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Notes and comments

Characterizing the speed and paths of shared bicycle use in Lyon

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ABSTRACT

Data gathered relating to the Lyon's shared bicycling system, *Vélo'v*, is used to analyze 11.6 millions bicycle trips in the city. The data show that bicycles now compete with the car in terms of speed in downtown Lyon. It also provides information on cycle flows that can be of use in the planning of dedicated bicycle lanes and other facilities.

1. Introduction

Bicycles offer a mode of transportation that can be both environmentally friendly and offer health benefits from the exercise that it affords users. While there have been previous studies on the social benefits of cycling, data limitations have generally limited detailed analysis. The system of publicly available bicycles in Lyon, France is an innovative scheme to foster more cycling and recent data releases provide a useful source of information of its impact.

2. The *Vélo'v* system

Lyon's *Vélo'v* started in May 2005 was the first large scale shared bicycling system. Today, 4000 bikes can be taken at one of 343 stations spread across the city (Fig. 1). On average, some 16,000 journeys per day are completed by these machines, but when public transportation is on strike, this number, not unexpectedly, doubles. The dataset, provided by *Vélo'v* operator JC Decaux (2010), contains information on all trips that occurred between May 25, 2005 and December 12, 2007. Each record provides details of the location and the time of the beginning and the end of a trip, as well as the precise trip distance measured by a counter on the bicycle. The average trip distance was 2.49 km and the average trip time 14.7 min.

3. The impacts on travel behavior

Speed is generally an important quantitative feature in the determination of the efficiency of a transportation system. Fig. 2a shows that cyclists' average speed reaches a peak of 14.5 km/h during early weekday mornings when there is almost no impedance from cars or traffic lights. This peak is the only time when average summer and winter speeds were identical and may thus be seen as an intrinsic limit of the system. For any other time of the day, winter speeds are higher, up to 9% higher in the evening. The 14.5 km/h morning peak corresponds to an average value: experienced or cyclists in a hurry can go faster as seen in by the black curve in Fig. 2a when speeds reach 20 km/h. Lower speeds may be explained by traffic con-

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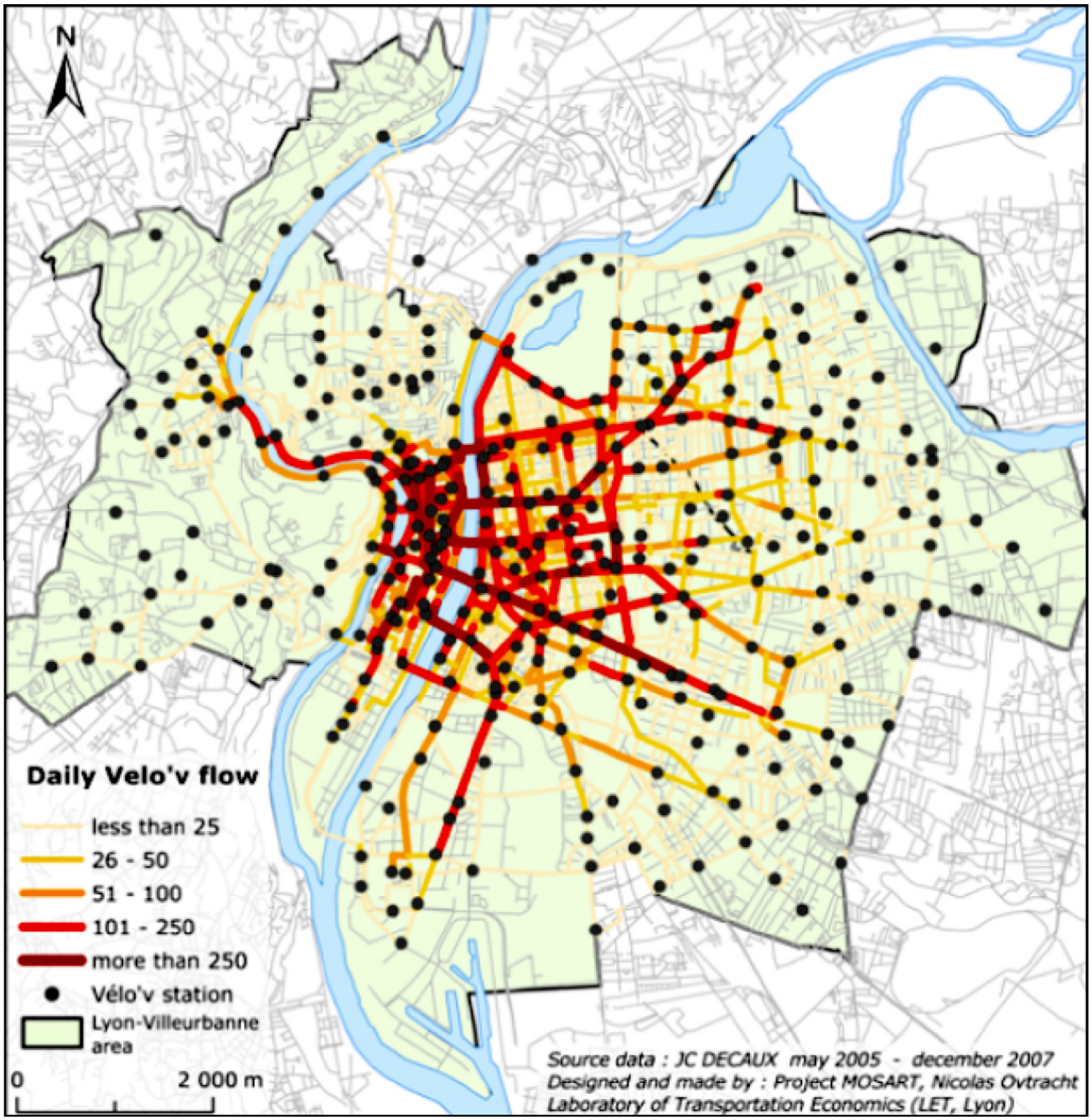

