



# Velocity, safety, or both? How do balance and strength of goal conflicts affect drivers' behaviour, feelings and physiological responses?



Martin Schmidt-Daffy<sup>a,\*</sup>, Stefan Brandenburg<sup>a</sup>, Alina Beliaevski<sup>a,b</sup>

<sup>a</sup> Department for Psychology and Ergonomics, Berlin Institute of Technology, Germany

<sup>b</sup> Faculty of Medicine, University of Ottawa, Canada

## ARTICLE INFO

### Article history:

Received 28 August 2012

Received in revised form 29 January 2013

Accepted 18 February 2013

### Keywords:

Anxiety

Loss aversion

Motivational conflict

Speed choice

Task demands

## ABSTRACT

Motivational models of driving behaviour agree that choice of speed is modulated by drivers' goals. Whilst it is accepted that some goals favour fast driving and others favour safe driving, little is known about the interplay of these conflicting goals. In the present study, two aspects of this interplay are investigated: the balance of conflict and the strength of conflict. Thirty-two participants completed several simulated driving runs in which fast driving was rewarded with a monetary gain if the end of the track was reached. However, unpredictably, some runs ended with the appearance of a deer. In these runs, fast driving was punished with a monetary loss. The ratio between the magnitudes of gains and losses varied in order to manipulate the balance of conflict. The absolute magnitudes of both gains and losses altered the strength of conflict. Participants drove slower, reported an increase in anxiety-related feelings, and showed indications of physiological arousal if there was more money at stake. In contrast, only marginal effects of varying the ratio between gains and losses were observed. Results confirm that the strength of a safety–velocity conflict is an important determinant of drivers' behaviour, feelings, and physiological responses. The lack of evidence for the balance of conflict playing a role suggests that in each condition, participants subjectively weighted the loss higher than the gain (loss aversion). It is concluded that the interplay of the subjective values that drivers attribute to objective incentives for fast and safe driving is a promising field for future research. Incorporating this knowledge into motivational theories of driving behaviour might improve their contribution to the design of adequate road safety measures.

© 2013 Elsevier Ltd. All rights reserved.

## 1. Introduction

One of the most important causes of traffic accidents is excessive speed (e.g., Aarts and Van Schagen, 2006). Given that excessive speed is often due to the deliberate decision to drive in a risky manner, countermeasures require knowledge about the psychological determinants of speed choice. In the literature, there is a broad consensus that drivers' motivations play a key role in the choice of driving speed by either promoting or preventing risky driving (e.g., Näätänen and Summala, 1974; Wilde, 1982; Fuller, 2005; Summala, 2007; Vaa, 2007; Zuckerman, 2007; Koornstra, 2009). For example, speeding might be motivated by the thrill of speed (Rothengatter, 1988), by the aim to impress others (Lawton et al., 1997; Horvath et al., 2011), or by time pressure (Fuller et al., 2008a). In contrast, the aim to avoid an accident or penalty (De Waard and Rooijers, 1994) might motivate the driver to opt for more cautious behaviour

and thus, slower speeds. Despite consensus about the importance of drivers' motivations, there is a remarkable gap of knowledge about how the interplay of these motivations affects drivers' speed choice and about how this interplay depends on the current difficulty of the driving task. In particular, there are very few studies available that experimentally examine the combined effects of varied incentives for fast and safe driving and which test these effects across different task demands. A reasonable approach for filling such gaps in knowledge is to initially reveal basic principles with methods that preferentially satisfy internal validity. In line with this approach, the present paper reports on a study that used a highly standardized driving simulation (Schmidt-Daffy, 2012, 2013) to investigate the motivational underpinning of drivers' choice of speed.

### 1.1. Motivational underpinnings of speed choice

It is reasonable to assume that two kinds of motivation are almost always involved in driving behaviour: speed-related motivation and safety-related motivation. Speed-related motivation refers to a driver's basic reasons for travelling. Drivers are either travelling to reach a desired destination or driving itself is the

\* Corresponding author at: Biopsychology/Neuroergonomics, Technische Universität Berlin, MAR 3-2, Marchstr. 23, 10587 Berlin, Germany. Tel.: +49 30 314 25294; fax: +49 30 314 25274.

E-mail address: [martin.schmidt-daffy@tu-berlin.de](mailto:martin.schmidt-daffy@tu-berlin.de) (M. Schmidt-Daffy).

reason for travel. In both cases, an increase in speed usually favours the achievement of the respective travel goals. However, normal drivers do not drive with maximum possible speed. This can be explained by a driver's safety-related motivation, which is directed towards the avoidance of possible negative consequences associated with travelling, and in particular, accidents. Usually the probability of such consequences is effectively reduced by choosing a lower driving speed (Aarts and Van Schagen, 2006). Following this motivational analysis, drivers' speed decision making is framed by a goal conflict which requires a trade-off between velocity and safety. This trade-off is determined by the combination of two variables: the strength of a driver's speed-related motivation and the strength of a driver's safety related motivation. Different configurations of these variables lead to a variation of the goal conflict in two dimensions: balance of conflict and strength of conflict.

The balance of conflict refers to the relative strength of a driver's conflicting motivations. This dimension defines whether in a given driving situation the speed-related motivation or the safety-related motivation prevails. For example, during a trip in a fully insured car towards an urgent business meeting, the balance of conflict is probably shifted towards the speed-related motivation. In this case, the driver most likely drives faster than he or she would drive on the same road, with identical weather and traffic conditions in a car with third-party insurance only on a weekend outing with the family. The assumption that the motivational weighting of velocity and safety influences drivers' choice of speed is common to many motivational models on driving behaviour (e.g., Näätänen and Summala, 1974; Wilde, 1982; Fuller, 2005; Koornstra, 2009). However, although highly plausible, there is very little experimental work that provides evidence for this relationship. One aim of the present study was to overcome this lack of empirical substantiation.

