

A working memory model with three factor learning

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Cortical models of working memory exhibit persistent activity which is needed in situations where temporal stimulus-stimulus or stimulus-rewards associations have to be learned. Individual neurons or small subgroups can be switched into persistent activity by a localized stimulus which we call CS whereas a global stimulus (US) is used to switch off the activity. To achieve this behaviour the network has to be fine tuned to prevent global oscillations or global silence.

Here we present a working memory which fine-tunes its activity by itself and is learning stable persistent activity with the help of three factor Hebbian learning. The third factor serves here as a switch which enables learning only at certain moments. Here we switch on learning either at the moment of the CS or at the moment of the US. This leads to stable memory traces after a few trials. The third factor is motivated by the activity of dopaminergic neurons in the VTA which either fire at the moment of the CS or of the US.