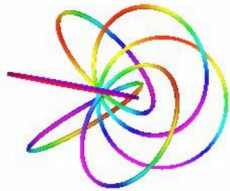
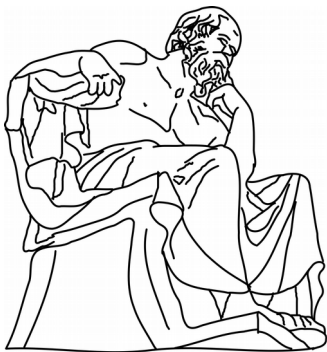


OPTIMAL DISTRIBUTION OF INCOME FOUND BY EVOLUTIONARY COMPUTATION

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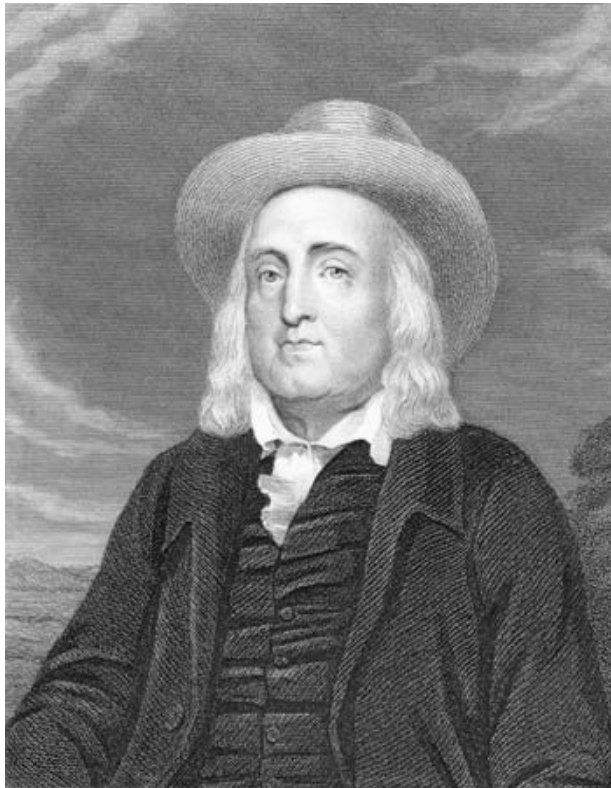
Non-profit science organization



Motivation

Goal of society as a whole according to **Utilitarianism** of Jeremy Bentham (1748-1832) and John Stuart Mill (1806-1873):

"The greatest good for the greatest number"

