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

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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

- Automated performance testing

- Neurophysiological functions

Handheld (PDA)

Tablet Computer

Digital Pen

Results presented at ICADTS 2004

Demonstrating Impairment

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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
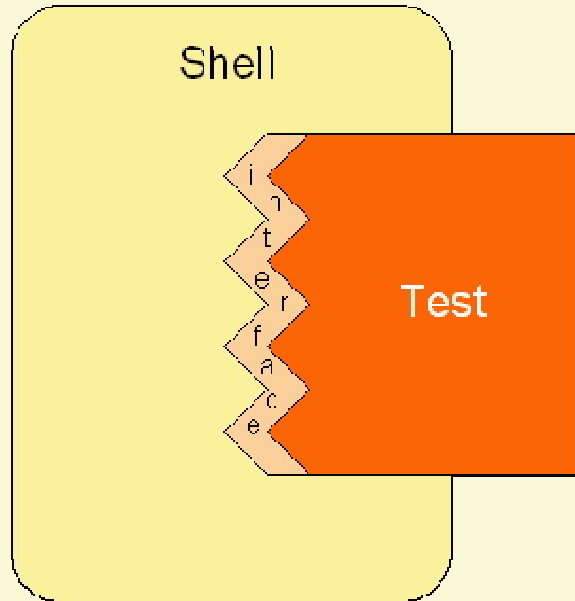- Modular design using Java

Modular System Architecture

App Management
(Menus, alarms)

Screen Display

User Responses

Data Storage

Data Transmission

Shell

interface

Test

Stimulus
Generation

Test Logic

Scoring

Shell

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Modular Design

- Different shells support different types of display and input

- Shell determines test selection and sequence

Modular Design

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

Arrows

Number Pair

Sentences

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The one I haven't written yet...
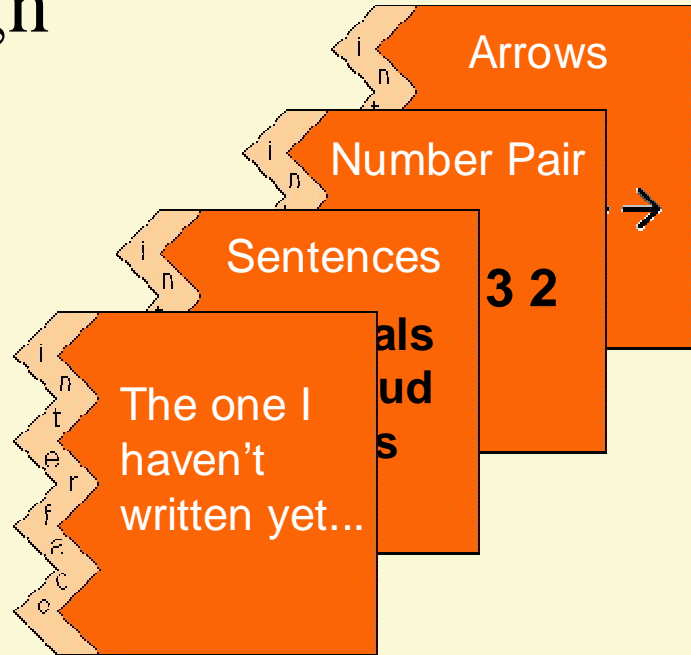
Write once use many

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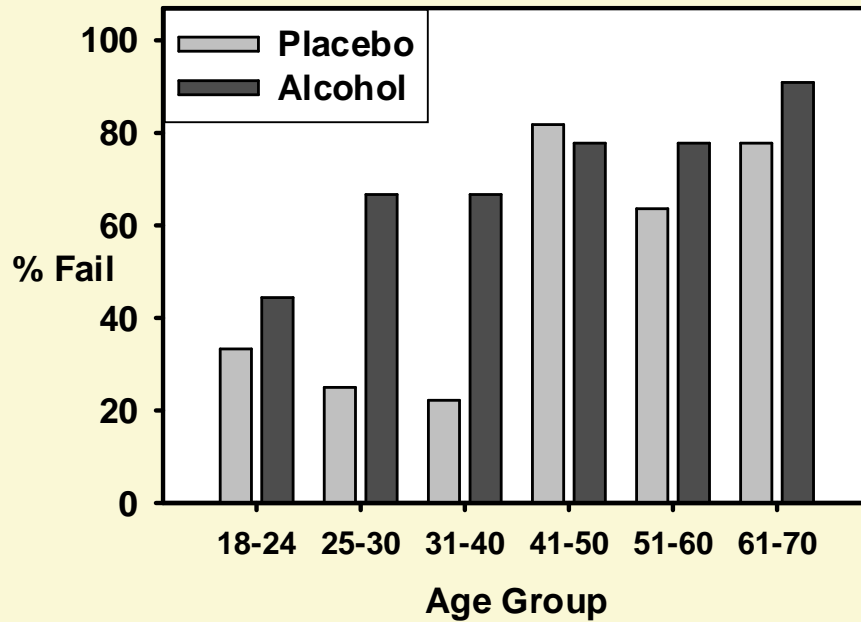- RITA best three: 70%
- Nystagmus : 74%

