SIMULATING THE SPEED AND DIRECTION TUNING OF MT NEURONS USING SPATIOTEMPORAL TUNED V1-NEURON INPUTS.

((J. A. Perrone)) Psychology Dept., University of Waikato, New Zealand and NASA Ames Res.Ctr., Moffett Field, CA.

**Purpose.** Neurons in the primate middle temporal cortical area (MT) show characteristic speed and direction tuning useful for the extraction of self-motion and depth information from 2-D image motion (Perrone, JOSA 1992; Perrone & Stone, ECVP 1992). Neurons at the preceeding cortical level (V1) are tuned for particular spatiotemporal frequencies and can be modelled using linear filters (Watson & Ahumada, NASA TM 1983). However such filters are not velocity selective since their outputs are affected by factors such as the spatial frequency of the stimulus. Independence from such 'extraneous' stimulus features is desirable if the neuronal output is to be used for self-motion and depth extraction. **Method.** In order to construct a sensor, we combined the motion-energy outputs (Adelson & Bergen, JOSA 1985) from sets of linear spatiotemporal filters using a range of spatial frequencies but only two temporal-frequency channels (sustained and transient) as suggested by human psychophysics (Kulikowski & Tolhurst, J.Physiol. 1973). To set up a particular speed preference for the sensor as a whole, we adjusted the output ratio of the two temporal channels within each spatial-frequency band. Thus we were able to tune each band individually to the appropriate temporal frequency. **Results.** The sensor was tested with moving bars using a range of speeds and directions. The direction and speed tuning matched that of an "average" MT neuron. Using moving sine-wave grating inputs, we confirmed that the speed and direction tuning of the sensors is largely independent of the input spatial frequency. **Conclusion.** Motion-energy responses like those of directionally-selective V1 complex cells can be combined to create direction- and speed-tuned responses similar to those of MT neurons.

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