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IMPROVING CLINICAL DEVELOPMENT TOGETHER!



Ambulatory Cognitive Assessment:

Measurement of Attention,
Psychomotor Performance and
Memory in an Everyday Life Setting

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Cognitive Assessment in Clinical Research

- Disorders where cognitive dysfunction is primary
 - Neurodegenerative disorders/dementia
 - Brain injury/stroke
- Disorders where cognitive dysfunction is secondary, or related to treatment
 - Cancer/chemotherapy
 - Anticholinergic treatment of overactive bladder
 - Alcohol/drug interactions

Assessments in Everyday Life

- Setting is familiar
- Frequent assessments can be made at different times of day
- Associations between different aspects of life can be investigated
- Portable technology is becoming increasingly powerful
 - Mobile (cell) phones
 - Palmtops/small tablet PCs

Familiar Setting

- Artificial and possibility threatening setting of lab or clinic is avoided
 - Anxiety and association with adverse effects of treatment
 - The “white-coat effect”
- Performance is assessed in the context of normal routine



Frequent Assessments

- Lab studies usually have short duration
- Performance and mood fluctuate with time
- Frequent assessments allow a full profile to be built up
 - Diurnal changes
 - Following conditions such as chronic fatigue syndrome
- Variability of performance may be an important indicator in its own right

Associations

- Mood and performance may be affected by variables that are hard to control
 - Sleep quality
 - Anxiety
- Even where factors can be controlled, studying relations in real life may have advantages
 - Eating
 - Drinking

Mobile Phones



- Widespread and Familiar
- Standard: Applications can be written to run on a wide range of phones, and transmit securely to a web sever.
- Small and portable: In many ways an advantage, but leads to the main limitation of mobile phones, which is screen size.

Mobile phones allow a wide range of assessments to be set up and used in an everyday life setting

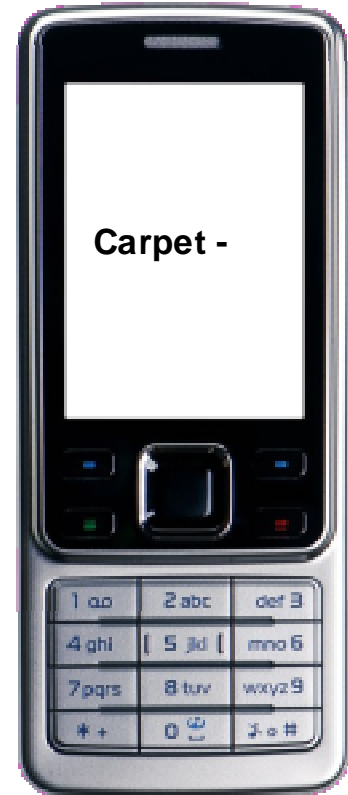
Word-Number Test

- Eight words are paired with the digits 1 – 8
- Word-number pairs appear one at a time on the phone screen



Word-Number Test

- Words then appear alone
- The user enters a number on the phone keypad, which appears next to the number
- And so on



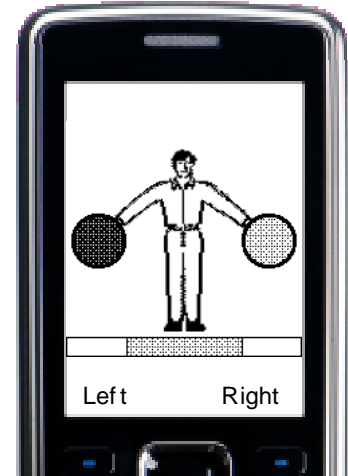
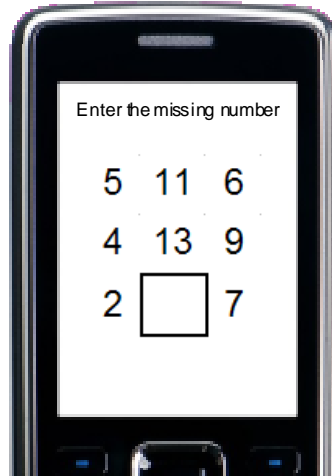
Word-Number Test

- Words then appear alone
- The user enters a number on the phone keypad, which appears next to the number
- And so on
- With no error feedback

