Journal of Transport & Health 1 (2014) 232–242

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Spatial and social variations in cycling patterns in a mature cycling country exploring differences and trends

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ARTICLE INFO

Available online 18 October 2014

Keywords:
Cycling
Social differentiation
Spatial differentiation
Social trends
Spatial trends
Cycling policy

ABSTRACT

Despite the Netherlands' position as a premier cycling country (mainly due to its high cycling mode share), there is scarce insight into the variations of bicycle use between different spatial and social contexts as well as changes and trends over time. This gap severely limits the understanding of the context-specific aspects of cycling trends and hinders the development of effective policies to promote cycling. In order to fill this gap, this paper explores the spatial and social differentiation of cycling patterns and trends in the Netherlands.

First, an overview of the known spatial and social drivers of mobility behaviour in general, and of cycling behaviour in particular, is provided. Next, these insights are used to structure the analysis of data from the Dutch National Travel Survey (NTS). Mobility diaries allowed us to distinguish trends in mobility behaviour across different spatial contexts and social groups.

Our findings revealed three important spatial and social differences in cycling patterns and trends. First, the spatial redistribution of the population towards urban areas ('re-urbanisation') has led to increasing aggregated cycling volumes in urban areas, and falling rates in rural areas. Second, the general mode share of cycling is mainly sensitive to changes in the composition of the population, especially elderly persons (higher rates) and immigrants (lower rates). Third, although per capita changes are minor, cycling shares among young adults living in urban areas and elderly baby boomers are growing.

The results emphasizes the need for a differentiated approach to promoting cycling and developing policies that can respond to location- and group-specific threats and opportunities. An awareness of these spatial- and social differences is especially important when cycling is used as policy intervention for public health; some groups and places are likely to profit, while others might remain immune. Additional research is needed to further clarify the drivers behind the observed trends and to fine-tune the intervention strategies.

1. Introduction

Bicycle use in Western countries has been increasing in recent years. Cycling is not only becoming more popular in traditional biking countries like the Netherlands, Denmark and Germany (Pucher and Buehler, 2008, 2012), but also in countries where it is still marginal, such as the USA and Canada (Pucher et al., 2011). At the same time car use seems to be stagnating or even declining in North America and many West-European countries, which recently has generated a lively discussion in the literature on what is being called 'peak car' (Goodwin and Van Dender, 2013). Policymakers are focusing on cycling, because it is often seen as a key and relatively simple element in the solution of complex mobility problems, together with having a positive impact in other policy domains most notably public health (Oja et al., 1998). As Rutter et al. states "Increasing regular physical activity is a key public health goal. One strategy is to change the physical environment to encourage walking and cycling" (Rutter et al., 2013, 89). Although there are concerns about potential negative effects on health due to increased exposure to risk and air pollution, there is evidence that suggests that the benefits greatly outweigh this (De Hartog et al., 2010).

When cycling can be an important intervention to increase public health, and a variety of other domains it is of utmost importance to improve our understanding of how it can be increased. Often, the Netherlands is referred to as the gold standard for bicycle use and bicycle

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http://dx.doi.org/10.1016/j.jth.2014.09.012
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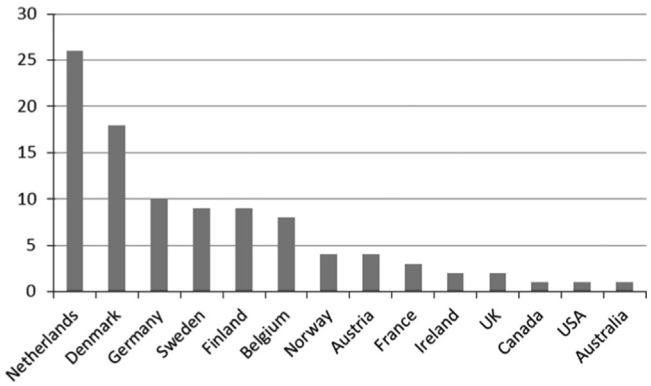

Fig. 1. Share of cycling as percentage of all trips in 14 countries (Pucher and Buehler, 2012).

policies. However, although the modal share for cycling is significantly higher than in other countries (Fig. 1) and the trend in urban areas is still more growth, very little is known about the dynamics that underpin this trend. More knowledge is needed on the spatial and social characteristics of cycling patterns and trends. Who is cycling more and who less? Where is cycling more popular and where less? How do these trends change over time? The answers to these questions can greatly enhance our understanding of the sensitivity of cycling to these different contexts and our capacity to develop policies that take this sensitivity into account (both in the Netherlands and abroad).

