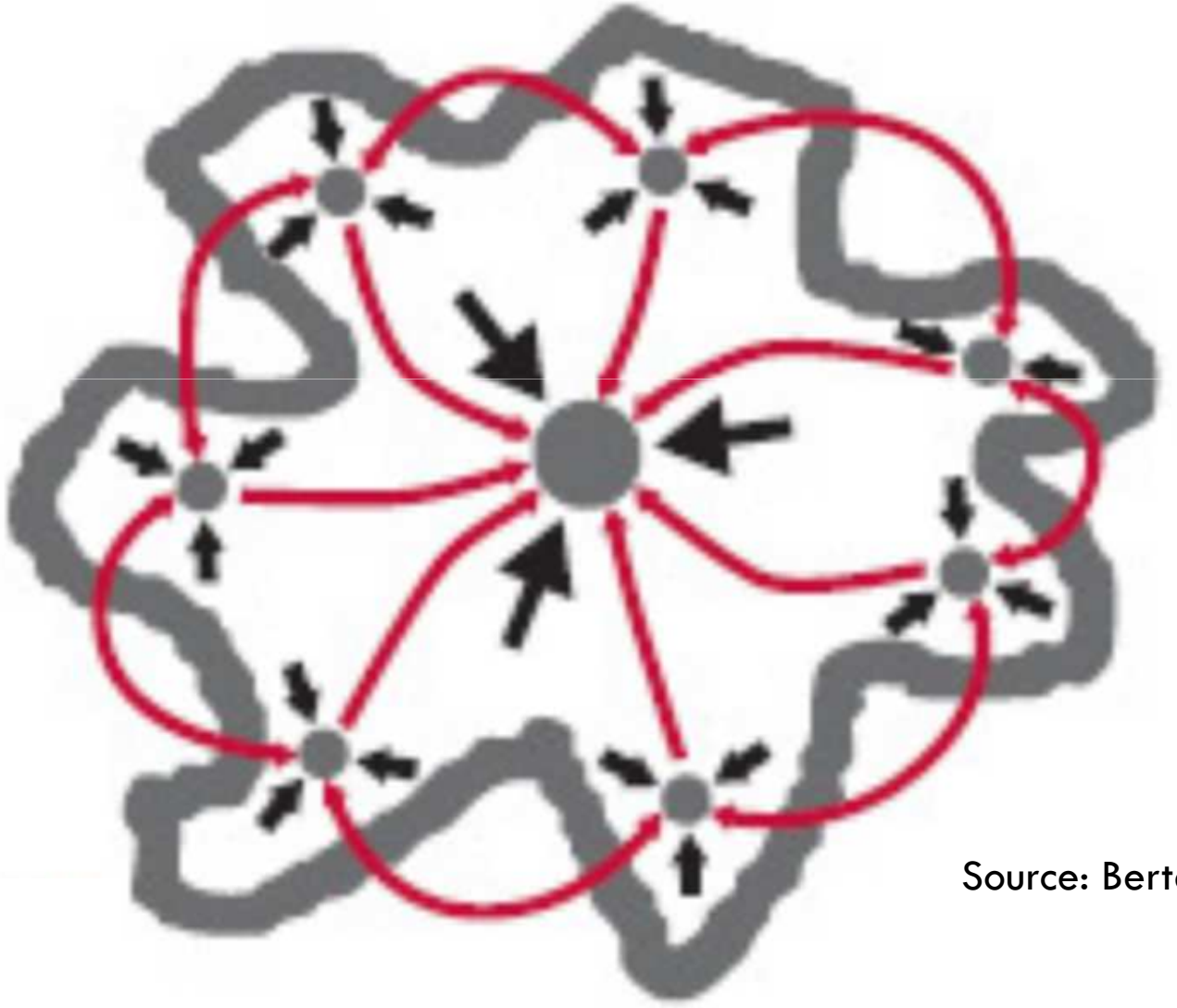
The Polycentric City



Source: Bertaud, 2001.

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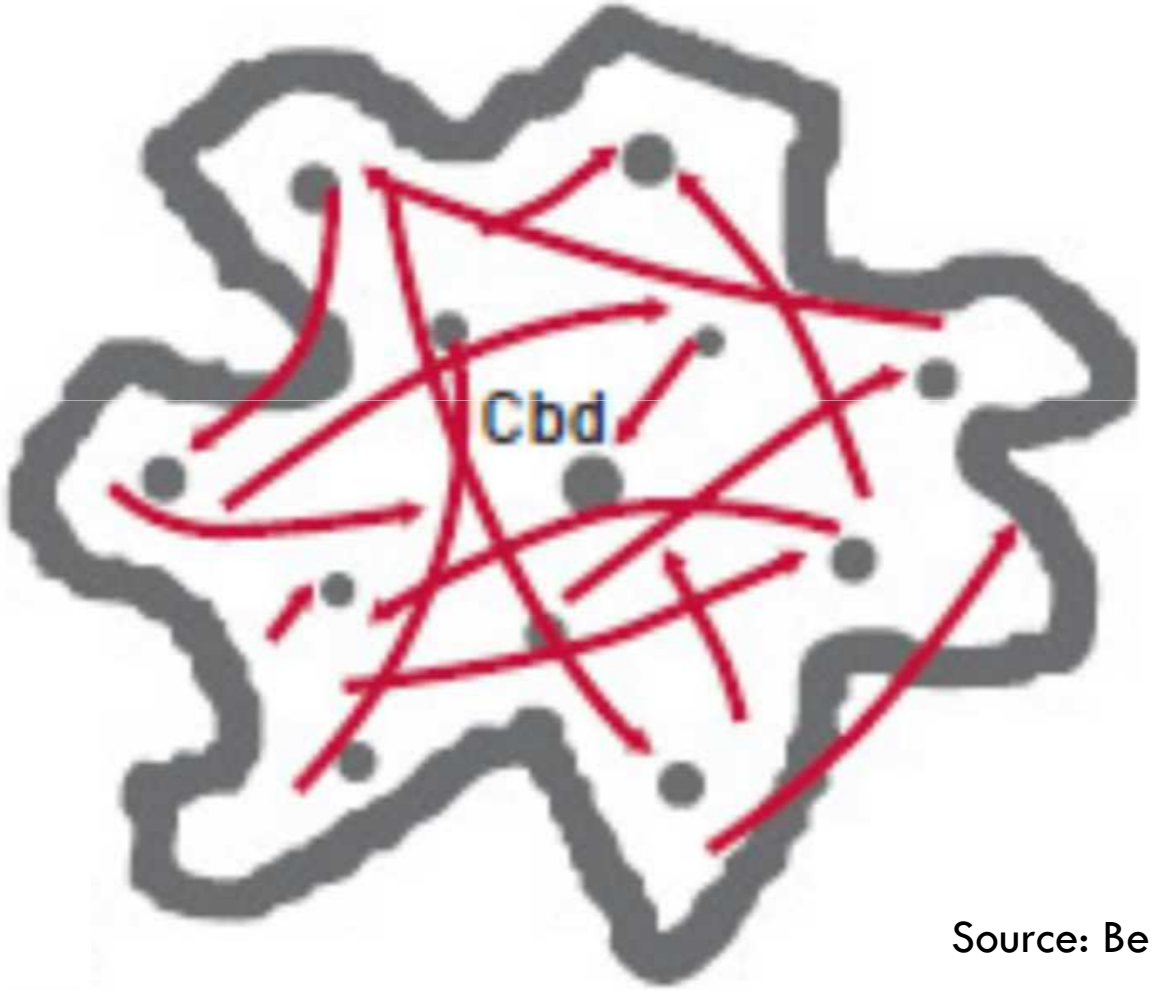
The Polycentric City with quasi "Brownian" type movements



Source: Bertaud, 2001.

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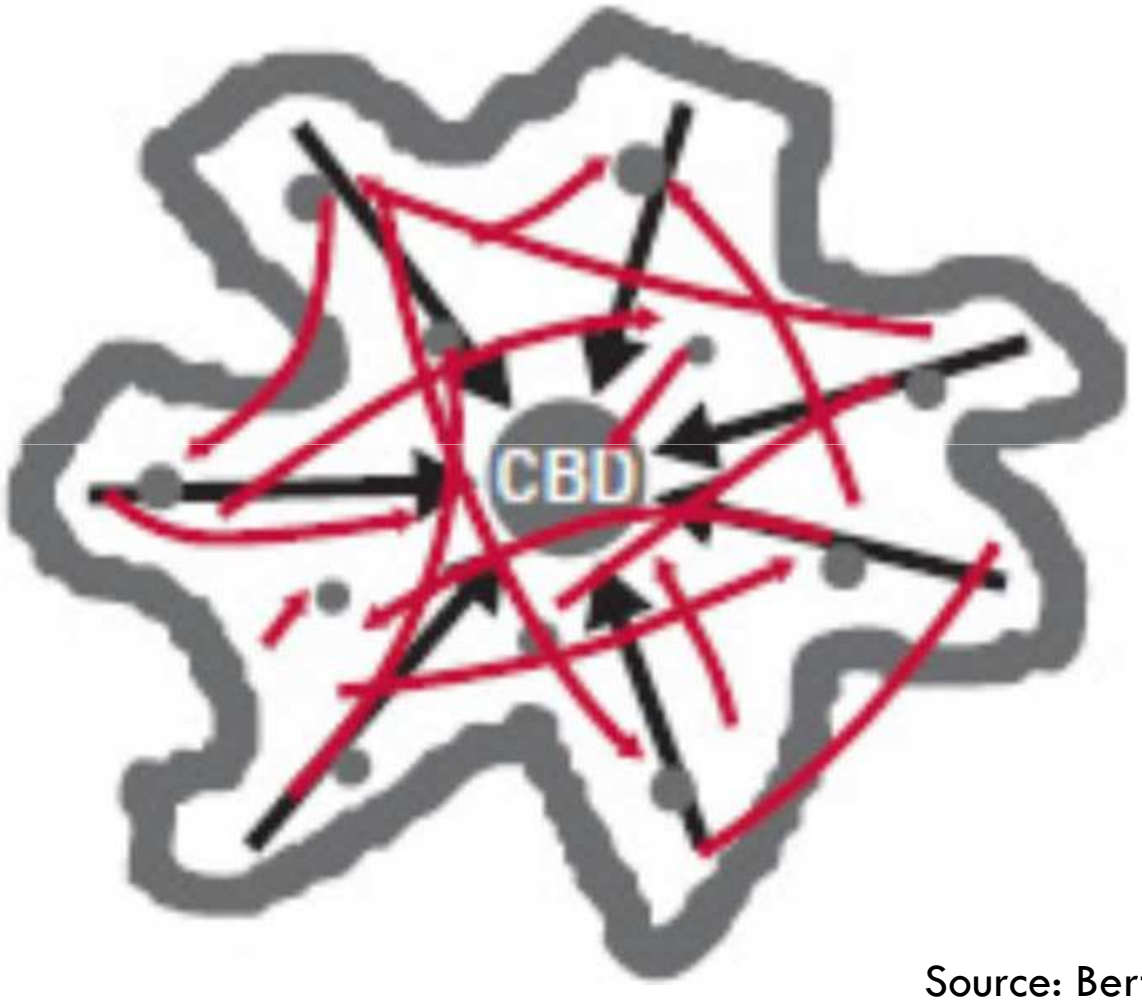
The Mega-City



Source: Bertaud, 2001.

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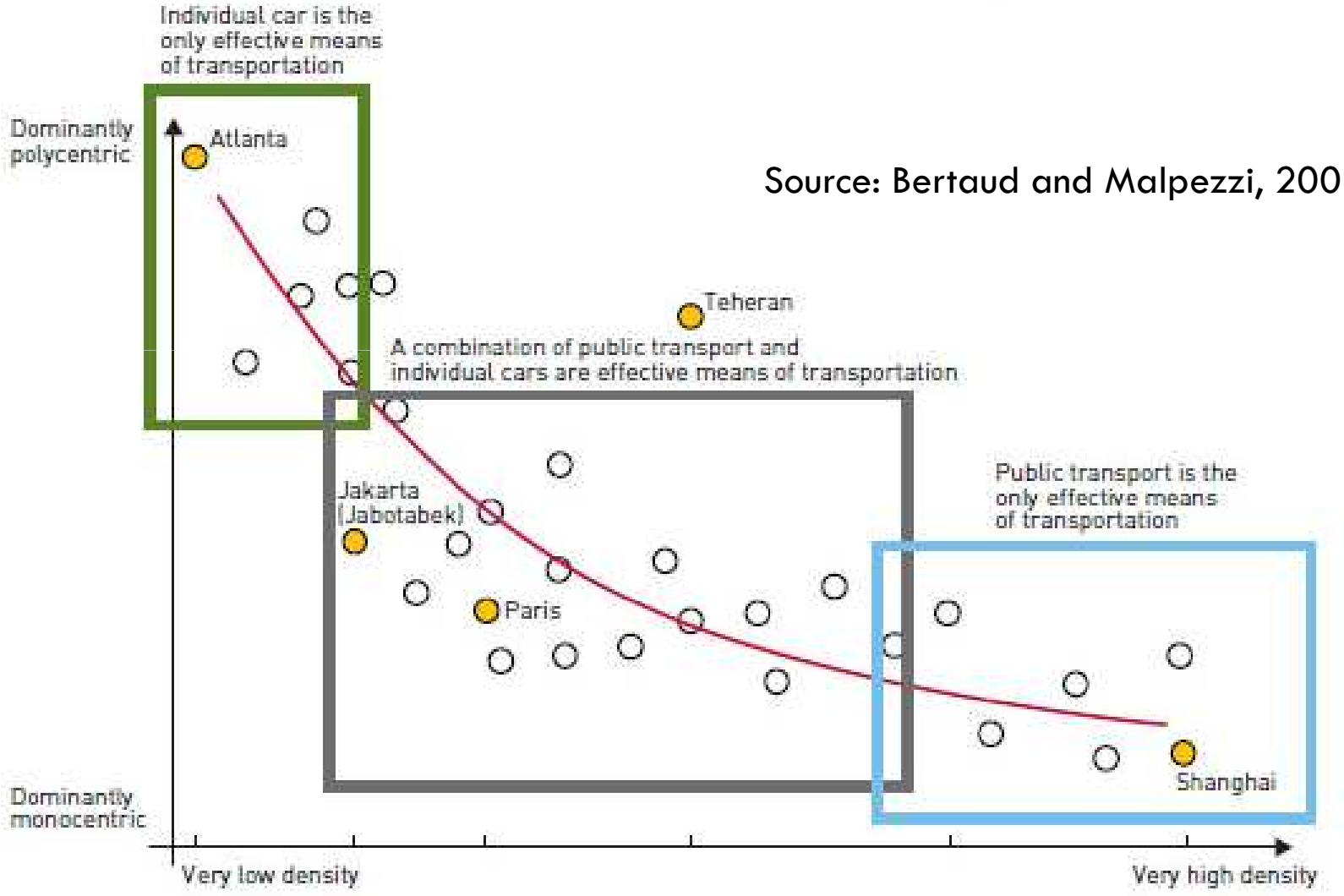
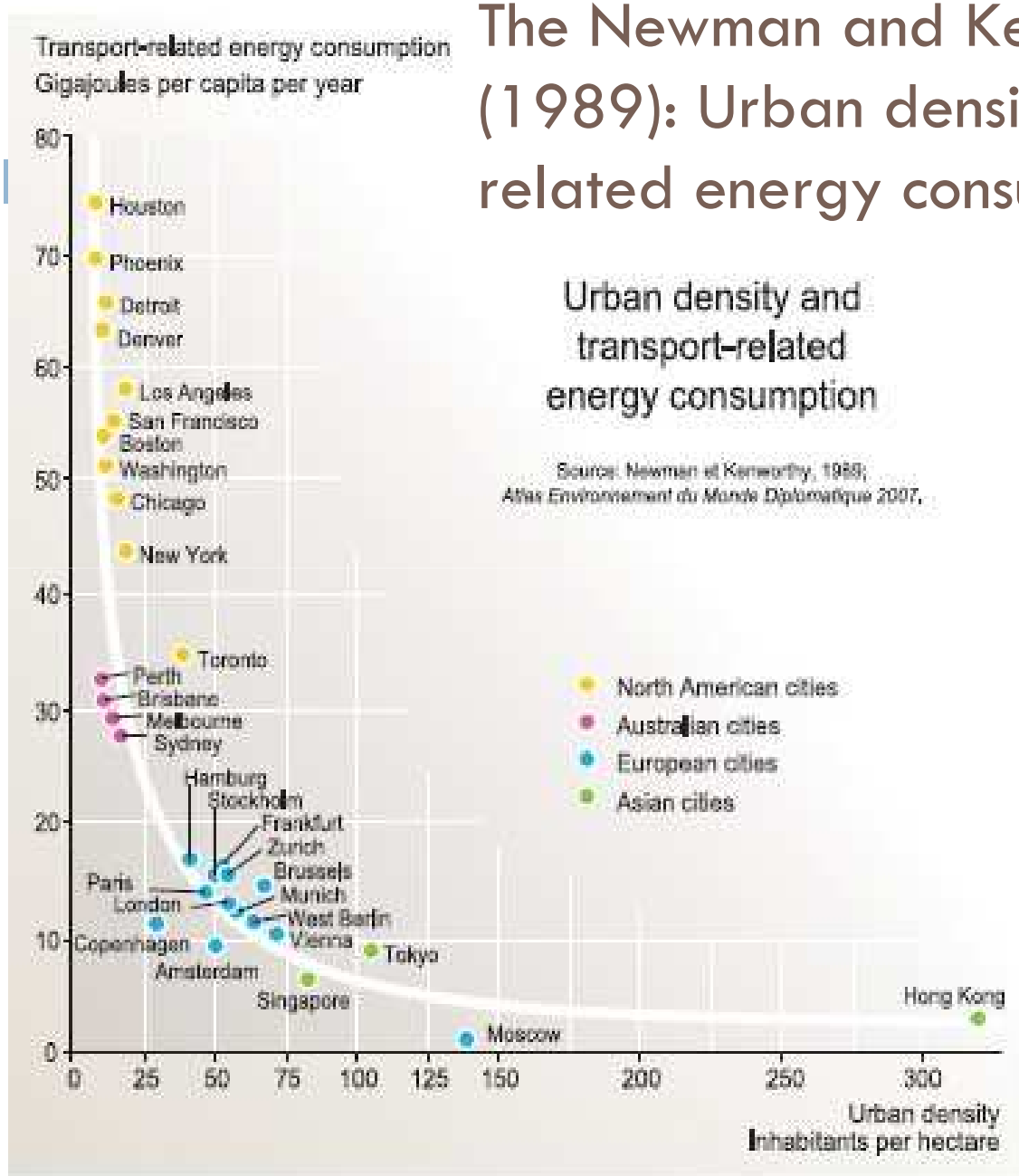
Relationship between spatial structure and the effectiveness of public transport



