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Psychological, sociodemographic, and infrastructural factors as determinants of ecological impact caused by mobility behavior[1]

Marcel Hunecke[a,*], Sonja Haustein[a], Sylvie Grischkat[b], Susanne Böhler[c]

[a] *Ruhr-Universität Bochum, Faculty of Psychology, Workgroup Environmental and Cognitive Psychology, 44780 Bochum, Germany*
[b] *Leuphana University of Lüneburg, International Research Centre for Environmental and Sustainability Management, Germany*
[c] *Wuppertal Institute for Climate, Environment and Energy, Germany*

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Abstract

In this study, the relevance of psychological variables as predictors of the ecological impact of mobility behavior was investigated in relation to infrastructural and sociodemographic variables. The database consisted of a survey of 1991 inhabitants of three large German cities. In standardized interviews attitudinal factors based on the theory of planned behavior, further mobility-related attitude dimensions, sociodemographic and infrastructural characteristics as well as mobility behavior were measured. Based on the behavior measurement the ecological impact of mobility behavior was individually assessed for all participants of the study. In a regression analysis with ecological impact as dependent variable, sociodemographic and psychological variables were the strongest predictors, whereas infrastructural variables were of minor relevance. This result puts findings of other environmental studies into question which indicate that psychological variables only influence intent-oriented behavior, whereas impact-oriented behavior is mainly determined by sociodemographic and household variables. The design of effective intervention programs to reduce the ecological impact of mobility behavior requires knowledge about the determinants of mobility-related ecological impact, which are primarily the use of private motorized modes and the traveled distances. Separate regression analyses for these two variables provided detailed information about starting points to reduce the ecological impact of mobility behavior.

Keywords: Environmental behavior; Environmental impact; Attitudes; Mobility behavior; Transportation

1. Introduction

One of the biggest global ecological challenges consists in the reduction of the ecological impact of individual mobility behavior. According to the Kyoto Protocol industrialized countries have to reduce their total greenhouse gas emissions by an average of 5.4% below 1990 levels in the first commitment period of 2008–2012 (Lenzen, Dey, & Hamilton, 2003). In Germany, within the last decades emissions of most pollutants caused by transportation could be reduced, whereas emissions of greenhouse gases, respectively, CO_2, from transport increased by about 6.3% between 1990 and 2003 (SRU (German Advisory Council on the Environment), 2005). These tendencies can be found in all western countries (IEA, 2000).

Several strategies have been proposed to implement environmentally sustainable passenger transportation, e.g. an increase of the efficiency of transportation technologies (Lovins & Cramer, 2004), the densification of housing, employment, shopping, and cultural activities (Stead & Marshall, 2001), and regulatory and fiscal measures (ECMT, 2004). In addition, the attractiveness of sustainable mobility has to be increased by soft policy measures such as public awareness campaigns for sustainable mobility and social marketing for public transportation (Brög, Erl, & Mense, 2004). For the design of soft policy interventions it is necessary to know the motivations of the users of different transport modes. Stern (2000) introduced the differentiation between an intent perspective and an

*Corresponding author. Tel.: +49 234 32 23030; fax: +49 234 32 14308.
E-mail address: marcel.hunecke@rub.de (M. Hunecke).

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impact perspective into environmental psychology. The intent perspective analyzes the motivational basis of conservation behavior; the impact perspective determines the ecological consequences of environmental behavior.

In the present study, we take into account both perspectives. From an impact perspective we analyze the relation of psychological variables to greenhouse gas emissions resulting from mobility behavior. In order to avoid an overestimation of psychological variables, sociodemographic and infrastructural variables are included in the analysis. From an intent perspective we analyze the motivational basis of mobility behavior.

