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Title: Bayesian Decision theory, visual Perception and the planning of movement

Bayesian decision theory is a method for computing optimal decision rules given a prior distribution, a likelihood function, and a loss function. A remarkable amount of perception research in the past 25 years can readily be modeled within the Bayesian framework and yet there has been no systematic attempt to test the framework itself, and it is sometimes claimed that it is too encompassing to ever be disproved. I'll describe ways of testing the components of Bayesian decision theory experimentally and illustrate how to test its applicability to modeling optimal speeded movement that takes into account the subject's own temporal motor uncertainty. In the experiment described, subjects attempted to touch small targets that abruptly appeared on a screen in front of them. If they touched a target, they earned money but the amount of money earned decreased rapidly over time. If they moved too quickly, they would likely miss the target, too slowly, they would hit it but earn little reward. The problem for the subject is to base their choice of movement plan on their own speed-accuracy tradeoff. In this task and others I will describe, we manipulate loss functions as independent variables and thereby test the Bayesian framework. Subjects' performance was close to the performance that maximizes expected gain as predicted by the model based on the framework.

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