Knowledge of Uncertainty in Physical Prediction

Kevin A Smith, Edward Vul

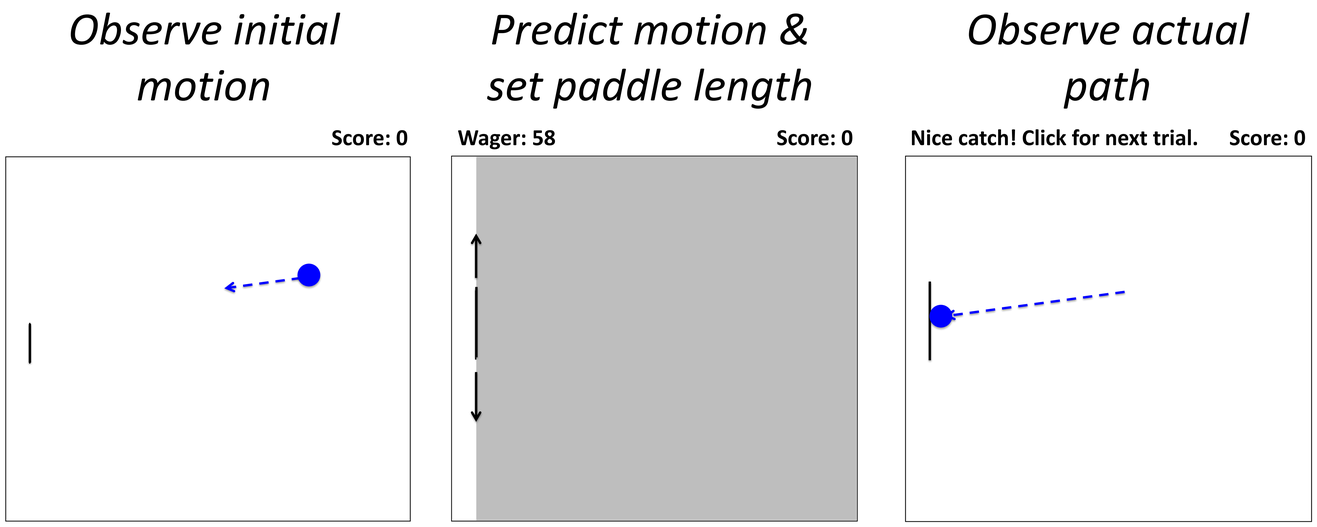
Department of Psychology, UC San Diego

Email: k2smith@ucsd.edu

Introduction

- Physical prediction is well explained as accurate extrapolation of an uncertain, probabilistic world (Battaglia et al 2013, Smith & Vul 2013)
- Implies that people form a probability distribution over possible future states
- Can people reason about the uncertainty captured in these probability distributions?

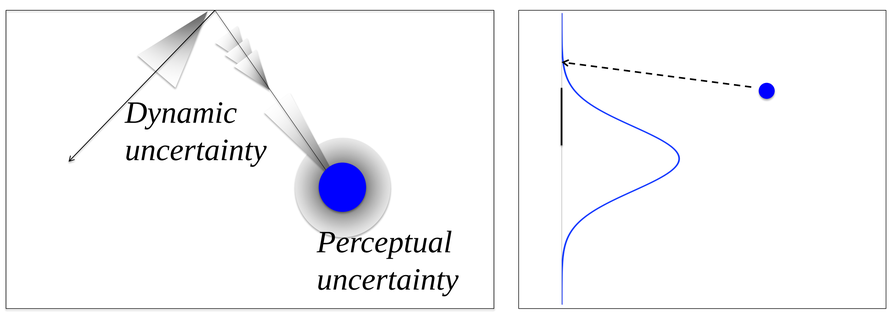
Task



- N = 43
- 450 trials / participant
- Measures:
  1. Predictions (paddle position)
  2. Uncertainty (paddle length)

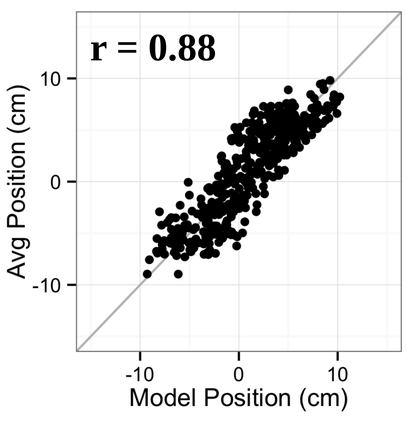
Prediction model

Physical forward model + Center expectation

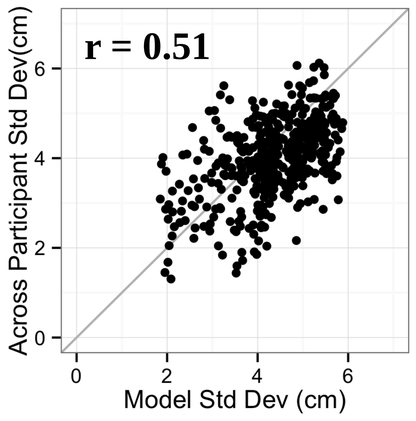


Smith & Vul (2013)

