A laminar model of the layer 4 of area V1 of mammals is presented. The model addresses development as well as functional roles of the horizontal connections found in this cortical layer. It is assumed that the layer 4 is subject to visual experience at the eye opening. It is further assumed that the LGN input is poorly tuned for orientations. These two assumptions are sufficient for modeling how a correlation based network of horizontal connections is developed in layer 4. These assumptions are in line with reports on rapid improvement of OS during the first weeks after eye opening, when the eyes are subject to normal visual experience. This period in an animal's life coincides with the development of the cortical horizontal connections as well.

The resulting networks resemble some of the cortical layers' properties. Units that are correlated develop E→E connections, whereas anticorrelation results in the development of E→I connections. Both types of connections target mainly the local iso-orientation domain, thus iso-orientation inhibition dominates cross-orientation inhibition. The layout of the long-range connections is different though. These connections are distributed equally between orientation domains.

The model shows that the presence of normally developed horizontal connections is responsible for emergence of OS. This is in line with rapid improvement of this response property after eye opening. Furthermore, the simulation results suggest that this property is dependent on the lateral extent of the horizontal connections. In the full network the units are highly orientation selective, in contrast to units in the local network that are poorly tuned. When the horizontal connections are absent the network cannot even converge. This indicates absence of OS.

The proposed layer 4 network addresses OS by assuming (i) normalization inhibition for controlling the total activity of the hypercolumn-modules, and (ii) long-range E→E connections, which provide units with information from a larger region than their classical receptive fields. Observe the layer 4 network addresses OS by assuming V1 like connectivity, i.e. the network is not dominated by extremely strong inhibition, and the excitatory network encloses its inhibitory equivalent.