

The influence of actor strategies on the spatial configuration of daily mobility: Exploration via simulation

Nicolas Lunardi¹

Abstract

Urban areas and their surroundings are under great changes. The "daily life proximity" is gradually removed in favor of a more diffuse organization, even outlying, of daily locations (Jouffe & al, 2015; Korsu 2010). This new organization is based on motorized transport modes which have high individual utility but alter the collective interest (pollution, congestion ...) (Heran, 2001).

A situation emerges where public stakeholders attempt to restrict issues generated by these "motorized" mobility behaviors. The various actions, strategies, implemented by public stakeholders are generally confronted to individual stakeholders. This individual stakeholders, who can be defined as "all the people living and interacting in an urban system", have often divergent mobility strategies which limit the effectiveness of public stakeholders' strategies (Anable, 2005; Buehler, 2011; Vredin Johanson et al, 2006).

Keywords

Daily mobility, Modeling, Stakeholder strategies, Game theory.

¹ Laboratoire ThéMA, Université de Franche-Comté, France.

An endless retroaction

Any action taken by public stakeholders alter the urban system. It result an evolution of mobility practices of individual stakeholders that attempt to adapt to the new system, while continuing to achieve their goals. Part of individual stakeholders can then modify or adapt their mobility behavior to skip "obstacles" from new policies. This response of individual stakeholders in turn causes a change of the system, which is often different from the expected one (Figure 1).

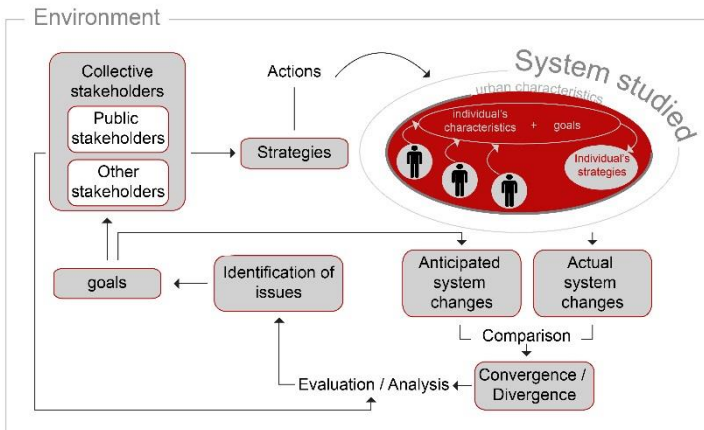


Figure 1 - Combined influence strategies for collective and individual stakeholders on the reconfiguration of daily mobility

An approach by game theory...

The goal of our research is to reach a good understanding of individual stakeholders' mobility strategies. To do this we use principles of game theory. Reflections leading to the choice of a particular strategies to achieve a goal, or the

different phases of a strategy (tactics, actions ...) can be identified thanks to game theory (Lehning, 2013; Wulforst, 2007). The principles of game theory enable to identify cases in which individuals opt for individual, collective or cooperative strategies in order to achieve their goals while limiting constraints. The thoughtful choice of individuals can lead to a lower individual gain than it could have been (eg traffic congestion ...) (Guerrien, 2002).

In a sense life is different from game, because decisions and goals are not only depending on rules and state of the game. Goals are strongly influenced by individual characteristics (family or professional situation ...), so basically people do not share same goals. Therefore, as goals are different, and strategies are depending on goals, the adopted strategies are not similar between individuals. Chosen strategies are also dependent of urban characteristics' and of all trips the individual has to perform. A good understanding of travel behavior and decision is not easy, however, if individuals do not look like themselves and therefore their couple objectives/strategies differ, it is possible to achieve sub-groups (Van Exel et al, 2011).

...And by modeling

Once the system analysis done and all the goals and strategies of individuals and public stakeholders defined, we would like to analyze the influence of stakeholder strategies on daily mobility configuration. To work on this issue and try to bring some answers, we propose an approach by modeling and simulation. This approach requires a tool which take into account (a) urban environment characteristics - the physical environment, transportation systems, the distribution of open spaces and all other elements created by Men for Men - and its evolution over

time; (b) population and the characteristics of each individual and their evolutions (family, professional, psychosocial, economic, cultural ...).

Assuming that each individual or group of individuals have different strategies depending of their own goals, and that these individual behaviors are the cause of the mesoscale phenomena, the modeling tool used must represent mobility behavior as closer to the individual entity as possible.

In addition, individuals' goals and strategies will evolve over time. A change in the social or family environment, or other any of individual's characteristics causes a change in mobility practices (Scheiner J. & C. Holz-Rau, 2013). The modification of urban system resulting from public policies lead to changes in individual mobility practices as well. The model must be able to take into account these developments.

Future outlooks

This research aims to integrate within a multi-agent system other stakeholders influencing mobility (public stakeholders, economic stakeholders...) in order to analyze stakeholders' mobility strategies (or their combination) influence on daily mobility configuration

References

- Anable J. (2005), 'Complacent car addicts' or 'aspiring environmentalists'? Identifying travel behaviour segments using attitude theory, *Transport Policy*, 12(1), pp. 65-78.
- Buehler R. (2011), Determinants of transport mode choice: a comparison of Germany and the USA, *Journal of Transport Geography*, 19(4), pp. 644-657
- Guerrien B. (2002), *La Théorie des Jeux*, Paris, Economica
- Héran F. (2001), La réduction de la dépendance automobile, *Cahiers Lillois d'Economie et de Sociologie* [The reduction of automobile dependence, *Lille Books of Economics and Sociology*], 37, pp. 61-86.
- Jouffe Y., Caubel D., Fol S., Motte-Baumvol B. (2015), Faire face aux inégalités de mobilité, *Tactiques, stratégies et projets des ménages pauvres en périphérie parisienne* [Addressing inequalities in mobility. Tactics, strategies and projects of poor households in the Paris suburbs], *Cybergeo: European Journal of Geography*, 708
- Korsu E. (2010), La proximité domicile-travail dans les choix résidentiels et professionnels de l'individu hypermoderne [Home-work proximity in the residential and professional choices of the hypermodern individual], in Massot M.H, *Mobilités et Modes de Vie Métropolitains: Les Intelligences du Quotidien* [Metropolitan Mobility and Lifestyles: The Intelligences of Everyday Life], Paris, L'Oeil, pp. 75-91
- Lehning H. (2013), Théorie des jeux: Stratégies et tactiques [Game theory: Strategies and tactics], *Tangentes*, 46
- Scheiner J., Holz-Rau C. (2013), A comprehensive study of life course, cohort, and period effects on changes in travel mode use. *Transportation Research Part A: Policy and Practice*, 47, pp. 167-181.

- Van Exel N. J. A., de Graaf G., Rietveld P. (2011), I can do perfectly well without a car!, *Transportation*, 38(3), pp. 383-407.
- Vredin Johansson M., Heldt T., Johansson P. (2006), The effects of attitudes and personality traits on mode choice, *Transportation Research Part A: Policy and Practice*, 40(6), pp. 507-525.