



Challenge of The Human Machine Interface

Alan Stevens

Research Director, Transportation

ITF/OECD Seminar on Distraction and Fatigue



Many different concepts related to distraction and fatigue...

Distraction

Arousal

DROWSINESS

Impairment

Fatigue

Alertness

Cognitive load

Attention

Vigilance

Mental effort

Mental workload

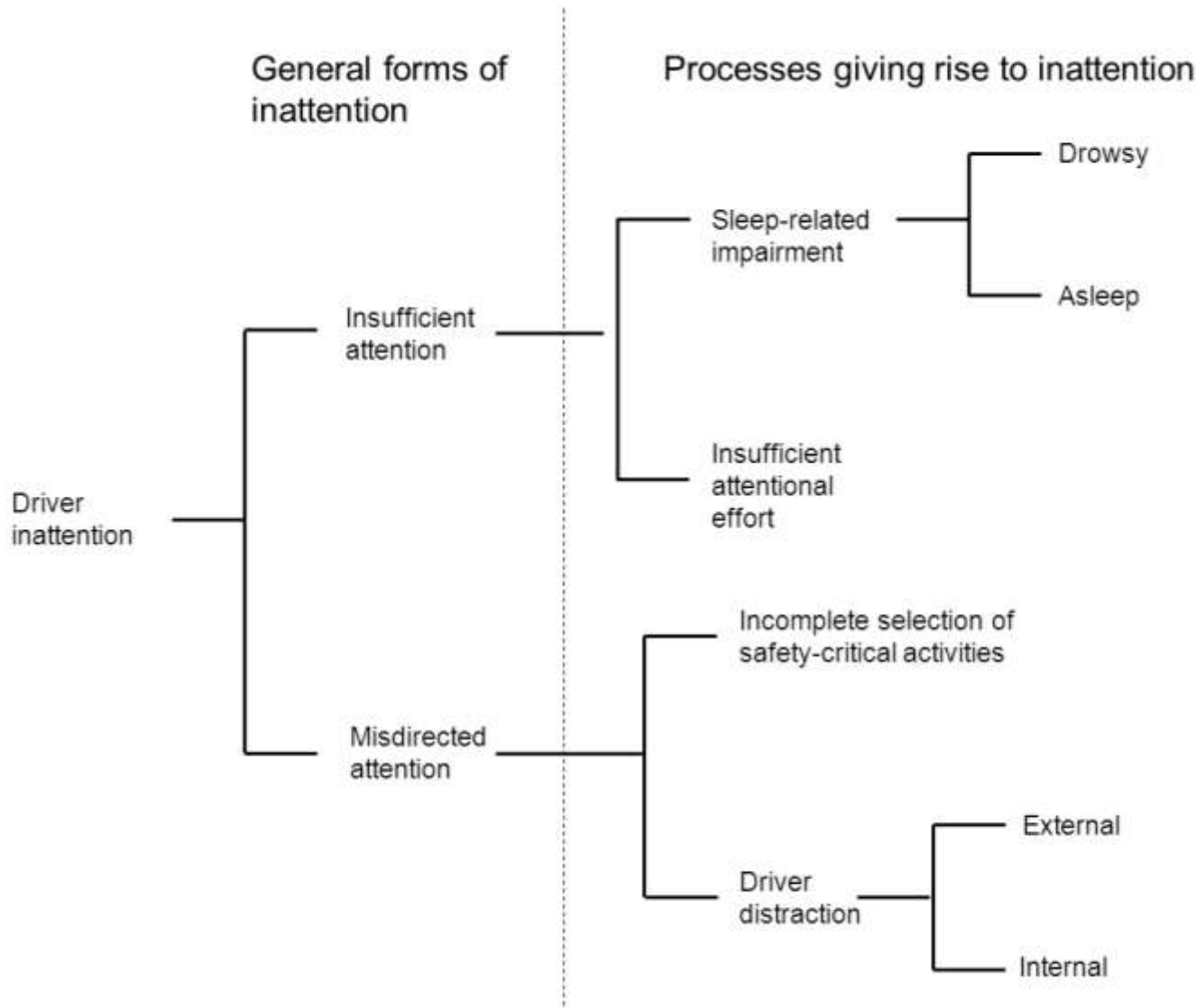
Looked-but-did-not-see

Inattentional blindness

