



Anger expression among Danish cyclists and drivers: A comparison based on mode specific anger expression inventories



M. Møller*, S. Haustein

Technical University of Denmark, Department of Management Engineering, DK-2800 Kgs., Lyngby, Denmark

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ABSTRACT

Based on the short form of the driving anger expression inventory (DAX-short, 15-item), the present study developed an adapted version of the DAX for cyclists (CAX, 14 items). The data basis was an online survey of 2000 inhabitants of Denmark. A principle component analysis on the translated DAX-short confirmed the 4-factor solution of the original study differentiating between (1) personal physical aggressive expression, (2) use of a vehicle to express anger, (3) verbal aggressive expression and (4) adaptive/constructive expression. In case of cycling, the factor “use of a vehicle to express anger” only included one item and was left out. Based on the results, reliable subscales were developed. Drivers scored higher in verbal aggressive expression than cyclists, while there was no significant difference in constructive expression. The subscales for drivers and cyclists showed significant relations to age, gender, self-reported aggressive behaviours and traffic fines: Women scored for instance lower in physical expression, while older people scored higher in constructive expression. The effect of age and gender on anger expression among drivers and cyclists remained significant when controlling for exposure and other factors in linear regression analyses. These analyses also showed a relationship between a positive attitude towards driving and higher levels of anger expression among drivers, while this was not the case for cyclists.

1. Introduction

According to Shinar (1998) awareness of driver anger and aggression stems back at least to the middle of the last century and the work by Tillman and Hobbs (1949) on accident involvement among taxi drivers. Since then many studies have looked into the prevalence and aetiology of driver aggression from different perspectives. Examples include road anger as an example of violence towards strangers (e.g. Harding et al., 1998), perceived status and threat (e.g. Lu et al., 2013; McGarva and Steiner, 2000); traffic culture characteristics (e.g. Matsumoto et al., 2010; Parker et al., 2002; Sullman, 2006), personality, mental illness and other individual characteristics (e.g. Björklund, 2008; Bogdan et al., 2016; Dahlen et al., 2005; Fong et al., 2001; Lajunen and Parker, 2001) as well as vehicle and traffic situation related characteristics (e.g. Fraine et al., 2007; O'Brien et al., 2004; Shinar and Compton, 2004). In the late 1980's and early 1990's the concept of road rage was introduced (Fong et al., 2001) thereby creating the impression of the occurrence of a new phenomenon and causing conceptual confusion (Dula and Geller, 2003).

In this study, data on anger expression among drivers and cyclists is based on the Driving Anger Expression Inventory (DAX) (see

Deffenbacher et al., 2002), a widely used questionnaire specifically developed to measure expression of driving related anger. The original DAX included sixty-two items, but recently Stephens and Sullman (2014) developed a 15-item version (DAX-short). The development of the DAX was inspired by findings derived in the late 1980's/early 1990's where studies on anger showed that anger is not only a result of a general individual trait-based tendency to experience anger across different situations but can also be triggered off by specific situational factors. To explore this and specifically measure driving related anger the Driving Anger Scale (DAS) was developed (Deffenbacher et al., 2016), and was later supplemented by the DAX to measure the actual expression of driving related anger. According to Deffenbacher et al. (2001) anger is conceptually related to aggression as also indicated by the labelling of the forms in which drivers express their anger for example “verbally aggressive expression” and “physical aggressive expression” (see Deffenbacher et al., 2002). In line with the general understanding of driver aggression (Wickens et al., 2013), the phrasing of the specific DAX-items (see Table 3) indicates that the aggressive expressions are seen as deliberate and directed towards other road users either directly by behaviours such as “scare the other road user” or indirectly by behaviours such as “tell myself to ignore it”. However,

* Corresponding author.

E-mail address: mette@dtu.dk (M. Møller).

driver aggression as measured by DAX is different from aggressive driving, which often does not include the adaptive/constructive element and is limited to behaviours performed while driving (e.g. Dula and Geller, 2003; Rowden et al., 2016).

As is the case with many aspects of road user behaviour, research on anger and aggression in traffic has mainly focused on drivers, driver behaviour, and driver related situations. Even in the rare studies including cyclists, the perspective of the driver is the main focus (e.g. Fruhen and Flin, 2015). However, with increasing attempts to promote cycling with reference to individual and societal benefits such as increased health (e.g. Oja et al., 2011; Tainio et al., 2016), environmental benefits (e.g. Xia et al., 2015), and reduced congestion (e.g. Project, 2016) knowledge on anger expression among cyclists is increasingly relevant. Beyond that, the increased awareness of negative consequences and challenges related to different types of emotional stress triggered off by cyclists and drivers sharing the road (e.g. Aldred, 2013; Kaplan and Prato, 2016) and driver harassment directed towards cyclists (e.g. Heesch et al., 2011) clearly indicate the relevance of knowledge on the occurrence on cyclist anger and possible differences between driver and cyclist anger expression in order to support safe and peaceful interaction between cyclists and drivers sharing the road.

