INHIBITION AS BINDING CONTROLLER IN A NETWORK OF BINDING NEURONS

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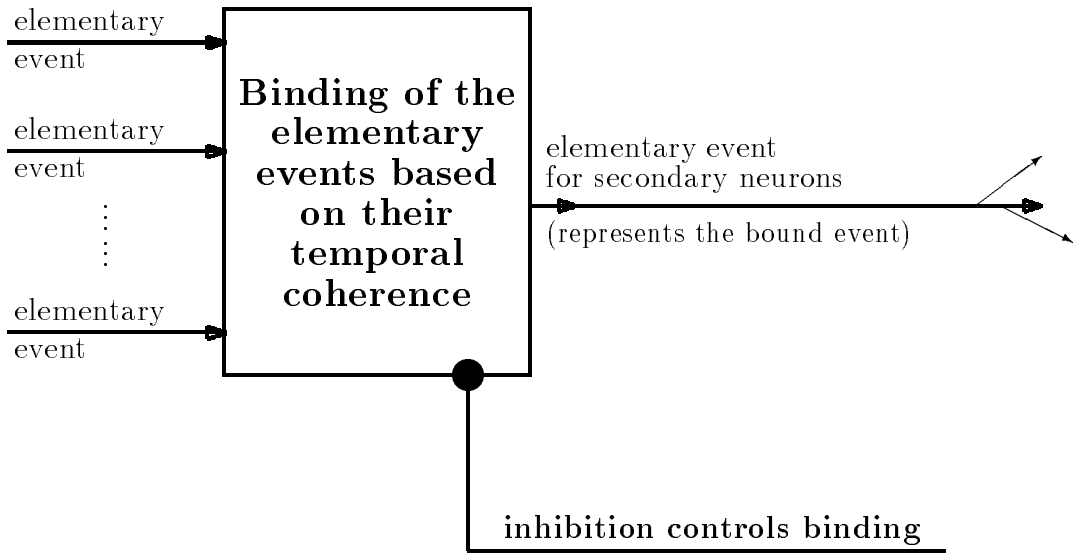
Binding or feature linking is a concept giving a generic name for various phenomena observed during neural processing in brain. The usefulness and relevance of the binding concept for describing neural processing and coding is approved by experimentally observed separate neural representation of different features of a single object [2, 6]. Variants of binding are reported in sensory pathways of different modalities [3, 4, 5, 7], as well as at different levels of the CNS [1, 8]. A variant of bindind can be attributed to a single generic neuron. Here is the scheme of the single-neuron binding proposed in [9].



This schematic representation has been realized as a C^{++} program, representing a cell receiving synaptic inputs at various moments of time. If, in a time window of width W the total number of inputs reaches the firing threshold, the cell's output becomes active (the spike is generated). The degree of inhibition in the cell is expressed in terms of W: the smaller is the W, the more inhibited is the cell (see [9]). A square lattice of 15×15 cells of this type is modelled as C^{++} program. The network allows for playing patterns by means of activation of external excitatory inputs available for each cell. The excitatory

and inhibitory connections between the cells are chosen in such a way that a selfsustaining firing pattern can represent a connected geometrical figure (the bound pattern). By means of forced playing specific pattern, the network is trained in such a way that another selfsustaining pattern is possible as well. In this pattern, the neurons representing the same geometrical figure are active, with some of them continuously silent. As a result, in this pattern the geometrical figure is decomposed into two disjointed parts (the disconnected or unbound pattern). Thransitions between the two patterns of activity can be performed by changing inhibition, which is applied uniformly to all cells. Namely, with higher inhibition ($W = 15$ ms), the unbound pattern is realized. If inhibition is decreased ($W = 25$ ms), the disconnected pattern turns into the bound one. This observation is interpreted as an example of the way the inhibition is able to control binding in a neuronal groupe.

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