Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Variance adaptation in navigational decision making[1] MARC GERSHOW, RUBEN GEPNER, JASON WOLK, DIGVIJAY WADEKAR, New York Univ NYU — *Drosophila* larvae navigate their environments using a biased random walk strategy. A key component of this strategy is the decision to initiate a turn (change direction) in response to declining conditions. We modeled this decision as the output of a Linear-Nonlinear-Poisson cascade and used reverse correlation with visual and fictive olfactory stimuli to find the parameters of this model[2]. Because the larva responds to changes in stimulus intensity, we used stimuli with uncorrelated normally distributed intensity derivatives, i.e. Brownian processes, and took the stimulus derivative as the input to our LNP cascade. In this way, we were able to present stimuli with 0 mean and controlled variance. We found that the nonlinear rate function depended on the variance in the stimulus input, allowing larvae to respond more strongly to small changes in low-noise compared to high-noise environments. We measured the rate at which the larva adapted its behavior following changes in stimulus variance, and found that larvae adapted more quickly to increases in variance than to decreases, consistent with the behavior of an optimal Bayes estimator[3].

[1]Supported by NIH Grant 1DP2EB022359 and NSF Grant PHY-1455015
[2]Gepner, R., et al., eLife Sciences 4, e06229 (2015)
[3]DeWeese, M. & Zador, A. Neural Computation 10, 11791202 (1998)

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Date submitted: 11 Nov 2016 Electronic form version 1.4