

# Portable approaches to assessing driver impairment

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# Background

- Drinking and driving declined substantially during the 1980s.
- More recently levels have tended to stabilise, but alcohol is still implicated in a significant proportion of fatal crashes – 17% in the UK
- Concern at increasing level of driving after taking drugs

# Approaches to enforcement

- Demonstrate that the driver is impaired
- Show that the driver has alcohol or drug in a concentration known to cause impairment in lab studies
- Zero tolerance:
  - Prosecute for any concentration of illicit substance
  - Alcohol limit set as near zero as practicable (usually 20 mg/100 ml)

# Demonstrating Impairment

- Field Impairment Test
- Automated performance testing
- Neurophysiological functions



# Demonstrating Impairment

- Field Impairment Test

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Pupil Examination

Time Estimation (Romberg)

Walk and Turn

One Leg Stand

Finger to nose

See, e.g. Oliver et al. (2006);  
Stough et al. (2006)

# Demonstrating Impairment

- Field Impairment Test
  - Handheld (PDA)
  - Tablet Computer
- Automated performance testing
  - Digital Pen
  - Results presented at ICADTS 2004
- Neurophysiological functions

# Demonstrating Impairment

- Field Impairment Test
  - Automated performance testing
  - Neurophysiological functions
- Horizontal Gaze Nystagmus

# Automated Performance Testing

- A wide range of tests are available for assessing performance, mostly based on PC systems
  - Psychomotor speed and accuracy
  - Attention
  - Memory
  - Higher cognitive function
- Many of these tests assess driving-related skills
- Smaller platform than PC needed for roadside assessment

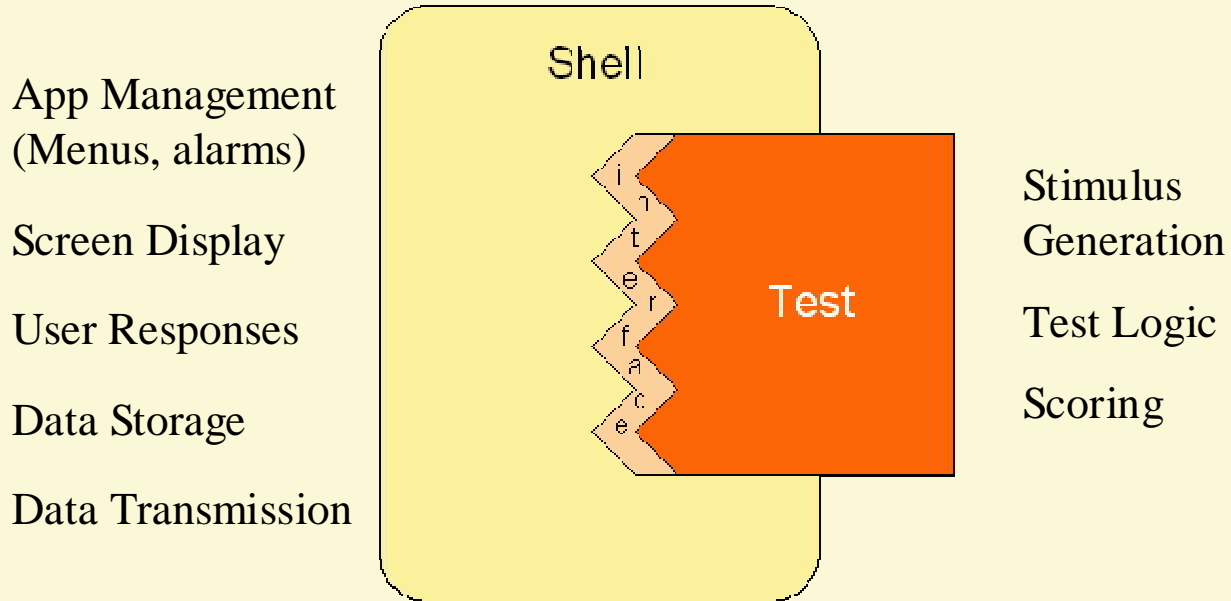
# Development Principles

- Suite of tests that can be run on a variety of platforms
  - Internet PC (Browser)
  - Standalone PC
  - Handheld PDA
  - Mobile Phone
- Maximum re-use of code