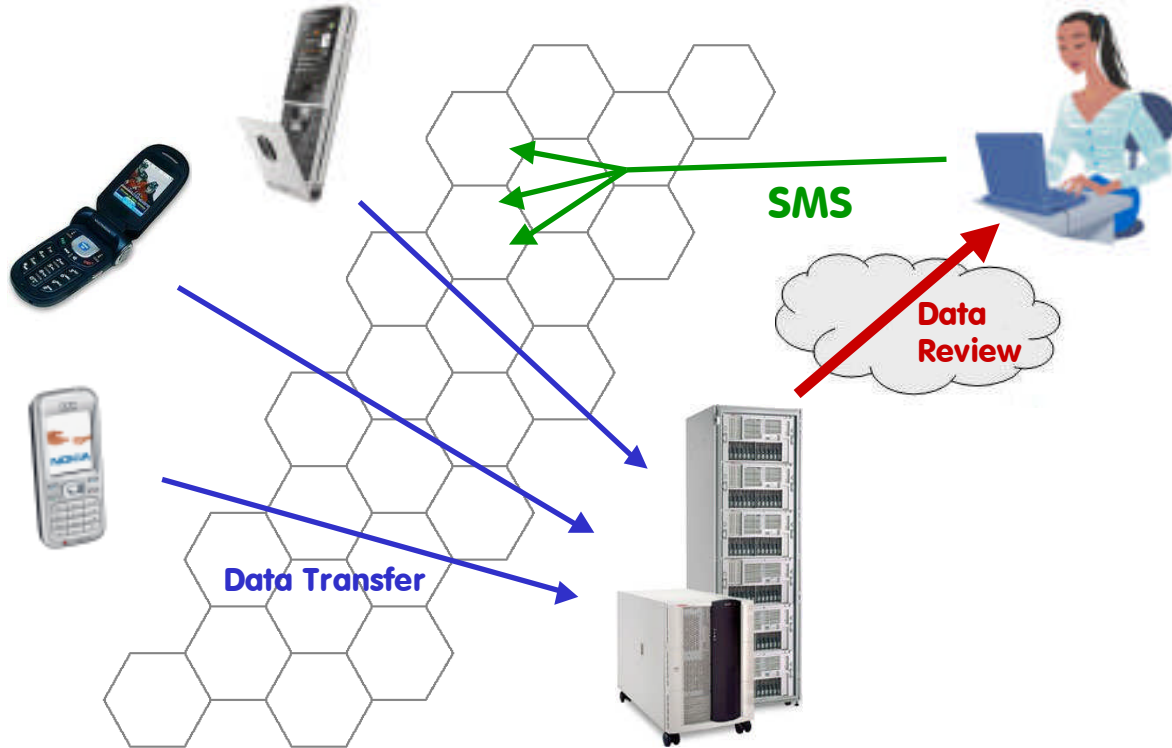


Screen Size

- Some tests cannot be set up on a mobile phone screen
- A wide range of tests, covering most cognitive domains, can be readily implemented:



Mobile Phone Data Model



A Validation Study: Alcohol in Everyday Life

- How do effects of alcohol assessed in everyday life compare with lab findings?
- Is the mobile phone a practical and effective way of collecting data?
- Study compared laboratory and everyday life assessments in the same volunteers

Everyday Life

- Thirty volunteers, 16 males and 14 females, aged 19-64 years (mean 37.4) took part
- Text (SMS) messages were sent twice a day at different times to the phones over 14 days.
- Volunteers were asked to complete assessments as soon as possible after receiving each text message.