Source: Bertaud and Malpezzi, 2003.

The Newman and Kenworthy hyperbola (1989): Urban density and transport-related energy consumption



Source: UNEP, 2008,

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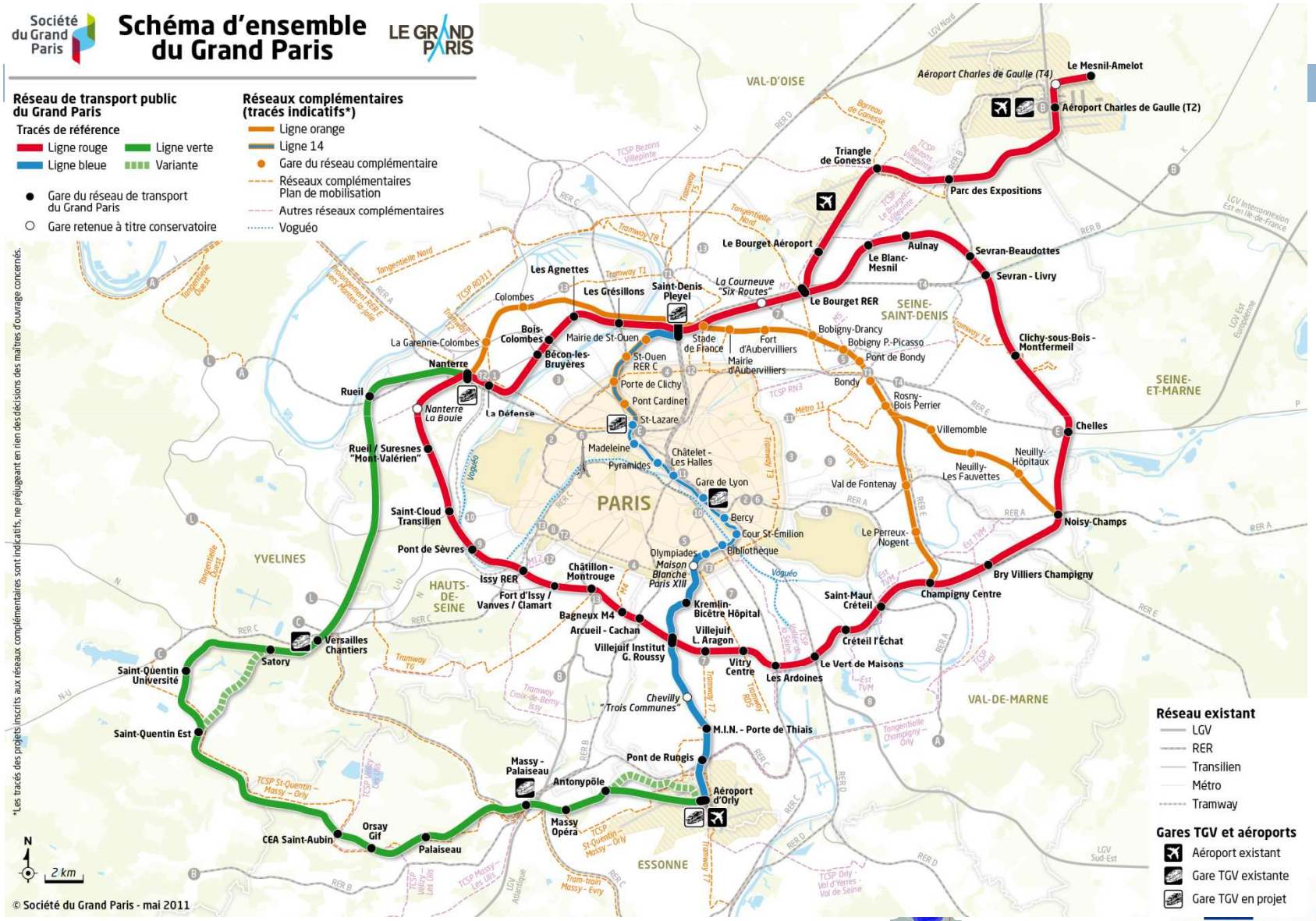
The Grand Paris project



Individual nested decisions

Moving, tenure status, housing type, residential location, job location, job type: which decisions in which order?

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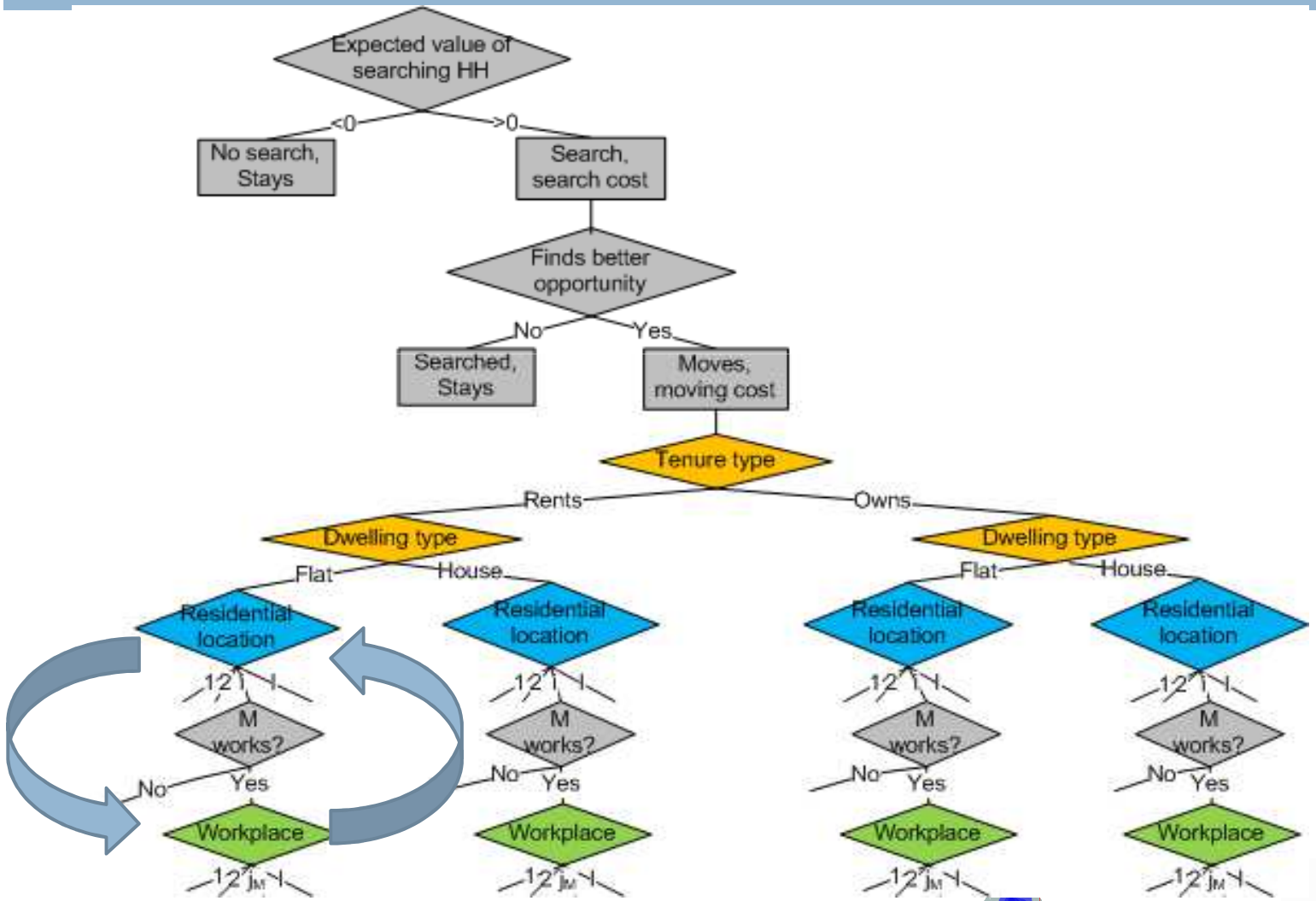
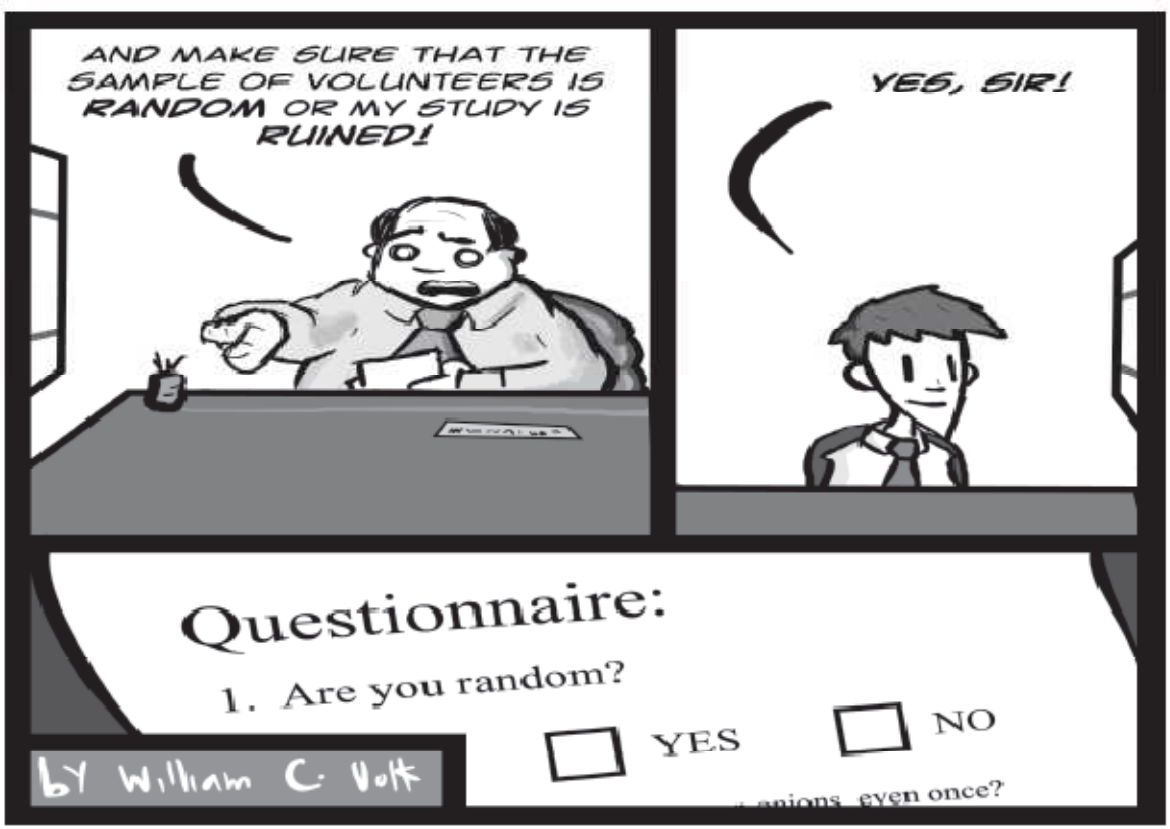
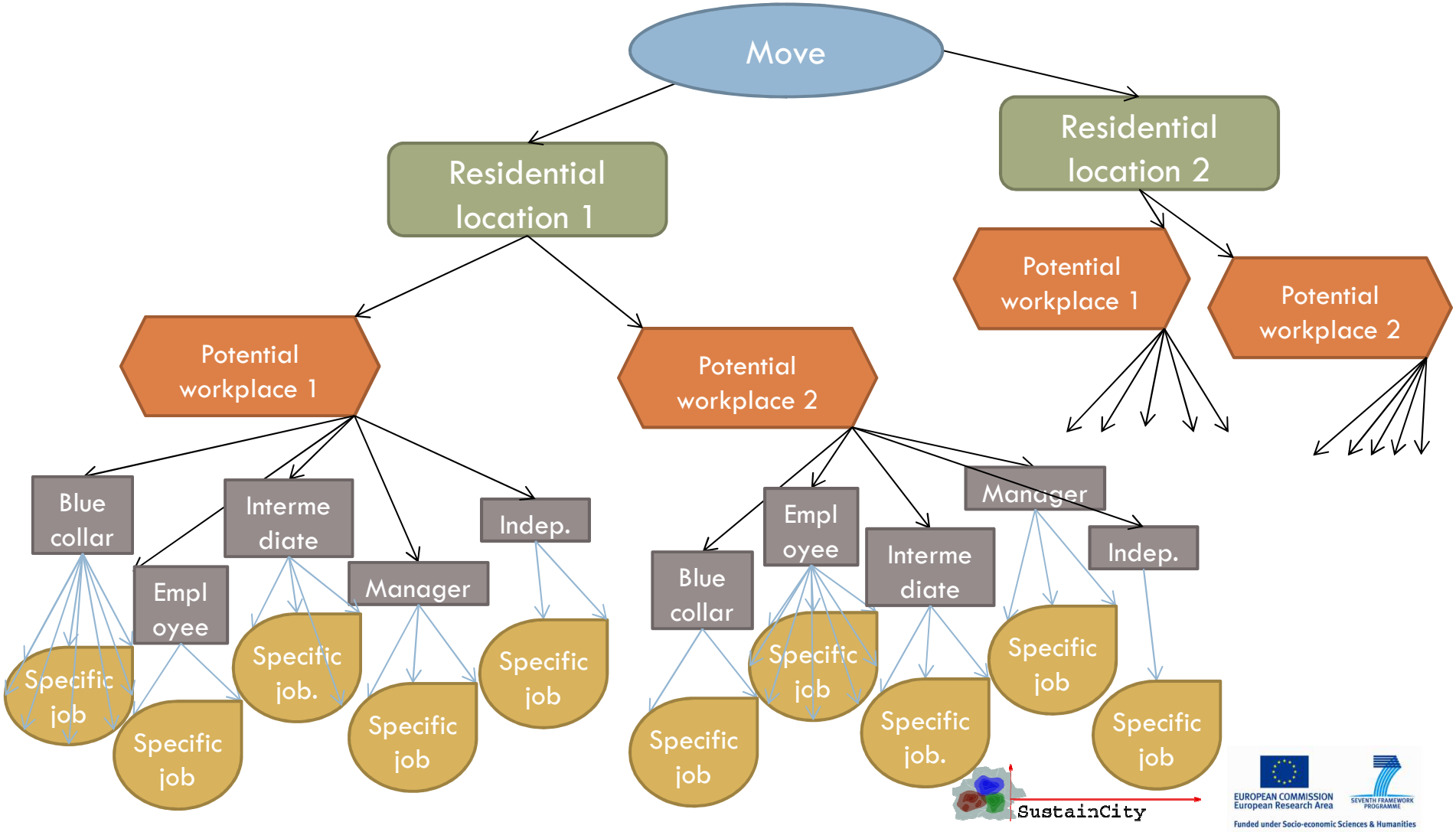
Full decision tree, individual level, residential location before workplace



