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The impact of multiple noise sources on maximally informative adaptive dynamics in neural populations[1] WEI-MIEN MENDY HSU, Salk Institute and University of California, San Diego, DAVID KASTNER, University of California, San Francisco, STEPHEN BACCUS, Stanford University, TATYANA SHARPEE, Salk Institute and University of California, San Diego — Sensory neural populations are thought to be optimized to transmit information about the sensory environment either in the course of evolution in the dynamically to adapt neural responses to the current stimulus environment. Recent work has shown that when encoding a particular stimulus feature, the existence of multiple neuronal types with different thresholds increases information transmission when sensory noise drops below a certain level. This prediction across an evolutionary timescale simultaneously explains the existence of adapting and sensitizing Off retinal ganglion cells, which have high and low thresholds for spiking, respectively, as well as the absence of comparable types among On that have higher effective noise level. However, the difference in thresholds between adapting and sensitizing cells is systematically lower than the one that would yield maximal information in an environment of stationary contrast. Here we show how predictions for the optimal threshold difference change when the overall sensory noise is treated as the combination of multiple noise sources separated by nonlinear steps. Analyzing responses of adapting and sensitizing ganglion cells types we identify an additional noise source that affects adapting but not sensitizing ganglion cells.

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Wei-Mien Mendy Hsu
Salk Institute and University of California, San Diego

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