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Influences of urban characteristics on cycling: Experiences of four cities

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ABSTRACT

Cycling level was investigated for four cities with similar land area namely, Beijing, Berlin, Canberra and Singapore. Four characteristics namely, urban structure, transport policy, public transport service and cycling infrastructure, as affecting cycling activities in urban areas were compared. A cycling line was devised and used to position and compare each city by the stages of cycling level. Cycling level in Berlin is comparatively high and remains on an increasing trend which is at the promising stage. Recommendations are given for the other three cities (Beijing, Canberra and Singapore) that could improve cycling level.

1. Introduction

Cycling with its myriad of advantages for society, economy, and environment, is starting to receive increasing attention as a sustainable transport mode by many countries worldwide. As listed by European Commission (2000), the main benefits of cycling include: (a) social benefits: such as equity of road uses, greater accessibility to more facilities for more people (e.g. the young and elderly); (b) positive ecological impacts: such as lowering the impacts of further land development on biodiversity and habitat; (c) economic benefits: such as reduction in oil prices, and reduction of health costs from the effects of regular exercise; and (d) political benefits: reduction of dependency on fossil energy sources. Although it is a worldwide recognition that cycling should be advocated for environmental sustainability and individual health as well as reducing harmful impacts of using car, cycling usage varies across countries to a great extent (Gu, Sun, & Wennersten, 2013). A variety of aspects may cause this difference which Pucher, Peng, Mittal, Zhu, and Korattyswaroopam (2007) identified as climate, (government) transport policies, land use pattern (urban structure), availability of transit services, cycling facilities, as well as car availability and cost.

In this research, four urban aspects were chosen in the context of four cities to discuss how these aspects influence cycling levels. The four aspects are land use pattern, transport policies, public transport service and cycling infrastructure. Literature review of each aspect is introduced in Section 2. Detailed information for the four cities is described in Section 3. After comparing the cycling level for the four cities, a cycling line is devised and used in Section 4 to analyze the cycling development level. Finally, Section 5 presents the conclusions and suggestions.

2. Literature review

2.1. Urban structure

Land use pattern and transport are co-dependent and mutually influencing each other in a complex and dynamic way. On one hand, the land use pattern influences the transport mode choice to a large extent. For example, the density and mixture of land use can affect public transport usage (Curtis & Perkins, 2006). While there is a huge vehicle dependency in US because of sprawling suburb land use pattern of the major metropolitan regions, there is stronger urban planning and design controls in European countries, leading to a more compact and higher density urban form and hence an increased use of public transport. On the other hand, the developing transport technology affects human settlement pattern as well. Cervero and Duncan (2003) found that urban landscapes can generally affect walking and cycling, such as in the San Francisco Bay Area. Docherty and Shaw (2008) reported that widening choices of transport modes encourage a separated and dispersed urban land use form. This resulted in the new spatial phenomenon of the 'suburbs', places where commuters lived, but did not work.

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2.2. Transport policies

Among the variables, (government) transport policies provide most of the strategic and political vision for encouraging cycling levels. Whether the transport policies give priority to motorized transport or non-motorized transport is vital for the cycling levels in a city. Under the policies promoting non-motorized transport, some methods can be adopted such as tax policies for restricting car uses and government funding for new cycling infrastructures. The context in which transport policy is being developed is complex with various interest groups and stakeholders involved (Servaas, 2000). Forming appropriate policies is a good way for balancing the interests of these groups and also for identifying the responsibilities of these stakeholders in facilitating cycling levels. Government policies are commitment of politicians and bureaucracies who indicate their willingness to put cycling on the agenda, to endorse legislations, to allocate funding and to enable the stakeholders to participate (Servaas, 2000). It is only under the combination of political support, proper bicycle plan, and internal management of the project that activities promoting cycling levels will be sustainable.

Pucher, Dill, and Handy (2010) found that most of the evidences suggested that public policy plays a crucial role in encouraging cycling, such as overall measures of "bikeability" (Amiri & Sadeghpour, 2013; Sener, Eluru, & Bhat, 2009a; Titze, Stronegger, Janschitz, & Oja, 2008), on-road bicycle lanes (Dill, 2009; Parkin, Wardman, & Page, 2008; Sener, Eluru, & Bhat, 2009b), two-way bicycle travel on one-way streets (Transport for London, 2005) and shared bus/bike lanes (Nabti & Ridgway, 2002; Reid & Guthrie, 2004). Jäppinen, Toivonen, and Salonen (2013) studied the impacts of bicycle sharing system on public transport travel time; they showed that open transport information interfaces can provide new effective means to evaluate multimodal accessibility patterns in urban areas and reduce the public transport travel times. Aldred and Jungnickel (2014)'s research suggested that traffic policymaker should take culture into consideration in transportation practices based on four case analysis in Bristol, Cambridge, Hackney, and Hull.