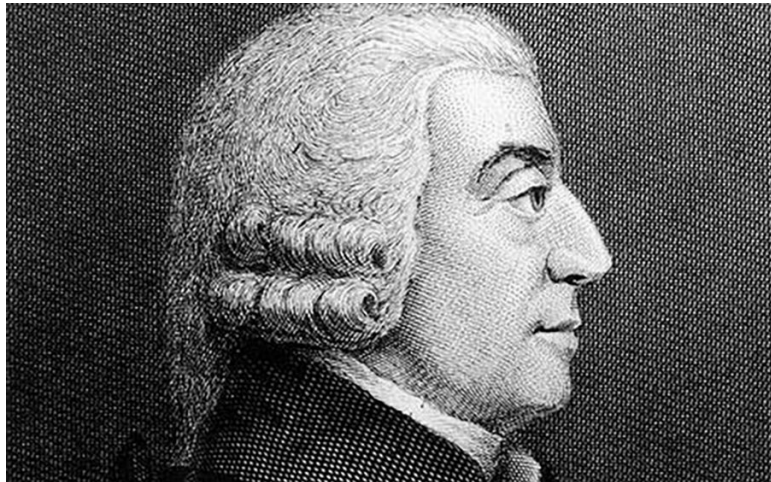


Reality

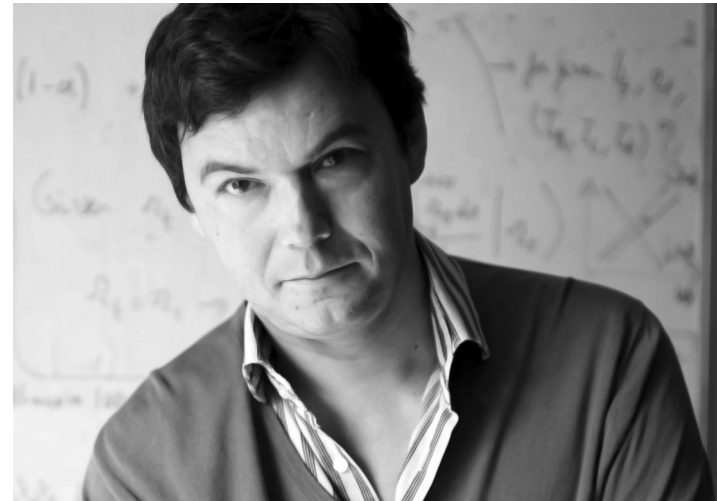
The greatest **total** good. Total production W will be maximized

Capitalism:

The **capital**, in control of the **decisions** in production, will want to **maximize total production** since the profit is empirically always 5% of production (Thomas Piketty); increasing production will increase profit.