Dealing with random sampling



Example: Residential location, workplace, job type & individual-specific accessibility



Model (Inoa, Picard, de Palma, MPS)

- Max. of the utility:

$U^T(l, k)$ utility of type of job *l* of type *k*,

$U^W(j, i)$ of work place *j*, of residence *i* ,

$-C^{WR}(j, i)$ of commuting cost from *j* to *i*

$$U_n(l,k,j,i) = U_n^T(l,k) + U_n^W(j) + U_n^R(i) - C_n^{WR}(j,i)$$
$$\forall \quad (l,k,j,i) \in \mathcal{E}_n$$

$$= V_n^T(k) + \varepsilon_n^0(l) + \varepsilon_n^1(k) + V_n^W(j) + \varepsilon_n^2(j)$$
$$+ V_n^R(i) + \varepsilon_n^3(i) - C_n^{WR}(j,i)$$
$$\forall \quad (l,k,j,i) \in \mathcal{E}_n$$

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Individual specific attractiveness-Accessibility

- Attractiveness of workplaces j over types k

$$S_n(j) = \mu_n^1 \ln\left(\sum_{k'=1,\ldots,K;N_{k'j}>0}^{K} \exp\left(\delta_n^1 + \delta_n^0 \ln\left(N_{k'j}\right)\right)\right)$$

➔more efficient than the usual total #jobs N_j for explaining workplace choice

- Accessibility of residential location i to work places, j

$$LS_n(i) = \mu_n^2 \ln\left(\sum_{j' \in J_i} \exp\left(\frac{V_n^W(j'; X_n, Z_{j'}) - C_n^{WR}(j', i) + S_n(j')}{\mu_n^2}\right)\right)$$

➔ more efficient than the usual the usual accessibility measure for explaining residential location

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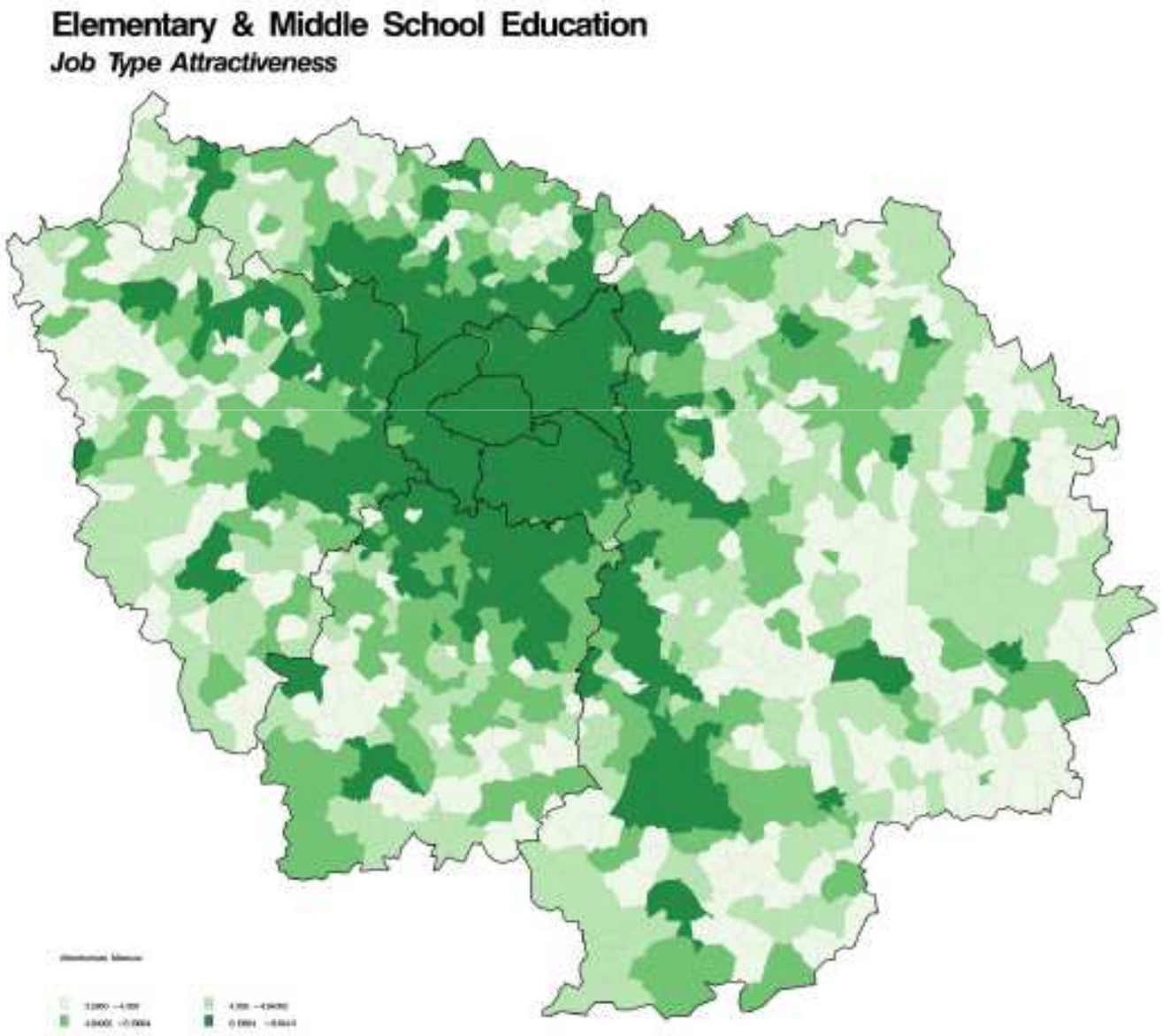
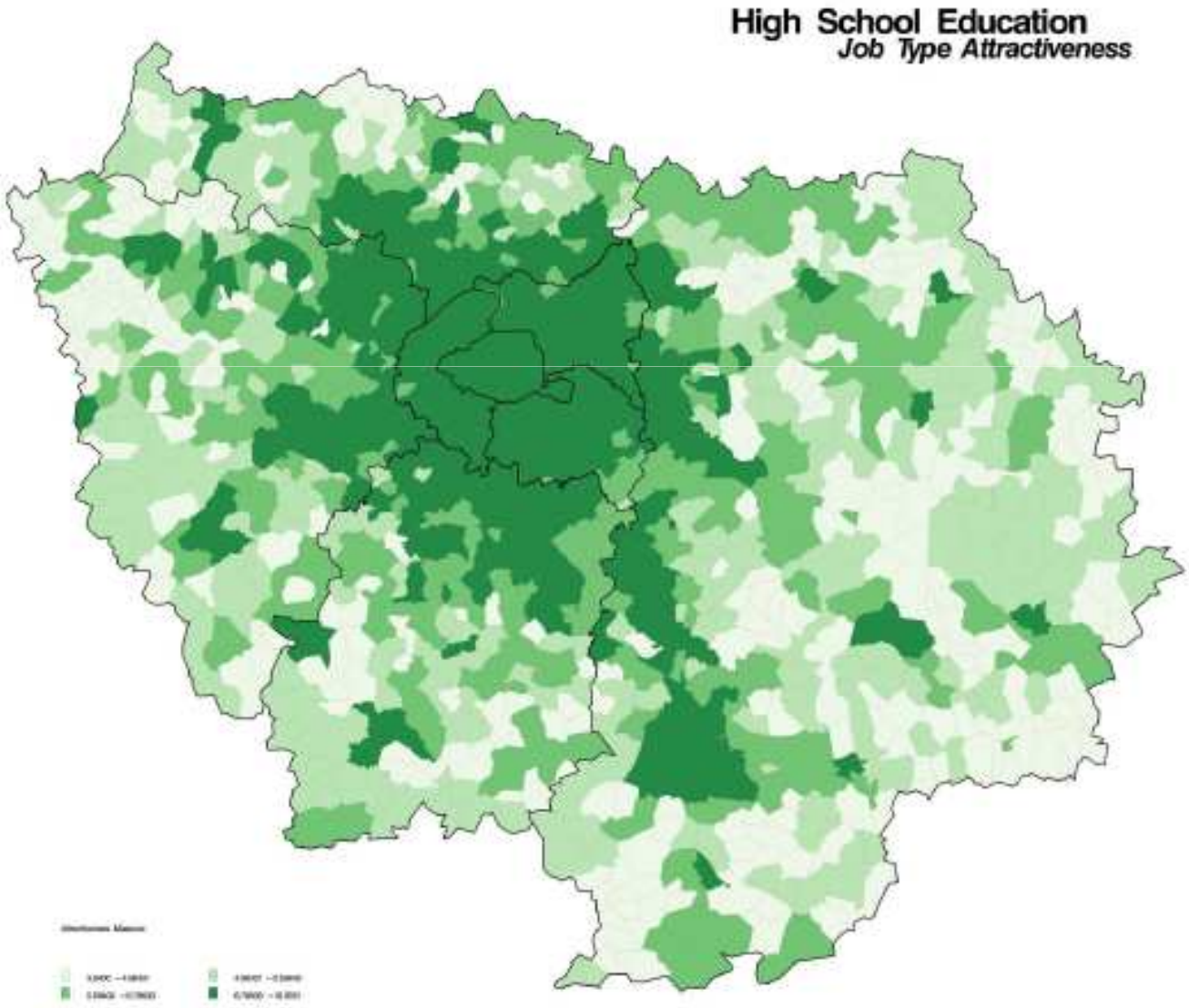
Attractiveness measure by education



Attractiveness measure by education



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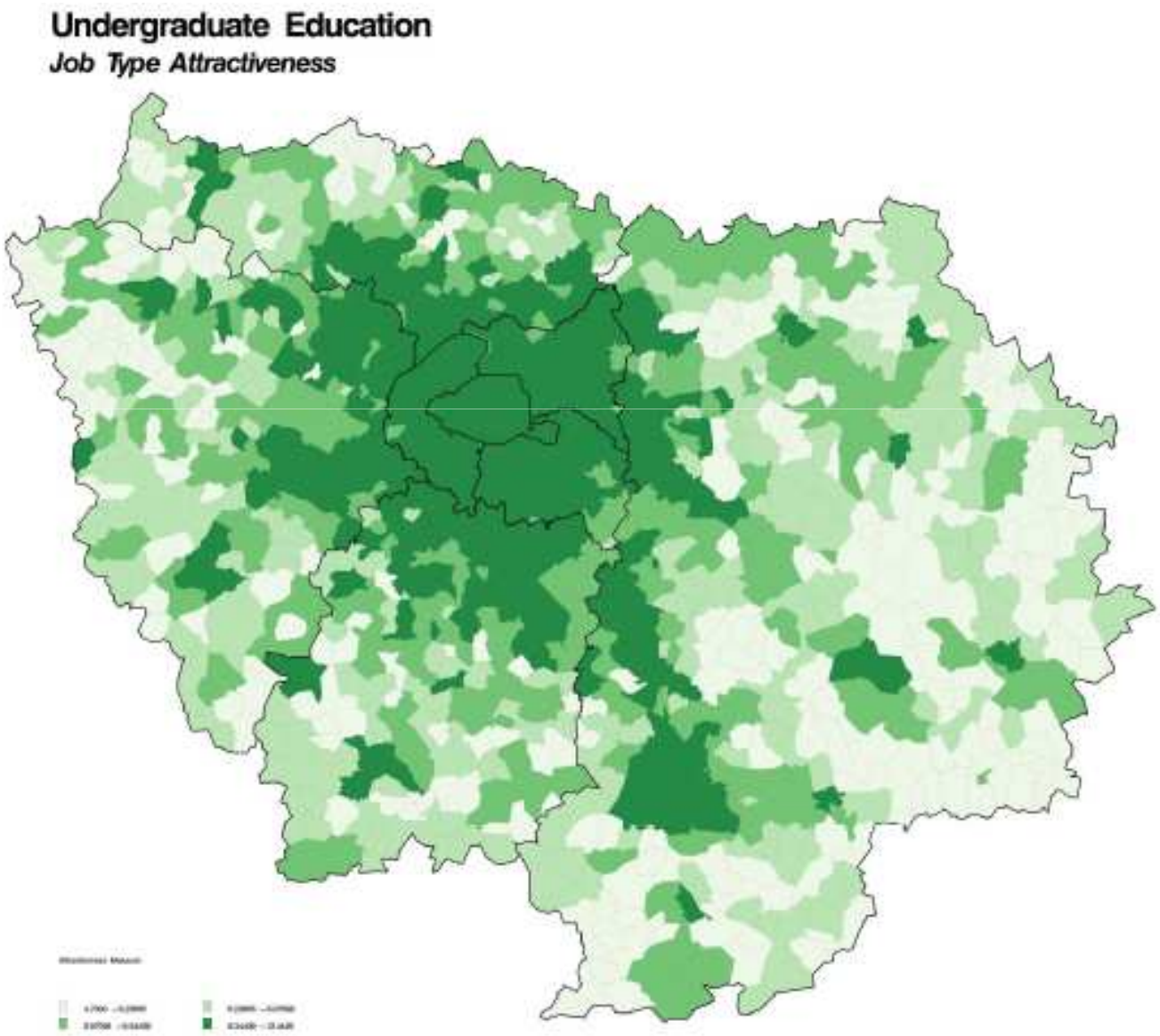
Attractiveness measure by education



