

# The Village People Meet Lord Ga

Cianan Sims

## 1. Introduction

Can a village of peasant-folk survive under the rule of a genetic algorithm?

We install a learning algorithm, “Lord Ga”, as the leader of villages comprised of families of farmers, crafters and guards. Using tournament selection, mutations and crossover, Lord Ga attempts to evolve an ideal distribution of professions to ensure the longevity of his subjects.

**The goal:** develop an adaptive GA that can produce optimal genomes to:

- Guide villages for hundreds of years
- Enable village survival against catastrophes

## 2. Methods

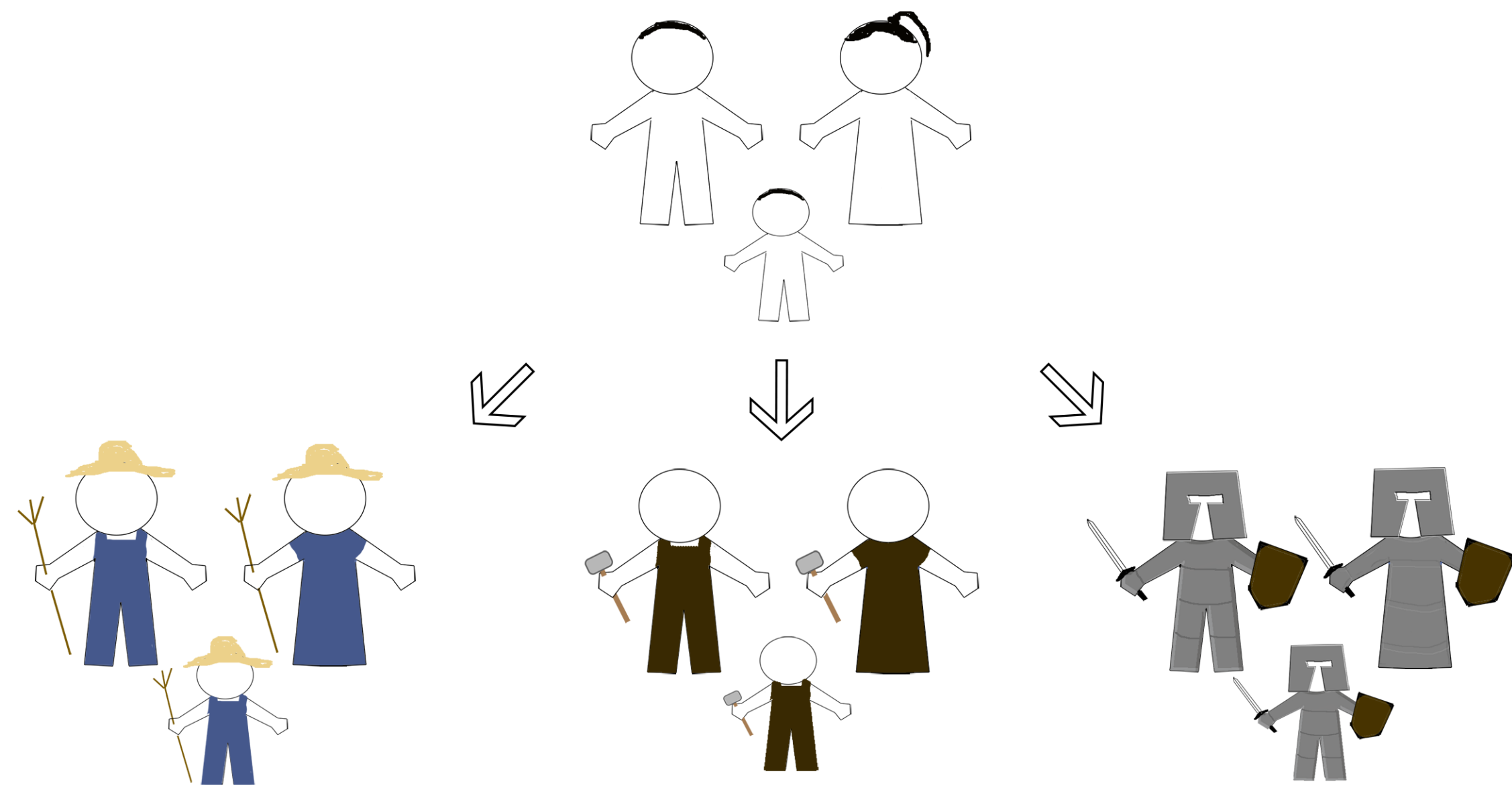
A genetic algorithm was applied to a village simulation. **The GA controls the distribution of professions in the village populace.** It was tuned on the fitness (age) of villages being iterated over. Each trial consisted of 100 generations, each with 30 villages. The max fitness was set to 500.

