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# Why early adopters engage in interpersonal diffusion of technological innovations: An empirical study on electric bicycles and electric scooters

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ABSTRACT

Early adopters promoting electric vehicles in their social network may speed up market uptake of this technology. Apart from their opinion leader status, few previous research details the motivations which turn early adopters into advocates for innovation who approach the non-adopters among their family and friends, or casual acquaintances.

Drawing on a survey among 1398 e-bike and 133 e-scooter early adopters in Austria, personal drivers of engagement in interpersonal diffusion are investigated. Longitudinal data one year later for 157 e-bike users allows tests of causal relations. A complementary sample of 33 network peers illustrates the early adopters' social impact.

Early adopters engage actively in discussing product features, instigating trial behavior and recommending purchase. Analyses by structural equation modeling show that efforts at interpersonal diffusion are driven by opinion leadership, experienced product performance, and perceived normative expectations of others toward pro-environmental technologies. Mediator and moderator analyses underline that opinion leadership is conveyed upon early adopters because personal norms and technophilia qualify them as credible and competent for the specific topic of e-vehicles. Social norm interrelations point to dynamic interactions and discourse between early adopters and their addressees. Evidence from the peer sample suggests though that the persuasive impact of early adopters is small.

To accelerate market entry of electric vehicles, public or private agencies should foremost approach early adopters scoring high in the identified drivers, and empower them in their role as multiplicators by providing pre-prepared product information and encouraging them to continuously address peers.



## 1. Introduction

Electric mobility seems a promising option to reform the transport system in Austria and other western industrialized countries. If powered by substantially less carbon-intensive fuel, electric vehicles could cover most short-range trips which amount to the bulk of travel performance, thus reducing local emissions. While electric cars and electric scooters may replace their conventional, fossil-powered counterparts, electric bicycles could complement mechanical bicycles. Electric

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bicycles could allow more people to cycle at all (e.g., the elderly, physically impaired or less fit), or to cycle over longer distances, more often, and in hilly terrain (Ahrens et al., 2013).

European and Austrian policy initiatives call for a fast market entrance of electric vehicles (European Commission, 2011a,b; BMLFUW, BMVIT & BMWFJ, 2012). However, market uptake of full electric cars has been remarkably slow in Austria: By 2013, 0.2% of newly registered cars in Austria featured purely electric propulsion (Statistics Austria, 2014). Sales of electric bicycles and electric scooters were more successful in absolute numbers, amounting to approx. 45,000 e-bicycles in 2012, but their relative market share is also small compared to conventional bicycles and scooters (VCÖ, 2013). The slow market entrance of e-vehicles is attributed to high initial costs and uncertainty on the maturity of the technology, especially regarding battery capacity and durability (Egbue and Long, 2012; Carley et al., 2013; Franke and Krems, 2013).

In response to this slow market adoption, several public bodies in Austria provided subsidies to private households for the acquisition of an e-car, e-scooter or e-bike. The main objective of these subsidies was to facilitate market entry by reducing purchase costs. Beyond the small circle of direct recipients, the subsidies also targeted mainstream consumers by increasing public visibility of e-vehicles and by initiating social discourse on its advantages and disadvantages. If the subsidized early adopters promoted the innovation in their social network, the effect of the subsidy may multiply, ideally sparking a wave of adoption that spreads throughout the Austrian population, evolving a former niche market to rapid market penetration (Rogers, 2003; Meade and Islam, 2006).

The diffusion of consumer products is inherently a social process, with product information and normative expectations moving through interpersonal networks (Dattée and Birdseye Weil, 2007). Facing uncertainty about an innovation, a prospective buyer turns to experienced adopters for first-hand advice and guidance. In this process, early adopters may play a pivotal role as multiplicators and persuasive agents (Shoham and Ruvio, 2008).

However, surprisingly few studies investigated what makes these early adopters pro-actively approach the non-adopters among their family and friends, and motivates them to talk even to casual acquaintances and passersby they meet in the street. Apart from their status as opinion leaders and network hubs, we know little about the intrinsic motivations and perceptions from their peers which turn early adopters into advocates for innovation (Axsen and Kurani, 2012). The actual process how opinion leaders spread their influence over communities is widely unspecified (Wejnert, 2002; Watts and Dodds, 2007).

The present paper thus explores personal drivers why early adopters engage in interpersonal diffusion, relying on a longitudinal sample of Austrian early adopters who received a subsidy for their electric vehicle. Complementary to the early adopters' self-reports, a small sample of network peers illustrates whether the early adopters indeed exert social influence.

The paper focuses on e-bikes, because most subsidies in Austria were requested for this technology, and replicates the insights with a smaller sample of e-scooter users. Due to the negligible market share of full electric cars, the survey yielded too few e-car respondents for conclusive analyses. While most previous studies investigate e-cars, this paper extends e-mobility research to the less-considered e-bike and e-scooter technologies. Compared to e-cars, e-bikes and e-scooters are cheaper in initial investment and operating costs, and promise a more mature and more reliable technology. Furthermore, they may more easily substitute or complement their conventional counterparts, because the shorter distances of bicycle or scooter trips suffer less from battery range impediments (Ahrens et al., 2013). However, since all e-vehicles share the same underlying technology, the present paper builds its theoretical background on e-car studies, too.

The diffusion of innovations among private individuals is a core topic in social network analysis (e.g., Watts and Dodds, 2007) and agent-based modeling (e.g., Eppstein et al., 2011). The present paper refers to theoretical concepts from these fields, but models neither the network interactions between distinct agents nor the interplay of individual appraisal and social influence in purchase decisions. Instead, the present study looks at the drivers which make some adopters take an ambassadorial role promoting an innovation among their peers – shifting the perspective from the diffusion targets to the hitherto underrepresented diffusion sources. Thereby, the present study aims to complement the vast body of literature on the emergence of diffusion patterns in social networks (Macy and Willer, 2002).

In the remainder of the paper, Section 2 characterizes interpersonal diffusion and reviews the characteristics of early adopters who drive this process. Section 3 summarizes the research questions, highlighting the unclear role of opinion leadership in interpersonal diffusion. Section 4 describes data, measures and the analytical approach employing structural equation modeling. The results Section 5 shows that efforts in interpersonal diffusion strongly depend on opinion leadership and product performance, and elaborates the feedback dynamics between the early adopter and the normative expectations and actions of others. Section 6 discusses implications for policy and future research, as well as limitations of empirical research on interpersonal diffusion.

## 2. State of research

### 2.1. Interpersonal diffusion

Interpersonal diffusion of innovations refers to the spread of a product among a network of private consumers by word of mouth. Interpersonal diffusion is basically pictured as a unidirectional contagion process, like the proliferation of an epidemic disease (Rogers, 2003; Watts and Dodds, 2007): A person is more likely to get sick if many people around her already