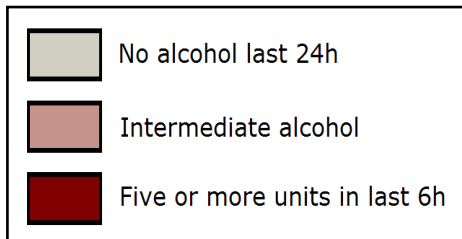
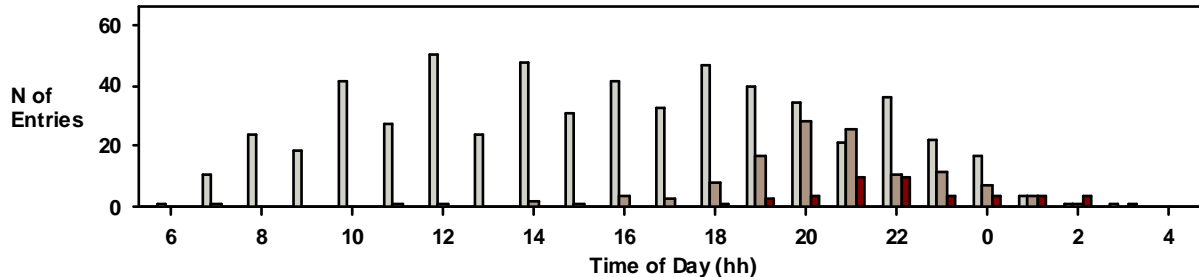
Assessments

- They recorded number of alcoholic drinks consumed, having been asked not to change their normal drinking during the study.
- They carried out the following tests:
 - Memory Scanning (Working memory)
 - Number-Pair Matching (Attention with distractors)
 - Word-number Test (Verbal recollective memory)
 - Visual Analogue Scales. Drunkenness, drowsiness, and mood (Happy–Sad).

Compliance

- No specific time-windows were set for completing assessments, as the aim was to obtain data over a wide range of times, not at defined intervals.
- Entries were made to 85% of text messages (i.e. before the next message was sent).
- Compliance was similar in older (> 33 years) and younger volunteers

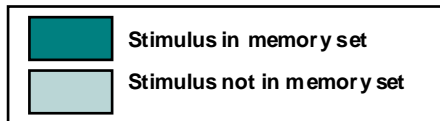
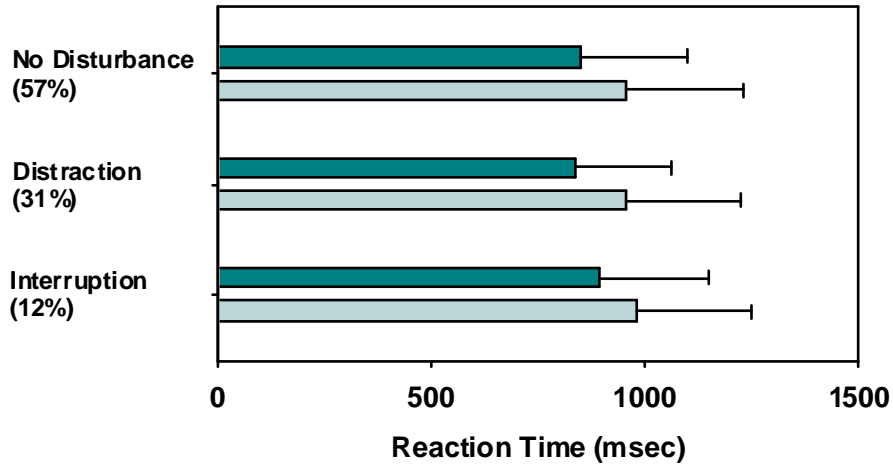
Distribution of Entries



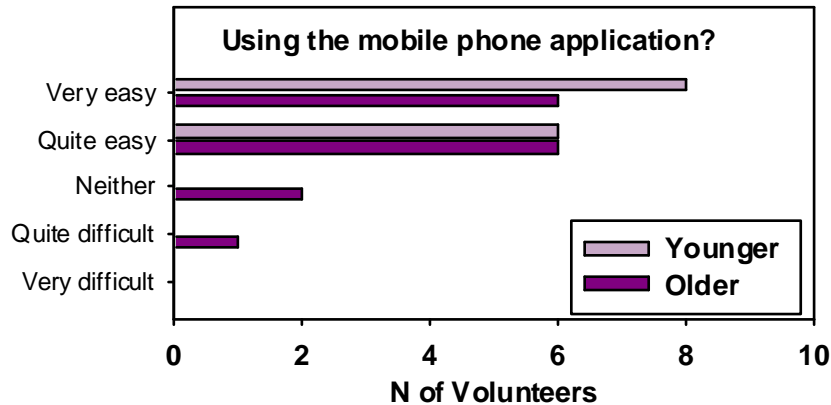
Entries with at least 5 units:

- 19/30 volunteers had at least one entry ≥ 5
- Maximum was 26 units (median 6)
- Previous work suggests that 6 units (reported) corresponds to a BAC of about 82 mg/100 ml, about the UK legal limit for driving

Task Integrity - Memory Scanning



Ease of Use



All the younger volunteers, and the majority (11/14) of the older volunteers found the application either very or quite easy to use.