### A. The Village People simulation

**Villagers** are the atoms of each village. Villagers age, eat, work and have a family. Monthly work output is influenced by age, health and availability of tools.

**Families** are comprised of a mother and father and up to ten children. Family members all share the same profession. Families with both parents have a 20% chance of having a baby each year.

Each village starts with ten married couples, each with one child. New families



### Growing Up

Upon reaching adulthood, villagers start a new family, get married, and are assigned a new profession: farmer, crafter or guard.

**Farmers** create food, which keeps everyone alive.

**Crafters** create supplies to keep productivity high and to build homes.

**Guards** protect against invasions. And eat a lot.

## 3. Methods (cont.)

### B. Lord Ga, the genetic algorithm

The genetic algorithm ruler relies on tournament selection, mutations and crossover to develop long-lasting villages.

Two types of mutation were tested:

**Random row mutation:** replace genome with randomly-generated genome

**Switch mutation:** replace every other profession assignment with a new one, biased toward farmers and crafters.

Simulations were run with and without a genetic algorithm, and with and without catastrophes.

### C. Catastrophes

To test Lord Ga even further, later simulations were subjected to random catastrophes:

**Invasions** destroy food & supplies and “remove” villagers. Guards can lessen the destruction, depending on their number.

**Famine** severely reduces the village food supply.

## 4. Results

### Lord Ga Optimization:

Crossover, elitism always good.

Switch mutation (green) outperforms random row mutation (purple).

