Suboptimal movements under risk due to experimentally imposed anisotropic endpoint variance

Hadley Tassinari¹, Todd E. Hudson¹,² and Michael S. Landy¹,²
¹Department of Psychology & ²Center for Neural Science, New York University

Introduction

In a rapid pointing task under risk, do subjects account for:
- increased movement variance?
- anisotropic variance?

Method

Subjects reached to a screen as follows:
- 450 ms movement time limit
- Hitting within a green target circle earned 1 point
- Hitting within a red penalty circle cost 0, 2, or 5 points (by block)
- Subjects were paid $0.02 per point

12 penalty positions (θ = 15, 45, 75...°) varied by trial

2 Conditions:
- vibration of triceps surae
- unvibrated

Ideal behavior

Aim point gain landscape:

Subjects’ endpoint distributions are anisotropic:

Endpoint covariance ellipse (measured from subject's data)

The ideal shift away from P1 should be greater than that away from P2.

Results (3 examples)

Average aim points

Shift (function of $\sigma_p$)

Efficiency

Simulated experiments were conducted as follows:
- endpoints chosen from 2-d Gaussian with covariance as measured from subjects' data, centered on subjects' aimpoints
- scores calculated for each set of simulated endpoints
- simulations repeated, yielding a distribution of predicted scores for each subject in each condition
- observed scores matched predictions
- simulations repeated, using ideal aim points, to predict the range of optimal performance for each subject:

Conclusions

Most subjects shifted further with increased variance.

Subjects did not adjust ideally for anisotropy in endpoint variance.