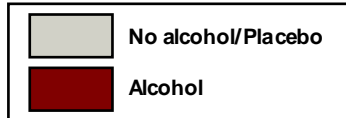
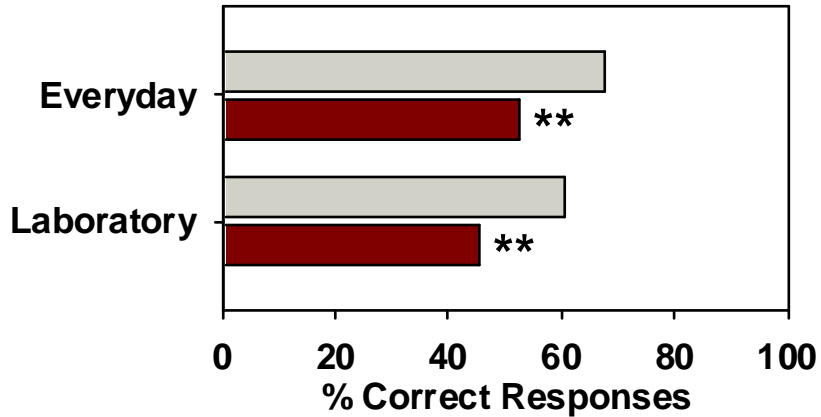
**Mobile given was different from my own.
Took me a while to get started**



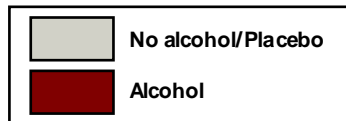
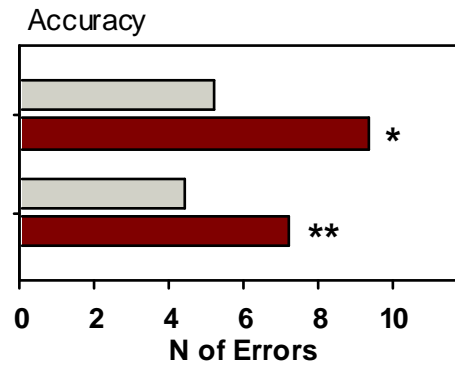
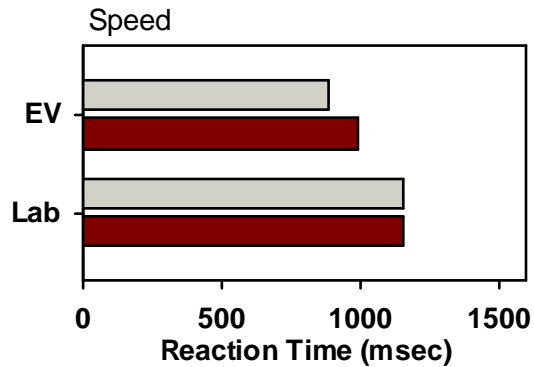
Laboratory

- Volunteers took part in the lab study after completing everyday assessments.
 - They received alcohol and placebo on separate days in random order
 - They completed assessments at intervals up to 2h after the drink.
- Mean peak blood alcohol concentrations were 110 mg/100 ml (UK legal limit 80)

