

Sleep Dependent Automation and Global Consolidation of Visual, Procedural Memory

Abstract

Previous research has found that consolidation of procedural memory for the visual discrimination task (VDT) is sleep-dependent. While overnight improvement on the VDT may involve attentional reallocation among multiple brain areas, there is no behavioral evidence for this phenomenon. Repetitive transcranial magnetic stimulation (rTMS) has been used to investigate the localization of sleep-dependent motor memory consolidation, but this technique has not yet been employed with respect to visual memory. Subjects trained on the VDT, received rTMS, and then retested the following morning. Data was confounded because controls did not perform as expected, possibly because of stressful sleep lab conditions. There was no influence of rTMS on post-sleep VDT performance among outpatients, indicating either that our stimulation was ineffective or that sleep-dependent consolidation does not occur exclusively in V1 immediately after training. In a second study, subjects performed a new adaptive version of the VDT, called the VDT Staircase, during two sessions. Subjects improved overnight to a greater extent than has been shown in the standard version, but not during the day. Stabilization and automation were also achieved after sleep but not wake, which may mean that top-down changes of attentional input onto the visual cortex are sleep-dependent. To investigate the policy implications of my findings, I monitored Harvard undergraduates for their sleep habits and emotional well-being over the course of a semester. They exhibited highly individualized and often unhealthy sleep habits, especially preceding an exam. Dissemination of information about the benefits of healthy sleep and curricular restructure should be concentrations of education reform.