Too Much of a Good Thing? An Experimental Investigation of the Impact of Digital Technology-enabled Business Models on Individual Stress and Future Adoption of Sustainable Services

Completed Research Paper

Ilja Nastjuk
University of Goettingen
Chair of Information Management
Humboldtallee 3
37073 Goettingen, Germany
inastju@uni-goettingen.de

Andre Hanelt
University of Goettingen
Chair of Information Management
Humboldtallee 3
37073 Goettingen, Germany
ahanelt@uni-goettingen.de

Lutz Maria Kolbe
University of Goettingen
Chair of Information Management
Platz der Goettinger Sieben 5
37073 Goettingen, Germany
lkolbe@uni-goettingen.de

Abstract

The pervasive diffusion of digital technologies affords the development of innovative and sustainable business models. With increased connectivity, options arise for enabling sharing-based services with pay-per-use pricing. Besides the merits that these services gather, e.g., concerning sustainability, flexibility and economics, less is known about the potential adverse impacts on individuals. Thus, we employed an experimental research design to examine how digital technology-enabled business models affect individual stress and perception concerning the future usage of these services. Specifically, we investigated the context of car sharing, a service that has recently been advanced by the use of digital technologies and received increasing adoption rates. The empirical results indicate that digital technology-enabled business model designs significantly influence psychological stress in an unfavorable manner, and hence, negatively affect the willingness to use car sharing. Thus, our investigation points to the importance of accounting for potential dysfunctional societal effects of information systems in sustainability transformation.

Keywords: Stress, Business Model, Sustainability, Digital Technologies, Car Sharing

Introduction

Pervasive connectivity has widened the solution space for business model innovation in various areas (Bharadwaj et al. 2013). Emerging digital infrastructures (Tilson et al. 2010) provide the backbone for new services that cater to individuals' personal lives (Yoo 2010). Moreover, these innovative services bear the potential to reduce the negative environmental impacts of conventional alternatives by enabling a better utilization or shared use of resources (Teubner and Flath 2015; Wagner et al. 2014). Recent research has shown that through the use of digital technologies (Bharadwaj et al. 2013), the attractiveness of these sustainable business models can be increased (e.g., Hildebrandt et al. 2015). For instance, an alternative mobility service known as *car sharing* can be leveraged, e.g., through increased reliability and flexibility for users stemming from the advanced connectivity (Hildebrandt et al. 2015). Moreover, with the resulting constant availability of information, actual usage behavior can be tracked and priced, providing much more transparency and optimization potential to providers (Wagner et al. 2014). Thus, as exemplified with this example, by the use of information systems (IS), environmentally sustainable business models can be enhanced for both customers and providers. By doing so, an important contribution to overall sustainability can be made (Boons and Lüdecke-Freund 2013; Schaltegger et al. 2012). Consequently, the IS community has started to investigate these business models euphorically (e.g., Teubner and Flath 2015). However, the adverse effects that might result for individuals when these digital technology-enabled potentials are realized in business model designs are less understood.

Characteristic research of these IS-enabled sustainable services has delineated that digital technology usage carries distinct features in business model design known from the digital space. This especially holds true for consumption based pricing (Knote and Blohm 2015). However, constant monitoring and pay-per-use pricing systems may induce individual stress, which in turn, may negatively affect the future willingness to use such innovative sustainable services at all. Hence, if this "dark side" of IS support is not considered appropriately, a negative effect may occur in regards to the further success of sustainable business models, and ultimately, on the sustainable development of society. Recent research has begun reflecting on the potential adverse effects of the digital transformation of business models (Galliers et al. 2015). Loebbecke and Picot (2015), for instance, describe potential negative impacts on employment, e.g., by big data analytics innovations partially rendering human labor and knowledge obsolete. However, there is a lack of understanding regarding the danger of deterring individuals from using sustainable services by digital technology-enabled business model innovations (Veit et al. 2014).

Within the last decade, the IS research community has picked up the topic of sustainability, especially with regard to its environmental dimension (e.g., Chen et al. 2008; Melville 2010; Watson et al. 2010; Elliot 2011; Jenkin et al. 2011). Prior research has demonstrated that, for example, IS-enabled real-time feedback about energy consumption provides a beneficial effect on in-house energy consciousness and conservation behavior (e.g., Allen and Janda 2006; Faruqui et al. 2010; Oltra et al. 2013). Moreover, IS-enabled feedback about the individual's driving behavior is recognized as an effective means to change driving style in favor of environmental impacts (e.g., Meschtscherjakov et al. 2009; Dogan et al. 2014; Tulusan et al. 2012).

Besides general models based on the interaction of IS and environmental sustainable behavior (e.g., Elliot 2011), specific potentials of Green IS with regard to sensemaking and sustainable practicing are described by Seidel et al. (2013). Apart from that, recent research has pointed to the ability of IS in driving sustainable innovation (Van Osch and Avital 2010). Here, the importance in the advancement of alternative, sustainable business models and the role of IS in this regard (Hildebrandt et al. 2015) have been described and examined with reference to special instances (e.g., Teubner and Flath 2015). However, so far, research on the actual impact of IS on sustainability transformations is scarce (Malhotra et al. 2013). Moreover, as Bui and Veit (2015) highlight, prior research has primarily focused on the organizational or business level, thus neglecting the individual level of analysis. Here, e.g., in the case of car sharing, although IS usage enables increased flexible usage of sustainable services for individuals (Hildebrandt et al. 2015), it may set individuals under pressure to save time and money during their trips, thus inducing driver stress. In that regard, researched associated stress caused by an individual's inability to cope with IS in a healthy manner is described by the term technostress (Brod 1984). Weil and Rosen (1997) conceptualize technostress as "any negative impact on attitudes, thoughts, behaviors, or body physiology that is induced either directly or indirectly by technology." Technostress can be experienced, for example, due to increased dependency on technology, information overload, or increased complexity of technology (Ragu-Nathan 2008). Despite the numerous physiological and mental health problems caused by psychological stress, such as heart disease, depression, sleeplessness, or burnout (Avey et al. 2003; Marin et al. 2011; Richardson et al. 2012), driver stress is also considered to be a key factor in increasing the risk of accidents (Matthews et al. 1998). In that regard, road traffic injuries are the eight leading cause of deaths globally and will become the fifth by 2030 (Lozano et al. 2013; WHO 2008). However, psychological stress might also have a negative impact on the willingness to use innovative and sustainable services in the future. Although the influence of IS on individual stress is interesting in general (see Nastjuk and Kolbe 2015), the impact on sustainable service adoption is of special importance, bearing the ability to counteract the important potentials that IS generally have to offer for sustainability transformation (Vom Brocke and Seidel 2012; Watson et al. 2010; Chen et al. 2008).

In this study, we aim to investigate the impact of digital technology-enabled business model designs for sustainable services on the perception of individual stress and the resulting effect on the willingness to use sustainable services. For our investigation, we focus on the context of car sharing because it represents an instance of modern, sharing-based business models, in addition to investigating the impact of dynamic consumption-based pricing systems known to be an important characteristic of digital technology enabled business models for sustainable services (Knote and Blohm 2016; El Sawy and Perreira 2013). More specifically, we concentrate on the case of e-car sharing, i.e., car sharing with electric vehicles already identified as, under the right conditions, being more sustainable than car sharing with conventional vehicles and thus bears greater potential to contribute to sustainability transformation (Seidel et al. 2013) in general. Moreover, only the deployment of digital technologies affords highly dynamic usage-based (e.g., per second) pricing systems (King and Lyytinen 2005). Furthermore, pricing systems belong to the business model aspects that affect the customer directly (Osterwalder et al. 2005). Therefore, digital technology-enabled pricing systems are an important snapshot of contemporary digital business model designs, thus offering the possibility to learn about their impact on individual's stress perception. We therefore elaborate on the following research questions:

1. *How do digital technology-enabled pricing systems influence driver stress in car sharing?*
2. *How does driver stress induced by digital technology-enabled pricing systems influence the individual's willingness to use car sharing.*

To evaluate the proposed research model, we conducted experiments in real traffic situations, putting participants in the mindset of a car sharing user. In that regard, participants were each confronted with different digital-enabled pricing schemes, e.g., charging every half an hour and second-based charging. The results revealed a positive impact of digital technology-enabled pricing systems on psychological stress. Moreover, we found evidence that psychological stress is negatively associated with the willingness to use car sharing. In sum, this study makes several contributions. First, it emphasizes important potential dysfunctional consequences of increased use of IS in digital business model innovation (Fichman et al. 2014). Second, it relates these potential adverse effects to the user acceptance of sustainable services, and thus, shows the negative influences that might result for sustainability transformation. In that regard, the enhanced use of IS in the context of car sharing constitutes a new application field to be added in the research stream of technostress, as previous research has primarily focused on technostress in an organizational environment (Nastjuk and Kolbe 2015; Riedl 2012). As the reach of IS, in recent years, has left the organizational sphere and entered personal lives (Tilson et al. 2010; Yoo 2010), research on the impact of IS must also account for such contexts. Finally, the study points out the importance of experiments in the business model innovation process (Chesbrough et al. 2010), especially when innovating with digital technologies as, by these means, potential negative effects can be detected.

Theoretical Background and Related Work

Information Systems and Business Models for Sustainable Services

Sustainability transformation (Seidel et al. 2013) belongs to the key challenges for contemporary societies and strives at achieving sustainability with respect to its three intertwined dimensions of social, economic, and environmental sustainability (Elkington 1997). Interested in providing contributions to its solution, senior researchers from the IS community have selected this topic at the beginning of this decade, primarily focusing on the environmental dimension (e.g., Watson et al. 2010; Melville 2010). For instance, Watson et al. (2010) conceptually describe the potential of IS for the sustainable transformation of the energy domain. The authors demonstrate how the efficiency of energy systems can be increased by IS that, connected to sensitized objects, coordinate supply and demand. These initial efforts have spurred academic interest in the role of IS for environmental sustainability, referred to as Green IS (Malhotra et al. 2013). In general, prior works have shown that IS can contribute to environmental sustainability in two ways: (1) monitoring and informing about human behavior and it's environmental consequences, and (2) enabling or enhancing new sustainable practices (Seidel et al. 2013; Elliot 2011; Chen et al. 2008). Both aspects influence human behavior and, in turn, have consequences on the individual, the environment, and society at large (Elliot 2011; Melville 2010).

Drawing on prior related works, Kossahl et al. (2012) derive a taxonomy of sustainable IS research. The authors identify that research targeting IS-enabled opportunities that contribute towards sustainable transformation in non-IS-industries, named Green by IS, can be differentiated according to the respective industrial setting, such as the energy, healthcare or the mobility sector. Due to its massive contributions to overall emissions, the mobility domain has received some attention from the Green IS research community, e.g., in the field of electric mobility (e.g., Brandt et al. 2012). Here research has, for instance, focused on optimizing vehicle routing and scheduling (Sbihi and Eglese 2010; Groër et al. 2009). Hanelt et al. (2015) described that IS in electric vehicles can increase their attractiveness, such as implementing mobile applications, providing more reliability and comfortability in vehicle usage, e.g., by easing charging processes. Besides e-mobility, Green IS research has increasingly drawn from the potentials that arise from the improved connectivity of the vehicles. For instance, Hilpert et al. (2013) develop a Green IS artifact that tracks the greenhouse gas emissions of vehicles and supports knowledge-gathering and decision-making for sustainable business practices. Furthermore, Corbett et al. (2011) investigate the connection between IS and environmental-sustainability measurement principles and suggest that IS in the form of vehicle telematics can contribute to better environmental decision-making.