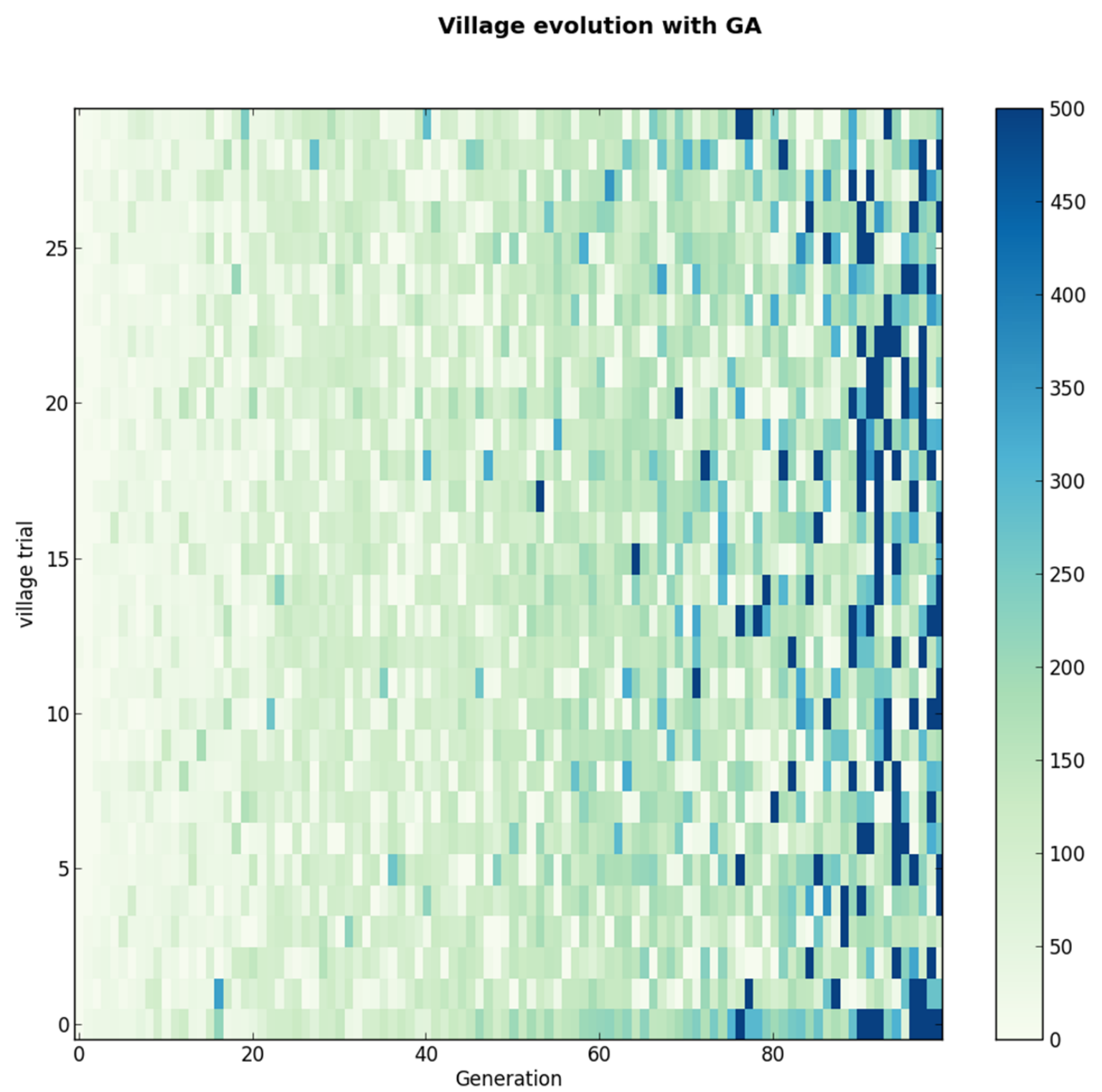
