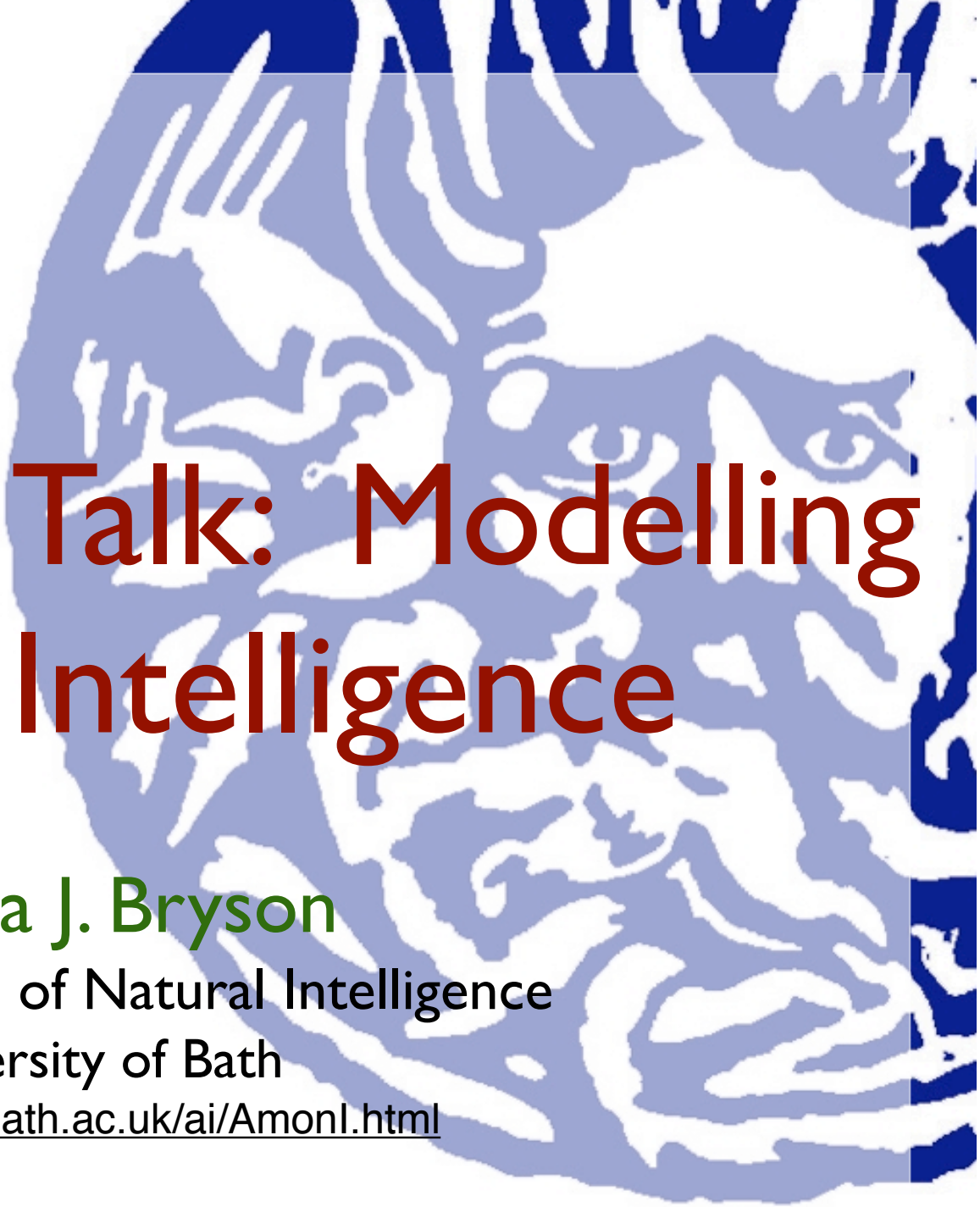


MSc Project Talk: Modelling Natural Intelligence

Joanna J. Bryson
Artificial Models of Natural Intelligence
University of Bath
http://www.cs.bath.ac.uk/ai/AmonI.html

Interests

- Systems Artificial Intelligence
  - Modularity & Coordination (Planning).
  - Autonomous Systems–Agency & Ethics.
  - Programmability for Pervasive AI–"AI Plumbers"
- Natural Intelligence
  - Modularity & Organization (Neuroscience).
  - Origins of Cognition (Behavioural Ecology).
  - Culture & Sociality (Biological Anthropology).

