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# Active transport, public transport and electric car as perceived alternatives in a motorized Norwegian sample

Trond Nordfjærn [a,*], Özlem Simsekoglu [b,c], Torbjørn Rundmo [a,b]

[a] NTNU Samfunnsforskning, Studio Apertura, Dragvoll Allé 38 B, 7491 Trondheim, Norway
[b] Norwegian University of Science and Technology, Department of Psychology, Dragvoll, 7491 Trondheim, Norway
[c] Nord University, Traffic School and Driver Teacher Education, 7505 Stjørdal, Norway

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ABSTRACT

Research regarding perceptions of mode alternatives to a motorized car may yield essential information about the modes that people are likely to use if they reduce their motorized car use. These perceptions are likely to be associated with demographics, spatial factors and psychological variables. The current study aims to investigate the relative role of such factors for perceived transport alternatives to a motorized car in an urban motorized Norwegian sample. The study is based on a survey conducted in a random representative sample of individuals with car access ($n = 878$) residing in the six largest urban areas in Norway. The results reflected that demographics, spatial and psychological factors relate to perceived mode alternatives and their relative role seems to differ according to the mode alternatives in question. Low income, basic education and low annual mileage were related to a high probability of considering public transport as an alternative to motorized car use. Individuals who did not perceive public transport mode use as a sign of low social status and had a weak self-determination to use a motorized car also had higher probability of considering public transport. Priorities of flexibility reduced the likelihood of considering public transport as an alternative to motorized car use. Practical barriers, such as travel distance and weather conditions, were associated with a low probability of considering active transport (i.e. walking and bicycling). Priorities of flexibility were also related to a low probability of considering active transport. Low annual mileage, less self-determination regarding car use and pro-environmental attitudes were associated with flexible considerations of mode alternatives. Mode shift interventions need to take demographic, spatial as well as psychological factors into consideration. The interventions may improve the effectiveness when they are differentiated according to the specific transport modes that they aim to promote.



## 1. Introduction

Motorized car use constitutes a substantial issue and causes traffic congestion, noise and excessive use of land. Motorized cars also contribute to a large proportion (20%) of the total $CO^2$ externalities in the European Union (Commission of the European Communities, 2007). This problem is of particular concern in urban areas, and several Norwegian cities are reporting motorized car-related pollution levels that violate the thresholds established by the European Economic Area (EEA)

* Corresponding author. Fax: +47 73 59 63 30.
*E-mail address:* nordfjar@gmail.com (T. Nordfjærn).

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agreement (Norwegian Broadcasting Corporation, 2013). Therefore, it is imperative for urban quality of life and sustainable urban development that individuals reduce their car use or shift to alternative and more pro-environmental transport, such as walking and bicycling (active transport), public transport or electric car. The current study will investigate the relative role of demographics (e.g. gender, age and income), spatial factors (e.g. travel distance and transport availability) and psychological factors (e.g. environmental attitudes) for perceived transport alternatives in an urban motorized Norwegian public.

Perceived transport alternatives are here defined as the subjective transport choice-set (Punj & Brookes, 2001) that the individuals may put to use in a scenario where they reduce their motorized car use. In order to develop effective mode shift policies, it is important to obtain more knowledge about the modes that car users are likely to seek if they reduced their motorized car use. One could argue that the transport alternatives that are focused in the current study (active transport, public transport and electric car) are all feasible alternatives to a motorized car from an environmental perspective. However, all types of transport put demands on energy and infrastructure resources. As such, none of the modalities are in isolation capable of handling the reduction in car use as this would overload the capacity of, for instance, the public transport system and pavement/bicycle infrastructure. Electric cars also contribute to congestion and require land use in a similar manner as motorized cars. It is therefore of value to examine characteristics amongst those who would shift to the various transport alternatives in order to improve our understanding about how people would act out in a motorized car-reduction scenario.