Explains predictions

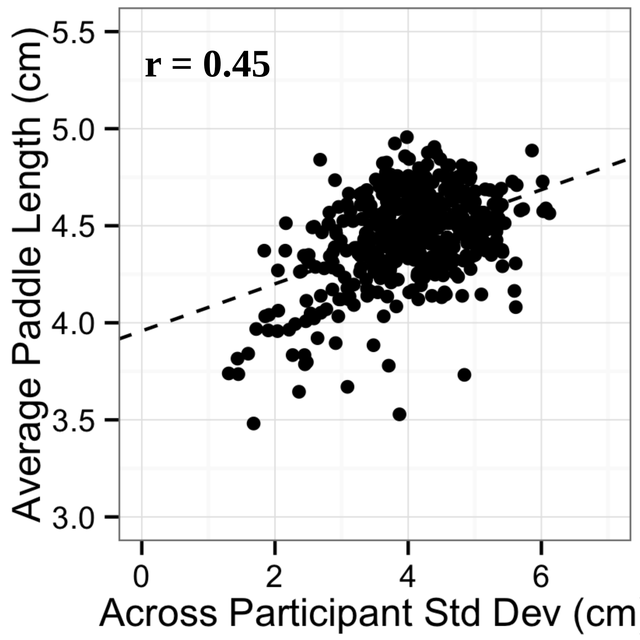


Explains variability

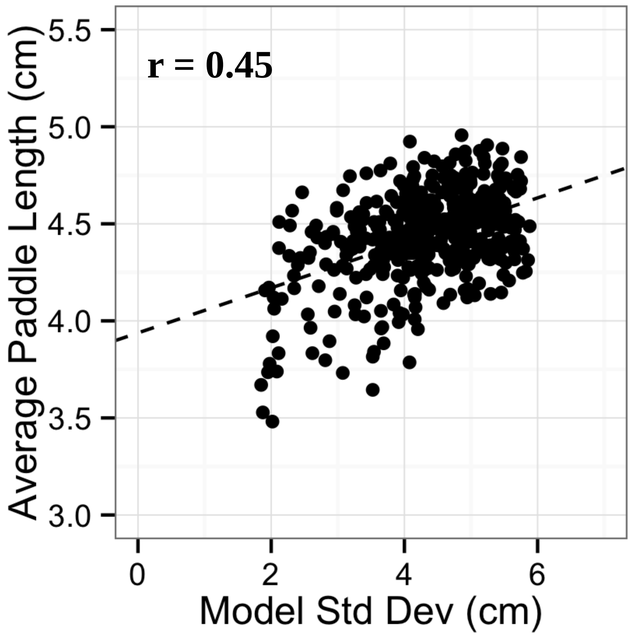


Results

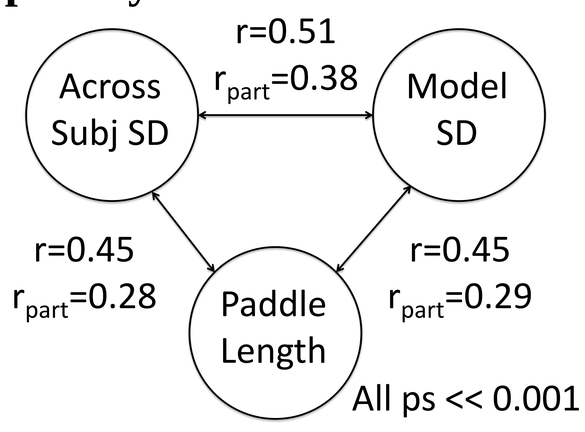
1) By-trial uncertainty relates to variability in predictions



2) Model explains by-trial uncertainty well



3) Uncertainty explained in part by both measures



Discussion

- Explicit measures of uncertainty track estimates of how much uncertainty people should have
- Suggests that people have and use probabilistic distributions over where objects might go
- Both estimates of uncertainty capture different facets of peoples' uncertainty

References

Battaglia, P., Hamrick, J., & Tenenbaum, J. (2013). *Simulation as an engine of physical scene understanding.* Proceedings of the National Academy of Sciences, 110(45), 18327-18332.

Smith, K. A., & Vul, E. (2013). *Sources of uncertainty in intuitive physics*. Topics in Cognitive Science, 5(1), 185-199.