Background

- Artificial Intelligence
  - PhD (MIT 2001), MSc (Edinburgh 1992).
  - LEGO (Denmark), HCRC (Edinburgh).
- Natural Intelligence
  - BA (Chicago 1986), MPhil (Edinburgh 2000).
  - Primate Cognitive Neuroscience Labs (Harvard 2001-2, Edinburgh 1996-7).
- Bath Intelligent Systems (2002-now).

Current Work

- Artificial Intelligence
  - Intelligent systems development. (e.g. game characters, intelligent environments.)
  - Making AI accessible to non-experts.
- Natural Intelligence
  - Brain organisation: modularity & "attention".
  - Evolution, cognition and primate social structure.
  - Evolution, sociality & public goods investment.

Outline

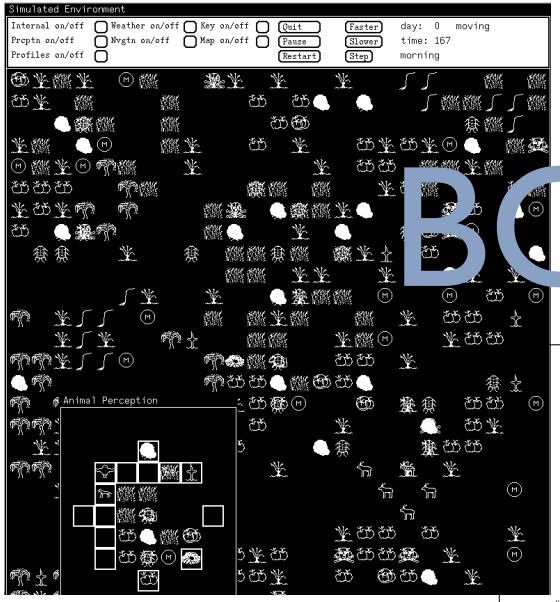
- Introduction
- Methods
- Current Projects
- Proposed Projects

Behavior Oriented Design

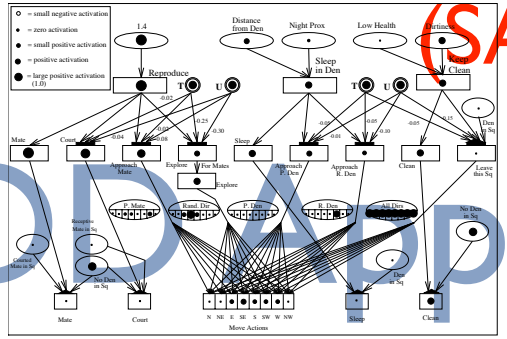
- All search (learning, planning) is done within modules with specialized representations.
- Specialized representations promote reliability, determine decomposition.
- Modules provide perception, action.
- Module coordination through hierarchical dynamic plans.

