

**Use of Cell Phones  
to Assess Cognitive  
Function in  
Everyday Life:  
Effects of Alcohol**



**Brian Tiplady**



# ANNUAL CONVENTION

AUGUST 4-7, 2011 • WASHINGTON, DC  
AMERICAN PSYCHOLOGICAL ASSOCIATION

# Cell Phones, Cognition and Alcohol

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- Field assessment of alcohol use and effects
- Applying the Ecological Momentary Assessment (EMA) model to cognitive performance
- Development and use of cell phones for performance assessments
- Everyday alcohol use and impact on performance
- Comparison of everyday assessment with lab studies

- Most research on alcohol effects on cognitive performance has used either:
  - Laboratory studies with pre-specified doses of alcohol consumed in a short period (the pharmacological model)
  - Studies of the association of risk (e.g. of car crashes) with alcohol consumption or blood concentrations (the epidemiological model)
- Field research aims to overcome the limitations, in particular of the pharmacological model

# The Pharmacological Model

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- The protocol, not the drinker, determines
  - Dose of alcohol
  - Rate of consumption (often within 10-15 minutes)
  - Composition (e.g. vodka in orange juice)
- Studies are often blind, so the drinker may not know the dose given
- Setting is a laboratory
  - Often no social contact between volunteers
  - Quiet
  - Usually during the day, not in the evening

# Naturalistic Research

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- Aims to study drinker behaviour in a setting where:
  - Drinker controls type, amount and rate of alcohol consumption
  - Environment is social, maybe noisy and distracting
  - Time of drinking is chosen by drinkers
- Two main scenarios
  - Focussed on drinking environment, e.g. “bar laboratory”
  - Focussed on everyday life



# Field Studies in Bars and Clubs

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- Many field studies on drinking patterns, expectations, and intention to drive
- Few studies directly measure cognitive performance

Curran & Travill (1997) Parrott & Lasky (1998)	Club	Focussed on illicit drugs, alcohol as control
Mills & Bisgrove (1983)	Hybrid	Conventional recruitment, drinking and testing in party environment
Binder (1971)	Hybrid	Bar recruitment and drinking, testing in laboratory
Lyvers & Tobias-Webb (2010) Scholey et al. (2005) Tiplady et al (2006)	Bar/Pub	Drinking and testing in bar/pub environment

# Edinburgh Pub Study

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- Volunteers recruited and tested in pubs in central Edinburgh during the evening
- Self-report of number of drinks
- Testing using cell phone and paper tests
  - Subjective drunkenness
  - Attention
  - Reaction Time
  - Memory
  - Psychomotor Performance
- Breath Alcohol Concentration

# Edinburgh Pub Study

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## 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.



- Dose-dependent impairment found for most tests
- Paired-Associates showed increase in errors but not in reaction time
- Extent and pattern of impairment similar to that found in laboratory studies

Source: Tiplady et al. (2006)



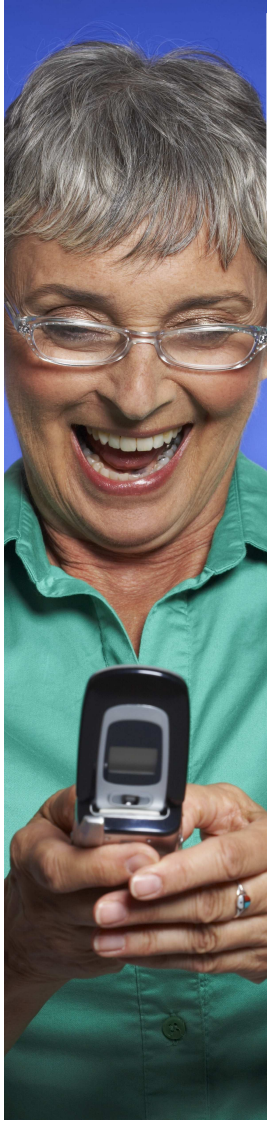
# Field Studies and Everyday Life

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- Pub/bar studies are valuable, and generally confirm pattern of impairment seen in the lab
- Much drinking takes place in other environments, such as home, restaurants and private parties
- Other drugs, in particular illicit ones, are harder to study in a field setting
- Alternative is to test in an everyday life context:

