



# Introducing a multivariate model for predicting driving performance: The role of driving anger and personal characteristics

Ernst Roidl <sup>\*</sup>, Felix Wilhelm Siebert, Michael Oehl, Rainer Höger

Institute of Experimental Industrial Psychology, Leuphana University of Lüneburg, Wilschenbrucher Weg 84a, 21335, Lüneburg, Germany

## ARTICLE INFO

### Article history:

Received 25 October 2012  
Received in revised form 2 June 2013  
Accepted 1 August 2013  
Available online 15 August 2013

### Keywords:

Emotions  
Driving anger  
Driving motivation  
Driving performance  
Risky driving

## ABSTRACT

**Introduction:** Maladaptive driving is an important source of self-inflicted accidents and this driving style could include high speeds, speeding violations, and poor lateral control of the vehicle. The literature suggests that certain groups of drivers, such as novice drivers, males, highly motivated drivers, and those who frequently experience anger in traffic, tend to exhibit more maladaptive driving patterns compared to other drivers. Remarkably, no coherent framework is currently available to describe the relationships and distinct influences of these factors. **Method:** We conducted two studies with the aim of creating a multivariate model that combines the aforementioned factors, describes their relationships, and predicts driving performance more precisely. The studies employed different techniques to elicit emotion and different tracks designed to explore the driving behaviors of participants in potentially anger-provoking situations. Study 1 induced emotions with short film clips. Study 2 confronted the participants with potentially anger-inducing traffic situations during the simulated drive. **Results:** In both studies, participants who experienced high levels of anger drove faster and exhibited greater longitudinal and lateral acceleration. Furthermore, multiple linear regressions and path-models revealed that highly motivated male drivers displayed the same behavior independent of their emotional state. The results indicate that anger and specific risk characteristics lead to maladaptive changes in important driving parameters and that drivers with these specific risk factors are prone to experience more anger while driving, which further worsens their driving performance. Driver trainings and anger management courses will profit from these findings because they help to improve the validity of assessments of anger related driving behavior.

© 2013 National Safety Council and Elsevier Ltd. All rights reserved.

## 1. Introduction and theoretical background

In recent years, driving at high speeds has become prevalent on streets worldwide (Deffenbacher, Deffenbacher, Lynch & Richards, 2003; Paleti, Eluru and Bhat, 2010; Stradling & Parker, 1997). The American Automobile Association found that speeding was responsible for 31% of incidents and was the most prevalent cause of fatal crashes between 2003 and 2007 (AAA Foundation for Traffic Safety, 2009). In Germany, almost 400,000 people were involved in traffic accidents in 2011, and approximately 4000 people died (Destatis, 2012); maladaptive speeds (e.g., speeding, or failing to adjust for bad weather or road conditions) were responsible for over 26% of vehicle crashes. The impact of high speeds on driving safety is manifold. For example, driving too fast can lead to decreased reaction times and to the loss of control over the car or to reductions in the distances from other traffic to below safe levels due to increased variation in speed across all traffic (Aarts & Van Schagen, 2006). However, the currently available traffic studies normally do not provide any conclusions about the motivational or emotional states of the drivers, and speeding is usually described

simply as an example of dangerous, risky, and/or aggressive driving behavior (AAA Foundation for Traffic Safety, 2009; NHTSA, 2008). The lack of information about driver states and the use of different wordings across studies may inhibit understanding, create communication problems between researchers, and slow the pace of progress in the traffic psychology domain (Dula & Geller, 2003; Reason, Manstead, Stradling, Baxter & Campbell, 1990).

Shinar (1998) defines two states of unsafe driving behavior. In the “cold”-state, drivers exhibit maladaptive driving behaviors, such as driving at high speeds or violating the speed limit in a risky but non-malicious way, to overcome obstacles and accomplish their goals without the intention of harming others. However, drivers in a “hot”-state are prone to behave aggressively toward other drivers (Shinar, 1998). Both states can involve tailgating, running red lights and cutting other drivers off, but only the latter state incorporates the clear intention to do harm (Dula & Geller, 2003; Ellison-Potter, Bell & Deffenbacher, 2001; Lajunen, Parker & Stradling, 1998). Dula and Geller (2003) suggested that the term dangerous driving be defined as a construct with three dimensions: risk-taking, negative emotions experienced while driving, and intentional acts of aggression toward others. Several correlations exist between these dimensions and their impacts on driving safety. Risk taking can include driving at high speeds, fast acceleration, and poor lateral control (Dula & Ballard, 2003) and may be intensified

<sup>\*</sup> Corresponding author. Tel.: +49 176 210 5555 4; fax: +49 4131 677 7935.

