

The OEE measure - will it blend?

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1 minute about each:

- 1 Motivation
- 2 Design
- 3 Application 1
- 4 Application 2
- 5 Conculutions

Motivation

Explaining the analogy

<https://www.youtube.com/watch?v=5MMmLQ1rBws>



- measuring activity in ALife systems is like blending consumer electronics.
- Yes – you get a comparison, but the comparison isn't telling you what you want to know.
- Need this be the case?
- Is this an area we should be working on?

Reason 1: Finding key events

- In chemical systems, it is sometimes impossible to figure out what's going on.
- Not so in software systems – here the problem is handling 'complete knowledge'
- Particularly so with large-scale simulations
- An EA measure should help us to detect these things

Reason 2: Comparing Designs

- We start from scratch too often in ALife
- We don't compare systems rigorously
- We can't improve systems without measuring them
- All of these arguments require a measure.

Design

Quantitative Non-Neutral EA

- We want a *numeric* measure – not simply graphical
- Based *solely* on population data – which will then be widely applicable
- We don't want to distinguish between intrinsic or extrinsic fitness

Evolutionary Activity measure

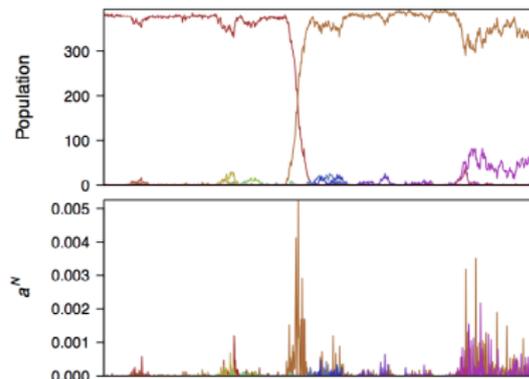
We need to measure the activity of the system. We use the QNN measure, which we've used to analyse mutation rates in *tierra* previously:

The activity of species i at timestep t is:

$$a_t^i = \begin{cases} (p_t^i - e_t^i)^2 & \text{if } e_t^i < p_t^i \\ 0 & \text{otherwise} \end{cases}$$

The total non-neutral activity A_Q of the simulation is the sum of each species activity at each timestep:

$$A_Q = \sum_i \sum_{t=0}^T a_t^i$$

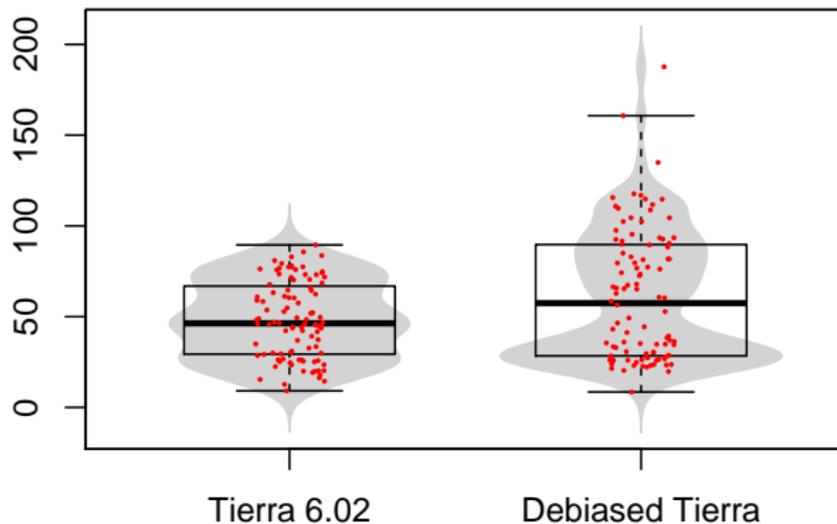


Example I: Tierra

- Tierra is an *emulation* of life – not a *simulation*.
- Biases are features that influence the evolution of the system in ‘unplanned’ ways:
 - **Reaper bias:** ‘double hit’ for ‘correct’ behaviour
 - **Substitution bias:** ‘guided mutation’
 - **Length bias:** ‘tuned mutation’
 - **Zero-address bias:** ‘undocumented niche’

Experiments - headline result

QNN Activity values for 100 trials per two configurations:

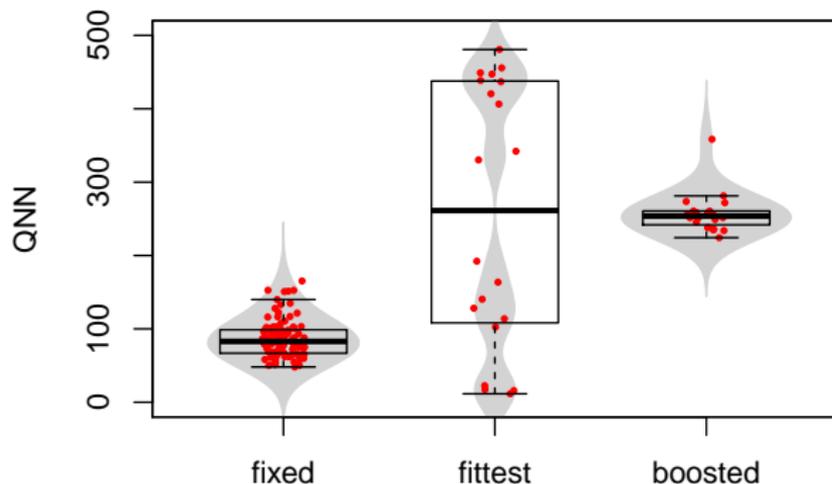


(Note the different scaling of the y-axis)

Example II: Stringmol

Conservation of Matter in AutChems

- Fixed: equal 'concentrations' of each opcode
- Fittest: evolved, variable concentrations of each opcode
- Boosted: As fittest, but with increased concs. of the scarce opcodes



Conclusion

- QNN is a useful measure for comparing systems and improving designs
- Useful for finding examples of ‘activity’ in large datasets
- Should not be used in isolation – we need more measures – OEE is multi-objective
- The potential to be used as a ‘meta-evolver’ for OEE

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