**Ecological Momentary Assessment of Cognition**

- Participant performs cognitive assessments according to a fixed schedule or in response to signal
- Other data collected on factors that may influence performance
  - Alcohol and drug intake
  - Sleep quality
  - Eating
- Fluctuations in performance can be followed
- Several possibilities for data collection:
  - Cell phones
  - Handheld (Lamond et al., 2005; Waters and Li, 2008)
  - Web-based assessment (Barnard et al., 2007; Mills et al., 2009)



# Cognitive Assessment on Cell Phones

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- Modern cell/mobile phones have substantial processing capacity
- Compact and easily carried around
- Familiar to most users
- Data can be transferred automatically to secure server as soon as collected
- Screen size can be a limitation, but adequate for a wide range of tests

# Word-Number Test

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



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- Words then appear alone



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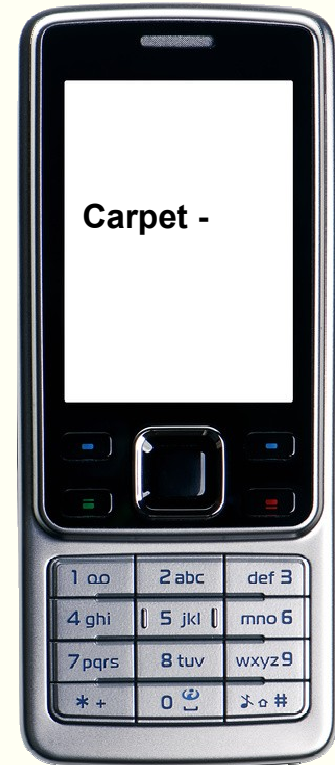
- Words then appear alone
- The user enters a number on the phone keypad, which appears next to the number



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- And so on





# Word-Number Test

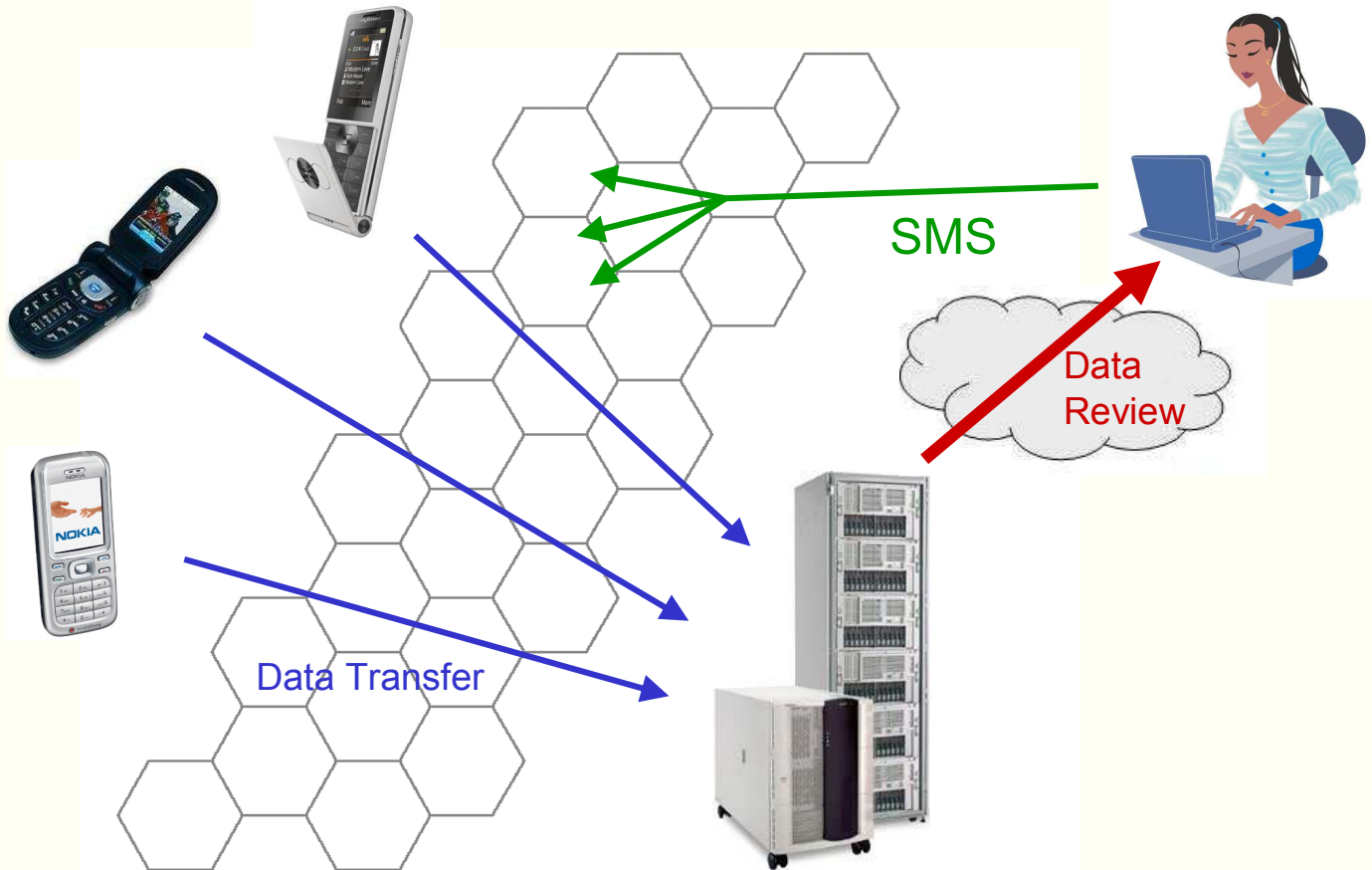
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- Words then appear alone
- The user enters a number on the phone keypad, which appears next to the number
- And so on
- With no error feedback



