

Acute effects of alcohol on prospective memory

Introduction

Memory impairment is a robust acute effect of alcohol. Many studies have shown its effects range from mild deficits at low doses through to ‘black-out’ at high doses. When events occurred while an individual was intoxicated, their memory for this part of their *past* experience is reduced.

Most of our acts of everyday forgetting reflect *not remembering to do something in the future* such as forgetting to take your medication on time or to book an appointment or to do something you promised to do. This type of memory concerned with future events is called *prospective memory*.

Prospective memory failures cause more deficits in daily life than retrospective memory failures. They may also be an important problem for people who experience difficulties in trying to control their alcohol use.

Surprisingly, no previous study has examined how alcohol influences prospective memory performance, and so this was the aim of the present study. Specifically we set out to determine the effects of a single dose of alcohol on prospective memory using a task that closely parallels the demands of everyday life - a task called the ‘virtual week’.

‘Virtual week’ was specifically chosen because it allows the investigation of the different types of prospective memory tasks we encounter in our day to day life (Figure 1a). Some of these are tasks which need to be done *regularly* like taking a tablet every morning. Other tasks are *irregular* such as returning the DVD you rented at the weekend to the shop on your way home from work on Monday. Further, some tasks are *time-based* when an action needs to be carried out at a specific time (e.g. ‘phone your manager at 2pm). This relies upon self-initiated activities like checking the clock. In contrast *event-based* tasks such as remembering to buy pasta when you are in the supermarket rely more on prompts from external cues such as being in the right aisle or checking a shopping list. In virtual week, each virtual day involves a combination of these types of prospective memory tasks.

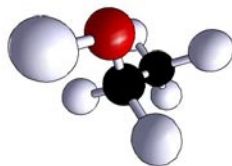
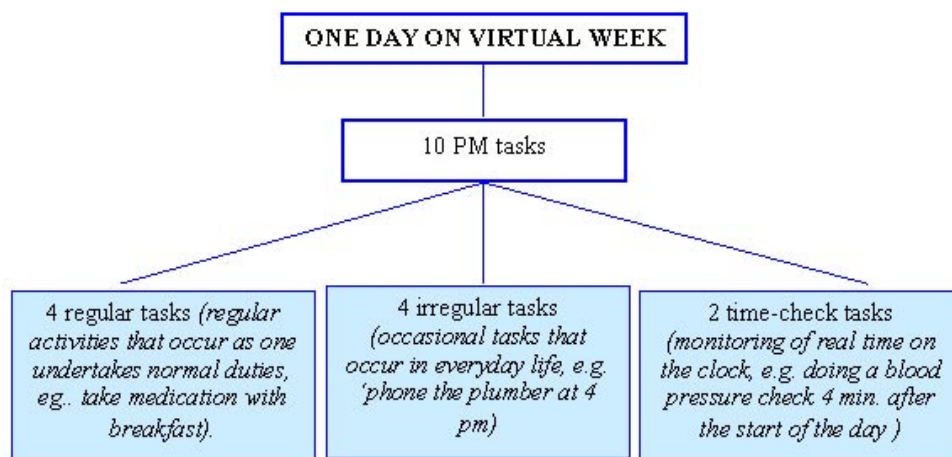


Figure 1: Prospective Memory (PM) tasks on each day of the Virtual Week



Our study involved forty healthy volunteers aged 18-35 years. They were given a drink containing either 0.6g/kg ethanol (roughly 4-5 units) or a matched ‘placebo’ which contained no ethanol. The drinks looked and tasted the same and were given ‘double-blind’ so that neither the participant nor the researchers knew which drink was being given. After the alcohol had been absorbed, they completed the first three days of Virtual Week using standard instructions. They also were given a prose recall task to tap ‘retrospective’ memory and an executive function task to tap planning abilities. These two tasks were used because we know that prospective memory also relies to some extent on retrospective memory and planning.

For the last 3 days of virtual week, we varied the instructions to the task to determine whether any alcohol-induced impairment could be overcome by ‘helping’ the participant to focus on the task in different ways (Figure 2). The 4th day was standard with no additional instructions; the 5th day asked the participant to simply rehearse out loud what s/he needed to remember to do in the future. On the 6th day they were instructed to mentally imagine in as vivid a way as possible, actually doing what they needed to remember to do. This strategy is termed ‘future event simulation’.

