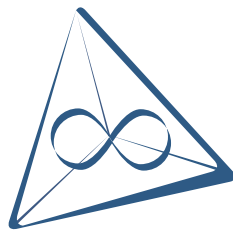# An Introduction to Evolutionary Dynamic

By

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A short course introducing the theory of Evolutionary dynamic for junior researchers at the Max Planck Institute for Mathematics in the natural Sciences

Pre-requirements

- Basic statistic and probability

- Basic Markov process

- Basic differential geometry.

Goals and non-goals

GOALS	NON-GOALS
Evolution as dynamic	Evolution as history
Reduction to principle	Explanation of patterns
Intuition	Rigor
Collaboration with some of you	Showing off

Contents

1. Selection

- Naive samply vs. evolution

- Notion of fitness

- Dynamics of fitness distributions:

  1. Cumutants and GF
  2. Asymptotic
  3. Universality
  4. Comparison with EVT

1.1 Naive sampling

n components, each with probability p,

$$Prob(success) = p^n$$

For $p = \frac{1}{2}$ and $n = 100$, $2^{-100} = 8 \cdot 10^{-31}$ $(1kg/mass)$
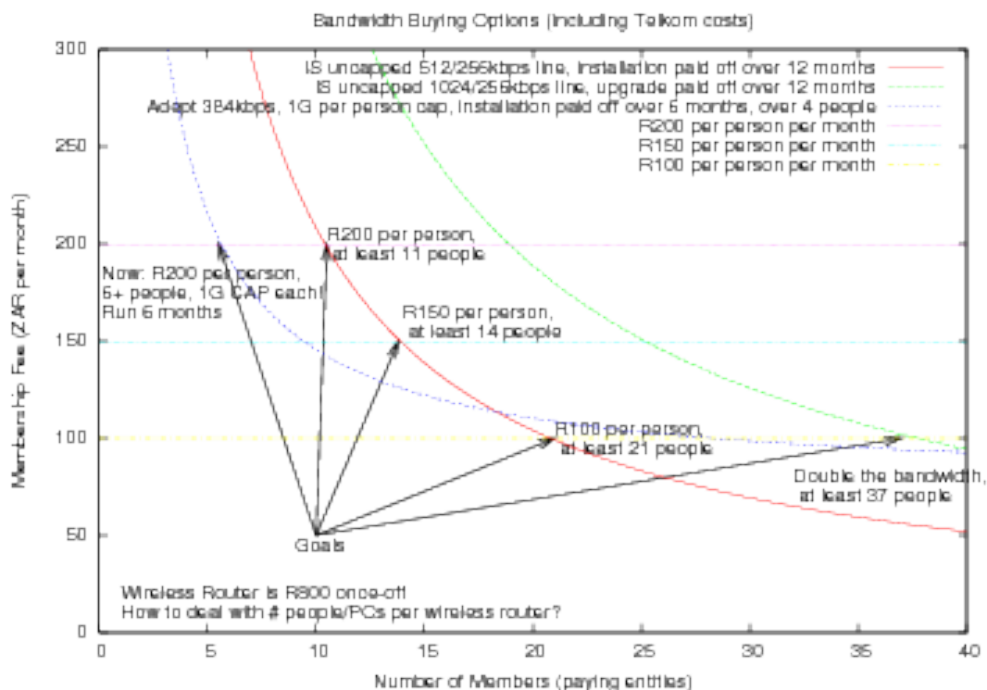
Figure 1.1: Planning community bandwidth sharing costs. Note caption capitalization.

Remember how to include code with `verbatim` and to fix the tabs in python in a verbatim environment? It may be best to have an 'include' command for code, not to have to re-edit it all the time.

```
# This program prints hello

import Scipy as S

if __name__ == "__main__":
        print "hello"
```

1.2 Selection: exponential amplification of rare events

2. Mutation

2.1 Global models, Local models

Algorithm 1: How to write algorithms

Data: this text
Result: how to write algorithm with LaTeX2e
1 initialization;
2 **while** *not at end of this document* **do**
3   read current;
4   **if** *understand* **then**
5   go to next section;
6   current section becomes this one;
7   **else**
8   go back to the beginning of current section;
9   **end**
10 **end**

2.2 Error thresholds

Algorithm 2: Division Algorithm

Input : $f_1, f_2, f_3...f_s$ and $<$
Output: $q_1, q_2, q_3...q_s$
1 initialization $q_1 = q_2 = q_3 = ... = q_s = 0$;
2 **while** $v \neq 0$ **do**
3     $i = 1$;
4   **while** $i \leq 8$ **do**
5   **if** $Lt(f_i/Lt(v))$ **then**
6             $q_i = q_1 + \frac{Lt(v)}{Lt(f_i)}$;
7             $v = v - \frac{Lt(v)}{Lt(f_i)}f_i$;
8   **else**
9             $i = i + 1$;
10   **end**
11   **end**
12     $h = h + Lt(v)$;
13     $v = v - Lt(v)$;
14 **end**
---

3. Neutrality

Theorems before the chapter's first section will be dot-zero, and their numbering is completely wrong. You can avoid this by simply always starting a chapter with a section. Ta Da! It will probably help you structure your essay anyway.

3.0.1 Theorem (My Theorem2). *This is my theorem2.*

Proof. And it has no proof2. □

3.1 Neutral evolution as SRW

Text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text.

3.1.1 Theorem (My Theorem2). *This is my theorem2.*

Proof. And it has no proof2. □

Text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text.

$$x = y + y \tag{3.1.1}$$
$$= 2y \tag{3.1.2}$$

see equations (3.1.1) and 3.1.2

3.2 Neutral evolution as MERW

Here's a conjecture

3.2.1 Conjecture. The washing operation has fixed points.

and here's an example

3.2.2 Example. 5 Rand coin.

4. Prediction

An average essay may contain five chapters, but I didn't plan my work properly and then ran out of time. I spent too much time positioning my figures and worrying about my preferred typographic style, rather than just using what was provided. I wasted days bolding section headings and using double slash line endings, and had to remove them all again. I spent sleepless nights configuring manually numbered lists to use the LaTeX environments because I didn't use them from the start or understand how to search and replace easily with texmaker.

Everyone has to take some shortcuts at some point to meet deadlines. Time did not allow to test model B as well. So I'll skip right ahead and put that under my Future Work section.

4.1 Effective potential: dare and dressed suggestions

Text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text.

Some essays may have 3, 5 or 6 chapters. This is just an example. More importantly, do you have at most 35 pages? Luck has nothing to do with it. Use the techniques suggested for writing your essay.

Now you're demonstrating pure talent and newly acquired skills. Perhaps some persistence. Definitely some inspiration. What was that about perspiration? Some team work helps, so every now and then why not browse your friends' essays and provide some constructive feedback?

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