



Not all prospective bicyclists are created equal: The role of attitudes, socio-demographics, and the built environment in bicycle commuting



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ARTICLE INFO

Article history:

Received 13 October 2014

Received in revised form 4 February 2015

Accepted 6 February 2015

Available online 5 March 2015

ABSTRACT

Barriers to bicycling may vary widely depending on individual, attitudinal, and built environment characteristics; barriers may be modest for some (e.g. requiring secure bike parking) or significant for others (e.g. improving regional bicycle-accessibility). This research suggests that for a substantial population of travelers who are interested in bicycling but unwilling to cycle regularly, barriers to increasing commute cycling may be different than for individuals who already commute by bicycle at least occasionally. Treating these two populations as one homogenous group may be inappropriate and reduce the effectiveness of bicycle promotion strategies. This research disaggregates these two prospective commute-cyclist populations and tests how attitudes, socio-demographics, and the built environment impact their commute mode choice. Socio-demographic and attitudinal data are drawn from a survey of "Bike to Work Day" participants in Denver, Colorado while built environment measures – including street network connectivity, street network density, and trip distance – were calculated with GIS. Bicycle commuting decisions within the two groups of prospective cyclists are estimated using binary and ordered logistic regression. Distinct socio-demographic and built environment factors are significant for different groups of prospective cyclists. Significant attitudinal variables are similar across groups; for both populations, convenience and utility of the bicycle relative to other modes is significant, suggesting that these factors outweigh issues regarding safety for the sample population. Findings from this research demonstrate that there are important distinctions between the decision to start commuting by bicycle and the decision to increase the frequency of bicycling to work.

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1. Introduction

Bicycling may be a viable alternative for many commuters, and one that can carry both health and environmental benefits. Unfortunately, efforts to encourage Americans to bicycle to work have met with limited success as bicycling only accounts for 1% of all trips in the US and 0.6% of commute travel (Pucher et al., 2011). Part of the problem may be that bicycle promotion strategies lack a clear target population. Social programs and infrastructure investments tend to treat cyclists as a homogenous group, but this is likely not the case. Appropriate strategies for encouraging bicycling likely vary greatly across different groups; thus, identifying populations that are more prone to travel behavior change may be an important strategy for rapidly and effectively impacting commute mode choice.

Barriers to bicycling can vary depending on individual, attitudinal, and built environment characteristics; barriers may be modest for some (e.g. requiring secure bike parking) or significant for others (e.g. improving regional bicycle-accessibility). In recent years, the Portland-based typology of "four types of transportation cyclists" has gained popularity as a tool for understanding different groups of cyclists (Dill and McNeil, 2013). Cyclists are grouped based on needs and concerns (rather than socio-demographics or other more traditional categorization strategies). Analysis of these typologies suggests that there is a substantial population of travelers who are *at least* interested in bicycling, but concerned and therefore unwilling to cycle regularly. This population may include individuals who are unable or unwilling to cycle to work for various reasons. At a minimum, they are able to ride a bike and have likely ridden in the past (possibly as a child). Such individuals may ride today in their neighborhood or on recreational trails but do not commute by bike. This group of prospective cyclists represents an opportunity for dramatically increasing bicycle commute mode share.

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Annually, promotional activities such as “Commuter Challenges” and “Bike to Work Day” events are held in many US cities and draw out large populations of bicycle commuters. Attendance at these events, and corresponding bicycle counts, reveal dramatically higher numbers of cyclists riding on event days than on other days (Nordback, 2014). Research indicates that significant numbers of those who attend such events only bicycle to work on that day (Piatkowski et al., 2014) despite the fact that this population is physically able to ride a bicycle, owns a bicycle, and has tried bicycle commuting at least once. Why does this significant population of bicyclists refrain from commuting by bicycle more often? This research examines individual, attitudinal, and built environment factors that may impact the commute behavior of these prospective cyclists. We then compare this group to those who already cycle more regularly. It is hypothesized that barriers to bicycling differ for those who already bicycle-commute to some degree from those who can bicycle to work, have tried it in the past, but still choose not to. This study addresses the following research questions:

- How can practitioners spur bicycle commuting among individuals who can bicycle but do not on a regular basis?
- How does spurring *some level* of commuter-cycling among a “could bike commute but choose not to” population differ from *increasing* commuter-cycling among those who ride to work on at least an occasional basis?
- Are different promotional strategies necessary for different groups of prospective bicyclists?

