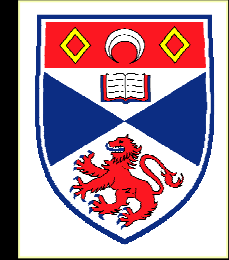


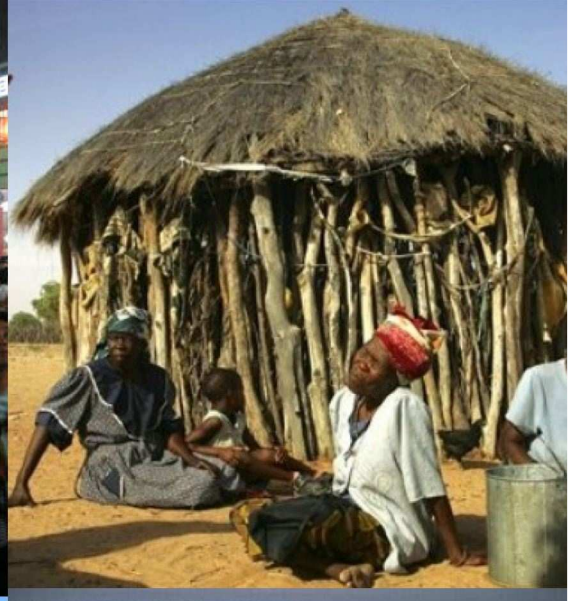
lalandlab.st-andrews.ac.uk



Running the social learning strategies computer tournament on the NGS

Luke Rendell
ler4@st-andrews.ac.uk





Social Learning Strategies

Individuals ought to be selective with respect to when they rely on social learning, and from whom they learn

(Boyd & Richerson, 1985; Rogers, 1988; Giraldeau et al., 2003).

Natural selection ought to have fashioned specific adaptive ***social learning strategies***

(Boyd & Richerson, 1985; Henrich & McElreath 2003; Laland 2004)

home

participants

research program

publications

tournament



cultaptation

dynamics and adaptation in human cumulative culture



a research project sponsored by the European Commission through the Sixth Framework Programme

Social Learning Strategies Tournament

€10,000 prize

Suppose you find yourself in an unfamiliar environment where you don't know how to get food, avoid predators, or travel from A to B. Would you invest time working out what to do on your own, or observe other individuals and copy them? If you copy, who would you copy? The first individual you see? The most common behaviour? Do you always copy, or do so selectively?

What would *you* do?

Tournament outline

- Environment = 'multi-armed bandit', i.e. multiple possible acts
- Payoffs change over time
- 100 individuals
- Evolution through death-birth process with mutation and fitness \sim mean lifetime payoff
- Each round, each individual can INNOVATE, OBSERVE or EXPLOIT

Tournament structure

- Phase 1: *Round-robin*. Pair-wise contests in which strategies take turns at invading the other. Top ten scorers in phase 1 progress.
- Phase 2: *Melee*. All ten strategies compete simultaneously, over a range of simulation conditions. Strategy with highest average frequency wins.

Running the tournament

- 104 entries
- A variety of academic disciplines (Anthropology, Biology, Computer Science, Engineering, Environmental science, Ethology, Interdisciplinary centres, Management, Mathematics, Philosophy, Physics, Primatology, Psychology and Sociology)
- Entries from 16 countries (Belgium, Canada, Czech Republic, Denmark, Finland, France, Japan, Netherlands, Portugal, Spain, Sweden, Switzerland, UK, USA)

Running the tournament

104 entries \rightarrow 5,356 'contests'

$5,356 \times 20 = 107,120$ simulations

Running the tournament

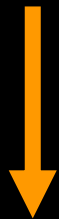
job001 ← *Submit multiple run*** files*



run001 ← *calls pairwiseRun for 5 contests per file*



pairwiseRun ← *shell script, runs a single contest, 20 simulations per contest*



tournament.m ← *matlab / octave code*

Running the tournament

Shell file 'pairwiseRun':

```
#!/usr/local/NGS/octave-3.0.0/bin/octave-3.0.0.real -q
```

```
arglist = argv();
```

```
for r = 1:10
```

```
    [results] = tournament(0.01, 1, 0.05, 1, 50, 1/50, 0, -1, 1, arglist);
```

```
    fn = sprintf(['pairwiseNGS_' strrep(arglist{2},'.m','') '_invades_'  
strrep(arglist{1},'.m','') '%02d.mat'],r);
```

```
    save('-v7',fn,'results');
```

```
    [results] = tournament(0.01, 1, 0.05, 1, 50, 1/50, 0, -1, 1, fliplr(arglist));
```

```
    fn = sprintf(['pairwiseNGS_' strrep(arglist{1},'.m','') '_invades_'  
strrep(arglist{2},'.m','') '%02d.mat'],r);
```

```
    save('-v7',fn,'results');
```

```
end
```

