# Decision-theoretic models of perception and action

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Bayesian decision theory (BDT) is a method for computing optimal decision rules. It is also an appropriate model for modeling how organisms compensate for their motor uncertainty in planning movement. I'll first describe recent experiments that explore how human subjects plan movements in tasks where good performance requires that the subject take into account his own spatial and temporal motor uncertainty. Subjects' performance in these experiments was typically close to the performance that would maximize expected gain as predicted by BDT. Moreover, they transfer information about one task to the other without any apparent need to learn.

These outcomes is surprising since these tasks are mathematically equivalent to decision making under risk and subjects in economic decision making experiments typically fail to maximize expected gain and also exhibit changes in behavior across trials consistent with reinforcement learning. In particular, they show characteristic distortions of probability information (exaggerating small probabilities) and value information.

I'll describe two final experiments that allow direct comparison of decision making under risk and planning of movement in equivalent tasks. We find that probability information is distorted in both decision making and movement planning but the patterns of distortion are very different in the two kinds of tasks. I'll discuss the

implications of these differences for modeling how the nervous system compensates for uncertainty in perception, action, and cognition.

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