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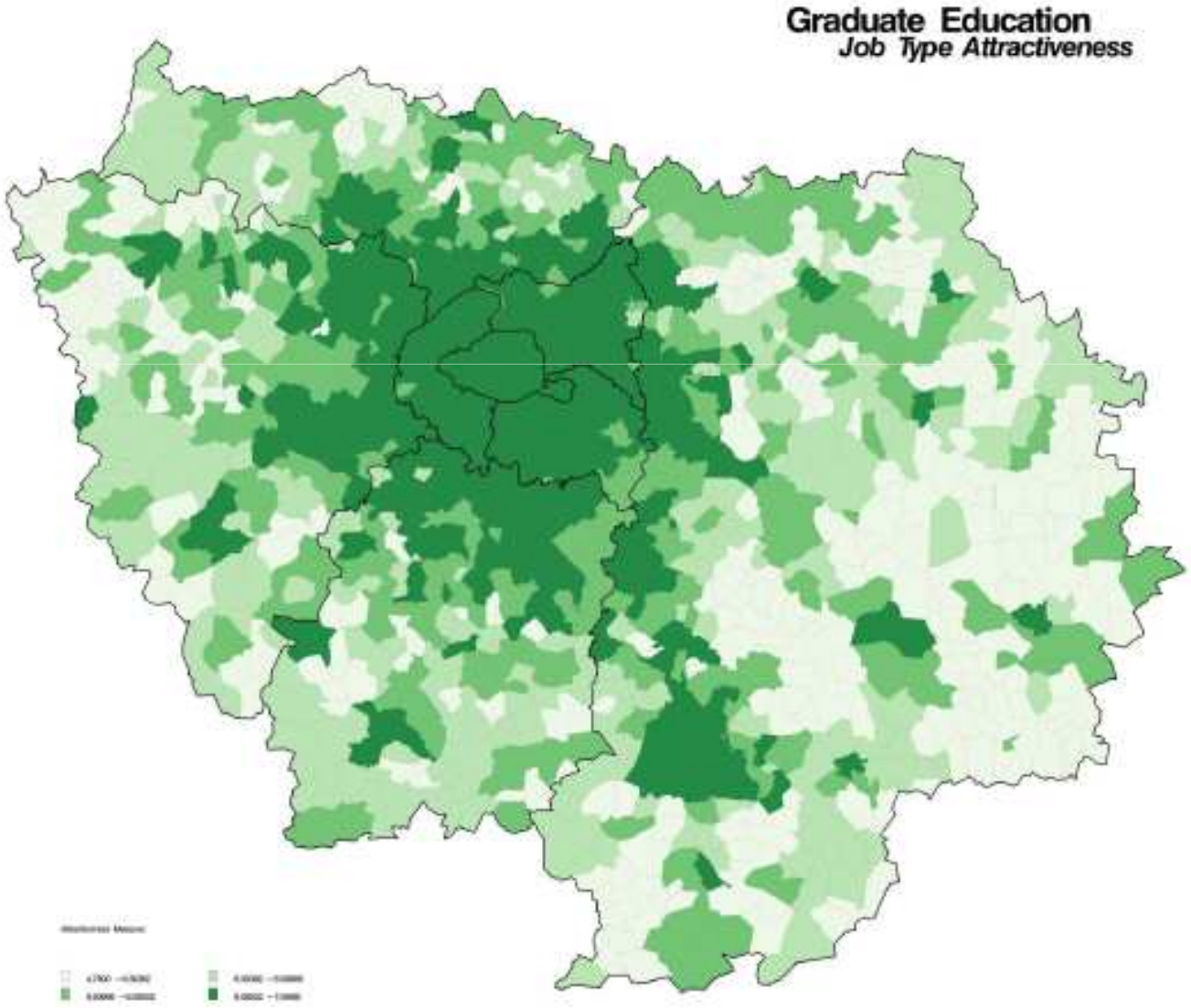
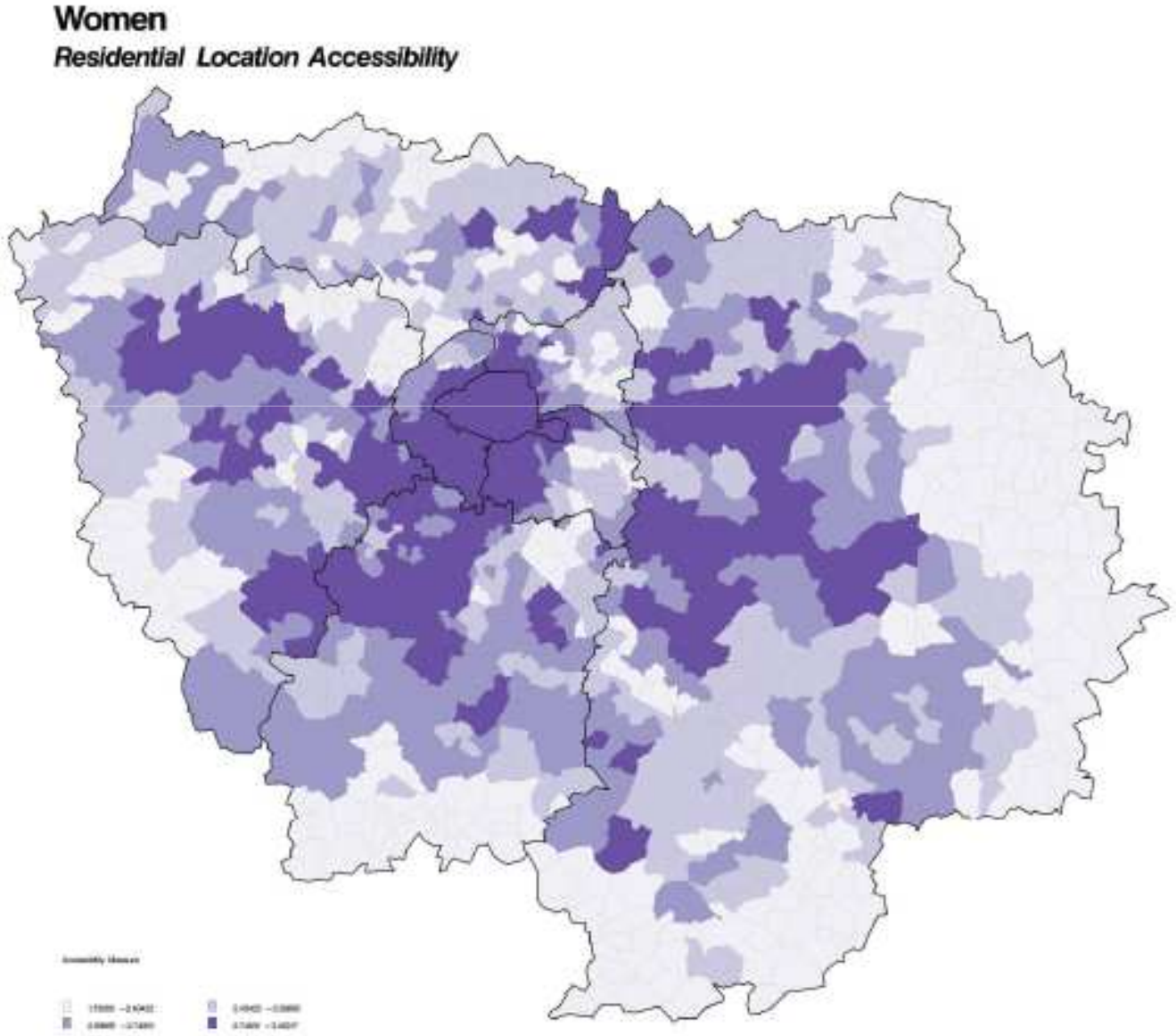
Attractiveness measure by education



Accessibility measure by gender



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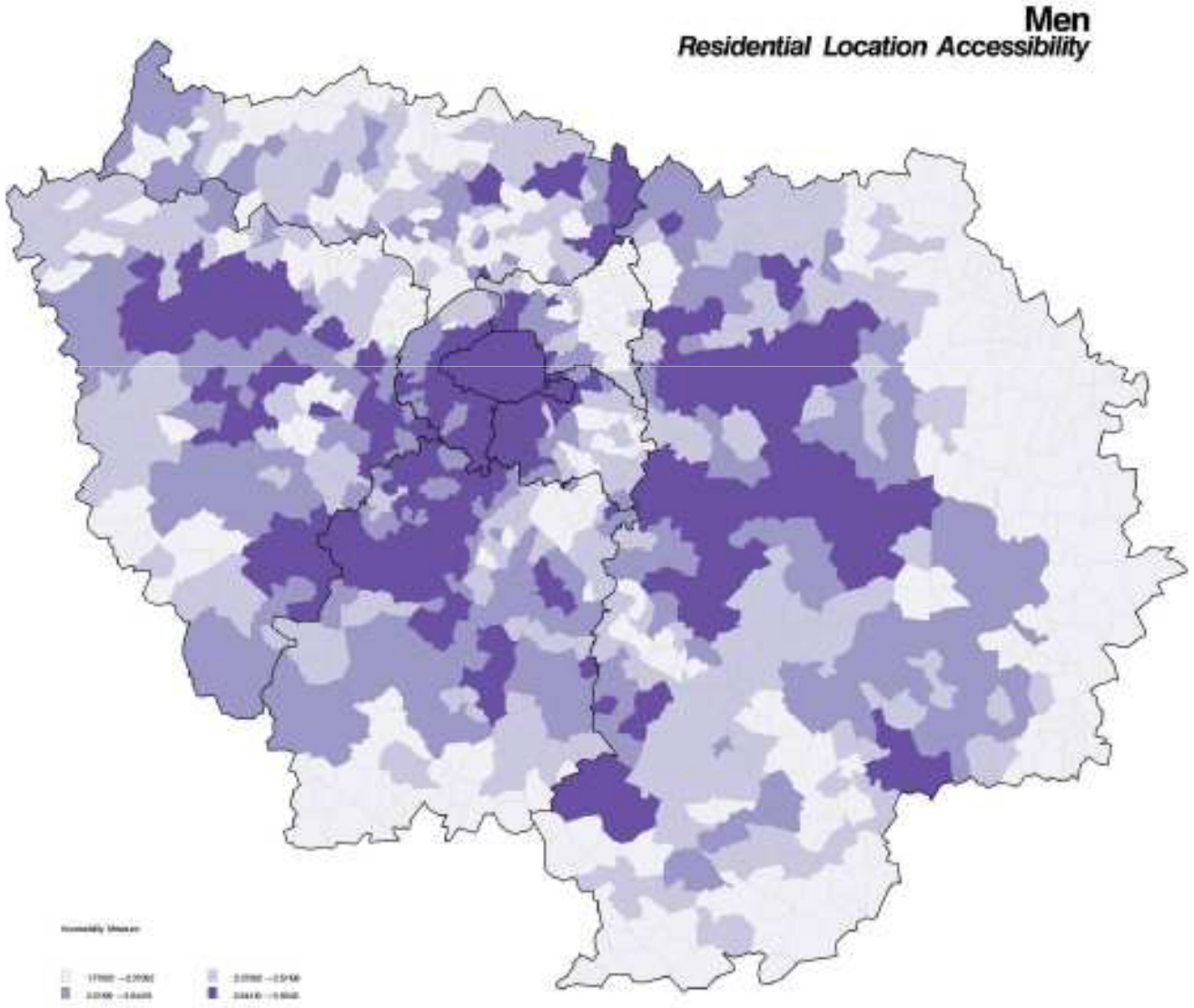
Accessibility measure by gender



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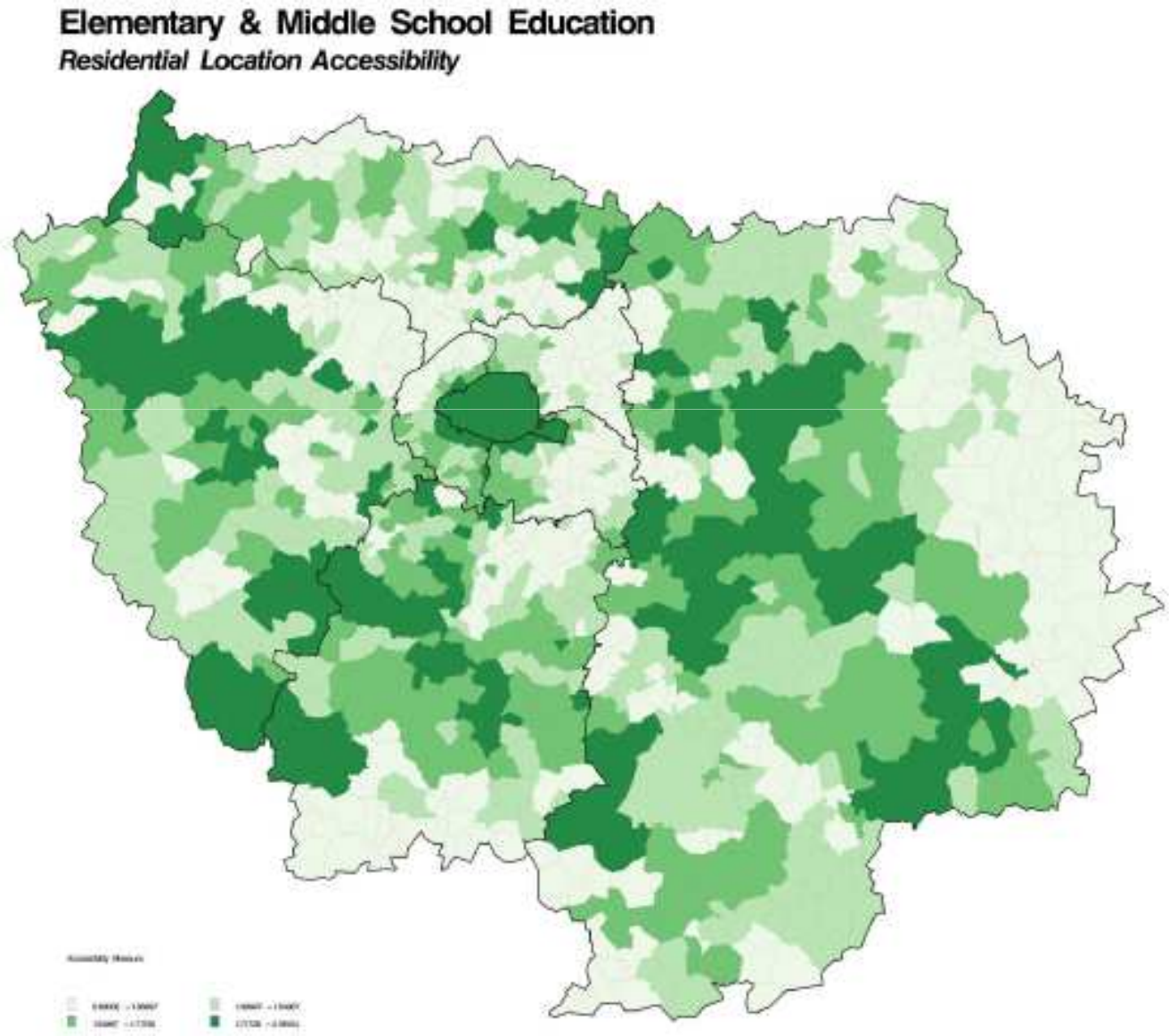
Accessibility measure by education



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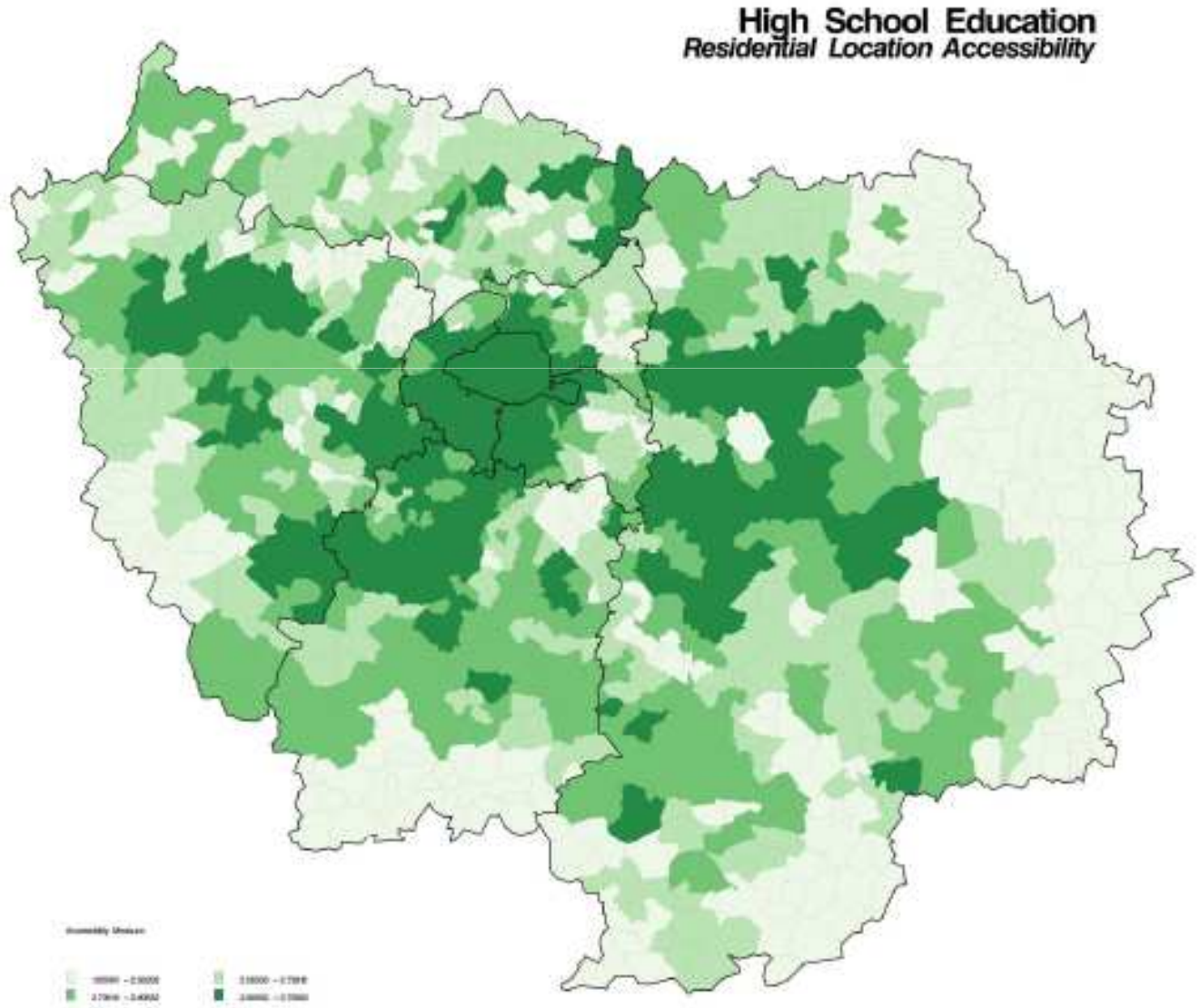
Accessibility measure by education



