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# MULTISCALE NETWORK IN A METROPOLITAN REGION

Accessibility indicators to estimate territory structuring in Nord-Pas-de-Calais

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## ABSTRACT

In the thematic of relations between transport networks and territorial processes, in particular that of metropolisation, we locate as spatial planners. Thus, we tend to consider transport networks as a tool for territory planning and construction. According to this point of view, this essay lies in an analysis of transport service in a metropolitan region. Applied to the case of Lille metropolitan region, the work address for opportunities of territorial and metropolitan construction offered by transportation service. Furthermore, the goal is to work out proposals of organization improvements, in an action-oriented approach.

To do so, measures of accessibility are used. They are developed in software which models transport networks in a scheduled graph, using graph theory and shortest path algorithms. This equipment allows simulations, part of a forecasting approach.

## KEYWORDS

Multiscale network system, Metropolitan region, territory structuring, accessibility, Service modelling.

## INTRODUCTION

We currently consider that demographic growth and spatial spreading of larger cities inside their own region gave birth to "metropolitan regions". These ones are multifunctional, containing both dense centre-towns and less dense areas, but keep a kind of cohesion [5]. The process of metropolisation involves the combination of several phenomena: concentration, linking of different places, appropriation of the territory by people and mobilization of private and public territorial players. These processes are strongly linked with increasing spatial mobility possibilities. If one can agree that car is one of the main factors involved in the metropolisation processes, we can nevertheless consider the opportunity of a development of collective transport. Indeed, on the one hand urban flows are generally channelled and concern masses of people, and on the other hand, car showed its limits (congestion...).

The main aim of this communication is to relate the development of public transportation service with the metropolisation process.

## PROBLEM STATEMENT

The study object is conceptualized as the metropolitan collective transport network system. Although this system is reticular, it is also territorial, possessing some thickness ("*épaisseur*") [9]. That is why we refer to the territorial system and its three aspects defined by Maryvonne LeBerre [8]: shape of the networks ("*matérialité physique*"), running by interactions between different components ("*organisation*") and appropriation of the territory by networks practices, from people and institutional players ("*entité territoriale*").

In fact, this object is distinguished by its multiscale nature. These transport networks can indeed serve territories at different scales, from communal networks to international railways. These scale-different networks are superimposed, entangled, and sometimes overlapped in order to better answer to the explosion of mobility.

Yet transport network planning is not conceived the same way whether one wants to connect city boroughs or to link urban areas in a region.

Our position here is to understand transports like a tool of territorial construction [4]. Thus, the criterion to estimate opportunities offered by transport service, and further to propose hypotheses of improvement, will be the potential to help building a metropolitan region. More precisely, the services must allow concentration in urban poles, link places together and incite territorial appropriation. In fact, the transport service must allow the metropolitan region to work in a coherent way, which means linking places according to type and scale of the urban functions they foster. By linking a polarity to another complementary polarity at an appropriate period, transport services structure territory. This structuring includes hierarchy, appropriation and economical and social working.

To deal with this issue with an action-orientated approach, the study is applied to the Lille metropolitan region in the Nord-Pas-de-Calais, France. The main issue concerns the use of high speed at a regional level through TER-GV (*Train Express Régional à Grande Vitesse*, High speed regional express train) and weakness of the links between secondary poles.

## **METHODOLOGIES**

According to the works of spatial planners modelling transport networks in a territorial perspective [6] [7] [11], we use the concept of accessibility to estimate territorial results of transport networks. Accessibility, representing the more or less high easiness of moving from one place to another in order to carry out an activity, can be defined as a measure of spacing or gap between places, "*une généralisation et une particularisation du concept de distance*" (a generalization and a particularization of the concept of distance) [3]. However, accessibility introduces also a notion of opportunity, because of the goal of the trip. Indeed, in this meaning [2], we can measure accessibility to a function and not simply a place; this function is the attractor of the trip. So, here the choice is made to measure accessibilities at places fostering a metropolitan function. Doing this we attempt to address directly the capacity of the multiscale transport network system to permit metropolitan good running. The general idea is that a network permitting good access to metropolitan functions can strengthen region's organization and cohesion. Plus, if this access is made possible daily and relatively continuously in time, we can make the hypothesis that it would contribute to develop some habits and so a potential appropriation from population.

This method does therefore not focus on spatial processes but rather on space-time organization. In consequence modelling is directly following the subjects of Time-Geography. Accordingly, transport supply is modelled in a scheduled graph, which is a graph (nodes and edges) representing transport networks, but taking into account departure and arrival schedules, instead of usual costs attributed to the edges.

MapNod software offers, through accessibility indices (with shortest path algorithm), an action-oriented simulation tool, valuing at a disaggregated level. Therefore, it avoids a set of simplifications that could lead to some mistakes, because transport supply includes components of demand [1]. In addition, this tool gives some possibilities in valuing adequacy to urban rhythms, through «arrival schedule constraint», which is for example a nine o'clock arrival at some given working place.

## EXPECTED RESULTS

Evaluation through accessibility measures toward metropolitan functions would allow us to test different possibilities, representing spatial planning choices. Inspired by Vodoz's territorial organization principles (mixing, density, polycentricity) [12], introduced like recommendations in territorial planning, which aim to reduce energetic consumptions, we can bring in three scenarios. These suit to the will to promote collective transports in metropolitan regions present here. More precisely in proposing an efficient service at different scales, adequate with urban rhythms and organized according to a spatial planning principle. Results would show an organization principle designed to promote territorial construction, particularly in the case of Lille metropolitan area.

## FURTHER DEVELOPMENTS

In order to include new components of metropolitan collective transport network system, we can propose to link accessibility indices with morphological indices, relating shape with function.

## CONCLUSIONS

Aiming at analysing transport service in a metropolitan region and furthermore at proposing a territorialized action designed to deal with metropolitan construction, we develop a forecasting approach based on simulations and scenarios. To do so modelling software is mobilized. The methodology is based on scheduled graph modelling, departing from the classical gap between supply and demand (Four step models...).

Moreover, scheduled accessibility measures offer an alternative to the simple average travel time measure, which doesn't vary in time or only distinguishes peak and off-peak periods.

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