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Non-motorized transport and university populations: an analysis of connectivity and network perceptions

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ABSTRACT

This research examines local bicycle and pedestrian networks in the vicinity of the University of Alabama campus to assess the utility of these networks for travel to the university by students and employees. Network connectivity is examined using Geographic Information Systems (GIS) and the results compared to a survey of 3731 university students and employees. Results indicate that areas within one mile of the University of Alabama's campus have the highest levels of bicycle and pedestrian network connectivity and accessibility. The survey results show that an individual's positive perception of the bicycle and pedestrian networks is related to their travel behavior, and that this knowledge decreases within an increase in commute distance to campus. Increases in connectivity can be expected to lead to an increase in non-motorized travel, but it is also clear that lack of knowledge of driving and cycling laws is a deterrent to many.

1. Introduction

In recent decades there has been an increasing amount of interest in non-recreational bicycle and pedestrian travel within U.S. cities. Non-motorized travel is seen as an inexpensive, efficient, and healthy mode of travel for covering short distances when compared to automobiles. Yet these remain a small part of urban travel, making up about 3.5% of all commuting trips within the U.S., and are limited by a number of factors including the lack of adequate infrastructure.

Within American cities, university campuses can be expected to be among the more likely places for non-motorized travel to occur. When compared to the U.S. population, college and university populations have displayed higher rates of bicycle and pedestrian use (Whalen et al., 2013; Delmelle and Delmelle, 2012; Bonham and Koth, 2010; Shannon et al., 2006; Plaut, 2005; Pucher et al., 1999; Tolley, 1996). There are a number of explanations for these trends. Demographically, university populations tend to live closer to their main travel destination (the college campus) and have greater access to a non-motorized transportation network. They also tend to be younger in age, rent their residence, and are less likely to own cars. Many colleges and universities across the country have also turned to the promotion of more sustainable modes of transportation such as bicycle and pedestrian travel as a means to help address many of today's challenging issues (Balsas, 2003). Universities would appear to provide ideal conditions for non-motorized travel. Yet college campuses often remain automobile focused, as does the travel behavior of students, staff, and faculty.

An example of these factors affecting the use bicycle and pedestrian transportation can be found in the Tuscaloosa, Alabama, area (Fig. 1). The University of Alabama (UA) has a student enrollment of 31,747 in 2013 and is also currently the largest employer in the Tuscaloosa metropolitan area with 5712 employees. Despite being a growing college-centered town, census data shows that non-automobile transportation remains underutilized in the area (AASHTO, 2010). The UA campus provides some facilities for bicycle and pedestrian travel as well as a bus transit system. However, areas outside of campus lack adequate infrastructure and facilities to safely support non-motorized transportation even though the majority of the area surrounding UA is zoned residential (Fig. 2). In May 2010, the city of Tuscaloosa failed to achieve recognition from the League of American Bicyclists as a bike-friendly community due to the lack of bicycle-friendly infrastructure, bicycle related programs, and future planning geared towards bicycle transportation (League of American Bicyclists, 2010).

This research seeks to explore the utility of the bicycle and pedestrian networks for travel to the UA by students and employees by analyzing network connectivity through Geographic