2.3. Public transport services

Well-developed public transport service is beneficial for a sustainable city by reducing private car usage and also for promoting cycling. Cyclists do not need to ride for a long way to get to the destination, which may be tiring. They can cycle for part(s) of the journey and complete the rest with public transport. Cycling and public transport developments need to work hand in hand to successfully encourage car drivers to give up their cars. Without the establishment of a comprehensive public transport network, cycling alone is not attractive enough to car drivers, especially for long distance travel. The challenge of a good public transport-cum-cycling strategy is to replace the door-to-door convenience of the private cars.

Hegger (2007) discussed how public transit and cycling can be complementary modes of transport. Hegger pointed out that cycling facilities must be available in order to assure any form of intermodality. Transit policy must be accepting and welcoming of bicycles on buses and trains for bike-ride-bike program to work. As cycling and public transport also appear to be attractive for short distance trips, they would compete with each other on some routes. For example, in some German and Dutch cities, it is found that students prefer to use public transport than cycling because of the provision of very low-cost semester and annual tickets (Dutch Bicycle Council, 2010; Schwanen, 2002). Hagelin (2007) did a survey about the influence of bikes-on-bus programs, which showed that this strategy can promote the use of transit.

2.4. Cycling infrastructures

Cycling infrastructures are found to be an important factor influencing the extent and quality of cycling levels (Asadi-Shekari, Moeinaddini, & Shah, 2013; Browne, Rizet, Anderson, Allen, & KeIta, 2005; Heinen, van Wee, & Maat, 2010; Tirachini & Hensher, 2012). Stinson and Bhat (2005) found that cyclists are sensitive to different kinds of cycling route. Pucher and Buehler (2008) pointed out that high level of cycling in the Netherlands is partly due to the comprehensive cycling infrastructure network (including bike lanes and separated paths). The Dutch promoted the bike-and-ride schemes with some measures focused on bicycle parking facilities, egress trips for train services and access and egress trips for slower modes of public transport with favorable results in the use of the bicycle for access trips (Martens, 2007). Hunt and Abraham (2007) reviewed the influences factors on cycling, where cycling facility and the roadway type were found to affect the cyclist travel preference. Garrard, Rose, and Lo (2008) pointed out that improving the cycling infrastructure, such as developing the cycling lane will promote the women's cycling usage level. Clayton and Musselwhite (2013) reported that enhancements to cycling infrastructure alone would not always translate to more cyclists, and it is more important to improve the safety of the network and build high-quality, acceptable cycle lanes and routes for all users.

3. Detailed information of four selected cities

Four cities are chosen as case studies in this research to discuss the connection between four urban aspects (land use pattern, government policies, public transport services and cycling infrastructures) and cycling level in urban areas. The cities are Beijing (China), Berlin (Germany), Canberra (Australia), and Singapore as shown in Fig. 1. All four selected cities are the capital cities of respective countries with fairly similar land area size. Besides, all the four cities have high purchasing power parity which reflects the economic and purchasing index (World Bank, 2014). However, the land use pattern and urban structure of these cities differ a lot from each other. Since the four cities are located in different parts of the world with different histories and cultures, it provides an interesting setting to compare the respective transport developments. Table 1 summarizes the population, land area and population density figures of the four cities.

3.1. Basic information

Bicycle use in European cities started as early as 1930s before the advent of motorized vehicles. They were used to replace walking for longer traveling distances (Pucher & Buehler, 2008). During 1950–1960s, car ownership increased rapidly, bicycle use fell sharply (from 50 to 85% of trips in 1950 to 14–35% in 1975). Many European cities focused on expanding roadway and car parking while largely ignoring the needs of cyclists. This is likely due to many people viewing ownership of a motorized vehicle as being of higher status than riding a bicycle. The aspirations of owning a private car led to several problems such as congestion, air pollution, accidents and health issues. By mid 1970s, many European countries started to have dramatic shift in transport policies that favor walking, cycling and public transport, due to the harmful effects of car use. Many European cities started to improve cycling infrastructure while imposing restrictions on car use. The population of motorized vehicles continued to increase but at a slower, controlled pace. As cycling infrastructure is being built up, the cycling population revived however, the increase in cycling use has yet to reach pre-motorization level (18–44%). Generally, West European cities can be seen as leaders of cycling revitalization or 'Re-cycling'.