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Impact of Driver Distraction on Driving Behavior and Road Safety

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Background and Objective

- In the framework of BeSmart Project, critical driving risk factors are identified in order to develop an innovative smartphone application aiming at assessing and improving behavior and safety of all drivers.

- Driver distraction, considered as a typical part of everyday driving, constitutes an important factor of increased risk of road crashes worldwide.

- The objective of this presentation is to provide an overview and assessment of existing studies on distraction, focusing specifically on in-vehicle driver distraction.

BESMART

European Union
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Definitions and types of driver distraction

- Definition: "A diversion of driver's attention by focusing on an object, person, task or event not related to driving, which reduces driver's awareness, decision making ability, leading to an increased risk of corrective actions, near-crashes, or crashes" (Regan et al., 2008).

- There are four distinct categories of distraction defined as: visual distraction, auditory distraction, physical distraction and cognitive distraction.

- Driver distraction factors can be subdivided into internal (in-vehicle) and external.

Results of review (1/2)

- There is a variety of applied methodologies for the assessment of distracted driving: questionnaires, polls, crash analyses, driving simulator studies, test-track studies, field studies and naturalistic driving experiments.

- Distraction factors may affect driver behavior (speed, lateral position, headways) and road safety (reaction time, crash probability).

- Distraction caused by interacting with in-vehicle devices while driving impair drivers on the road more than external distractions.

Results of review (2/2)

- Mobile phone use and complex conversation appear to be the most critical in-vehicle distraction factors as they induce higher mental workload and cognitive functions and reduce reaction times to events.

- Drivers using their mobile phone while driving present up to 4 times higher crash risk.

- Regarding external distraction sources, advertising signs are associated with increased driver distraction but not with crash risk.

Overview of driving distraction studies

Study Chacteristics		Experiment Type						Distraction Source						Sample Characteristics						Outcome Indicator										Analysis Method
														Gender			Age													
Author(s)	year	simulator	naturalistic	accident analysis	on road	questionnaire	meta-analysis	cell phone	conversation	music	IVIS	extemal		total	male	% male	25-	26-55	55+	speed	reaction time	lane position	headway	number of accidents	accident severity	accident probability	attention lapses	eye glance	accel./decceleration	
Beede & Kass	2006	●						●						36			●	●			●	●	●				●			Descriptive statistics | Absolute difference comparison
Strayer et al.	2006	●						●						40	25	0.63	●	●		●	●		●	●						Multivariate analysis of variance
Bellinger et al.	2009	●						●		●				27	16	0.59	●				●									Descriptive statistics | Absolute difference comparison
Gliklich et al.	2016					●		●						1211	608	0.5	●	●	●							●				Logistic regression | Cronbach's alpha
Fitch et al.	2015		●					●						204	75	0.37	●	●	●									●		Descriptive statistics | Analysis of variance
Dingus et al.	2016		●					●	●	●	●	●		3500	1559	0.45	●	●	●							●				Mixed effect random logistics model
Caird et al.	2008						●	●												●	●	●	●					●		Meta-analytic correlation analysis
Backer-Grøndahl &	2011			●				●						9314	5961	0.64	●							●						Quasi-induced exposure
McEvoy et al.	2007					●		●	●	●	●	●		1367	652	0.48	●	●	●					●						Logistic regression models
Lee & Abdel-Aty	2008			●					●					2817	1859	0.66	●	●	●					●	●					Bivariate probit model | binary logit model
White & Caird	2010	●							●					40	20	0.5	●										●			Discriminant function analysis
Papantoniou et a	2016	●						●	●					95	47	0.49	●	●	●	●	●									Generalized linear models | generalized linear mixed models
Theofilatos et al.	2018						●		●															●						Random effects meta-analysis
Jamson & Merat	2005	●									●			48				●			●									Repeated measures analyses of variance
Donmez et al.	2006	●									●			28				●	●	●			●					●	●	Mixed linear model
Metz et al.	2011	●									●			40	22	0.55		●										●		Mixed analyses of variance
Xie et al.	2013	●			●						●			12	4	0.33	●	●	●									●		Analysis of variance | Bonferroni Multiple Comparisons
Hatfield & Chamberlain	2008	●								●				27	12	0.44	●	●	●	●		●		●						Repeated-measures analyses of variance with planned contrasts
Young et al.	2012	●								●				37	17	0.46	●	●		●		●	●				●	●		Repeated-measures analyses of variance, with five levels
Brodsky & Slor	2013				●					●				85	49	0.58	●			●			●				●			Repeated measures analyses of variance
Young et al.	2009	●										●		48	29	0.6	●	●				●						●		Repeated measures analyses of variance with two factors
Edquist et al.	2011	●										●		48	30	0.63	●	●	●								●			Mixed-model analyses of variance
Yannis et al.	2013			●								●												●						Before-and-after statistical analysis at 95% confidence level
Donmez & Liu	2015			●								●		115796			●	●	●						●					Ordered logit model
Terry et al.	2008	●										●		78	43	0.55	●	●	●		●		●							Repeated-measures multivariate analysis of variance

Future Research

- Importance of investigating distracted driving as a chain of events and examining the combined effect of all distraction factors.
- Cross validation through experiments (driving simulator, naturalistic driving) and epidemiological studies.
- Focus on the exploitation of technological advancements in data recording systems so that driver distraction can be measured under naturalistic driving conditions.

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