



Bicycle-friendly infrastructure planning in Beijing and Copenhagen - between adapting design solutions and learning local planning cultures

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ABSTRACT

Cities around the world are constructing bicycle infrastructure to increase cycling. However, identifying efficient design solutions and determining how bicycle infrastructure planning knowledge can be integrated into comprehensive policy remains a challenge. The objective of this paper is to shed light on the strengths and weaknesses of current bicycle infrastructure planning in both an experienced city, Copenhagen, and in a less experienced city, Beijing. The paper examines how local design solutions are identified, how efficient they are and to what extent bicycle infrastructure planning is supported by the local planning cultures. The study draws on the successful experience of Copenhagen to identify challenges to bicycle infrastructure planning in Beijing and to improve it based on lessons learnt. The study uses qualitative semi-structured data collected from 11 interviews with key planners. It employs the Dutch CROW principles to assess the efficiency of the bicycle infrastructure planning. The analysis of the role of the local planning culture is framed by the 'culturized planning model'. The study finds that bicycle-friendly infrastructure planning could be strengthened in Beijing by integrating and applying all the CROW principles simultaneously. It concludes that Beijing can draw inspiration from Copenhagen by increasing the priority of cycling in both the planning and societal environment. The planning environment could be strengthened by professionalizing bicycle infrastructure planning and by aligning the prioritization of bicycle transport between policies. The societal environment could become more supportive by improving the status of the bicycle as a means of transport.

1. Introduction

Cycling plays an important role in urban sustainability as it can reduce traffic congestion, alleviate air pollution, reduce CO₂ emissions, promote energy efficiency, and enhance public health and urban livability (Fraser and Lock, 2011; Krizek et al., 2009; Pooley et al., 2013; Pucher et al., 2011b; Pucher and Dijkstra, 2003). Constructing bicycle infrastructure is essential for cities' investment to increase the cycling mode share. Urban environments are bicycle-friendly to varying degrees and the extent to which city authorities support bicycle infrastructure planning differs. Some cities have extensive experience with bicycle infrastructure planning, while others have relatively little. Hence, bicycle infrastructure planning has developed to varying degrees in different cities (Hull and O'Holleran, 2014; Pucher et al., 2010).

In particular, cities in Denmark, the Netherlands, and Germany have extensive experience with bicycle infrastructure planning (Pucher and Buehler, 2008, 2017). For example, Copenhagen in Denmark is often

referred to as one of the most bicycle-friendly cities in the world. In many other countries, cities, such as Beijing, are beginning to focus more attention on bicycle infrastructure planning, but they are struggling to find effective solutions. Due to its high cycling mode share, Copenhagen is often highlighted as a successful model, and the city has attracted the attention of cities worldwide (Chataway et al., 2014; Gössling, 2013; Pucher and Buehler, 2008; van Goeverden et al., 2015). Accordingly, Copenhagen is recognized as having extensive experience and knowledge on how to facilitate cycling, and the city has developed specific policies and guidelines for bicycle infrastructure planning. Copenhagen enjoyed its highest cycling mode share of about 60% in the 1930s, but this declined after World War II with the emergence of the automobile era, like in most other European cities. However, the cycling mode share began to increase again in the 1970s (Carstensen and Ebert, 2012) and by 2014, the cycling mode share for commuting had reached 45% of all trips to work or education in Copenhagen (City of Copenhagen, 2015). A series of policies have been implemented over

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time to increase the mode share, and bicycle infrastructure has steadily been expanded, even during periods marked by a decline in the cycling mode share (Carstensen et al., 2015).

Like Copenhagen, Beijing has a long tradition for cycling, which experienced a boom from the late 1970s to the 1990s. Today the cycling culture is still substantial with a cycling mode share of around 12% (Beijing Municipal Commission of Transport, 2016a). Although cycling has been marginalized both culturally and politically during the past two decades (Wang, 2012), severe societal challenges, including traffic congestion, air pollution, threats to public health and climate change caused by a rapid growth in motorized traffic and urbanization, have focused the attention of urban transport planners on cycling. Currently, cycling is receiving unprecedented attention in Beijing, which consequently received economic funding to enhance cycling infrastructure. In 2016, Beijing set the goals for its 13th five-year plan: by 2020, Beijing will have improved its existing 3200 km of cycle lanes so that they are more bicycle-friendly (Beijing Municipal Commission of Transport, 2016b). However, in line with the political objectives for enhancing non-motorized transport, the increasingly motorized urban environment of today's Beijing calls for knowledge of and experience with enhancing the quality of bicycle infrastructure planning in order to increase the cycling mode share (Beijing Municipal Commission of Transport, 2016b).

Around the world, cities are seeking knowledge of and experience with enhancing the quality of bicycle infrastructure planning in order to increase cycling mode share. Cities such as Beijing, which have little experience with bicycle infrastructure planning, are expanding and constructing bicycle infrastructure as one of their main strategies for increasing cycling (Buehler and Dill, 2016). However, identifying which infrastructure elements are suitable and efficient, and determining how bicycle infrastructure planning can be integrated into comprehensive policy making remain challenging (Badland et al., 2013).

