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## Exploring shared mobility services beyond the common-sense understanding: a combination of diachronic and spatial analysis based on case studies of Paris and London

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### 1. Extended Abstract

Urban transportation systems in developed countries have traditionally been divided between public transit and individual (motorised) transport. Recently, some factors like the increasing saturation of urban public space or the growing pressure on public funding, have affected the urban transportation settings. The spreading use of digital technologies has been at the same time a driver of, and a solution to, some of the transformations observed. A renewed system is emerging that blurs the boundaries between individual and public transport, enabling a large spectrum of hybrid modes. Such hybridisations include various forms of mobility services, the common features of which are demand-responsiveness and the sharing of trips or means of transport. Usually this multimodal universe of services in-between individual transport and public transit is known as paratransit (Cervero, 1997) or “shared

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mobility” (Shaheen et al., 2015a). Car-based paratransit can take several forms, for example, carsharing, taxi, Transportation Network Company (TNC), carpooling, etc.

Despite it being the focus of increasing research, there is still no unified definition for shared mobility or paratransit modes. In their emergence phase and up until recently, research has mostly produced fragmented analyses of these modes, whether focused on a particular service (Anderson, 2014), or on a category of service (Clavel et al., 2009), investigating – mostly using empirical approaches – the customer base, the travel behaviour, the pricing strategy, the impacts on mobility patterns, etc., of said service or category of service (Sioui et al., 2013; Shaheen et al. 2010). In such research, a definition of the type of service considered would be articulated as a preliminary to the investigation, and usually on the basis of a literature review on the topic.

Such research, together with the growing actual implementation of these services, have allowed to create a fair level of common-sense understanding about car-based shared mobility services among researchers and policymakers. Carsharing services have been classified according to their operating models: one-way, two-way or free-floating (Shaheen et al., 2015b). Basic distinctions have been identified in terms of the type of area in which each model of carsharing would best operate. For instance, free-floating services are known to operate in denser areas than one-way or two-way carsharing services (Millard-Ball, 2005; Kortum et al., 2016), whereas two-way carsharing is known to be able to operate as an isolated hub, like in a particular residential neighbourhood (Celsor and Millard-Ball, 2007). As far as TNCs are concerned, the rapid development of Uber-like services has led public policymakers to regulate and set specific standards (Seattle’s license regulation, London’s ban) as they have been acknowledged to be direct competitors of traditional taxis (Cramer and Krueger, 2015).

The objective of this paper is to provide a comparative analysis of shared mobility services, with a view to building a bottom-up, yet systematic typology of such services. The underlying research develops an objective, systematic methodology of analysis, based on the one hand on an original set of indicators describing service operations at the city scale and on the other hand on a diachronic analysis of services and public policies in the cities considered. Geospatial data was collected through web scraping method, then geocoded using GIS (Geographic Information System). Our grid of indicators includes characteristics of the territory, general information on the service, as well as physical, geospatial and economic features of the service. For the context analysis, information was collected from a wide range of sources, including academic, governmental (official documentation, websites, open data, and regulations) and professional (both operators and specialised media sources) over a 20-year period for all types of services. This comparative method is applied to two selected cities, namely: Paris (France) and London (United Kingdom). The two territories have been selected because they display similar features when looking at basic indicators such as population, densities, motorisation rates, quality of life and transportation infrastructures (IAU, 2014).

Despite being in an early stage of development, the method presented here attempts to consolidate original insights from a bottom-up analysis (grid of indicators) and a top-down analysis (diachronic analysis of services and public policies). The results allow us to verify findings from the literature review about the preferential geographic location of carsharing services, the extent of operational areas and the ratios between taxi and TNC fleets. Besides, less intuitive results show that different operating models of carsharing services (one-way, two-way, free-floating) can have similar features in terms of densities and network effects. In fact, the case can be made that carsharing operating models do not condition the way services develop and operate as much as policies. For example, in Paris, the government-led, one-way carsharing service Autolib already runs operations that are somehow close to a free-floating service due to its dense spatial distribution and strong network effects. As a result of this predominant service setting, other commercial services have been forced to adjust their trajectories and operating models. Judging by the distances between stations, other services appear to have very limited network effects. In London the

two-way carsharing service Zipcar is the predominant carsharing system in the territory. The mapping and computing of analytical indicators describing the features of carsharing services reveal further similarities between two-way carsharing services and free-floating services. Such observations point to the adaptive trajectories of carsharing services, whereby dense two-way services could evolve in the future into one-way, free-floating or hybrid services (as illustrated by Zipcar Flex in London). In addition, our results reveal monopolistic trends in the development of several types of shared mobility services, and reveal the influence of public policy in such trends.

In conclusion, our research shows that spatial and diachronic analyses already bring robust insights into, and promising research directions on, shared mobility services when used independently. But the combination of both provides a deeper understanding of how and why such services may differ in their development trajectories. The paper reveals directions for further research and calls for further investigation on how the trajectories of shared mobility services are shaped.

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