Pacific Union College

Good Night, and Good Luck Remembering: Effect of Sleep on False Recall

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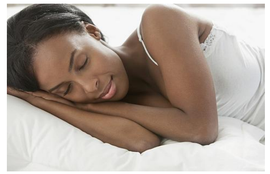


Abstract

The effect of sleepiness on false memory produced by the Deese, Roediger and McDermott (DRM) procedure is not entirely clear. In general, research has shown that sleep enhances false recall, but these studies focused on the effect of sleep on retrieval. The present study assessed the impact of sleep on encoding. We hypothesized that sleep deprived participants would show less false memory than those in the rested condition. Sixty-six undergraduates were randomly assigned to one of two conditions: early morning (2:00 a.m.) or early evening (6:00 p.m.) and then administered eight DRM word lists, taking a recall test after each list. The hypothesis was not supported, and for two of the lists we found that sleep deprived participants actually had more false recall. Our results suggest that while sleep deprivation after encoding but prior to retrieval decreases false recall, sleep deprivation prior to encoding increases it. It seems likely that false recall is increased by processes that impair encoding or enhance retrieval.

DRM Procedure

Roediger and McDermott (1995) demonstrated that false memory can be created in the laboratory, using word lists developed by Deese (1959). This Deese-Roediger-McDermott (DRM) procedure uses words related to the same non-presented target and generates high levels of false recall of the critical lure. Brainerd, et al. (2006) suggested that processes that facilitate gist relative to verbatim memory maximize false recall.

Sleep and False Memory

Payne et al. (2009) found that subjects who slept after learning a DRM list produced more false memory than those who had been awake for an equivalent period after list learning. Darsaud et al. (2011) found that although sleep enhanced true memory, it also increased false memory. These studies suggest that sleep prior to retrieval increases false recall, probably through memory consolidation. It is less clear what effect sleep prior to encoding would have. Based on studies cited above, we expected that rested participants would exhibit more false memory than sleepy participants, because their cognitive processes would not be as efficient.

Hypotheses

The current study sought to explore the effects of sleepiness prior to (rather than after) list-learning in the DRM paradigm. We both experimentally manipulated sleepiness and measured ambient levels of sleepiness, and measured its effect on false recall.

We hypothesized that:

1. Participants in the sleep deprived condition prior to list encoding would show less false memory than those in the rested condition (this is the manipulated condition); and

2. Participants who were sleepier before list encoding would exhibit less false memory than rested participants (this is the ambient condition).

Method

Participants

Sixty-six students (32 men and 34 women) from a college in northern California (age range: 18 - 25 years) participated. The ethnic makeup of participants consisted of 21 Caucasians, six African Americans, 10 Asians, 11 Hispanics, 13 Multiracial individuals, and five who selected "Other". There were 20 freshmen, 16 sophomores, 15 juniors, and 15 seniors.

Materials

Participants completed a basic demographic and sleep survey that asked questions about the number of hours they had slept in the last 24 hours and prior week. Sleepiness of the participants was measured using the Epworth Sleepiness Scale, or ESS (Hagell & Broman, 2007). The eight, 15-word lists used were "Window", "Doctor", "Chair", "Rough", "Anger", "Soft", "Cup", "Mountain."

Procedure

Participants were randomly assigned to the rested condition (6:00 p.m.) or the sleep deprived condition (2:00 a.m.). Those assigned to the 2:00 a. m. condition were asked not to sleep before coming to the study. All participants watched a 25-minute episode of a television program ("30 Rock") to ensure that everyone was alert for testing.

Ambient levels of sleepiness were determined by administration of the demographic and sleep survey, and the ESS. Participants then listened to the eight recorded word lists. After the last word of each list, participants were given two minutes to recall words for each list. This procedure was repeated for all eight word lists. After the last recall test participants were thanked and debriefed.

Word Lists

List 2 (Doctor)		List 5 (Anger)	
Nurse	Sick	Mad	Fear
Cure	Medicine	Hate	Rage
Health	Hospital	Temper	Fury
Dentist	Physician	Enrage	Wrath
Ill	Patient	Happy	Fight
Office	Stethoscope	Hatred	Mean
Surgeon	Clinic	Calm	Emotion

Figure 1: False Recall and Sleep Deprivation for Lists 2 & 5
List 2 (doctor) and List 5 (anger), rested participants experienced less false recall (19% and 38%) than sleep-deprived participants (41% and 68%); $\chi 2$ (1) = 3.93 and 6.02, p = .048 and .014.

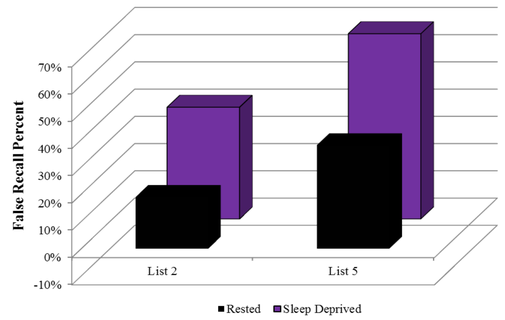
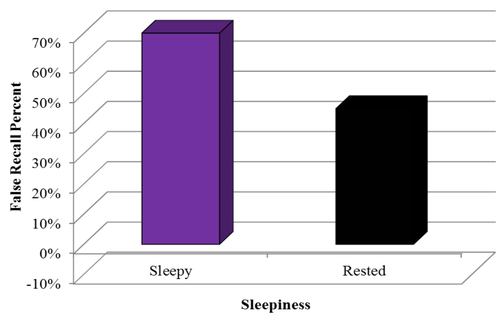


Figure 2: False Recall and Sleepiness
For List 5 (anger) sleepy subjects (less than 6 hours of sleep in the previous 24 hours) demonstrated more false recall (77%) than rested subjects (45%); $\chi 2$ (1) = 5.05, p = .025.



Results

We found substantial levels of false recall; the average false recall for all participants in our sample was 46% (SD = 25.5), compared to the average valid recall rate of 54% (SD = 10.8).

Contrary to hypothesis 1, rested participants (M = 43.4%, SD = 25.8%) did not show more total false recall than sleep deprived participants (M = 48.9%, SD = 25.4%; t(64) = -.88, p = .38). For Lists 2 and 5 rested participants actually showed less false recall (**see Figure 1**).

Contrary to hypothesis 2, participants who got six or more hours of sleep in the previous day (M = 51.5%, SD = 19%)) did not show more total false recall than those who got less than six hours (M = 44.4%; SD = 27%; t(40) = 1.77, p = .25). For List 5 rested participants actually showed less false recall (**see Figure 2**).

Discussion

The current results suggest that the effects of sleep on false memory are different prior to encoding than they are prior to retrieval. Both Payne et al. (2009) and Diekelmann et al. (2010) found that sleep deprivation after list-learning but before retrieval reduced false recall. At least for two of our lists, sleep deprivation prior to list-learning increased false recall. Since sleepiness can be assumed to impair both encoding and retrieval processes, it seems that false recall is increased by impaired encoding and enhanced retrieval. This is consistent with data from our non-manipulated sleep variables; sleepy subjects were more likely to experience false recall on one of the lists.

While our sleep manipulation (random assignment to a list learning and recall session at 6:00 pm, or at 2:00 am) was successful in producing two groups with significantly different levels of sleep, the sleep deprived group only had 15% less sleep than the rested group (a difference of about an hour). A more powerful manipulation may have produced more widespread false recall differences.