Diversity of responses to gratings in V1 of alert monkey

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We have previously shown that most cells in alert monkey V1 have overlapping increment and decrement activating regions (ARs) and nonlinear response properties ("duplex" cells). Diverse responses of these cells to drifting gratings differ from the unmodulated firing usually ascribed to complex cells, and can not be predicted from receptive field spatial maps. We recorded from single cells in V1 of alert macaques performing a fixation task, while systematically varying temporal frequency, spatial frequency and width of a stimulus grating patch. Some cells that responded with pseudolinear (F1) modulation to mid-to-high temporal frequency gratings, showed frequency doubled (F2) or mixed (F1, F2, F3 harmonics) responses at low temporal frequencies. Grating spatial frequency and width profoundly influenced the response of most cells. The main patterns were: F2 responses to gratings of very low spatial frequency and/or small width; decrease of F2 and increase of F1 with increase of spatial frequency and/or width; decrease of F1 and appearance of "subF1" modulation with further increase of spatial frequency. Finally, the responses of many cells to stationary gratings of mid-to-high spatial frequency unexpectedly exhibited robust low frequency modulation in the range similar to the "subF1" modulation elicited by drifting gratings. Thus, the form of the response, not only the amplitude, depended on stimulus parameters. Since existing models of cortical cells do not account for the response diversity exhibited by duplex cells, these results suggest an alternative duplex cell model based on interactions between increment and decrement ARs and surround.

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