Modeling distributions of arm movements

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The motor control literature has been successful in finding optimization principles that can explain many types of voluntary movements. That is, a criterion can be defined such that minimizing or maximizing this quantity produces good predictions of average behavior. However, movements show significant variations over multiple repetitions, and in populations with motor disorders, and during development, the movements we produce are often far from optimal. In these populations, it is generally impossible to come up with a good prediction for the trajectory that will be used in any given movement. What is possible, however, is to predict the properties of distributions of movements, i.e. predict relevant properties of a relatively large number of movements.

Recently, numerous researchers have noted that movement production and decision-making are intimately connected – before making any movement, we need to decide which movement to make, when to make the movement, as well how we will produce the movement (e.g. trajectory and velocity profile). In this talk, I will describe how we can combine noisy evidence accumulation models, which are typically used to model decision-making processes, with models of motor production. I will present the predictions of these models, compare them to data sets from several experiments, and explain how we can extract and interpret meaningful parameters from these models.