Recently, the Green IS community has also expanded the focus of IS's potential to contribute to the attractiveness of alternative business models in the mobility sector carrying a lower environmental footprint (e.g., Hildebrandt et al. 2015). Prior studies in business and environmental research have pointed to the particular importance of business model innovation for sustainable development (Boons and Lüdecke-Freund 2013; Schaltegger et al. 2012). They bear the potential to deploy eco-friendly technologies in an economical or alternative method of consumption, e.g., by allowing the distribution of resources among several users (Bocken et al. 2014). A central trait of these business models is providing access to resources, rather than ownership, on a pay per use base (Knote and Blohm 2016). Consequently, IS research has begun to deal with these instances. For instance, Teubner and Flath (2015) delineate the potentials of IS to enhance the economics of ride sharing. An additional example of the potentials of digital technologies for digital business model innovation is car sharing (Fichman et al. 2014). The service is long known (Shaheen et al. 1998), but has recently gained momentum with the help of IS (Wagner et al. 2014; El Sawy and Perreira 2013). For instance, Lee et al. (2011) describe the use of mobile technology in e-car sharing. Hildebrandt et al. (2015) show that the implementation of IS in car sharing operations can attract customers by simplifying the vehicle locating process using smartphones and sensors. In a similar vein, Firnkorn and Müller (2011) describe that digital technologies provide the necessary real-time information to leverage free-floating car sharing (as opposed to traditional station-based car sharing) business models, thus becoming a more relevant alternative for a wider range of people. El Sawy and Perreira (2013) provide a case study on the business model of Zipcar. The authors delineate that by applying digital technologies, a whole new business model became possible. A central element of digital car sharing, compared to former business models, is the tightening of the temporal pricing scheme permitted by on-board devices and connectivity.

In general, with regard to business models, with the increasing diffusion of digital technologies (Bharadwaj et al. 2013), the role and use of IS have gradually enlarged in the last decades (Merali et al. 2012) and have ultimately reached the interfaces to customers (Osterwalder et al. 2005), thus enabling enhanced value propositions of products as well new pricing systems (e.g., Desyllas and Sako 2013; Veit et al. 2014; Matt et al. 2015). Zolnowski et al. (2011) draw on the case of manufacturing business models, describing that connectivity technology "serves as an enabler for new pricing models like pay-for-performance." Through digital technologies and digital infrastructures (Tilson et al. 2010), it is possible to precisely track, measure, and eventually, price human behavior when using the respective service, e.g., in the case of dynamic insurance pricing (Desyllas and Sako 2013). Although business models comprise various different components (Osterwalder et al. 2005), Bocken et al. (2014) describe the special importance of the pricing systems regarding these "business models for delivering sustainability" stemming from the direct relation to customer behavior. This is illustrated by the case of Xerox's document management systems, which "is based on customer payment per print or copy, which could dis-incentivise printing." Although these features might enhance the economics of the sustainable service for both customer and operator, thus contributing to economic and environmental sustainability, there might emerge severe adverse effects on the individual and the society, thus harming social sustainability (Dyllick and Hockerts 2002).

Literature on both the role of IS on social sustainability as well as on the societal impacts of digital innovations is scarce (Malhotra et al. 2013). With regard to the former, existing works have predominantly focused on describing the role of IS in social reporting issues (e.g., Morhardt 2010). On the other hand, recent research has started reflecting on the potential negative effects of the digital transformation of business models (Galliers et al. 2015; Loebbecke and Picot 2015). However, the negative individual and societal impacts of increasing IS usage, especially in the context of sustainability transformation is particularly unexplored.

The Concept of Stress

Within our study, we conceptualize stress from a transaction-based perspective, as it emphasizes the bilateral relationship between the environment and individuals. In this context, Lazarus and Folkman (1984) propose one of the most influential stress theories by defining stress as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being." This definition, on the one hand, considers the specific characteristics of the person taken into account, and on the other hand, considers the property of the event that may trigger the stress reaction. Lazarus and Folkman (1987) emphasize that the transaction-based view considers the environment and the individual not as independent entities but rather as two closely intertwined subsystems. The transaction-based stress model emphasizes three main cognitive appraisal processes: primary appraisal, secondary appraisal, and reappraisal (Lazarus 1966; Lazarus and Folkman 1984). Appraisal is a process in which an individual permanently evaluates the importance of events for their personal well-being (Lazarus 1993a). Within the primary appraisal process, individuals interpret the event as either benign-positive, irrelevant, or stressful for its well-being (Lazarus and Folkman 1984). While as irrelevant appraised events carry no implications for an individual's well-being, benign-positive events occur when the result of an encounter is interpreted as positive for the well-being and are often accompanied by pleasurable emotions such as love, joy, or happiness. This separation is significant, as irrelevant and benign-positive appraisals do not trigger the stress process. Three types of stressful appraised events can be distinguished: (1) threat appraisals (anticipated future harms or losses, e.g., imminent operation), (2) challenge appraisals (challenging situation that is conquerable when efficiently mobilizing personal resources, e.g., paper submission), and (3) harm/loss appraisals (damage or loss has already happened, e.g., the loss of a loved person).

Once an individual appraises an event as stressful, s/he evaluates, within the secondary appraisal process, the coping options available for dealing with the situation. In this complex psychological process, individuals consider which coping resources are useful to overcome the stressful situation and the likelihood that the coping strategy can be applied effectively. In that regard, the individual's competence, social support, material, and other resources are evaluated to re-establish a balance between the individual and the environment (Jerusalem and Schwarzer 1992). Thoits (1995) refers to two main psychological resources, locus of control and self-esteem, which are evaluated by the individuals in the secondary appraisal process. While the former refers to the individual's belief to be on control over a situation (Rotter 1966), self-esteem is an important concomitant of the self-concept of own abilities that is defined as the perceived ability to manage a specific situation (Crocker and Major 1998).

According to Lazarus's transaction-based view on stress, psychological stress occurs when an individual perceives that the coping resources (secondary appraisal) are insufficient to handle an event appraised as stressful (primary appraisal). In such a case, the individual puts "cognitive and behavioral efforts to master, reduce, or tolerate the internal and/or external demands that are created by the stressful transaction" (Folkman 1984). Finally, in case of environmental perception changes, a reappraisal may occur. In that regard, a situation initially appraised as irrelevant may be evaluated as stressful post processing new information from environment (Lazarus and Folkman 1984).

The transactional-based perspective on stress has also found recognition in the context of driving. In that regard, Gulian et al. (1989) refer to the transaction stress model of Lazarus and Folkman (1984) and define driver stress as a "set of responses associated with the perception and evaluation of driving as being demanding or dangerous relative to the individual's driving capabilities." Fuller (2000; 2005) emphasizes in the task-capability model that a loss of control of the situation arises when the demand of the driving task exceeds the driver's capability. In that regard, drivers compare individual coping resources (driver capability) with the confronted stressors (task demand). The resulting appraised person–environment relationship determines the amount of perceived strain (task difficulty). The person–environment balance can be affected by various dimensions, such as driver aggression, dislike of driving, irritation and frustration connected with the overtaking process, or increased alertness and concentration due to permanent monitoring of other's traffic behavior (Gulian et al. 1989).

However, recent research has also conceptualized the interaction with in-vehicle IS as a further dimension of driver stress (Nastjuk et al. 2015). In that regard, the interaction with in-vehicle systems relies on the driver's limited resources necessary for the evaluation of the current traffic situation, and thus, might lead to driver distraction and stress (e.g., Baumann et al. 2008; Brooks and Rakotonirainy 2007; Osswald 2012). On a related note, Brandt (2013) emphasizes that the driver interacts with a variety of different in-vehicle information systems, such as convenience, communication, and entertainment systems allowing travelling to be more enjoyable, in addition to, systems that provide information about the current location of the vehicle or traffic conditions (e.g., traffic information systems and global positioning systems), monitoring systems that measure and display the current status of the vehicle, and safety and collision avoidance systems that support the driver to prevent collisions. Driver stress can be expressed in the form of emotional, physiological, and behavioral responses (Gulian et al. 1989; Matthews et al. 1991). While emotional and physiological are characterized by responses, for example, increased anxiety or heart rate, a behavioral response may lead to an adaption of an unsustainable driving behavior due to an aggressive driving style. Despite the variety of health problems associated with stress, aggressive driving behavior is a main culprit of road traffic collisions (e.g., Wickens et al. 2013). According to WHO (2013), approximately 1.24 million people die each year due to road traffic collisions.

Research Model and Hypotheses Development

In this study, we aim to investigate the impact of digital technology-enabled business model designs on individual stress and future adoption of sustainable services by using the example of car sharing. We assume that an increased level of stress induced by the digital technology-enabled pricing systems negatively affects an individual's decision to use such sustainable services. Our research model is illustrated in Figure 1 below.

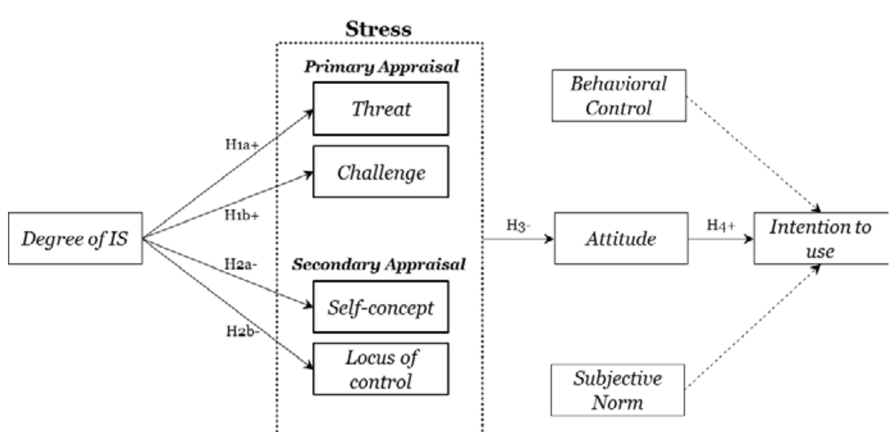

Figure 1. Research Model

We conceptualize stress from a transaction-based perspective by relying on the well-established transactional stress model of Lazarus and Folkman (1984). In that regard, stress is triggered by an imbalance between an environmental demand and the individuals coping resources. This imbalance results from the interaction between the primary and secondary cognitive appraisal processes. We expect that an increased degree of IS deployment (in terms of accuracy of the digital technology-enabled pricing system) influences both cognitive appraisal processes in an unfavorable manner, and hence, lead to an increased stress perception.

