Understanding behaviour among bicycle sharing system users in Southern European island cities

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Abstract

Bicycle sharing systems (BSS) have been implemented in cities worldwide in an attempt to promote cycling. Cycling as a mode of transport has the potential to provide transport alternatives for those marginalized by car-based mobility, to reduce traffic related diseases and injuries, noise and air pollution, and to promote an active lifestyle and improve public health. The three Southern European island cities included in this research, Limassol (Cyprus), Las Palmas de Gran Canaria (Spain) and the Valletta conurbation (Malta), exhibit characteristics considered as barriers to cycling, such as hot summers and high humidity, hilliness and car-oriented culture and infrastructure. Thus far, cycling modal share is low: under 1%. However, bicycle sharing systems and policies promoting cycling have emerged in these cities too. In this research a year of trip data, shared by the BSS operators, is used to analyse the system use on an aggregate and station level by analysing the origin-destination matrices to identify spatial patterns, and by assessing different usage types to capture the behaviour of users. Particular attention is paid to the influence of tourism on the system use, through a classification of BSS use for leisure, commuting or other purposes, and analysis of the spatial influence of tourist accommodation and points of interests and the temporal influence of tourist arrivals. The comparative analysis between the three cities shows that despite sharing commonalities, the cities exhibit differences in their user base and their shared bicycle use.

Keywords: bicycle sharing systems (BSS); cycling; travel behaviour; OD matrix; Southern Europe

1. Introduction

Bicycle sharing systems, or BSS, are shared bicycle fleets allowing short-term public use (Shaheen, Guzman & Zhang, 2010). Since the late 1990s, when only a handful of bicycle sharing systems existed, the number of BSS around the world has spread rapidly across the globe, growing to over 1,000 active systems in 2016 (Médard de Chardon, 2016). Cities around the world have introduced BSS as part of wider sustainable transport strategies (Fishman, 2016). Cities in Southern Europe, especially those on islands and the coast, need to provide for the seasonal influx of tourists, especially during the summer months, in addition to daily residents’ movements for work, education and leisure.

Previous BSS studies have looked at factors influencing the use of the system, e.g. land use variables, weather variables and network variables (e.g. Buck & Buehler, 2012; Faghih-Imani et al., 2014). However, few studies have focused on behaviour by different types of users (Zhang et al., 2016), using their use of the system to try to classify the purpose of the trips. The influence of tourism numbers has not been evaluated in analyses of BSS use thus far, although the influence of points of interest and tourism destinations within a buffer zone around BSS stations have been assessed in case studies of Santander and Melbourne (Bordagaray et al., 2016; Jain et al., 2018).

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2. Methodology

Twenty-first century bicycle sharing systems are characterised by a system comprised of docking stations and bicycles, which can be unlocked using a monitor at the docking station or through a mobile app, with payment linked to the users’ credit card. These are considered third generation bicycle sharing systems (Fishman, 2016), following earlier experiments where shared bicycle experiments were available for free or through coin-based payment systems. Third generation BSS produce different forms of data (Romanillos et al., 2016; Zhang et al., 2016): trip, or flow, data (time varying origin–destination matrices); point, or stock, data (station locations and statuses); and in certain cases, routing data (the details of the route that users take between origin and destination on the street network; only for bicycles with GPS). In this study, the focus is on trip-level and station-based data, as GPS data is not available. The BSS trip datasets consist of one year of origin-destination (OD) data for all BSS trips from April 2018 to March 2019, including the location of the origin and destination stations, the date and time when the bicycle was rented and returned, the bicycle number and an anonymised user ID. Fig.1 shows an example of the OD flows between stations in Limassol.

To understand and explain variation in system use, i.e. why certain stations and station pairs are more active than others, trips are classified based on different characteristics to cluster them based on their purpose (leisure, commuting, utilitarian, other) or the spatial and temporal variables influencing their use (Borgnat et al., 2011; Bordagaray et al., 2016). This includes characteristics such as: a) trip type (round trip, single trip, or symmetrical trip); b) trip duration; c) number of rentals per user; d) station location (land use, socio-economic and network variables at station location); e) station activity; and f) seasonal variation in trip types, duration and use of stations.

Fig. 1. OD flows between BSS stations in Limassol (drawn by author).

References


