Road user behaviour, new technologies and road safety

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Understanding road users’ interactions with new technologies

Centre for Connected & Autonomous Vehicles

European Commission  EPSRC

Engineering and Physical Sciences Research Council

Innovate UK

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Main facilities
Improving road safety

Pillar 1: Road safety management
Pillar 2: Safer roads and mobility
Pillar 3: Safer vehicles
Pillar 4: Safer road users
Pillar 5: Post-crash response

- Education and Campaigns
- Engineering measures
- Enforcement
- Technology
What contributes to risk on the road?

Rumar, 1985, see Lum & Reagan, 1995
Number of people killed in Traffic Collisions in GB

Source: PeterEastern at en.wikipedia
Global Megatrends

Demographic and Social Change

Shift in Global Economic Power

Rapid Urbanization

Climate Change and Resource Scarcity

Technological Breakthroughs

Analysis by PWC
Changes to cars

1920s

1940s

1950s

1970s

1910

1980s

Future?

NOW

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The ‘intelligent car’

- Electronic Stability Control (ESC)
- (Emergency) Brake Assist (EBA) and Antilock Braking System (ABS)
- (Adaptive) Cruise Control (CC, ACC)
- Lane Change Assist
- Blind Spot Assist
- Lane Keeping Systems (LKS)
- Autonomous Emergency Braking
- Traffic Jam Assist
- Intelligent Speed Adaptation (ISA)
- Intelligent Parking

Etc.

**Photo from ‘Technicity’ Magazine**

- 1971 ABS – prevents wheel lock-up to maintain friction between wheel and road surface
- 1995 Electronic Stability Control – maintains directional controllability through brake intervention
- 1999 Adaptive Cruise Control (ACC) – replaces the driver in the car following task by driving at a set headway
- 2000 Lane Departure Warning
- 2005 Blind Spot Warning – to assist in lane changing
- 2006 Lane Keeping System – applies corrective steering responses to steer the vehicle back into lane
- 2006 Forward Collision Warning
- 2007 Collision Warning with Auto Brake – intervenes in potential rear-end collisions if the driver does not react
- 2007 Stop and Go – extends ACC to stop and start traffic
- 2010 Volvo Cars Pedestrian Detection with Full Auto Brake
- 2011 Mercedes Active Lane Keeping Assist – applies brakes if it senses the vehicle is drifting out of lane
- 2013 Volvo Cars Cyclist Detection with Full Auto Brake

**Automated/autonomous/driverless vehicles**
Shaping the future of autonomous transport
Changing pattern of road use

London in early 1900s

London now

London 2050?

Image from hubpages.com

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Drivers ↔ VRUs (Human Factors)

- Age
- Experience
- Gender
- Mood/Personality
- Impairment
  - Drug/Alcohol
  - Fatigue
  - Distraction

![Venn Diagram](image)
Age and Gender

Source: NHTSA

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“Speed remains a very important risk factor. It has a greater effect on the number of accidents and injury severity than almost all other known risk factors.” Elvik, (2009)

Professor Oliver Carsten to Speak at European Parliament Debate on In-Vehicle Safety

31 October on Government, Research, Safety, Transport

Professor Oliver Carsten of the University of Leeds Institute for Transport Studies will be speaking at a dinner debate on “Fitting Safety as Standard” at the European Parliament on Monday 3 November.
Impairment, Fatigue and Distraction
Ironies of automation

• Unintended consequences
• Behavioural Adaptation

Sullivan et al., 2016
Virginia Tech 100 Car Study (Dingus et al., 2005)

• 100 highly instrumented cars driven in “naturalistic” circumstances for a year in Virginia
• Particular focus on young drivers
• Covered both near-misses and crashes
• Almost 80% of crashes and 65% of near crashes involved the driver looking away from the forward roadway just prior to the onset of conflict
• Inattention, including secondary task distraction, was a contributory factor in 93% of the incidents with lead vehicles
• Phone and PDA use was a major factor in incidents
Surveys of phone use while driving in south-east England

TRL, 2009

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Surveys of phone use while driving in south-east England

TRL, 2009
Distraction versus Drugs

Ironies of automation

- Unintended consequences
- Behavioural Adaptation

Sullivan et al., 2016
ITS for congestion

Automatic Number Plate Recognition (ANPR)
Effect of Congestion Charge on Traffic

People entering central London in the weekday morning peak
- road traffic by main mode of transport

Source: London Transport Data

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Effect of Congestion Charge on Health?

Source, Cyclists in the City

Trend in casualty rate per 100m km - pedal cycles

- London
- Rest of England

Source, Cyclists in the City

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ITS for safety and information
ITS for advertising – distraction?

It’s so easy to pick you out in a crowd.

Porsche
Restating the National Highway Transportation Safety Administration’s National Motor Vehicle Crash Causation Survey for Automated Vehicles

Casualty Actuarial Society Automated Vehicles Task Force

EXECUTIVE SUMMARY

The National Highway Transportation Safety Administration (NHTSA) concluded its National Motor Vehicle Crash Causation Survey (NMVCCS) in 2008. The NMVCCS analyzed the events leading up to a motor vehicle crash to determine what was causing automobile accidents. This study, which found that 93% of accidents are caused by human error, is often referenced to justify and
Influence of Technology

• If technology limitations (e.g. weather, vehicle errors, inoperable traffic control) are taken into account, this figure drops to 78%

• Difference between 93% and 78% = 830,000 accidents or $45 Billion
• **Situation awareness** is lower than in manual and reduces with increasing automation, especially if drivers engaged in another task (Merat et al, 2012)

• When required to **resume control** drivers take up to ~30 seconds to stabilise behaviour (Merat et al., 2014)

• **VRUs** need to interact safely with AVs and share the same space
Remaining challenges

- Distraction and fatigue
- VRUs
- Infrastructure
- Natural disasters
- Ageing population
- Educating school children/young adults
- Technology must go hand in hand with societal needs
Thank you for your attention!

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