Change blindness

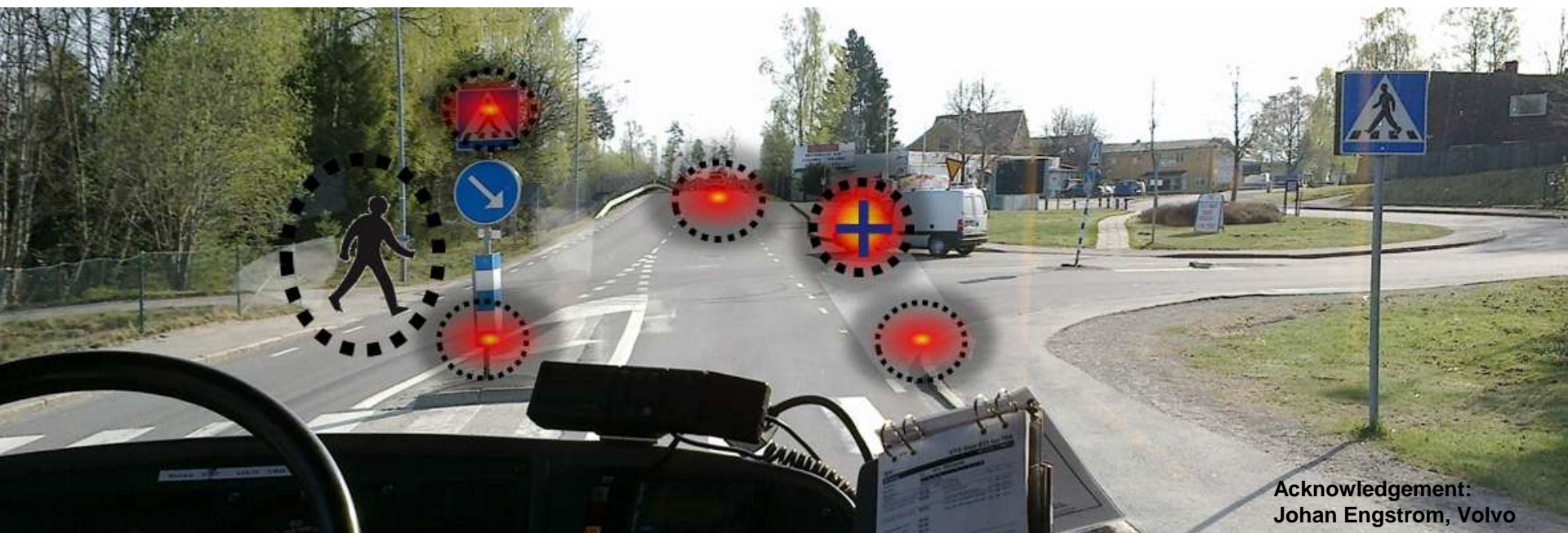
Proposed taxonomy

Starting from more general "Inattention"



Misdirected attention/Incomplete selection of safety-critical activities

- Related to failures in selecting among activities critical for safe driving



Acknowledgement:
Johan Engstrom, Volvo

Example: Driver allocates sufficient attentional activation to several relevant locations but fails to select the pedestrian

