LOOKING FOR URBAN MOBILITY SOLUTIONS: Is it a namely technological question?

HOW WILL OUR FUTURE CITIES LOOK LIKE?

Will we use flying cars to avoid the rush-hour in the cities of the future?

Or will electrical, automated, connected vehicles be the panacea?
BUT....

Before proposing solutions to a relevant socio-economical phenomenon, that so strongly conditions our quality of life, may be we should try to understand the causes of the phenomenon.

Ask ourselves whether the solution could namely be technological or... we do need something else?
TRENDS IN URBAN DEVELOPMENT

• Urban Growth
  • In 2008 more than 50% of world population was living in cities
  • Today 75% of anthropogenic GHG from cities
  • In 2050 70% of world population will live in cities
• Urban Sprawl: combined effect of growing affluence, changing life-styles and vast advance in personal mobility
INTERDEPENDENCIES BETWEEN TRANSPORT MODES AND URBAN TRENDS

Separation of living and working areas

⇔ Enabled by (individual) transport systems
⇔ Congestion ⇔ Impact on energy consumption ⇔ emissions
⇔ Quality of life & sustainability

Car travel
More cars increase traffic
More traffic problems & congestions
Reduced supply of public transport
Reduce use of public transport
Public transport speed reduction
People move out of cities
Reduced quality of life in cities
More pollution, noise, accidents...
Workplaces are moved out of cities
Worse access to workplaces

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THE CITY AS A COMPLEX SYSTEM OF SYSTEMS

From “Smart Cities” (A market driven concept) to “Wise Cities” (A Citizen driven concept)

W Wellness and Walkable
I Intelligence & ICT
S Sustainable & Safety
E Ecology, Energy & Economy

https://lancenl.wordpress.com/tag/smart-city/
INVESTIGATING THE COMPLEXITY OF CITIES

Urban transportation systems are **complex dynamic subsytems of the city**, a larger more complex system ⇒ *The Smart City as a System of Systems*

To understand the complexity of these systems a suitable **methodological modeling** approach is *System Dynamics*, which has the ability to account for the multiple variables, feedback loops between components and the role of the influencing factors

**SPATIAL INTERACTION PARADIGM:**

*Interaction between individual mobility and location behavior*
UNDERSTANDING AND INTERPRETING MOBILITY IN TERMS OF THE SPATIAL INTERACTION PARADIGM

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IDENTIFYING MOBILITY PATTERNS IN TERMS OF ORIGIN-DESTINATION (OD) TRIP MATRICES
UNDERSTANDING MOBILITY: ELECTRONIC DATA COLLECTION FOR ACTIVITY BASED DEMAND MODELING

BCALs
Sensor data
No operation needed
In-store data
Detailed actions observed

GPS mobile phones
Paper questionnaire
Macro
Meso
Micro
Sensor data
No operation needed
In-store data
Detailed actions observed

Observation of pedestrian excursion trip

Expended hours on each links
Raw trajectory data in Sibuya downtown area (Tokyo)

Source: Electronic Instrument Design and User Interfaces for Activity Based Modeling (Hato & Timmermann (2008))
EXPLOITING MOBILE PHONE DATA (*tracking cell phones*)

Example of sequence aggregates

OD demand on the census tract level

Sources:
DYNAMIC INSIGHTS


Smart Steps

is an Insights solution that uses anonymous and aggregated mobile data to help organizations make better business decisions based on actual behavior.
Mobile event data extracted and stored from our network.

Personal data eliminated and hashed with an ID.

Algorithms applied to represent entire population of Spain.

IDs grouped to crowd data, no individual is identifiable.

Smart Steps
WHICH MUNICIPALITIES GENERATE MOST TRAFFIC IN THE NUDO DE MANOTERAS?
WHERE (EXCLUDING THE CENTRE OF MADRID) DOES THE TRAFFIC COME FROM?
Analysis of the traffic on the Manresa - San Cugat del Valles road. OD Matrix for all surrounding areas of the road.
CONCEPTUAL FRAMEWORK FOR THE ESTIMATION OF OD MATRICES COMBINING NOMADIC DEVICES DATA AND TRAFFIC DATA

Nomadic Device Data (CRD, GPS…)

Preliminary Data Processing (Counting, Clustering…) to generate initial “transient” OD

Traffic Data (Flow counts, speeds, travel times…)

Network Data

Transform “transient” OD Matrix into a Traffic Analysis Zone or Node-to-Node OD Matrix

Expand/Adjust the sample matrix estimating adjustment or scaling factors by Simulation or Mathematical Programming Models

Actual OD Matrix

A critical problem: How to expand samples to full population avoiding biases and ensuring the quality

Resort to external “ground truth” references, e.g. traffic flow counts, travel time measurements......