Based on: Frankhuizen et al. (1978)

# Cell Phone Data Model



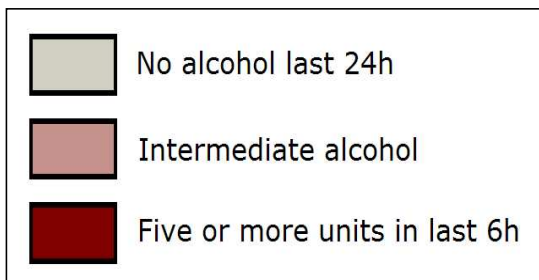
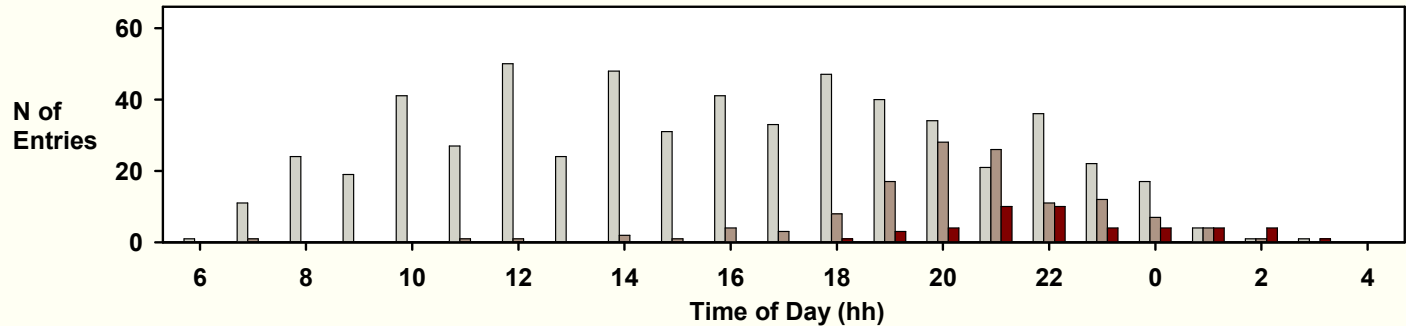
# Validation Study

