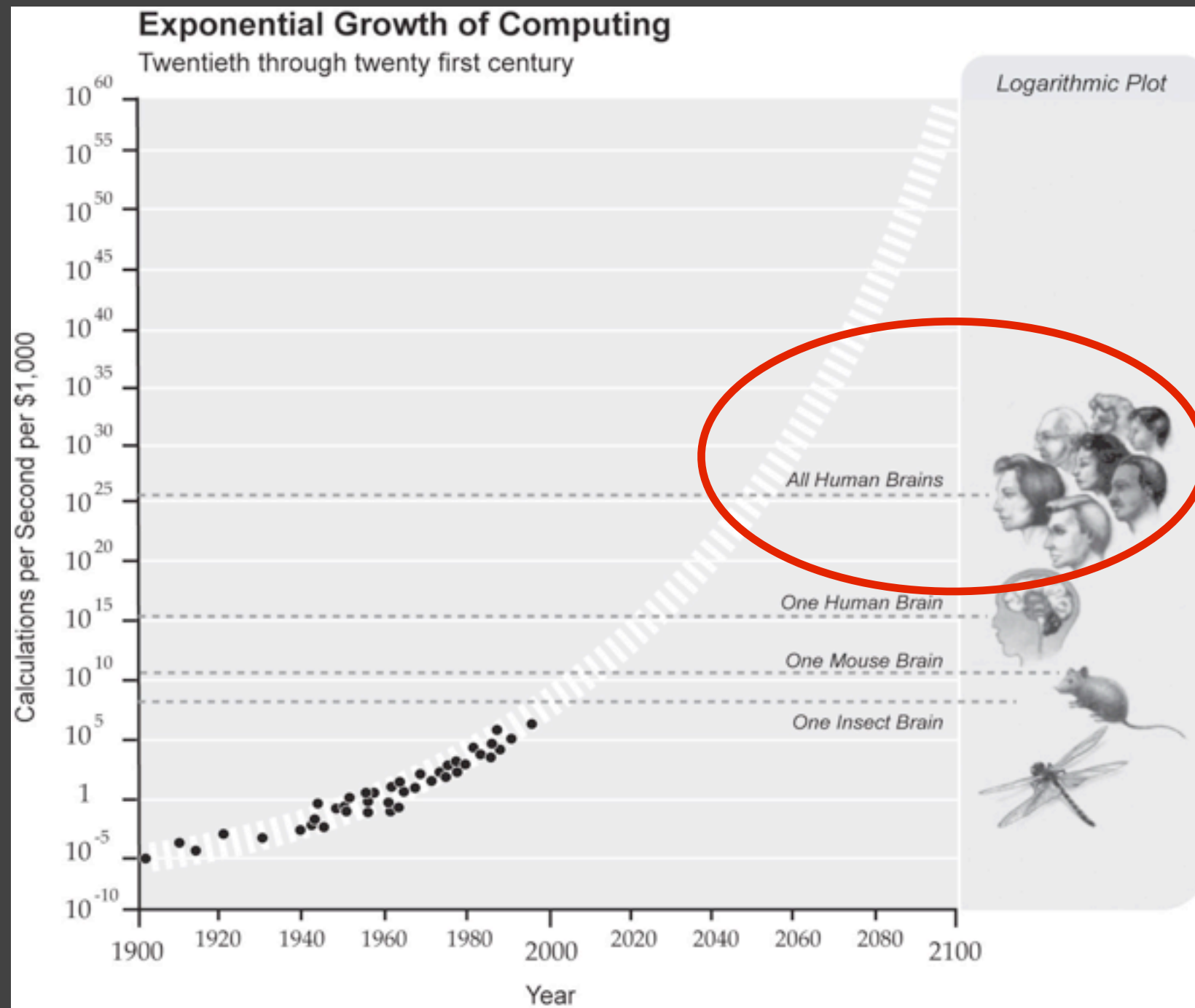


Collective Action, Incentives, and Performance Evaluation

Course 1

Open Collaboration and Peer Production
(i290m)

Will computer power outpass human intelligence ?



Ray Kurzweil

Computing vs Human Brain Power ?

[...] performance gains due to improvements in algorithms have vastly exceeded even the dramatic performance gains due to increased processor speed.



[...] An expert in optimization, observes that a benchmark production planning model solved using linear programming would have taken 82 years to solve in 1988, using the computers and the linear programming algorithms of the day. Fifteen years later – in 2003 – this same model could be solved in roughly 1 minute, an improvement by a factor of roughly 43 million. ***Of this, a factor of roughly 1,000 was due to increased processor speed, whereas a factor of roughly 43,000 was due to improvements in algorithms!*** Grötschel also cites an algorithmic improvement of roughly 30,000 for mixed integer programming between 1991 and 2008.

source : Designing a Digital Future, *Report to the President and the U.S. Congress* (2010).

