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Situational driving anger, driving performance and allocation of visual attention

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ABSTRACT

The effects of situational (state) driving anger on driving performance and allocation of driver visual attention were studied using a driving simulator experiment. A total of 24 licensed drivers, half being experienced and half novices, took part in this study. Each participant completed two similar drives, one in an emotion-neutral condition and one in an angry state. The anger emotion state was induced using a 5-min long traffic-related video clip. The results showed that compared with emotion-neutral drivers, drivers in an angry state tended to drive faster, maintain less headway while following a lead vehicle, and accept shorter gaps when performing left-turns. Moreover, when angry, drivers tended to adopt later and harder braking in the lane merging event, indicating a failure to respond properly to an imminent crash that fell into the peripheral areas of the road. Responses to emergency situations that happened in the centre areas of the road, however, were unaffected by situational anger. Results on eye movement data revealed that when angry, drivers scanned a narrower area and applied a more heuristic processing style, both of which may increase the chance of missing potential hazards in peripheral areas. Furthermore, it was found that increased experience did not better prepare drivers for the adverse influences of situational anger. Recommendations for intervention strategies and further research are presented.

1. Introduction

Anger, an emotional state characterized by feelings of annoyance, fury or rage, is frequently experienced while driving. Mesken, Hagenzieker, Rothengatter, and de Waard (2007) found that during a 50-min test drive, participants on average reported experiencing anger 1.5 times. One survey on a sample of ten thousand Chinese drivers showed that 61% of the respondents had experienced anger on the road, especially when encountering traffic violations by other drivers or when stuck in traffic (Sohu, 2008). A relatively recent development is that road rage seems to be becoming more severe due to increasingly heavy traffic congestion (Li, Yao, Jiang, & Li, 2014). A study carried out in the United States found that the number of people who admitted having felt "uncontrollable anger toward another driver" doubled between 2005 and 2013 (Washington Post Poll., 2014).

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Two modes of driving anger, i.e., trait driving anger and situational (state) driving anger, have been distinguished by Deffenbacher, Getting, and Lynch (1994). The former refers to the propensity of drivers to become angry when driving, while the latter to certain temporary emotional state experienced during driving (Deffenbacher et al., 1994). Trait-based driving anger is a relatively enduring and stable personality while situational driving anger is an emotional state, the intensity of which can vary significantly within a short time. A series of follow-up studies carried out by Deffenbacher and his colleagues demonstrated that trait driving anger was a significant predictor of situational driving anger (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003; Deffenbacher, Lynch, Oetting, & Yingling, 2001; Deffenbacher, Richards, Filetti, & Lynch, 2005). In particular, they found that drivers with high trait driving anger had their anger triggered by a wider number of situations and experienced more frequent and intense situational anger while driving.

The adverse effects of anger on driving behaviours have been well documented in a number of questionnaire survey studies. In these studies, the Driving Anger Scale (DAS) developed by Deffenbacher et al. (1994) was used to measure trait driving anger. It has been found that the DAS score was positively related to driving violations (e.g. red light running or speeding) (González-Iglesias, Gómez-Fraguela, & Luengo-Martín, 2012; Sullman, 2006, 2015; Sullman & Stephens, 2013), driving errors (e.g. deviation from the centre line) (Berdoulat, Vavassori, & Sastre, 2013), aggressive driving behaviours (e.g. tailgating or honking) (Berdoulat et al., 2013; Li et al., 2014; Sullman, Stephens, & Yong, 2014) and even accident involvement (Dahlen, Martin, Ragan, & Kuhlman, 2005; Sullman, Gras, Cunill, Planes, & Font-Mayolas, 2007).