Fig. 1. *Vélo'v* stations and average daily flows on Lyon's streets. Source: http://www.mosart.let.fr/

ditions or lack of any hurry on the part of the traveler. After the 6 am peak, average speeds decrease even if the fastest cyclists speed up as indicated by average speeds during rush hours on working days (Fig. 2a, inset) with clear peaks for the fastest cyclists after 7:45 am that then plateau between 8:45 am and 9:45 am. When there is less need to hurry, average speeds falls to 10 km/h, as in weekends afternoons. Wednesday morning speeds (the upper curve in the inset) are systematically higher than on other weekdays. Since car traffic does not decrease on that day, this higher speed may be related to a higher proportion of faster, male cyclists because a significant number of women stay home to care for children on Wednesdays (Bel, 2008). The data allows us to compare *Vélo'v* trip distances between stations to car and pedestrian distances. Fig. 2b shows that cyclist' patterns of travel are much closer to pedestrians. Indeed, when there is a shortcut, 68.2% of trips by bicycle are shorter than by car (left of the vertical line in Fig. 2b), the average distance reduction being 13%. The proportion is slightly smaller (61.3% of 3,506,294 trips) if all weekday hours are taken into account. In both cases, we only look at trips over 500 m between pairs of stations where the car distance is significantly longer than for pedestrians (i.e. at least 200 m). This suggests that, as dedicated bicycle tracks were very uncommon in Lyon at the time, that most cyclists use sidewalks, drive the wrong way up one-way streets, or use the bus/tramway lanes. Finally, using data on flows of traffic between

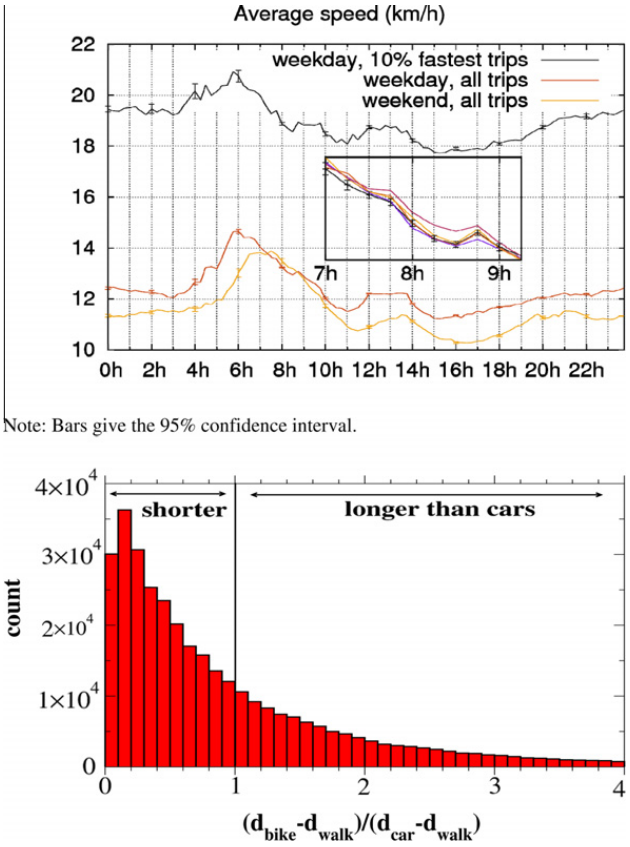

Fig. 2. (Upper) Average speed per hour on weekdays and weekends. (Lower) Histogram of (velov-pedestrian)/(car-pedestrian) distances for the 375,165 morning (7.00–9.00 am) weekday trips. Note: bars give the 95% confidence interval.

pairs of stations, and assuming cyclists follow pedestrian paths, we calculate spatial patterns in *Vélo'v* use on all streets (Fig. 1). Knowing this should help town authorities design cycle paths networks where they are most useful.

The data show that in the morning rush hours, cyclists' average speeds – in normal conditions and for average users – is 13.5 km/h. Adding the effect of shorter bike trips (Fig. 2b) leads to a speed close to 15 km/h, compared to the average speed of cars in downtown European cities that vary from 10 km/h to 15 km/h (Paris, 2010; Prudhomme and Bocarejo, 2005). Therefore, even when considering basic speeds, bicycle travel is faster than car travel in downtown areas, and this difference is not offset by including the average time needed to reach the car or bicycle – the walking distance to car parking in central Lyon is of order 200 m which is similar to that to the closest *Vélo'v* station. Finding a parking slot is also generally more difficult than finding an empty *Vélo'v* slot. The combination of these elements may explain the number of cyclists has almost doubled in Lyon since the initiation of the scheme (Grand Lyon, 2010).

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