Personality factors are associated with simulated driving outcomes across the driving lifespan

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A R T I C L E   I N F O
Article history:
Received 20 March 2015
Received in revised form 22 March 2016
Accepted 26 January 2018

Keywords:
Driving behaviour
Personality
Driving simulation

A B S T R A C T
Research has shown that personality factors are related to driving safety. However, the majority of existing studies rely on self-report measures of driving behaviour and sample drivers from limited age ranges. This study sought to examine the relationship between personality and objective driving outcomes as assessed by a driving simulator in a sample of young, mid-aged, and older adults. A total of 114 active drivers completed personality questionnaires as well as a simulated driving assessment protocol. The results showed that: (1) Extraversion and neuroticism were significantly associated with driving simulator performance; (2) conscientiousness was significantly associated with driving performance among middle-aged adults; (3) sensation seeking was an important personality factor primarily for young drivers and was positively correlated with driving speed in the simulator. These results provide further support for the link between personality factors and driving performance, and suggest certain directions for future research.

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1. Introduction
Driving a vehicle is an important feature of modern North American culture and is inextricably linked to independence, autonomy, and quality of life (Dickerson et al., 2007; Kua, Korner-Bitensky, Desrosiers, Man-Son-Hing, & Marshall, 2007). Unfortunately, traffic-related collisions represent a considerable social and economic burden on our society. Canadian data from 2013 show that there were approximately 120,000 collisions that resulted in personal injuries and 1750 collisions that resulted in fatalities (Transport Canada, 2015).

In Canada, drivers aged 16–24 years are consistently overrepresented in traffic collision statistics (Transport Canada, 2011). While this age group constitutes only 13% of the driver population, it represents 24% of driver fatalities and 26% seriously injured drivers (Transport Canada, 2011). However, not all younger drivers are equally at risk. In particular, national hospitalization data shows that among young drivers, males are almost twice as likely as females to be hospitalized due to a

This research was supported by a Social Sciences and Humanities Research Council of Canada (SSHRC) doctoral scholarship granted to Dr. Julie Riendeau.

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https://doi.org/10.1016/j.trf.2018.01.022
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motor vehicle collision and three times more likely than females to die due to a motor vehicle collision (Public Health Agency of Canada, 2012).

Given the increased susceptibility of older age groups to injury and death, it is not surprising that the second highest rate of fatal and non-fatal crash injuries per kilometre driven is among those aged 70 years or older (McGwin, Owlsley, & Ball, 1998). For example, Bédard, Guyatt, Stones, and Hirdes (2002) compared drivers aged 65–79 years and drivers aged 80 or older to drivers aged 40–49, and found significantly higher odds of a fatal injury in both of the older groups: for drivers aged 65–79 years, the odds ratio (OR) was 2.33 (99% CI, 1.58, 3.43); and for drivers aged 80 or older, the OR was 4.98 (99% CI, 2.01, 12.37). Increases in the occurrence of crashes among older drivers are expected over the next several decades as Canadians aged 65 years or older represent the fastest growing segment of the driving population and this group is projected to make up 24% of the total population by the year 2036 (Statistics Canada, 2010; Turcotte, 2012). The crash risk across the lifespan of drivers is often described as exhibiting a U-shape with young and older drivers being at greatest risk (Evans, 2000).

Research indicates that approximately 90% of all crashes are the result of driver characteristics and behavior (Lewin, 1982). Identified risk factors for crash involvement are quite different among young and older drivers (Owsley, McGwin, & McNeal, 2003). Crash risk among young drivers has been associated with driving inexperience, risk-taking behavior (e.g., speeding, passing when not safe to do so), moving violations, and alcohol use (Owsley et al., 2003). Among older adults, traffic-related collisions have been attributed to difficulties negotiating driving situations where complexity and time pressure are elevated (e.g., unprotected left turns, stop sign controlled intersections; Bédard, Stones, Guyatt, & Hirdes, 2001; Freund, Colgrove, Burke, & McLeod, 2005).

