

Driving & IVIS usage: benchmarking the impairment to alcohol

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Background

- Driving impairment by alcohol established in laboratory and accidentology
- Traffic regulation typically limits alcohol consumption to below 0.05 or 0.08 mg alcohol/100ml of blood
- Mobile phone usage is growing rapidly, especially in the vehicle, and evidence on impairment in laboratory and accidentology studies is accumulating.
- Regulation is being implemented rapidly, albeit inconsistently
- Limited policy for driving impairment resulting from in-vehicle information system (IVIS) usage

The 'problem' with IVIS

A diverse technology: different platforms, different applications and different opportunities for interaction and distraction

- From navigation support on an OEM system...
- ...to on-line gambling on a smartphone

Problems of definition and measurement

- Lab based comparisons of alcohol impaired and mobile phone distracted driving (e.g Burns et al. 2002):
 - Phone usage more impairing than legal limit for alcohol
- 'Operational' assessment for alcohol v Lab based definitions for distraction
- Consumer education – how much distraction is 'acceptable/dangerous'
- Impact can be considered as
 - Visual distraction (system outputs and inputs)
 - Cognitive performance – event detection and reaction time
 - Behavioural - Impaired vehicle control
- The need for a simple 'standard' measure rather than relative measures
 - Driving is a self paced task with a highly dynamic workload component
 - System A may be better than system B but both could be dangerous
 - We have no universally accepted performance criteria

Potential 'standard' measures

- '15 second' rule (SAE J2364): a standardised time on task measure:
 - ...arguably focuses on interaction rather than visual distraction
 - 'allows' tasks that many would regard as inappropriate
- Peripheral detection task
 - .. A tertiary task and some questions raised about sensitivity to workload variation
- Occlusion goggles
 - ...absence of a secondary task, so poor match with time sharing
- Lane change task
 - Control and event detection so good match to driving task,
 - But some concerns over absence of longitudinal control

aims

- A comparison of alcohol impairment and IVIS distraction impairment using a standard set of tasks:
 - Lane Change Task (LCT)
 - PDA based data retrieval task

To provide:

- A baseline and procedure for the assessment of IVIS systems
- A measure of impairment that can be presented in terms that are already familiar to a non-scientific audience

nota bene!

- It is recognised that alcohol impairment and distraction differ in important ways (e.g.):
 - Alcohol impairment may be temporary but is pervasive
 - Distraction is episodic
 - Alcohol acts as a CNS depressant
 - IVIS distraction is a reflection of driver ability to complete a divided attention task
- Outcomes may be superficially similar but more research is needed to explore performance differences before the benchmarking could be proposed with confidence