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- Thirty volunteers, 16 males and 14 females, aged 19-64 years (mean 37.4) took part
- Everyday assessments twice a day for 14 days at different times in response to SMS text messages.
- Lab study carried out after everyday assessment
  - Alcohol and placebo on separate days in random order
  - Assessments at intervals up to 2h after the drink.
  - Mean BAC 110 mg/100 ml (UK legal limit 80)

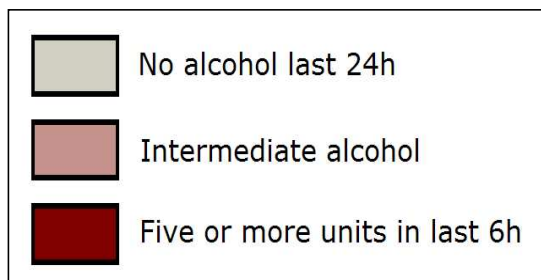
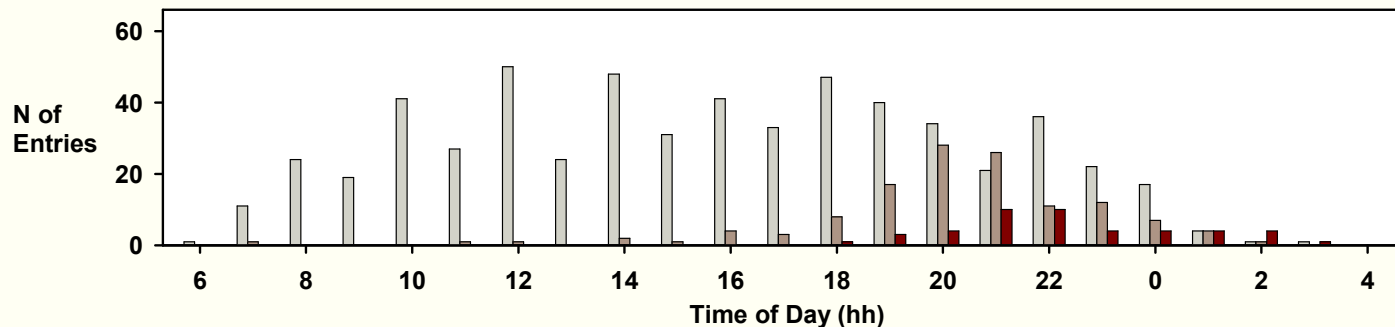
# Everyday: Distribution of Entries

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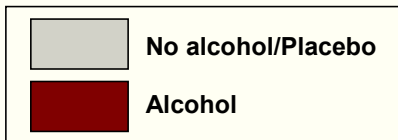
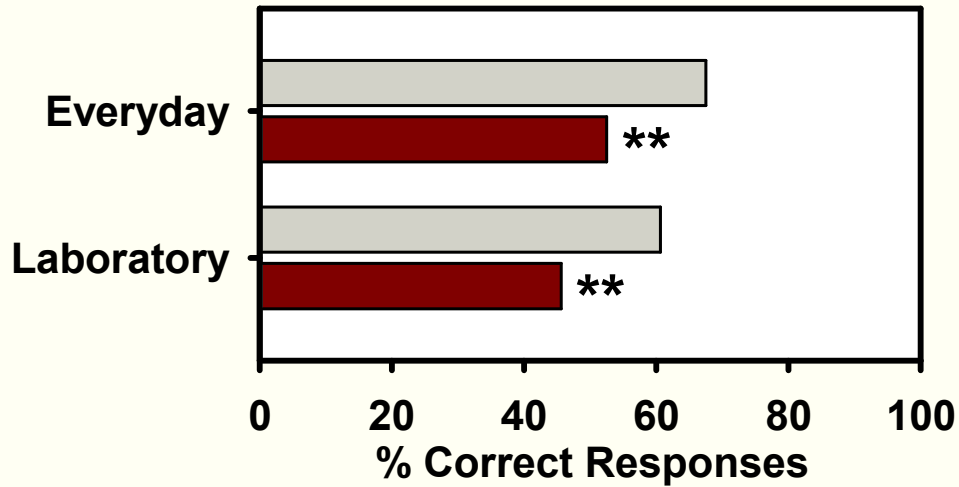


## Entries with at least 5 units:

- 19/30 volunteers had at least one entry  $\geq 5$
- 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