E-mail addresses: [roidl@leuphana.de](mailto:roidl@leuphana.de) (E. Roidl), [felix.siebert@leuphana.de](mailto:felix.siebert@leuphana.de) (F.W. Siebert), [oehl@leuphana.de](mailto:oehl@leuphana.de) (M. Oehl), [hoeger@leuphana.de](mailto:hoeger@leuphana.de) (R. Höger).

by negative emotions such as anger and/or frustration (Stephens & Groeger, 2009). The effect of negative emotions may be due to more perceived control and therefore more optimistic risk appraisal (Lerner & Keltner, 2001). The influence of anger and risk-taking on higher speeds and increased acceleration in traffic has been shown in a series of studies (Deffenbacher et al., 2003; Matthews et al., 1998; Mesken, Hagenzieker, Rothengatter & De Waard, 2007; Stephens & Groeger, 2009). Aggressive actions while driving are also related to the emotions of frustration and/or anger and usually include intentionally aggressive actions directed toward other drivers including gestures, honking, and giving chase (Britt & Garrity, 2006; Dula & Ballard, 2003; Taubman-Ben-Ari, Mikulincer & Gillath, 2004). Velocity, acceleration, lateral acceleration, and speeding were the focus of this study due to the relevance of these factors to emotional driving that has been documented in the literature (Cai & Lin, 2011; Deffenbacher et al., 2003; Stephens & Groeger, 2009).

Research suggests that driving-related anger is an important negative emotion that can increase risky driving behaviors such as driving high speeds and/or speeding (Björklund, 2008; Deffenbacher et al., 2003; Lajunen & Parker, 2001; Nesbit, Conger & Conger, 2007). However, other variables, such as driving experience, gender (Björklund, 2008; Dula & Ballard, 2003; Ferguson, 2003; Laapotti & Keskinen, 2004; Mesken, Lajunen & Sumala, 2002), and driving motivation (Philippe, Vallerand, Richer, Vallières & Bergeron, 2009), can also lead to similar driving patterns. There is little research employing empirically tested models that combine these variables to reveal the interactions and distinct impacts of personal characteristics, driving-related anger, and key indicators of safe driving performance. To create and validate such a model, we conducted two simulator studies. The core elements of our model are the following: (a) the impact of anger on potentially relevant driving parameters (velocity, speeding, longitudinal and lateral acceleration); (b) the influence of personal characteristics on the experience of anger experiences in traffic; and (c) the impact of personal characteristics on the driving parameters independent of anger. The following sections review the literature and discuss the key findings regarding these specific core components. The lack of research that examines the interactions of these elements emphasizes the necessity of a coherent model.

### 1.1. Driving anger and risky driving

Unlike emotional and hostile aggression in driving situations, which is fed by strong emotional states and focuses on harming other traffic participants, risky driving patterns often lack accompanying emotions or the intention to harm (Shinar, 1998). Nonetheless, studies indicate a consistent relationship between anger and specific risky driving behavior in traffic (e.g., Dahlen & White, 2006; Deffenbacher et al., 2003). Most importantly, anger can produce increases in speed (Deffenbacher, Lynch, Oetting & Yingling, 2001; Matthews et al., 1998; Underwood, Chapman, Wright & Crundall, 1999), traffic violations (Maxwell, Grant & Lipkin, 2005; Sümer, 2003), and more generic risky behavior such as driving recklessly or acting carelessly when other people are in the car (Deffenbacher et al., 2001). These behaviors can increase the risk of crashes and endanger other road participants (Chliaoutakis et al., 2002; Deffenbacher et al., 2003; Underwood et al., 1999). Generally, a moderate relationship exists between anger and risky driving, which is typically described with broad behaviors (e.g., reckless or drunk driving) and less often in terms of the specific driving patterns. Therefore, real driving and simulator studies are necessary to adequately assess driving parameters such as speed (Matthews et al., 1998; Mesken et al., 2007). Stephens and Groeger (2009) added means and standard deviations of longitudinal and lateral acceleration, lateral position, steering throttle and brake input to the predicted parameters. Those authors revealed a consistent relationship between high anger levels and increased values for most of those variables.