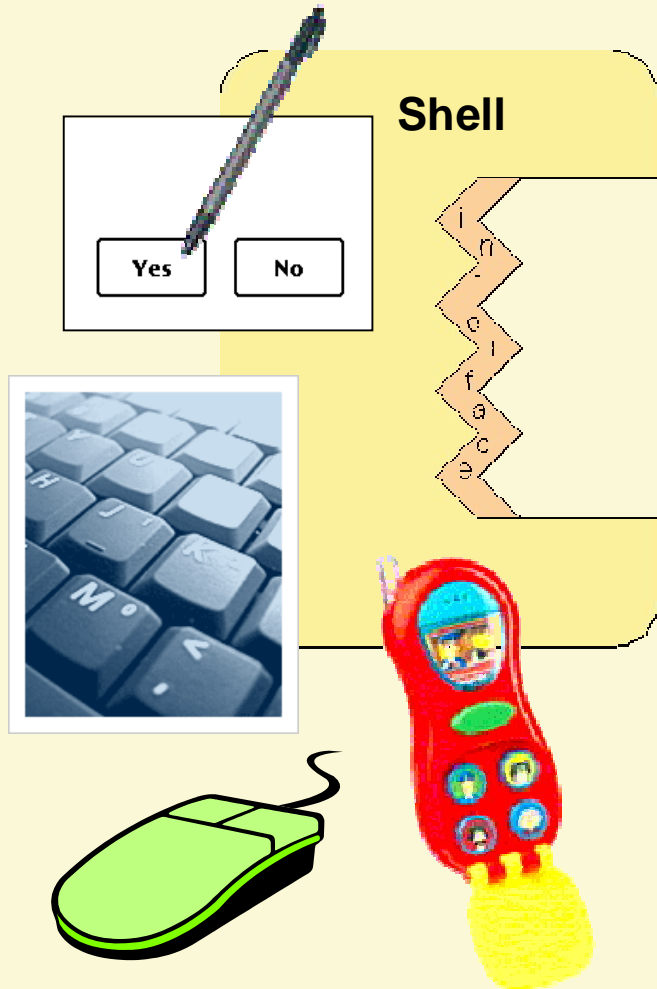
# Portable Design

- Core tests use common input format
  - 3 buttons maximum: Left, Right, Confirm
  - PC can use keyboard or mouse buttons
  - PDA can use physical or virtual buttons
- Core tests designed to fit mobile phone screen
  - System automatically scales to display
- Modular design using Java

# Modular System Architecture



# Modular Design

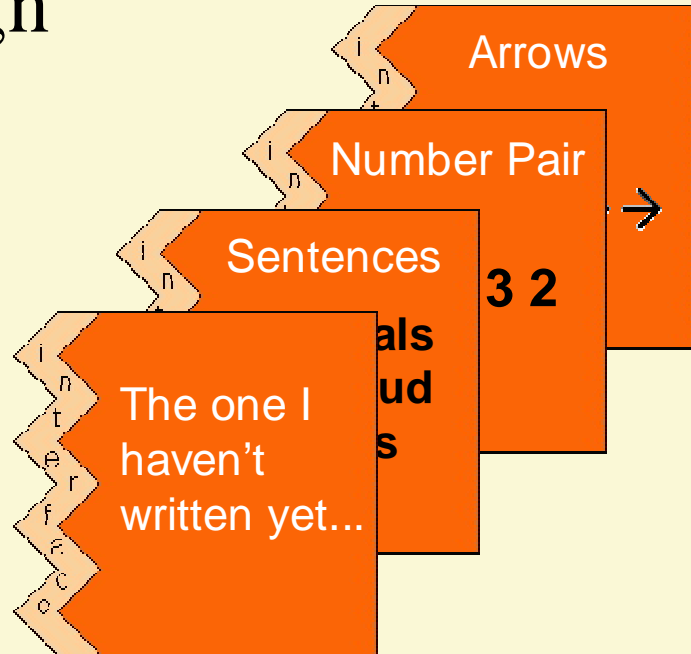


- Different shells support different types of display and input
- Shell determines test selection and sequence

