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Driver inattention and driver distraction in serious casualty crashes: Data from the Australian National Crash In-depth Study

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ABSTRACT

Driver inattention and driver distraction represent a major problem in road safety. Although both are believed to contribute to increased crash risk, there is currently limited reliable information on their role in crashes. The current study used in-depth data from the Australian National Crash In-depth Study to investigate the role of driver distraction and inattention in serious casualty crashes. The sample included 856 crashes from 2000 to 2011, in which at least one party was admitted to hospital due to crash-related injuries. Crashes were coded using a taxonomy of driver inattention that delineates five inattention subtypes: restricted attention, misprioritised attention, neglected attention, cursory attention, and diverted attention (distraction). Approximately 45% of crashes could not be coded due to insufficient information while in an additional 15% the participant indicated the "other driver was at fault" without specifying whether inattention was involved. Of the 340 remaining cases, most showed evidence of driver inattention (57.6%) or possible inattention (5.9%). The most common subtypes of inattention were restricted attention, primarily due to intoxication and/or fatigue, and diverted attention or distraction. The most common types of distraction involved voluntary, non-driving related distractions originating within the vehicle, such as passenger interactions. The current study indicates that a majority of serious injury crashes involve driver inattention. Most forms of inattention and distraction observed are preventable. This study demonstrates the feasibility of using in-depth crash data to investigate driver inattention in casualty crashes.

1. Introduction

Globally road crashes account for 1.3 million deaths and up to 50 million serious injuries, costing approximately US$518 billion annually (WHO, 2009). Serious injury crashes have been increasing in Australia over the past decade, with 32,543 individuals seriously injured during 2007–2008; a rate of 153.4 per 100,000 population (Henley and Harrison, 2011). There are ongoing efforts to identify factors that contribute to serious crashes and thus develop methods for eliminating or mitigating these contributing factors. Driver inattention and distraction have received considerable attention over the past decade, arguably due to the proliferation of nomadic technologies that can be used in vehicles (e.g., mobile phones). There has been considerable investment in curtailing driver distraction, with the most prominent efforts being made by the European Union[1] and US government.[2]

Driver inattention and distraction occur when a driver fails to pay sufficient attention to activities that are required for safe driving (Lee et al., 2009; Regan et al., 2011). Although distraction has been demonstrated to result in poorer driving performance (Bayly et al., 2009; Drews and Strayer, 2009), there is limited reliable evidence regarding its prevalence in road crashes, with estimates ranging from 2 to 14% of crashes (Gordon, 2005; Glaze and Ellis, 2003; McEvoy et al., 2007; Stevens and Minton, 2001; Stutts et al., 2005; Wang et al., 1996). Even less is known about the role of inattention in crashes, though its prevalence appears much greater; US estimates suggest nearly half of all crashes involve driver inattention (Stutts et al., 2001).

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[1] For example, the US-EU Bilateral ITS Technical Task Force Expert Focus Group on Driver Distraction, http://ec.europa.eu/information_society/activities/esafety/doc/intl_coop/us/eg_driver_distract.pdf.
[2] For example, the US NHTSA Programme on Driver Distraction, www.distraction.gov.

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1.1. Inattention and distraction in crashes: methodological issues

Examining the role of distraction and inattention in crashes is a complex undertaking for multiple reasons. First, it is challenging to obtain reliable information about pre-crash circumstances. Second, attributions regarding what constitutes a distraction and which activities are critical for safe driving are not fixed and are therefore difficult to determine a priori (Hancock et al., 2009; Regan et al., 2009). This can create erroneous assumptions regarding crash causality; we assume that since the crash occurred after the distraction, it was caused by the distraction (Lee et al., 2009). Such an assumption may be inaccurate because most crashes have multiple determinants and therefore it is generally not accurate to say that distraction caused a given crash, but rather that distraction *contributed* to the crash (e.g., by slowing the driver's response times). Several research methods have been used to obtain data on the role of distraction and inattention in crashes, including examination of police records and naturalistic driving studies. Each method has unique strengths and weaknesses with regard to these challenges, as briefly reviewed below.

Studies using official crash records utilise existing data, which reduces the costs of data collection but the information may not be sufficiently reliable for several reasons. Since the police officers' role involves determining culpability, drivers may be unwilling to admit to engaging in distractions. In addition, information regarding distraction and inattention may not be collected, or may not be collected in sufficient detail to permit an adequate judgement concerning the association between certain driver behaviours and crash rates. Some studies partially overcome these limitations by using crash records in conjunction with other data; for example, consulting phone records to determine whether a driver was using his or her mobile phone immediately before the crash (McEvoy et al., 2005).

