

## **Are Happy Drivers Better Drivers? The Impact of Emotion, Life Stress and Mental Health Issues on Driving Performance and Safety**

Mitchell L. Cunningham, Michael A. Regan

The Australian Road Research Board

### **Abstract**

While observable distractions have been studied extensively (e.g. due to mobile phone use), less obvious sources of distraction, such as that derived from being emotionally aroused, have not. The overarching purpose of this article is to review relevant literature and analyse how emotions may impact on driving behaviour. This manuscript discerns three potential impacts: (a) how elicited emotions may impact on driving performance; (b) the experience of stressful life events (e.g. financial issues) and their impact on driving safety; and (c) mental health issues, such as anxiety, may impair driving performance and safety. The implications of these findings are discussed.

### **Background**

Driver distraction is defined as ‘...the diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient or no attention to activities critical for safe driving’ (Regan, Hallett & Gordon 2011, p. 1776). Driver distraction is a significant road safety problem worldwide and, in Australia, it has been estimated to be a contributing factor in around 16% of fatal and injury crashes (Beanland et al. 2013). While observable distractions have been studied extensively (e.g., visual distraction due to interactions with a mobile phone), less obvious sources of distraction (e.g., daydreaming or driving while emotionally aroused) have not been so frequently examined (National Highway Traffic Administration [NHTSA] 2009). NHTSA has only recently started to classify emotion as a source of distraction (NHTSA 2010).

Driving requires significant attentional resources (Wickens, Toplack & Wiesenthal 2008) in order to manoeuvre, control and plan (Michon 1985). However, emotional stimuli, both internal (e.g. worrying about something) and external (e.g., billboard content) have the ability to be particularly potent in capturing attention, and therefore pose a higher risk of producing driver distraction, compared to other non-emotional stimuli (Compton 2003; Vuilleumier 2005). Testament to this, a recent US naturalistic driving study (Dingus et al. 2016) found that driving in an observable emotional state (e.g., anger, sadness, crying, and/or emotional agitation as observed through footage of the driver) increased crash risk by 9.8 times. Moreover, nascent research also suggests that positive-valence emotions (e.g., happiness, joy) can have a profound impact on driver behaviour. Both positive and negative valenced emotions were in scope when this review was undertaken.

The purpose of this manuscript is to review relevant and current literature and present an analysis of how emotion may impact on driving performance and safety. In achieving this, the current article aims to: 1) provide an overview of simulated driving research that has examined how emotional experiences and emotional stimuli impact on driving performance, and the potential mechanisms that underlie this influence; 2) summarise research assessing the impact of life stress, which can bring about emotional experiences while driving, on driving safety; 3) present research that has attempted to link mental health issues, which are commonly hallmarked by prolonged and/or intense emotional experiences, to driving performance and safety, and lastly 4) discuss the implications of this research in terms of licensing practices and fruitful avenues for future research.

## Method

A literature review was undertaken to glean information to address the four research aims noted above. Both journal and conference publications were the focus of this review, and 18 research articles were reviewed in total.

## Results, Discussion and Conclusions

In reference to the first aim, four simulated driving studies were reviewed showing that negative-valence emotions (e.g., anger), induced through means such as words on a billboard in the driving environment (Chan & Singhal, 2013) or radio music (Pecher et al., 2009), were associated with performance decrements such as lane keep errors, traffic rule violations and aggressive driving. Interesting, happiness induced in drivers also was found to be related to some decrements in driving performance (e.g., lane keeping errors and poorer speed maintenance) compared to control (neutral) groups.

In reference to the second aim, research (seven studies were reviewed) suggests that life stress (e.g. through financial or interpersonal issues) can ‘spill over’ into one’s driving and be linked to increased driving errors and increased crash risk (e.g., Legree et al., 2003; Legarde et al., 2004). Many of the studies controlled for important covariates (e.g., basis demographics, mileage) which provide further confidence of the validity of the link between life stress and its impact on driving performance.

In reference to the third aim, common mental health concerns, such as anxiety and depression, can also negatively impact on driving performance and safety. For example, studies (seven studies were reviewed) have shown that anxious individuals tend to report more failures of observation while driving (e.g., failing to check mirrors before changing lanes; Shahr, 2009) and an increased number of driving lapses (attentional and memory failures while driving) (Wong, Mahar & Titchener, 2015). Depressive symptoms, also, have been shown to not only be associated with poor driving performance in simulator studies (e.g., slower reaction times to critical road events; Bulmash et al., 2006), but also be linked a four-fold increase in crash risk in Australian heavy vehicle drivers (Hilton et al., 2009).