Within the primary appraisal process, stressful events are evaluated as either challenging or threatening (we neglect the harm appraisal because it refers to previously experienced loss). In general, opposed to comparably safe environments, such as using a desktop personal computer, the driving task itself constitutes a potentially challenging and threatening situation due to the constantly changing environment (Osswald et al. 2012). The driving task on an operational level (e.g., holding the distance to other traffic participants) comprises various activities and perceptions from second to second. These tasks create a constant time pressure because the driver has only limited time for the decision-making processes (Brouwer et al. 2002). Time pressure is determined by the degree of information that an individual has to process within a given time and may lead to psychological stress and even frustration (Shinar 1998; Zur and Breznitz 1981). The digital technology-enabled pricing system creates a secondary task in addition to the driving process, as it confronts the driver permanently with information about the costs of using the car sharing service that the driver monitors. Therefore, in addition to the time pressure created by the driving task itself, we assume that the permanently displayed information about the duration and costs of using the car sharing service puts the driver even under more time pressure because s/he aims to minimize the costs by, e.g., adjusting the driving style in terms of speeding or overtaking (Adams-Guppy 1995; Katzev 2003; Millard-Ball 2005; Osswald et al. 2012). However, in addition to the primary task of driving, the secondary task of monitoring imposes a cognitive load on the driver, as it captures the driver's valuable resources necessary for the assessment of the current traffic situation and its development (Baumann et al. 2008). As a consequence, the driver's attention may shift away from driving, which in turn increases the risk of accident (Bruyas et al. 2008; Pettitt et al. 2005). In that regard, the distraction reinforces the driving task as being more challenging or threatening. We establish our assumptions in the following pair of hypotheses:

H1a⁺: *Individuals perceive to use the car sharing service as more threatening when digital technology-enabled pricing systems are provided.*

H1b⁺: *Individuals perceive to use the car sharing service as more challenging when digital technology-enabled pricing systems are provided.*

Within the secondary appraisal process, individuals evaluate their coping resources to manage the stressful demand. In that regard, two main psychological resources, locus of control and self-concept, are evaluated by the individuals (see Section "The Concept of Stress"). The individual's perception of the self-concept of own abilities is strongly affected by the perception of a situational factor (Fisher 1996) and might be questioned in an uncertain environment (Kienhues and Bromme 2011). Uncertainty is generally associated with the probability to forecast a situation, and influences the perception of own abilities to cope with a situation (Babrow et al. 2000; Brashers 2001). As mentioned above, the driving process itself is described by an environmental uncertainty due to, for example, the rapidly changing traffic situation. Therefore, it is nearly impossible for the driver to estimate the exact time of arrival. We argue that the time pressure created by the digital technology-enabled pricing system empowers the awareness of uncertainty about time of arrival, as an increase in travel time results in increased costs of using the car sharing service. In that regard, time pressure is reinforced with a higher level of awareness about a time-sensitive situation (Wright 1974). Supporting our assumption, a recent study of Nastjuk and Kolbe (2015) suggests that the belief in one's abilities to overcome a critical range situation in electric vehicles increases with a higher degree of environmental uncertainty. In addition, uncertainty is highly intertwined with the perception of being in control over a situation (Penrod 2001; Whitson and Galinsky 2008). Following the same line of argumentation for the influence of the digital technology-enabled pricing system on the perception of self-concept of own abilities, we posit that uncertainty is reinforced due to a higher awareness, thus leading to a weakened belief to be in control over the situation. Prior IS research also emphasizes the risk of information overload created by information and communication technologies through a flood of information that an individual is not able to handle (Ragu-Nathan 2008). The pricing system provides an additional source of information that the driver has to interact with, apart from the plethora of information within the vehicle (e.g., Brandt 2013). According to Bach et al. (2009), information systems within the vehicle substantially account for information overload for the driver because it relies on the same cognitive capacity as the task of driving. As a result, the pricing system forces the driver to consider more information than they can effectively process, which strengthens the perception of losing control over a situation (Heylighen 2002; Wurman 2001). Following this logic, we assume that the provision of the digital technology-enabled pricing system influences the appraisal of the driver's abilities and locus of control in the following manner:

H2a$^-$: *Individuals perceive their self-concept of own abilities to be weakened regarding the usage of car sharing when digital technology-enabled pricing systems are provided.*

H2b$^-$: *Individuals perceive their locus of control to be weakened regarding the usage of car sharing when digital technology-enabled pricing systems are provided.*

Furthermore, we draw on the theory of planned behavior (Ajzen 1991), an intention-based theory with a superior explanatory of behavior tendencies (Armitage and Conner 2001; Krueger et al. 2000; Mathieson 1991; Pavlou and Fygenson 2006), to explain the impact of perceived stress on the adoption of car sharing. The theory of planned behavior (TPB) is considered to be a suitable framework to explain mobility behavior because it comprises the central predictors (Haustein and Hunecke 2007). The TPB aims to explain the individual behavior by behavioral intentions (the individual's degree of effort to perform a specific behavior), which in turn, is determined by perceived behavioral control, subjective norm, and attitude toward behavior (Ajzen 1991). Subjective norm refers to the evaluation of social pressure from important others about performing the behavior. Perceived behavioral control is defined as "the perceived ease or difficulty of performing the behavior" (Ajzen 1991). Attitude captures an individual's overall assessment of performing a specific behavior and can be classified into three main classes of responses: cognitive, conative, and affective (Ajzen 2005; Breckler 1984; Greenwald 2014). While the cognitive dimension captures the knowledge and perceptions about the intended behavior, the conative dimension refers to the likelihood to perform a specific behavior. However, the affective component reflects an individual's feelings and emotions and takes on an important role in our research context, as stress is considered a subset of emotions and usually arises from negative emotions (Lazarus 1993b; Lazarus 2006; Perrewè and Zellars 1999). According to this relationship, we posit that with an increased level of perceived stress, the attitude toward using car sharing decreases. This assumption is also supported by previous research. In that regard, Eisel et al. (2014) demonstrate, in a mental simulation experiment, that range stress negatively affects the adoption decision of electric vehicles. Nastjuk and Kolbe (2015) arrive to similar dependencies, showing evidence on the duality of stress in IS research that the attitude construct is negatively influenced by the individual stress level. Kulviwat (2007) demonstrate a substantial influence of emotional responses to consumer attitudes. Furthermore, attitude has empirically long been shown to be a predictor of behavioral intentions (Ajzen and Fishbein 1980). Following the theory of planned behavior, we assume that the attitude toward using car sharing is positively linked to the behavioral intention. We summarize our assumptions in the following hypotheses:

H3$^-$: *Psychological* stress *negatively influences the attitude toward using car sharing.*

H4$^+$: *The attitude toward using car sharing is positively associated with behavioral intention.*

Research Methodology

To test how digital technology-enabled pricing systems affect stress and perception concerning the future usage of car sharing, we performed field experiments in real traffic situations with a between-subjects design. As part of the experiment, we developed two scenarios in which participants had to drive an electric vehicle on a predefined city track of 10 km. The electric vehicle used for the experiment was a *Volkswagen e-up!* equipped with an electromotor of 60 kW maximum engine power and a maximum speed of 130 km/h. Moreover, the vehicle's lithium-ion battery holds a capacity of 18.7 kWh, which enables a driving range of between 120 and 160 km under normal driving conditions (Volkswagen 2016). For the two scenarios, the treatment differed in terms of the accuracy of the pricing system.

Data-collection Procedure and Sampling

Altogether, the study draws on a sample of 69 participants. We used different recruitment streams such as social networks, announcement in lectures, and direct acquisition. To obtain a snowball effect, we also asked initial participants to invite their circle of acquaintances to participate in the experiment (Biernacki and Waldorf 1981). The possession of a driving license was the only necessary condition for participation. Each participant was randomly assigned to one of the groups (Bhattacherjee 2012). Before conducting the experiment, the scenarios were pre-tested by researchers in the field of IS and psychology. The pre-tests led to minor changes in terms of wording and design of the scenarios. Experiments were conducted at the same time of the day (afternoon) to avoid potential effects of, for example, darkness or rush hour. Furthermore, the experiments were not conducted under extreme weather conditions. Participants' age ranged from 20 to 39 years (Mean = 25.79, SD = 3.17), of which 44.9 percent were woman. Moreover, while most participants completed the qualification for university admission or obtained a university degree (84.06 percent), 44.93 percent lived in a household without a personal vehicle. An average participant spent around 28.81 min commuting per weekday for a distance of 13.36 km. Assessed on a 7-point Likert scale, the direct experience among participants with e-car sharing was relatively low (Mean = 2.26, SD = 1.99).

Field Experiment Setting

Before starting the experiment, the vehicle was prepared by the experimenter. In that regard, the experimenter ensured that the battery capacity for each participant was not lower than 75% (approximately remaining driving range of 90 km) in order to avoid range anxiety — stress that results from a concern of getting stranded due to a depleted battery (Nastjuk and Kolbe 2015; Tate et al. 2008; Rauh et al. 2014). Furthermore, depending on participants' group affiliation, the vehicle was prepared with the respective digital technology-enabled pricing system. In that regard, while group 1 (24 participants) was charged every half an hour a fixed amount of 7.29 EURO, group 2 (23 participants) was charged 0.0041 EURO per second. To avoid cost disadvantages within groups, the extrapolated price of the second-based pricing was set as equal to the pricing system based on every half an hour. The chosen charging prices were close to the usual prices of local car sharing companies.

The respective pricing information was displayed to the driver *via* a self-developed application installed on a smartphone that was mounted on the vehicle's center console prior to the driving task. The application displayed the costs of using the car sharing services based on the trip duration (hours, minutes, and seconds) in real time. The vehicle used by the control group (22 participants) was not equipped with a digital technology-enabled pricing system. Instead, participants of the control group were informed in advance that their ride would be charged following the classical car sharing combined pricing scheme based on kilometers driven and hours used. Furthermore, all participants were provided with a navigation system (maps+more) to ensure that they actually drive the designated route.

After preparing the vehicle, participants were briefed about using the electric vehicle (e.g., using and interpreting the in-vehicle information systems). Subsequently, participants performed a test drive to get used to the practical handling of the electric vehicle and to avoid cognitive arousal due to inexperience with driving an electric vehicle (Rauh et al. 2014). Participants then received the driving task in paper-based form to read. Participants were instructed that they are customers of a local car sharing company and have rented the provided *Volkswagen e-up!* for a maximum duration of 30 min to drive a designated route of 10 km, which lasts about 21 min depending on traffic and driving style. The route was divided into three tracks. While track 1 contained high and middle volume of traffic with a speed limit of 50 km/h, track 2 was a reduced-traffic area with speed limits of 30 km/h. Track 3 was dominated by a low traffic volume and speed limits up to 70 km/h. Furthermore, the instruction included an explanation of the charging system for the vehicle usage. Participants were provided with a fictive budget of 10 EURO, of which they had to pay the car sharing service. When exceeding the rental time of 30 min, a fine of 5 EURO was subtracted from the provided budget. In order to increase external validity of the experimental design, i.e., to design the situational context as realistically as possible, especially regarding the rational to minimize the personal costs of car sharing usage, we introduced a monetary incentive within the experiment. In each group, the participant with the highest residual fictive budget received 50 EURO. If this condition applied to more than one person, we drew lots. The experimenter asked participants to repeat the given instruction in their own words, in order to ensure that all participants had understood the task. The experimenter sat down in the rear seat after clarifying all open questions. From this moment on, the communication between the driver and the experimenter was prohibited in order to avoid any distraction. After completing the city track, participants received the questionnaires and were debriefed.

Measurement of Constructs

To evaluate the perceived psychological stress for the respective driving task, we used the widely recognized Primary Appraisal Secondary Appraisal (PASA) questionnaire (Gaab 2009; Gaab et al. 2005), which refers to the transactional stress model of Lazarus and Folkman (1984). The related questionnaire assesses the two main cognitive appraisals (primary and secondary) with two subscales. While the primary appraisal measures the perceived demand with the scales *threat* and *challenge*, the secondary appraisal assesses the coping resources with scales *self-concept of own abilities* and *locus of control*. The questionnaire measures each construct with four items on a 6-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree). Attitude toward behavior, subjective norm, perceived behavioral control, and behavioral intention were derived from the well-established theory of planned behavior (Ajzen 1991). For measuring these constructs, we followed the manual for constructing questionnaires based on the theory of planned behavior proposed by Francis et al. (2004). In that regard, attitude toward using the e-car sharing service was measured on a 7-point Likert scale with four items (e.g., using the e-car sharing service is good vs. bad; pleasant vs. unpleasant). While subjective norm (perceived social pressure to engage in an action) and perceived behavioral control (perception of ability to perform a certain behavior) were operationalized by four items each, intention to use the e-car sharing service was assessed with three items on a 7-point Likert scale.

The between-subjects factor (degree of IS) was measured using an ordinal scale, with 1 corresponding to the control group, 2 referring to the group charged a fixed amount every half an hour, and 3 relating to the group charged every second. In order to ensure that participants perceived the stimuli, we asked whether they were provided with a digital technology-enabled pricing system, and if they said yes, whether they were charged for the e-car sharing service every half an hour a fixed amount or per second. Furthermore, participants had to respond to some questions on a 7-point Likert scale concerning the influence of the pricing systems on their driving behavior (e.g., "Did you feel pressured to drive faster due to the displayed costs?" or "Did the pricing system put you under pressure while driving?")