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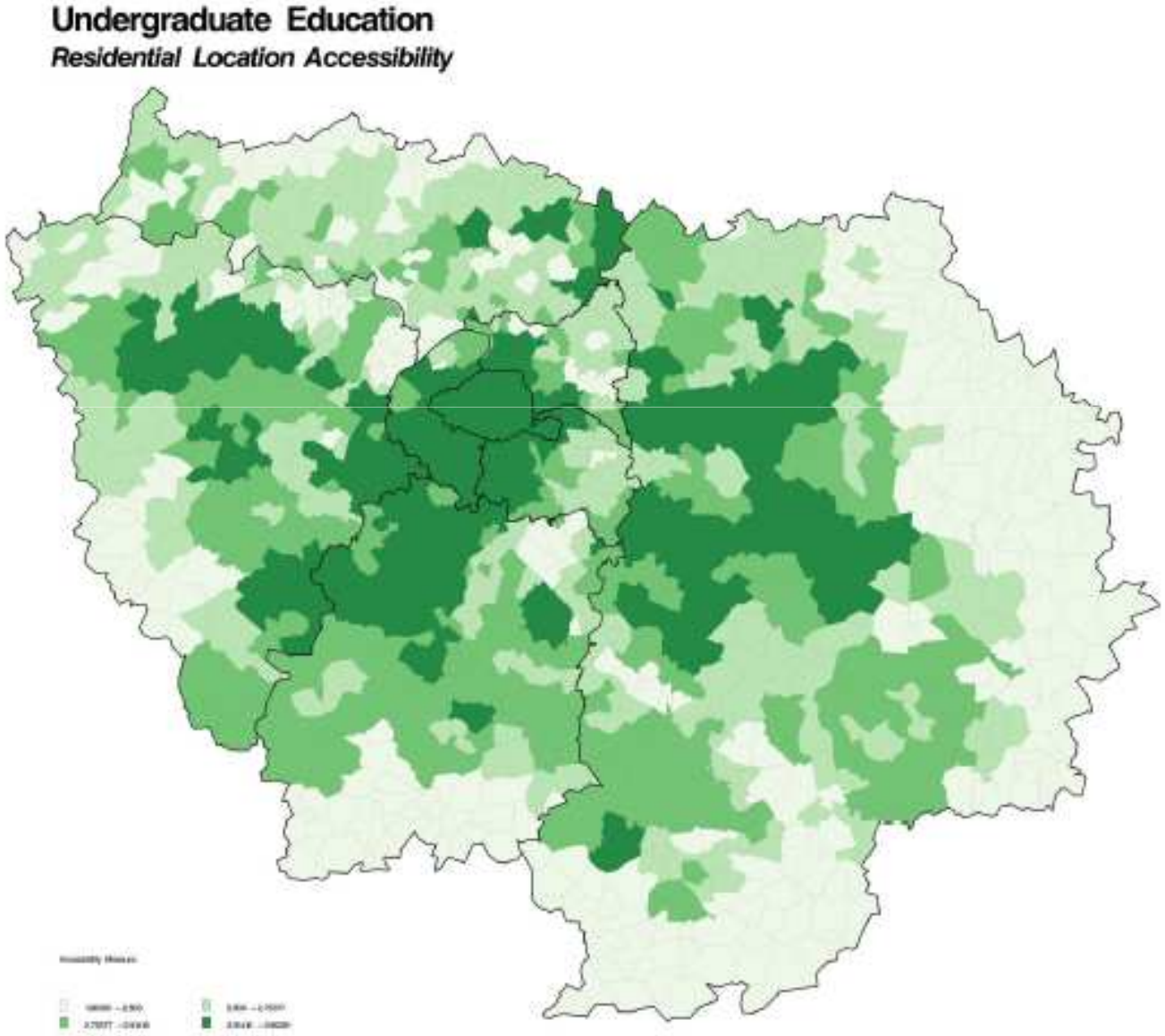
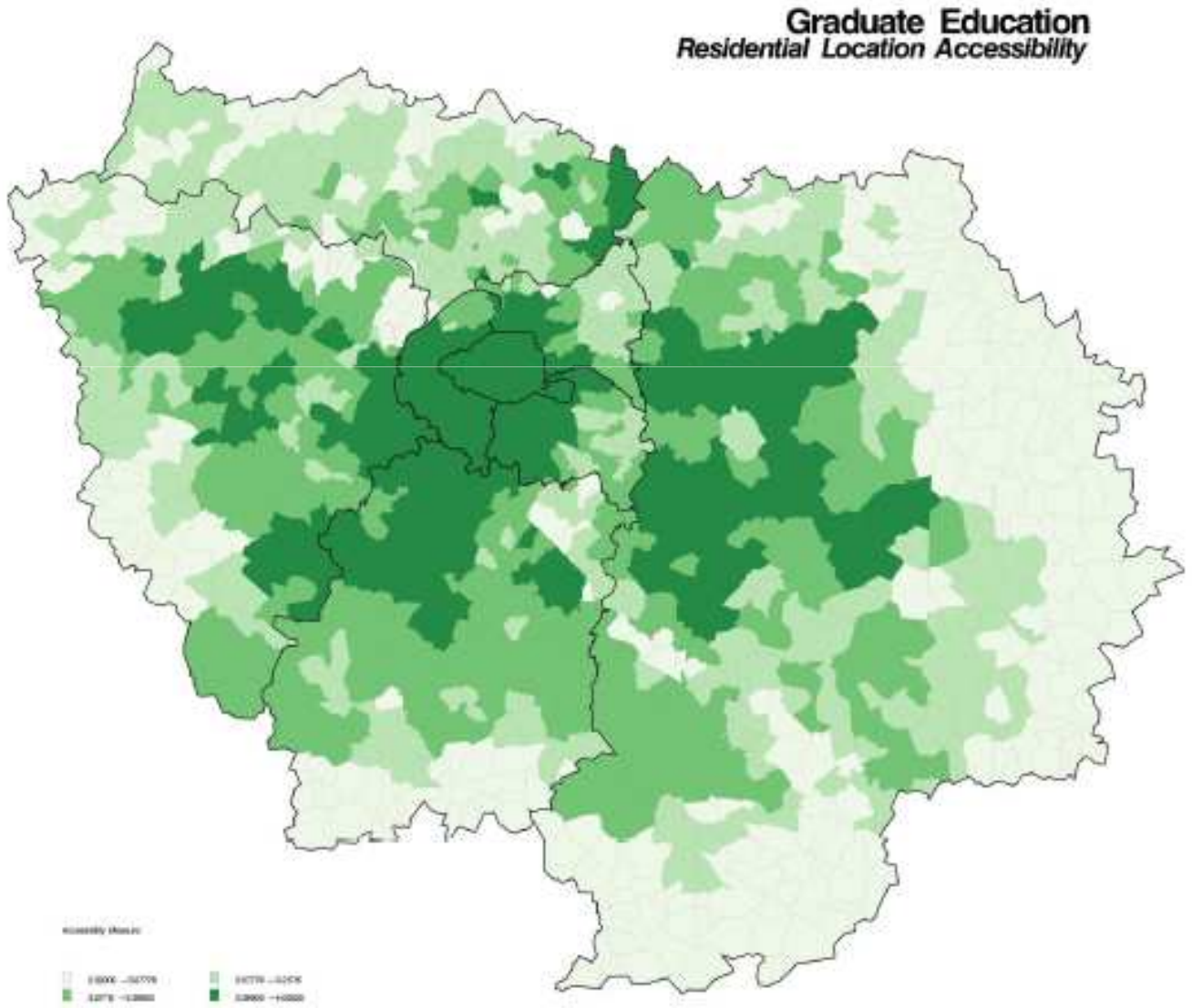
Accessibility measure by education



Accessibility measure by education



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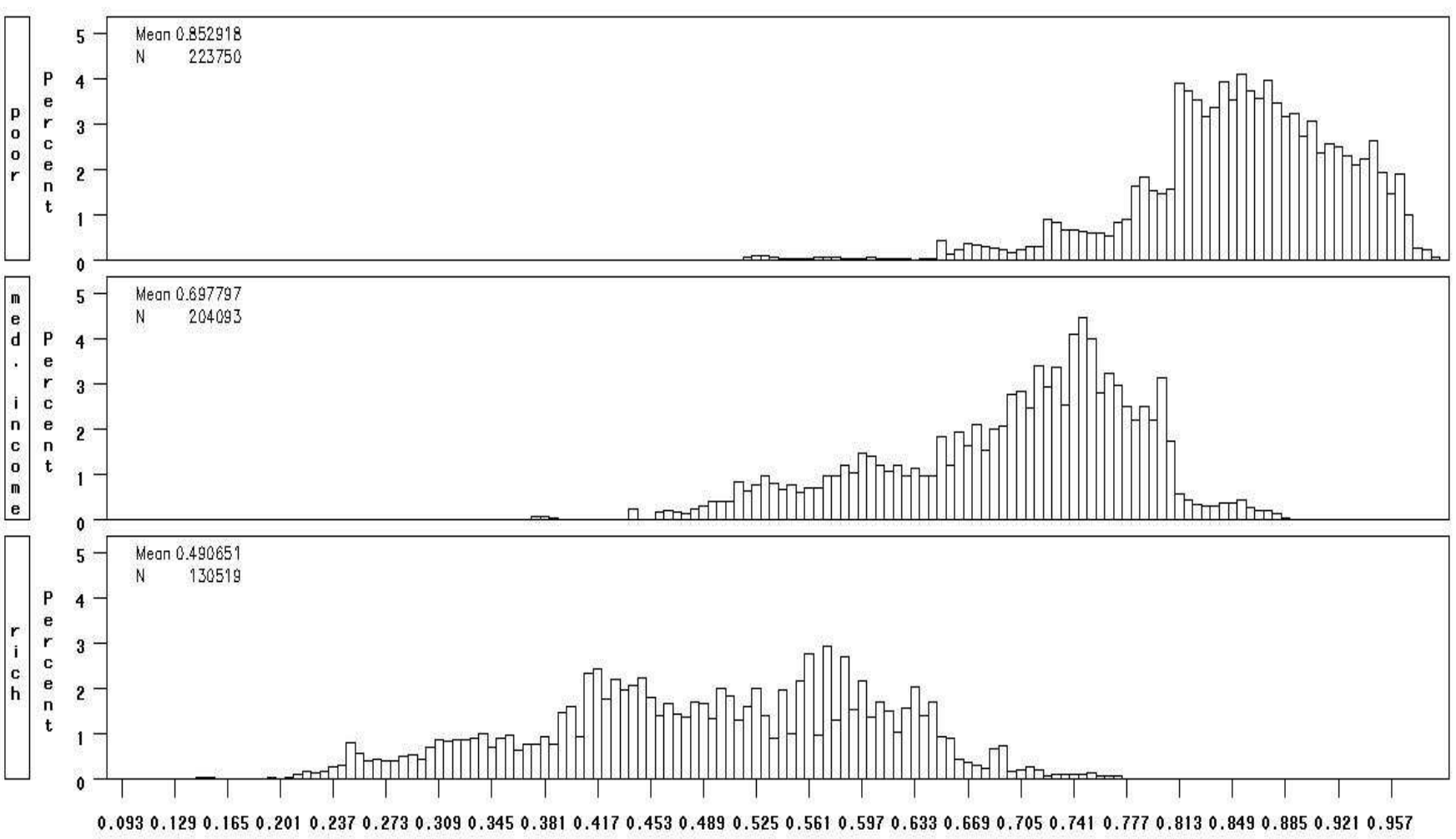
Distribution of the probability to be constrained for Poor/Medium/Rich



Source: Dantan, Picard (2013)

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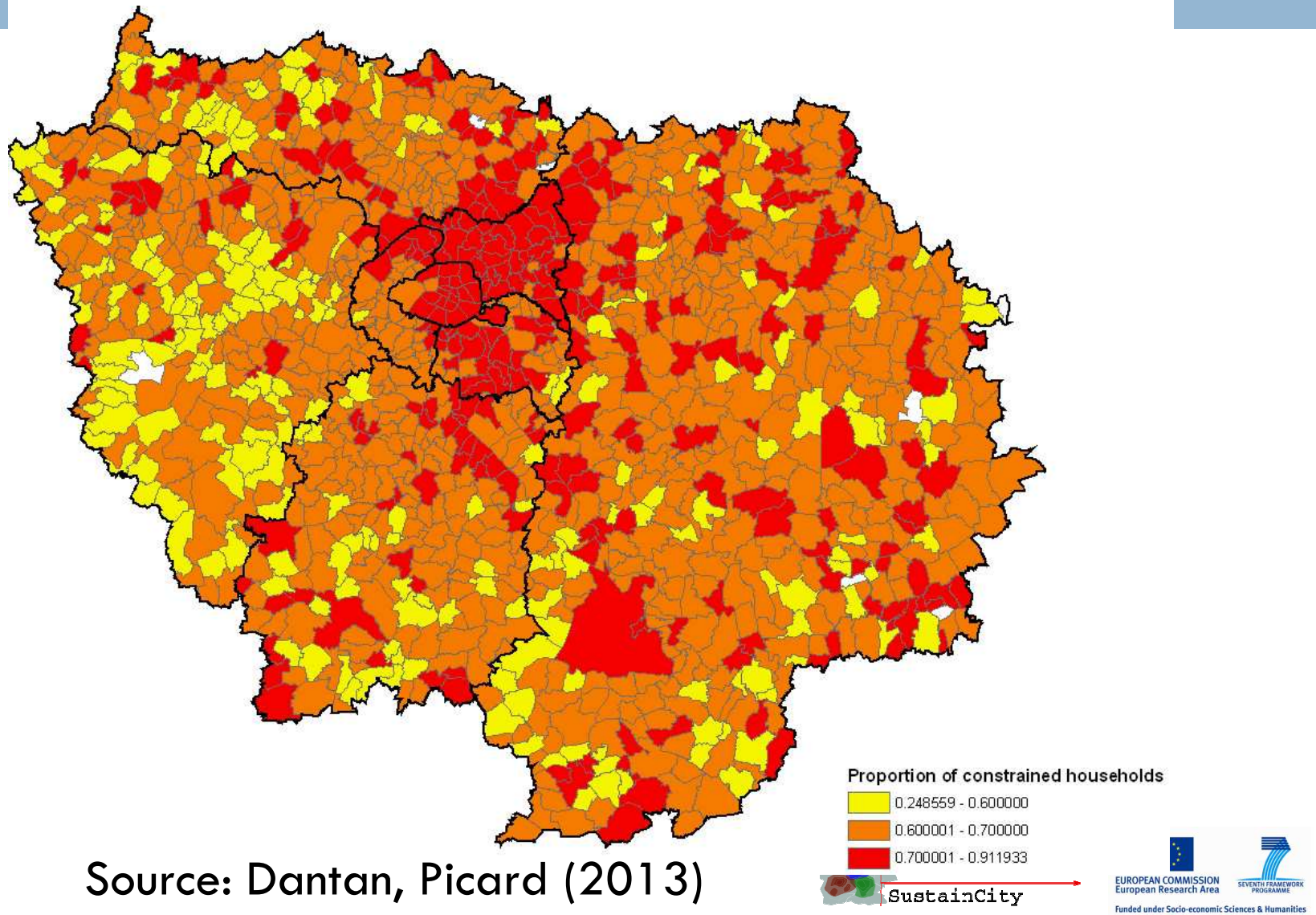
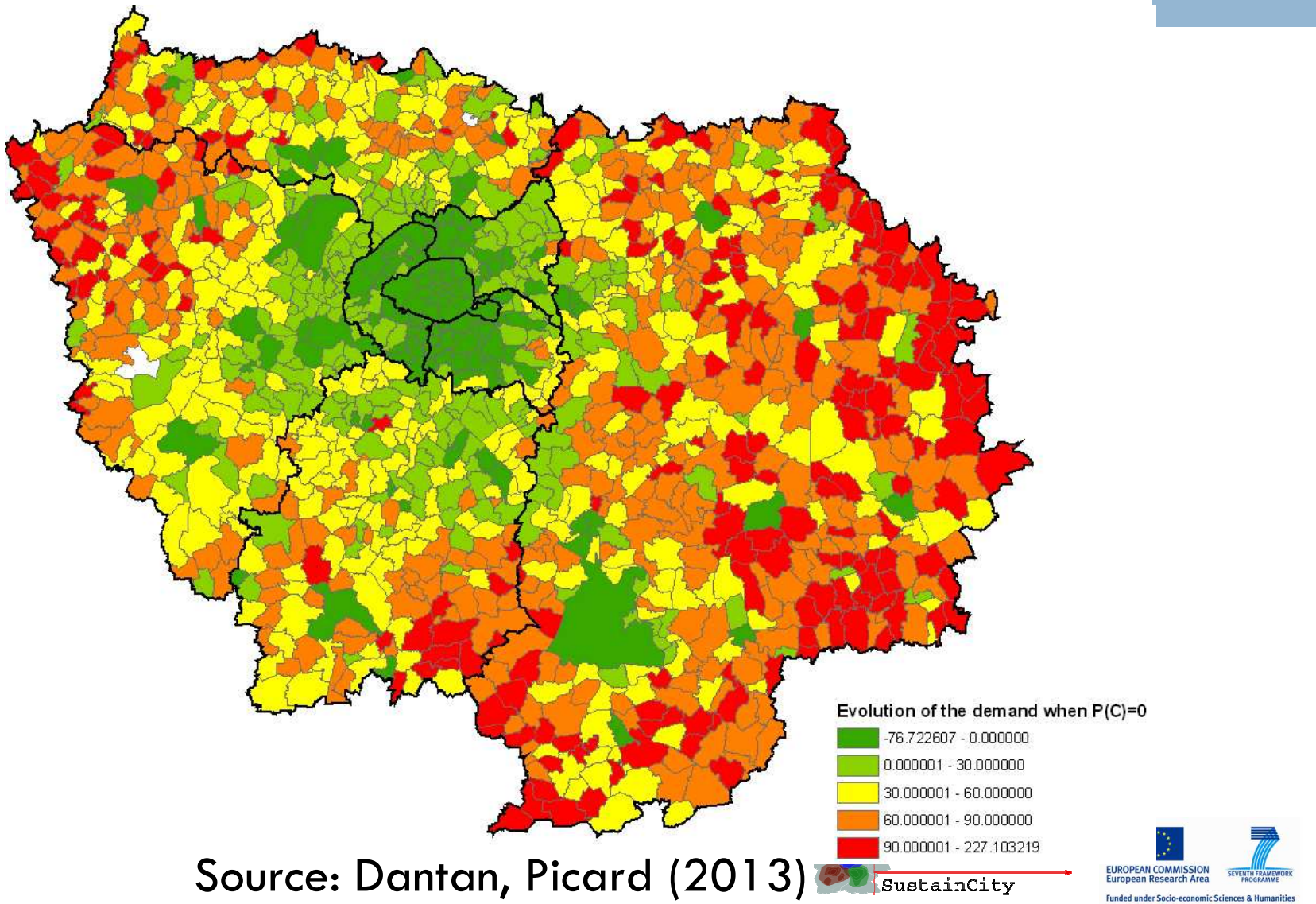
Proportion of **constrained** households, by commune



