



# Improving young drivers' speed management behaviour through feedback: A cognitive training intervention



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## ABSTRACT

The aim of the present study was to examine which aspect of content-based feedback about drivers' speed management behaviour (performance, financial infringements and safety implications for speeding) yielded positive changes in compliance with the speed limit. One hundred young drivers were randomly allocated to one of five groups (Control, Performance Feedback, Performance and Finance Feedback, Performance and Safety Feedback, Combined Feedback). Depending on group randomly allocated to, participants completed a baseline drive and received feedback about their speed management (except control). Immediately after, all groups completed a post-training drive, followed by a second drive one week later. A reduced sample (25 per cent dropout) completed a third test drive six month post-training. All drives were completed in a computer-based driving simulator. Feedback pertaining to their speed management behaviour was provided verbally immediately after the baseline drive by the researcher. Performance Feedback group received feedback about own speed-related performance (e.g., mean speed, time violated during the drive); Performance and Finance Feedback group received feedback about own performance and potential fines that could be received for exceeding the speed limit; Performance and Safety Feedback group received feedback about own performance and potential safety outcomes for them and other passengers; the Combined Feedback group received feedback about own performance, financial infringements and safety implications for speeding; and the Control group received no feedback. The results showed that all types of feedback are effective in modifying young drivers' speed management behaviour, and these effects were present up to six months post-training in both low and high-speed zones. These findings have valuable implications in the development of a new training approach to improve young drivers' speed management behaviour.

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## 1. Introduction

Speeding is recognized as one of the leading risk factors contributing to road crashes (World Health Organization – WHO, 2013). For young people aged from 15 to 24 years in Australia, road crashes account for approximately a quarter of all deaths (Bureau of Infrastructure, Transport and Regional Economics – BITRE, 2013). In New South Wales (NSW), Australia, and while there has been a decrease in the number of road fatalities in the last 10 years, the proportion of young drivers involved in these has remained largely unchanged (Transport for NSW, 2017). Excessive speed is reported to be the leading causal factor

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in fatal crashes involving young novice drivers (De Pelsmacker & Janssens, 2007; Scott-Parker, et al., 2013; TfNSW, 2017). For young drivers, the first year of solo driving presents the highest level of risk: they are 22 times more likely to be involved in a fatal accident in this time than any other time throughout their driving career (Mayhew and Simpson, 2002; Williams, 2003). Hence, the main aim of the present study is to test the effect of various types of content-based feedback, in improving young drivers' driving behaviour, in terms of speed management.

In NSW, as part of the Graduate Licence Scheme, newly-licensed drivers obtain a provisional driver's licence (P1 followed by P2) before progressing to an unrestricted driver's licence (Transport for NSW, 2017). A number of driving restrictions are imposed on provisional licence holders, such as: maximum speed limit, ban on all mobile telephone usage, zero blood alcohol concentration limit, and type of vehicle permitted to drive based on engine capacity to name a few. Provisional licence holders also have fewer demerits points than a fully licensed holder. A provisional licence 1 holder has four demerit points, whereas a provisional licence 2 holder has seven. A minimum of four demerit points is imposed for any speeding offence, meaning that a P1 licence holder will have their licence suspended for at least three months if caught speeding.

Speed management is defined as "a set of measures to limit the negative effects of excessive and inappropriate speeds" (Organisation for Economic Cooperation and Development - OECD, 2006, p. 8). Key to effective speed management is the accurate estimation of speed, which has been found to be particularly problematic for young novice drivers (Fildes et al., 1998). Traditional methods employed to facilitate speed management skills involve education and training, which are generally reinforced through enforcement. New technology, such as intelligent speed adaptation and speed exceedance alerts in motor vehicles can also improve speed management. Despite such measures, speeding remains common with approximately 50% of all drivers exceeding the speed limit in different speed zones, but young drivers are the most involved in speeding behaviour (OECD, 2006). For example, in low-speed zones (i.e., 40 km), young Australian drivers typically exceed the speed limits by 10 km/h, and in high-speed zones (i.e., 80 km), they typically exceed the speed limit by 4–5 km/h (Ellison et al., 2011).

