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Assessing the impact of long-term mobility choice motivation and short-term mobility means connotation on the use intention of electric cars in rural areas

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ABSTRACT

In this study several hypotheses comprising a heuristic framework derived from rational-choice (RC) premises and regarding some potentially influencing variables on future use intention of different vehicle types are tested with a rural area sample. Especially the differentiation between long-term vs. short-term as well as functional/rational vs. extra-functional/emotional motivators is assessed. Results suggest a predominance of functional motivators and rational connotations over extra-functional/emotional ones. The models to check whether short-term or long-term effects dominate did not clearly confirm a predominance of long-term factors as hypothesized. In several regression models a moderating effect of rational short-term connotations on different long-term motivators was found, thus contributing notably to the prediction of future vehicle use-intention. The need for further research and theory-driven modeling is briefly discussed.

1. Introduction

Electric mobility has become an important objective in the transformation of mobility systems and means in recent years, thus promoting related efforts in research and development both in technical and non-technical fields. While for the United States yet more than 30 years ago studies carried out to assess the market potential of electric vehicles with the technology of that time claimed that up to one third of combustion engine vehicles could be substituted with electric vehicles (Booz, 1980 as well as, though yet less optimistic, Segal, 1995), the actual number of vehicles remained at a very low level for quite some time. Apart from technical research and development aims, when one talks about electric mobility, the assessment of (potential) users' perspectives and acceptance of this new technology is a major scientific challenge as well. This applies even more considering the still very low number of electric car registrations in Germany (total stock in 2013: 6051, cf. KBA, 2014) and other countries (for a discussion on perspectives and limits of electric mobility cf. Klühspies, 2012). To be able to achieve the announced target of 1 million electric vehicles in Germany until 2020 (NPE, 2011), since about 2010 several demonstration and development projects and regions for electric mobility have been initiated. Most of these projects deal with urban mobility, thus making it difficult to transfer the results to rural environments due to significant differences with regard to infrastructure, public transport services provision, mean number of ways and distances traveled, mobility behavior of the population as well as demographic development and social structure. On the other hand, the question is occasionally raised whether especially rural regions may be an important catalyst to bring forward market penetration of electric cars (cf. Mager,

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2014). This argument might be plausible, as e.g. the mean number of ways and distances to be traveled in rural areas in Germany, especially by commuters, are matching current performance parameters of electric cars better, i.e. more congruently, than in urban settings, aside from higher dependencies in the countryside on motorized individual transport means due to usually lower levels of public transport supply. Recent studies (e.g. Plötz et al., 2014) support this assumption and locate major early adopter groups (cf. for an elaboration on the early adopter concept Rogers, 2003) for electric vehicles in rural and suburban settings.

To be able to provide tailored rural mobility services for different target groups, a deeper understanding of the mechanisms affecting people's mobility choice decisions, especially motivating factors/drivers influencing these choices, seems necessary. Theoretical frameworks aimed at connecting attitudes toward action like the Theory of Planned Behavior/TPB (Ajzen, 1991) claim that the intention to act is an important (albeit not the only) predictor of real action. In this theoretical context, motivation should especially be related to control beliefs as a pre-stage of the intention to act. The TPB can be conceived as an interpretation of so called "wide" conceptions of rational choice theory (cf. Finkel, 2008, p. 32). These broader theoretical approaches in the social sciences aim at linking micro-level outcomes (i.e. the results of individual (or individualized) decisions of actors) to macro-level occurrences, hence the aggregation of individual action (for a brief outline in the context of rational choice theory also cf. Hechter and Kanazawa, 1997). It is usually assumed that motivating factors in mobility decisions are more related to long-term than short-term preferences (for a discussion of habitualization and routines in traffic means choice cf. e.g. Canzler, 2008; Verplanken et al., 1994). In this case, the question arises how this motivation is related to mobility-means specific, i.e. more situational or short-term, factors in the actual intention building process for the use of electric vehicles. The interplay between general motives for mobility choice decisions and actual connotations of certain transport means (as an indicator for short-term influences on choice decisions) might significantly affect future use intention and should therefore be elaborated on.

Current efforts in scientific research on electric mobility reveal several insights into customers' expectations regarding the potential of electric cars to reduce CO_2 emissions (Götz et al., 2012), user and business models (Peters and Hoffmann, 2011), user and expert perceptions of necessary means to foster user acceptance of electric cars (Graham-Rowe et al., 2012; Peters and Dütschke, 2010; Politis et al., 2012; Skippon and Garwood, 2011; Türnau, 2014), demands of long-distance commuters using electric vehicles (Ramsbrock, 2013) or applications of electric vehicles in commercial fleets (Dütschke and Globisch, 2013). Many of these studies rely on bivariate correlational measurements of relationships in more or less large datasets comprising up to three data collection waves within different electric mobility projects. Alternatively, qualitatively gathered and analyzed data is often used to explore latent constructs or complex relationships. Despite the undoubted benefit of such analyses, a more concept driven/multivariate approach might help in systematically structuring results, thus amplifying the scope of measures and practical steps in actively framing and governing future mobility toward more sustainability as well as adequateness with regard to different target groups.

The study at hand is intended to address the above mentioned objective by applying a multivariate research approach. The main objective is to elaborate on the effects of mobility motivators as long-term influences and vehicle connotations (after having used an electric vehicle) as short-term influences upon the future use intention of battery electric vehicles (BEVs), plug-in-hybrid electric vehicles (PHEVs)[1] and (conventional) combustion vehicles (CVs).[2] These influencing factors can conceptually be further differentiated into the two broad motive groups "functional motives" and "extra-functional motives" and connotations into "rational connotations" and "emotional connotations" respectively. Whether differentiating makes sense in this study had to be checked empirically. Results should help in gaining a deeper understanding of those factors that promise a greater chance to foster market penetration of electric vehicles (EVs[3]) compared to combustion engine/conventional vehicles (CVs). The limitation of analysis in the presented study to certain concepts does not imply that these concepts are or have to be the most important ones exerting influence; they are just plausible ones derived from a rational choice (RC)-framework that can help in further developing the understanding of mobility choice decisions in rural areas.

An important difference of this study to comparable ones is the clear focus on the use of EVs in rural areas. In fact, only people having used an EV mainly in rural areas are included in the sample.

The study aims at providing answers to the following research questions and hypotheses:

1. Assuming that motives can be parted comparably to preceding studies (e.g. (Schuitema et al., 2013; Steg, 2004), what is the relative influence of functional vs. extra-functional mobility motivators upon the intention to use EVs in the future? The hypothesis (H1) here is, accordingly to preceding qualitative analyses (Türnau, 2014), that the influence of functional motives is stronger than the influence of extra-functional motives.
2. Assuming that connotations can be parted comparably to motives, what is the relative influence of rational vs. emotional connotations upon the intention to use EVs in the future? The hypothesis (H2) here is that the influence of rational connotations is stronger than that of emotional connotations if H1 is confirmed.

[1] PHEVs are sometimes seen as an interim solution in the transformation of mobility systems toward more sustainability. They usually provide a certain (short) battery range that can be increased by a combustion power generator ("range extender") producing electric energy.

[2] PHEVs and CVs are included in the analysis mainly to validate the measurement of BEV use intention.

[3] EV ("Electric Vehicles") refers to both BEVs and PHEVs.