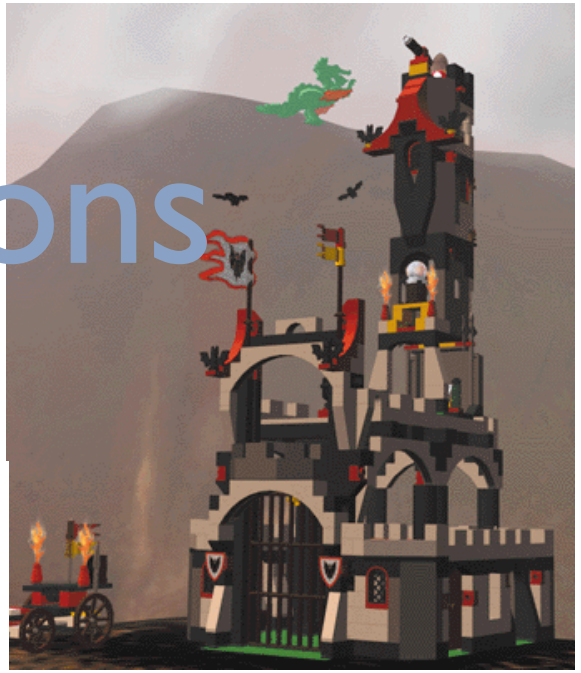
(Bryson 2001, 2003)

BOD Applications

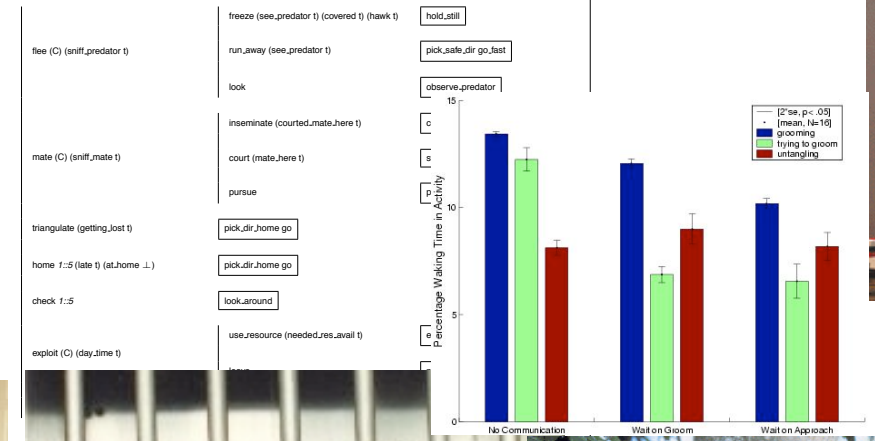


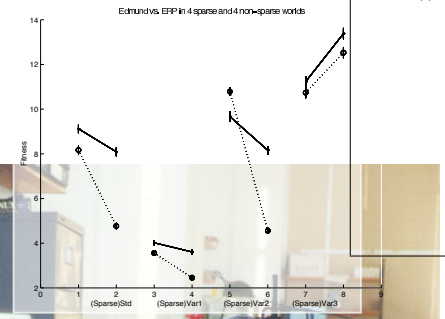
(SAB 2000)

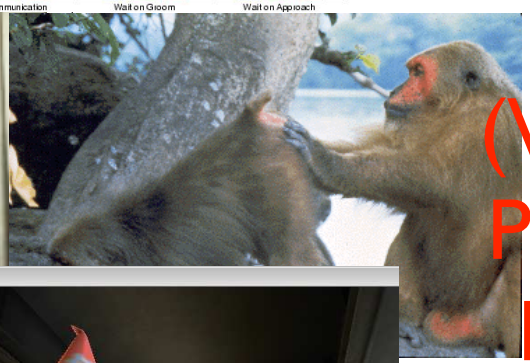




(VR(J) 2000)



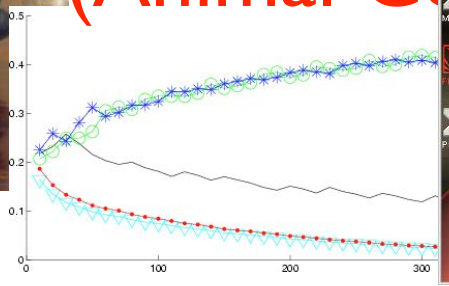




(WRAC 2003,
PTRS B 2007,
BICA 2008)