Evidence from research indicates that speeding increases the risk of a crash, and the severity of the outcome associated with the crash (Kloeden et al., 1998). Young drivers tend to underestimate risks associated with speeding (McKenna & Horswill, 2006). They also overestimate their own driving abilities (Gregersen, 1996). Hence, there appears to be a disconnect between the dangers associated with speeding and how this applies to them personally. The present research attempts to address this imbalance through training.

Training is central to the effective development of skills. In high-hazard environments such as driving, it is essential that training programmes for young novice drivers target specific skills to reduce the risks associated with hazardous activities. One training approach that has shown promise in improving young drivers' speed management behaviour is 'feedback' (Hill & Salzman, 2012; Krasnova, Molesworth, & Williamson, 2015). Feedback is broadly defined as "the provision of information about a system or process that may affect a change in the process" (Toledo & Lotan, 2016, p.306). Effective feedback is argued to be "the information about previous performance that is used to promote positive and desirable development" (Archer, 2010, p.101). Specifically, 'information about a system or process' can comprise various aspects that can affect an individual (Toledo & Lotan, 2016). Hence, it is not yet clear which characteristics of feedback are more effective in facilitating an individual's behavioural change. For young drivers, feedback is particularly important as the receipt of objective information following performance in a task directly challenges their self-belief (Kuiken & Twisk, 2001), however, the precise mechanism of change following the receipt of feedback remains unknown.

Previous studies in a number of settings have shown positive results of feedback in realigning perception of skill with actual skill level (Groeger & Brady, 1999; Hatala, Cook, Zendejas, Hamstra, & Brydges, 2014; Hill & Salzman, 2012; Kluger & DeNisi, 1996; Molesworth, Wiggins, & O'Hare, 2006). In the high-hazard activity such as aviation, for example, feedback has been used to improve novice pilots' risk management skills, in terms of minimum altitude descended during a low-level flying task (Molesworth, Bennett, & Kehoe, 2011; Molesworth et al., 2006). In the medical profession, feedback has been used to improve the procedural skills of doctors (Hatala et al., 2014). In the context of driving, there is evidence that the application of feedback facilitates safe driver behaviour, including: improving speeding behaviour through the use of variable message signs (Schramm et al., 2012); improving drivers' compliance with the speed limits (Carsten & Tate, 2005; Krasnova et al., 2015; Prabhakaran & Molesworth, 2011), and traffic laws of seatbelt use (Lie, Krafft, Kullgren, & Tingvall, 2008). Numerous studies have clearly demonstrated that feedback is effective in improving individuals' performance, but the application of feedback comprising different aspects of feedback (i.e., evaluation of performance, consequences to self, recommendations for further driving, warning of a driver potential risk, or a combination of these elements) remains questionable. Specifically, the question remains regarding which aspect/type of feedback contributes most to the success of feedback. Hence, the objective of this study is to explore the effect of various types of feedback on safe driving performance in young novice drivers, in particular as they are in most need of effective driver training methods.

While evidence suggests that feedback is effective in improving driver behaviour (Prabhakaran & Molesworth, 2011), it is important to understand the various aspects of feedback and their effectiveness (Archer, 2010). Feedback, as a complex construct, comprises various characteristics: the source of the feedback, the time of its delivery, and the content of the feedback, each of which may be adapted to different contexts. Both visual and auditory types of feedback (i.e., source of feedback) have shown to reduce percentage of time speeding in a driving simulator (Brookhuis & de Waard, 1999), and mean speed on the road (Adell, Várhelyi, & Hjälmdahl, 2008). However, no long-lasting effects were evident (Adell et al., 2008). Studies of novice drivers also showed that verbal feedback about individual driver performance provided by a driving instructor was

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