Despite the clear connection between impaired driving and trait anger, drivers are also seriously and directly affected by situational driving anger (Abdu, Shinar, & Meiran, 2012; Nesbit, Conger, & Conger, 2007). Unfortunately, only limited attention has been paid to the influences of situational anger on driving performance. One pioneering work in this area was a field driving study carried out by Mesken et al. (2007). In their experiment, participants were required to drive in real traffic for 50 min and verbally report their emotional state every 3 min. For emotional ratings, participants either reported "no emotion", or chose one out of three emotions (angry, nervous, and happy) and indicated the strength of that emotion on a 5-point scale. The results clearly showed that participants who had experienced anger drove faster and exceeded the speed limit more often than those who reported no anger. While the study of Mesken et al. (2007) contributes to the understanding of the effects of situational anger, the lack of control over the driving scenarios across participants made it difficult to establish a cause-and-effect relationship between the situational anger and degraded driving.

Other studies on situational anger have used driving simulator experiments to ensure the same driving scenarios for all participants. In the study of Stephens and Groeger (2011), two groups of drivers first received different treatments in a manipulation drive where one group was impeded by slow moving lead vehicles and the other group experienced no such hindrances. All drivers then performed a non-provocative drive. The results showed that the impeded drivers reported higher levels of anger immediately after the manipulated drive and exhibited more risky driving styles (e.g. larger speed variations and more dangerous overtaking manoeuvres) than the non-impeded group during the non-provocative drive. However, the anger levels remained similar between the two groups during the non-provocative drive and therefore it was unclear whether the observed risky driving behaviours occurred as a direct result of driving anger. In another two simulator studies (Abdu et al., 2012; Jeon, Walker, & Yim, 2014), situational anger was induced before the driving task by recall of past experiences of anger. In both studies, it was found that drivers with induced anger made more driving errors and violations, but did not have more collisions, than those without. However, a potential shortcoming of both studies was that the intensity of the induced anger was relatively low (an average of 3.93 on a 10-point scale and 3.3 on a 7-point scale, respectively), so may not have elicited possible important associations between driving anger and accident risk. Therefore, while the reviewed studies suggest that situational anger degrades driving performance, the lack of control on extraneous factors may have compromised the validity of the cause-and-effect relation between situational anger and driving.

In addition to effects on driving behaviour, the allocation of visual attention by a driver can be affected by situational driving anger. Easterbrook (1959) was among the first to propose that high-arousal negative emotions such as anger can result in tunnel vision. Tunnel vision is a phenomenon where there is loss of peripheral vision, but retention of central vision, such that the field of vision narrows to be constricted to something like a tunnel. This proposition has received a lot of empirical support from previous psychological studies (for a review, see Friedman & Förster, 2010). Visual perception is the main source of information for driving and visual search behaviour is required for hazard perception and driving performance in general (Crundall, Chapman, Phelps, & Underwood, 2003). Drivers experiencing tunnel vision are likely to focus mainly on traffic events directly ahead and miss safety–critical information in peripheral vision, resulting in higher risk of hitting pedestrians and bicyclists who are likely to fall into peripheral space. Also, with tunnel vision, if central vision is directed away from traffic events ahead, there is a risk that a threat ahead will be missed because it will be in peripheral vision. Tunnel vision has been observed among drivers experiencing high anxiety. The study by Janelle, Singer, and Williams (1999) showed that when drivers had higher levels of anxiety, their reaction times increased and accuracy in detecting peripheral visual targets decreased. Briggs, Hole, and Land (2011) found that when drivers were involved in anxiety-inducing conversations during driving, there were significant declines in both horizontal and vertical ranges of visual fixations, than the ranges found when they were involved in more mundane conversations. However, it has never been investigated as to whether or not anger will have the effect of narrowing the scanning range of drivers.

There are individual differences in the way people deal with frustrating situations (Phillips, Henry, Hosie, & Milne, 2006). In driving safety literature, some studies have found that experienced drivers tended to have lower levels of driving anger than inexperienced drivers (Roidl, Frehse, Oehl, & Höger, 2013; Sullman, 2006; Villieux & Delhomme, 2010). As noted by