Number Pair

# Modular Design

- Modules written in “generic” Java
- Each test module runs without modification on all platforms



**Write once use many**

# Modular Design

- Economical on programming and testing resources (in the longer term!)
- Flexibility of setup and platform choice
- Standardisation gives comparability of results using different systems

# Test Library

Attention	Arrow Flankers, Continuous Attention, Continuous Performance Task, Number Pairs, SART, Visual Search
Psychomotor	Simple RT, Arrow RT, Choice RT
Memory	Paired Associates, Word List, Word-Number, Memory Scanning, N-back
Cognition	Sentence Verification, Serial Sevens, Number Puzzles, Little Man

# Selection for Roadside Tester

- Assess both speed and accuracy of performance
  - Both are important for real driving
  - Different individuals may be impaired on different aspects
  - Possibility of cheating if only one aspect is scored
- Include judgement, not just skill
- Include element of conflict (e.g. response suppression) or task division

# Arrow Flankers

Five symbols appear, the middle one is always an arrow. Press Left or Right response button corresponding to the central arrow

- Neutral Distractors



- Congruent Distractors



- Incongruent Distractors



# The RITA project

- Several prototype devices evaluated
  - Results presented at ICADTS 2004
  - Validation using alcohol and illicit drugs
  - Findings promising
- Formed basis for evaluation system
  - Set up on small tablet PC
  - 30 minutes testing, intended to be reduced to 10-12 minutes for roadside use
  - Initial evaluation used alcohol, though other drugs important for intended use.

# RITA Evaluation Study

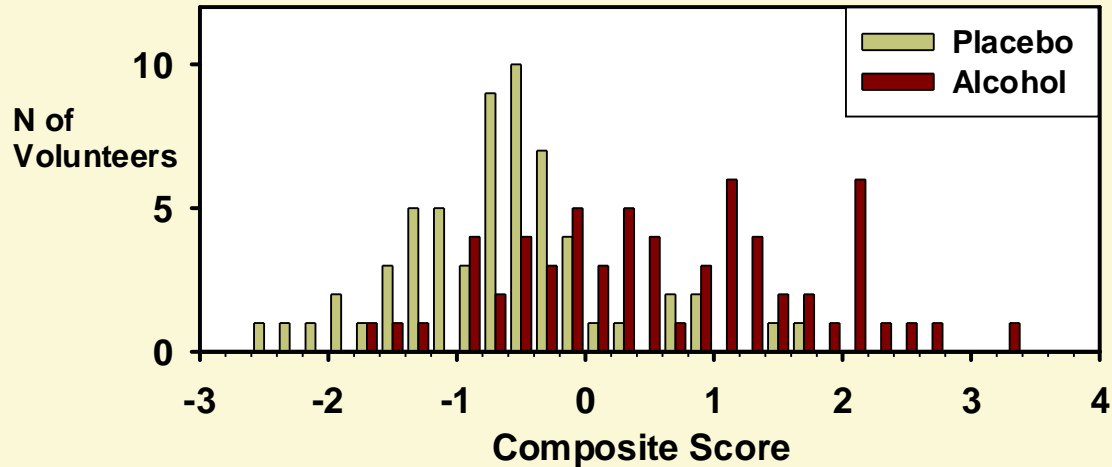
- 122 healthy volunteers, evenly spanning age range from 18 – 70, equal numbers of male and female
- Single dose of alcohol, target 90 mg/100 ml average, given in placebo-controlled crossover
- Assessments over 2.5h:
  - RITA (Six tests)
  - FIT
  - Nystagmus
- Obtain best test combination from RITA, and compare accuracy to other methods

