

Modelling the acquisition of grammars with STDP

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The acquisition of grammar is a cognitively demanding task for human learners and still poorly understood in terms of identifying the underlying learning mechanisms. We propose to model the acquisition of grammars that consist of long-range or non-adjacent dependencies (NADs) between their constituting elements, using a recurrent neural network (RNN) and spike-timing dependent plasticity (STDP). The RNN successfully acquired NADs with different degrees of structural complexity. Moreover, the network's ability to learn grammars across several feature variations (i.e. variability of non-grammatical material, varying distances between grammatical units, variability of stimulus pauses and emphasis on grammar elements) complied with performance patterns observed in human learners. Our results show that the learning of grammars including NADs can be explained by an associative, general purpose learning algorithm of the cerebral cortex. Integrating this finding with recently observed NAD learning capacities in non-human primates, STDP potentially represents a central cognitive building block across species.