



The potential for e-biking among the younger population: A study of Dutch students



Paul A. Plazier*, Gerd Weitkamp, Agnes E. van den Berg

Department of Cultural Geography, Faculty of Spatial Sciences, University of Groningen, Landleven 1, 9747 AD Groningen, The Netherlands

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ABSTRACT

This study assessed the benefits and limitations of e-bike use for students participating in a pilot in a university town in the Netherlands. It targets a gap in the literature regarding e-bike use in early adulthood. Thirty-seven pilot participants completed a survey on their e-bike experiences, and follow-up in-depth interviews were held with eight participants. Results suggest there is a considerable potential for e-bike use among students. Participants valued e-bike speed, ease of use, the enjoyable experience of assisted cycling and independency from public transport schedules. Main impediments were the high costs of e-bikes, which have to compete with low-cost regular bikes and free public transportation. The study was based on a small, non-representative sample. Self-selection of participants and self-report of travel behaviors may have affected the internal and external validity of the results. Yet, the study offers first insights in the potential for e-bike use among younger populations. The positive attitudes of students suggest increased acceptance of e-bikes for everyday use, and likelihood of use in later life. Insights may guide future development of sustainable transport systems in university environments specifically and society in general. Results reveal a high potential for e-bikes to substitute public transportation use, but the high purchasing price makes it difficult for the e-bike to compete with other transport modes.

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1. Introduction

Electrically-assisted cycling, or e-biking, is growing in popularity in many countries across the world (Fishman and Cherry, 2015). E-bikes combine propulsion by user pedaling with assistance through a computer-guided electric motor. They permit cycling at constant and augmented speeds against reduced physical effort, and enable cyclists to cover longer distances in shorter amounts of time. Together with high energy efficiency compared to conventional motorized transportation, this makes them potentially effective in reducing traffic congestion, associated environmental problems, and increasing users' physical activity levels. Thus, e-bikes can be considered a viable alternative to conventional motorized transport on distances too long to cover by regular bike (Fyhri and Fearnley, 2015).

Case studies in Europe, North America and Australia have suggested that e-bike use is especially high among middle-aged and older adults (Fishman and Cherry, 2015). Little is known about its potential among younger populations. Yet, stimulation of e-bike adoption in early adulthood may help to reduce demands on

public transportation systems and can possibly substitute younger adults' use of conventional motorized transportation now and in later life.

The present study aimed to gain insight in the potential benefits and limitations of e-bike use for young adults by evaluating an e-bike pilot among university students. These insights may be used to develop indicators of future e-bike use in this population and prospective developments in e-bike mobility in general. Before presenting the method and results of the study, we first discuss university students' travel behavior, determinants of behavior change, and we briefly review the current knowledge on e-bike mobility.

1.1. Student travel behavior

There is a general lack of understanding regarding university student travel behavior. Many travel behavior studies are not inclusive of the unique travel patterns of students that are closely tied to university land use, class schedules, recreation and work (Eom et al., 2009). Yet, as pointed out by Balsas (2003), the distinctive character of university student environments offers unique opportunities for communicating sustainability practices and shaping future transportation patterns. As such, positive experi-

* Corresponding author.

E-mail address: p.a.plazier@rug.nl (P.A. Plazier).

ences with sustainable modes of transport during university years can potentially play an important role in encouraging sustainable travel behaviors (Zhou, 2012).

The majority of student travel behavior studies to date have focused on U.S. university campus environments. Eom et al. (2009) found that walking was a prime mode for students living on-campus at the North Carolina State University, while driving was the prime mode for off-campus residents. Walking or driving to the university may also be dependent on commuting distance. For example, a study by Chen (2012) stressed differences between college-town and urban universities, with the latter having higher rates of motorized (public) transport use among students due to longer commuting distances. Other possible factors of influence on student travel behavior are climate and weather. A study at the University of California Los Angeles demonstrated generally high rates of cycling, walking and public transport use, which potentially relate to the favorable climate (Zhou, 2012). Indeed, a study at the University of Idaho showed important fluctuations in mode use due to seasonal variations (Delmelle and Delmelle, 2012). Another study at Kent State University in Ohio showed low walking and cycling shares throughout the year (Kaplan, 2015), although it was pointed out that weather was but one factor alongside time pressure, busy streets, safety concerns and supportive infrastructures for walking and cycling. In sum, important factors in modal travel choice of U.S. students seem to be distance, weather conditions and the presence of walking and cycling-friendly environments.