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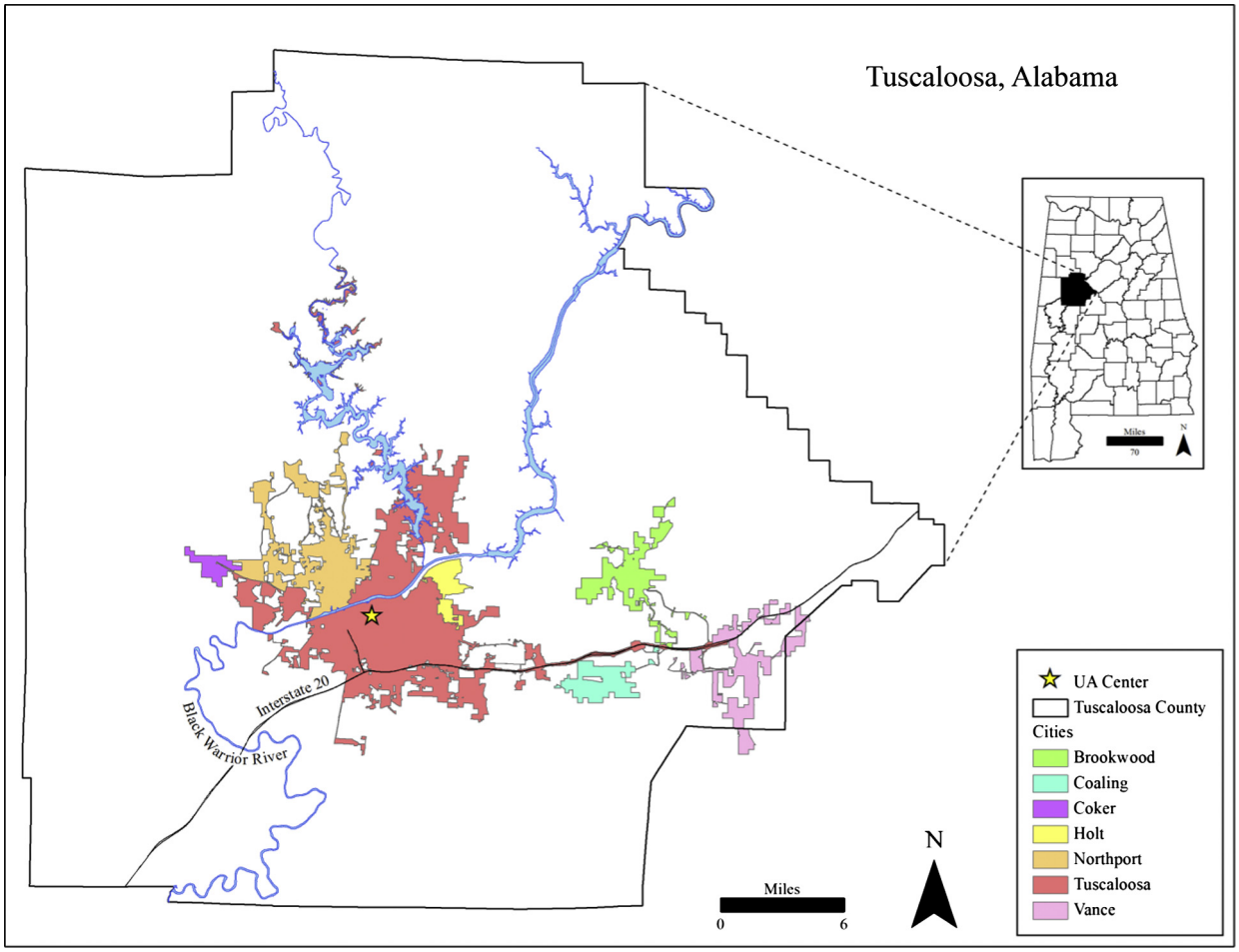

Fig. 1. Location of Tuscaloosa and University of Alabama campus.

Information Systems (GIS) and comparing the results with a survey of 3731 university students and employees. Two questions are addressed: what is the connectivity and utility of the non-motorized network for travel to the UA campus; and are connectivity and availability of the non-motorized networks important explanations for the commuting behavior of UA students and staff?

2. Literature review

Considerable attention has been given to explaining and predicting non-motorized travel behavior. These efforts have often focused on the key role of infrastructure. Higher amounts of bicycle-friendly infrastructure, such as bicycle lanes, paths, bicycle boulevards, or off-street trails, have the potential to increase the likelihood of bicycling (Dill, 2009; Krizek and Johnson, 2006; Moudon et al., 2005; Stinson and Bhat, 2003). Other factors associated with the built environment that have been shown to affect rates of bicycle travel include distance from automobile traffic, buffers or barriers from automobile traffic, volume of automobile traffic, grade, presence of parallel parking, pavement type, width of road way, and one-way streets (Krizek and Roland, 2005; Allen-Munley et al., 2004; Stinson and Bhat, 2003). Less traffic and greater separation from automobile traffic are important explanations for higher bicycle use.

For pedestrians, not only does the mere presence of sidewalks and trails encourage foot travel, but studies have found that the width and condition of sidewalks, proximity to automobile traffic, speed and volume of automobile traffic, buffers or barriers from vehicle traffic, land-use, and connectivity are correlated with higher amounts of use (Koh and Wong, 2013; Guo, 2009; Zahran et al., 2008; Landis et al., 2001). Sspecifically designated bicycle and pedestrian facilities are perhaps the most effective ways of increasing non-motorized travel, and promote higher perceptions of safety in addition to encouraging new and infrequent users (Larsen and El-Geneidy, 2011; Xing et al., 2010). This infrastructure can come in the form of bicycle racks, signage, separate routes, pathways, sidewalks, lanes, boulevards, trails, and bridges.

Considerable research has examined the role of the neighborhood age in the presence or absence of infrastructure such as sidewalks and their consequent effect on behavior. Berrigan and Troiano (2002) found that individuals living in neighborhoods with homes built before 1973 were significantly more likely to walk at least a mile 20 times a month because these neighborhoods are more likely to have a high concentration of pedestrian infrastructure such as sidewalks. Over the years, changes in land-use, local zoning ordinances, financial pressure, and urban sprawl have decreased the amount of pedestrian facilities in newer neighborhoods. A growing body of research has examined connections between the built environment and obesity (Feng et al., 2010; Frank et al., 2004), suggesting that urban environments may be 'obesogenic' if walking and cycling are not feasible. The role of limited network connectivity in reducing possibilities for exercise is unclear but has some support in research findings (Feng et al., 2010).

A critical factor for any non-motorized travel is the level of connectivity in a network, as bike lanes or sidewalks that lead