Data Analysis and Results

To test our proposed research model, we relied on variance-based partial least squares structural equation modeling (PLS-SEM; Lohmoeller 1989) using the software SmartPLS 3 (Ringle et al. 2015). We decided to apply variance-based model estimation because PLS-SEM requires fewer statistical constraints, for example, the assumption of normally distributed data or requirements regarding sample size (Henseler et al. 2009; Reinartz et al. 2009). We additionally used IBM SPSS Statistics 23 (IBM 2015) to assess the group differences in the respective subdimensions of stress. We followed the widely adopted two-step modelling approach for data analysis (Anderson and Gerbing 1988). We first assessed the measurement model to ensure reliability and validity of the constructs. Afterwards, we tested the structural model.

Validation of the Measurements

Before starting the analysis, we checked whether participants correctly assigned the provided digital technology-enabled pricing system (second-based and half an hour-based) to the respective scenario. All participants were able to correctly assign the system to their allotted scenario. Furthermore, participants rated relatively high on the 7-point Likert scale concerning whether they felt forced to drive faster due to the displayed costs (group1: $M = 5.25$; group2: $M = 5.04$), whether they felt stressed due to the provided digital technology-enabled pricing system (group1: $M = 5.42$; group2: $M = 5.17$), and whether the digital technology-enabled pricing system put them under pressure while driving (group1: $M = 5.33$; group2: $M = 5.26$). Hence, we assume that participants perceived the intended manipulation, and therefore, consider all responses suitable for further analysis.

To assess the quality of the reflective constructs, we examined content, convergent, and discriminant validities. Content validity describes the degree to which a measure represents every element of the underlying social construct (Haynes et al. 1995). We argue that content validity is given as our constructs and measures follow established theories and existing scales. Convergent validity is defined as the degree to which multiple items of the underlying construct correspond with one another (Bagozzi and Phillips 1991). According to Fornell and Larcker (1981), convergent validity can be assessed by calculating individual indicator reliability, composite construct reliability (CR), and average variance extracted (AVE). Due to low factor loadings, we dropped two items from the challenge and self-concept scale. Afterwards, all items loaded on their own construct at .60 or higher, which indicates an acceptable reliability of the indicators (Chin 1998; Hulland 1999). Furthermore, the CR varied between .851 and 1.000, above the acceptable limit of .07 (Hulland 1999). All AVEs exceeded the suggested lower bound of .50 (Bhattacherjee and Premkumar 2004). Discriminant validity refers to the extent to which the measures of a construct are empirically distinct from the measures of other constructs in the same model (Bagozzi and Phillips 1991). The square roots of the AVEs are greater than the corresponding construct correlations, indicating discriminant validity (Fornell and Larcker 1981). Finally, each item loaded on its respective construct higher than on the other constructs in the model, confirming that the measures represent their assigned construct better than any other construct (Chin 1998). The results of the validity assessment are presented in Table 1.

Construct	Loadings	CA	AVE	CR	1	2	3	4	5	6	7	8	9
1 Attitude	.676-.824	.653	.591	.862	**.769**								
2 Intention	.631-.964	.811	.739	.891	.504	**.859**							
3 Behavioral Control	.682-.941	.856	.613	.862	.218	.396	**.783**						
4 Subjective Norm	.751-.905	.863	.711	.907	.450	.587	.183	**.843**					
5 Threat	.693-.928	.840	.680	.894	-.134	-.022	.126	-.059	**.824**				
6 Challenge	.853-.868	.649	.740	.851	.-159	.102	.124	.023	.337	**.860**			
7 Locus of Control	.770-.868	.866	.715	.909	.142	-.017	-.036	.149	-.554	-.315	**.845**		
8 Self-Concept	.713-.875	.741	.663	.854	.446	.301	.220	.239	-.293	.220	.449	**.814**	
9 Degree of IS	1.000	1.000	1.000	1.000	-.192	.090	.032	.005	.376	.408	-.443	-.436	**1.000**

AVE: average variance extracted; CA: Cronbach's Alpha; CR: composite reliability; bolded numbers: square root of AVE.

Table 1. Factor Loadings, CA, AVE, CR, and Inter-Construct Correlations

Hypotheses Testing

We decided to check for group differences in order to assess the effect of digital technology-enabled pricing systems on the stress construct and on the subdimensions' threat, challenge, self-concept, and locus of control (H1a-H2b). Following Gaab (2009), we computed the stress construct by subtracting the mean of the secondary appraisal's subscales from that of the primary appraisal's subscales. Before selecting an appropriate method for assessing the group differences, we tested in the first step the data for non-normality. The Kolmogorov–Smirnov test and Shapiro–Wilk test showed highly significant results for the construct threat ($p < .001/p < .001$), self-concept ($p = .032/p = .034$), locus of control ($p < .001/p < .001$), and stress ($p = .008/p = .003$), thus indicating non-normal distributed data.

Therefore, we used the nonparametric Leven test in the second step for assessing the homogeneity of variances among groups (Nordstokke et al. 2011). The test reveals significant results for the construct threat ($F = 5.544$; $p = .006$) and non-significant results for the construct challenge ($F = 0.001$; $p = .999$), self-concept ($F = 1.589$; $p = .212$), locus of control ($F = 0.409$; $p = .667$), and stress ($F = 0.446$; $p = .642$).

Since our data are, to a great extent, homoscedastic but non-normally distributed, we decided to apply the Kruskall–Wallis test to assess whether there are differences between the three groups (McKight and Njab 2010). The groups differed statistically significantly in the construct threat (χ^2 (2) = 9.316; $p = .009$), challenge (χ^2 (2) = 13.182; $p = .001$), self-concept (χ^2 (2) = 18.004; $p = .001$), locus of control (χ^2 (2) = 14.523; $p = .001$), and stress (χ^2 (2) = 29.705; $p < .001$).

To investigate post-hoc the group-specific differences within each construct, we applied the nonparametric Mann-Whitney U test (Nachar 2008). Furthermore, the approximated effect size (r) was calculated by dividing the z-score by the square root of the sample size (Field et al. 2013). Following

Cohen (1992), effect sizes between .10 and .30 were considered small to medium, whereas those between .30 and .50 were regarded as medium to large. A Bonferroni correction was used to reduce Type I errors due to multiple testing (Rice 1989). In that regard, the critical 5 percent level of significance was corrected to 0.0125. The results of the Mann-Whitney U test and the effect sizes are presented in Tables 2–5.

Compared to the control group, the results indicate that both digital technology-enabled pricing systems led to an increased stress perception while driving (Table 2 and Table 3). In that regard, we could find a significant positive effect of the fixed-based price charging system (group 1) on the primary appraisal dimension challenge ($U = 133.5$; $p = .004$) and a negative effect on the secondary appraisal dimension's self-concept ($U = 87.0$; $p < .001$) and locus of control ($U = 140.0$; $p = .006$). Overall, the charging system led to an increased level of perceived stress ($U = 71.0$; $p < .001$).

Regarding the second-based pricing system (group 2), the analysis revealed a significant positive impact of the system on the scales threat ($U = 134.0$; $p = .004$) and challenge ($U = 108.5$; $p = .001$), and a significant negative effect on the subscales self-concept ($U = 103.0$; $p = .001$) and locus of control ($U = 96.0$; $p < .001$). Overall, the second-based pricing system led to a significantly increased level of stress perception ($U = 37.5$; $p < .001$).

The results of the group comparison between both digital technology-enabled pricing systems (Table 4) indicated no significant differences in stress and its subscales. Taking into consideration the impact of digital technology-enabled pricing systems in general (groups 1 and 2) on the subdimensions of stress, the results (Table 5) clearly showed a significant positive effect on threat ($U = 320.0$; $p = .007$) and challenge ($U = 242.0$; $p < .001$), and a significant negative impact on self-concept ($U = 190.0$; $p < .001$) and locus of control ($U = 236.0$; $p < .001$). In that regard, participants perceived more stress when providing a digital technology-enabled pricing system ($U = 108.5$; $p < .001$).

	Group 1	Control group		Mann-Whitney U test			
Constructs	MR	MR	Δ MR	U-statistics	Z-score	Sign.	r
Threat	26.75	19.95	6.80	186.0	-1.906	.057	0.229
Challenge	28.94	17.57	12.37	133.5	-2.888	.004	0.348
Self-concept	16.13	31.55	-15.42	87.0	-3.926	.000	0.473
Locus of control	18.33	29.14	-10.81	140.0	-2.760	.006	0.332
Stress	31.54	14.73	16.81	71.0	-4.259	.000	0.513

SD: standard deviation; Sign.: significance; r: effect size; MR: mean rank

Table 2. Group Comparison Fixed-based Pricing

	Group 2	Control group		Mann-Whitney U test			
Constructs	MR	MR	Δ MR	U-statistics	Z-score	Sign.	r
Threat	28.17	17.59	10.58	134.0	-2.911	.004	0.350
Challenge	29.28	16.43	12.85	108.5	-3.300	.001	0.397
Self-concept	16.48	29.82	-13.34	103.0	-3.429	.001	0.413
Locus of control	16.17	30.14	-13.97	96.0	-3.604	.000	0.434
Stress	32.37	13.20	19.17	37.5	-4.903	.000	0.590

SD: standard deviation; Sign.: significance; r: effect size; MR: mean rank

Table 3. Group Comparison Second-based Pricing

	Group 1	Group 2		Mann-Whitney U test			
Constructs	MR	MR	Δ MR	U-statistics	Z-score	Sign.	r
Threat	21.21	26.91	-5.70	209.0	-1.483	.138	0.179
Challenge	22.40	25.67	-3.27	237.5	-0.825	.410	0.099
Self-concept	23.71	24.30	-0.59	269.0	-0.150	.881	0.018
Locus of control	26.21	21.70	4.51	223.0	-1.143	.253	0.138
Stress	20.69	27.46	-6.77	196.5	-1.696	.090	0.204

SD: standard deviation; Sign.: significance; r: effect size; MR: mean rank

Table 4. Group Comparison between the Digital Technology-enabled Pricing Systems

	Group 1+2	Control group		Mann-Whitney U test			
Constructs	MR	MR	Δ MR	U-statistics	Z-score	Sign.	r
Threat	39.19	26.05	13.14	320.0	-2.715	.007	0.327
Challenge	40.85	22.50	18.35	242.0	-3.561	.000	0.429
Self-concept	28.04	49.86	-21.82	190.0	-4.236	.000	0.510
Locus of control	29.02	47.77	-18.75	236.0	-3.659	.000	0.441
Stress	43.69	16.43	27.26	108.5	-5.271	.000	0.635

SD: standard deviation; Sign.: significance; r: effect size; MR: mean rank

Table 5. Group Comparison between Classic and Digital Technology-enabled Pricing

Furthermore, to assess hypotheses H3 and H4, we examined the influence of stress on attitude and intention to use the service of car sharing. Using the indicator reuse approach, we operationalized stress as a reflective-reflective second-order construct with the four subdimensions of stress as lower-order constructs (Lohmoeller 1989; Ringle et al. 2012). To evaluate the structural path of the model, the bootstrapping re-sampling procedure was applied with 5000 subsamples (Chin 1998; Hair et al. 2011). An overview of the structural model estimations can be found in Figure 2.

