Effects of ethanol on re-consolidation of human memory

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Background

When new memories are formed, material is initially in a labile state (primary or short-term memory), and becomes consolidated over a period of several hours. Recent work has suggested that when a consolidated memory is activated (brought into working memory) it becomes vulnerable to disruption by conditions that prevent consolidation of initial learning. Thus it appears that a process of reconsolidation is necessary for maintenance of the memory (Nader, 2003). Most of the relevant work has been done in rodents, using electro-convulsive shock or inhibitors of protein or RNA synthesis to disrupt consolidation. Some human work has been done, investigating the effects of sleep on consolidation and reconsolidation, or using learning of one type of material to disrupt learning of another type (Fenn et al., 2003; Walker et al., 2003). No work has looked at direct disruption of consolidation in humans in the way that was used with experimental animals.

There would be a number of advantages in establishing the circumstances under which disruption of reconsolidation can occur in humans. Clearly this would require the use of much less drastic methods than electro-convulsive shock or inhibition of protein synthesis. Ethanol impairs formation of new long term memory at doses that can be routinely given in human volunteer studies. One of ethanol's actions is inhibition of NMDA receptors. Since NMDA may be required for reconsolidation (Torras-Garcia et al., 2005) we investigated the effects of ethanol on reconsolidation in humans.

Fact Learning

Volunteers learned 90 "facts", for example

Gordon Brown was once attacked by a Swan.

60 target "facts" were invented, to ensure that they were not already known, and recall of these false facts was analysed .

Word List Learning

Volunteers learnt four lists of different types of words, each with 15 words, viz:

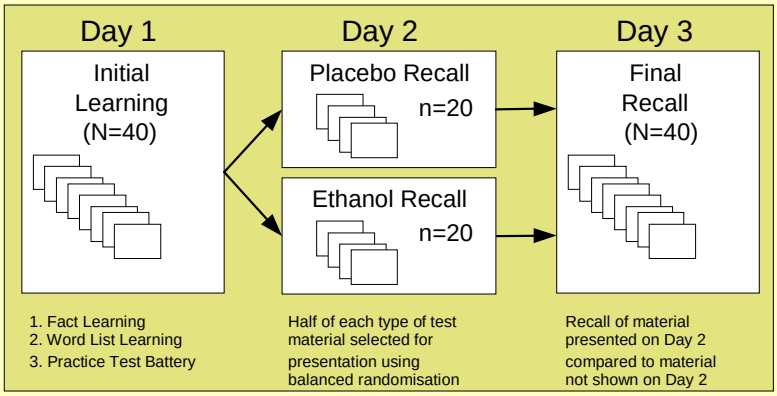
Animals **Vehicles**
Furniture **Plants**

Initial presentation was in a selective reminding format. In recall sessions, volunteers were asked to write down as many words as possible from each specified list

Both test paradigms are known to show impairment of consolidation with ethanol (Tiplady et al., 1999)

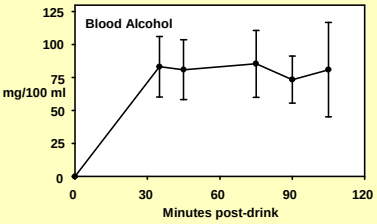
The Study

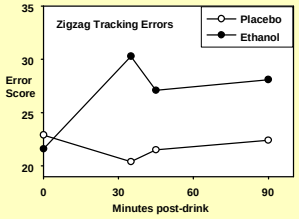
Forty healthy volunteers (19 male) aged 19-50 years (mean 23) weighing 54-89 kg (mean 70) took part in three session on successive days. On day 1 they learnt two types of test material; on day 2 half took ethanol half placebo at random, then recalled half of the test material between 45 and 75 minutes post-drink; on day 3 they recalled all the test material.



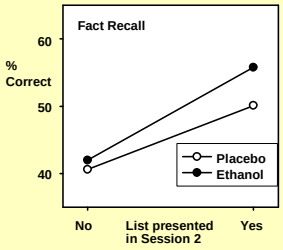
Results and Discussion

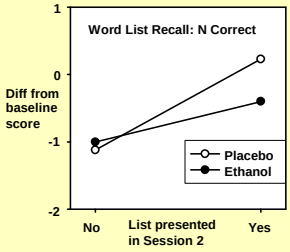
Blood alcohol concentrations on Day 2 were as expected (peak level 88.3 mg/100 ml, S.D. 23.0) and the test battery showed significant ethanol effects over the relevant time-course:





For both fact and word recall, items tested on Day 2 were recalled significantly better on Day 3 then those not recalled on Day2. This was true for both ethanol and placebo groups. The prediction from the reconsolidation hypothesis is that items recalled on Day 2 should be recalled **less well** on Day 3 in the ethanol group. Thus the study does not provide evidence for disruption of a reconsolidation process.





Conclusions

1. No disruption of reconsolidation was seen with ethanol.
2. Effects of ethanol on performance of psychomotor tasks were as expected, and the concentrations of ethanol were at levels known to impair the memory tests used.
3. These results do not support the idea that reconsolidation is essentially a repetition of initial consolidation

References.

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