SustainCity Project

Applying UrbanSim to the Greater Paris Region

A road map for future innovations

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THE SUSTAINCITY PROJECT

European research project started this year

Aims at substantial theoretical/practical improvements

Ultimate goal : developing a version of UrbanSim befitting the European context, UrbanSimE

3 case study

- Brussels (STRATEC, ETHZ,…)
- Paris (ENS-Cachan, UCP-Thema, ...)
- Zurich (ETHZ, …)

BACKGROUND: THE SIMAURIF PROJECT

French research project from 2003 to 2007

- calibration of UrbanSim for the Greater Paris Region (*Île-de-France*)
  - version 2.0 : gridcells of 500*500m
  - calibration between years 1990 and 1999
- application to the economic assessment of the *Tangentielle Nord*, a circular transit project in the north of the Paris area

Main difficulties faced by the team

- gridcells are not consistent at all with French data
- learning and calibrating UrbanSim is a lengthy process, especially more so if having to switch to a newer version

OBJECTIVE : 4 MAJOR INNOVATIONS

1. A micro-macro demographic model
2. Better representation of the decision process at the household level
3. Finding a relevant system of zones
4. A better integration with the transportation model

PART 1

The demographic model

INDIVIDUAL EVENTS TO BE MODELED

Leaving parental home

Cohabitation

Marriage (or remarriage)

Separation / divorce

Live in a communal establishment (or not)

Having a child

Death

A MODULE EXAMPLE : HOUSEHOLD FORMATION

Household formation

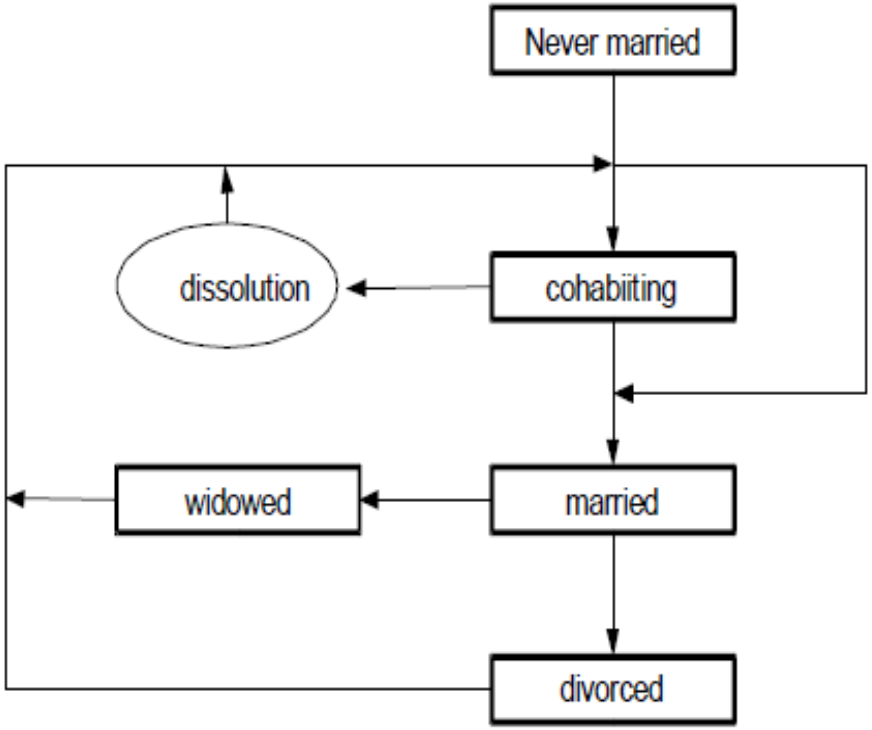
- Cohabitation
- Marriage

Household dissolution

- Widowhood
- Divorce
- Dissolution

Equations for each event

- separation=f(X,β)
  - X : time dependent covariates (age, child) or not (gender)
  - β : parameters



Source : Pennec, S. & Bacon B. (2008)

ABOUT THE MODEL

Closed, discrete time model (step =1 year)

Women driven (cohabitation, children, separation)

Partner matching

Identification of father, mother, partner, household

- a new household identification number is given to each man and each woman when they leave parental home
- women keep this number all through the simulation

Immigration

Order of events

PART 2

Toward a better representation of the decision process

COLLECTIVE DECISION-MAKING WITHIN COUPLES: BASIC MODEL

Objectives, preferences, constraints may differ between husband/wife

Two decision-makers $\Rightarrow$ unitary models irrelevant but one can assume more cooperation than usually assumed in, e.g., labor market

Collective models developed by Pierre-André Chiappori: Pareto-optimal decisions; no restrictions on decision process

- Chiappori, P.,-A. (1988) : "Rational household labor supply," Econometrica, 56(1), 63-90
- Chiappori, P.,-A. (1992) : "Collective Labor Supply and Welfare", Journal of Political Economy, 100, 437-467

RESEARCH ON COUPLE RESIDENTIAL LOCATION AND SPOUSES WORKPLACES

Job opportunities are fairly different for husband and wife within a family (despite assortative mating)

- compute (expected) travel times specific to gender, age, education, profession, and (endogenous?) mode
- is chosen HH location Pareto-optimal?
- relative bargaining powers measured by respective influence of male/female accessibilities

Short run/Long run bargaining power and nest order

- short run → distance to current job; Nest Workplace → Residence
- long run → accessibility to jobs; Nest Residence → Workplace, forward-looking