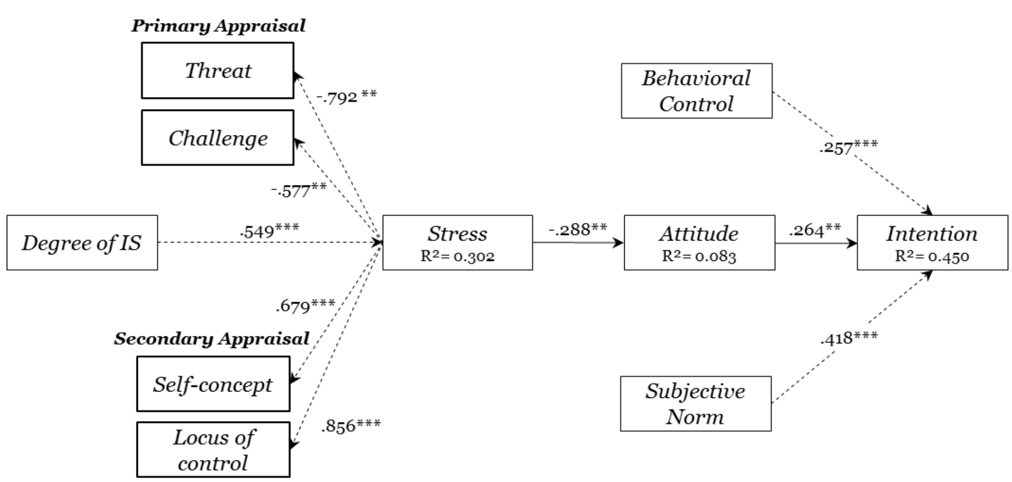

Figure 2. Path Coefficients of the Structural Model

PLS regression analysis revealed a significant positive effect of the degree of IS used ($b = .549$, $p < .01$) on perceived stress and a negative significant impact of stress on the attitude toward using the car sharing service ($b = -.288$, $p < .05$). Considering the relationship between attitude and intention, the results indicated that attitude is a significant predictor ($b = .264$, $p < .05$) for the intention to use the car sharing service. Furthermore, subjective norm ($b = .418$, $p < .01$) and behavioral control ($b = .257$, $p < .01$) were found to be a significant predictor for intention. Overall, the model can explain 45.0% variance in intention to use car sharing, indicating an above-average explained variance (Chin 1998).

Discussion

The increased connectivity, which stems from the diffusion of digital technologies in an increasing number of areas of life (Yoo 2010) together with the rising coverage of general digital infrastructures (Tilson et al. 2010), has been credited to enable and improve sustainable business models (e.g., Chen et al. 2008). By an increased availability of real-time information, the viability of such business models is heightening (Teubner and Flath 2015), e.g., by increasing the flexibility of their use as well as the increased control and monitoring potentials for suppliers (e.g., Hildebrandt et al. 2015). Thus, digital technologies can contribute to the sustainable development of modern societies, a potential selected by recent Green IS research (Malhotra et al. 2013). However, besides these potentials, the consequences of digital business model innovation for sustainable services on the individual must be considered (Elliot 2011). By their affordances, digital technologies might further contribute to the heightening turbulence and frantic pace in our society. In a time of rising cases of stress-related disorders, digitally enabled business model designs that overstrain individuals might have a significant impact on the willingness of these individuals to use the services in the future. Thus, the sustainability transformation afforded by IS might be constrained before it actually reaches its full potential.

In this study, we experimentally investigated the impact of digital technology-enabled pricing systems, an important characteristic of digital business model designs for sustainable services (e.g., Hildebrandt et al. 2015), in the context of car sharing on individual stress and on the factors that determine future adoption of such services. Our results clearly indicated that a higher level of IS application results in an increased stress appraisal. A closer look at the primary appraisal processes of the transactional stress model indicates that participants perceive the car sharing usage as more threatening and challenging when provided with digital technology-enabled pricing systems. Furthermore, considering the secondary appraisal processes, the digital technology-enabled pricing systems led to a decreased evaluation of the situation as controllable, and moreover, reinforced participants feel less confident in managing the given task. These differences can, to some extent, be explained by the time pressure that the pricing system creates due to a permanent display of the travel time and costs. In that regard, time pressure impairs the driving task because it leads to cognitive strains that distract an individual (Keinan et al. 1999). Moreover, the provided pricing systems induce an increased pressure to monitor the driving progress, which in turn, consumes the limited mental resources needed for effective task performance (Baumeister et al. 1998; Karau and Kelly 1992; Kelly et al. 1997). This is especially important because contemporary automobiles are considered complex mobile computers equipped with a number of interactive systems, such as navigation system, range gauge, or speedometer (Brandt 2013; Krum et al. 2008). The interaction with this wide range of in-vehicle IS constitutes additional tasks that compete with the primary task of driving, which may lead to stress reactions (Hollnagel et al. 2003; Horberry et al. 2006; Matthews et al. 1998; Osswald et al. 2012; Schmidt et al. 2010). In that regard, the provided pricing systems constitute an additional information resource along with the existing in-vehicle information systems. According to Bach et al. (2009), the interaction with in-vehicle IS is a main source of information overload because it relies on the same capacity as that of the driving task. This overload also produces a perceived loss of control over a situation, as the capacity for decision-making is limited, thus inhibiting the individual to consider the optimal solution for handling a given task (Heylighen 2002).

Within the IS community, the cognitive strain related to the interaction with information and communication technologies is summarized under the term *technostress*, defining “a modern disease of adaptation caused by an inability to cope with new technologies in a healthy manner” (Brod 1984). Ragu-Nathan et al. (2008) state that one major stress factor created by information and communication technologies is caused by the increasing continual exposure to technologies, thus leading individuals to perceive to be dependent on technologies. Transferred to our scenario, participants may perceive that their style of driving is partly dependent on the provided pricing system, as they were permanently exposed to the displayed information in terms of costs of using the car sharing service and trip duration. This is in line with the findings of Nastjuk and Kolbe (2015), showing in a mental simulation experiment that participants experience technostress due to the driver's perception of being permanently connected with in-electric vehicle IS. Moreover, it is difficult for participants to determine the actual duration of travel. Consequently, the final costs for using the car sharing service, as, for example, traffic jams, construction zones, and further related uncertainty factors might influence the actual journey time. Such uncertainty is correlated with the individual's ability to forecast an event, which in turn, affects the individual's competence to manage a specific demand (Babrow et al. 2000; Brashers 2001).

However, the test for group differences revealed no significant differences in stress perception between both digitally enabled pricing systems. This result is surprising, as we expected that the second-based pricing system increases the awareness about the time-sensitive situation more than the half an hour-based pricing system. Nevertheless, as both pricing systems permanently displayed the costs of using car sharing services based on the trip duration, we assume that participants of both groups were exposed to a nearly equal time pressure, and thus, both scenarios show a comparable extent of stress. Moreover, our findings reflect that perceived stress led to a decreased propensity of the test persons to further use sustainable services. In that regard, we found that stress negatively influences attitude — a significant predictor of the intention to use car sharing. This relationship can be proved by the affective dimension of the attitude construct, as it reflects the individual's emotions — a concept that is inextricably linked to stress (Ajzen 2005; Lazarus 1993b). Following Nastjuk and Kolbe (2015), IS-induced stress is accompanied by negative emotions; therefore, this stress negatively influences the attitude toward behavior. Participants seemed to reflect the digital technology-enabled pricing systems on the attitude, and thus, on the intention to use car sharing. In line with the theory of planned behavior (Ajzen 1991), we also found perceived behavioral control and subjective norm to be important predictors of the intention to use car sharing.

As personal mobility accounts for a large part of the contribution to environmental degradation and car sharing, in general, represents a more sustainable form of flexible individual transport (Wagner et al. 2014), the results indicate how opportunities for sustainability transformation can actually be reduced by higher levels of IS support. Transferred to a higher level of abstraction, our findings thus point to a dangerous yet less-discussed adverse effect of digital technology-enabled business model innovation for sustainable service adoption. Precise pricing, e.g., in a tight temporal pricing scheme, an important characteristic of modern digital technology-enabled business models for sustainable services (Knote and Blohm 2016), may increase cognitive loads, in turn inducing stress. Although generally problematic, this effect might even hinder the future adoption of these sustainable services, leading to regression with regard to sustainability transformation. A majority of sustainability IS research so far has dealt with the question of conceptualizing as well as analyzing the relationship between IS and sustainable practices, while research on the design and actual impact of these systems is scarce (Malhotra et al. 2013). Moreover, sustainability IS research on the individual as a unit of analysis is missing (Bui and Veit 2015). Our study contributes to both these fields by, first, empirically delineating a multi-level negative impact: individuals experience increased stress levels induced by IS-supported pricing systems, which were found to negatively influence the factors influencing individual adoption behavior. By this relationship, the negative impact on the individual is elevated, as with lower adoption of sustainable services, lower environmental benefits can be gained, and progress toward sustainability transformation slows down. Second, these insights provide important aspects to consider in the design of Green IS and the services building upon them. Here the provision of more amount of as well as more frequent information and advanced monitoring of usage behavior and usage-based pricing represent design options that are enabled by IS. However, although certainly beneficial in general, the degree of their implementation needs to be handled with care as adverse effects on human behavior might emerge. To date, research on the design of green IS (e.g., Hilpert et al. 2013) has focused on the respective functionality, but rather neglected the importance of individual factors. Recent studies have described that we are witnessing a changing nature of IT (El Sawy 2003), where it is increasingly fused with everyday life (Yoo 2010). However, besides the potentials for digital innovation (Fichman et al. 2014; Yoo et al. 2010) that emerge from this development, it needs to be considered that this fusion demands more attention to the human factors in designing IS artifacts.

With these insights, we contribute to the literature on business model innovation (Chesbrough and Rosenbloom 2002) as well as digital innovation (Fichman et al. 2014). In particular, our findings reveal that conducting field experiments is an important means to uncover the potential adverse effects on human behavior, which in turn, might hinder the actual adoption of the respective innovation. Thus, our results underscore the importance of conducting experiments for business model innovation, as described by Chesbrough (2010) and Sosna et al. (2010), especially when digital technologies are deployed. Therefore, our study points to a profound issue in sustainable IS research. While the new possibilities in business model innovation that result from progresses in digital technology diffusion might increase the economics of sustainable business models (e.g., Wagner et al. 2014), thus creating options to transform our economies toward more environmentally friendly ways of doing business and consumption (Chen et al. 2008), the third pillar of sustainability, the social dimension, must not be forgotten (Elliot 2011). Apart from that, when related to the *Conceptual Model of the Intended Impact of Fundamentally Changed Human Behavior on the Environment* by Elliot (2011), our research highlights the importance of a less-discussed relationship in sustainable IS research. While prior research demonstrates how IS can provide monitoring functionalities, the impact of this IS-enabled monitoring and feedback generation via continuous display of real-time information on individual well-being is less understood. We address this perspective with our research but call for further investigations on this subject.

Moreover, further social costs emerging as increasing stress levels lead to more cases of stress-related disorders (e.g., burn-out and depression). These aspects point to the importance of employing a more sound perspective in sustainable IS research comprising economic, social, and environmental factors, as neglecting one dimension will automatically harm the others. Thus, our research contributes to recent calls to investigate the individual and societal impacts of digital transformation and related business model innovation (Loebbecke and Picot 2015).

There are important implications that can be derived from our results for managerial practice. Most importantly, we provide insights for managers in design, product or business model innovation management in regards to two specific aspects. First, experts from this audience might be questioning about using the potentials of increased connectivity to implement new or adapted business models with highly precise pricing systems. However, our results show that these potentials, appearing interesting in the economic reasoning, may have significant downturns in terms of customer acceptance as a result of the stress they impose on the individual. Higher levels of stress, induced by IS, are not only unhealthy for an individual but generally also burdens societies. In our research context of personal mobility, driver stress is related to safety issues such as accidents, and thus, injuries and deaths (Kontogiannis 2006; Matthews et al. 1998). In that regard, road traffic injuries are the eighth leading cause of death globally with approximately 1.24 million people dying each year on the world's roads (Lozano et al. 2013; WHO 2013). To counteract these adverse effects, the general display of pricing information could be less fine-grained and only provide more detailed information if demanded. As stress is an individual phenomenon, innovators may also offer customizable displays allowing customers to adapt to the level or frequency of information they feel comfortable with. Second, we show that experimental testing may be applied to identify the optimal amount and frequency of information provision and thus contribute to risk reduction in innovation, and important consideration before taking huge investments as they can be conducted with relatively small samples and yield robust results. Moreover, the insights are regularly more realistic in comparison to many other means of market research, e.g., surveys or laboratory experiments. Finally, conducting field experiments is a beneficial method to integrate the customer in the innovation process, which may result in a superior customer orientation within the business model innovation.