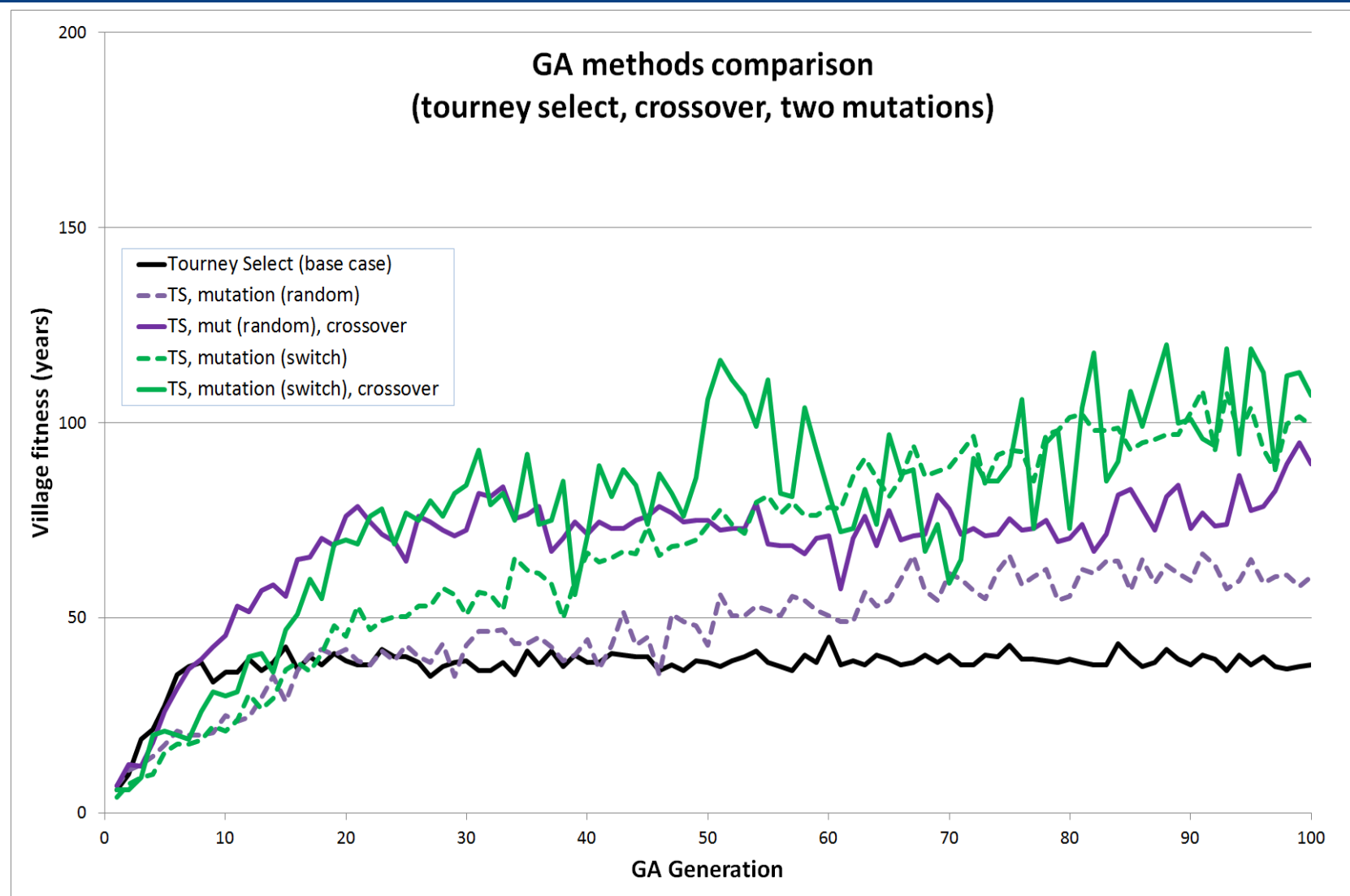
### Applying the GA:

GA with tournament select, switch mutation, crossover and elitism consistently leads villages to > 300 years of prosperity.

### Right Plot:

Individual village performance throughout 100 generations.

Darker colors denote better fitness.



## 5. Results (cont.)

The results show the performance of Lord Ga, as well as the effects of catastrophes on the GA strategy.

### No GA (random professions)

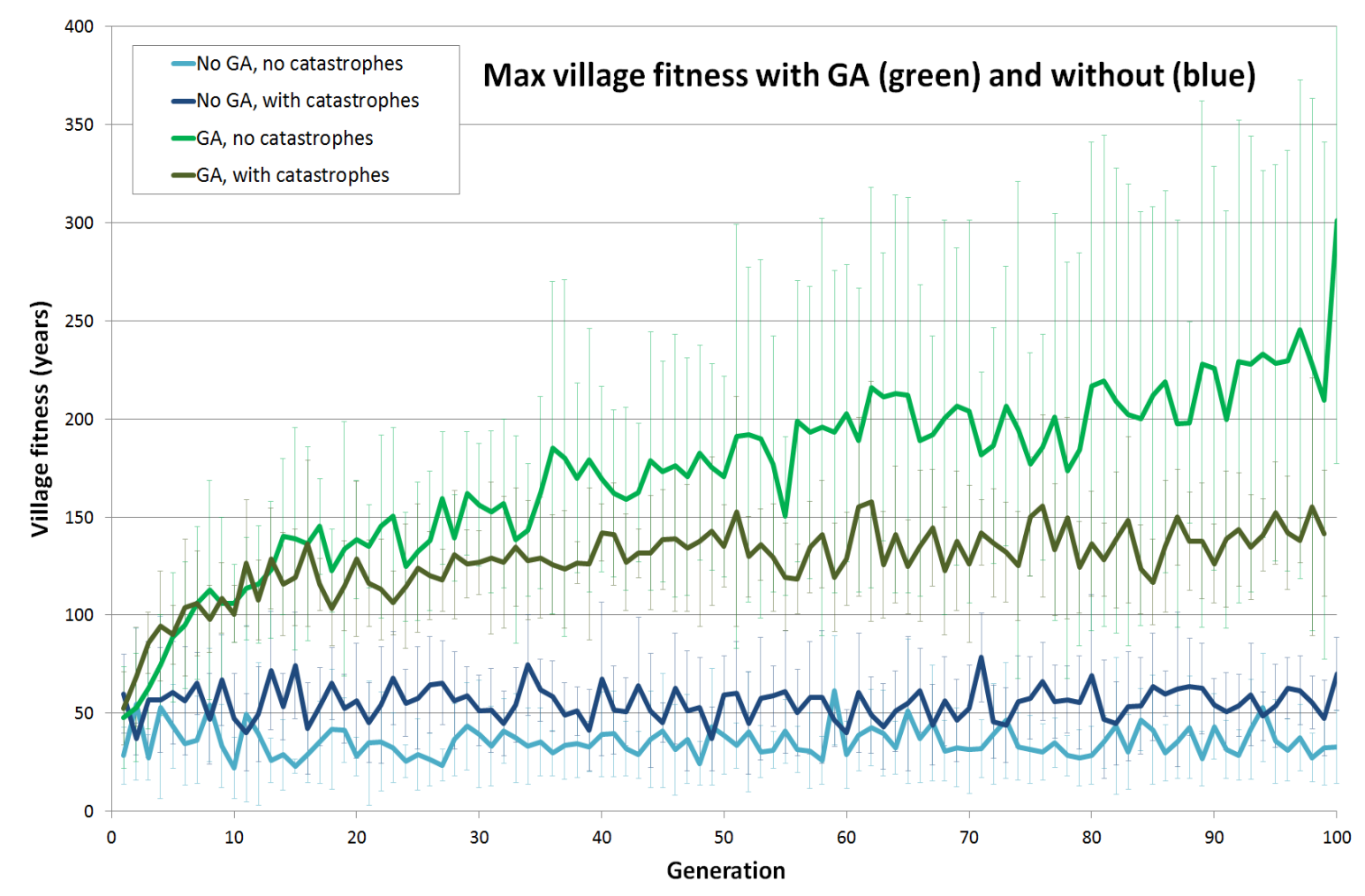
Without catastrophe:  
**8 years** (average), max 60