The second motivational determinant of drivers' speed choice is the strength of conflict. Variations on this dimension depend on the combined strength of both speed-related motivation and safety-related motivation. In routine driving situations, in which only weak incentives for driving faster or slower exist, drivers probably do not experience a substantial goal conflict. Instead, the current speed is perceived to be adequate for achieving both the velocity and the safety goal. However, there are situations in which the strength of conflict is substantially increased. A typical example is a driver who is in a hurry to get to an important appointment, but who is also aware of the financial loss which would result from a speeding fine. According to the goal-conflict model proposed by Schmidt-Daffy (2012), increases in conflict strength have a self-contained effect on the choice of speed. The model proposes that conflict activates a neuroanatomically-defined emotion system, called the behaviour inhibition system (Gray and McNaughton, 2000) that favours more cautious driving.

In line with this prediction, two driving simulator studies (Schmidt-Daffy, 2012, 2013) confirmed that increases in incentives for both speed and safety lead participants to prefer lower driving speeds. However, there were some limitations of these studies regarding their validity for real-life driving situations. First, participants chose their driving speed by pressing one of four keys on a standard keyboard – each associated with a discrete velocity (40 km/h, 60 km/h, 80 km/h, and 100 km/h). Therefore, it is unclear if results also hold for a continuous range of speeds chosen with a foot pedal. Second, the money participants gained when they arrived quickly or lost if they had an accident was admittedly fictitious. It cannot be taken for granted that the amount of gain and loss would have the same effect on the choice of driving speed if real money were at stake. Finally, in each conflict condition the amount of gain was equivalent to the amount of the loss. Because this might be a rare condition in real driving situations there is the need to clarify whether the effects of increasing strength of conflict depend on the balance of the conflict. By addressing these questions, the

present study aimed to confirm and extend the knowledge about the impact of conflict strength on driving behaviour.

In addition to drivers' motivations, choice of speed also depends on the external demands of the driving task (Fuller, 2005). For example, choice of speed differs if fog is present compared to non-foggy road sections (Van Nes et al., 2010). Other variables that determine speed choice are, for instance, road geometry (e.g., curved vs. straight roads, Edquist et al., 2009), or the road environment (Aarts et al., 2011). From a motivational point of view, such variables can be considered to be setting the general conditions for the drivers' trade-off between safety and velocity. For instance, achieving the same amount of safety during foggy and non-foggy conditions requires different driving speeds. However, adjusting driving speed to different viewing conditions reduces the chance of achieving speed-related travel goals. The mutual dependence of task difficulty, speed choice, and goal achievement suggests a close linkage between drivers' goal conflict and the current demands of the driving task. Therefore, the present study tested the interplay of incentives for fast and safe driving during varied task demands.

### 1.2. Emotional concomitants of speed choice

The psychological concepts of motivation and emotion are closely related to one another. Accordingly, many motivational models of driving behaviour are simultaneously models of drivers' emotions (e.g., Summala, 2007; Vaa, 2007). Since early on, the emotions of fear and anxiety have played a key role in motivational models (e.g., Taylor, 1964; Wilde, 1982). Therefore, in order to investigate the impact of driver's goal conflicts on his or her choice of driving speed, it is important to consider the role attributed to these emotions.

Many motivational models of driving behaviour propose that drivers respond to an increase in accident risk or an impeding loss of control with an increase in an internal variable that is closely related to fear (for an overview see Schmidt-Daffy, 2013). Depending on the model the correlate or symptom of fear is either predominantly conceptualized as a cognitive variable (task difficulty, Fuller, 2005), a subjective feeling (e.g., Wilde, 1982; Koornstra, 2009) or a bodily response (e.g., Taylor, 1964; Vaa, 2007). It is proposed that the respective internal variable usually informs the driver if the chosen speed is too dangerous for a given driving situation. This would lead the driver to slow down until the desired emotional status is re-established. Hence, given a driver who is capable and willing to align his or her speed to the current task demands, it is not expected that changing task demands involve persistent changes in symptoms of fear.

In contrast, however, most models imply that motivational conditions may cause sustained emotional responses while driving. In particular, the increasing importance of speed-related goals is assumed to motivate drivers to accept a higher subjective risk (Wilde, 1982) or task difficulty (Fuller, 2005). Accordingly, most models would predict that a shift of a driver's balance of conflict in favour of fast driving is accompanied by an increase in symptoms of fear.

Some authors emphasized the emotional ambiguity of risky driving (Zuckerman, 2007; Koornstra, 2009). According to their models an increase in subjective risk does not only increase fear but – at least to some extent – involves an affectively positive aspect as well. This aspect is called (positive) arousal and seems closely related to the thrill induced by risky driving. Therefore, shifting the balance of goal conflict in favour of speeding might involve affectively positive and negative emotional responses.

Finally, the goal conflict model (Schmidt-Daffy, 2012) complements other motivational models of driving behaviour by proposing that the strength of conflict influences a driver's emotional state in addition to the balance of conflict. According to this

Download English Version:

<https://daneshyari.com/en/article/6966339>

Download Persian Version:

<https://daneshyari.com/article/6966339>

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