Implicit Learning Performance as a Function of Energetics
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Introduction

The Hebb Digits task requires participants to reproduce a sequence of nine numbers (1-9) in varying orders on each trial (Hebb, 1981). Unbeknownst to subjects, an identical 9-digit sequence is repeated on every third trial. Hebb’s results demonstrated cumulative learning on the repeated sequence, but little or no improvement of learning on the intervening or random trials. Although the Hebb Digits Task requires the explicit memorization of the current series of digits, learning is considered incidental because performance improvement occurs without conscious mediation (McKelvie, 1987; Seger, 1994; Stadler, 1993).

Previous results have found that Hebb Digits learning is dependent on individual differences in working memory capacity such that those with greater working memory capacity demonstrate greater learning and awareness for the repeated digit sequence (Weitz, O’Shea, Zook, & Needham, 2011).

Individual differences in mood and physiological states have been found to exert effects on working memory performance. For example, working memory capacity has been found to benefit from positive affect (Brose, Lovden, & Schmiedek, 2014) and readiness (Kuriyama et al., 2008). However, the automatic nature of implicit learning suggests that it would be immune to the everyday effects of psychological and physiological states.

In this study, we test the hypothesis that mood intensity, high or low, may be related to learning and awareness in the Hebb Digits task. Specifically, we predict that low intensity mood would benefit learning of the repeated sequence due to the automatic nature of implicit memory. Furthermore, a borderline state of sleepiness would facilitate the automatic processing of implicitly learned information.

General Method

On a computer monitor, participants were visually presented with a series of digits (1-9) in varying orders on each trial (Hebb, 1961). Unbeknownst to participants every third trial of digits was in an identical order.

Digits were presented in a positional fashion with each digit appearing at a location to 9 in varying order, without repetition of individual digits) at a rate of 1 digit/sec. On a computer monitor, participants were visually presented with a series of digits (1-9) in varying orders on each trial (Hebb, 1961). Unbeknownst to subjects, an identical 9-digit sequence is repeated on every third trial. The Hebb Digits task requires participants to reproduce a sequence of nine numbers (1-9) in varying orders on each trial (Hebb, 1981). Unbeknownst to subjects, an identical 9-digit sequence is repeated on every third trial. Hebb’s results demonstrated cumulative learning on the repeated sequence, but little or no improvement of learning on the intervening or random trials. Although the Hebb Digits Task requires the explicit memorization of the current series of digits, learning is considered incidental because performance improvement occurs without conscious mediation (McKelvie, 1987; Seger, 1994; Stadler, 1993).

Sleepiness

Recall Performance Learning was assessed by comparing the mean recall of the final two non-repeated sequence trials (trials 11 and 13) with recall of the final presentation of the repeated sequence (trial 12).

Awareness was determined by participants’ verbal responses to a questionnaire.

Hebb Learning: Recall of the Repeated sequence was significantly greater than recall of the Non-Repeated series (F(1, 24) = 4.98, p < .05) across all conditions.

Recall of repeated series for High and Low PANAS participants:

• Learning of the repeated sequence was significantly greater for participants with high PANAS scores compared to those with low PANAS scores (F(1, 10) = 4.58, p < .05).

Conclusions

• Hebb digits learning can be demonstrated in a brief 13 trial task.

• Aware participants demonstrate greater learning of the repeated sequence compared to unaware participants.

• Mood intensity inhibits sequence learning.

• Borderline sleepiness benefits sequence learning.

• Hebb digits learning is facilitated by both psychological and physiological states with low-intensity mood and borderline sleepiness resulting in optimal learning.

• Future work should examine the effect of mood and alertness changes in a longer version of the Hebb digits task.

References