With catastrophes:  
**4 years** (average), max 40

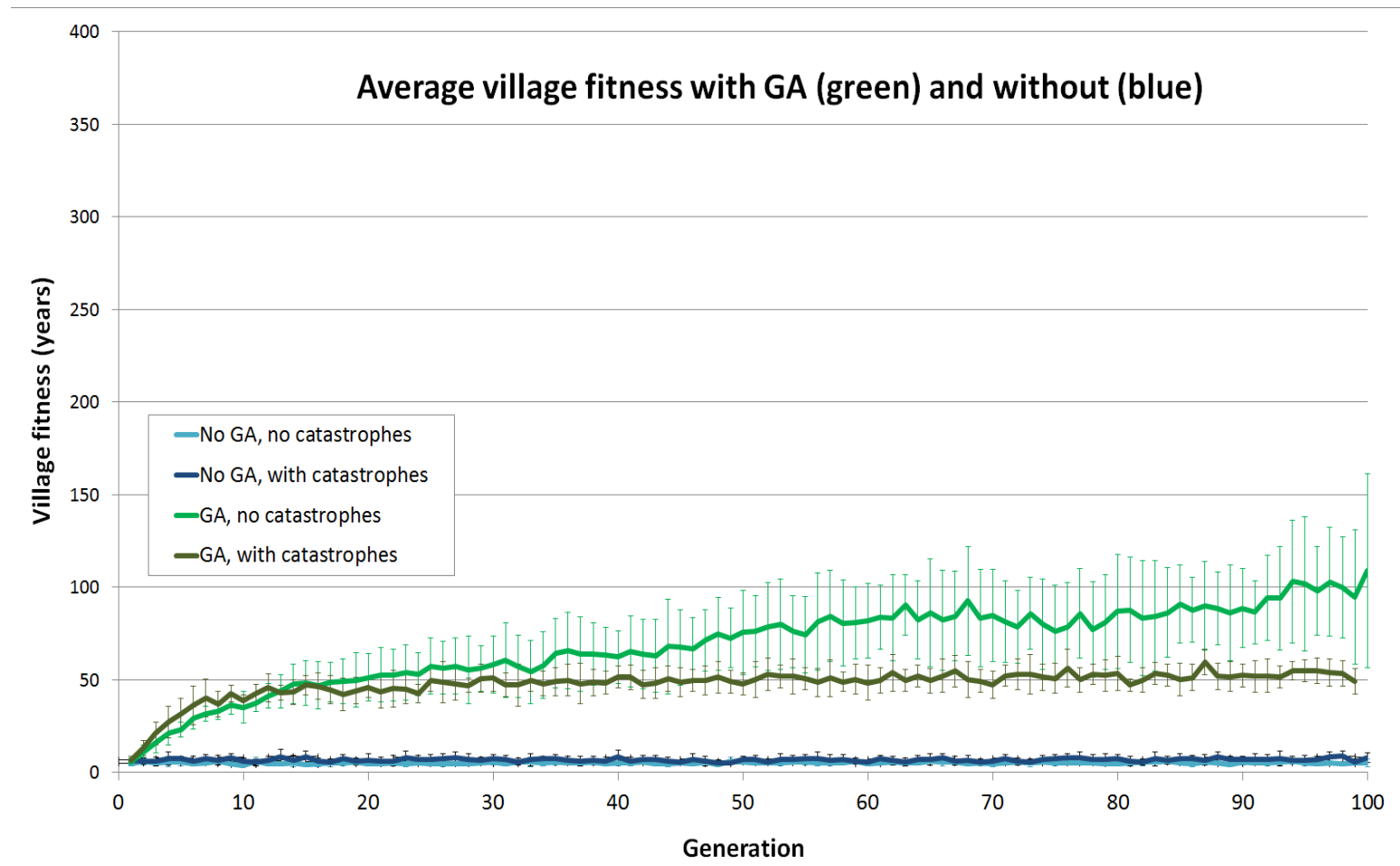
### Lord Ga Performance

Without catastrophes:  
**110 years** (average), max 300  
(*still increasing* at gen 100!)