1.1. Psychological variables and mobility behavior

In transport science, it is agreed that infrastructural factors have a great impact on mobility behavior because they determine behavioral options. For example, if no public transportation services exist, people have to use the car, in spite of a high motivation to use a bus or train. Mobility behavior, however, is not solely determined by infrastructural constraints. There are two types of personal factors relevant for individual mobility, sociodemographic characteristics and attitudinal factors. Sociodemographic aspects include factors such as age or employment status, which determine individual options and necessities for mobility activities (e.g. Hanson & Schwab, 1995). Attitudinal factors include values, norms, and attitudes, which affect preferences for specific activities, destinations, routes, and means of transport (e.g. Anable, 2005; Anable & Gatersleben, 2005; Bamberg & Schmidt, 2001, 2003; Heath & Gifford, 2002; Hunecke, Blöbaum, Matthies, & Höger, 2001; Steg, 2005; Steg, Vlek, & Slotegraaf, 2001). Consequently, the most important task for mobility research is an integrated analysis of the infrastructural and personal determinants of mobility behavior.

So far, only one interdisciplinary study has tested multivariate regression models for travel mode choice and distances traveled by including psychological, sociodemographic as well as infrastructural variables (Van Wee, Holwerda, & Van Baren, 2002). In this study the psychological influences are operationalized as a preference for a certain transport mode. The results indicate an increase of explanatory power for a model including the preference variable compared to a model that only comprises sociodemographic and infrastructural variables. Furthermore, the analysis shows that the predictive power of preferences is higher for travel mode choice than for traveled distances. One crucial restriction of the Van Wee study is the low reliability of the preference measurement by one item only; here people have to categorize themselves as preferring a certain mode of transportation.

In social and behavioral research, more sophisticated theoretical approaches like the Theory of Planned Behavior (TPB; Ajzen, 1991) have been applied to explain mobility behavior by personal factors rather than by simple preferences for different transport modes. The TPB regards the constructs attitude, subjective norm (SN), perceived behavioral control (PBC), and intention as predictors of behavior. Intention is seen as a summary of all the pros and cons a person takes into account when deliberately reasoning whether a behavior should be performed or not. Intention itself is viewed as causally determined by attitude, SN, and PBC. Attitude toward a behavior is the degree to which the performance of the behavior is positively or negatively valued. SN is defined as the perceived social pressure to engage or not to engage in a behavior. PBC refers to people's perceptions of their ability to perform a behavior. It is assumed to be a direct predictor of both, intention and behavior. The TPB also postulates that sociodemographic and contextual factors, values, and general beliefs affect behavior only indirectly via the four predictors of the TPB.

There are two reasons why the TPB offers an adequate theoretical framework to explain goal-directed mobility behavior: On the one hand, applications of the TPB in the domain of mobility behavior provide strong empirical support for this model (e.g. Bamberg, Hunecke, & Blöbaum, in press; Bamberg & Schmidt, 2001, 2003; Heath & Gifford, 2002). On the other hand, comprising four predictors only, the TPB is a comprehensive and economical model to explain mobility behavior with the limited resources of survey studies.

In mobility research further mobility-related attitudinal factors could be identified that affect mobility behavior and are not measured explicitly by the constructs of the TPB.

Several studies have demonstrated a positive effect of personal norm (PN) on the use of environmentally friendly travel modes (e.g. Harland, Staats, & Wilke, 1999; Hunecke et al., 2001; Nordlund & Garvill, 2003). The TPB only measures the SN, which is defined as the perceived social pressure to engage or not to engage in a behavior and is determined by normative expectations of important referents. In contrast to SN, PN measures the intrinsic moral obligation to behave morally right (Schwartz, 1977). The relevance of moral norms in travel mode choice is relatively well analyzed. A direct effect of PN on travel mode choice could not be shown when controlling for TPB constructs systematically (Bamberg & Schmidt, 2003; Heath & Gifford, 2002). Instead, the relation between PN and behavior is an indirect one, mediated by intention (Bamberg et al., in press).

In addition, the psychological construct perceived mobility necessities (PMN) extends the TPB providing a more differentiated understanding of the use of environmentally friendly transport modes. Haustein and Hunecke (2007) could demonstrate that PMN, defined as people's perceptions of mobility-related consequences of their personal living circumstances, have an independent effect on travel mode choice in the context of TPB. The factor PMN differentiates the measurement of control beliefs, which were previously only measured implicitly by PBC. Regarding travel mode choice, PBC is defined as people's perceptions of their ability to use a certain mode of