Can we explain attention-related errors while driving?

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Abstract

Driver inattention is one of the main causes of road crashes. Factors that result in drivers' attention-related errors, especially from the perspective of driver characteristics, have not been systematically investigated. This study conducted a questionnaire survey and investigated the inter-relationship between driver characteristics and their attention-related errors. Results indicated that (1) driving experience decreases attention-related errors while driving; (2) a higher frequency of driving violations, high disinhibition, and high susceptibility to involuntary distraction are associated with frequent attention-related errors. The findings shed light on the direction of countermeasures to reduce distracted driving and attention-related errors.

Background

Driving is an attention demanding task that requires continuous interactions between humans, vehicles and road infrastructure. However, with the proliferation of cell phones and other nomadic devices in daily life, drivers often engage in secondary tasks while driving such as texting or listening to music, which potentially interrupts the driving process. This interference could result in road crashes. For example, in Australia, it has been reported that use of a mobile phone up to 10 minutes before a crash was associated with a fourfold increased likelihood of crashing (McEvoy et al., 2005). Nonetheless, there are still many unknown factors regarding crash processes in mobile phone distracted driving (Oviedo-Trespalacios, Haque, King, & Washington, 2016).

Educational campaigns, legislation and enforcement have been frequently implemented to stop distracted driving, however their success has been insufficient. In Australia, the high prevalence of mobile phone use while driving confirms that there are a large number of distracted drivers on roads and the need to explore new approaches to prevent attention-related errors is imperative (Oviedo-Trespalacios, King, Haque, & Washington, 2017; Waddell & Wiener, 2014). Therefore, the aim of this research is to characterize the inter-relationship between a group of driver characteristics (e.g. age, gender, driving experience, sensation seeking, and distracted driving susceptibility) and attention-related errors.

Method

Participants

A cross-sectional design was selected. A total of 466 participants (65% females) completed a 30-min questionnaire. Participants have an average age of 29 years and reported holding a valid driving license for 11 years on average. Personal characteristics of the participants are reported in Table A1.

Questionnaire

The scales utilized in this study are showed in Table 1.

Data analysis

Reliability of the scales was studied using Cronbach's alpha coefficient. A value of 0.70 or greater was considered adequate. Additionally, a correlation analysis was conducted to determine any relationships among the variables tested.

Table 1 – ***Scales included in the Questionnaire***

Scale	Definition	Subscales	Responses	Author
Sensation Seeking (SS)	Sensation seeking is explained as the need for novelty and complexity of stimulation	(a) Experience seeking, (b) Boredom susceptibility, (c) Thrill and adventure seeking, and (d) Disinhibition	(1) "Strongly disagree" – (5) "Strongly Agree"	Hoyle, Stephenson, Palmgreen, Lorch, and Donohew (2002)
Attention-Related Driving Errors Scale (ARDES)	ARDES mainly refers to the non-deliberate errors in driving performance resulting from an attentional failure	N/A	(1) "never or almost never" – (5) "always or almost always"	Rubén D. Ledesma, Silvana A. Montes, Fernando M. Poó, and María F. López-Ramón (2010)
Condensed Behaviour of Young Novice Drivers Scale (BYNDS)	Inventory of risky driving behaviours in Australia	(a) Transient violations (risky driving behaviours that can change throughout the journey, such as speeding), and (b) fixed violations (risky driving behaviours that are not transient in nature, such as not wearing seatbelt)	(1) "Never" – (5) "Nearly all the time"	Scott-Parker, Watson, King, and Hyde (2012)
Crash-involvement Scale	Prior involvement in crashes (at least one in the last three years)	N/A	(1) "No" – (2) "Yes"	N/A
Susceptibility to Driver Distraction Questionnaire	Involuntary and voluntary distraction involvement	(a) Distraction engagement, (b) Attitudes and Beliefs about Voluntary Distraction, and (c) Susceptibility to Involuntary	(1) "Strongly disagree" – (5) "Strongly Agree"	Feng, Marulanda, and Donmez (2014)