Adam Smith

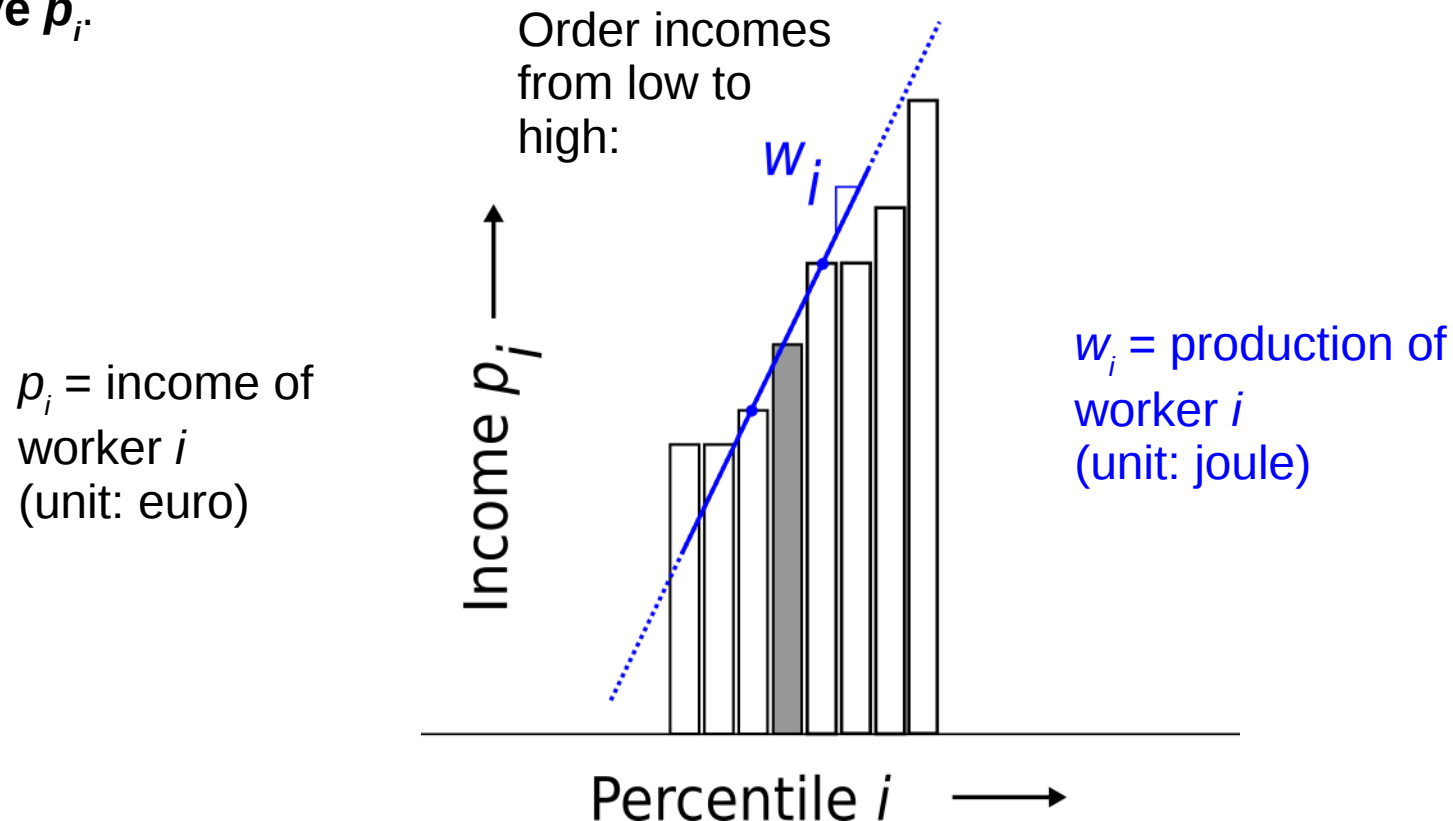


Thomas Piketty

Axiom

A worker will be incentivated to work if he sees it pays off. When his neighbor below him earns less and above him earns more he will work harder and produce more.

The **productivity** of the worker i is **proportional to this 'derivative' in the income curve p_i** .



Note:

a worker's salary is not assumed necessarily proportional to his productivity, because nobody cares about 'justice' of salary ...

Method

Evolutionary computation / molecular dynamics:

We start with any distribution (p_i), sort it, and calculate the production of the workers (w_i) and the total production $W = \sum w_i$

We make a random tiny change in the distribution p_i and sort it. Calculate W and if it is bigger, we keep this distribution (because the capital likes it)

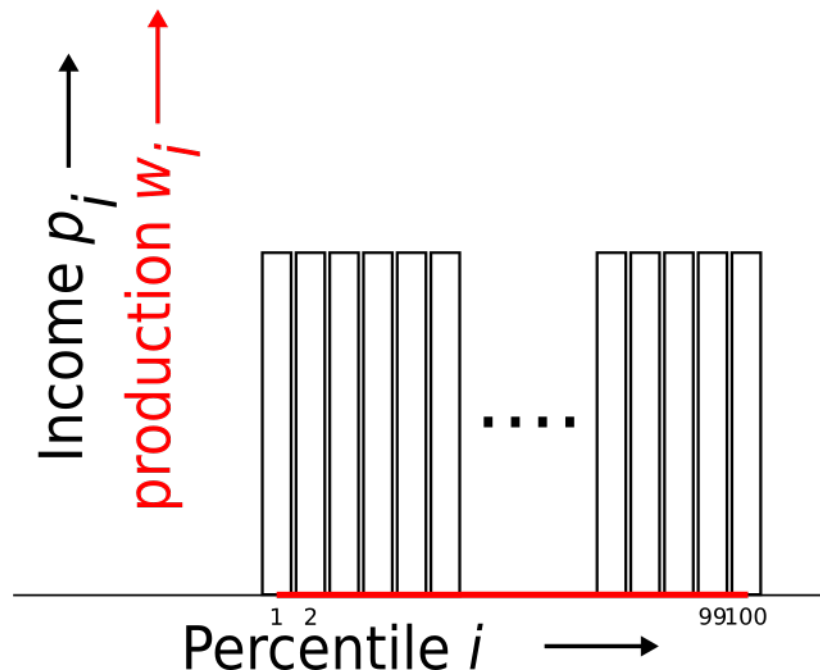
Repeat until it stabilizes

'Communism'

If we start with a 'communist' income distribution of 100 people, $p_i = 1$ (euro) for all i , the derivative is 0 and nobody works, $w_i = 0$ (joule) for all i and $W = \sum w_i = 0$ (joule)