Source: Dantan, Picard (2013)

Differential in **demand if there were no borrowing constraints**



Source: Dantan, Picard (2013)

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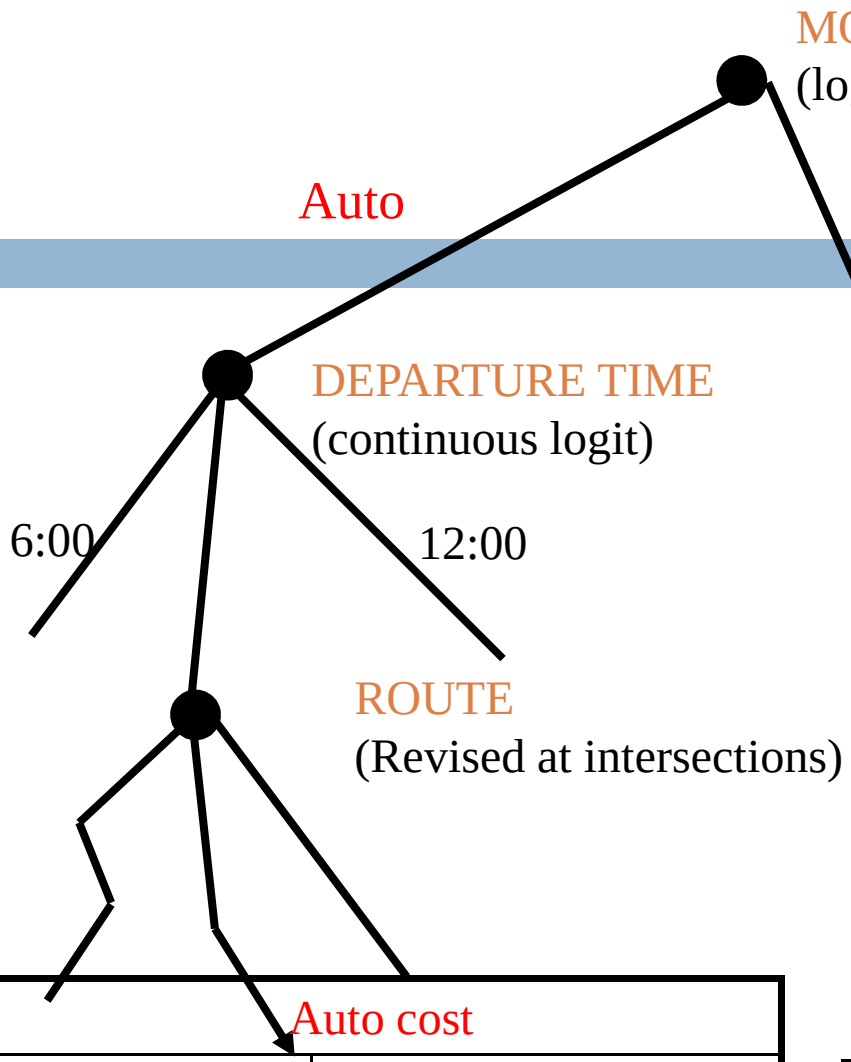

Auto cost	
Travel time	Free-flow + congested
Schedule delay	Early, on-time, late
Toll	Route & time dependent

Public transport cost	
Travel time	Exogenous
Schedule delay	—
Penalty	Exogenous

Optimal housing consumption

and portfolio choice with exogenous random shocks (A. de Palma and J.-L. Prigent)

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Impact of an exogenous random shock

- Divorce, death, lost of job,…
- Bond, stock, money market and housing (Brownian)
- Three situations
  - Perfect forsight
  - Myopic
  - Rational expectation
- Issue: how does the shock change the consumption and saving patterns?

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Couple residential location:

contrasting preferences and bargaining powers

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Nothing personal

No, we stay!

We shall move near my office

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Motivation

Couple Residential Location Choice:
Who decides?

- How do dwelling characteristics, local amenities and spouses workplaces affect the location choice?
- Is the residential location choice a Pareto optimal one?
- What is the weight of each member in the bargaining power?

Neglecting the bargaining power would lead to biased measures of the individual values of time. Here, we:

- Disentangle bargaining power from the values of time of spouses.
- Measure the influence of explanatory variables separately, on the bargaining power and on the values of time.

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Spouses' utility functions

- Dwelling characteristics and local amenities Z (P is the dwelling price)
- Cost of commuting time t^g: function of individual-specific value of time
- Daily consumption of private d^g and public good d^c

Utilities are assumed to be additively separable:

$$U^g = V^g(P, Z) - c^g(t^g) + \phi^g(d^g, d^c),\ g = m, f$$

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Couple utility function:
μ_1, μ_2 and μ_3 are Pareto weights

A partially optimal household location would then maximize:

$$V(P,Z) \qquad -(1-\mu)\,c^m(t^m) - \mu\, c^f\left(t^f\right)$$

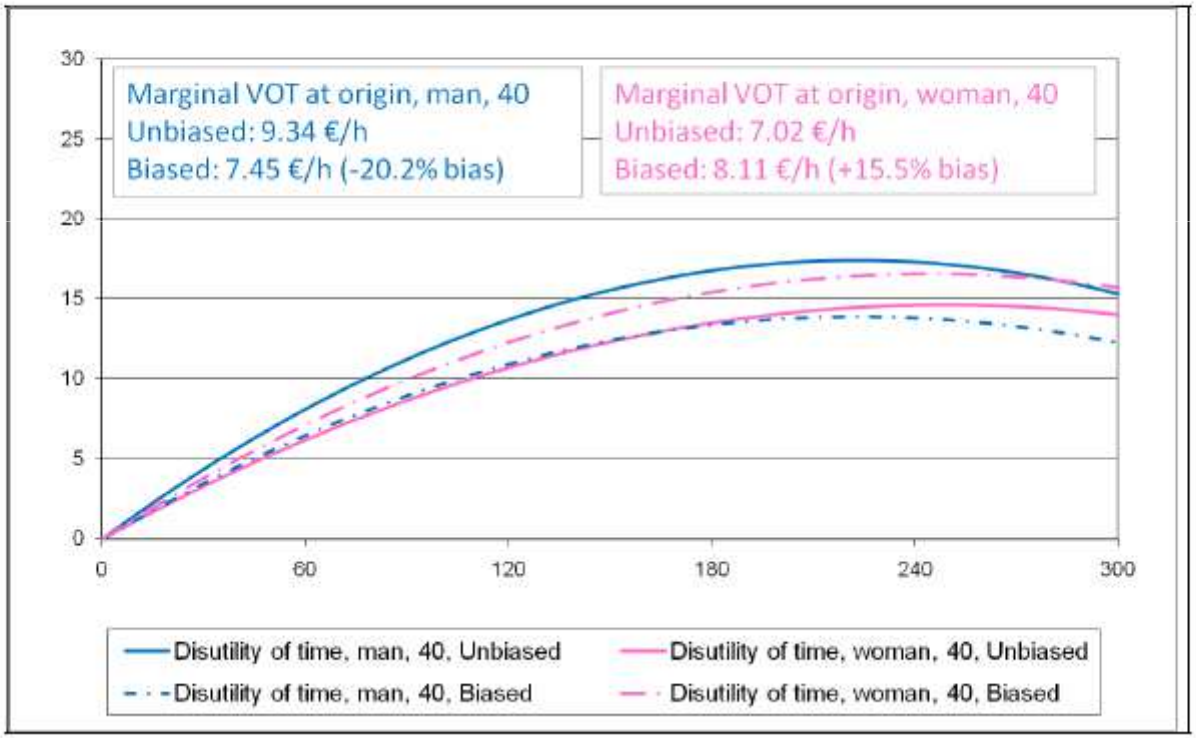
μ_1, V^m, V^f cannot be disantangled
➔ V(P,Z) alltogether

Pareto weight specific to each decision

Unobserved, easy to optimize daily
➔omitted

Minimum distance estimator approach VOT biases (1/2)

Figure 1: Magnitude of bias in VOT (40 years old)



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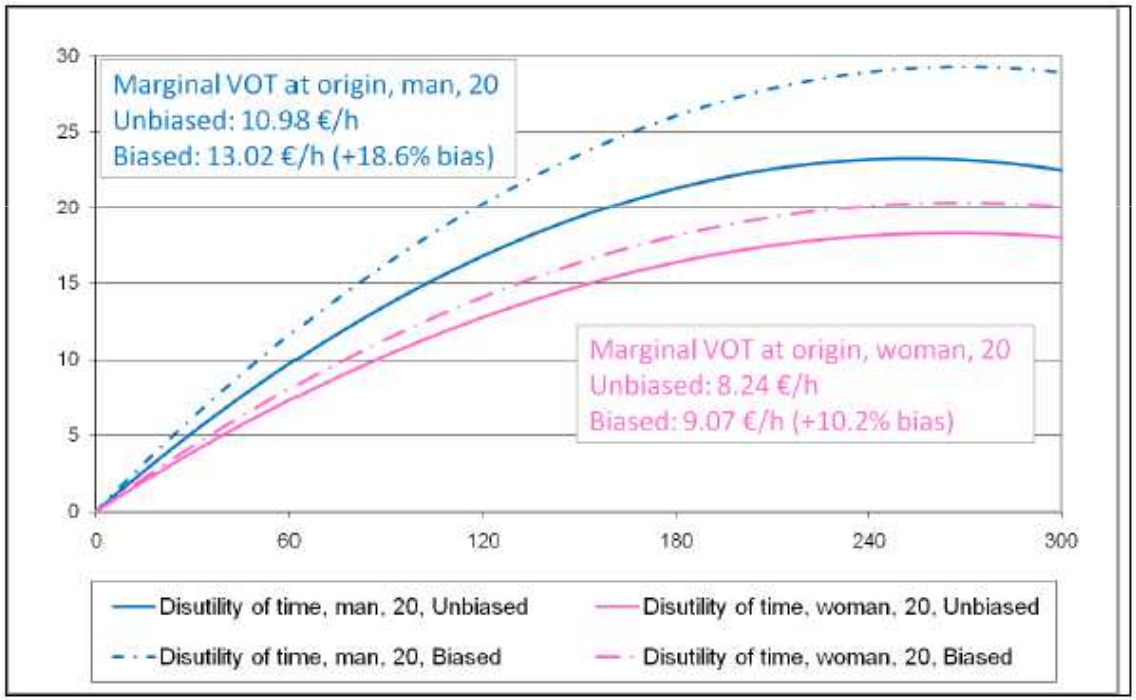
Minimum distance estimator approach VOT biases (2/2)

Figure 2: Magnitude of bias in VOT (20 years old)



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Animal and human architecture

Closing

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Individual behavior (Guy Théraulaz)

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Collective behavior

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Route choice : same lenght

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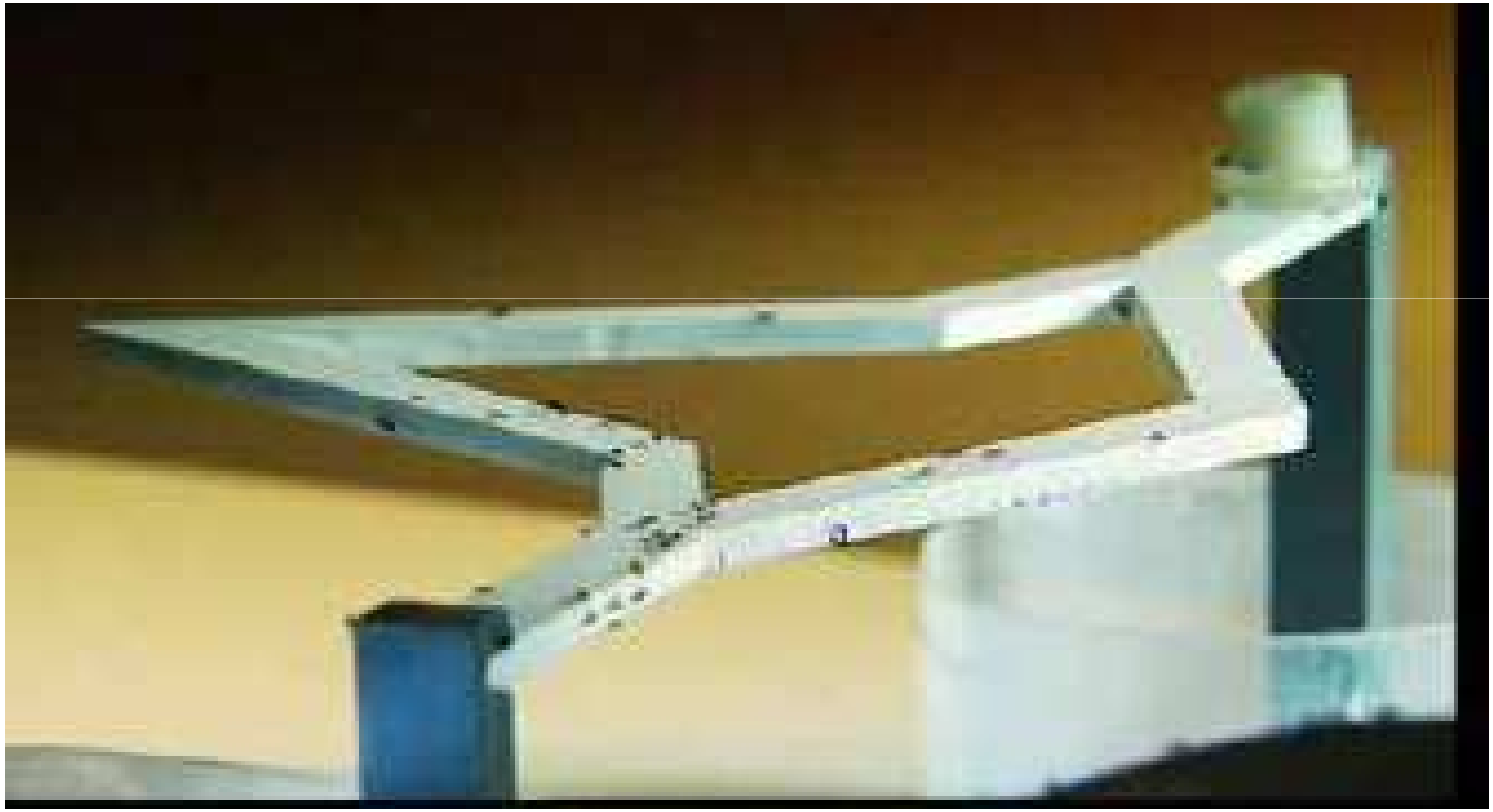
Shortest path