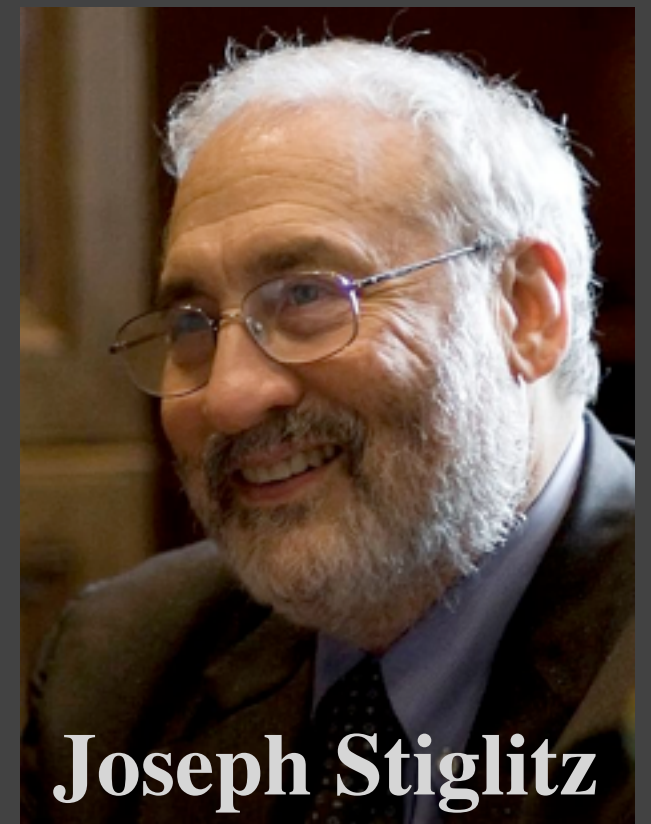
Competition : Technology vs. Labor

Technologies put pressure
on labor wages
(*Cause*)

Wages go down
(*1st order consequence*)

Socio-economic crises
(*“Side” Consequence*)

Low wages help entering a new industrial era
(*2nd order consequence*)



Joseph Stiglitz



640k users

1.9m questions

4.2m answers

6.9m comments

92% questions get answered

median time to response : 11 minutes

Hanrahan, Benjamin V., Gregorio Convertino, and Les Nelson.

"Modeling problem difficulty and expertise in stackoverflow."

Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work Companion. ACM, 2012.

THE PENGUIN AND THE LEVIATHAN



THE TRIUMPH OF COOPERATION
OVER SELF-INTEREST

YOCHAI BENKLER

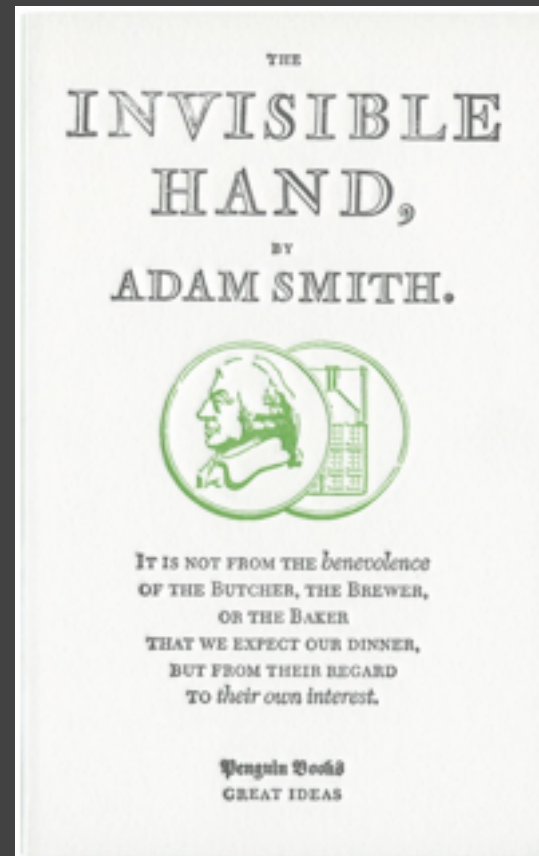


Yochai Benkler

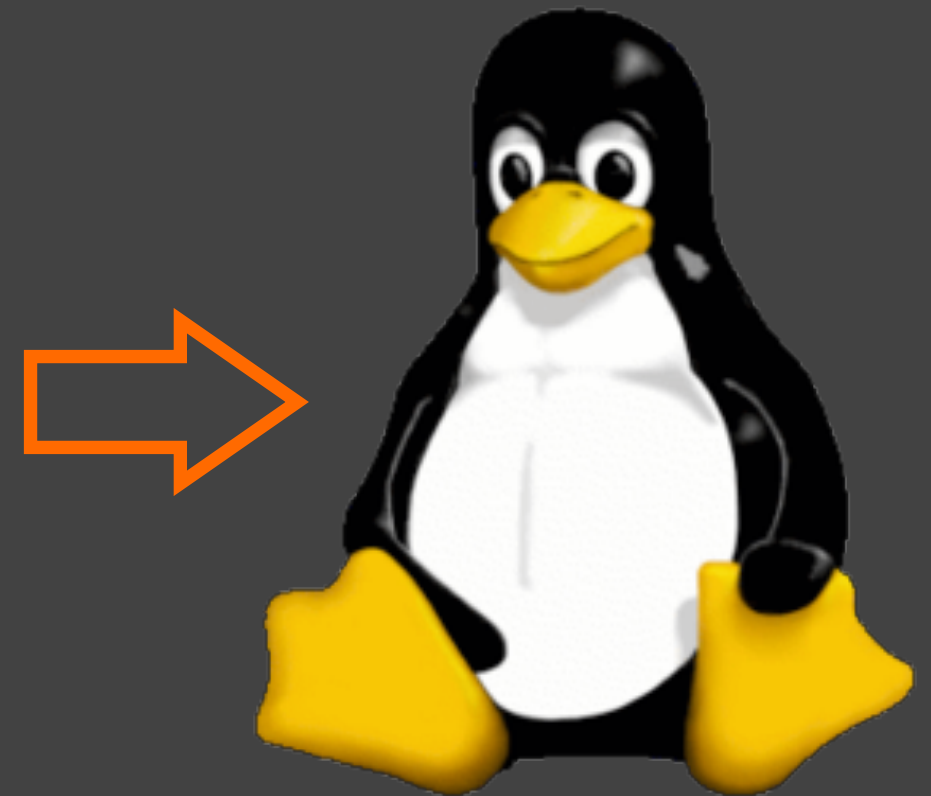
The Triumph of Cooperation over Self-Interest



