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Bicycling frequency: A study of preferences and travel behavior in Salt Lake City, Utah

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ABSTRACT

Improving our understanding of cycling behaviors in urban areas is an important step in producing a more sustainable transportation system. Based on a hybrid stated and revealed preference survey (n = 132) in Salt Lake City, Utah, this paper studies the influence of attitudes and demographics on cycling frequency. A factor analysis of stated preferences shows the existence of four attitudinal factors concerning bicycling: safety, direct benefits, comfort, and timesaving. In turn, these are used in a multivariate model of cycling frequency and the decision to cycle is found to be positively correlated with the timesaving and convenience factors, and negatively correlated with preferences for travel comfort. Our results provide a broader empirical base for the complex relationships between attitudes, demographics and travel behaviors and point to some policy recommendations for increasing cycling uptake in the region.

1. Introduction

Bicycling is a healthy mode of transportation and an efficient form of exercise. However, beyond the personal benefits of cycling, increasing bicycle use in a region that is automobile dependent is a step toward a more sustainable transportation system, because shifting drivers to bicycling reduces problems caused by extensive automobile use. For example, studies have found that as bicycling levels increase, traffic injury rates fall, making bicycling safer and therefore providing societal benefits over and above those pertaining to personal health (Elvik, 2009; Jacobsen, 2003; Robinson, 2005). Additionally, both air and noise pollution can be reduced and controlled by increasing bike use in urban areas (Elvik, 2009).

The research literature indicates the necessity to increase bicycle use through the production of cycling infrastructure, achieving a high level of safety, and the implementation of policies that facilitate cycling (Pucher et al., 2010). However, attitudes toward cycling is a less considered factor that may influence ridership. Recent literature has revealed that attitudes and habits significantly influence bicycling behavior and should receive further attention (Gatersleben and Appleton, 2007; Heinen et al., 2011). Current work on attitudes and values tends to focus on the impact of attitudinal factors on transportation mode choice. However, a more specific focus on cycling frequency is still needed in order to improve our understanding of the relationships between bicycling attitudes, the provision of infrastructure and policies, and the ensuing bicycling behaviors.

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The purpose of this paper is to add to the growing empirical body of work investigating cycling behavior. We do this through a probabilistic analysis of cycling frequency and present findings from a bicyclist preferences survey collected in Salt Lake City, Utah. The survey simultaneously collected stated preferences data for cycling frequency and revealed bicycle routes for each respondent. The routes are used to better understand route-preferences in another aspect of this research project (see Fu, 2015). Factor analyses and ordered probit models are applied to analyze the relationship between rider attitudes and bicycling frequency. The influence of travel purposes and social-demographic factors are also analyzed in these models, giving rise to a number of new understandings regarding cycling behaviors and their policy implications.

The remainder of the paper is structured as follows. Section 2 contains a review of previous research in this area. Data and methods are described in Sections 3 and 4 respectively. The results are provided in Section 5. Finally, in Section 6, we summarize the contributions of the work, discuss policy implications, and point out several directions for future inquiry.

2. Literature review

Generally, cyclists' mode and route choice decisions have been found to be influenced by factors relating to the cycling environment, individual socio-demographic characteristics, and one's attitudes, values and preferences (Stinson and Bhat, 2003; Heinen et al., 2011). Because of these multiple influencing factors, cycling behaviors can be complex and difficult to predict, and any attempt to do so should include controls for all three dimensions of factors. Our literature review will first focus on the three categories of factors that influence cycling behavior, both in terms of mode choice and route attraction. Following this, we will discuss previous research on methods for analyzing bicycle behaviors.

2.1. Built environment factors

The role of the built environment on generating and attracting cycling trips has received much attention in the literature (Antonakos, 1994; Moudon et al., 2005; Dill, 2009; Pucher et al., 2010). Link-level characteristics of the transportation network, specifically, travel time, cycling infrastructure, vehicular traffic volume and speeds, surface quality, and grade have an evident relationship with bicycle use (Antonakos, 1994; Sener et al., 2009; Stinson and Bhat, 2003). Research shows that bicyclists place higher importance on bicycling facilities, especially lanes that are separated from automobile traffic (Broach et al., 2012; Parkin et al., 2008; Wang et al., 2012). Apart from bicycle routes and lanes, point-of-destination facilities provided at schools, workplaces or other attractions also encourage people to use bicycles as their means of transportation. Examples include bicycle parking, changing and showering facilities, and bike sharing programs (Pratt et al., 2012).

2.2. Social-demographic factors

Socio-demographic characteristics form a second category of factors that will influence bicycling frequency and route choice. In consideration of travel costs, income obviously has a determining role in one's travel mode. Bicycle use is found to be higher among groups with annual household incomes less than $50,000 (Krizek and Johnson, 2006) since lack of car ownership greatly increases the likelihood of both walking and bicycling (Pucher and Renne, 2003). But, distinction has to be made between voluntary and non-voluntary cyclists (Damant-Sirois et al., 2014). A large number of higher income bicyclists choose this transportation mode voluntarily, for recreation, exercise or as a statement of their values, and therefore attitudes toward cycling must also be considered (Kuzmyak et al., 2014). Education level also influences perceptions of bicycle use and choice of travel mode. Bicycling rates are the highest among those in the lowest education group, presumably due to income effects, and highest education group, presumably due to preferences (Kuzmyak et al., 2014). Similar to the situation of income analysis, there is an obvious relationship between travel purpose and bicycling frequency among groups with different education levels. People with higher education levels are likely to ride more often for transportation rather than recreation, which may be due to a working or studying population at a local university or college who live within bicycling distance (Xing et al., 2010). Furthermore, gender may play an important role in influencing individual choices to participate in cycling activities. One study found that 65% of male cyclists who cycle to work do so even though they perceive risks associated with cycling, while only 50% of female cyclists with similar perceptions do so (Wang et al., 2012). This result is consistent with gender-related attitudes toward risk aversion in route choice behaviors; female commuter cyclists prefer to use routes with maximal separation from motorized traffic. It follows that improved bicycling facilities in the form of bicycle paths and lanes that provide a high degree of separation from motorized traffic are likely to increase cycling activity among women (Akar et al., 2013).

2.3. Attitudinal factors

Aside from the physical environment and social-demographic factors, research suggests that attitudinal factors are as important in analyzing physical activities such as bicycling (Handy, 2005; Moudon et al., 2005; Fernández-Heredia et al.,