

Fig. 1. LISSOM model. Each sheet of LGN units receives input from its circular receptive fields (RF) on the retina. Sample connections are shown for one unit in each sheet. V1 units have circular RFs on LGN sheets of both types. Initial lateral excitatory and inhibitory inputs to a V1 unit are illustrated by the small dotted and large dashed circle, respectively.

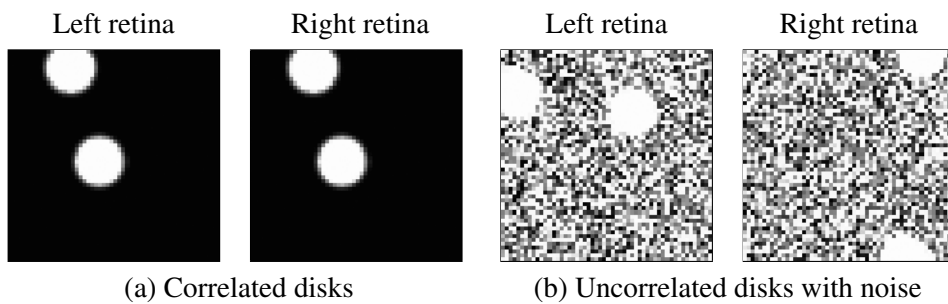


Fig. 2. Sample input patterns from two conditions: (a) correlated disks without noise, and (b) uncorrelated disks with uncorrelated random noise.

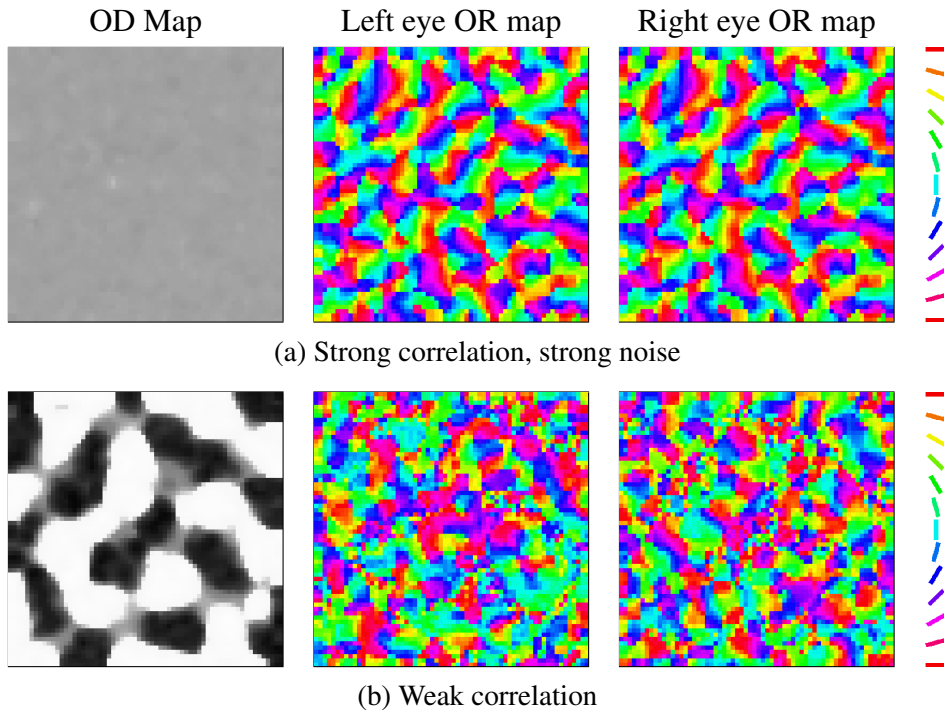


Fig. 3. Sample maps developed at two extreme levels of correlation in the input. In the OD map, eye preference from left to right is encoded in grayscale from white to black; in the OR map, the colors indicate orientation preference according to the key on the right. (a) The input pattern consisted of two pairs of disks (two disks in each eye), one uncorrelated with varying random brightness ( $\mu = 0.0, \sigma = 1.0$ ), and one correlated with brightness level 1.0. In addition, there was correlated random noise with brightness level 1.0. Such strong correlation and strong noise yield matching, strong OR maps but no OD map. The weak uncorrelated input component is not enough to drive the development of the OD map. (b) The input consisted of one uncorrelated pair of disks (one disk in each eye) with varying, random brightness ( $\mu = 0.5, \sigma = 1.0$ ) together with correlated noise that had random brightness ( $\mu = 0.5, \sigma = 1.0$ ). Such a weak correlation yields very strong ocular dominance, but patchy and non-matching OR maps.