Leviathan
(*absolute order*)



Invisible Hand
(*self-regulation*)



Penguin
(*peer-production*)

The Triumph of Cooperation over Self-Interest

Selfishness and cooperation in Nature

(*The Selfish Gene*, Richard Dawkins, ch. 2)

Selfishness and cooperation in Society

(“*Pay forward*”, Benjamin Franklin, ch. 2)

Social contagion & imitation

(*herding, memes*, ch. 3)

Social norms vs economic norms

(*Day nursery*)

The Triumph of Cooperation over Self-Interest

“Cheap talks” are not not important
(*Numerous experiments in economics, ch. 5*)

Moral and norms in cooperation
(*Institutions, ch. 7*)

Motives go beyond earning money
(*Intrinsic motivation, ch. 8*)

Business of cooperation
(*NUMMI Factory, ch. 9*)

Coase's penguin, or, linux and “the nature of the firm”



Ronald Coase

Market
versus
Firm

1937

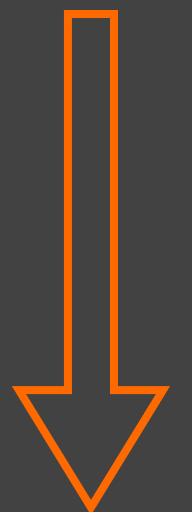
Transformative innovation : Internet (*many-to-many*)



Yochai Benkler

Peer
Production

2002



Benkler, Y. Coase's penguin, or, linux and "the nature of the firm". *The Yale Law Journal* 112, 369+ (2002).

Peer Production

bottom-up organization

(*task self-selection, self-censorship*)

peer-review

(“*praise*” *delivery* \Rightarrow *gift-giving*)

non monetary transactions

(“*archaic*” *social organizations*)

Collective Action : Governing the Commons



Harsh environments
(*e.g. high mountains, deserts*)

Scarce resources
(*e.g. arable land, water, food*)



High uncertainty & hazard rate
(*e.g. climate sensitivity, economic instabilities*)



⇒ Give up (some) private property & share
⇒ Create institutions to manage the commons
(*i.e. avoid the Tragedy of the Commons*)

Ostrom, E. *Governing the Commons: The Evolution of Institutions for Collective Action*
(*Political Economy of Institutions and Decisions*)
(Cambridge University Press, 1990).

“the whole is more than the sum of its parts”
Aristotle.

The Collapse of Financial Markets

(2008)

Alan Greenspan

“ Those of us who have looked to the self-interest of lending institutions to protect shareholder’s equity (myself especially) are in a state of disbelief ”

