The use of a mobile phone to administer a cognitive task

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Background

Handheld computer systems are increasingly being used to administer cognitive and psychomotor tasks (Totterdell & Folkard, 1992; Tiplady, 1994). These devices may replace a conventional computer in a laboratory setting. They also have great potential for performing assessments outside the laboratory because of their portability and ease of use. Examples include use in a hospital ward, at home, in clubs or music festivals, or for driver assessment at the roadside.

Mobile phones represent the next step in this development, as they offer even greater portability, and are used by a much greater proportion of the population. Thus people are already comfortable with their use, and there is the possibility of carrying out tests on the user's own mobile phone.

Mobile phones have certain limitations. The screens tend to be rather small, and touch screens are not generally available. Thus attention must be paid to screen layout and response formats. In general the most appropriate approach is to use the two buttons on the left and right of the screen for responses, as is done in many games. Many tests already use such a two-choice format, and others can be adapted.

### The Arrow Flanker Task.

Four types of stimuli are used:

Congruent	← ← ← ← ←
Neutral	□□ ← □□
Incongruent	→ → ← → →
No-Go	✗✗ ← ✗✗

The Arrow Flanker Task

was programmed in Java ® (J2ME). The two buttons just below the screen were used for responses. The volunteer pressed the right button if the arrow pointed to the right, the left button if the arrow pointed to the left, as quickly as possible. If the flanker symbols were crosses, no response was to be made. Response times and the number of correct and incorrect responses to each type of stimulus were recorded.

Initial Evaluation

Eleven volunteers aged 18-24 years practised the task twice, and then carried out the test four times. All volunteers found the task easy to perform on the mobile phone. Mean response times increased as stimulus difficulty increased, indicating that the task was performing as expected. (Page's L test; p < 0.001):
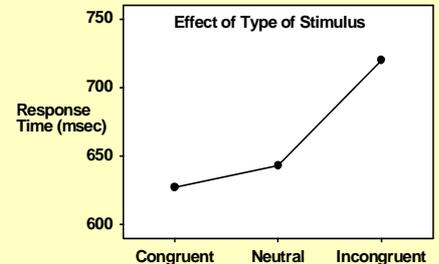
Discussion

Using a mobile phone is clearly a practical way of administering cognitive tests. Many tests can be presented in this way, including measures of sentence comprehension and working memory:

Future Developments

Other methods could be used, for example presenting material in spoken form through the phone's speaker. This would allow assessment of source memory, where words are presented by either a male or female speaker, and this information tested as well as recall of the word itself.

Data can be transmitted automatically from the phone to a central server. This has advantages for field-work, both simplifying data management and allowing faster access to data.

Phones could allow integration of cognitive assessments with diary assessments in patients, allowing comparison of CNS function with other symptomatolgy in the context of everyday life.

Mobile phone applications can be downloaded from the world-wide web, allowing the use of a person's own phone for testing. This would be particularly useful where recruitment was also via the web.

References.
Totterdell, P. & Folkard, S. (1992). *In situ* repeated measures of affect and cognitive performance facilitated by use of a hand-held computer. Behavior Research Methods, Instruments, and Computers, 24: 545-553.
Tiplady, B. (1994). The use of personal digital assistants in performance testing in pharmacology. Demonstration, British Pharmacological Society, London, January 1994. British Journal of Clinical Pharmacology, 37: 523P.

Effect of Type of Stimulus

The Sentence Verification Task

(Baddeley 1981). The Yes button is used for a true sentence, the No button for False

Paired-Associate Learning.

Two shapes appear, one on the left, the other on the right of the screen

Then single shapes appear. The volunteer presses the Left or Right button to indicate on which side the shape originally appeared.

Word List Learning

A series of words appears on the screen. The volunteer presses the Yes button if the word has appeared previously, the No button otherwise