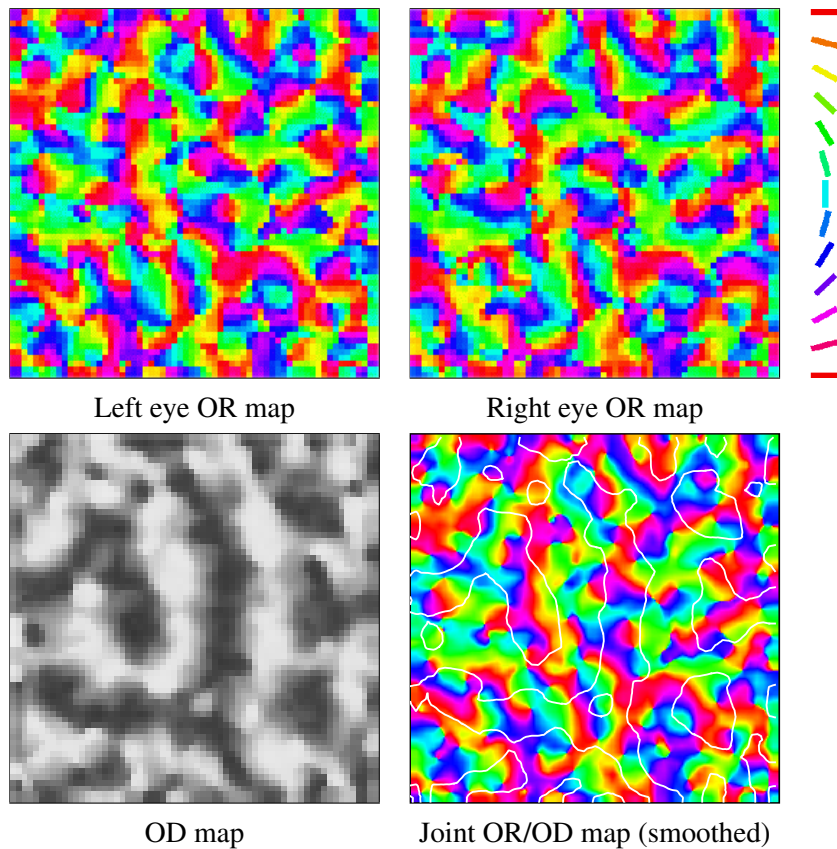


Fig. 4. Maps developed jointly with correlated and uncorrelated disks and uncorrelated random noise input patterns. Similar to biological maps, the OR maps match in both eyes, pinwheel centers tend to be located within OD columns, and OR and OD bands intersect orthogonally. The maps in the Joint OR/OD plot have been smoothed so that the intersection trends are easier to see.

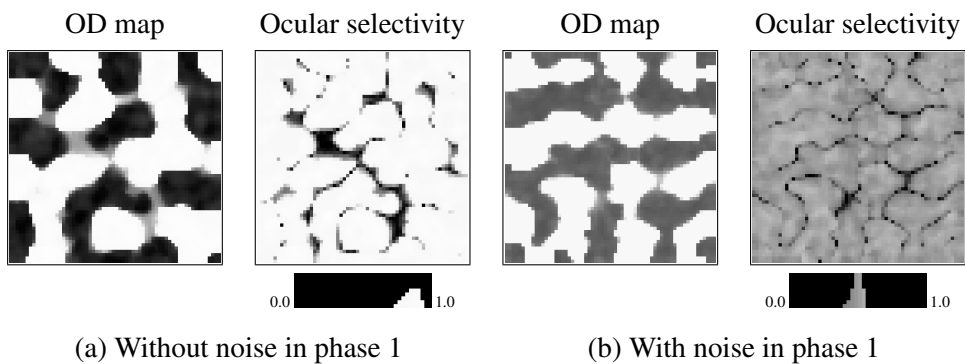


Fig. 5. OD map and ocular selectivity after 10,000 iterations. The brightness of the selectivity map represents how strongly the neurons prefer their dominant eye, with white denoting maximum and black minimum. Below the selectivity map, a histogram illustrates the number of units at a particular level of selectivity. In a series of simulations, the input during the first 1,000 iterations consisted of disks with an uncorrelation level of 1.0, (a) without and (b) with uncorrelated random noise. In the following 9,000 iterations, noiseless disks were presented with an uncorrelation level between 0.4 and 1.0 (0.4 for the map shown in this figure). Without noise in the first 1,000 iterations, neurons become much more selective (indicated by brighter and darker colors in the OD map, and lighter colors in the selectivity map). Higher uncorrelation in the second phase does not change the maps significantly, indicating that the effect is robust.