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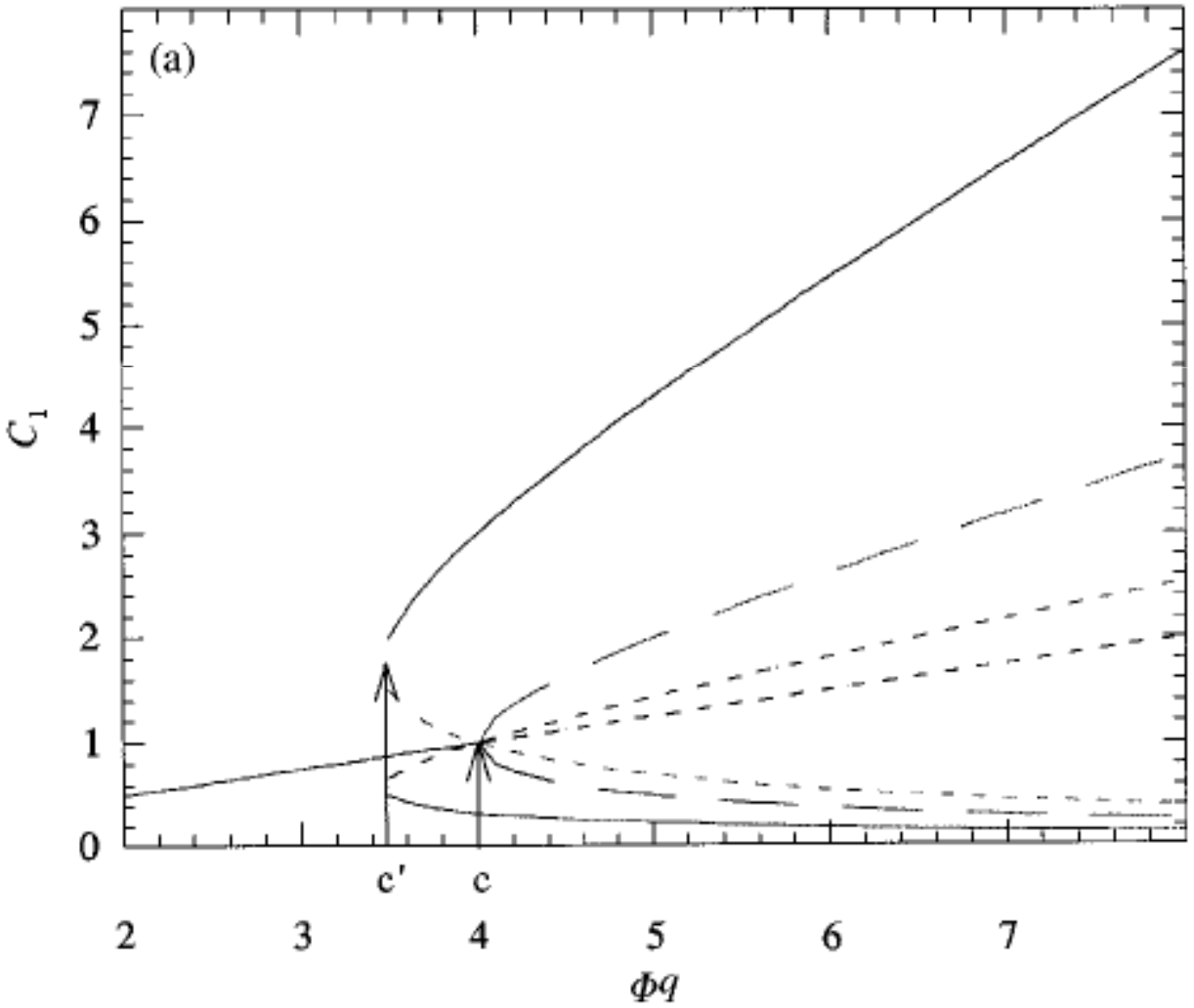
Bifurcation diagram



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Key ingredients

- Positive (and negative) feedbacks
- Open Systems
- Dissipation of energy (and exchange)

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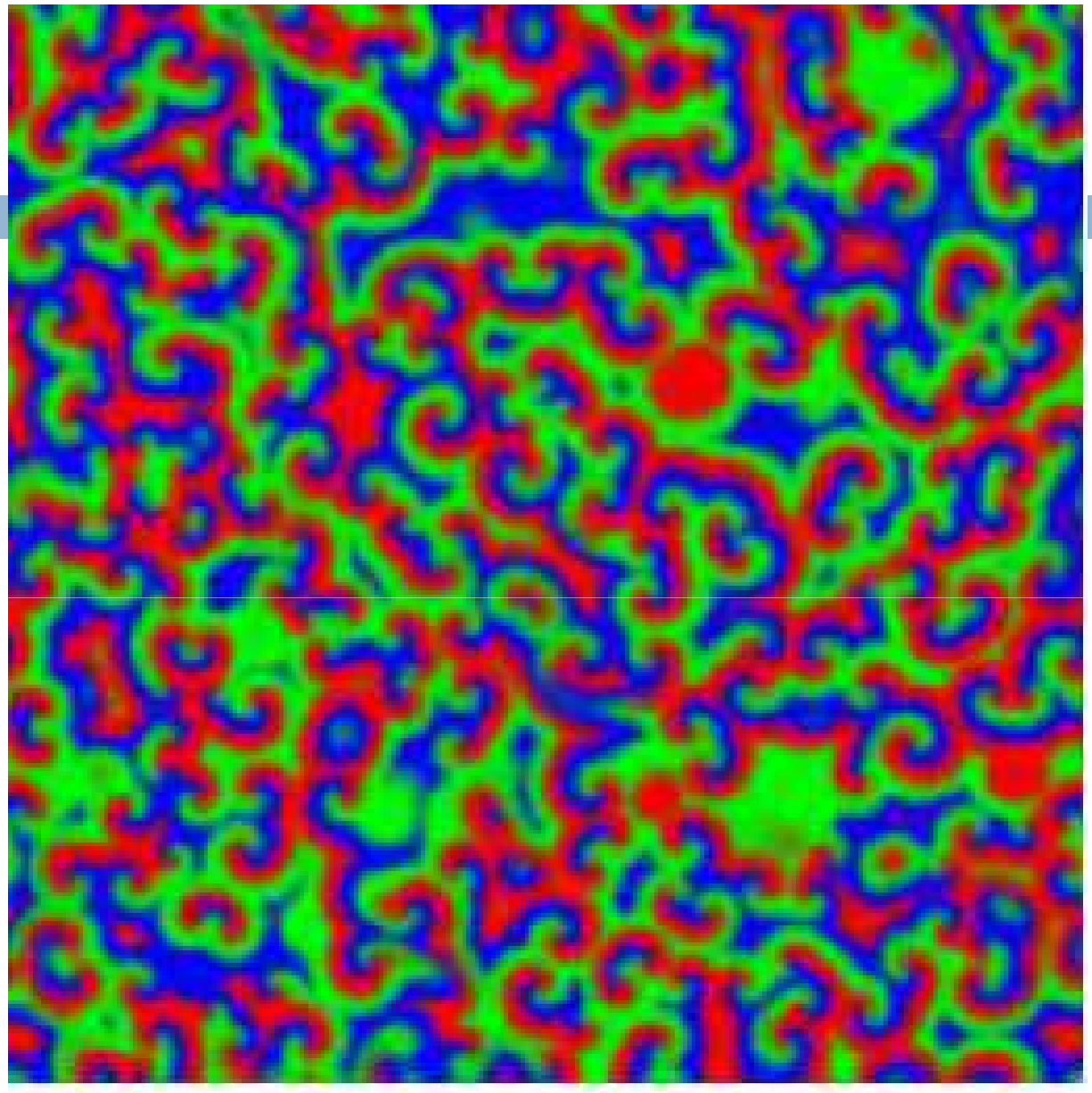

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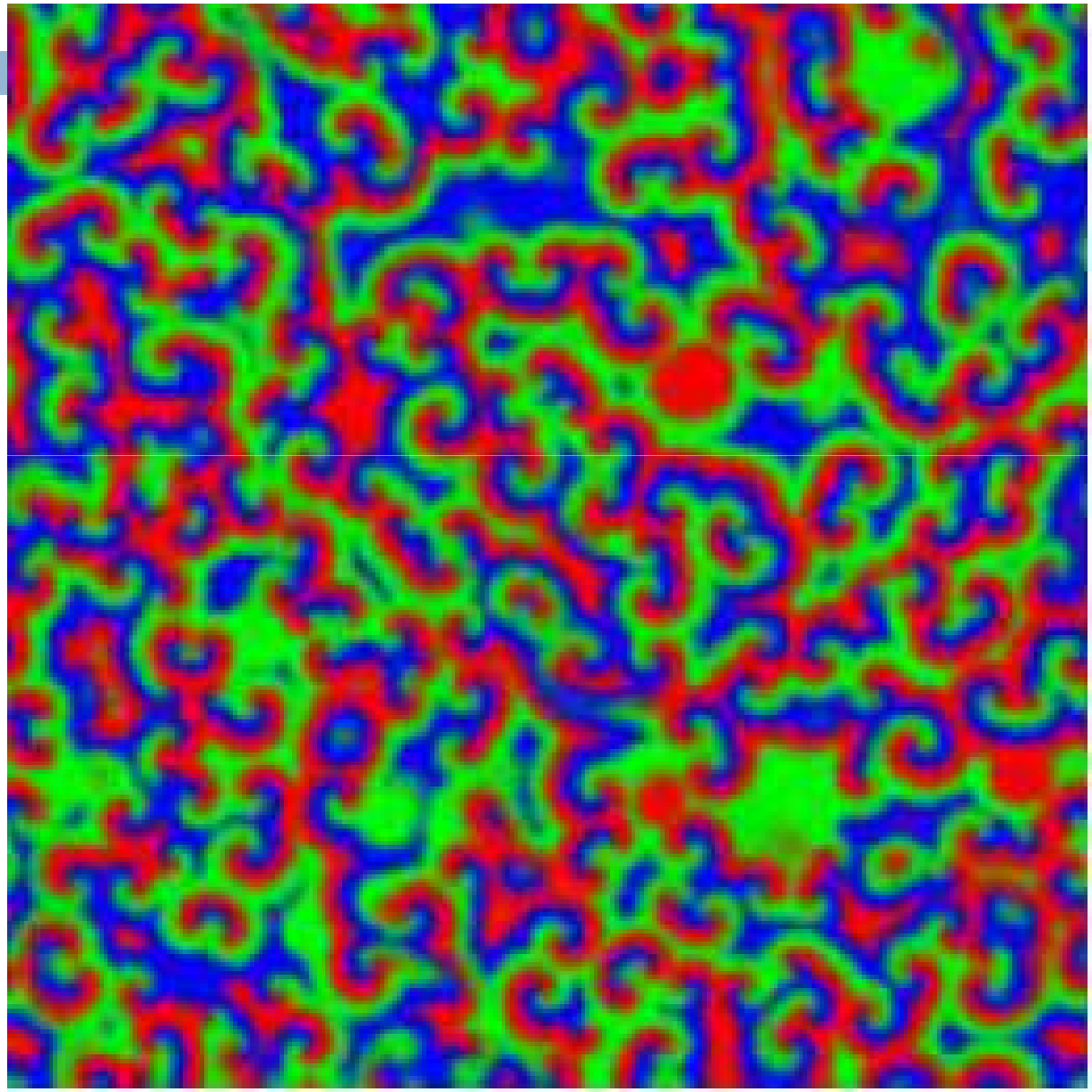
Belouzof-Zhabotinsky



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Local interactions and global structures

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Urban Dynamics: key elements

- Agglomeration effects
- Non-linearities: economies of scales, thresholds, congestion effects, systemics effects,
- Dissipation (energy consumption, etc.) and exchanges of energy and information with the outside world

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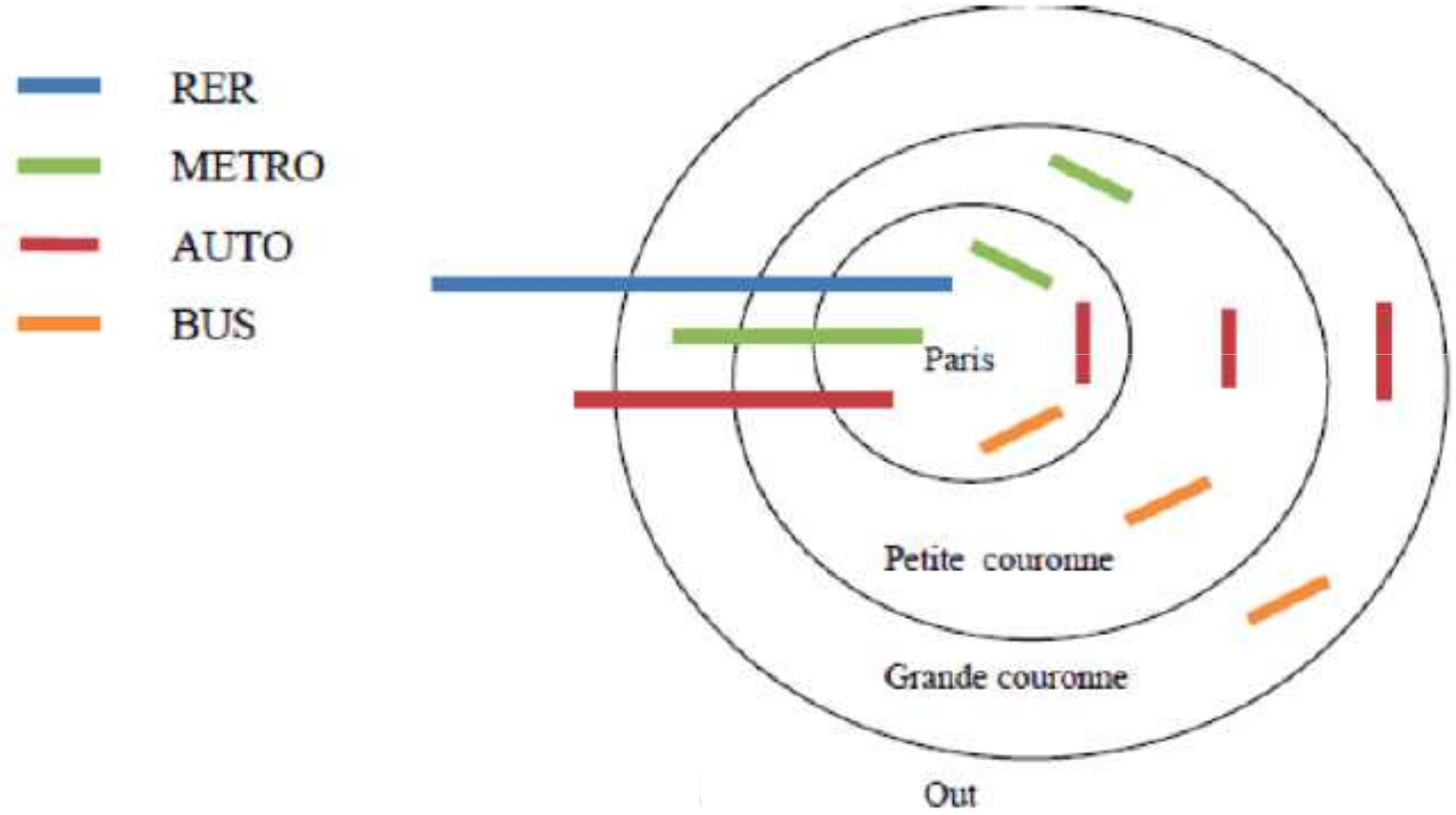
Keep it simple “Stef Proost, 1999”