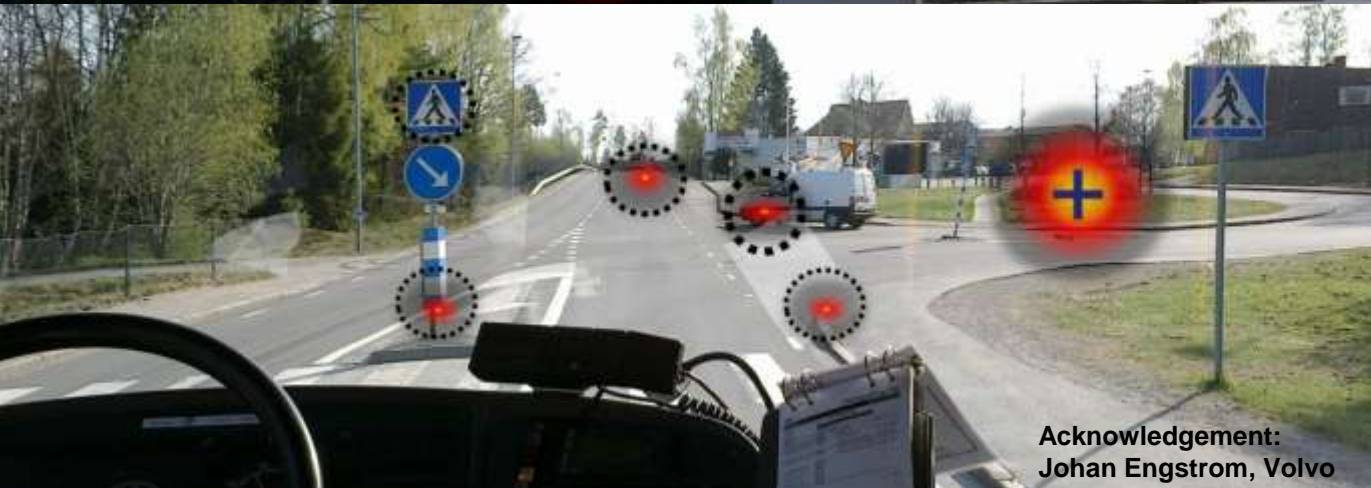


Misdirected attention/Driver distraction

- Diversion of attention away from activities critical for safe driving to one or more activities that are not critical for safe driving



Vehicle-internal distraction



Vehicle-external distraction

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Johan Engstrom, Volvo



Risk of distraction-related crash

- Is a function of :
 - **Timing** (e.g. coinciding with unexpected event is more critical than in a low workload situation such as or stopped at a traffic light)
 - **Intensity** (e.g. texting requires more resource than listening to the radio)
 - **Frequency** – more often repeated actions more likely to coincide with a critical event
 - **Duration** of the distraction – again increasing the probability of the distraction coinciding with a critical situation



Interface Technology Development: Nomadic Devices

■ Blessing:

- Rapid product cycles
- → Information, Warnings, Assistance, road charging, Emergency Call etc.
- Potential for integration of services onto a single device; "Apps"

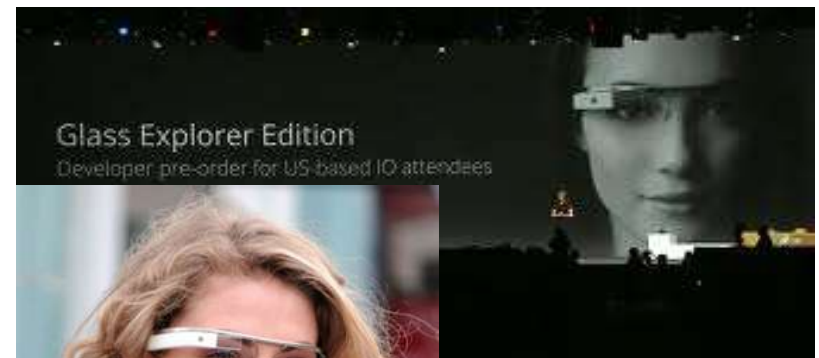
■ Curse:

- "Dogs breakfast" interface to driver
- → confusion, overload, lack of acceptance
- True integration requires unified business models behind the interfaces