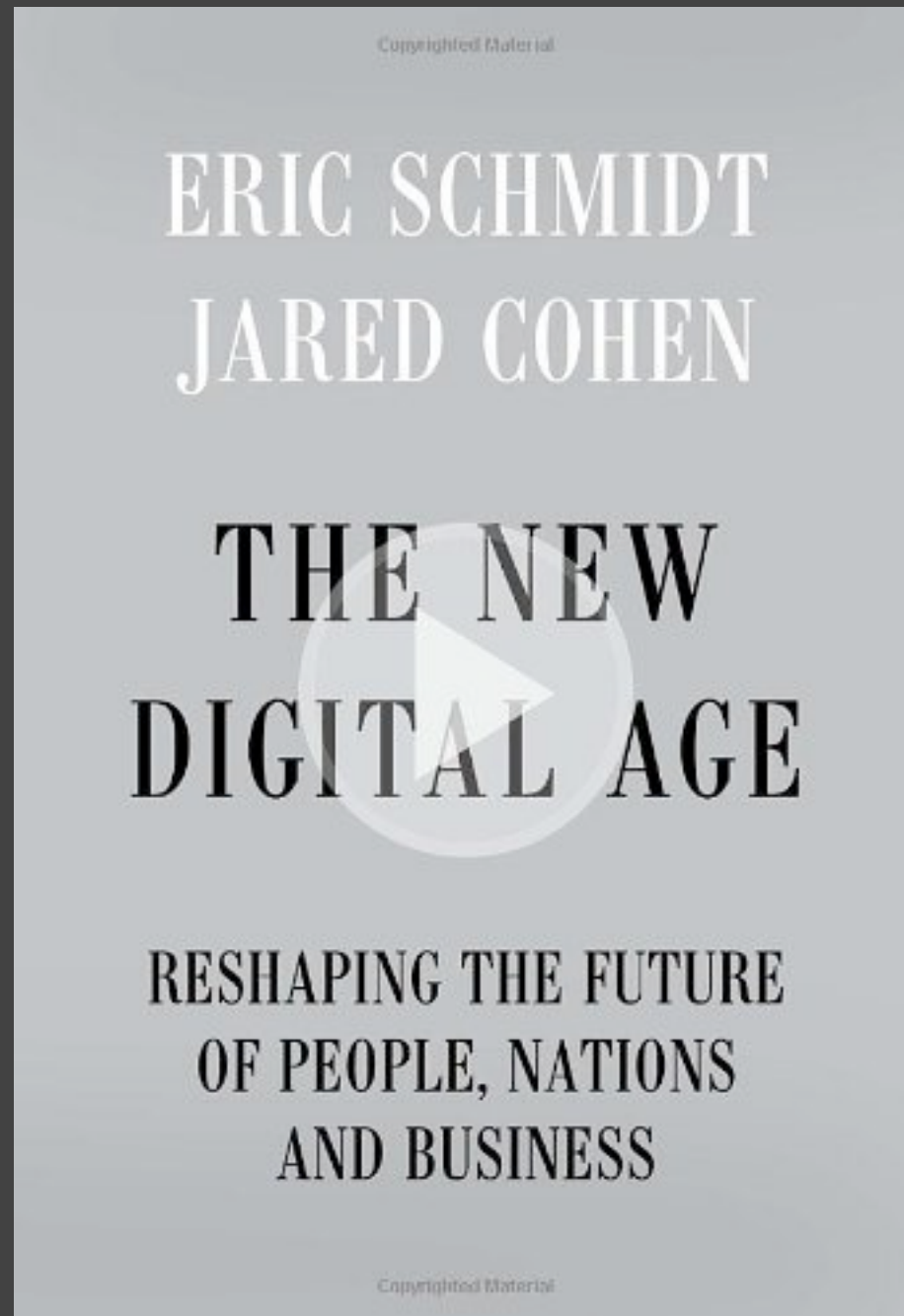
Senator Henry Waxman

“In other words you found that your view of the world, your ideology was not right. It was not working.”

Alan Greenspan

Precisely ... that’s precisely the reason I was shocked because I’ve been going for forty years or more with very considerable evidence that it was working exceptionally well.

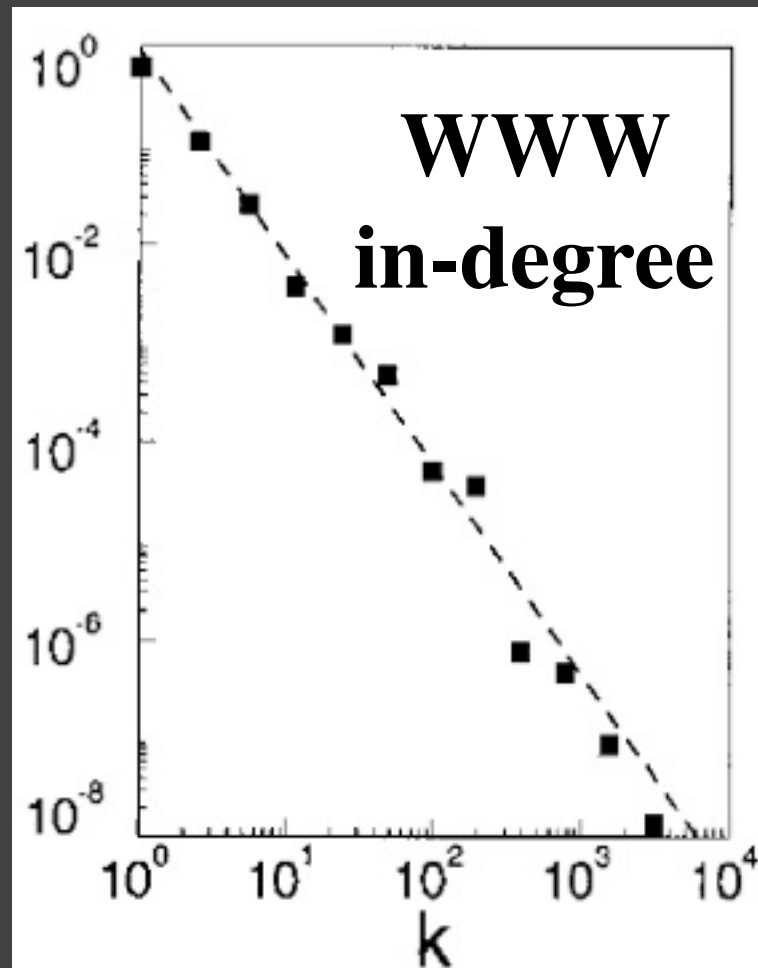
Testimony of Dr. Alan Greenspan to the Senate Committee of Government Oversight and Reform (October 23, 2008)



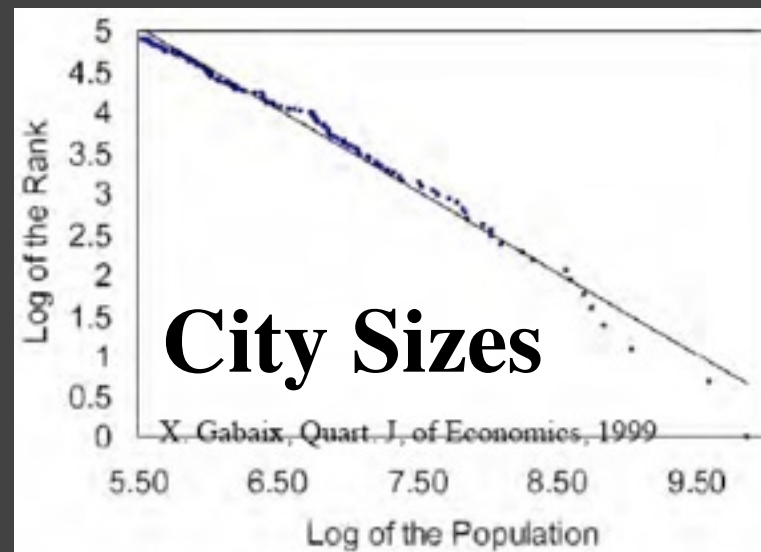
Eric Schmidt

2013 : The Leviathan is back !?