(Animal Co

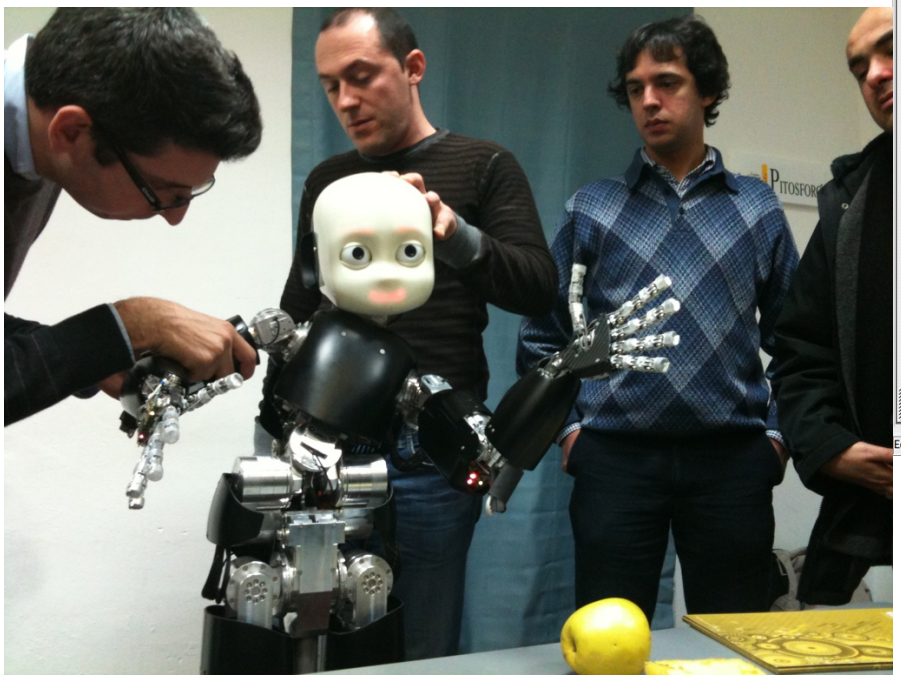
(ATAL 1997)