Results and conclusions

The correlations are reported in Table A1. Some of the findings include:

- Years with a valid driving license was negatively correlated to attention-related errors. Experience driving serves as a protective factor against attention-related errors. A focus on novice drivers' prevention is essential.
- Attention-related errors are positively correlated with transient and fixed driving violations. Tackling distraction would potentially benefit other risky driving behaviors. This also supports a systematic approach for driver safety, and it is not efficient to just target one behavior. Further research is necessary to study causality relations. Based on the literature we know that distracted drivers change their driving performance (Li, Yan, Wu, Radwan, & Zhang, 2016).
- Disinhibition was positively correlated to attention-related errors and presented as the largest correlation among the SS subscales. In addition, disinhibition has been consistently linked with mobile phone use while driving and multitasking (Oviedo-Trespalacios, Haque, King, & Washington, 2017). This personality trait seems to be characteristic of distracted drivers who present frequent attention-related errors.
- Distraction engagement was not correlated directly with attention-related errors. A potential explanation is that disinhibition regulates the distraction-error relationship. Particularly, highly disinhibited drivers could be more invested in mobile phone tasks. This is also a promising line of research.
- Susceptibility to involuntary distraction is positively correlated to attention-related errors. A potential explanation for this phenomenon is that drivers are not able to activate timely self-regulation behaviours such as selective engagement or workload management (Li et al., 2016; Oviedo-Trespalacios, King, et al., 2017). Efforts to prevent involuntary distraction could reduce the number of inattention errors.

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Appendix

Table A1 – ***Participants' characteristics, responses to scales, and correlation analysis***

Variables	M	SD	Driver Characteristics				Sensation Seeking (SS)				Risky Driving (BYNDS & Crash involvement)			Susceptibility to Driver Distraction Questionnaire			Attention-Related Driving Errors Scale (ARDES)
			S	A	YDL	DW	EX	BO	TA	DI	TR	FI	CI	DE	AB	SID	
Sex (S)	0.35[a]	N/A	1	-.1	-.07	-.06	-.08	-.05	-.17**	-.14**	-.09*	-.15**	.04	.06	-.01	-.00	-.04
Age (A)	29	11		1	.95**	.08	-.03	-.24**	-.20**	-.30**	-.22**	-.03	-.43**	-.2**	-.21**	.08	-.06
Years with a valid driving license (YDL)	11.0	11.1			1	.07	.02	-.23**	-.18**	-.25**	-.17**	-.01	-.45**	-.2**	-.16**	.02	-.10*
Driving hours per week (DW)	2	1				1	.13**	.11*	.04	-.11*	.05	-.04	.01	.05	.02	-.08	-.09
Experience seeking (EX)	3.54	.99					1	.46**	.40**	.26**	.13**	.04	-.11*	.22**	.23**	-.14**	-.01
Boredom Susceptibility (BO)	3.07	.96						1	.34**	.36**	.15**	.11*	.01	.22**	.19**	-.07	.10*
Thrill and adventure (TA)	2.65	1.16							1	.44**	.23**	.19**	-.04	.20**	.19**	-.04	.11*
Disinhibition (DI)	2.49	1.12								1	.38**	.27**	.02	.33**	.27**	-.07	.17**
Transient Violations (TR)	2.16	.69									1	.44**	-.01	.48**	.37**	-.00	.33**
Fixed violations (TR)	1.20	.43										1	.02	.11*	.11*	.11*	.56**
Crash-involvement (CI)	0.5[b]	N/A											1	-.04	.00	.04	.01
Distraction Engagement (DE)	3.34	.63												1	.55**	-.07	.09
Attitudes and Beliefs (AB)	3.28	.48													1	-.25**	-.01
Susceptibility to Involuntary Distraction (SID)	2.78	.64														1	.29**
Attention-Related Driving Errors Scale (ARDES)	1.49	.46															1

[a] represents the percent of male drivers;
[b] represents the percent of drivers that are involved in crashes before;
* represents a significance level of 0.05;
** represents a significance level of 0.0