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

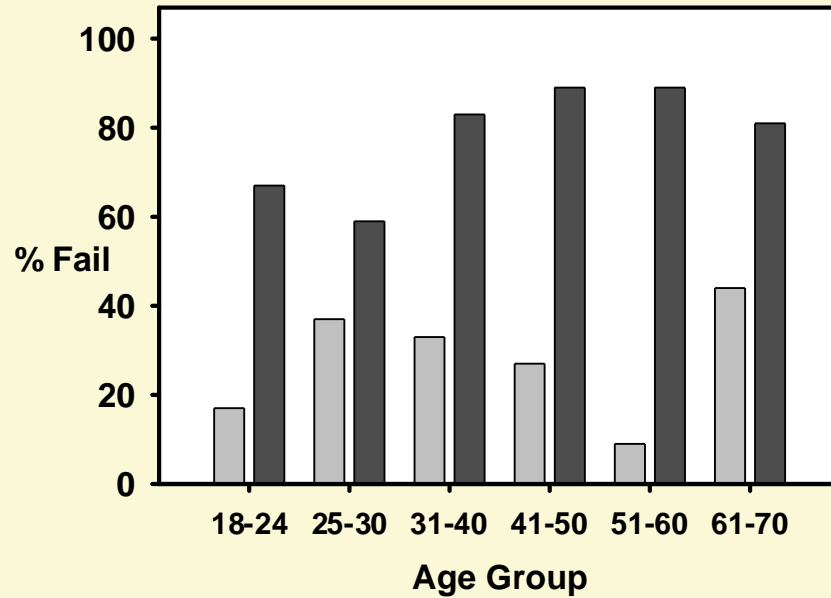# Issues: Population Variability
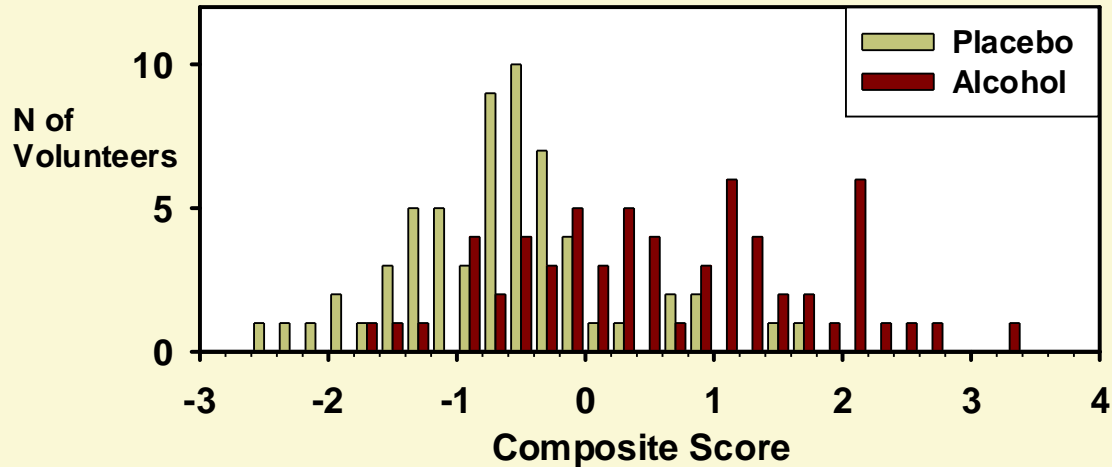
Issues: Age

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

Acknowledgements

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