Transportation Research Part F 31 (2015) 87–98

Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

Young driver distraction by text messaging: A comparison of the effects of reading and typing text messages in Chinese versus English

Wei Yan [a,*], S.C. Wong [a], Y.C. Li [a], N.N. Sze [b], Xuedong Yan [c]

[a] Department of Civil Engineering, The University of Hong Kong, Pokfulam Road, Hong Kong, China
[b] Department of Civil and Natural Resources Engineering, University of Canterbury, Christchurch, New Zealand
[c] Key Laboratory of Ministry of Education – Urban Transportation Complex Systems Theory and Technology, School of Traffic and Transportation, Beijing Jiaotong University, China

ARTICLE INFO

Article history:
Received 23 July 2014
Received in revised form 19 February 2015
Accepted 12 March 2015
Available online 21 April 2015

Keywords:
Traffic safety
Driving distraction
Driving simulator
Text messaging

ABSTRACT

Background: Reading and typing text messages while driving seriously impairs driving performance and are prohibited activities in many jurisdictions. Hong Kong is a bilingual society and many people write in both Chinese and English. As the input methods for text messaging in Chinese and English are considerably different, this study used a driving simulator approach to compare the effects of reading and typing Chinese and English text messages on driving performance.

Method: The driving performances of 26 participants were monitored under the following conditions: (1) no distraction, (2) reading and typing Chinese text messages, and (3) reading and typing English text messages. The following measures of driving performance were collected under all of the conditions: reaction time (RT), driving lane undulation (DLU), driving speed fluctuation (DSF), and car-following distance (CFD) between test and leading cars.

Results: RT, DLU, and DSF were significantly impaired by reading and typing both Chinese and English text messages. Moreover, typing text messages distracted drivers more than reading them. Although the Chinese text messaging input system is more complicated than the English system, the use of Chinese did not cause a significantly different degree of distraction.

Conclusion: Both reading and typing text messages while driving should be prohibited regardless of whether Chinese or English is used.

1. Introduction

Driver distraction is one of the most common causes of traffic crashes. A distracted driver is two to nine times more likely to be involved in a crash than a driver who is not distracted (Redelmeier & Tibshirani, 1997; Violanti & Marshall, 1996). Research has demonstrated that using a mobile phone while driving increases a driver's mental workload (Drews, Yazdani, Godfrey, Cooper, & Strayer, 2009; Makishita & Matsunaga, 2008; Patten, Kircher, Östlund, & Nilsson, 2004), distracts attention, increases reaction time delay (Al-Darrab, Khan, & Ishrat, 2009; Consiglio, Driscoll, Witte, & Berg, 2003; Hosking,

* Corresponding author. Tel.: +852 2859 2662; fax: +852 2517 0124.
E-mail address: maggievi@hku.hk (W. Yan).

http://dx.doi.org/10.1016/j.trf.2015.03.010
1369-8478/

Young, & Regan, 2009), impairs driving maintenance by increasing deviation in the vehicle's lateral position, and increases traffic violations such as speeding and running stop signs (Beede & Kass, 2006; Drews et al., 2009; Hosking et al., 2009; Törnros & Bolling, 2005). It therefore increases the overall risk of traffic conflicts and crashes.

Numerous studies have concluded that text messaging while driving is risky (Hallett, Lambert, & Regan, 2012; Harrison, 2011; Nemme & White, 2010; Owens, McLaughlin, & Sudweeks, 2011; Young, Rudin-Brown, Patten, Ceci, & Lenné, 2014). Text messaging impairs a driver's cognition, decision-making ability, and ability to maneuver safely. A driver's reaction time (RT), driving lane undulation (DLU), and driving speed fluctuation (DSF) are effective indicators of impaired performance due to distraction, as shown in Table 1.