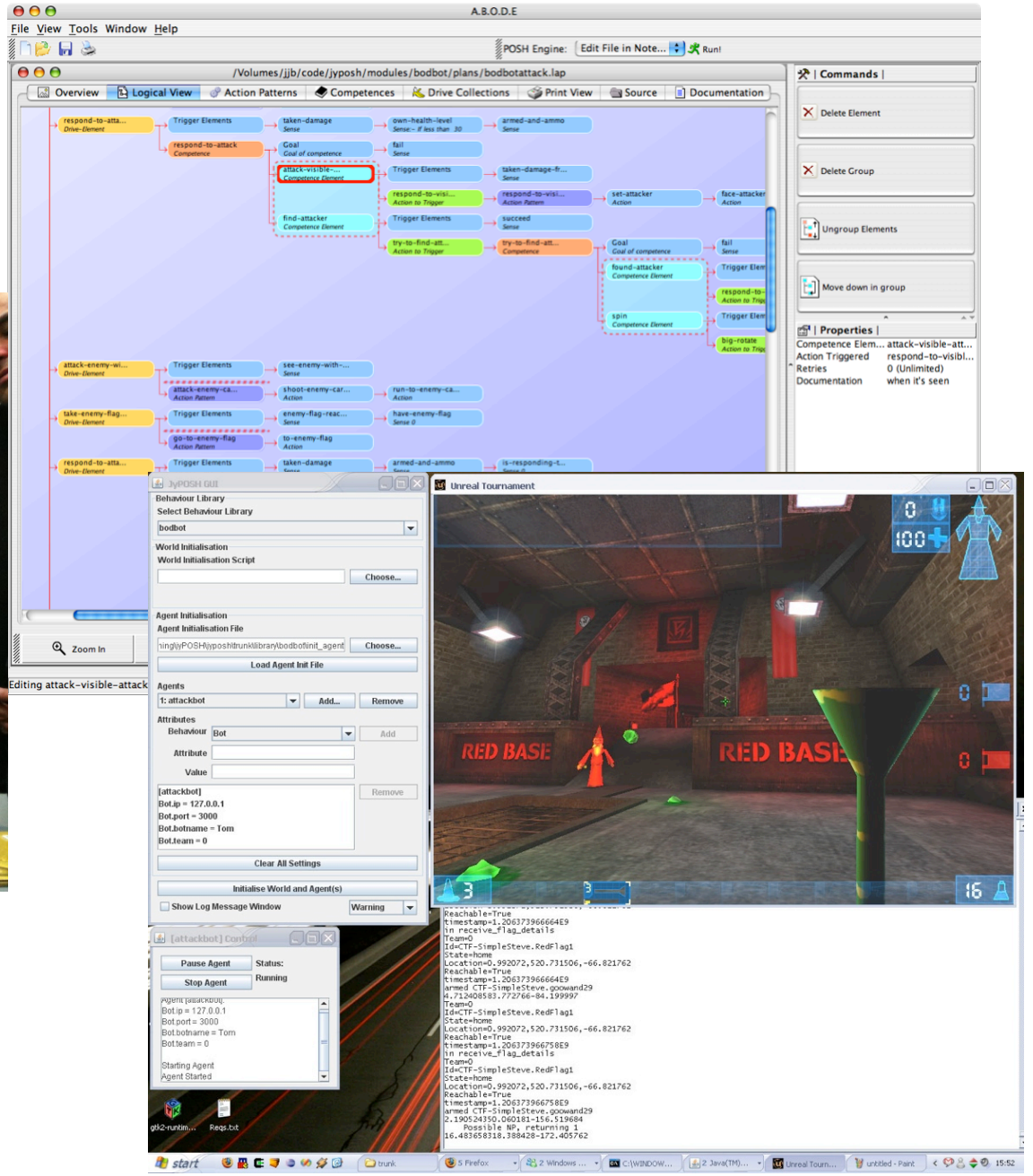


(IVA 2005,
CGames 2006
IEEE SMC 2008)

