7 Parking as a Challenge for Urban Mobility: Introduction

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Abstract

This part of the book collects smart city approaches to support parking, mostly focusing on the parking pressure in inner-urban areas. The presented recipes for parking information and management rely on a *smart* – sensor-infused, connected, digitally enhanced – urban parking infrastructure that incorporates and utilizes the smart geospatial technologies presented in the first part. It also complements the approaches presented at the end of the first part, which focused on avoiding and shifting private motorized trips in cities, and thus alleviated parking pressure. The approaches presented also weigh also their options when confronted with traffic on roads with less infrastructure and less discipline.

Keywords

Parking, mobility, traffic

Parking is a necessity. A vehicle is a means to an end, and once the end has been accomplished – the travel destination reached – the vehicle can be disposed of, or *parked*, for reuse. This means, parking is intrinsically tied to urban mobility. All forms of urban mobility require some form of parking: self-directed vehicles, shared vehicles (e.g., Figure 7.1), and even autonomous vehicles – at some times and at some places. In this book, however, we focus on the parking of self-directed vehicles, and these vehicles need to be parked close to the destination of the trip.

In principle, the individuals participating in urban mobility – satisfying their need for some access – have a choice of how to travel, when to travel, and, if choosing to travel in a self-directed vehicle, where to park. Thus, since parking is intrinsically tied to mobility, parking can be addressed from three angles:

1. By avoiding trips, or reducing the need to travel. This first angle is mostly in the minds of urban planners thinking about densification. If work, services, and goods are offered at shorter distances – and thus, outside the city center – travel demand decreases as a consequence.

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2. By shifting trips to other modes. This second angle relies on choice, and then on making the alternatives attractive by some tangible or intangible incentives. Ways to use data and information services to shift mobility demand away from the use of private vehicles have been discussed in the first part of this book, or are often subsumed as mobility as a service, or *MaaS* (Exposito-Izquierdo et al., 2017). This includes the disruption of urban mobility (Meyer and Shaheen, 2017) driven by three technologies: the shared (platform) economy, autonomous driving, and electrification of power trains. Each of these has an impact on parking demand and parking space management.

3. By building the smart infrastructure to better manage the existing parking supply or parking demand. Managing parking supply includes, for example, informing drivers of the occupancy status of parking spaces around, while managing parking demand includes, for example, dynamically influencing the drivers' behavior or choice depending on prior information. This third angle will be the topic of this part of the book.

Figure 7.1: Tram depot in Adelaide, South Australia. Source: `https://bit.ly/3d24m54` (© SCHolar44, 2018, original by © Adelaide h class, 2009, public domain).

Smart infrastructure, a loose term used here for the overlap of data (sensors), information, and communication technologies (ICT), and the Internet of Things (IoT), facilitates urban parking in two ways: informing any decision making and collaboration:

1. Drivers of self-directed vehicles have a limited information horizon. Using the terminology of Montello (Montello, 1993), we can distinguish between the space that these drivers immediately perceive – their *vista space* – and

the space that their current travel can take them to – their *environmental space*. Drivers make decisions on their search for parking based on their perceptions in their current vista space and their experience or their estimate about the state in their environmental space. Smart infrastructure, however, can widen the information horizon and provide *advanced parking information*, for example, by replacing experience or estimates with real-time information on parking space occupancy, or simply with mapped data of available parking spaces.

2. Choosing a parking space is currently an individual decision, at the most, informed by the parking guidance systems described above. These individual decisions are made out of self-interest, i.e., each individual driver is trying to optimize his/her total cost of parking, which is influenced by many factors, such as parking fees, search time, or distance to the trip destination (walking time). For one, drivers are not completely rational about their choices, biased by what psychologists call the prospect theory (Kahneman and Tversky, 1979), a behavior that is influenced by risk avoidance. But the sum of all individual interests is not necessarily the global optimum for a system: If each driver is aiming for the next parking space, for example, some may lose out and end up with very long search times. *Advanced parking management* interferes with individual strategies and interests by incentivizing behavior that will lead to parking closer to the global optimum. It includes some form of collaboration.

The very first section in this part, however, will look at the nature of parking in global cities.

These approaches also take into account the traffic conditions in countries where private motorization has not yet reached saturation levels, for example, Indian cities. We have seen before ("parking is not a right, but a privilege" (National Transport Development Policy Committee, 2012)) that parking is a private use of public resources, where the common good includes land opportunity costs, capital costs, and operation and maintenance costs. If the public provides space for parking, this provision cannot grow with demand because space is limited – the dilemma of the commons (Hardin, 1968). Countries where private motorization has not yet reached saturation levels experience this dilemma twice as hard, since urbanization increases the pressure on mobility in the city, and rapid growth of motorization levels only make things worse.

Cities in these countries often lack the infrastructure to cope with parking. But where on-road parking is unregulated or free, induced parking demand is high. For Indian cities, for example, with exponential growth of motorized mobility and from levels that are far from saturated (National Transport Development Policy Committee, 2014), the typical consequence is haphazard parking[1] To stem the

[1] `https://bit.ly/3ctGBUi` – Smart Cities Council India, 2018

demand, the Indian National Transport Development Policy Committee made a number of recommendations that are based on a strategy of *avoid, shift, improve* (National Transport Development Policy Committee, 2012) – *avoid* increased demands for mobility by reducing the number of trips as well as also reducing the length of trips, *shift* trips to more sustainable modes, and *improve* the infrastructure. This strategy's main recognized management tool is the pricing of parking. The Committee states (National Transport Development Policy Committee, 2014, p. 425): "Land is valuable in all urban areas. Parking places occupy a large part of such land. This should be recognized in determining the principle of allocating parking space. Levy high parking fees that represent the value of the land occupied."

Of course mechanisms are available that reduce urban parking pressure by advertising or incentivizing the use of other modes of traveling, such as park-and-ride, or ridesharing, or discouraging the use of the private car, such as by levying a congestion tax. These mechanisms have been discussed before. In this part, we focus on smart tools to monitor parking pressure, generate information about parking pressure, and track the use of this information by the drivers of private vehicles. A particular focus is put on the cruising time in search for (affordable) parking space, which is known to contribute significantly to inner city (peak hour) traffic – with large variations in numbers reported in the literature. Cruising for parking and parking itself affects land use, air quality, traffic congestion, travel behavior, people's safety, people's moods, people's disposable times, and the economic development of a city.

Most of the solutions currently suggested for smart cities are developed and tested in countries with private motorization at saturation, and are not directly transferable to Indian conditions. Unlike in western countries, reserved parking space is scarce in India; instead, parking is often uncontrolled. The reasons for this are manifold and include a reluctance to pay for parking space, inadequate monitoring mechanisms to detect unauthorized or illegal parking, and accordingly, Indian drivers being less accustomed to following traffic rules. For the same reasons, the current parking infrastructure in India cannot sustain costly sensors. The wide variety in types of vehicles on India's roads adds to the problem of uncontrolled parking.

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