Alcohol and Memory: A Selective Reminding Word-Number Test Administered on a Mobile Phone

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Recall and Recognition

"A critical problem of long standing in psychological study of memory is concerned with the relation between recall and recognition. In what sense are they the same, and in what sense are they different?" (Tulving and Watkins, 1973)

Since 1973, literally thousands of papers have been published on this topic. It is now believed that there are two distinct processes, recollection and familiarity detection. Recall depends only on the first, while recognition may involve both processes (see e.g. Aggleton and Brown, 2006). It is important that both processes are evaluated.

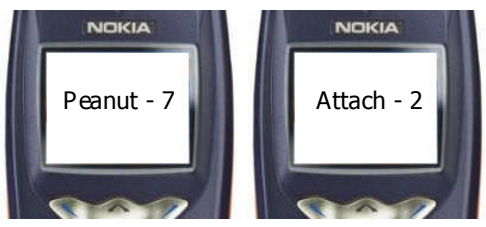
Automated Memory Testing

Setting up recognition memory tests on a computer testing system is straightforward, but the most widely used measures of recall, such as word-list learning, require a verbal response which is then recorded by the investigator.

We have evaluated an alternative paradigm, first suggested by Frankhuizen et al. (1978). Words are presented paired with digits. The response to each word is then to press the corresponding number button. Since all of the set of digits are used for each stimulus set, response familiarity is not a valid cue, and only recollection can be used.

Word-Number Test

1. Eight word-number pairs appear one at a time on the screen. The digits 1-8 are used.



2. Words then appear singly, and the volunteer presses the corresponding number key. This number then appears. No feedback for correct or incorrect responses is given at this stage.

3. The word-number pairs NOT correctly recalled are then presented again (selective reminding, Buschke and Fuld, 1974)

4. Step 2 is then repeated, with the complete set of eight words.

Mobile Phone Test System

- Tests were set up on a mobile phone
- Text messages were sent to volunteers when test entries were scheduled, allowing systematic sampling over time
- Data were transmitted automatically to a central server

Study Outline

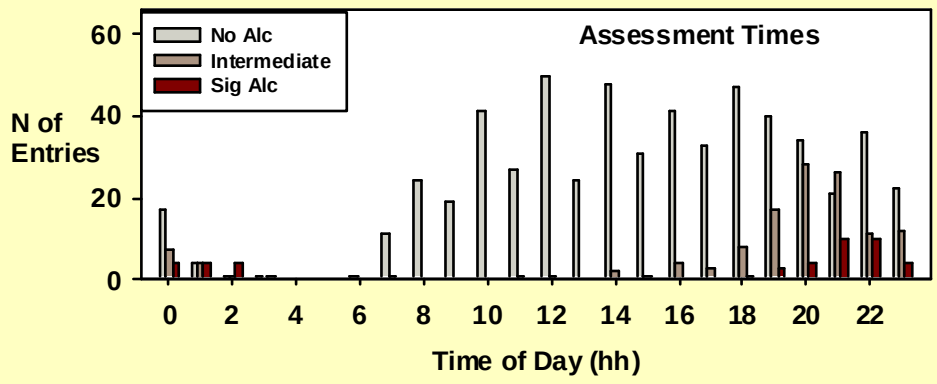
Thirty volunteers took part in this study of the effects of alcohol (ethanol) on performance in an everyday setting. They received text (SMS) messages twice a day on the mobile phones, and were asked to complete the test/questionnaire application as soon as practicable after receiving the text. The battery included tests of memory, attention and reaction time, visual analogue scales (VAS), and questions on alcohol consumption and the test environment.

Everyday Life Responding

Compliance was assessed as the percentage of scheduled assessments completed before the next text message was sent. Overall compliance was 85%.

Each assessment was classified as: No Alcohol: No alcohol consumption reported in the previous 24 h; Significant alcohol: 5 or more drinks reported in the previous 6 h; or intermediate. Data are presented here for No (A-) and Significant (A+) assessments. With one exception all A+ assessments were between 7 pm and 4 am. Test scores for A+ were compared with A- assessments for the same volunteers over the same time period.

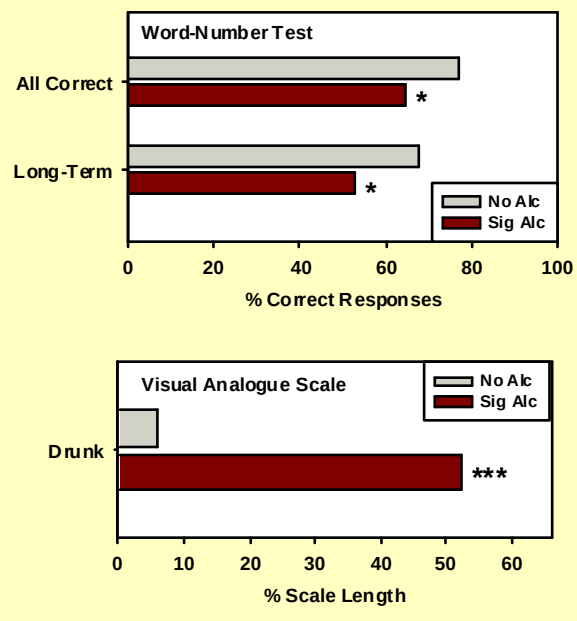
Data were available for these comparisons for 16 volunteers, 8 male, 8 female, aged 19 – 58 years (mean 30.4). All found the application either "Very easy" or "Quite easy" to use on a 5-point scale from "Very easy" to "Very difficult".



Effects of Alcohol

Alcohol was associated with impairment on the Word-Number test, both for the total number correct and for the responses attributed to long-term memory recall. The trend was to a greater effect for the latter parameter, as has been seen previously with selective reminding recall tasks (Tiplady et al., 2003). Response times were slightly, but not significantly, faster for the A+ condition.

The subjective scores on the sober—drunk VAS showed a large and highly significant effect of alcohol, as expected.



Light bars: No alcohol consumed in past 24 h

Dark bars: Five or more units of alcohol in last 6 h

Significance (Signed Ranks)

* p<0.05
*** p < 0.001

Summary and Conclusions

1. The Word-Number Test is practicable for use in a mobile phone cognitive test system.
2. The Word-Number test is sensitive to the effects of alcohol as assessed in an everyday life setting
3. The pattern of impairment seen is similar to that previously noted for a selective reminding word-list task

References.

Aggleton & Brown (2006) Trends Cogn Sci 10: 455-463
Buschke and Fuld (1974) Neurology 24: 1019-1025
Frankhuizen et al. (1978) Br J Anaesth 50: 229-234
Tiplady et al. (2003) J Psychopharmacol 17: 41-49
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