Limitations

The following limitations should be considered when interpreting the results of this study. Generally, field experiments in natural settings suffer from a low controllability of external factors (Harrison and List 2004). Shifting to our scenario, we could not control for certain factors that influence an individual's driving behavior and stress perception, such as traffic jams or behavior of other traffic participants. Moreover, stress perception is strongly dependent on personal factors, such as education, age, gender, driving experience, experience with e-car sharing, or affinity for technology (e.g., Burke and Mikkelsen 2005; Fernandes et al. 2009; Gallo and Matthews 2003; Nastjuk et al. 2015). In that regard, participants that are younger are probably more price sensitive and technologically educated than the general population. Furthermore, the sample in this study is relatively unexperienced with e-car sharing. However, typical early adopters of sustainable services, such as car sharing, are tendentially represented by young and educated population (Hampshire and Gaites 2011). Therefore, our results make meaningful contribution to the adoption of these services. Nevertheless, the results draw on a small sample size of 69 participants, which does not allow our results to be generalized. A variation and extension of the small sample size could increase the predictive power of the proposed research model. In addition, our results are based on a specific scenario within a European country, limiting its generalizability. To confirm the proposed research model, the influence of digital technology-enabled business models on individual stress and perception with regards to the future usage of these services should be investigated with further scenarios. Finally, there are certainly more digital technology-enabled business model design aspects beyond the pricing system. We selected this treatment due to its direct relation to customer behavior and its status as a representative characteristic of digital business models for sustainable services (e.g., Knote and Blohm 2016; Bocken et al. 2014). However, other aspects certainly need similar attention as well, thus providing important avenues for future research. Apart from that, it is notable to mention the arising interest to also compare our results to car sharing with conventional combustion engine vehicles. It appears that our results would also apply for that case. However, as we intended to investigate the impact on the acceptance of sustainable services, we opted for using e-car sharing since it demonstrates, under the right conditions, to produce less environmental degradation than car sharing with conventional vehicles and thus represents an overall greater potential contribution to sustainable transformation. However, testing our results in comparison to conventional car sharing settings has been noted as an interesting aspect to assess in future research.

Conclusion

Digital technologies afford business models for the efficient, flexible and reliable use of sustainable services, e.g., car sharing. While prior research has investigated these positive influences of IS in this regard (e.g., Hildebrandt et al. 2015), this study set out to examine the negative individual impacts that might result from specific digitalized business model design options. To do so, we developed a comprehensive research model that relates the popular transactional stress model of Lazarus and Folkman (1984) to the well-established theory of planned behavior (Ajzen 1991). To evaluate the proposed research model, we conducted experiments in real traffic situations, putting 69 participants in the mindset of car sharing users. The results indicated that the deployment of digital technology-enabled pricing systems in car sharing influences the cognitive appraisal processes in an unfavorable manner, and hence, lead to an increased stress perception. Moreover, the results revealed that an increased level of stress negatively affects the individual's decision to use car sharing in the future. With our findings, we point to a dangerous side effect of increasing IS-usage in business models and the potential negative impacts on sustainability transformation in general. Thus, we provide a foundation for further research on the societal impacts of digital technology-enabled business models.

References

Adams-Guppy, J. R., and Guppy, A. 1995. "Speeding in relation to perceptions of risk, utility and driving style by British company car drivers," *Ergonomics*, (38:12), pp. 2525-2535.

Ajzen, I. 1991. "The theory of planned behavior," *Organizational Behavior and Human Decision Processes*, (50:2), pp. 179-211.

Ajzen, I. 2005. *Attitudes, Personality and Behavior*, New York: Mc-Graw Hill International.

Ajzen, I., and Fishbein, M. 1980. *Understanding Attitudes and Predicting Social Behavior*, Englewood Cliffs, NJ: Prentice-Hall.

Allen, D., and Janda, K. 2006. „The effects of household characteristics and energy use consciousness on the effectiveness of real-time energy use feedback: a pilot study, in *Proceedings of the American Council for an Energy-Efficient Economy*, pp. 1-12.

Anderson, J. C., and Gerbing, D. W. 1988. "Structural equation modeling in practice: A review and recommended two-step approach," *Psychological Bulletin* (103:3), pp. 411-423.

Armitage, C. J., and Conner, M. 2001. "Efficacy of the Theory of Planned Behaviour: A meta-analytic review," *British Journal of Social Psychology*, (40:4), pp. 471-499.

Avey, H., Matheny, K. B., Robbins, A., and Jacobson, T. A. 2003. "Health care providers' training, perceptions, and practices regarding stress and health outcomes," *Journal of the National Medical Association* (95:9), pp. 833-845.

Babrow, A. S., Hines, S. C., and Kasch, C. R. 2000. „Managing uncertainty in illness explanation: An application of problematic integration theory," in *Explaining illness: Research, theory, and strategies*, B. Whaley (ed.), Hillsdale: Erlbaum, pp. 41–67.

Bach, K. M., Jæger, M. G., Skov, M. B., and Thomassen, N. G. 2009. "Interacting with In-Vehicle Systems: Understanding, Measuring, and Evaluating Attention," in *Proceedings of the 23rd British HCI Group Annual Conference on People and Computers: Celebrating People and Technology*, Cambridge, UK, pp. 453-462.

Bagozzi, R. P., Yi, Y., and Phillips, L. W. 1991. "Assessing Construct Validity in Organizational Research," *Administrative Science Quarterly* (36:3), pp. 421-458.

Baumann, M. R., Petzoldt, T., Groenewoud, C., Hogema, J., and Krems, J. F. 2008. "The effect of cognitive tasks on predicting events in traffic," in *Proceedings of the European Conference on Human Centred Design for Intelligent Transport Systems*, Lyon, France, pp. 3-11.

Baumeister, R. F., Bratslavsky, E., Muraven, M., and Tice, D. M. 1998. "Ego depletion: is the active self a limited resource?," *Journal of Personality and Social Psychology* (74:5), p. 1252.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., and Venkatraman, N. 2013. "Digital Business Strategy: Toward a Next Generation of Insights", *MIS Quarterly* (37:2), pp. 471–482.

Bhattacherjee, A. 2012. *Social Science Research: Principles, Methods, and Practices*, University of South Florida: Open Access Textbooks.

Bhattacherjee, A., and Premkumar, G. 2004. "Understanding Changes in Belief and Attitude Toward Information Technology Usage: A Theoretical Model and Longitudinal Test," *MIS Quarterly* (28:2), pp. 229-254.

Biernacki, P., and Waldorf, D. 1981. "Snowball Sampling: Problems and Techniques of Chain Referral Sampling," *Sociological Methods & Research* (32:1), pp. 148–170.

Bocken, N. M. P., Short, S. W., Rana, P., and Evans, S. 2014. "A literature and practice review to develop sustainable business model archetypes, " *Journal of Cleaner Production*, *65*, pp. 42-56.

Boons, F., and Lüdeke-Freund, F. 2013: "Business Models for Sustainable Innovation: State of the Art and Steps Towards a Research Agenda," *Journal of Cleaner Production* (45), pp. 9-19.

Brandt, T. 2013. "Information Systems in Automobiles –Past, Present, and Future Uses," in *Proceedings of the 19th Americas Conference on Information Systems*, Chicago, IL, pp. 1-10.

Brandt, T., Feuerriegel, S., and Neumann, D. 2012. „Road to 2020: IS-Supported Business Models for Electric Mobility and Electrical Energy Markets," in *Proceedings of the International Conference on Information Systems (ICIS)*, Orlando, FL, pp. 1-10.

Brashers, D. E. 2001. "Communication and Uncertainty Management," *Journal of Communication* (51:3), pp. 477-497.

Breckler, S. J. 1984. "Empirical validation of affect, behavior, and cognition as distinct components of attitude," *Journal of Personality and Social Psychology* (47:6), pp. 1191-1205.

Brod, C. 1984. *Technostress: The Human Cost of the Computer Revolution*, Boston, MA: Addison-Wesley.

Brooks, C., and Rakotonirainy, A. 2007. "In-vehicle technologies, Advanced Driver Assistance Systems and driver distraction: Research challenges," in *Distracted Driving*, I. J. Faulks, M. Regan, M. Stevenson, J. Brown, A. Porter, and J. D. Irwin (eds.), Sydney, Australia, pp. 471-486.

Brouwer, W. H., Withaar, F. K., Tant, M. L., and van Zomeren, A. H. 2002. "Attention and Driving in Traumatic Brain Injury: A Question of Coping with Time-Pressure," *The Journal of Head Trauma Rehabilitation* (17:1), pp. 1-15.

Bruyas, M. P., Brusque, C., Auriault, A., Tattegrain, H., Aillerie, I., and Duraz, M. 2008. "Impairment of lane change performance due to distraction: Effect of experimental contexts," in *Proceedings of European Conference on Human Centred Design for Intelligent Transport Systems*, Lyon, France, pp. 89-100.

Bui, A. and Veit, D. 2015. "The Effects of Gamification on Driver Behavior: An Example from a Free Float Carsharing Service," in Proceedings of *23rd European Conference on Information Systems (ECIS)*, Research-in-Progress Papers, Muenster, Germany, pp. 1-14.

Burke, R. J., and Mikkelsen, A. 2005. "Gender issues in policing: do they matter?," *Women in Management Review* (*20*:2), pp. 133-143.

Chen, A.J., Boudreau, M.-C. and Watson, R. 2008. "Information Systems and Ecological Sustainability," Journal of Systems and Information Technology (10:3), pp. 189-201.

Chesbrough, H., and Rosenbloom, R. S. 2002. "The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spin-Off Companies", *Industrial and Corporate Change* (11:3), pp. 529–555.

Chesbrough, H. 2010. "Business Model Innovation: Opportunities and Barriers", *Long Range Planning* (43:2), pp. 354–363.

Chin, W. W. 1998. "The Partial Least Squares Approach to Structural Equation Modeling," *Modern Methods for Business Research* (295:2), pp. 295-336.

Cohen, J. 1992. "A power primer," *Psychological Bulletin* (112:1), pp. 155-159.

Corbett, J., Webster, J., Boudreau, M.-C., and Watson, R. 2011. "Defining the Role for Information Systems in Environmental Sustainability Measurement," *Sprouts: Working Papers on Information Systems* (11:2), pp. 1-9.

Crocker, J., and Major, B. 1989. "Social Stigma and Self-Esteem: The Self-Protective Properties of Stigma," *Psychological Review* (96:4), pp. 608-630.

Desyllas, P., and Sako, M. 2013. "Profiting from business model innovation: Evidence from Pay-As-You-Drive auto insurance," *Research Policy* (42:1), pp. 101-116.

Dogan, E., Bolderdijk, J. W., and Steg, L. 2014. "Making small numbers count: environmental and financial feedback in promoting eco-driving behaviours," *Journal of Consumer Policy* (37:3), pp. 413-422.

Dyllick, T., and Hockerts, K. 2002. "Beyond the Business Case for Corporate Sustainability," *Business Strategy and the Environment* (141), pp. 130-141.

Eisel, M., Schmidt, J., Nastjuk, I., Ebermann, C., and Kolbe, L. 2014. „Can Information Systems Reduce Stress? The Impact of Information Systems on Perceived Stress and Attitude," in *Proceedings of the 35th International Conference on Information Systems*, M. D. Mayers and D. Straub (eds.), Auckland, NZ, pp. 1-16.

El Sawy, O. A. 2003. "The IS Core IX: The 3 Faces of IS identity: connection, immersion, and fusion," *Communications of the Association for Information Systems*, (12:1), pp. 588-598.

El Sawy, O. A., and Pereira, F. 2013. Business modelling in the dynamic digital space: An ecosystem approach. Los Angeles: Springer.Elkington, J. 1998. *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, Stoney Creek: New Society Publishers.

Elliot, S. 2011. "Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-enabled Business Transformation," *MIS Quarterly* (35:1), pp. 197-236.