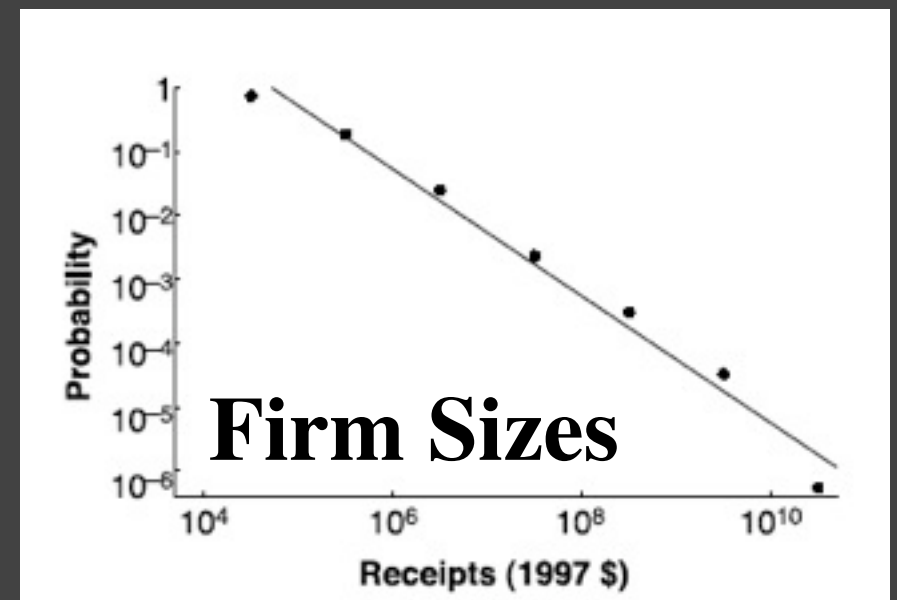
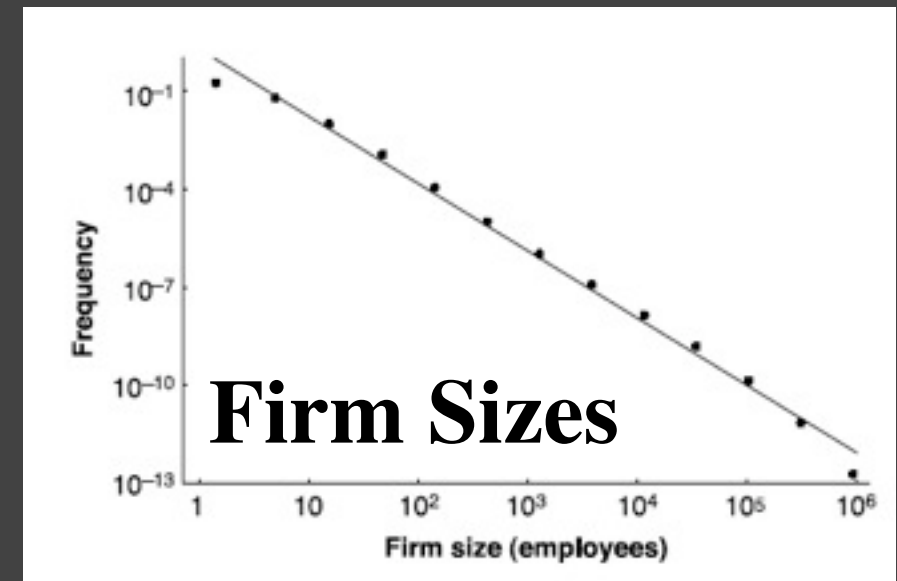
from “Chaos to Order” to “Chaos and order”



Barabasi and Albert
Science (1999)



