A neurobiologically inspired model of repetition blindness

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Abstract

Various psychological phenomena require the establishment of separate episodic representations for each of the objects perceived in the environment. There is neurobiological evidence supporting the theory that the episodic context of an object is stored separately from its identity. We describe a model of one such phenomenon, *repetition blindness*, which uses separate representations for the identity and word location information.

Repetition blindness (RB) is the failure to detect the repeated occurrence of a stimulus which is presented in a rapid serial visual presentation experimental paradigm. If the exposure of the first occurrence of the stimulus, or critical word (C1), is set so that it is just identifiable—about 100 ms—then identification of the second occurrence (C2) is impeded.

The existence of two separate functional pathways extending from the occipital to the parietal and temporal lobes is now well established. The ventral, temporal pathway, is specialised for identifying *what* an object is. The dorsal, parietal pathway, is responsible for spatial perception or locating *where* an object is in space.

Drawing on the presence of these functional streams, we propose a model of RB which follows this roughly Y-shaped division. It consists of three laterally connected self-organising maps of spiking neurons. One of the networks identifies the letters, another localises the letter in the input array and the third, playing the role of what is commonly called association cortex, allows for identity and location information to be bound together even though two different networks sub-serve these functions.

It is our contention that an interactive process involving the establishment of synchronous oscillations in the network permits the binding of what and where information, thus forming a stable percept.

Furthermore, we show that on the time scale at which RB occurs, presentation of stimuli, in this case individual letters, disrupts the establishment of synchronous oscillations interfering with the establishment of stable percepts for each of the two identical stimuli presented to the network.

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