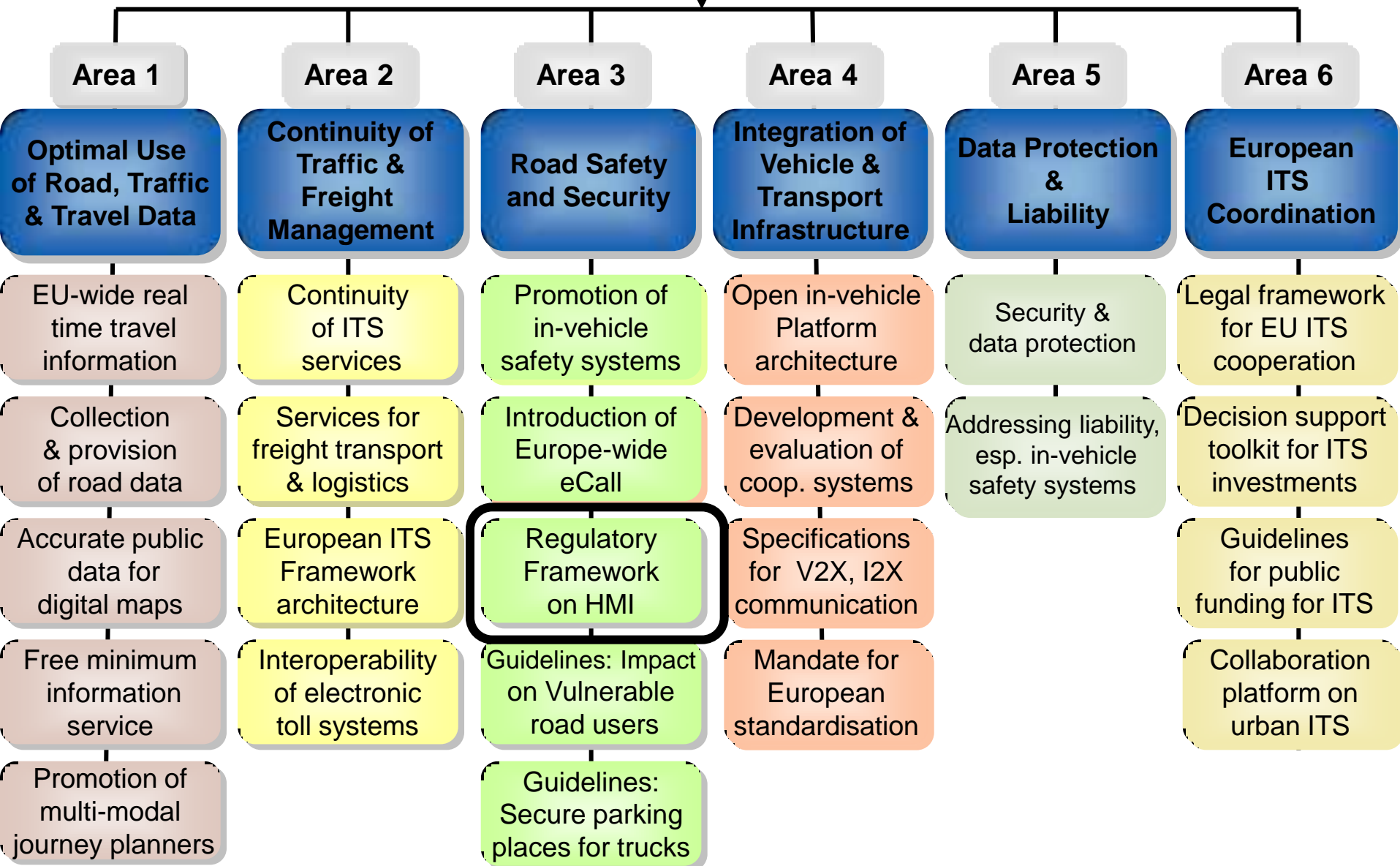


Interface Technology Development: HUD

- Benefits of Head-Up displays:
 - Reduces eye movement and accommodation time
 - Can overlay conformal symbology
 - Faster recognition
- BUT:
 - Attention capture of compelling information
 - Targets in peripheral areas missed
 - Using HUD needs training



ITS ACTION PLAN



Mitigation by Good Design: The European Statement of Principles (ESoP)

- EC Commission
“Recommendation”
- Voluntary, relatively high-level principles
 - Balanced risk/benefit approach
 - Not constraining design options
- Assessment
 - By inspection – Result = Yes/No, or
 - Assessment and Judgement – no specific criteria




Developing the ESoP as a design assessment checklist

- Excel Spreadsheet for PC, tablet etc.