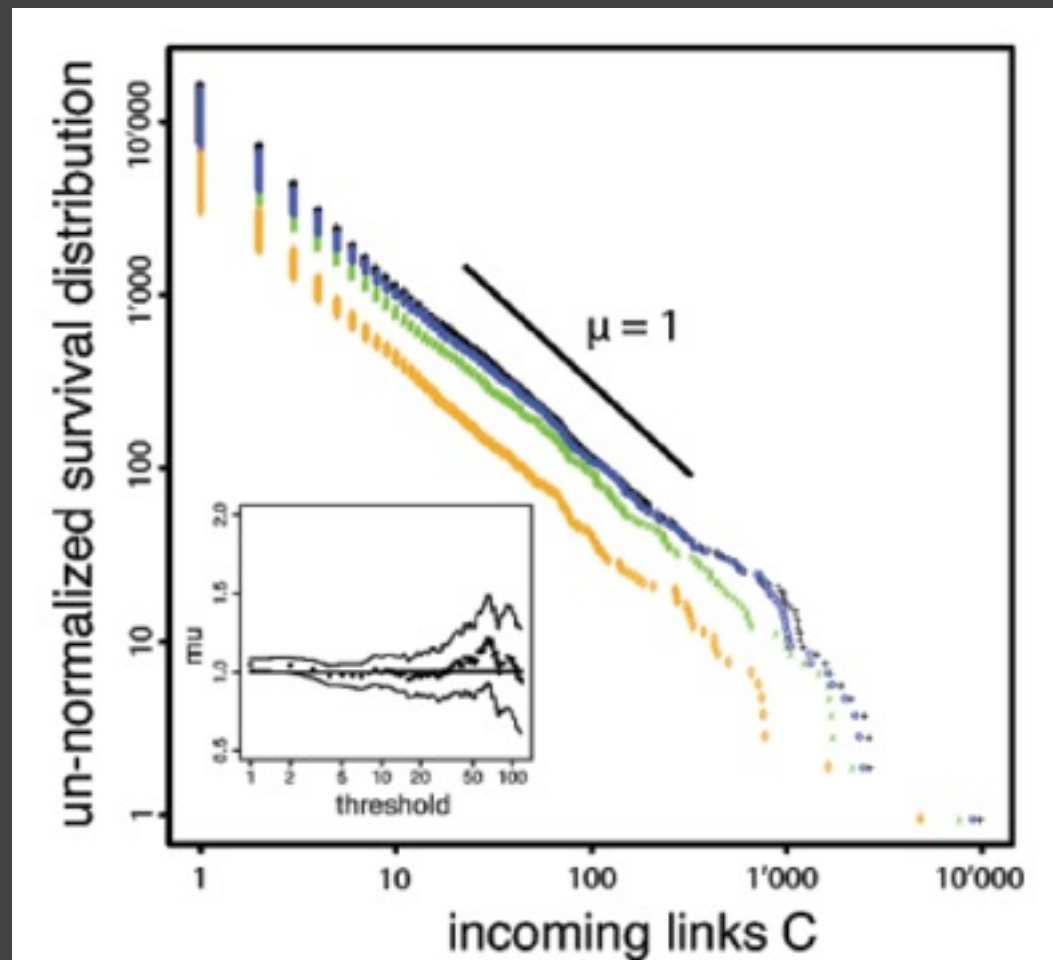
X. Gabaix
Quart. J. of Economics
(1999)



R.L.Axtell, *Science* (2001)

... as well as species per genus, etc.
(see L.A. Adamic and B.A. Huberman, *Glottometrics*, 2002)

from “Chaos to Order”
to “Chaos and order”



Power Law Distribution

$$p(x) \sim 1/x^{1+\mu}$$

Debian Linux
(*A Complex Network of
Knowledge Reuse*)

T. Maillart, D. Sornette, S. Speath and G. von Krogh, Empirical Tests of Zipf's law Mechanism In Open Source Linux Distribution, *Physical Review Letters*, **2008**.

from “Chaos to Order”
to “Chaos and order”

Gibrat principle

$$dC = r(C)dt + \sigma(C)dW,$$

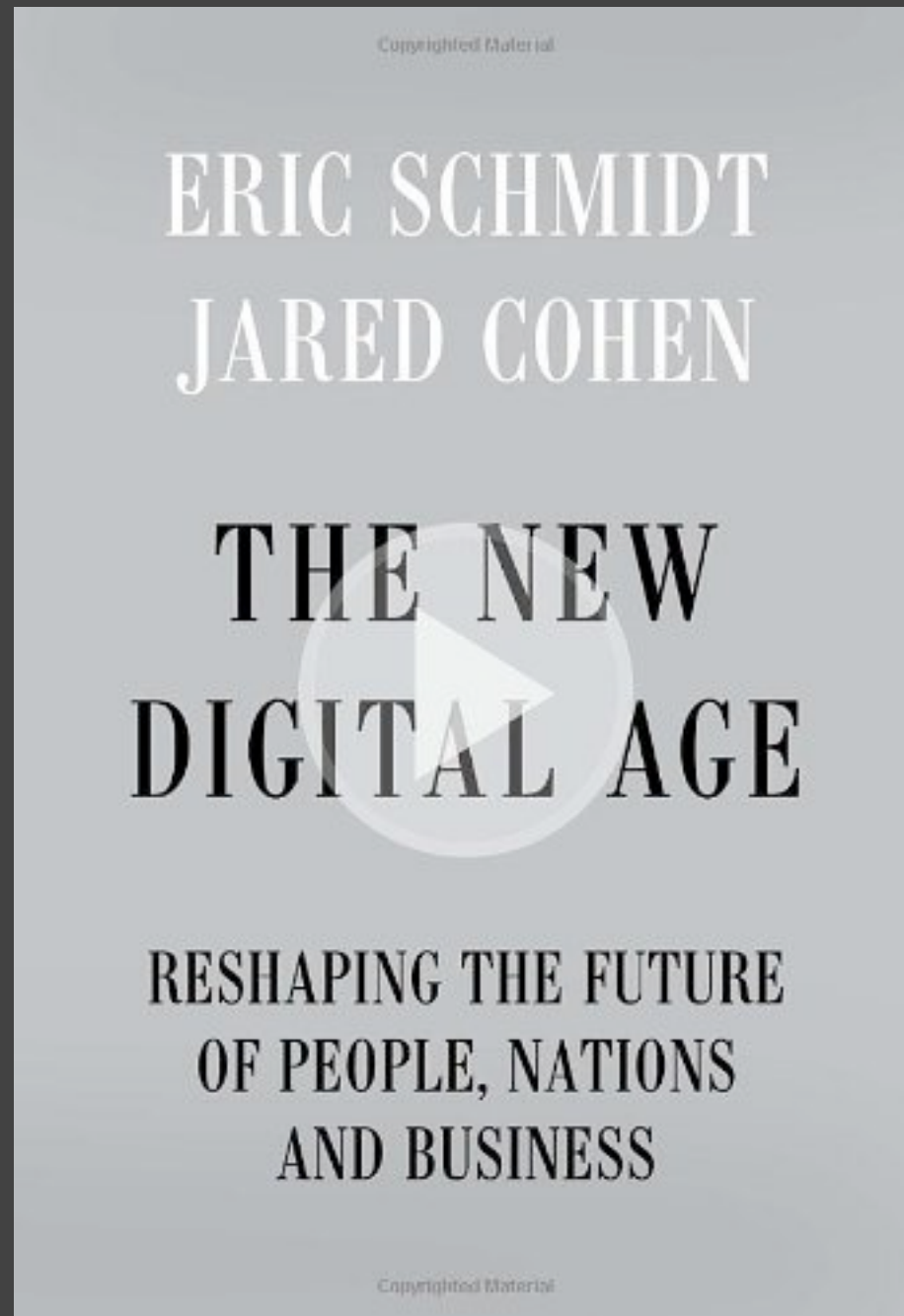
Simplest implementation (first by Herbert Simon)