A previous screening of the transportation research literature (Zhou, 2012) identified six core categories of variables that may influence transportation mode use or choice: (1) physical environment and urban factors, e.g. population density and topography, (2) mode specific factors, e.g. availability, travel time and access of transport, (3) travellers' personal attributes or demographic characteristics, e.g. gender and income, (4) trip characteristics, e.g. trip distance and destination, (5) the presence of transport measures, e.g. parking costs and (6) psychological factors, e.g. attitudes. Zhou (2012) concluded that although research has been conducted within all domains, the studies have been fragmented and tended to overfocus on the first category. Furthermore, research on the six categories have mainly been conducted in isolation, and few studies have incorporated aspects from the different categories and examined them in parallel within one coherent study. Such an approach may reveal information about the relative importance of the different variables for perceived mode alternatives amongst motorized car users. The present study will focus on variables from categories 2, 3, 4 and 6 (mentioned above). These factors will have the main focus because we have tested both the role of physical and urban factors (e.g. Rundmo, Sigurdson, & Cerasi-Roche, 2011) as well as transport measures (e.g. Nordfjærn & Rundmo, 2015, 2016) in the current sample and similar samples in previous work.

In one of the studies that focused on perceived transport alternatives to car use, it was concluded that overestimations of travel time by public transport was related to a reduced probability of considering public transport as a feasible transport alternative (Van Excel & Rietveld, 2009). Zhou (2012) found that commuting distance was associated with carpooling amongst college students. In addition, female gender and being an undergraduate student was related to active transport use, whereas increased age was associated with less use of public transport. Another study showed that car users may be averse to the physical efforts required by walking, and that travel distance may be an important barrier for use of such active transport (Loukopoulos & Gärling, 2005). However, the explanatory power of the model was relatively low, which may suggest that there are additional factors to consider. For instance, in spite of interesting findings in the three studies cited above, none of them had a strong focus on psychological variables, such as attitudes and motivational factors, in the theoretical taxonomy.

The Theory of Planned Behaviour (TPB) is one of the most prominent theories regarding the role of psychological factors for behaviour (see Ajzen, 1991). One of the central assumptions based on the theory is that attitudes towards transport (i.e. favourable or unfavourable evaluations of transport modes) could be expected to be related to mode use and, potentially, perceptions of likely transport alternatives to be used in a car-reduction scenario. Bamberg, Ajzen, and Schmidt (2003) showed that attitude change was one of the most important factors related to change from motorized car to public transport (see also Bamberg & Schmidt, 2003). In addition to attitudes regarding different transportation modes, global attitudes regarding the environment and climate, operationalized through the New Environmental Paradigm (Dunlap, 2008), have been found to be important for pro-environmental behaviour (Poortinga, Steg, & Vlek, 2004; Vining & Ebreo, 1992). Transportation and global environmental attitudes may also relate to perceived transport alternatives to motorized car use.

Further, recent research has shown that motivational factors and how people prioritize different factors in transport (e.g. the relative importance of travel time, safety and security and costs) could influence mode use (e.g. Nordfjærn, Simsekoglu, & Rundmo, 2014) and how different mode alternatives are perceived. Rundmo et al. (2011) showed that individuals who prioritized health and environmental issues were more likely to use public or active transport, whereas individuals who tended to use a motorized car reported stronger priorities of travel flexibility and comfort. A common limitation in these psychological studies, however, was that spatial factors and demographics were not included.

In spite of the inter-disciplinary nature of the transportation research field, the relative role of spatial, demographics and psychological factors for perceptions of motorized car alternatives has mainly been examined in isolated studies. Also, several of the studies have been conducted within rather narrow geographical areas, such as one or two cities within a country (e.g. Bamberg & Schmidt, 2003; Bamberg et al., 2003). Further, some of the studies (e.g. Bamberg & Schmidt, 2003; Zhou, 2012) were conducted in relatively homogenous groups, such as university students, which call into question the generality of the findings. Accordingly, the aim of the current study is to investigate the relative importance of demographic character-