### 1.2. Personal characteristics and driving anger

To describe the factors that influence anger in traffic environments more precisely, the personal characteristics of the driver must be taken into account (Mesken, Lajunen & Sumala, 2002). Driving experience, as measured in total or yearly mileage, is inconsistent as a predictor of anger and is strongly dependent on gender (Lajunen & Parker, 2001). In a study by Björklund (2008), driving experience was found to influence drivers' anger levels in situations involving reckless driving or direct hostility toward others but only for female participants. In the male population, there was no effect of mileage on experienced anger (Björklund, 2008). The gender of the participants can influence anger-reactivity in various situations: men report more anger when they are impeded by other drivers (Deffenbacher, Oetting & Lynch, 1994), and women are more angered when they are confronted with direct hostility, illegal actions by others, or traffic obstructions (Parker, Lajunen & Sumala, 2002). Together, these findings seem to indicate a strong situational component in the relationship between anger, driving experience, and gender.

A more constant link exists between trait-related anger and 'state anger,' which is the actual anger experienced in traffic situations (Deffenbacher, Huff, Lynch, Oetting & Salvatore, 2000; Deffenbacher et al., 2001). People show different tendencies to become angry in traffic, such as in frustrating or provoking situations (Deffenbacher et al., 2003). Subsequently, drivers with high trait anger experience more and intensified anger in such situations compared to drivers scoring low on trait anger (Deffenbacher et al., 2003; Spielberger, 1988). This disposition to become angry in traffic is a construct labeled trait-driving anger and is often measured with the driving anger scale (DAS, Deffenbacher et al., 1994).

Another important determinant of anger while driving is driving motivation. When driving begins to play a role in the personal identities of traffic participants and becomes an obsessive passion that controls their actions, it can lead to intensified driving behavior (Philippe et al., 2009; Vallerand, 2008). These highly motivated drivers tend to experience more intense and more frequent negative emotions such as anger in goal-blocking situations (e.g., impeded progress on the road or the erratic driving of others; Philippe et al., 2009).

Reviews of the big five factors (extraversion, neuroticism, conscientiousness, agreeableness, and openness) have revealed that sometimes neuroticism is related to anger in driving contexts, and emotionally unstable individuals report more intense anger in various traffic situations (Dahlen & White, 2006).

### 1.3. Personal characteristics and risky driving

In addition to the relationship between personal characteristics and driving anger, some evidence indicates a direct influence of personal characteristics on risky driving patterns without driving anger (Fisher et al., 2002; Krahé & Fenske, 2002; Reason et al., 1990). Males drive faster than females in traffic (De Winter et al., 2009; Dejoy, 1992; Shinar, Schechtman & Compton, 2001), which may increase the frequency and severity of accidents. An important reason for this behavior is the differences in risk homeostasis levels between males and females, which increase risk taking behavior in males, which could in turn lead to higher speeds and more traffic violations in general (Deery & Fildes, 1999; Laapotti & Keskinen, 2004; Rosenbloom, Sahar, Elharar & Danino, 2008). Furthermore, male drivers may overestimate their driving skills, which could lead to driving at higher speeds and increases in the frequency of involvement in motor vehicle accidents (Deery & Fildes, 1999; Dejoy, 1992; Ulleberg, 2002; Yagil, 1998).

The findings surrounding the impact of driving experience on (maladaptive) driving performance are more complex. There is a consensus that constant exposure to traffic (operationalized as miles per year) shapes the mental models of drivers and improves their abilities to detect hazards (Brown & Groeger, 1988; Deery & Fildes, 1999; McKnight & McKnight, 2000; Underwood, Chapman, Brocklehurst, Underwood &

Download English Version:

<https://daneshyari.com/en/article/587440>

Download Persian Version:

<https://daneshyari.com/article/587440>

[Daneshyari.com](https://daneshyari.com)