$$r(C) = r \times C, \quad \sigma(C) = \sigma \times C,$$

with $r < \sigma$, expresses that proportional growth
is generally dominated by the stochastic component

Schumpeterian Creative Destruction !

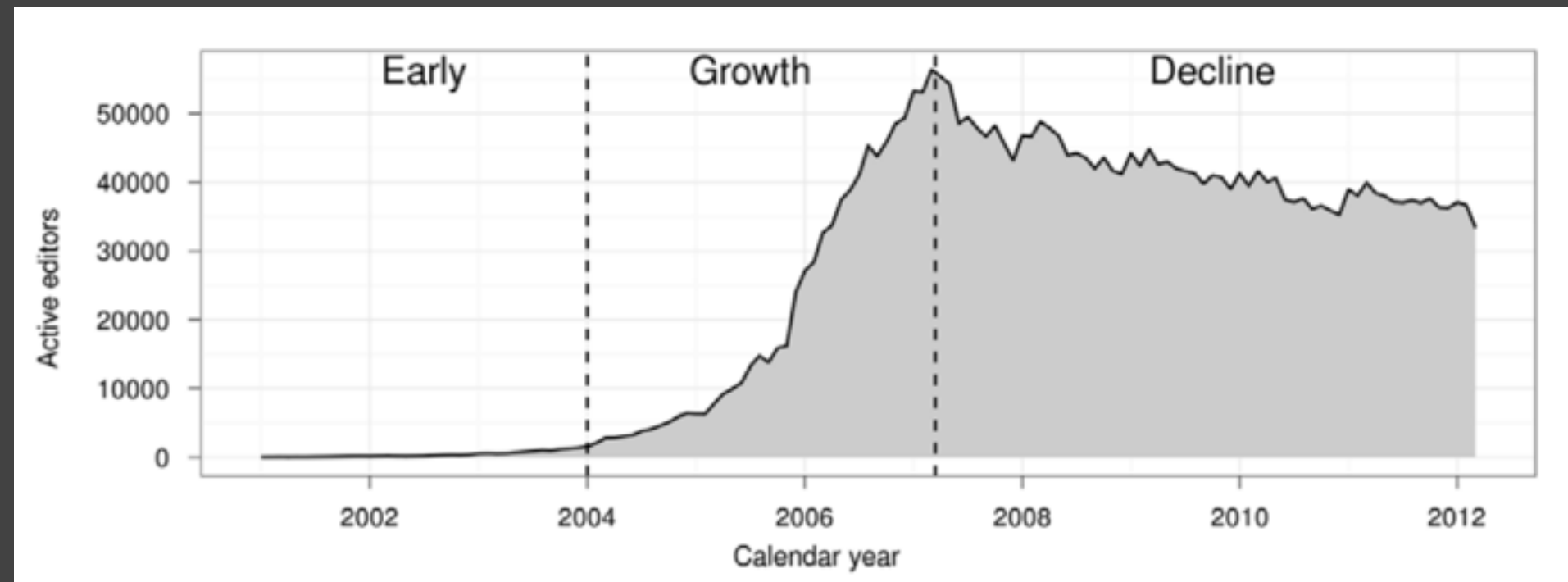
**Zipf's law implies an optimal ecosystem, with
perfect balance between exits and new entrants**



Eric Schmidt

2013 : The Leviathan is back !?

Failed institution, ageing or Leviathan ?



“ [...] several changes the Wikipedia community made to manage quality and consistency in the face of a massive growth in participation have ironically crippled the very growth they were designed to manage. Specifically, the restrictiveness of the encyclopedia’s primary quality control mechanism and the algorithmic tools used to reject contributions are implicated as key causes of decreased newcomer retention. Further, the community’s formal mechanisms for norm articulation are shown to have calcified against changes – especially changes proposed by newer editors.”