PART 3

Toward a multiscale model

4 INTERTWINED GEOGRAPHIC LAYERS

Ilôts-MOS

- very fine geographic level used for land-use data

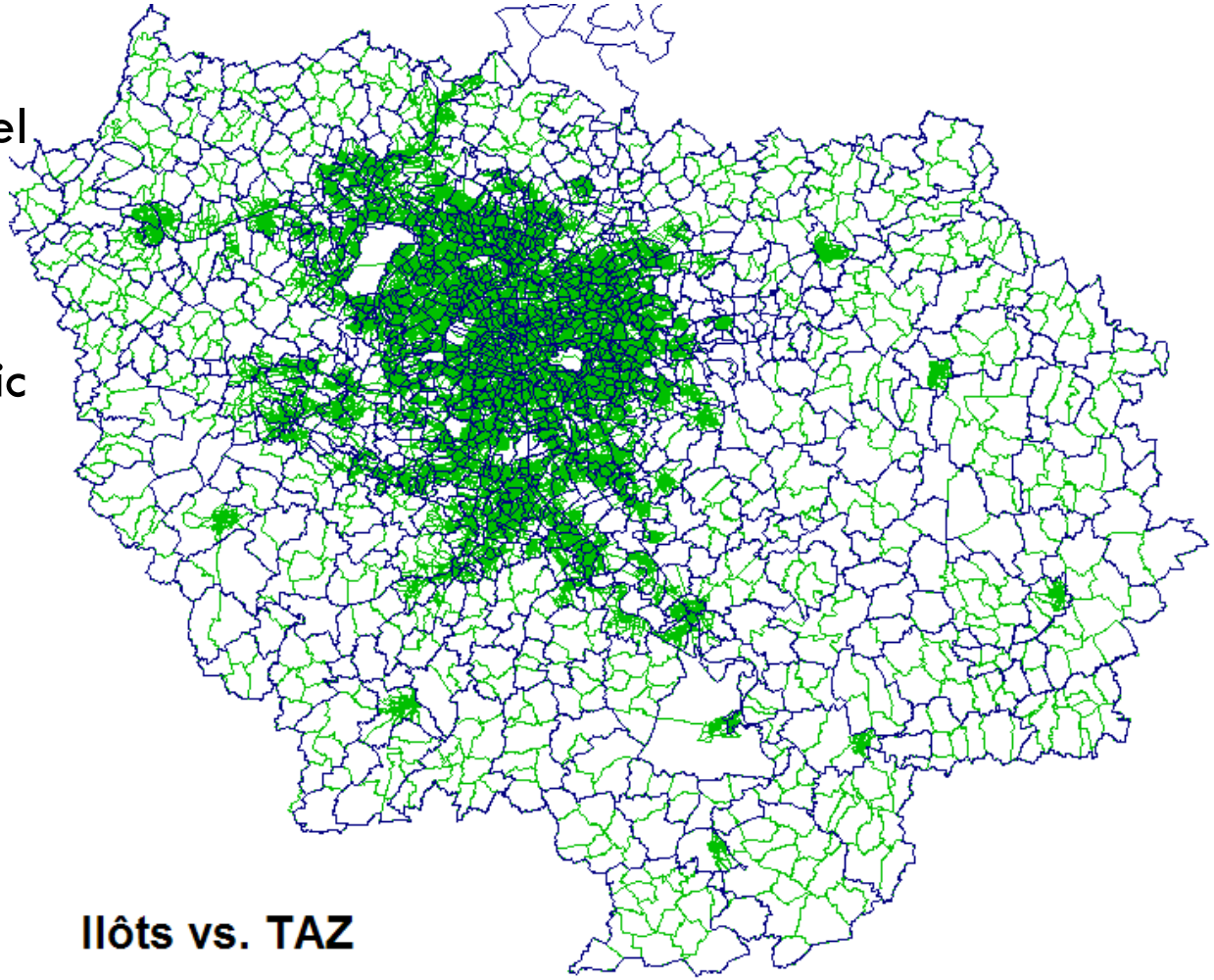
Ilôts (52027)

- quite detailed geographic level for Census data

Communes (1300)

- relevant level for employment data in low-density areas

TAZ (1289)



Ilôts vs. TAZ

LEVEL OF OPERATION FOR EACH MODEL

Residential location model

- Nested choice: *Commune* (or set of *Communes*), *Ilôt*

Job location model

- A minima: *Commune*
- If possible: *ilôt* for dense areas (only)

Real estate price model

- *Ilôt* or *Commune* depending on available data

Land development model

- Ilôt-MOS (preferably)

COPING WITH A COMPLEX SYSTEM OF ZONES

« Inclusion » relationships :

- *Ilôt-MOS* ⊂ TAZ & Commune *(to be confirmed)*
- *Ilôt* ⊂ TAZ & Commune
- in most cases, TAZ ⊂ Commune or Commune ⊂ TAZ
- in most cases, *Ilôt-MOS* ⊂ *Ilôt*

Main foreseeable issues

- defining neighborhood for *Ilôt-MOS* and *Ilôts* (strong size heterogeneity)
- each model uses variables from other models which might be located at differing scales
  - Household location model uses job accessibility measures
  - Land development model operates at *Ilôt-MOS* level and should provide new housing supply at *Ilôt* level.

PART 4

Toward a multiscale model

INTERACTION BETWEEN URBANSIM AND THE TRANSPORT MODEL

Transport model to UrbanSim

- the transport model feeds UrbanSim with travel times
- no particular issue

UrbanSim to transport model : 3 possibilities

- feed the transport model with zonal aggregates of jobs and population then perform the first two of the 4 steps (generation and distribution) $\Rightarrow$ significant loss of information
- use information on workplace at the individual level to generate an activity schedule and infer travel behavior : MATSIM

LOOKING FOR A "MIDDLE PATH"

Information available in UrbanSim

- population
- jobs
- workplace for employed individuals

The middle way

- using workplace information to generate a morning (evening) home-work O-D matrix
- complete this matrix with standard generation-distribution procedures for other purposes