- Supportive Information for each question is available via a 'help' icon
- Assessment Summary Sheet is automatically populated based on the data entered


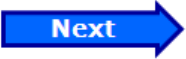
Part A - Installation

A8 Is physical and visual access to primary driver controls free from obstruction by the IVIS and its mounting? 

The IVIS does not interfere with normal leg, hand and arm movements.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with use of the accelerator, brake or clutch.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with the use of the steering wheel.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with the direction indicators or windscreen wipers.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with the use of the lights.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with the use of the horn.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with use of the gear lever.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with use of the parking brake.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with the use of the hazard warning lights.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A
The IVIS does not interfere with the use of the de-mister controls.	<input type="radio"/> True <input type="radio"/> False <input type="radio"/> N/A

Answer None Minor Serious N/A

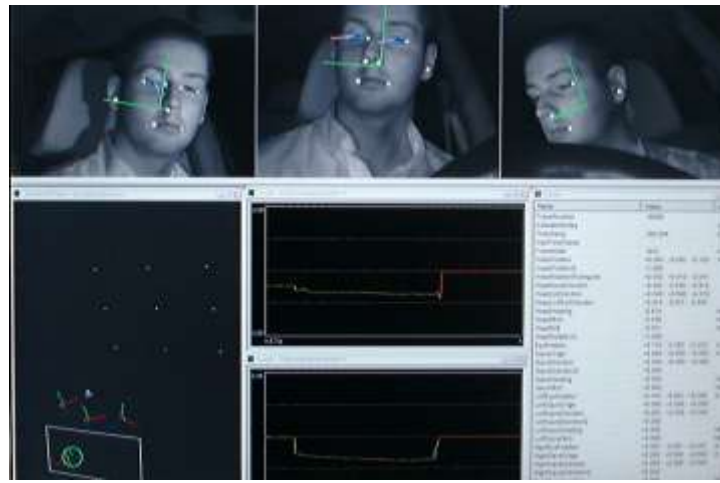
Comment

Ref: Checklist for the Assessment of In-Vehicle Information Systems
by A Stevens, S Cynk TRL Published Report MIS005

Prospects for scientific measurements

- Lane Change Task
- Occlusion method
- Peripheral/Tactile Detection Task
- Eye movement analysis
- Naturalistic studies