In relation to the fourth aim, the implications of this research linking both positive and negative emotions to impaired driving performance, the link between life stress and driving safety, and the association between mental health issues (anxiety and depression) and driving performance and safety, are lastly discussed. Specifically, we will illuminate how the outcomes of such research impact on driver licensing requirements (e.g., ‘fitness to drive’ guidelines) as well as the need for prospective naturalistic driving studies to attempt to investigate the link between emotional experiences (both negative and positive) and crash risk.

## References

- Beanland, V., Fitzharris, M., Young, K. & Lenne, M. (2013). Driver inattention and driver distraction in serious casualty crashes: data from the Australian National Crash In-depth Study, *Accident Analysis and Prevention*, 54, 99-107.
- Boer, E. R., & Hildreth, E. C. (1999). Modeling drivers' decision and control behavior on country roads, in AG Gale et al. (Eds.), *Proceedings of the Eighth International Conference on Vision in Vehicles*, Elsevier, Amsterdam.
- Bulmash, E. L., Moller, H. J., Kayumov, L., Shen, J., Wang, X., & Shapiro, C. M. (2006). Psychomotor disturbance in depression: assessment using a driving simulator paradigm, *Journal of Affective Disorders*, 93(1), 213–18.

- Chan, M. & Singhal, A. (2015). Emotion matters: Implications for distracted driving, *Safety Science*, 72, 302–309.
- Compton, R. J. (2003). The interface between emotion and attention: a review of evidence from psychology and neuroscience, *Behavioral and Cognitive Neuroscience Reviews*, 2(2), 115–129.
- Dingus, T. A., Guo, F., Lee, S., Antin, J. F., Perez, M., Buchanan-Kinga, M. & Hankey, J. (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data', *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, 113(10), 2636–2641.
- Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems, *Human Factors*, 37(1), 32–64.
- Hilton, M. F., Staddon, Z., Sheridan, J. & Whiteford, H. A. (2009). The impact of mental health symptoms on heavy goods vehicle drivers' performance, *Accident Analysis and Prevention*, 41(3), 453–61.
- Michon, J. A. (1985). A critical view of driver behavior model: what we know, what should we do?, in Evans, L, Schwing, RC (eds.), *Human Behavior and Traffic Safety*, Plenum Press, New York, pp. 485–524.
- NHTSA (2009). *An Examination of Driver Distraction as Recorded in NHTSA Databases*, Traffic Safety Facts, HS 811 216, National Highway Traffic Administration, Washington, DC, USA.
- NHTSA (2010). *Overview of Results from the International Traffic Safety Data and Analysis Group Survey on Distracted Driving Data Collection and Reporting as Recorded in NHTSA Databases*, Traffic Safety Facts HS 811 404, National Highway Traffic Administration, Washington, DC, USA.
- Lagarde, E., Chastang, J., Gueguen, A., Coeuret-Pellicer, M., Chiron, M., & Lafont, S. (2004). Emotional stress and traffic accidents: the impact of separation and divorce, *Epidemiology*, 15(6), 762–766.
- Legree, P. J., Heffner, T. S., Psotka, J., Martin, D. E. & Medsker, G. J. (2003). Traffic crash involvement: experiential driving knowledge and stressful contextual antecedents, *Journal of Applied Psychology*, 88(1), 15–26.
- Pecher, C., Lemercier, L. & Cellier J. M. (2009). Emotions driver attention: Effects on driver behaviour, *Safety Science*, 47, 1254–1259.
- Picard, R. (2010). Affective computing: from laughter to IEEE', *IEEE Transactions on Affective Computing*, 1(1), 11–17.
- Regan, M. A., Hallett, C. & Gordon, C. P. (2011). Driver distraction and driver inattention: definition, relationship and taxonomy, *Accident Analysis & Prevention*, 43, 1771–1781.
- Shahar, A. (2009). Self-reported driving behaviors as a function of trait anxiety, *Accident Analysis & Prevention*, 41(2), 241–45.
- Vuilleumier, P. (2005). How brains beware: neural mechanisms of emotional attention, *Trends in Cognitive Sciences*, 9, 585–594.

- Wickens, C. M., Toplack, M. E., & Wiesenthal, D. L., (2008). Cognitive failures as predictors of driving errors, lapses and violations, *Accident Analysis and Prevention*, 40(3), 1223-1233.
- Wong, I. Y., Mahar, D. & Titchener, K. (2015). Driven by distraction: investigating the effects of anxiety on driving performance using the Attentional Control Theory, *Journal of Risk Research*, 18(10), 1293–1306.