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**Title: Simple cells provide strong input to MT neurons**
**Conference: Cosyne 11**
**Date: 2/25/2011**

**Abstract:**
The middle temporal area (MT) in the macaque monkey plays a pivotal role in motion processing. Its main input comes from the primary visual cortex (V1). Previous recordings from monosynaptically connected V1 and MT neurons indicated that the V1 neurons that project to MT are predominantly of the complex type (Movshon and Newsome, 1996). This finding has been used to argue for a specific mapping between the motion energy model and the visual hierarchy. We used a reverse-correlation approach to investigate this claim.

Complex cells are invariant to the phase and luminance polarity of moving objects, but simple cells are not. We used this distinction to estimate the contribution of simple cells to MT responses.

We recorded single cell responses in area MT from two macaque monkeys while they observed a random noise stimulus. The stimulus was composed of rapidly alternating frames containing vertical bars of random luminance. We characterized the neural response using the Linear-Nonlinear-Poisson (LNP) model —linear filters followed by a static nonlinearity and a poison spike generator and used the information-theoretic spike-triggered average and covariance (iSTAC) technique to extract the most informative stimulus dimensions (Pillow and Simoncelli,2006). By estimating the nonlinearity for each of these dimensions, they can be classified as polarity sensitive or invariant.

We found that the first iSTAC dimension, the one carrying most information, was very similar to the STA for the majority of MT neurons. The shape of the nonlinearity confirmed the sensitivity to the polarity of this stimulus dimension. Polarity invariant dimensions generally provided less but still significant information. Taken together our findings show that MT cells responses are dominated by polarity sensitive input, which likely originates from simple cells.
Supported by the National Eye Institute (R01EY01765).