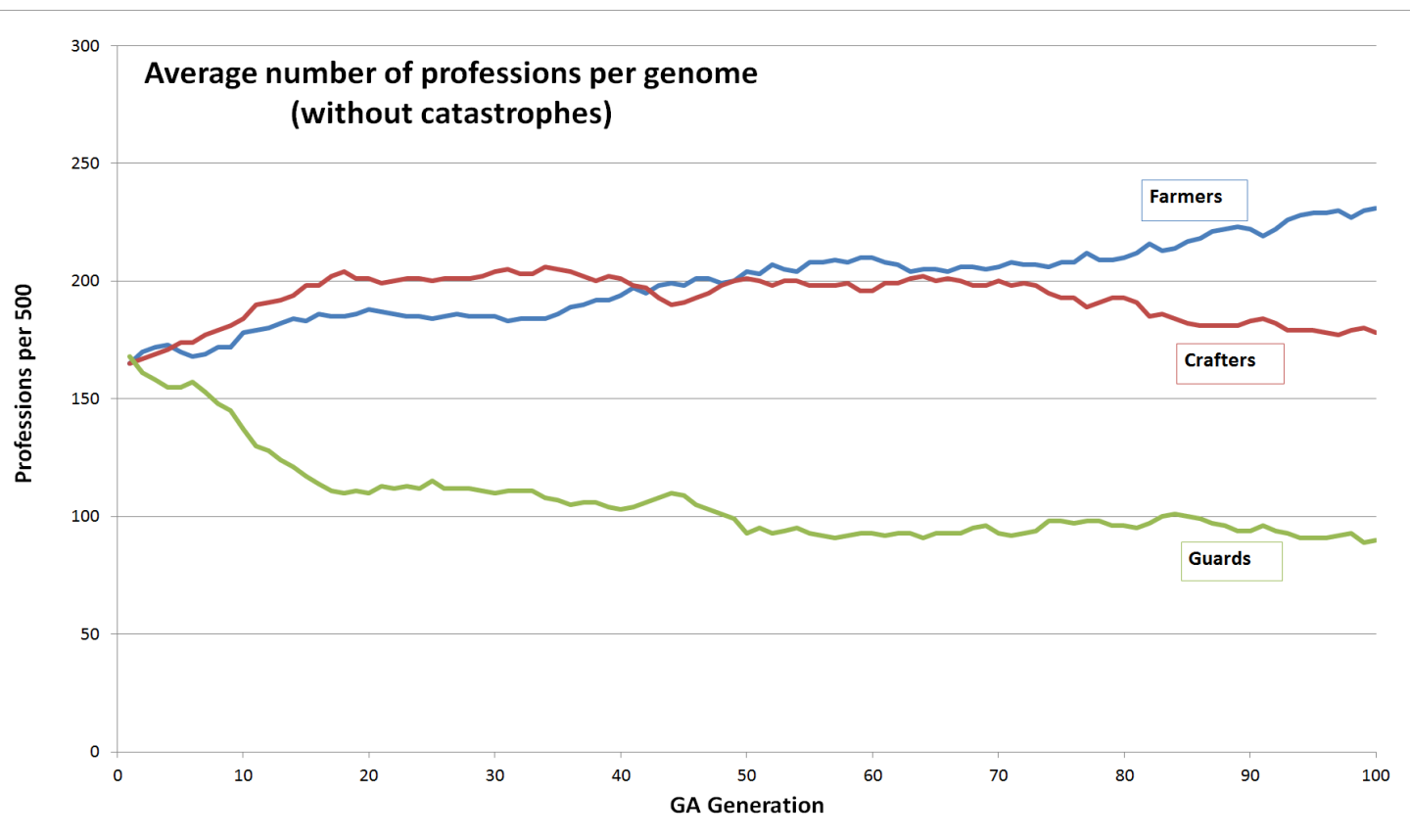
With catastrophes:  
**50 years** (average), max 150