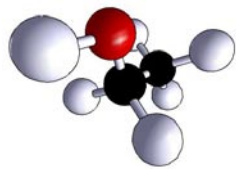
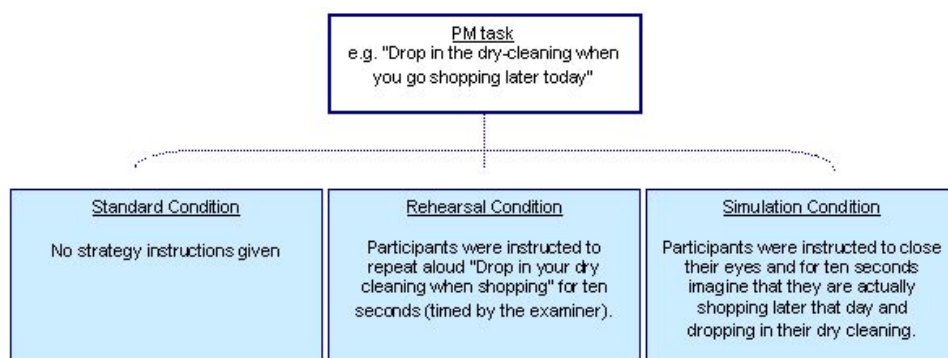


Figure 2: Instructions given for the last 3 days of Virtual Week



On the basis that retrospective memory is impaired by alcohol, we predicted that alcohol would impair prospective memory. Whether it would impair some types of prospective memory tasks more than others was an exploratory aspect of the study. Based on previous research, (Schacter, Addis and Buckner, (2008) we hypothesised that mentally imagining the event in its context would help prospective remembering in the placebo group but we did not predict effects in the alcohol group as there was no existing evidence on which to base predictions.

Findings

Alcohol acutely produced global impairments of prospective memory (p<0.002) regardless of whether the tasks involved remembering to do regular events, irregular events or time-based events (Figure 3).

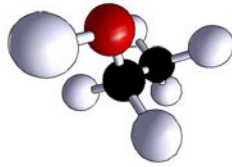
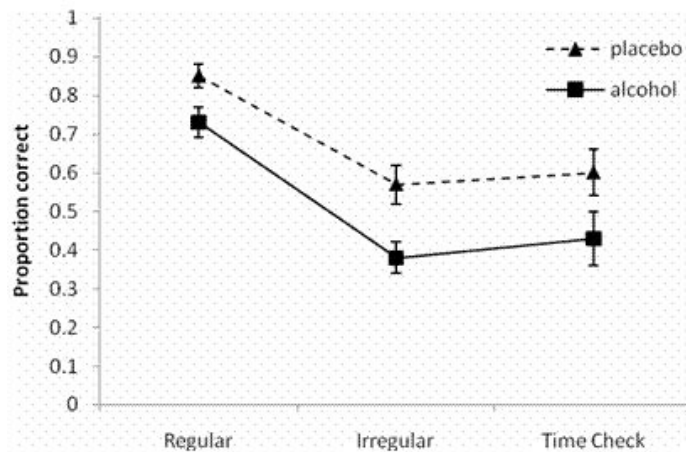


Figure 3: Average proportion correct for each type of prospective memory task for 20 people given alcohol and 20 given placebo



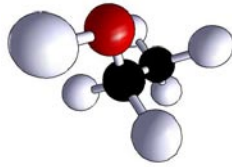
Future-event simulation tended to improve prospective remembering in the placebo group however it did not help those in the alcohol group.

As expected, alcohol impaired delayed prose recall. Interestingly, those impairments positively correlated ($r = .564, p = .012$) with prospective memory performance only on the irregular tasks. Alcohol had no effect on executive planning ability.

Implications

This study showed that a dose of alcohol corresponding to about 4-5 units significantly impairs people’s prospective memory. This impairment was across the board on all three types of prospective memory tasks: regular, irregular and time-based. Because Virtual Week reflects the memory demands of everyday life, these findings imply that this dose of alcohol will adversely impact an individual’s ability to remember to do things in the future and so compromise their everyday functioning.

An association between retrospective memory (delayed recall of prose) and pro-



spective memory performance was found only on irregular tasks. This suggests firstly that retrospective remembering plays a role in for these types of tasks. It also suggests that all prospective tasks involve processes besides retrospective memory and planning (which was not impaired by this does of alcohol).

Although prospective remembering was improved in the placebo group when they were instructed to imagine or simulate remembering to do something in the future. However, this strategy did not help those who had been given alcohol.

No research to date has determined chronic effects of alcohol on prospective remembering, despite this being one of the most clinically relevant aspects of memory. It would be important to conduct a similar study to this with people who have alcohol abuse or dependence. Prospective memory abilities play a key role in learning based therapies like CBT that are routinely used in treatment. We further suggest that prospective memory *failures* are one factor in relapse and so future research should assess how prospective memory abilities affect treatment outcome. Finally, strategies for improving prospective memory such as future event stimulation could helpfully be researched in a clinical population.

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