Running the tournament

Shell file 'run001':

```
#!/bin/sh
```

```
LD_LIBRARY_PATH="/lib64:/lib64/tls:/usr/lib64:/usr/local/NGS/HDF5-1.6.6/intel-64/lib:/usr/local/NGS/intel-compilers-9.1/fce/lib:/usr/local/NGS/octave-3.0.0/lib/octave-3.0.0";export LD_LIBRARY_PATH
```

```
./pairwiseRun aHandfulOfSkills.m adaptiveControl.m
```

```
./pairwiseRun aHandfulOfSkills.m adaptolution.m
```

```
./pairwiseRun adaptiveControl.m adaptolution.m
```

```
./pairwiseRun aHandfulOfSkills.m aynRandGambit.m
```

```
./pairwiseRun adaptiveControl.m aynRandGambit.m
```

Running the tournament

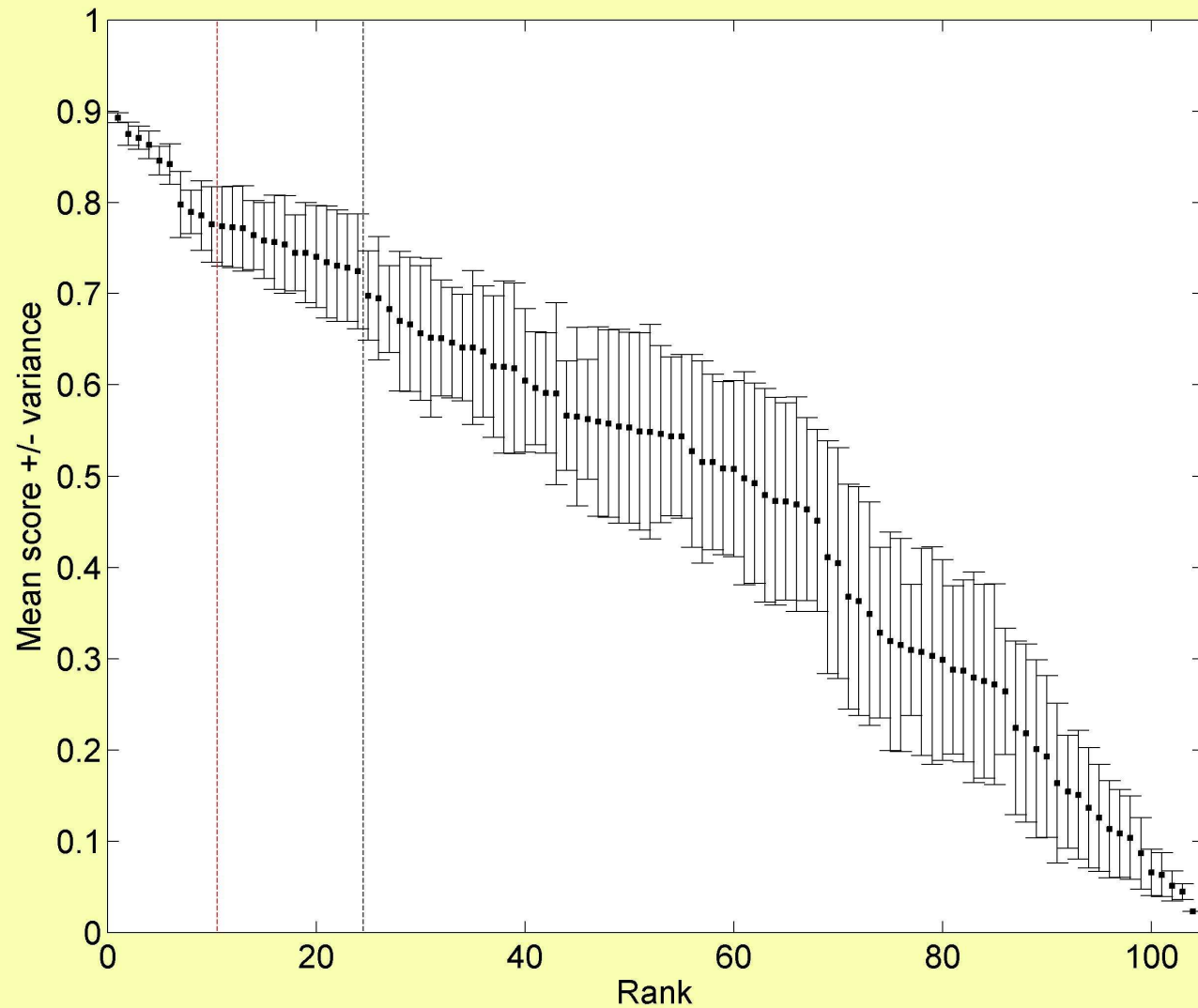
Shell file 'job001':

```
globus-job-submit ngs.leeds.ac.uk/jobmanager-pbs ./run001  
sleep 10  
globus-job-submit ngs.leeds.ac.uk/jobmanager-pbs ./run002  
sleep 10  
globus-job-submit ... etc
```