However, knowledge on driver anger and aggression may only partly be transferable to cyclists as earlier studies indicate the aetiology and prevalence to be multifactorial, and partly linked to the vehicle. While individual characteristics, such as personality, may influence driver and cyclist anger expression in similar ways, the influence from vehicle characteristics and perceived status may lead to differences in anger expressions. Despite limited knowledge on cyclists' anger and aggression, the relevance of specific knowledge on cyclist anger and aggression is supported by a recent study in which motorcyclist and driver aggression was compared (Rowden et al., 2016). Results identified both person and vehicle related differences between motorcyclist aggression and driver aggression. Thus, people were less likely to behave aggressively when riding a motorcycle than when driving a car, indicating a tendency to adapt to a defensive behavioural strategy as a response to a perception of inferior status or vulnerability, which is in line with previous studies (e.g., Gwyther and Holland, 2014; Klein et al., 2011; McGarca and Steiner, 2000). Cyclists are generally categorized as vulnerable road users and a defensive behavioural strategy similar to the behavioural strategy of motorcyclists could therefore be expected although examples of cyclist aggression do also exist (e.g. Lloyd, 2016). In terms of status, there may be smaller differences between drivers and cyclists in Denmark as compared to other countries, as Denmark is a country with a pronounced cycling culture (cf. Carstensen and Ebert, 2012; Hausteijn and Nielsen, 2016). This may lead to a more similar level of aggression between both groups. However, until now, very little research on cyclist anger exists, leaving a strong need for research in this area.

The purpose of this study was to compare self-reported expression of anger among Danish drivers and cyclists. The measurement of anger expression was based on a short version of the Driving Anger Expression

Inventory (DAX-short) (Stephens and Sullman, 2014), which includes four categories of anger expression (verbal aggressive expression, personal physical aggressive expression, use of vehicle to express anger, adaptive/constructive expression) as well as a total aggressive expression index. The short version was preferred to the original to avoid exhaustion of the participants due to the inclusion of other variables of key importance to the study. To measure cyclist anger expression an adapted version of the DAX-short was developed, the cyclist anger expression inventory (CAX).

2. Method

2.1. Procedure and participants

Data were collected based on an online panel of the market research institute EPINION on behalf of the Danish Road Safety Council in September 2016. The panel ("Danmarkspanelet") consists of 244,568 members (with a monthly inflow of 7510 new panellists) covering all regions of Denmark. Panellists get incentives in form of regular participation in lotteries (see Epinionglobal.com). Two thousand individuals aged between 18 and 75 years completed an online questionnaire (mean age: 48 years; SD: 16.5). About half of the participants were female (52.5%), and 62.4% were married and/or lived together with a partner. The level of education was a bit higher than in the general population of Denmark with only 9.3% who finalised school after the 9th or 10th grade without any further education (= basic education), and 18.1% with long further education (5 years or more, e.g. master degree).¹

Table 1 shows participants' car use frequency as driver and their cycling frequency. About half of the sample (49%) cycles weekly or more, while a quarter never cycles; 68% drive a car at least weekly, while about one fifth (19%) never drive.

2.2. Material

The use of different modes of transport (car as driver, public transport, conventional bike, e-bike, moped, motorcycle, walking) was assessed on a seven point frequency scale ("every day" - "never"). Attitudes towards driving and cycling were measured with four items each, asking participants how stressed they felt about driving and cycling, as well as about their attitude towards driving and cycling in terms of excitement and autonomy. The eight items which were assessed on a five point Likert scale (1 = "totally disagree" - 5 = "totally agree") were merged to four means scales with acceptable internal consistencies (car positive: $\alpha = 0.69$; car stress: $\alpha = 0.73$; bike positive: $\alpha = 0.80$; bike stress: $\alpha = 0.80$).

Involvement in traffic violations was assessed based on self-reported information regarding the last 12 months on being penalized of "speeding" as a driver, and "rule-breaching behaviours as a cyclist".

With regard to anger, the participants were asked about their involvement in five specific situations as victim and/or aggressor within the past 12 months. The specific situations included: (1) "yelling"; (2) "getting/giving the finger"; (3) "threats"; (4) "hitting/kicking a vehicle" and (5) "hitting/kicking a person". If involved, participants were further asked how many times it had happened as well as about the used transport mode (own/counterpart) in the latest situation within each category. Questions on anger expressions included the 15 items of the DAX-short (Stephens and Sullman, 2014) translated to Danish, as well as an adapted version of the items to cyclists (CAX; see Table 3). For one item ("roll down the window to communicate my anger") an adaption to cyclists was not possible, and the item was therefore not included in the

Table 1
Driving and cycling frequency of the sample.

	Car (as driver)		Cycle	
	N	%	N	%
Everyday	584	29.2	360	18.0
4–6 days per week	413	20.7	264	13.2
2–3 days per week	240	12.0	210	10.5
Weekly	127	6.4	148	7.4
1–3 days per month	103	5.2	167	8.4
Less than monthly	150	7.5	345	17.3
Never	383	19.2	506	25.3
Total	2000	100.0	2000	100.0

¹ In Denmark in 2017, 20.7% of the population aged 20–69 years had only basic education, while 10.4% had a long further education (own calculations based on Statistics Denmark, <http://www.statistikbanken.dk>).

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