Faruqui, A., Sergici, S., and Sharif, A. 2010. "The impact of informational feedback on energy consumption—A survey of the experimental evidence," *Energy* (35:4), pp. 1598-1608.

Fernandes, C. F. V., Kumar, S., and Nandakumar, M. 2009. "Gender Differences in Stress among Bank Officers of Private and Public Sectors," *The IUP Journal of Organizational Behaviour*, pp. 1-7.

Field, A., Miles, J., and Field, Z. 2013. *Discovering Statistics using IBM SPSS Statistics*, London, UK: SAGE Publications Ltd..

Folkman, S. 1984. "Personal Control and Stress and Coping Processes: A Theoretical Analysis," *Journal of Personality and Social Psychology* (46:4), pp. 839-852.

Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), pp. 39-50.

Fichman, R. G., Dos Santos, B. L., and Zheng, Z. (E.) 2014. "Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum," *MIS Quarterly* (38: 2), pp.329-353.

Fisher, C. 1996. "The Impact of Perceived Environmental Uncertainty and Individual Differences on Management Information Requirements: A Research Note," *Accounting, Organizations and Society* (21:4), pp. 361-369.

Francis, J. J., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy, R., Kaner, E. F. S., Smith, L., and Bonetti, D. 2004. *Constructing questionnaires based on the theory of planned behaviour. A manual for health services researchers*, Newcastle upon Tyne, UK: Centre for Health Services Research, University of Newcastle upon Tyne, pp. 1-42.

Fuller, R. 2000. "The task-capability interface model of the driving process," *Recherche-Transports-Sécurité* (66), pp. 47-57.

Fuller, R. 2005. "Towards a general theory of driver behavior," *Accident Analysis and Prevention* (37), pp. 461-472.

Gaab, J. 2009. "PASA–Primary Appraisal Secondary Appraisal," *Verhaltenstherapie* (19:2), pp. 114-115.

Gaab, J., Rohleder, N., Nater, U. M., and Ehlert, U. 2005. "Psychological determinants of the cortisol stress response: the role of anticipatory cognitive appraisal," *Psychoneuroendocrinology* (30:6), pp. 599-610.

Galliers, R., Newell, S., Shanks, G., Topi, H. 2015. "Call for papers for the special issue: the challenges and opportunities of 'datification'; Strategic impacts of 'big' (and 'small') and real time data – for society and for organizational decision makers," *The Journal of Strategic Information Systems* (24:2), pp. II–III.

Gallo, L. C., and Matthews, K. A. 2003. "Understanding the association between socioeconomic status and physical health: do negative emotions play a role?," *Psychological Bulletin* (129:1), pp. 10-51.

Greenwald, A. G. 2014. "Why are Attitudes Important," in *Attitude structure and function*, A. R. Pratkanis, S. J. Breckler and A. G. Greenwald (eds.), New York: Psychology Press, pp. 429-440.

Groër, C., Golden, B., and Wasil, E. 2009. "The Consistent Vehicle Routing Problem," Manufacturing & Service Operations Management (11:4), 2009, pp. 630-643.

Gulian, E., Matthews, G., Glendon, A. I., Davies, D. R., and Debney, L. M. 1989. "Dimensions of driver stress," *Ergonomics* (32:6), pp. 585-602.

Hair, J. F., Ringle, C. M., and Sarstedt, M. 2011. "PLS-SEM: Indeed a Silver Bullet," *Journal of Marketing Theory and Practice* (19:2), pp. 139–151.

Hampshire, R., and Gaites, C. 2011. "Peer-to-peer carsharing: Market Analysis and Potential Growth," *Transportation Research Record: Journal of the Transportation Research Board* (2217), pp. 119-126.

Hanelt, A., Nastjuk, I., Krüp, H., Eisel, M., Ebermann, C., Brauer, B., Piccinini, E., Hildebrandt, B. and and Kolbe, L. M. (2015), "Disruption on the Way? The Role of Mobile Applications for Electric Vehicle Diffusion", in Proceedings of the 12th International Conference on Wirtschaftsinformatik, Osnabrück.

Harrison, G. W., and List, J. A. 2004. "Field experiments," *Journal of Economic literature* (42:4), pp. 1009-1055.

Haustein, S., and Hunecke, M. 2007. "Reduced Use of Environmentally Friendly Modes of Transportation Caused by Perceived Mobility Necessities: An Extension of the Theory of Planned Behavior1," *Journal of Applied Social Psychology* (37:8), pp. 1856-1883.

Haynes, S. N., Richard, D., and Kubany, E. S. 1995. "Content Validity in Psychological Assessment: A Functional Approach to Concepts and Methods," *Psychological assessment* (7:3), pp. 238-247.

Henseler, J., Ringle, C. M., and Sinkovics, R. R. 2009. "The Use of Partial Least Squares Path Modeling in International Marketing," *Advances in International Marketing* (20:1), pp. 277-319.

Heylighen, F. 2002. "Complexity and Information Overload in Society: Why Increasing Efficiency Leads to Decreasing Control," *Draft Paper for The Information Society*, pp. 1-19.

Hildebrandt, B., Hanelt, A., Piccinini, E., Kolbe, L., and Nierobisch, T. 2015. "The Value of IS in Business Model Innovation for Sustainable Mobility Services - The Case of Carsharing," in *Wirtschaftsinformatik Proceedings 2015*, pp. 1008-1022.

Hilpert, D. W. I. H., Kranz, J., and Schumann, M. 2013. "Leveraging Green IS in logistics," *Business & Information Systems Engineering* (5:5), pp. 315-325.

Hollnagel, E., Nåbo, A., and Lau, I. 2003. "A systemic model for driver-in-control," in 2nd *International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*, Iowa City, IA, pp. 86-91.

Horberry, T., Anderson, J., Regan, M. A., Triggs, T. J., and Brown, J. 2006. "Driver Distraction: The Effects of Concurrent In-Vehicle Tasks, Road Environment Complexity and Age on Driving Performance," *Accident Analysis & Prevention* (38:1), pp. 185-191.

Hulland, J. 1999. "Use of partial least squares (PLS) in strategic management research: A review of four recent studies," *Strategic Management Journal* (20:2), pp: 195-204.

IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

Jenkin, T., Webster, J. and McShane, L. 2011. "An Agenda for 'Green' Information Technology and Systems Research," *Information and Organization* (21:1), pp. 17-40.

Jerusalem, M., and Schwarzer, R. 1992. "Self-efficacy as a resource factor in stress appraisal processes," in *Self-Efficacy: Thought Control of Action*, R. Schwarzer (ed.), London: Routledge, pp. 195-213.

Karau, S. J., and Kelly, J. R. 1992. "The Effects of Time Scarcity and Time Abundance on Group Performance Quality and Interaction Process," *Journal of Experimental Social Psychology* (28:6), pp. 542-571.

Katzev, R. 2003. "Car sharing: A new approach to urban transportation problems," *Analyses of Social Issues and Public Policy* (*3*:1), pp. 65-86.

Keinan, G., Friedland, N., Kahneman, D., and Roth, D. 1999. "The Effect of Stress on the Suppression of Erroneous Competing Responses," *Anxiety, Stress & Coping* (12:4), pp. 455-476.

Kelly, J. R., Jackson, J. W., and Hutson-Comeaux, S. L. 1997. "The Effects of Time Pressure and Task Differences on Influence Modes and Accuracy in Decision-Making Groups," *Personality and Social Psychology Bulletin* (23:1), pp. 10-22.

Kienhues, D., and Bromme, R. 2011. "Beliefs about abilities and epistemic beliefs: Aspects of cognitive flexibility in information-rich environments," in *Links between beliefs and cognitive flexibility*, J. Elen, E. Stahl, R. Bromme, G. Clarebout (eds.), Luxemburg: Springer Science & Business Media, pp. 105-124.

King, J.L., and Lyytinen, K. 2004. "Automotive Informatics: Information Technology and Enterprise Transformation in the Automobile Industry," In Dutton, W.H., Kahin, B., O'Callaghan, R., and Wycoff, A. Transforming Enterprise, MIT Press, pp. 283-313.

Knote, R. and Blohm, I. 2016. "Deconstructing the Sharing Economy: On the relevance for IS research," in *Proccedings of Multikonferenz Wirtschaftsinformatik (MKWI)*, Illmenau, Germany, pp. 45-54.

Kontogiannis, T. 2006. "Patterns of driver stress and coping strategies in a Greek sample and their relationship to aberrant behaviors and traffic accidents," *Accident Analysis & Prevention* (38:5), pp. 913-924.

Kossahl, J., Busse, S. & Kolbe, L.M. 2012. "The Evolvement of Energy Informatics in the Information Systems Community: A Literature Analysis and Research Agenda," in *ECIS 2012 Proceedings*, Barcelona, pp. 1-13.

Krueger, N. F., Reilly, M. D., and Carsrud, A. L. 2000. "Competing Models of Entrepreneurial Intentions," *Journal of Business Venturing* (15:5), pp. 411-432.

Krum, D. M., Faenger, J., Lathrop, B., Sison, J. A., and Lien, A. 2008. "All roads lead to CHI: interaction in the automobile," in *Extended Abstracts Proceedings of the 2008 Conference on Human Factors in Computing Systems*, Florence, Italy, pp. 2387-2390.

Kulviwat, S., Bruner, I. I., Gordon, C., Kumar, A., Nasco, S. A., and Clark, T. 2007. "Toward a unified theory of consumer acceptance technology," *Psychology & Marketing* (24:12), pp. 1059-1084.

Lazarus, R.S. 1966. *Psychological Stress and the Coping Process*, New York: McGraw-Hill.

Lazarus, R. S. 1993a. "From Psychological Stress to the Emotions: A History of Changing Outlooks," *Annual Review of Psychology* (44:1), pp. 1-22.

Lazarus, R.S. 1993b. "Why we Should Think of Stress as a Subset of Emotion," in *Handbook of stress: Theoretical and clinical aspects*, L. Goldberger and S. Breznitz (eds.), New York: Free Press, pp. 21-39.

Lazarus, R. S. 2006. *Stress and Emotion: A New Synthesis*, New York: Springer.

Lazarus, R. S., and Folkman, S. 1984. *Stress, Appraisal, and Coping*, New York: Springer.

Lazarus, R. S., and Folkman, S. 1987. „Transactional Theory and Research on Emotions and Coping," *European Journal of Personality* (1), pp. 141-169.

Lee, J., Nah, J., Park, Y., and Sugumaran, V. 2011. “Electric Car Sharing Service Using Mobile Technology,” in *Proceedings of the International Conference on Information Resources Management (*CONF-IRM), Seoul, South Korea, pp. 1-8.

Loebbecke, C. and Picot, A. 2015. “Reflections on Societal and Business Model Transformation Arising From Digitization and Big Data Analytics: A Research Agenda”, Journal of Strategic Information Systems (24), pp. 149–157.

Lohmoeller, J.-B. 1989. *Latent Variable Path Modeling with Partial Least Squares*, Heidelberg: Physica.

Lozano, R., ... , and Murray, C. J. L. 2013. “Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010,” *The Lancet* (380:9859), pp. 2095-2128.

Malhotra, A., Melville, N. and Watson, R. 2013. “Spurring Impactful Research on Information Systems for Environmental Sustainability,” *MIS Quarterly* (37:4), pp. 1265-1274.

Marin, M. F., Lord, C., Andrews, J., Juster, R. P., Sindi, S., Arsenault-Lapierre, G., Fiocco, A. J., and Lupien, S. J. 2011. “Chronic Stress, Cognitive Functioning and Mental Health,” *Neurobiology of Learning and Memory* (96:4), pp. 583-595.

Mathieson, K. 1991. “Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior,” *Information Systems Research* (*2*:3), pp. 173-191.

Matt, C., Hess, T., and Benlian, A. 2015. “Digital Transformation Strategies,” *Business & Information Systems Engineering* (57:5), pp. 339-343.