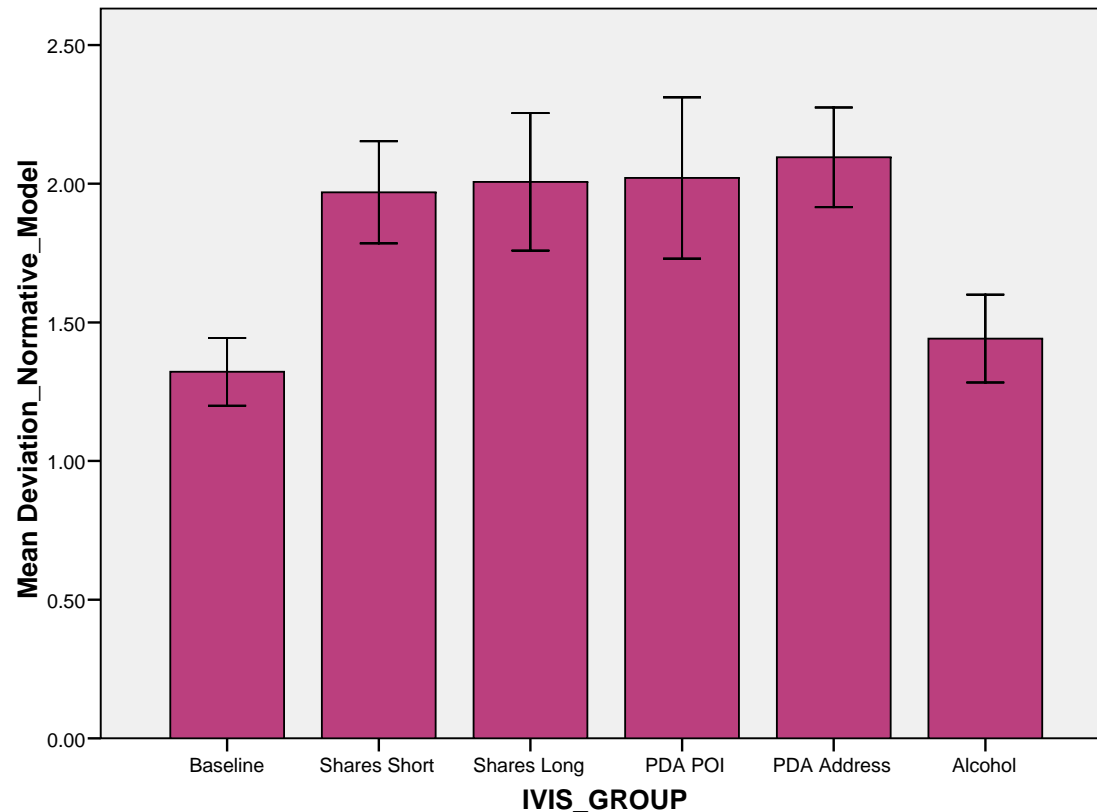
method

- Experimental Design
 - Within subjects, repeated measures design, partial counter balancing for order (alcohol condition always last)
- 15 participants
 - 8m / 7f; randomly selected from a volunteer driver database
 - Alcohol users but not abusers
- Standard LCT task as proxy for the driving task
 - Baseline Condition (5 LCT trials)
 - IVIS condition – HP iPAQ with a bespoke application (5 LCT trials)
 - four visual search and selection tasks
 - Alcohol condition – 80mg/100ml (5 LCT trials)

IVIS tasks

- Two common 'interactive' navigation system tasks:
 - **PDA Pol:** Selecting a destination from a list of 'points of interest'
 - **PDA Address:** Entering a new destination using a virtual keyboard
- Two visual search tasks:
 - **Shares short:** Finding a target share price in a single scrolling list
 - **Shares long:** Finding a target share price embedded in three columns of data
 - In both cases the target was presented verbally, as was the response

Results 1: strong effect for IVIS tasks



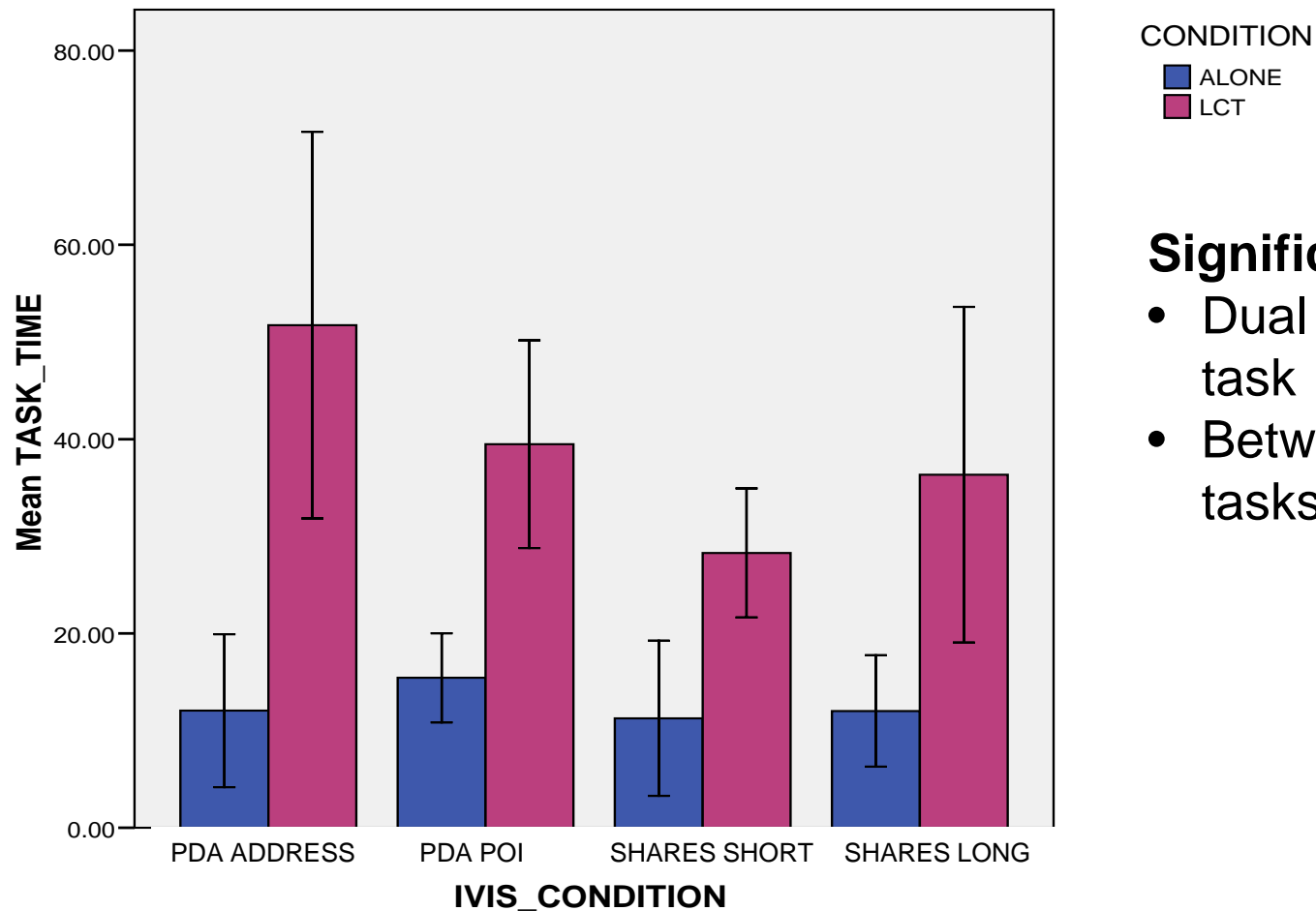
Significant:

- Baseline and IVIS
- Alcohol and IVIS

Non-significant:

- Baseline and alcohol
- Between IVIS tasks

Results 2: strong effect for dual task



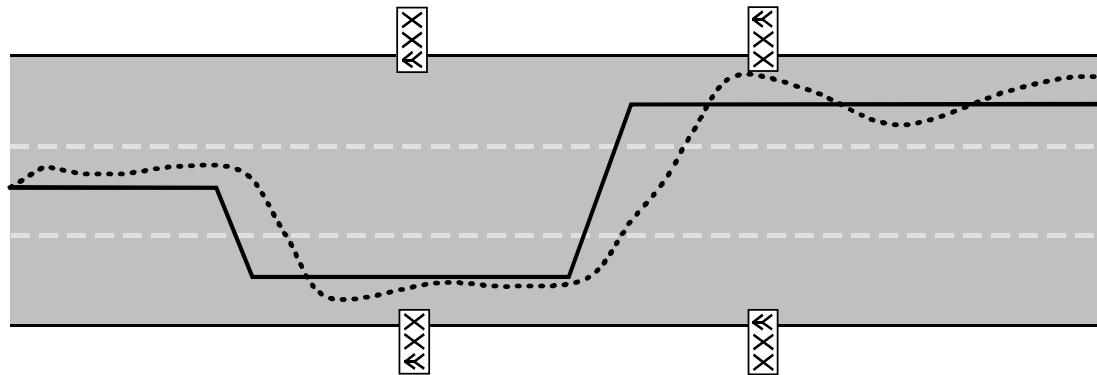
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Significant:

- Dual task v single task
- Between IVIS tasks in dual task

Results 3: LCT performance 'criterion' proposed

- Mean deviation from normative model (1.44m) in alcohol condition as first pass performance criterion



- Analysis using signal detection theory (SDT) indicates that this value would effectively discriminate between safe (baseline) and impaired (alcohol condition) drivers

Conclusions

- Confirmation of impairment caused by IVIS (cf baseline and alcohol), extends findings re mobile phone usage
- While no differences in LCT performance across IVIS conditions there were significant differences in total task time between IVIS tasks
- Surprising lack of effect for alcohol cf baseline:
 - Poor dosing procedure or learning effect?
 - Only one (relatively low) level of intoxication
 - Poor experimental control – extra training for the alcohol condition?
 - LCT task demand too low, speed is held constant only event detection and lateral control are dependent variables?

Next steps

- Repeat - with more rigorous management of alcohol condition
- Extend LCT to incorporate longitudinal control
- Explore wider range of IVIS tasks
- Contrast on-road results (no alcohol!) and lab results