# RITA Study: Overall Accuracy

- FIT 63%
- RITA best three: 70%
- Nystagmus : 74%

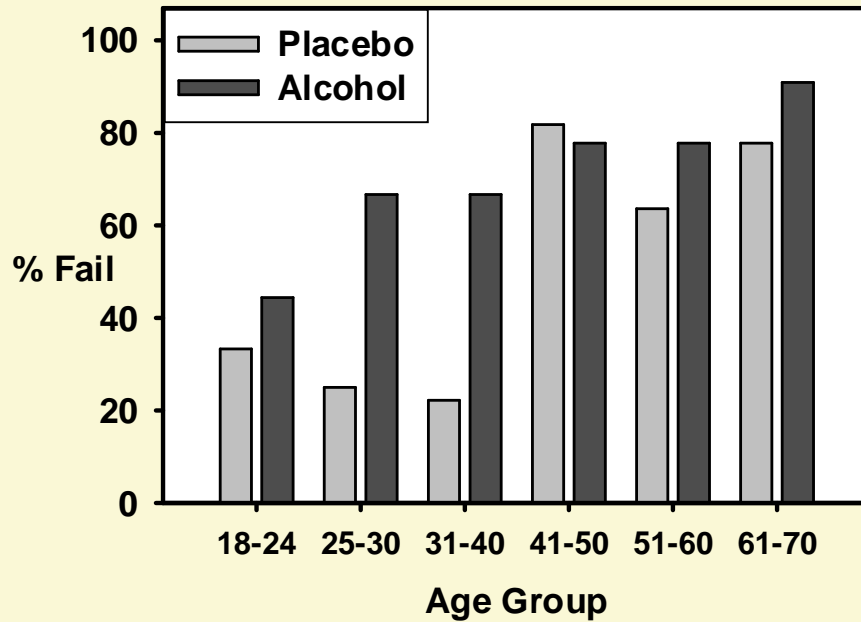
See: Dixon et al. (2009) *Accid Anal Prev* 41:412-8

# Issues: Population Variability



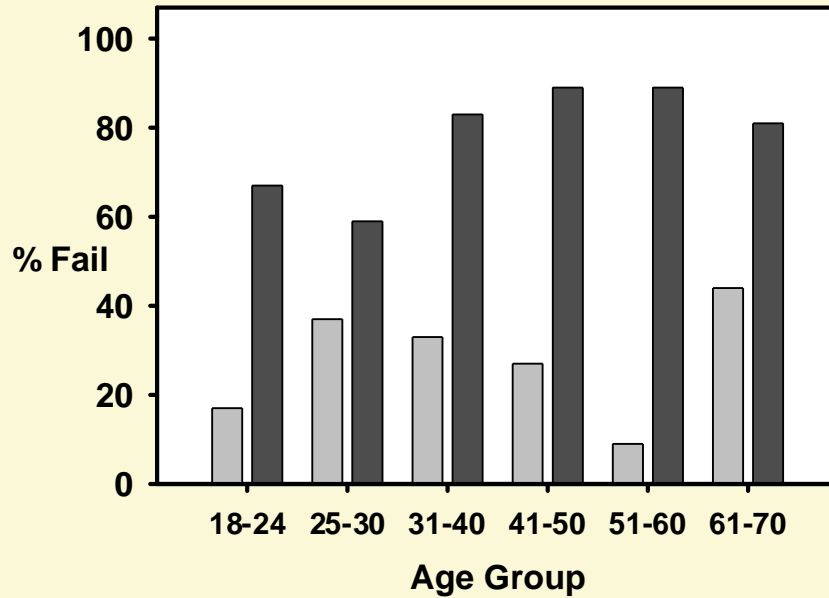
# Issues: Age

Field  
Impairment  
Test



# Issues: Age

RITA



# RITA: Conclusions

- RITA has slightly better accuracy than FIT overall
- RITA shows better discrimination in older drivers
- Advantages may not be sufficient to warrant development of production version of RITA
- Nystagmus has potential

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