Matthews, G., Dorn, L., and Glendon, A. I. 1991. “Personality Correlates of Driver Stress,” *Personality and Individual Differences* (*12*:6), pp. 535-549.

Matthews, G., Dorn, L., Hoyes, T. W., Davies, D. R., Glendon, A. I., and Taylor, R. G. 1998. “Driver Stress and Performance on a Driving Simulator,” *Human Factors: The Journal of the Human Factors and Ergonomics Society* (40:1), pp. 136-149.

McKight, P. E., and Najab, J. 2010. Kruskal-Wallis Test, in: Weiner, I. B., & Craighead, W. E. *The Corsini encyclopedia of psychology* (Vol. 4). John Wiley & Sons. *Corsini Encyclopedia of Psychology*.

Melville, N. P. 2010. “Information systems innovation for environmental sustainability,” *MIS Quarterly* (34:1), pp. 1-21.

Merali, Y., Papadopoulos, T., and Nadkarni, T. 2012. “Information Systems Strategy: Past, Present, Future?,” *The Journal of Strategic Information Systems* (21:2), pp. 125-153.

Meschtscherjakov, A., Wilfinger, D., Scherndl, T., and Tscheligi, M. 2009. „Acceptance of future persuasive in-car interfaces towards a more economic driving behaviour,” in *Proceedings of the 1st International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, Essen, Germany, pp. 81-88.

Millard-Ball, G. Murray, J. Ter Schure, C. Fox, and Burkhardt, J. 2005. “TCRP report 108: Car-sharing: Where and how it succeeds,” Transp. Res. Board Nat. Acad., Washington, DC.

Nachar, N. 2008. “The Mann-Whitney U: A test for assessing whether two independent samples come from the same distribution,” *Tutorials in Quantitative Methods for Psychology* (4:1), pp. 13-20.

Nastjuk, I., and Kolbe, L. M. 2015. “On the Duality of Stress in Information Systems Research - The Case of Electric Vehicles,” in *36th International Conference on Information Systems (ICIS),* Fort Worth, Texas, pp. 1-22.

Nastjuk, I., Trang, S., Kolbe, L. M. 2015. “The Influence of Sociodemographic and Technology-Associated Factors on Stress from Human Interaction with Electric Vehicle Information Systems,” in *21st Americas Conference on Information Systems (AMCIS)*, Puerto Rico, pp. 1-14.

Nordstokke, D. W., Zumbo, B. D., Cairns, S. L., and Saklofske, D. H. 2011. “The operating characteristics of the nonparametric Levene test for equal variances with assessment and evaluation data,” *Practical Assessment, Research & Evaluation* (16:5), pp. 1-8.

Oltra, C., Boso, A., Espluga, J., and Prades, A. 2013. “A qualitative study of users' engagement with real-time feedback from in-house energy consumption displays,” *Energy Policy* (61), *pp.* 788-792.

Osch, W. van, and Avital, M. 2010. “From Green IT to Sustainable Innovation,” in *AMCIS 2010 Proceedings*. Paper 490.

Osswald, S., Wurhofer, D., Trösterer, S., Beck, E., and Tscheligi, M. 2012. “Predicting Information Technology Usage in the Car: Towards a Car Technology Acceptance Model,” in *Proceedings of the 4th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, Portsmouth, NH, pp. 51-58.

Osterwalder, A., Pigneur, Y., and Tucci, C.L. 2005. "Clarifying Business Models: Origins, Present, and Future of the Concept," *Communications of the Association for Information* (16), pp. 1-25.

Pavlou, P. A., and Fygenson, M. 2006. "Understanding and Predicting Electronic Commerce Adoption: An Extension of the Theory of Planned Behavior," *MIS Quarterly* (30:1), pp. 115-143.

Penrod, J. 2001. "Refinement of the Concept of Uncertainty," *Journal of Advanced Nursing* (*34*:2), pp. 238-245.

Pettitt, M., Burnett, G. E., and Stevens, A. 2005. "Defining driver distraction," in *Proceedings of the 12th ITS World Congress on Intelligent Transport Systems*., San Francisco, USA.

Perrewé, P. L. and Zellars, K. L. 1999. "An Examination of Attributions and Emotions in the Transactional Approach to the Organizational Stress Process," *Journal of Organizational Behavior* (20:5), pp. 739-752.

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., and Tu, Q. 2008. "The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation," *Information Systems Research* (19:4), pp. 417-433.

Rauh, N., Franke, T., and Krems, J. F. 2014. "Understanding the Impact of Electric Vehicle Driving Experience on Range Anxiety," *Human Factors: The Journal of the Human Factors and Ergonomics Society* (57:1), pp. 177-187.

Reinartz, W. J., Haenlein, M., and Henseler, J. 2009. "An Empirical Comparison of the Efficacy of Covariance-Based and Variance Based SEM," *International Journal of Market Research* (26:4), pp. 332–344.

Rice, W. R. 1989. "Analyzing Tables of Statistical Tests," *Evolution* (*43*:1), pp. 223-225.

Richardson, S., Shaffer, J. A., Falzon, L., Krupka, D., Davidson, K. W., and Edmondson, D. 2012. "Meta-analysis of Perceived Stress and its Association with Incident Coronary Heart Disease," *The American Journal of Cardiology* (110:12), pp. 1711-1716.

Riedl, R., Kindermann, H., Auinger, A., and Javor, A. 2012. „Technostress from a Neurobiological Perspective," *Business & Information Systems Engineering* (4:2), pp. 61-69.

Ringle, C. M., Sarstedt, M., and Straub, D. 2012. "A Critical Look at the Use of PLS-SEM in MIS Quarterly," *MIS Quarterly* (36:1), pp. iii-xiv.

Ringle, C. M., Wende, S., and Becker, J. 2015. SmartPLS 3. Bönningstedt.

Rotter, J. B. 1966. "Generalized Expectancies for Internal versus External Control of Reinforcement," *Psychological Monographs: General and Applied* (80:1), pp. 1-28.

Sbihi, A., and Eglese, R.W. 2010. "Combinatorial Optimization and Green Logistics," Annals of Operations Research (175:1), pp. 159-175.

Schaltegger, S., Lüdeke-Freund, F., and Hansen, E. G. 2012. "Business Cases for Sustainability: The Role of Business Model Innovation for Corporate Sustainability," *International Journal of Innovation and Sustainable Development* (6:2), pp. 95-119.

Schmidt, A., Dey, A. K., Kun, A. L., and Spiessl, W. 2010. "Automotive user interfaces: human computer interaction in the car," in *Proceedings of the 28th International Conference on Human Factors in Computing*, Atlanta, GA, pp. 3177-3180.

Seidel, S., Recker, J., and vom Brocke, J. 2013. "Sensemaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformations," *MIS Quarterly* (37:4), pp. 1275-1299.

Shaheen, S.A., Sperling, D., and Wagner, C. 1998. "Carsharing in Europe and North America: Past, Present, and Future," Transportation Quarterly (52:3), pp. 35-52.

Shinar, D. 1998. "Aggressive driving: the contribution of the drivers and the situation," *Transportation Research Part F: Traffic Psychology and Behaviour*, (1:2), pp. 137-160.

Sosna, M., Trevinyo-Rodríguez, R. N., and Velamuri, S. R. 2010. "Business model innovation through trial-and-error learning: The Naturhouse case," *Long range planning* (43:2), pp. 383-407.

Tate, E. D., Harpster, M. O., and Savagian, P. J. 2008. "The Electrification of the Automobile: From Conventional Hybrid, to Plug-in Hybrids, to Extended-Range Electric Vehicles," *SAE International Journal of Passanger Cars –Electronic and Electrical Systems* (1:1), pp. 156-166.

Teubner, T., and Flath, C. M. 2015. "The economics of multi-hop ride sharing," *Business & Information Systems Engineering*, (*57*:5), pp. 311-324.

Thoits, P. A. 1995. "Stress, coping, and social support processes: Where are we? What next?," *Journal of health and social behavior* (35), pp. 53-79.

Tilson, D., Lyytinen, K. and Sørensen, C. 2010. "Research Commentary-digital Infrastructures: the Missing IS Research Agenda", *Information Systems Research* (21:4), pp. 748–759.

Tulusan, J., Staake, T., and Fleisch, E. 2012. "Providing eco-driving feedback to corporate car drivers: what impact does a smartphone application have on their fuel efficiency?," in *Proceedings of the 2012 ACM conference on ubiquitous computing*, Pittsburgh, USA, pp. 212-215.

Veit, D., Clemons, E., Benlian, A., Buxmann, P., Hess, T., Spann, M., Kundisch, D., Leimeister, J. M., and Loos, P. 2014. "Business Models - An Information Systems Research Agenda," *Business & Information Systems Engineering* (6:1), pp. 45-53.

Volkswagen AG 2016. "e-up! - Technische Daten des Wagens - Reichweite," (available at http://www.volkswagen.de/de/models/up/varianten.s9_trimlevel_detail.suffix.html/e-up~2Fe-up.html#/tab=1bae3a9b847aaf26d6dd239d0475be8f).

Vom Brocke, J. and Seidel, S. 2012. "Environmental Sustainability in Design Science Research: Direct and Indirect Effects of Design Artifacts Design Science Research in Information Systems", in *Advances in Theory and Practice*, K. Peffers, M. Rothenberger and B. Kuechler (eds.), Berlin/Heidelberg: Springer, pp. 294-308.

Wagner, S., Brandt, T., Kleinknecht, M., and Neumann, D. 2014. "In Free-Float: How Decision Analytics Paves the Way for the Carsharing Revolution", in *35th International Conference on Information Systems (ICIS 2014)*, Auckland, New Zealand, pp. 1-17.

Watson, R. T., Boudreau, M.-C. and Chen, A. J. 2010. "Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the Is Community", *MIS Quarterly* (34:1), pp. 23–38.

Weikl, S., and Bogenberger, K. 2012. "Relocation Strategies and Algorithms for free-floating Car Sharing Systems," Intelligent Transportation Systems Magazine, IEEE (5:4), pp. 100-111.

Weil, M. M., and Rosen, L. D. 1997. *Technostress: Coping with technology @ work @ home @ play*, New York: John Wiley & Sons.

Whitson, J. A., and Galinsky, A. D. 2008. "Lacking control increases illusory pattern perception", *Science* (322:5898), pp. 115-117.

WHO (World Health Organization). 2008. "The global burden of disease: 2004 update," Geneva, Switzerland.

WHO (World Health Organization). 2013. "Global status report on road safety 2013: supporting a decade of action," Geneva, Switzerland.

Wickens, C. M., Mann, R. E., and Wiesenthal, D. L. 2013. "Addressing Driver Aggression Contributions From Psychological Science", *Current Directions in Psychological Science* (*22*:5), pp. 386-391.

Wright, P. 1974. "The Harassed Decision Maker: Time Pressures, Distractions, and the Use of Evidence", *Journal of Applied Psychology* (*59*:5), pp. 555-561.

Wunderlich, P., Kranz, J. and Veit, D. 2013. "Beyond carrot-and-stick: How values and endogenous motivations affect residential Green IS adoption," in *Proceedings of the International Conference on Information Systems* (ICIS), Milano, Italy, pp. 1-19.

Wurman, R. A. 2001. *Information Anxiety 2*, New York, NY: New Riders Publishers.

Yoo, Y.J. 2010. "Computing in Everyday Life: A Call for Research on Experiential Computing", *MIS Quarterly* (34:2), pp. 213–231.

Zolnowski, A., Schmitt, A. K., and Böhmann, T. 2011. „Understanding the impact of remote service technology on service business models in manufacturing: from improving after-sales services to building service ecosystems," *ECIS 2011 Proceedings*, Paper 109.

Zur, H. B., and Breznitz, S. J. 1981. "The Effect of Time Pressure on Risky Choice Behavior", *Acta Psychologica* (47:2), pp. 89-104.