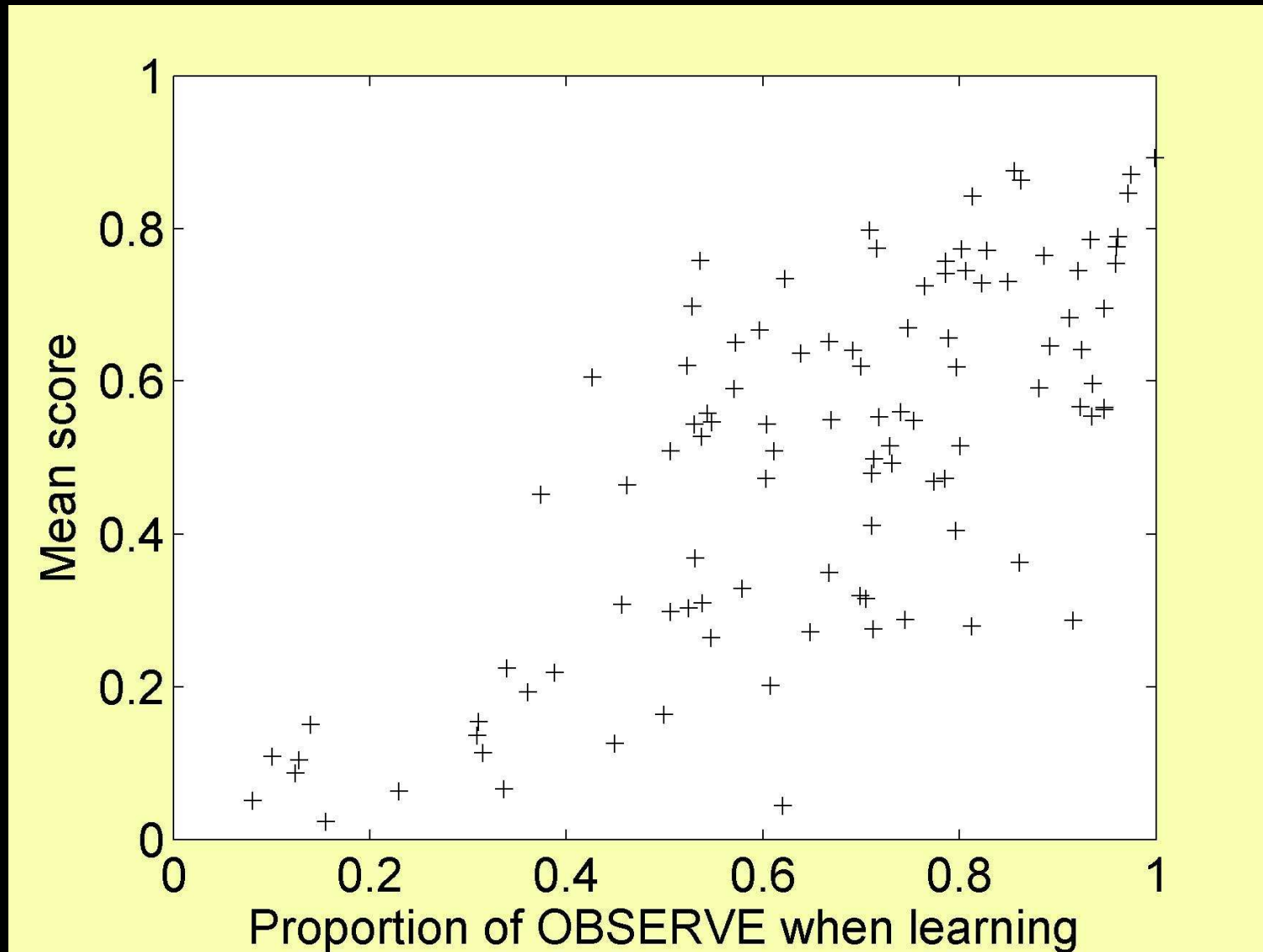
Running the tournament

- Stage 1 took 7.4 years of NGS computer time (~64,500 hrs)

Stage 1 results (single condition)



Copying pays



7 yrs later...

Why Copy Others? Insights from the Social Learning Strategies Tournament

L. Rendell,^{1*} R. Boyd,² D. Cownden,³ M. Enquist,^{4,5} K. Eriksson,^{5,6} M. W. Feldman,⁷ L. Fogarty,¹ S. Ghirlanda,^{5,8} T. Lillicrap,⁹ K. N. Laland^{1*}

208

9 APRIL 2010 | VOL 328 | SCIENCE | www.sciencemag.org

Lessons learned...

I  NGS!

Matlab / Octave – not so much –
my future is Pythonic

How to maximise convenience
for the NGS people?