

Some UK Perspectives on Occlusion and its Requirements for Validation

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Outline

- **UK Perspectives on Occlusion**
- **Research Considerations**
- **Alternatives to Occlusion**

UK Perspectives on Occlusion

Visual Occlusion Meeting, September 2001

Gary Burnett	University of Nottingham
Peter Burns	TRL
Mark Fowkes	MIRA
Frank Lai	ITS Leeds University
Terry Lansdown	Heriot-Watt University
Andrew Parkes	TRL
David Smith	Rover
Tracy Ross	Loughborough University



Empirical Basis for Occlusion

- Occlusion while driving
- Occlusion as a compliance test
- Inaccessible research
- Research standard

Occlusion Device

- Not just goggles
- Should be technology independent
- Comparison of tools



Applications

- Identify & define candidate in-vehicle systems
- Compliance and/ or design
- Limited to visual distraction

Primary/ Secondary Task

- Reversal of task order
- Occlusion interval - busy or not
- Interaction during occlusion
- Task/ sub-task definition
- Fixation/ orientation during occlusion
- Seating position

Locus of Occlusion

Occlusion Variables	Options
Vision interval	fixed time variable random
Occlusion interval	fixed time variable random
Locus of control	manual automatic partially automated

- Occlusion cycle

Benchmarking Occlusion

- **Accept/ reject = Safe/ unsafe**
- **Link to driving performance**
- **Compare accepted and unaccepted systems**

Other Comments on Occlusion

- Detailed subject selection
- Avoid confusing acronyms
- Provide illustrative examples
- Use diagrams

Research Considerations for Occlusion

- Face validity
- Construct validity
- Concurrent validity
- Predictive validity
- Diagnosticity
- Sensitivity
- Reliability
- Ease-of-use
- Intrusiveness

Alternatives to Occlusion

- Experts using guidelines and checklists
- Task completion time
- The peripheral detection task
- Automatic eye tracking

Dynamic Task Completion Time

Frank Lai - ITS Leeds University

Use of visual measures for in-vehicle task demand measurement

Measure	Secondary task	Primary task
Lane position variation	Easy = Medium < Hard	30 < 60
Probability of lane excursion	Easy = Medium < Hard	30 < 60
Speed variation	Easy = Medium < Hard	30 < 60
Single glance duration	Easy < Medium = Hard	30 > 60
Total glance duration	Easy < Medium = Hard	30 > 60
Glance frequency	Easy = Medium < Hard	30 = 60
Task completion time	Easy = Medium < Hard	30 = 60 Easy 30 < 60 Hard
Visual attention allocation %	Easy = Hard < Medium	30 > 60



Dynamic Task Completion Time

Equation 1: $R^2 = 0.7788$

Variations in lateral position = -0.0596
+ 0.0063 (Task completion time)
+ 0.0032 (Driving speed)
+ 0.0172 (Total glance duration)

Equation 2: $R^2 = 0.7696$

Variations in lateral position = -0.0455
+ 0.0109 (Task completion time)
+ 0.003 (Driving speed)

Equation 3: $R^2 = 0.7232$

Variations in lateral position = -0.1014
+ 0.0303 (Glance frequency)
+ 0.0031 (Driving speed)
+ 0.0279 (Secondary task difficulty)

The Peripheral Detection Task



Automated Eye Tracking

Road_Left