A POSH plan in ABODE

Advanced BOD Environment



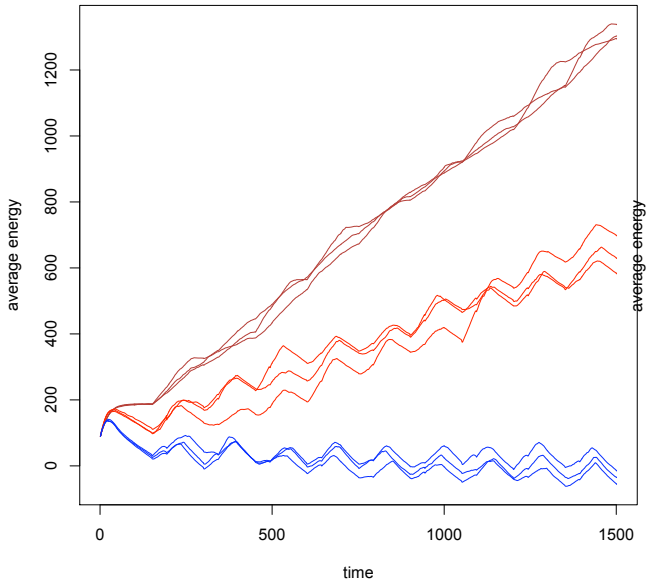


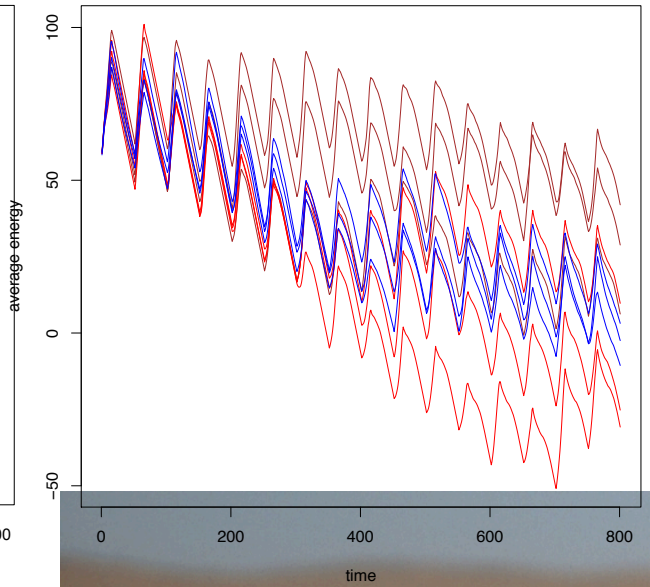
Simulations as Science

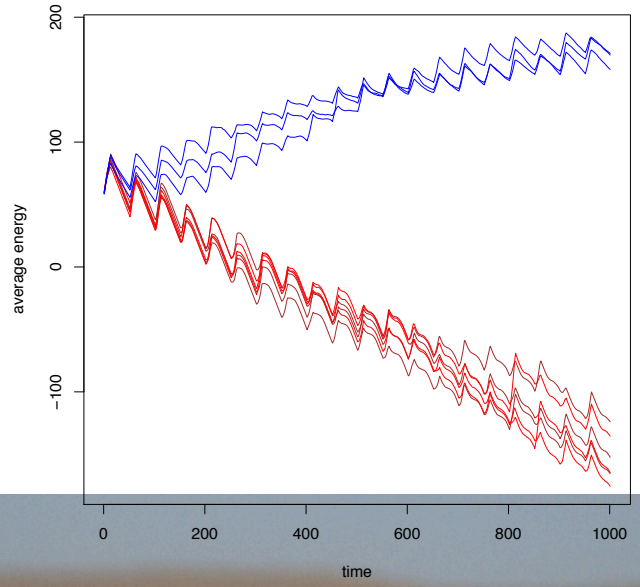
- A simulation is a hypothesis like any other.
  - Thesis / model specified so completely it can be run on a computer.
- Consequences of model assessed by sampling.
  - Model behaviour compared to target system's using standard hypothesis testing.

Joanna J. Bryson, Yasushi Ando and Hagen Lehmann "Agent-based modelling as scientificmethod: a case study analysing primate social behaviour", *Philosophical Transactions of the Royal Society, B — Biology*, **362**(1485):1685–1698, September 2007.