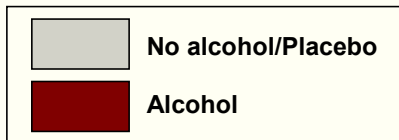
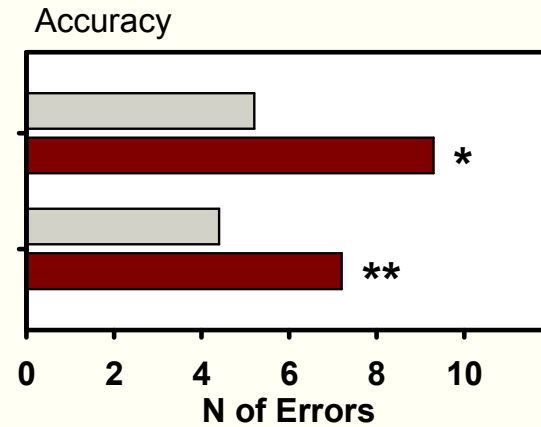
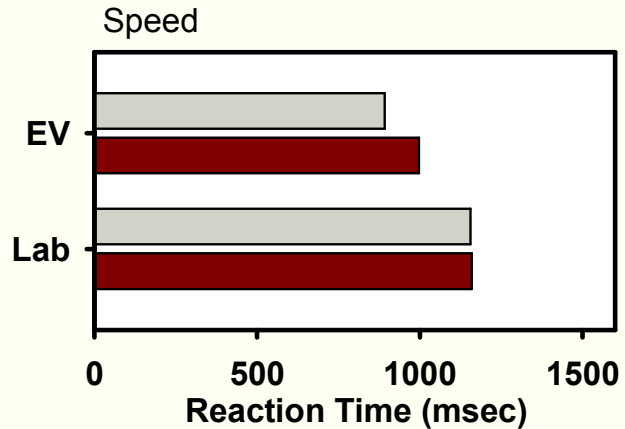
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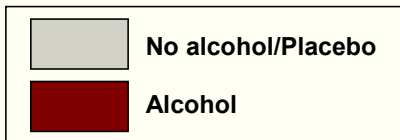
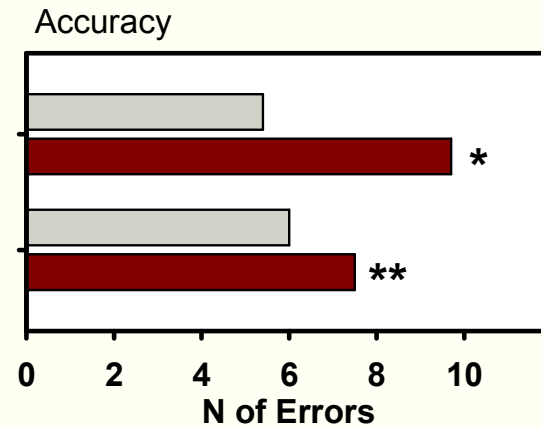
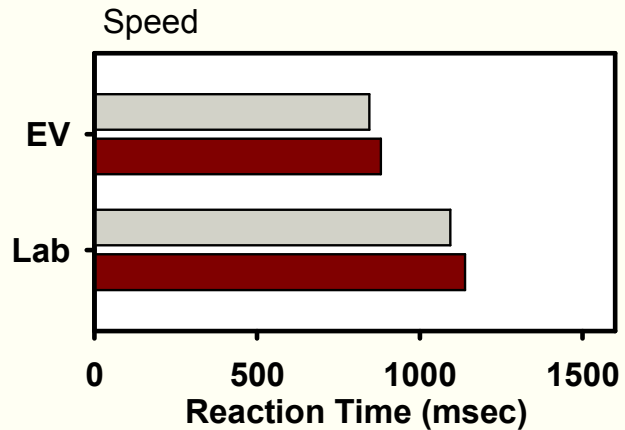
# Memory Scanning Test

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# Number Pairs Test

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Source: Tiplady et al. (2009)



# Study Conclusions

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- Good compliance with study procedures
- 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
- Cell phones are a practical and effective method of collecting data on cognitive performance





**2011**

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