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Implementation: UrbanSimM

UrbanSim and METROPOLIS

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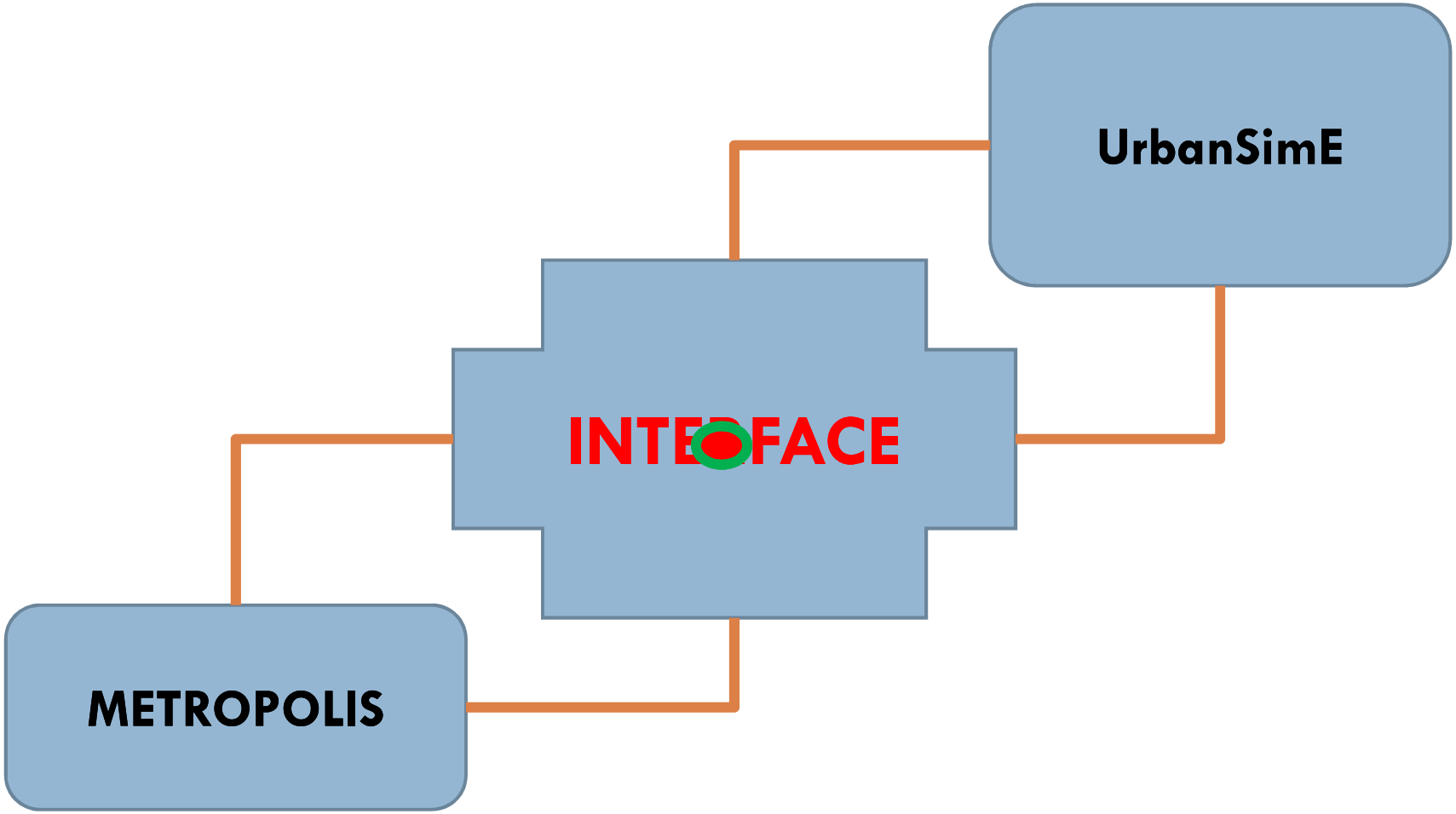
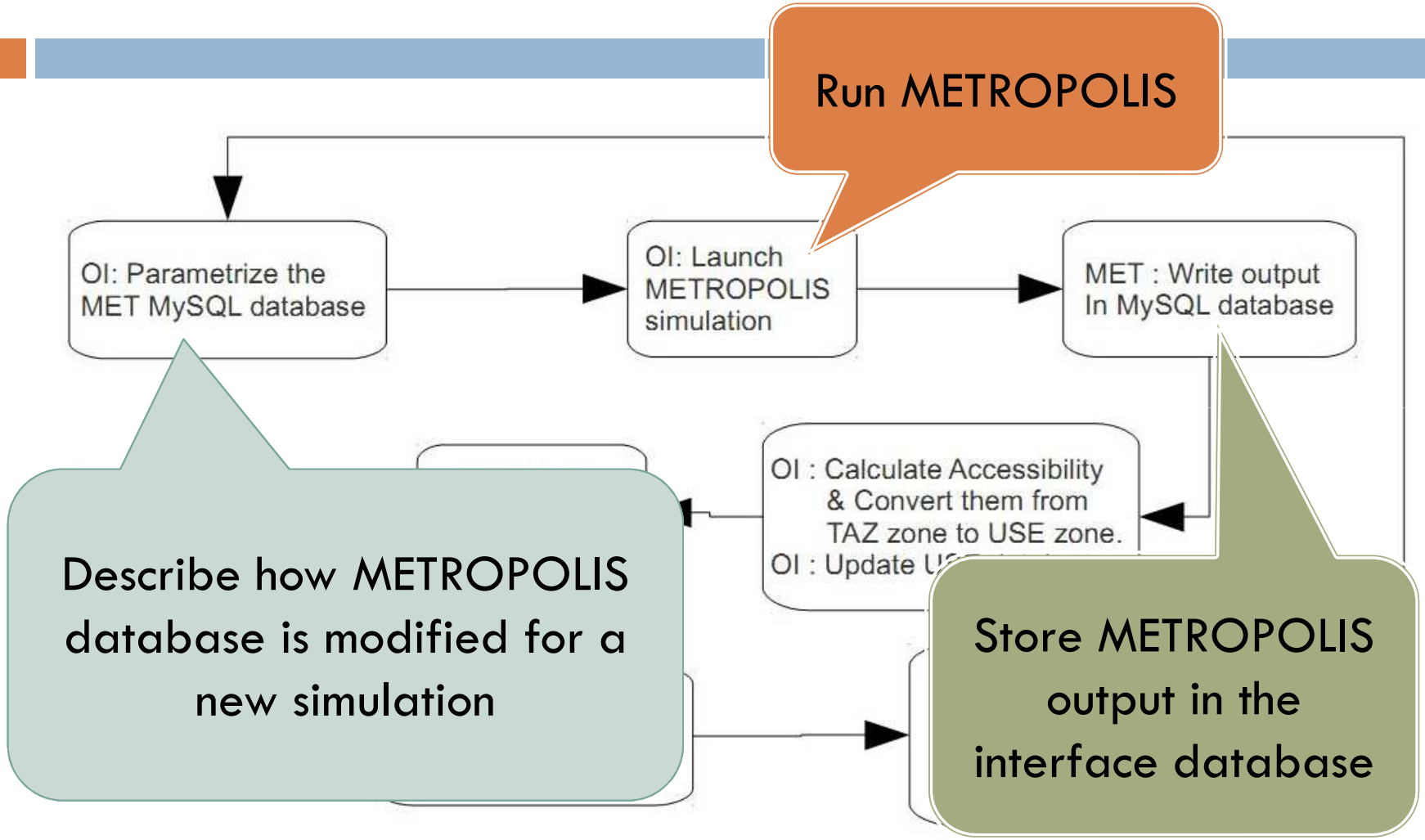
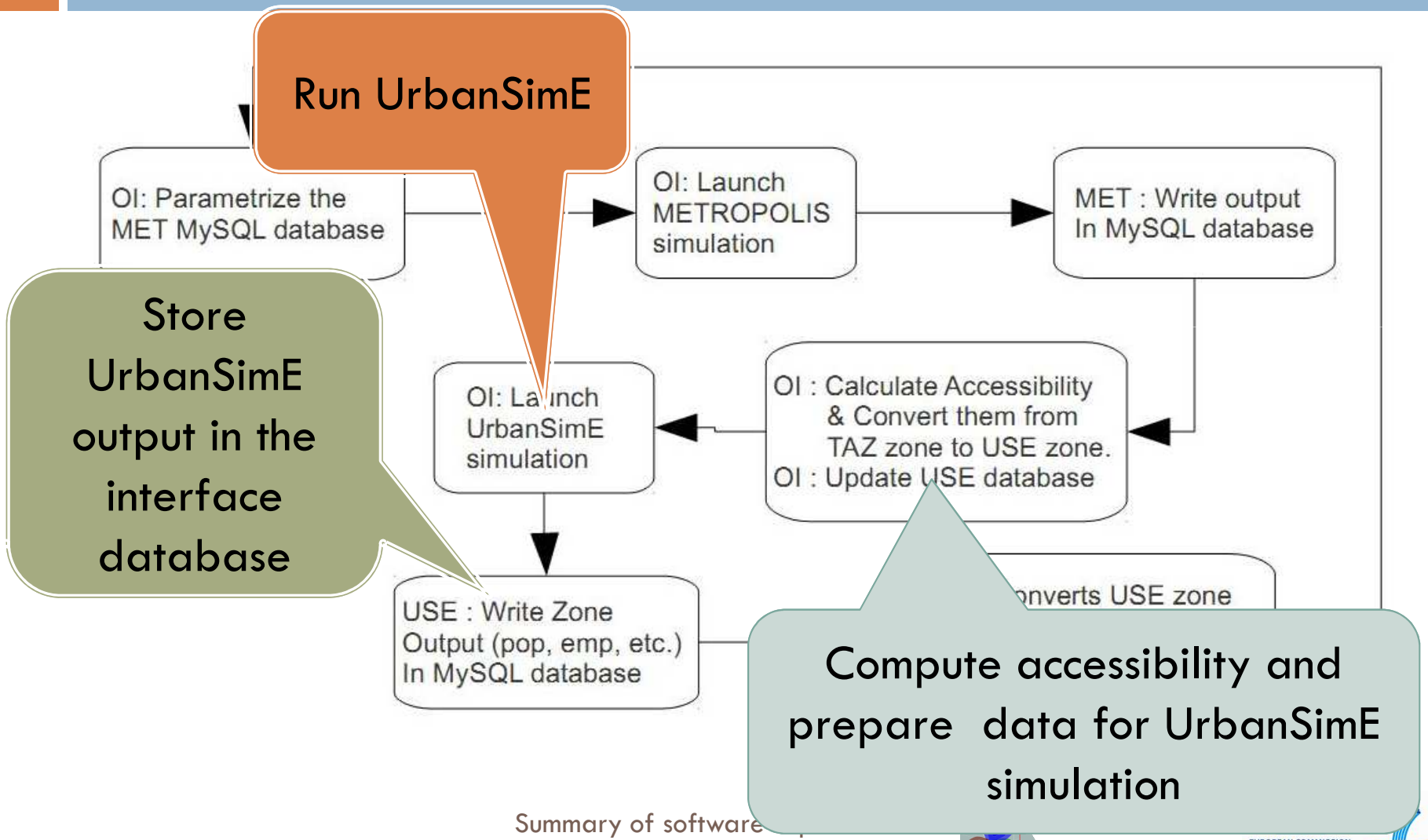
New Interface overview



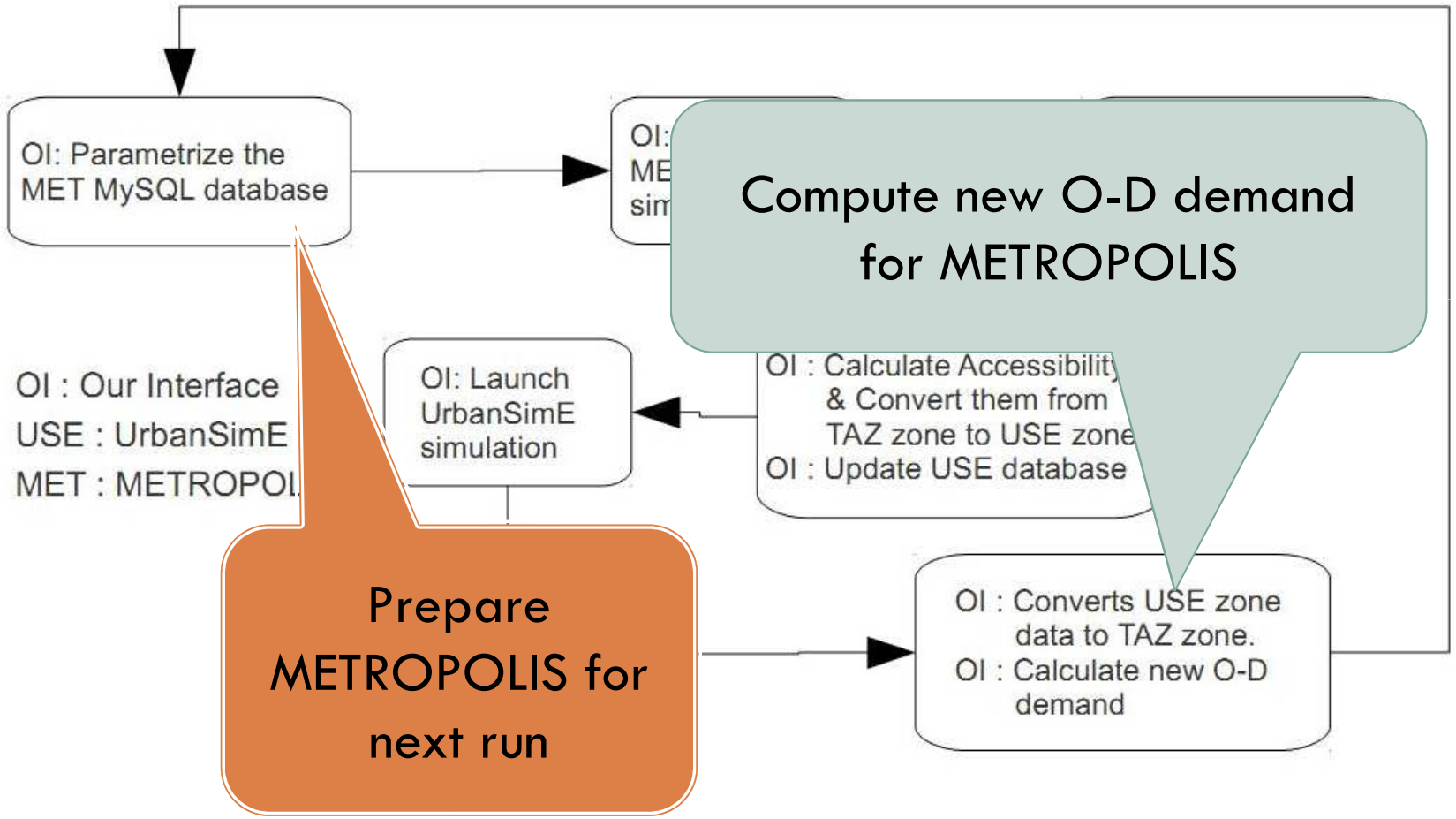
Work flow diagram of the Interface



Work flow diagram of the Interface



Work flow diagram of the Interface



Towards some ecumenism

- Molino (Proost) - mono-centric (Kilani)- UrbanSimM (Waddel)