Hypotheses & Validation







individual

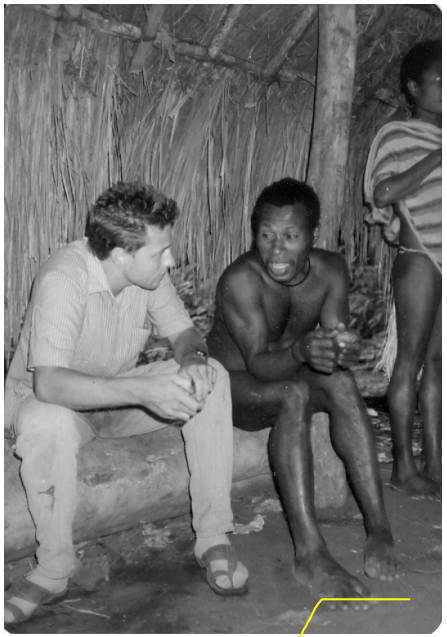
chase runners

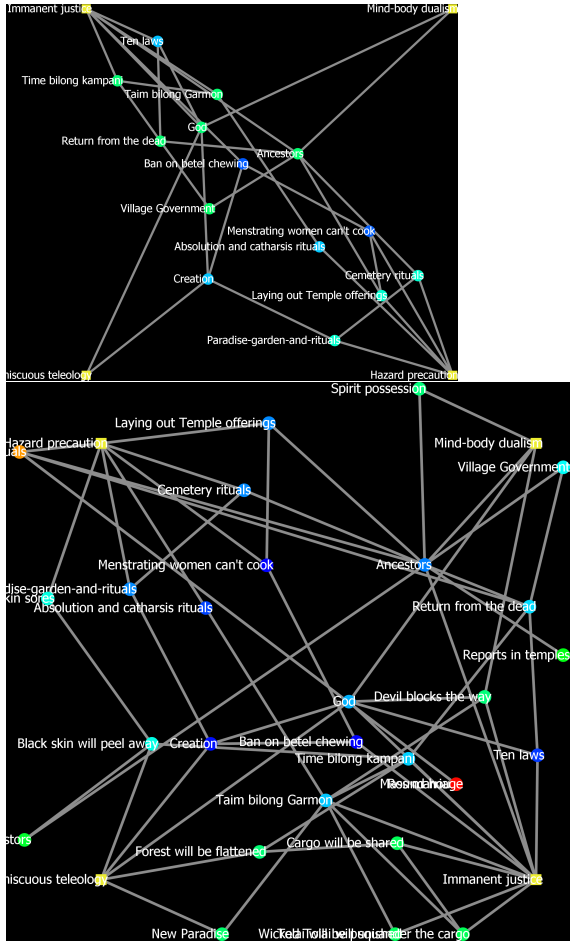
territory + chase

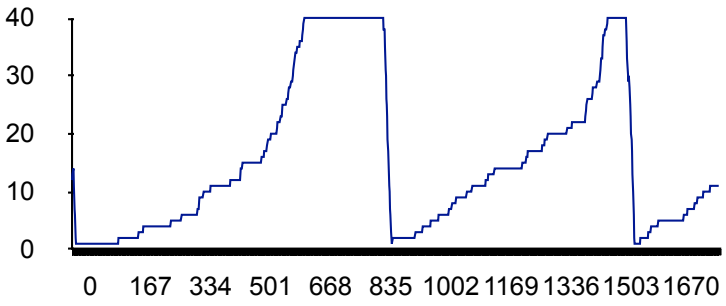
(Bryson, Kaczensky & Grove *in prep*)

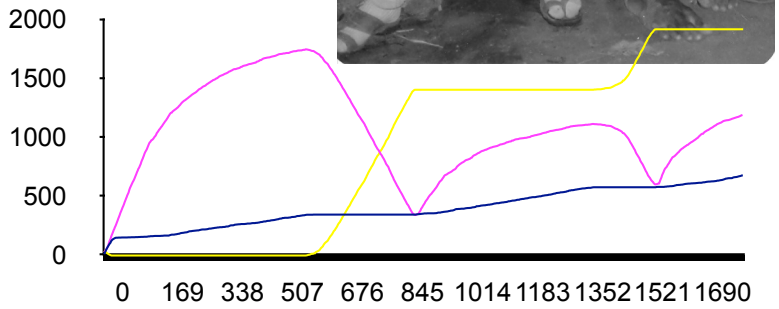
Specification as Theory Building

- Sometimes just the process of building a simulation finds fallacies or incompleteness in a model.









e.g. Whitehouse's Modes Theory of Religiosity (Whitehouse, Khan, Hochberg & Bryson *in review*)

AmonI Current Projects

- Bidan Huang: Robot Learning
- Dominic Mitchell: Public Language
- Marios Richards: Rates of Evolution
- Daniel Taylor: Evolving Culture
- Gideon Gluckman: Social Dynamics
- James Mitchell & Tom Hyde:
  Improving ABODE / BOD
- Karolina Sylwester & Simon Powers
  Variation in Public Goods Investment

Outline

- Introduction
- Methodology: Behavior Oriented Design
- Current Projects
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Proposed projects

1. BOD & ABODE for LEGO Robots.
2. Correlation of implicit semantics and implicit social biases.
3. Amoni Reproducable Research System: new acronym & work on revision control & scientific transparency.
4. Evolutionary tradeoffs for cognition: ageing?
5. Understanding dual replicator systems: Modelling evolution of mobile elements in bacteria.