Total income: $P = \sum p_i = 100$ €. Everybody gets a salary of 1 €, nothing is produced and the wealth (buying power) of people is zero

To buy 1 joule of goods, a worker needs $\sum p_i / \sum w_i = P/W = \infty$ euro on the free market



$W = 0$ joule

$P = 100$ euro

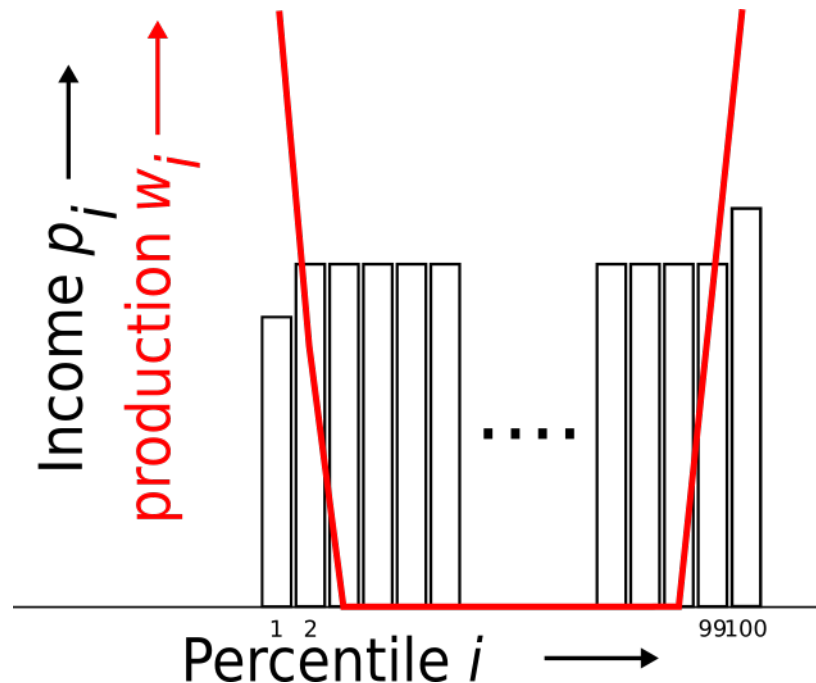
Prices: ∞ €/J

Median income: $c_{50} = 1$ € = 0 J

Redistribution

We take away 1% of the salary of 1 person and give it to another

People start working:



$$w_1 = p_2 - p_1 = 1 - 0.99 = 0.01 \text{ J}$$

$$w_2 = (p_3 - p_1)/2 = 0.005 \text{ J}$$

$$w_{99} = (p_{100} - p_{98})/2 = 0.005 \text{ J}$$

$$w_{100} = p_{100} - p_{99} = 0.01 \text{ J}$$

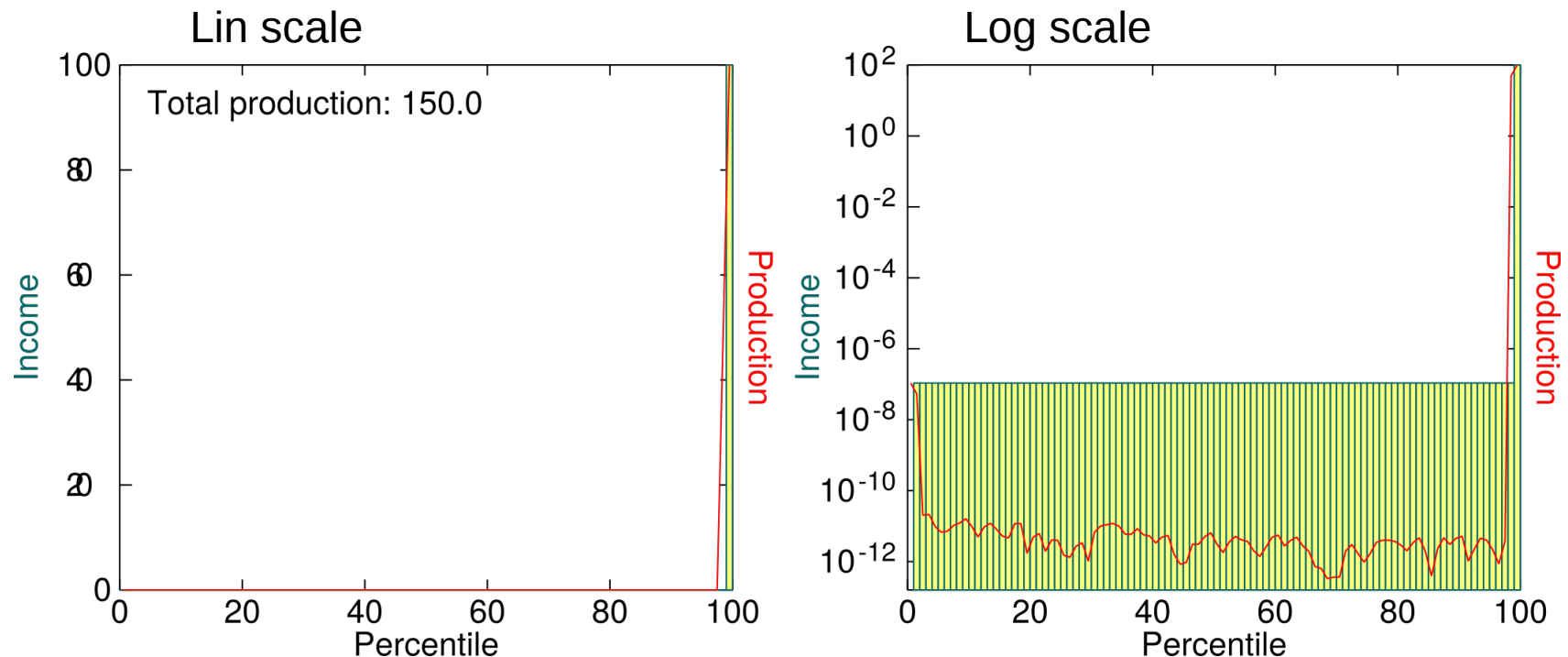
$$W = 0.03 \text{ J}$$

$$P = 100 \text{ €}$$

$$\text{Prices: } 3333 \text{ €/joule}$$

$$\text{Median income } c_{50} = 1 \text{ €} = 0.3 \text{ mJ}$$

Final distribution



$$\begin{aligned}
 p_1 &= 0 \text{ €}, w_1 = 5 \times 10^{-7} \text{ J} \\
 p_{50} &= 1.08 \times 10^{-7} \text{ €}, w_{50} < 5 \times 10^{-11} \text{ J} \\
 p_{99} &= 1.08 \times 10^{-7} \text{ €}, w_{99} = 49.999989 \text{ J} \\
 p_{100} &= 99.999989 \text{ €}, w_{100} = 99.999989 \text{ J}
 \end{aligned}$$

$W = 150 \text{ J}$
 $P = 100 \text{ €}$
 Prices: 0.67 €/J (lower)
 Average income: $1 \text{ €} = 1.5 \text{ J}$
 Median income: $c_{50} = 1.08 \times 10^{-7} \text{ €} = 1.6 \times 10^{-5} \text{ J}$ (less)
 'Top management': $c_{100} = 150 \text{ J}$
 'Middle management': $c_{99} = c_{50} = 1.08 \times 10^{-7} \text{ €} = 1.6 \times 10^{-5} \text{ J}$

Conclusions

Simple model: production proportional to derivative in income curve

Result:

- 1% (poor guys) works a little, gets nothing
- **Most do absolutely nothing, get crumbs**
- A couple of people at the top work a little. The top works hard.
- All income goes to the top 1%