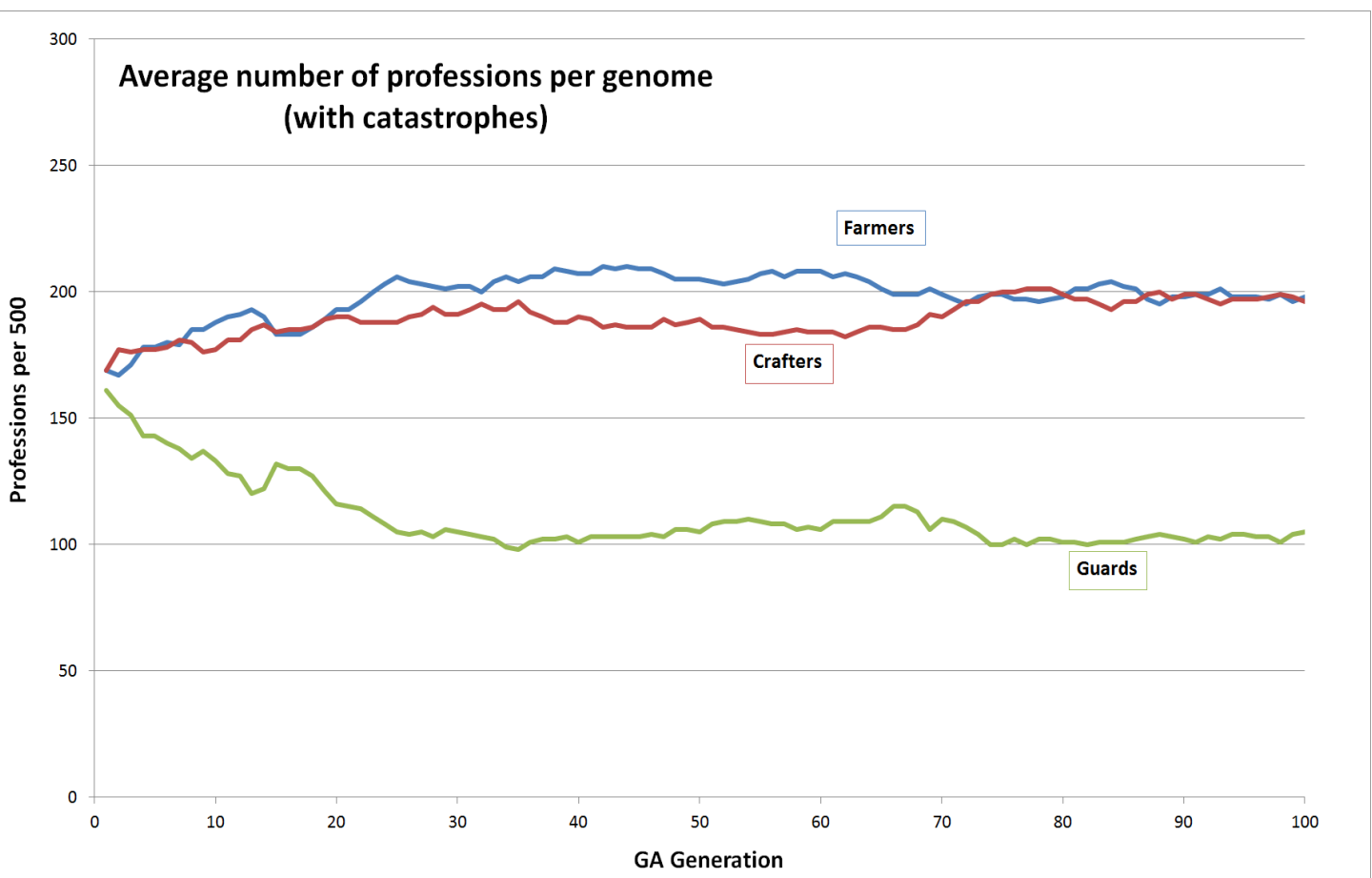
Max village fitness evolving with and without GA



Average village fitness evolving with and without GA



Number of professions per genome (no catastrophes)



Number of professions per genome (with catastrophes)

### Evolving distribution of professions

Farmers, Crafters, Guards

### Without catastrophes:

Farmers > crafters > guards  
Still evolving at gen 100  
(guards are useless)

### With catastrophes:

Farmers, crafters stabilize at 200 per 500 assignments.

Guard stabilizes at 100 per 500

## 6. Conclusions

Lord Ga gets the job done! **Villages last 10x longer with GA**, on average. With no catastrophes, GA performance still increasing after 100 generations.

**Future work:** optimize the simulation (can't run more than 500 years/village). Improve catastrophes, improve village realism.