This paper explores the spatial and social differences in cycling levels and trends in the Dutch context. First, we discuss recent literature on the drivers behind differences and changes in mobility, with a focus on cycling. In the third section we discuss our methodological choices, after which patterns and trends for the different spatial contexts and social groups in the Netherlands are explored. The paper continues with a discussion of the findings and methodology (Sections 4 and 5), finally closing with a consideration of their implications for policymaking and further research.

2. Recent research on social and spatial differences and changes in cycling

According to Van Acker et al. (2010) travel behaviour is the outcome of spatial, social and individual opportunities and constraints. The first relates to the quantity and quality of infrastructure and the built environment. The second relates to socio-demographic, socio-economic and socio-cultural factors, like gender, age, income and ethnicity. The third includes personal socio-psychological factors like attitudes and perceptions. Based on the available data, in this paper we focus on the first two layers of travel behaviour determinants: spatial and social differences and trends (Fig. 2). First we will review the recent literature contributions regarding spatial and social differences in cycling, second we will look at recent insights on changes and trends in mobility patterns and cycling.

2.1. Spatial and social differences in cycling

Heinen (2011, 23–30) gives an extensive overview of the spatial context variables that influence cycling, with density of the built environment and the diversity of urban functions as particularly important (Pucher and Buehler, 2012, 13; Nielsen et al., 2013; Heinen, 2011, 25). According to most research higher density of built environment and diversity of urban functions correlate with shorter distances to destinations and consequently a higher probability of cycling. Apart from density and diversity, the design of infrastructure and the urban landscape are also frequently mentioned: cyclists prefer separate bicycle lanes over roads with curb lanes or roads without any bicycle facilities (Heinen, 2011, 25) and prefer high levels of connectivity (e.g. an integrated network of cycling lanes; Titze et al., 2008). Stop signs and traffic lights can also cause irritation due to delays and the additional physical effort needed for stopping and accelerating (Fajans and Curry, 2001). Another design-related factor is the attractiveness of the built environment along cycling routes, with some authors suggesting that it has a positive effect on cycling levels (Gatersleben and Uzzell, 2007; Southworth, 2005).

As far as social context variables are concerned, Garrard et al. (2012) and Bonham and Wilson (2012) found that a large part of social variations in cycling behaviour can be traced back to basic demographics, like age and gender. International comparative studies found that as the cycling share increased, the differences in cycling between men and women decreased (Garrard et al., 2012, 215; Bonham and Wilson, 2012, 60). In countries with low overall cycling levels the majority (around 80%) of cyclists are male. In contrast, countries with relatively high cycling levels seem have more equally distributed cycling rates between men and women. The same holds true for age differences: the higher the cycling share in total trips, the smaller the differences between age groups. Overall, in countries with low cycling rates, mostly young adult men are cycling (especially for recreational purposes), whereas in places with high cycling rates children and the elderly are also cycling more, and utilitarian purposes are more important (Garrard et al., 2012; McDonald, 2012). Another demographic variable mentioned in the literature is household composition and activity patterns: According to research findings originating from countries with low cycling levels, having young children reduces the probability of cycling (Heinen, 2011; Ryley, 2006).

Apart from demographic aspects, socio-economic indicators (like income) also influence mobility levels, but as demonstrated by Heinen (2011) their relationship with cycling is unclear. In her analysis, she distils two opposing effects. First, people from higher income brackets can spend more money on a bicycle, which in turn increases cycling rates. This effect seems to be especially true for countries with a low overall cycling share, for example, the Unites States and Canada (Pucher and Buehler, 2008). Second, higher income also translates into higher car ownership rates, which has a strong negative impact on cycling levels. Pucher et al. (2011, 455) found that overall bicycling rates do not vary much with income levels in countries with high cycling levels. However, the motivation to use bicycles is different. Low-income individuals usually cycle for utilitarian reasons, while high-income individuals cycle more often for recreation and exercise. Another socio-economic aspect is education levels. Heinen (2011) finds a negative relationship between education levels and