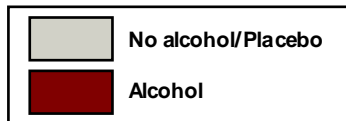
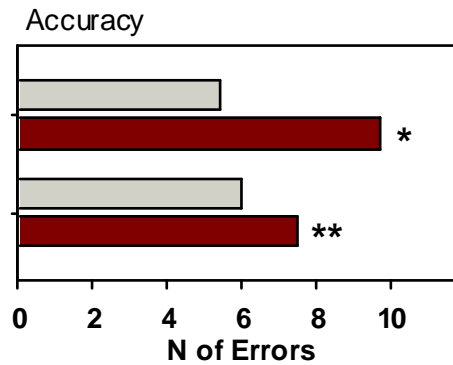
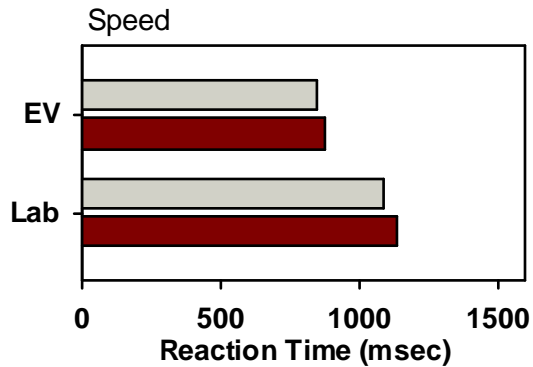
Word-Number Test



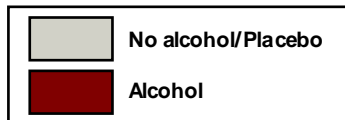
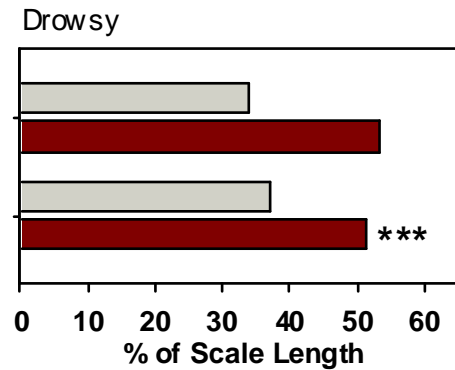
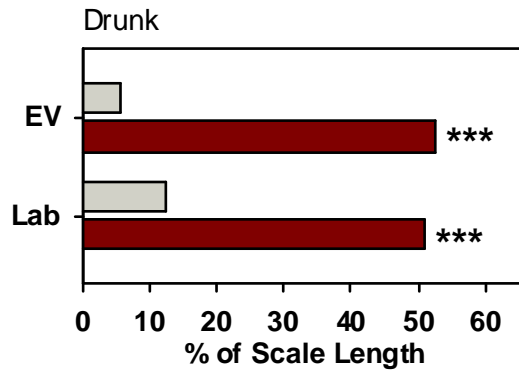
Memory Scanning Test



Number Pairs Test

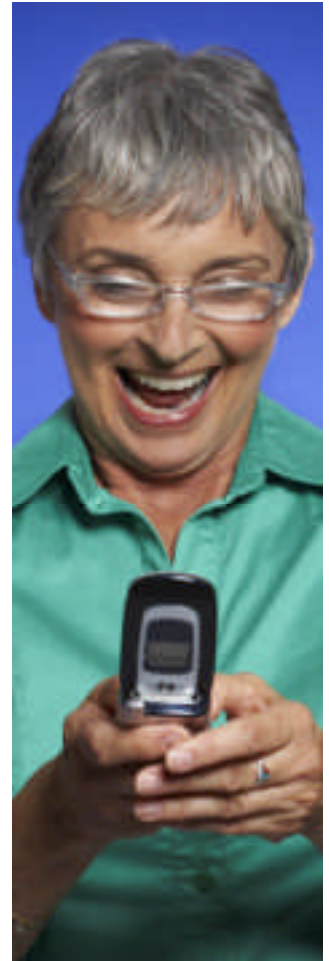


Visual Analogue Scales



Study Conclusions

- Good compliance with study procedures
- Indicators of data quality of everyday data are positive
- Impairment and subjective effects clearly seen in both everyday and lab settings
- Pattern of changes similar in two settings, with errors particularly affected in both cases
- Mobile phones are a practical and effective method of collecting data on cognitive performance and subjective state



Other Recent Work on Portable Cognitive Tests

- Field investigations of effects of alcohol in pub drinkers
- Effects of caffeine on sleep and subsequent daytime performance
- Effects of eating behaviour on performance
- Roadside assessment for driver impairment
- Assessment of sedation during anaesthetic procedures

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