Despite the barriers, U.S. cycling rates appear to be generally higher among students than in the general population (Pucher et al., 1999). The same seems to apply to the western European context. High rates of cycling in cities such as Groningen, Enschede (the Netherlands), Münster, Freiburg (Germany), Ghent (Belgium) and Odense (Denmark) correlate with the presence of large student populations (see Fietsberaad, 2006). A possible explanation is the low barrier of entry in terms of cost, and the potential to save money when cycling to the university instead of using other modes (Shannon et al., 2006, p. 247). In some countries, student populations are also eligible to free or discounted public transport use (De Witte et al., 2006). This is, for example, the case in the Netherlands, where high use of congested urban public transport by students has provided an impetus for attempts at modal shifts from train and bus to cycling and other forms of active commuting. In this context, the general need to decrease reliance on conventional motorized transport makes e-bikes a potentially interesting form of active travel to complement shares of walking and regular cycling in the Netherlands.

1.2. Determinants of travel behavior

Research on people's willingness to switch to environmentally friendly modes of transport has revealed that travel behavior, like most daily behaviors, ensues from automatic processes or habits (Müggenburg et al., 2015). Such habits permit to avoid continuously thinking about what we do, and therefore more efficiently allocate cognitive capacity to other tasks (Klößner and Verplanken, 2013). In particular the daily routine of commuting has been found to be strongly determined by habitual processes. This firmly embedded routine typically overrides conscious decision-making behavior (Guell et al., 2012). However, infrequent or major life events can tilt routines and offer opportunities for shifting commuting habits. These key events can interrupt habits and start a re-evaluation of mobility behavior through active decision-making strategies (Müggenburg et al., 2015). Previous

studies have stressed the importance of experiencing e-bikes firsthand. The opportunity to try an e-bike for an extended period of time can potentially start the process of re-evaluating habits (Popovich et al., 2014; Fietsberaad, 2013).

To students, the disruptive effect of trying an e-bike on commuting habits will depend on the extent to which it suits their particular lifestyle. Also, it will have to offer distinct qualities compared to other transport modes. Aspects for consideration are mode safety, reliability, speed, ease of use, comfort and an enjoyable experience (Van Hagen, 2011). We briefly discuss previous research on the qualities and impacts of e-bikes in the next section.

1.3. Research on e-bike mobility

Much of the existing research on e-bike mobility has been conducted in China (Ji et al., 2012). The high rates of Chinese adoption of scooter-style e-bikes, followed by a surge in e-bike rider injuries and fatalities, led to an abundance of studies on e-bike safety (Bai et al., 2015). Transferability of these insights to other contexts is limited, as in Europe and North America bicycle-style e-bikes are more common (Dill and Rose, 2012). Nonetheless, safety remains an important issue. This is due in part to the popularity among older adults (Fietsberaad, 2013). First evidence shows that in particular older and physically impaired e-bike crash victims are more likely to be hospitalized than victims of accidents with regular bikes (Schepers et al., 2014). Generally speaking, e-bikes seem to present slightly greater risks than regular bikes, which may be largely due to their higher speed (Schepers et al., 2014; Vlakveld et al., 2015).

Yet, speed seems to be the most distinctive characteristic of e-bikes and a major contributor to positive user experiences (Popovich et al., 2014). It has also been suggested that e-bikes' elevated speeds facilitate competition with local public transport and rush-hour driving (Fyhri and Fearnley, 2015). Related to speed is the reduced physical effort due to pedal assistance, which permits bridging longer distances and more complicated journeys. Jones et al. (2016) found that this is an important motivation for using e-bikes. Also, pedal assistance could allow parents to more easily transport small children. However, e-bike batteries, which give e-bikes their initial advantage, also restrict ease of use by adding to the weight and thus limiting cycling range and levels of assistance (Rose, 2012). Furthermore, battery visibility might in some cases add to the social stigma of assisted cycling being 'cheating' (Jones et al., 2016).

Finally, an important issue in e-bike mobility research is health. Assisted cycling requires lower levels of physical activity compared to conventional cycling. This is, among other things, reflected in lower cardiovascular and metabolic effort and less respiratory exchange (Sperlich et al., 2012). Other studies have demonstrated lower cycling intensities for assisted versus non-assisted cycling (Simons et al., 2009; Gojanovic et al., 2011). Nonetheless, while beneficial effects are clearly highest when substituting motorized travel, these studies conclude that assisted cycling offers sufficient physical activity to comply with moderate-intensity standards and thus promote good general health (Sperlich et al., 2012; Simons et al., 2009; Gojanovic et al., 2011).

In the remainder of this article, we present the details of a study on e-bike use among university students in the town of Groningen, the Netherlands. The study was conducted as part of a pilot initiated to explore the potential of the e-bike for reducing extensive use of public transport by students. We used this unique opportunity to examine students' personal experiences with e-bikes, which have thus far received little attention in the literature.

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