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Variability and Reliabiltiy in Axon Growth Cone Navigation Decision Making MARTA GARNELO, Imperial College London, SÉBASTIEN G. RICOULT, DAVID JUNCKER, TIMOTHY E. KENNEDY, McGill University, ALDO A. FAISAL, Imperial College London — The nervous system's wiring is a result of axon growth cones navigating through specific molecular environments during development. In order to reach their target, growth cones need to make decisions under uncertainty as they are faced with stochastic sensory information and probabilistic movements. The overall system therefore exhibits features of whole organisms (perception, decision making, action) in the subset of a single cell. We aim to characterise growth cone navigation in defined nano-dot guidance cue environments, by using the tools of computational neuroscience to conduct "molecular psychophysics." We start with a generative model of growth cone behaviour and we 1. characterise sensory and internal sources of noise contributing to behavioural variables, by combining knowledge of the underlying stochastic dynamics in cue sensing and the growth of the cytoskeleton. This enables us to 2. produce bottom-up lower limit estimates of behavioural response reliability and visualise it as probability distributions over axon growth trajectories. Given this information we can match our in silico model's "psychometric" decision curves with empirical data. Finally we use a Monte-Carlo approach to predict response distributions of axon trajectories from our model.

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