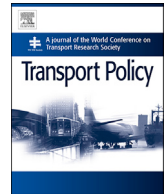




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## Cycling environmental perception in Beijing – A study of residents' attitudes towards future cycling and car purchasing

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### ABSTRACT

This study focuses on three groups: cyclists, non-cyclists, and non-car owners and examines the significance of the perceived cycling environment, current travel behavior, urban form and socio-demographic variables for the respondents' attitudes towards future cycling and car purchasing. The paper uses survey data (N = 1427) collected in eight Beijing neighborhoods. The analysis is carried out by means of principal component analysis and multinomial logistic regression analysis. The respondents were generally more positive towards continuing cycling or cycling more in the future than towards car purchasing. The perceived cycling environment was found to be associated with respondents' attitude towards future cycling and car purchasing. The higher the level of satisfaction with the clarity of cycling space allocation and the higher the agreement with pro-cycling policies, the higher the probability that the respondents will cycle in the future and the lower probability that they will buy a car. Associations with current travel behavior indicate that long everyday travel distances (e.g. 10 km to work or longer) negatively affects the respondents attitude towards their future cycling, whereas short everyday travel distances up to 2 km are positively linked to future cycling prospects. Non-car owners' attitude to future car ownership is strongly linked to socio-demographic status - low education and low income level groups seems to be most unlikely to take up driving in the future. To encourage people to cycle more and drive less, policy should direct efforts to promoting the clarity of cycling space on the street and strengthen pro-cycling policies. Attention should also be given to stabilizing the current travel modes of non-car users, including promoting the image of cycling, improving the service of walking, cycling, public transport and generally by introducing attractive alternatives to private car ownership.

### 1. Introduction

Increase in car ownership has been accelerating in China's mega cities since the end of the 1990s (Zhao, 2014), it has partly resulted in severe traffic congestion and frequent heavy smog, which reached an unprecedented level in 2015 and 2016, especially in Beijing, Tianjin and their adjoining regions (Beijing pollution, 2017; China Daily, 2015). While the prevailing travel mode choice (since the late 1990s) was rapidly shifting to private cars in Chinese cities, an evident corresponding decrease in cycling was observed (Yang et al., 2015). In Beijing, for all the trips, from 1986 to 2014, the car mode share increased from 5% to 32.6%, while cycling declined from 62.7% to 12.4% (Beijing Municipal Commission of Transport, 2016a). To solve the challenges caused by rapid urbanization

and increasing in motorized vehicles, reducing car use and promoting alternative modes has been moved up to the political agenda. Globally, cycling is considered either as a specific travel mode or as an integrated part of sustainable travel modes, and an alternative to car-driving (Bergström and Magnusson, 2003; Bongardt et al., 2010; Gössling and Choi, 2015; Olafsson et al., 2016; Rabl and de Nazelle, 2012). Hence, focusing on increasing cycling as one of the alternatives to car driving could be a part of the solution for Beijing.

#### 1.1. Why cycling more and driving less in Beijing?

In Beijing, most trip distances remain within a range where cycling could be competitive with other modes. By 2014, the mean trip distance

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for Beijing citizens was 11.3 km, while 52.9% of trips were less than 5 km, and 17.1% of trips were between 6 km and 10 km. However, 28% trips were within 5 km and 22% of the trips between 6 and 10 km were made by car (Beijing Municipal Commission of Transport, 2016b), which indicate a potential space for reducing the car using especially for the trips within 10 km, while bicycle transport can be as one of the alternative modes to car driving.

In addition, main roadways were originally designed with bicycle lanes which are still open on many arterials. The national road standard has since the 1970s (MOHURD, 1991), required cycling paths to be included in the planning of new main roads (Figs. 1–3). This has been beneficial for the current level of cycling infrastructure in Beijing. However, road space that was originally planned for cycling has gradually been taken over by motor vehicles or car parking. Nevertheless, space still exists and could potentially be reclaimed for bicycles.

Furthermore, the policy focus of the City of Beijing has shifted towards reducing car use and enhancing non-motorized transport. The City of Beijing has set the goal that by 2020, non-car modes should account for 75% of all trips, and that the cycling mode should make up at least 18% of all trips (City of Beijing, 2016). Consequently, Beijing's thirteenth five-year plan, has included retrofitting of 3200 km of existing cycling lanes before 2020 (Beijing Municipal commission of Transport, 2016), as well as a series of policy measures for restricting car use (Sun et al., 2014).

Identification of effective policy interventions for guiding people to cycle more and drive less, based on better understanding and predictions of cycling and car driving would greatly support the policy making for achieving the city's objectives. Against this background, the overall aim of this paper is to identify and understand the factors that influence the attitudes towards future cycling and car purchasing in Beijing. The overall aim is addressed by investigating on two research questions:

- 1) What is the Beijing residents' attitude towards future cycling and car purchasing?
- 2) How are the perceived cycling environment, travel behavior, urban form and socio-demographics related to the attitude towards future cycling and car purchase?

This paper intends to contribute to enhancing the state of the knowledge in two ways. First, it identifies the components of the perceived cycling environment based on respondents' satisfaction with different aspects of cycling environment in Beijing; second, it analyzes the associations between the perceived cycling environment, socio-demographics, urban form, and travel behavior variables with the intention of cycling and driving in a rapidly urbanizing city – Beijing. This knowledge would serve to help forecast and understand the trend of



Fig. 1. Physical fence for segregating cars and bikes in Beijing.



Fig. 2. Bicycle lane defined by painted line in white.



Fig. 3. Cycling space defined by red painting in the intersection, photos by C.L. Zhao.

future cycling and car driving behavior, which will support policy making in Beijing encouraging people to cycle more and drive less.

## 2. Literature review - why psychological interventions?

Even though, the basic infrastructure and policy conditions in Beijing have provided an open window for increasing cycling and reducing car use, to guide citizens to cycle more and drive less will require effective interventions. Previous studies and experimental programs indicated that interventions for changing travel behavior can be made through different approaches. Travel Demand Management (TDM) strategies are often based on investments/funding, new regulations and legislation, as well as communicative measures (Choocharukul and Fujii, 2007; Gärling and Fujii, 2009). Since 2008, when the Olympic Games were held in Beijing, a series of TDM strategies were implemented to reduce car use and increase cycling mode share. Measures included investing in public transport, implementing car restrictions, installing a public bike share scheme, and improving the walking and cycling environment by improving design standards and infrastructure (Beijing youth daily, 2016; Sun et al., 2014; Wang et al., 2014). However, in the long run the adequacy and comprehensiveness of the measures needs to be considered (Wang et al., 2014). In addition, to evaluating, developing and improving the existing TDM strategies, a more thorough understanding of the factors behind the changes in travel behaviors will be required (Adjei and Behrens, 2012).

For reducing car driving, Fujii et al. (2001) characterized possible interventions into two categories: structural and psychological. Structural interventions (e.g. car restriction policies, reducing the road space for cars while increasing space for public transport and cycling) are focused on reducing the opportunity and convenience of car use and making the car less attractive than other modes (Gärling and Schuitema, 2007; Graham-Rowe et al., 2011). Psychological interventions (such as social campaigns discouraging car driving, and claiming road space for cycling) focus on influencing travelers' mode choice through intervening

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