1.1. Bicycle infrastructure planning guidelines

Many cities have developed guidelines for their local bicycle infrastructure planning practice. However, language and the customized designed codes often limit the transferability of the knowledge to other cities. Nevertheless, accessible generic guidelines also exist, which focus solely on design solutions. A range of scholars have stressed that, in order to be able to promote cycling efficiently, bicycle infrastructure planning needs to incorporate cyclists' preferences and behaviours (Broach et al., 2012; Daniels et al., 2009; de la Bruhèze and Oldenziel, 2011; Jensen, 2008; Madsen and Lahrmann, 2016; Møller and Hels, 2008; Pucher et al., 2010). If bicycle infrastructure planning focuses exclusively on implementing specific design elements that have enhanced bicycle-friendliness in other urban environments, it probably will not be very effective.

In cities with extensive cycling experience, such as those in the Netherlands, bicycle infrastructure planning is supported by a set of generic planning principles, i.e. the CROW principles. These have been developed over time and summarize the experience gained from many years of bicycle infrastructure planning. Therefore, they reflect a profound understanding of cyclists' preferences and behaviours. CROW is a non-profit organization, which was established in 1987. It serves as a platform for developing and transferring technology and knowledge in the field of transport infrastructure. The organization focuses on establishing professional standardization and issues regulations for the Dutch planning authorities, with bicycle transport being one of their key themes. In 1993, CROW published their first set of guidelines for bicycle infrastructure planning to assist Dutch cities with increasing the cycling mode share. In the latest updated version from 2007, new knowledge from traffic engineering was added, and the following five generic principles for constructing bicycle-friendly infrastructure were derived: cohesion, safety, directness, attractiveness, and comfort

(Groot, 2007). The CROW principles are appropriate for exploring the state of bicycle infrastructure planning and identifying strengths and weaknesses (Hull and O'Holleran, 2014). The CROW principles are not only useful for the exchange of knowledge on bicycle-friendly infrastructure planning in Dutch cities as they are also generic planning guidelines, which have been translated into both English and German (Presto, 2010).

1.2. Bicycle infrastructure planning culture

Bicycle infrastructure planning is not merely a technical task concerning the implementation and the adaptation of design guidelines, it also involves connecting planning knowledge and forms of action in the planning environment (Friedmann, 1993). In the case of infrastructure planning, strong local planning cultures, in which planners share the cognitive frames, are key for an effective mediation of planning knowledge and planning practices (Schön and Rein, 1994). In most countries, there is no specific undergraduate education program focusing on bicycle transport planning. Therefore, planners are not educated specifically in bicycle infrastructure planning. Planners of bicycle infrastructure are located in a wide-ranging field, where they also act as urban planners, urban designers, traffic engineers, landscape architects or architects. Planners are influenced by the planning culture within which they are embedded, and they are involved in both the learning of technical skills and also in the adaptation of certain values and norms that define the occupation (Schein, 2010). Consequently, the learning of technical skills for bicycle infrastructure planning and the development of bicycle-friendly planning practices are gradually achieved through operating in local professional planning environments. Their values, operations and applications of professional knowledge depend on the societal contexts resulting in different planning trajectories (Fox-Rogers and Murphy, 2015; Knox and Cullen, 1981; Knox and Masilola, 1990; Tennøy et al., 2016). Thus studies of bicycle infrastructure planning need to pay far more attention to the role of planning cultures and the influence they may have on the potential for and barriers to knowledge exchange.

A number of studies which have compared cities with more or less efficient bicycle transport planning (Ekblad et al., 2016; Heinen and Handy, 2012; Hull and O'Holleran, 2014; Koglin, 2015; Pucher et al., 2011b) have found that sharing knowledge and experience enables cities with little bicycle infrastructure planning experience to learn from more experienced cities and accelerates the identification of effective design solutions (Pucher et al., 2011a; Pucher and Buehler, 2007, 2008). Extensive knowledge mediation and exchange between cities is taking place today, which will probably lead to more efficient bicycle infrastructure planning, as the case of Bogota in Colombia shows, where experiences from the Netherlands have contributed to a growth in cycling (Pucher et al., 2010).

However, how such knowledge exchange takes place and how it succeeds or fails to enhance the efficiency of bicycle infrastructure planning remains an unanswered question. As knowledge of bicycle infrastructure planning is based on experience gained in other settings and is, thus, to a large extent context-dependent (Campbell, 1975; Flyvbjerg, 2006), local adaptation is needed. *Transferring generic planning* guidelines may be supportive, but is far from sufficient. It needs to be supplemented by an enhanced knowledge and experience base in terms of specific conditions and challenges in order to facilitate the local planners' learning and shared understanding of the underlying rationales of the guidelines (Lindelöw et al., 2016). Hence, it is crucial to explore how knowledge exchange is taking place in order to uncover limitations to and potential for efficient learning.

In general, there is a deficit of studies conducting in-depth comparisons of different cities' bicycle infrastructure planning, which take bicycle infrastructure planning's embeddedness in the local planning culture into account. Against this background, the objective of this paper is to explore and compare bicycle infrastructure planning in

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