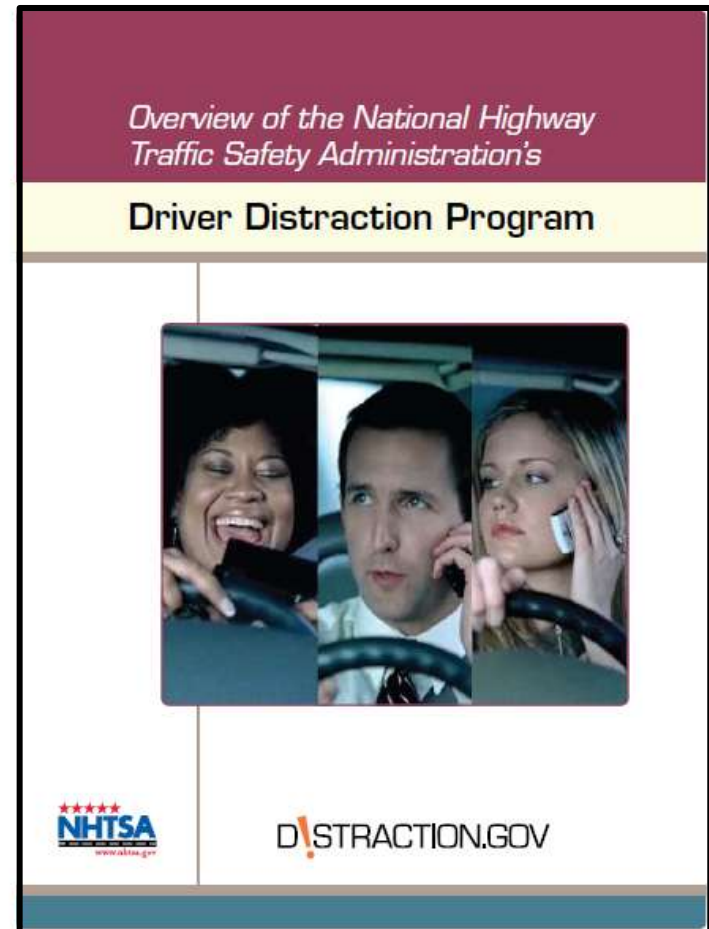


Design requirements – specific criteria

- NHTSA policy-driven approach



... and the Japanese JAMA guidelines



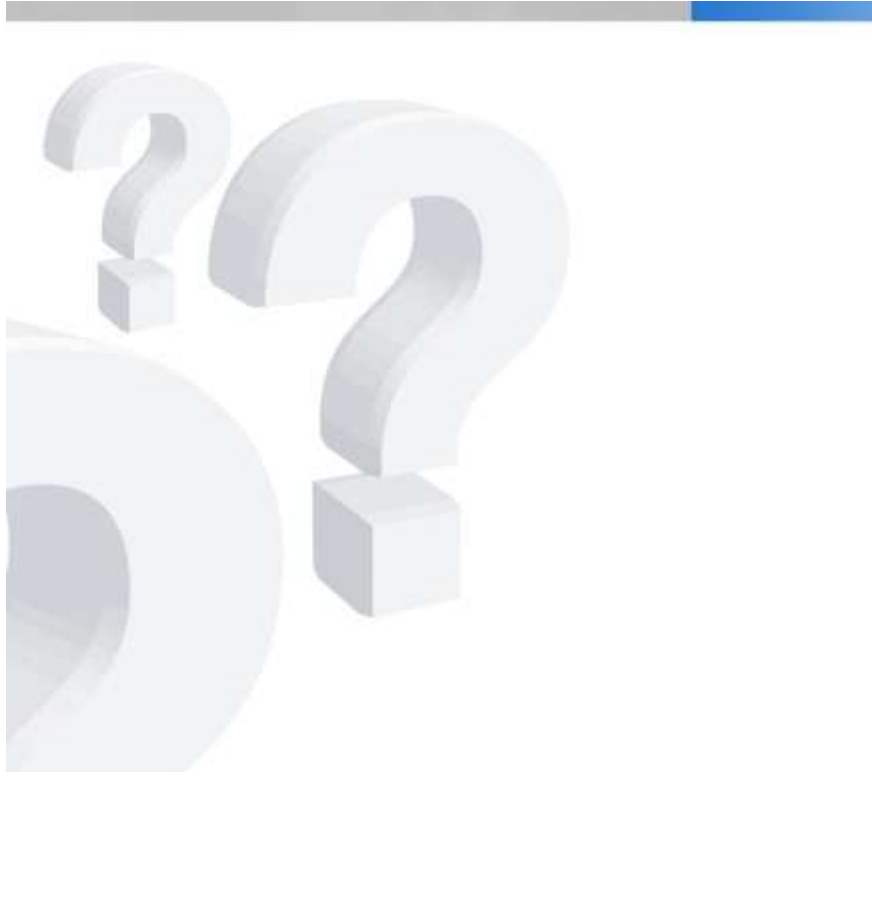
Overview of the National Highway Traffic Safety Administration's
Driver Distraction Program

NHTSA
www.nhtsa.gov

D!STRACTION.GOV

Some thought for later discussion ...

- Ultimately, safety is about preventing or mitigating crashes, particularly those leading to fatalities and severe injury
- Distraction is linked to lack of safety (face validity: if looking away from the road less opportunity to spot looming vehicles and respond in time)
- So, reducing distraction is (usually) “good”
- If designing a robotic driver we would ensure lots of sensors and sufficient processing power to respond to (most) external events – there may still be some inevitable crashes?
- But, for now, we only have human drivers; the question is how we make them as safe as possible:
 - Make the infrastructure more forgiving
 - Make the vehicles more interventional to support/avoid problems and safer in case of crash
 - Make the driver perform better???
- The driver has human needs and emotions; Drivers are distracted by passengers, children, pets, eating, grooming, cellphones, thoughts....
- Design out distractions? Instruct them no to be distracted!?
- Arguments for and against design requirements and strict criteria....



Alan Stevens
astevens@trl.co.uk