J. Barceló & L. Montero, A Computational Framework for the Estimation of Dynamic OD Matrices, 6th International Symposium on Transportation Network Reliability (INSTR 2015), Nara (Japan)

Causal relationships of the urban transportation system with its environment

EXAMPLE OF INTERRELATIONSHIPS AMONG ESSENTIAL SYSTEMS IN AN URBAN AREA
(IBM Institute for Business Value)

Human capital determines TIC penetration rates

COMMUNICATIONS

TIC adoption rate determines city’s company profiles

Public Transport quality strongly affects quality of life

CITIZENS

Commerce growth increases transport infrastructure use

WATER

Water quality strongly determines quality of life

Companies

TRANSPORTATION

Transportation growth increases energy consumption

Industrial activity has a strong influence on water consumption

ENERGY

Energy and water consumption are strongly dependent

Public Transport quality strongly determines quality of life

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THE SUSTAINABLE MOBILITY PARADIGM

- Alternative paradigm arising from the investigation of complexity of cities
  - Better understanding of the links between land-use and transport
- Implies mixed use developments
  - Preference to public transport
  - Accessible corridors near public transport interchanges
  - Satisfy the requirements of service and information based economies

• Sustainable transport asks for
  - Urban forms keeping average trip lengths below the thresholds required for maximum use of the walk and cycle modes
  - Not to prohibit the car but to design cities of such quality and at a suitable scale that people would not need to have a car

• THE KEY POLICY BECOMES THAT OF REASONABLE TRAVEL TIME RATHER THAN TRAVEL TIME MINIMISATION
EMERGING MOBILITY CONCEPTS
Future of Mobility & New Mobility Business Models (Frost & Sullivan, 2015)

- Transformational Shifts:
- New Business Models - Growth of Car Sharing
- Growth of Ride Sharing Business Models ("On Demand" Carpooling” UBER, SideCar, Lift....)
- Within 3 years ehailing taxis control close to 20% of the global taxi market (process of ordering a car, taxi, limousine, or any other form of transportation pick up via virtual devices: computer or mobile device.)
  - E-HAIL, Arro, Easy Taxi, Uber, Lyft, Carmel, GetTaxi, GrabTaxi, TaxiMagic, minicabit, G-Ojek,
- Integrated Mobility Technology enabled, any device delivery of real-time, door-to-door, multi-modal travel encompassing pre-trip, in-trip and post-trip services bringing Convenience, Time & Cost Savings to the Mobility User
- Group Rapid Transit to Replace Public Transport Buses To reduce congestion and reduce queuing in the event of demand Spike
- Changing relationships with vehicle owners - car ownership to mobility services
- Mobility delivered by non vehicle manufacturers – mobility assistents
Paradigm Shift from Vehicle Ownership to Vehicle Usage

Transport = Private Vehicle
- Freedom
- Convenience
- Status
- Progress
- No Real Alternative

Mobility Integration: Paradigm Shift from Vehicle Ownership to Vehicle Usage
- Connectivity
- Population Growth
- Pollution
- Globalization
- Virtualization
- Social Responsibility
- Natural Resources
- Urbanization
- Congestion
- Gen Y

Transport = Door-to-door Mobility
- **New Vehicles:** BRT, EV, High Speed Rail
- **New Business Models:** Vehicle Sharing, Car Pooling
- **Inter-Connectivity:** Inter-modality
- **Urban Planning:** Reallocation of street space
- **Integrated Mobility:** New technology enabled multi-modal integration

Source: Frost & Sullivan

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![Logo]

**Industrial Partners**

![Logo]
DOOR TO DOOR SEAMLESS MOBILITY SERVICES

Pickup & Delivery routing problems with time windows and time dependent link travel times
**FORTUNE (October 26, 2015)**

- **Toyota takes a small detour into car sharing**
- Toyota will launch a pilot car-sharing project using COMs, an ultra-compact electric vehicle.
- Toyota’s car sharing project illustrates the growing interest and investment by automakers into how people get from point A to point B.
- It’s no longer only about designing and selling as many cars and trucks as possible.
- Daimler, BMW, GM, and Ford are all operating, or testing, some variation of car sharing.
- The global car sharing industry is expected to exceed $6 billion by 2020, according to the [Carsharing Association](https://www.carsharingassociation.org).
MOBILITY AS A SERVICE (MaaS)

Seamless Smooth Door-to-door mobility services offered to users by ‘mobility operators’, supported by digital solutions operating in the cloud.

With open access to the timetables, real-time location information, and payment systems of existing transport service providers (e.g., railway operators, taxis, local transport operators, car sharing).
Thank you for your attention!