Given that human factors explain significantly more variability in crash rates than any other factors (e.g., vehicular, roadway), it is not surprising that more recent research has focused on examining the relationship between human factors and unsafe driving (Dahlen & White, 2006). One factor consistently linked to unsafe driving among young and mid-aged adults is personality (Schwebel et al., 2007). Proponents of personality psychology argue that some individuals are more likely than others to regularly engage in unsafe driving behaviour (Boyce & Geller, 2002). Research has revealed that personality characteristics are a direct contributor to engaging in unsafe driving behaviour among young and mid-aged adults and there is evidence to suggest that personality may act as a distal influence on driving behaviour through risk perception (Machin & Sankey, 2008). Surprisingly, little research has examined the role of personality characteristics in unsafe driving behaviour among older adults. However, the challenge for researchers is to provide a better understanding of how personality characteristics contribute to crashes among drivers, particularly those most at risk (Elander, West, & French, 1993).

Personality traits refer to relatively stable, enduring patterns of thoughts, feelings, and behaviours that describe the ways in which people differ from or are similar to one another (McCrae & Costa, 1995; Tellegen, 1991). The taxonomy of personality traits that has received the most empirical support over the past two decades is the five-factor model (FFM; Costa & McCrae, 1992). Also referred to as the Big Five, the broad traits composing the FFM have been provisionally named Extraversion (i.e., outgoing, expressive, energetic, and dominant), Neuroticism (i.e., tendency to experience negative affect and anxiety), Conscientiousness (i.e., dependability, responsibility, self-discipline), Agreeableness (i.e., helpfulness, trust), and Openness to Experience (i.e., adventurous, broad-mindedness) (Caspi, Roberts, & Shiner, 2005). As a comprehensive trait model of personality, the FFM has been widely used to provide a systematic approach to various outcome variables from organizational behaviour to crash involvement (Sümer, Lajunen, & Ozkan, 2005).

A number of empirical studies have explored the relationship between personality and driving behaviour. Arthur and Graziano (1996), for example, sampled 227 college students and 250 individuals recruited from an employment agency. They determined that among the college student sample, Extraversion was statistically significantly related to both self-reported number of at faulcrashes, \( r = 0.13, 95\% \text{CI}[0.000, 0.255] \) and total crashes, \( r = 0.15, 95\% \text{CI}[0.021,0.274] \), while Conscientiousness and Openness were related to at-fault crashes, \( r = 0.14, 95\% \text{CI}[0.010,0.265] \), \( r = 0.13, 95\% \text{CI}[0.000, 0.255] \) respectively. Among the individuals recruited from the employment agency, Conscientiousness was inversely related to total crashes, \( r = -0.19, 95\% \text{CI}[−0.306, −0.068] \). In a follow-up study, Arthur and Doverspike (2001) found an inverse relationship between Conscientiousness and self-reported crashes in a sample of young drivers. These results point to the importance of conscientiousness towards safe driving and also highlight that the relationship between personality and driving outcomes may be dependent on characteristics of the population from which the sample was drawn.

Sümer, Lajunen, and Ozkan (2005) sought to examine the relationship between the Big Five factors of personality, self-reported driving behaviour, and crash history. To this end, they had 1001 drivers complete a questionnaire related to aberrant driving behaviour, the Big Five Inventory, and a demographic questionnaire with self-reported crashes. Their results indicated statistically significant correlations between many personality factors and driving variables. However, Conscientiousness and Agreeableness correlated significantly and negatively with all of the driving variables that were assessed with \( r \)-values ranging from between \( r = −0.10 \) and \( r = −0.38 \).

In their meta-analysis of the relationship between crash involvement and the Big Five, Clarke and Robertson (2005) determined that Conscientiousness, Agreeableness and Extraversion are associated with self-reported crash involvement. Clarke and Robertson (2005) also provided a brief discussion of the hypothesized mechanisms underlying the relationship between personality and driving. In particular, they suggest that there is a tendency for extraverts to seek stimulation to a far greater extent and consequently demonstrate significantly poorer performance on vigilance tasks relative to introverts; there is evidence to support a decline in performance under monotonous conditions such as driving among extraverted individuals. Individuals low in conscientiousness tend to focus on their immediate needs and ignore future consequences and they fail to follow rules and regulations. Agreeableness and crash risk may be related to one another due to higher emotional arousal.
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