To answer these questions, we test the impact of individual socio-demographic factors, attitudes and perceptions, and the built environment on bicycling behavior. Individual and attitude/perception measures are drawn from 2012 and 2013 surveys of “Bike to Work Day” (BTWD) participants in Denver, Colorado. Built environment variables are computed using a geographic information system (GIS). The influence of these variables on commute-cycling is then estimated using binary and ordered logistic regression.

2. Literature review

Commute travel, and by extension bicycle commuting, is a form of non-discretionary travel and thus is likely impacted by different factors than those impacting the decision to bicycle for recreation (Heinen et al., 2010). Available literature not only suggests that individual socio-demographic factors, the built environment, and attitudes and perceptions each impact the decision to commute by bicycle, but also that the influence of these diverse factors varies based on the amount of bicycle commuting an individual typically engages in (Heinen et al., 2010, 2011; Schwanen and Mokhtarian, 2005b; Tin Tin et al., 2010). In this section, we review the pertinent literature regarding the impact of individual, environmental, and attitudinal factors. We also review findings regarding how these factors vary based on existing travel behavior.

2.1. Socio-demographic characteristics

Socio-demographic factors – including age, race, gender, education, income, and car-ownership – are frequently examined in studies of bicycle commuting. Generally speaking, gender is significantly associated with bicycle commuting: men are typically more likely to bicycle (and with greater frequency) than women (Heinen et al., 2010). Socio-demographic variables – particularly income and education – are often significant correlates of bicycle

commuting, but consensus regarding direction and effect size is lacking (Handy and Xing, 2011). As such, we include these variables in our statistical analysis.

2.2. The built environment

The relationship between built environment characteristics, infrastructure, and commute cycling is complex. Specific infrastructure or facility improvements are often associated with increased bicycle commuting (Buehler, 2012). The presence of bicycle facilities (such as bike paths and lanes) is frequently associated with increased bicycle commuting (see: Heinen et al., 2010; Handy and Xing, 2011 for reviews of existing research in this area); however, this is not always the case (Moudon et al., 2005). One variable, distance, is consistently found to be significant in the decision to bicycle (Saelens et al., 2003; Heinen et al., 2010), with shorter distances associated with increasing commuter cycling. With the exception of trip distance, there is limited consensus on the role of specific infrastructure, and it may be more constructive to examine the built environment using alternative metrics.

Beyond the presence or absence of bicycle specific infrastructure, the literature has identified more fundamental aspects of the built environment such as street network characteristics and connectivity. Density and accessibility have been associated with bicycling in general (Krizek et al., 2009; Saelens et al., 2003), and these variables are commonly associated with dense and connected street networks (Ewing and Cervero, 2010). Communities with higher street connectivity and network density may be more bicycle-friendly and reduce trip distance (Southworth, 2005). Increased street connectivity and density are also associated with increased bicycling (Marshall and Garrick, 2010) and positive health outcomes (Marshall et al., 2014). What is unclear is the extent to which this relationship extends to bicycle commuting in particular. We address this gap in the literature by including street network density and connectivity in our analysis of bicycle commute behavior.

2.3. Attitudes and perceptions

Attitudes and perceptions have long been recognized as significant factors impacting the decision to commute by bicycle, particularly in the United States (Dill, 2003; Pucher and Komanoff, 1999). Attitudes and perceptions may, in certain instances, be more strongly associated with the decision to bicycle than built environment factors (Schwanen and Mokhtarian, 2005a). Consensus from the literature is that positive attitudes are significantly associated with increased bicycle commuting (Heinen et al., 2010). Despite a lack of consistency in attitude constructs or measurement, convenience (Sener et al., 2013) and perceived safety and infrastructure quality (Winters et al., 2011; Sanders, 2013) have all been shown to be associated with the decision to commute by bicycle (Fernández-Heredia et al., 2014).

Equally as important as understanding the significance of attitudes in travel behavior is understanding how attitudes vary across different populations (Hunecke et al., 2008). Cyclists in general, and transportation cyclists in particular, are often better understood through shared attitudes and perceptions rather than neighborhood of residence or socio-demographic characteristics. The inclusion of attitudes tends to greatly increase the explanatory power of statistical models (Heinen et al., 2010). The literature has identified “types” of bicyclists – and the attitudes and behaviors associated with these types (Dill and McNeil, 2013) – but such research has not operationalized the distinction between *increasing* cycling and *beginning* to bicycle regularly. Understanding the extent to which these decisions are informed by a diversity of

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