Naturalistic driving studies (NDS) typically use unobtrusive cameras and other recording systems to continuously monitor drivers' daily behaviour for up to 18 months (e.g., Dingus et al., 2006; Hanowski et al., 2005) and provide rich information regarding observable in-vehicle distractions, such as phone use or interactions with vehicle systems (Dingus et al., 2011). NDS can provide information about the context in which drivers choose to engage in distractions; for example, if they primarily use phones during situations where they are unlikely to come into conflict with another vehicle. These studies cannot capture certain types of distraction, particularly internal distractions such as thinking and daydreaming (Gordon, 2009). Similarly, it is not possible to determine whether the driver "looked but failed to see" a hazard or another vehicle; although most studies include a forward view camera, they cannot accurately determine gaze location. There are also privacy issues when recording passengers, particularly if the camera records audio, and consequently passenger data is often not captured. Finally, NDS are extremely costly and labour-intensive, since they produce so much data, and the data generated may not be appropriate for examining crashes: a recent NDS examining distraction in heavy vehicle drivers did not record any distraction-related crashes, despite recording over 140,000 miles of footage (Hanowski et al., 2005).

The use of in-depth crash data for investigating the role of distraction in crashes overcomes several of the limitations posed by police records and NDS. Participant interviews are confidential and cannot be used to determine liability as per ethics committee approval, so drivers are more likely to offer information about their engagement in distracting activities compared to during a police interview. In-depth studies also provide significant detailed information about pre-crash circumstances and the structured interview provides a series of explicit prompts to help drivers recall specific information. Another advantage of in-depth studies is that data can be obtained on a wide array of distracting activities, including information on internal distractions or whether the driver was in a state of inattention. The main limitation of in-depth crash data is that it relies on subjective reports, albeit with efforts to validate the information using external data sources (e.g., records from police, emergency services, medical practitioners and towing/salvage operators). It is important to seek external validation as drivers may misinterpret or fail to remember what happened, especially if they incurred a head injury during the crash. Overall, however, in-depth crash data analysis represents a cost-effective potential way of examining distraction and inattention in a large number of crashes; a proposition that is the primary objective of this paper. To the authors' knowledge, in-depth crash data has not previously been used to examined driver inattention and distraction in any detail.

1.2. Inattention and distraction in crashes: theoretical issues

In order to obtain reliable information on the role of inattention and distraction in crashes, it is vital to have a standard definition of the concepts that can be operationalised and used to code data. One reason why the prevalence of distraction varies across studies is that researchers adopt different definitions of distraction (Gordon, 2009) and therefore employ different coding systems: some may only code in-vehicle distractions, others may exclude driving-related activities; some use the terms "distraction" and "inattention" interchangeably, whereas others define them as distinct constructs.

Researchers have recently attempted to identify common elements among varying definitions in order to reach a consensus; we adopted two such commonly derived definitions for the current study. Driver inattention can be defined as "insufficient, or no attention, to activities critical for safe driving" (Regan et al., 2011, p. 1775), while driver distraction entails "a diversion of attention away from activities critical for safe driving, towards a competing activity" (Lee et al., 2009, p. 34). In this model, distraction is a subtype of inattention; drivers can be inattentive without being distracted, but not vice versa. The distraction definition encompasses a range of potential distractions that vary across five aspects: *source*, meaning an object, event, activity or person, including the driver; *location*, specifically internal to the driver, in-vehicle, or external; *intentionality*, being voluntary or involuntary; *sensory processes*, which can be visual, auditory, physical–manual, and/or cognitive; and *outcomes* (Lee et al., 2009).

Building on recent attempts to devise a coherent, commonly agreed upon definition of driver distraction, Regan et al. (2011) created a taxonomy of driver inattention that delineates five subtypes of inattention: restricted, misprioritised, neglected, cursory and diverted attention (see Fig. 1). Given that previous research has suggested that the majority of crashes involve inattention, it is worth examining subtypes of inattention to assess whether specific forms of inattention and distraction are particularly prevalent and what types of behaviours are associated with each. *Driver restricted attention* (DRA) describes circumstances in which attention is limited due to physical or biological factors (e.g., drowsiness, glare), but does not include failure to detect objects that are obscured by other objects. *Driver misprioritised attention* (DMPA) occurs when the driver is excessively focused on less safety-critical aspects of driving; for example, focusing on adjacent vehicles when merging and failing to notice the car ahead braking. *Driver neglected attention* (DNA) occurs when the driver fails to attend to activities critical for safe driving, such as failing to look for hazards or oncoming vehicles. *Driver cursory attention* (DCA) occurs when the driver attends superficially to activities critical for safe driving, such as conducting a head check before executing a lane change and failing to notice an adjacent vehicle. The main distinction between