

# Modelling Handedness as a Function of Cooperation and Competition

Or: How I Learned to Bow Down to My Left-Handed Overlords

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# Outline

## Introduction

### History of Handedness

## Building the Model

## Comparing Model to Baseball Data

## History of Handedness

- ▶ 10% of population is left-handed.
- ▶ Why hasn't this percentage reached equilibrium in populations at either:
  - ▶ 50%-50% between left and right-handedness
  - ▶ 100% either left or right handed
  - ▶ Some other handedness ratio
- ▶ This paper proposes that hand preference may be influenced by costs and benefits of cooperation and competition during human evolution.

## Building the Model

- ▶ We want to model  $l$ , the proportion of lefties, over time.

$$\frac{dl}{dt} = (1 - l)P_{RL}(l) - lP_{LR}(l)$$

- ▶ Assume  $P_{RL}$  and  $P_{LR}$  are symmetric.

$$\frac{dl}{dt} = (1 - l)P_{RL}(l) - lP_{RL}(1 - l) \quad (1)$$

- ▶ Break  $P_{RL}(l)$  into increasing and decreasing components.

$$P_{RL}(l) = cP_{RL}^{\text{coop}}(l) + (1 - c)P_{RL}^{\text{comp}}(l) \quad (2)$$

# Video

## Using Athletics Data

### Ideally

Want to compare predicted equilibria of eq (1) to animal population data where cooperation is present.

- Quantification of cooperation and available data very depending on task

### Proxy Situation

Within athletics, data on handedness and cooperation are readily available.

### Baseball Rank Equation

$$I_r = \frac{1}{2} \frac{l_{bg} N \operatorname{erfc}(\hat{s}_r - \Delta \hat{s})}{r}$$

## Visualizations

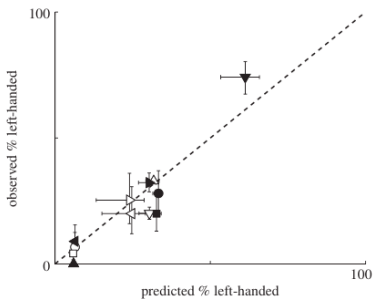


Figure : A subfigure

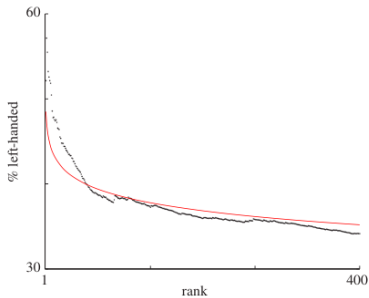


Figure : A subfigure

## Summary

- ▶ Sports data may not be analogous to natural world data; further quantitative analysis with social animal groups vital for future research.
- ▶ Analysis of athletics provides new insights into evolutionary origins of handedness.
- ▶ This model may be applied to any species of animal and may also be used in understanding other physical and/or behavioral lateralized adaptations.



## For Further Reading I



Abrams, Daniel M. and Panaggio, Mark J.

A model balancing cooperation and competition can explain our right-handed world and the dominance of left-handed athletes

*Journal of The Royal Society Interface*, 2012.