Text messaging is the primary form of communication among college students (Chiang, Tung, & Chen, 2002), as it supports peer-to-peer interaction and increases feelings of belonging; 98% of young drivers have texted while driving, regardless of the circumstances (Atchley, Atwood, & Boulton, 2011). Many young people text rather than talk while driving (Goodwin, O'Brien, & Foss, 2012). One study of U.S. college students revealed that 91% of frequent drivers have texted while driving, and that a considerable proportion were travelling with passengers at the time (Harrison, 2011). One Australian study conducted a follow-up survey of university students after a short training session and found that texting was still prevalent, despite the students' awareness that it was dangerous and illegal (Nemme & White, 2010). Another attitudinal survey of young drivers revealed that a decrease in mindfulness increased the prevalence of texting while driving, and that this association was mediated by emotion-regulation motives (Feldman, Greeson, Renna, & Robbins-Monteith, 2011). A nationwide online survey in New Zealand conducted by Hallett et al. (2012) found that younger drivers were more likely to engage in reading and texting messaging, as age was found to be an important indicator of participant's willingness to engage in this behavior. Therefore, further research on the factors that increase the prevalence of texting messages while driving among young people is essential for developing effective measures to combat this behavior.

Legislation and enforcement measures have been introduced in response to this high-risk activity; these measures use a deterrence theory approach to minimize unsafe driving behavior. The use of hand-held phones while driving has been prohibited in Hong Kong since July 1, 2000 (ROAD SAFETY COUNCIL, 2003). In one study of mobile phone distraction, a driver's attitude was found to be the most consistent predictor of his or her intention to use a mobile phone while driving (Walsh, White, Hyde, & Watson, 2008). A before-and-after study of the effects of hand-held mobile phone legislation in New York State revealed that 46 out of 62 counties experienced a reduction in fatal road crashes, and that all of the counties experienced a remarkable reduction in road casualties after similar legislation was implemented (Nikolaev, Robbins, & Jacobson, 2010). However, this deterrence-based traffic law enforcement approach has not always worked, and drivers continue to read and type text messages while driving. Ray (2014) suggested that, according to deterrence theory, to be effective, legislation prohibiting mobile phone use while driving must have consequences that are certain, swift, and severe. A questionnaire survey in China that examined the correlations between personality factors and driving behavior found that deterrence did not affect distracted driving (Nan et al., 2011). Harrison (1998) also argued that deterrence-based approaches that are not informed by psychological theory may not change driving behavior. In fact, in some cases, the use of a mobile phone while driving may increase in the short term after legislation is introduced (McCartt, Hellinga, & Bratiman, 2006). Additionally, a study of Kansas drivers (Nelson, Atchley, & Little, 2009) found that drivers' tendencies to talk on the phone and text messages while driving remained high even after the implementation of relevant legislation. Moreover, some convicted drivers reported simultaneously engaging in other risky driving behavior such as speeding, running stop signs, and changing lanes carelessly (Beck, Yan, & Wang, 2007; Harrison, 2011; Owens et al., 2011).

Hong Kong is a bilingual metropolis, and Chinese and English are both commonly used in reading and typing messages. However, because Chinese (shape based) and English (Latin alphabet based) characters are remarkably different in terms of their formation, text messaging in the two languages may make different cognitive demands on drivers and thus have different effects of their driving. Psychological and linguistic studies have observed that reading different languages requires

Table 1
Driving performance dependent variables, description, and references.

Variable classification	Variable	Description	Sample reference
Reaction Time	*Reaction time* (*RT*)	The time from a hazard to braking onset	Redelmeier and Tibshirani (1997), Makishita and Matsunaga (2008), Edquist, Rudin-Brown, and Lenné (2012), Consiglio et al. (2003), Christoforou, Karlaftis, and Yannis (2013), Hosking et al. (2009), Beede and Kass (2006)
Lateral Control	*Driving lane undulation* (*DLU*)	Standard deviation of lateral position	Horrey and Wickens (2006), Törnros and Bolling (2005), Owens et al. (2011), Hosking et al. (2009), Auberlet et al. (2012), Beede and Kass (2006), Stavrinos et al. (2013)
Longitudinal Control	*Driving speed fluctuation* (*DSF*)	Standard deviation of speed	Al-Darrab et al. (2009), Edquist et al. (2012), Drews et al. (2009), Törnros and Bolling (2005), Stavrinos et al. (2013)
	Car-following distance (*CFD*)	Distance to the rear bumper of the lead vehicle	