Stuart Geiger

Halfaker, Aaron, et al. "The Rise and Decline of an Open Collaboration System How Wikipedia’s Reaction to Popularity Is Causing Its Decline." *American Behavioral Scientist* 57.5 (2013): 664-688.

Benkler : The Penguin and the Leviathan

Observation

self-interest doesn't prevail anymore

*cooperation seems to (re)emerge everywhere, as a fund. mechanism
presumably good for society*

Causes

*failure of the market and the Leviathan
advent of empowering communication means*

Consequences

*peer-production as new production system !
“long-tail” is favored by opposition to “one-size-fits-all” innovation*

Designing organizations for cooperation

(*Benkler, ch. 10*)

Communication

Framing, fit and authenticity

Looking beyond ourselves
(*empathy and solidarity*)

Constructing moral systems
(*fairness, morality and social norms*)

Rewards and punishments

Reputation, transparency, and reciprocity

Building for diversity

Proposition

Cause

new communication means

Consequences

extended pools of labor forces

better division of labor

Positive feed-back loop

*(nearly all) Internet innovation capital is invested
in improving communications !*

(additional) Consequence

*Internet technologies allow better understanding of collective action
⇒ better collective action :-)*

Open questions

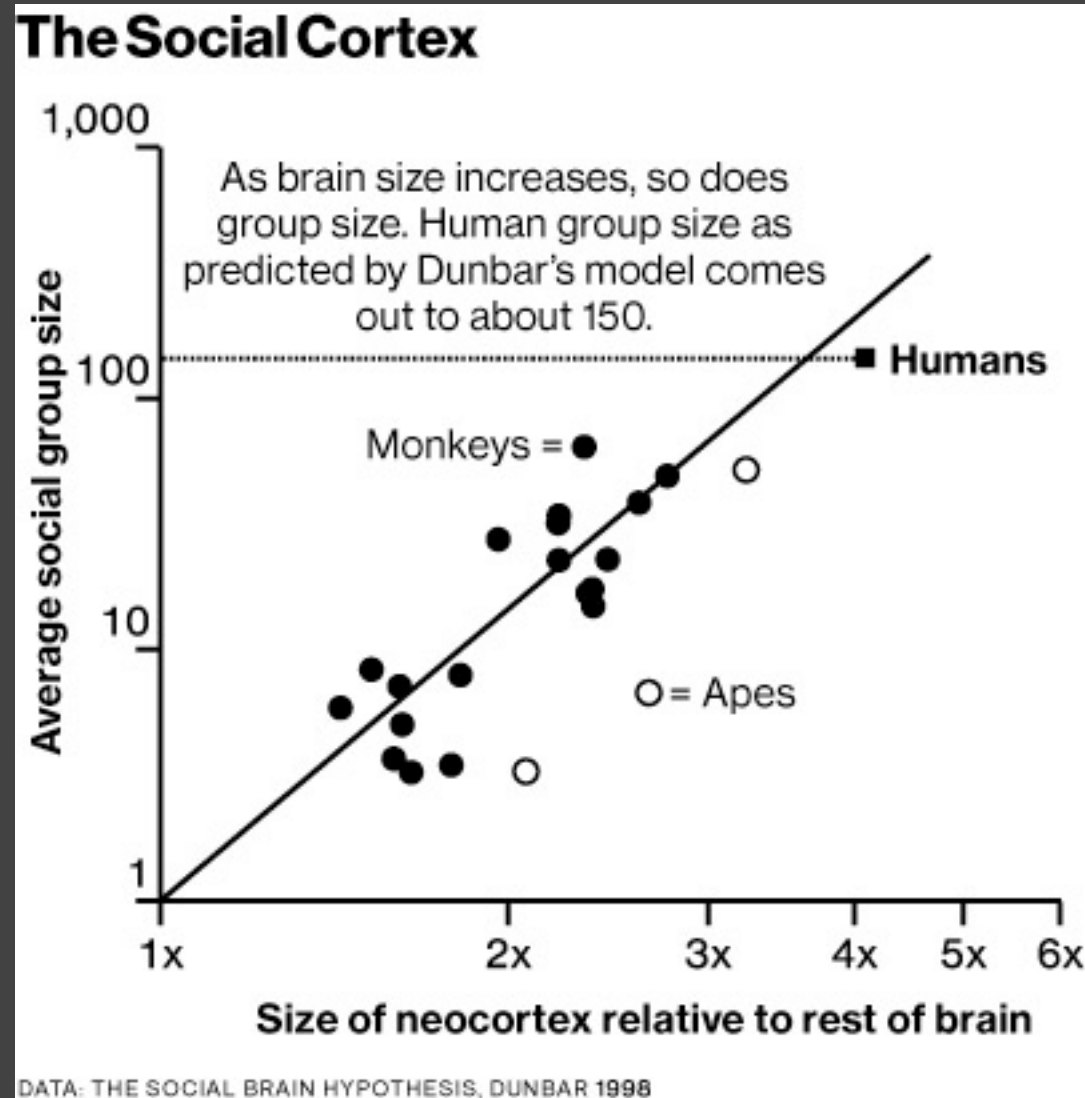
Do these mechanisms really favor
peer-production and/or collective action ?

Can we measure, verify (and manage) them ?

Are they indeed superior to classical production systems
or are they only filling a niche ?

How peer-production does play a fundamental role
for the evolution of society ?

The Social Brain Hypothesis



Robin Dunbar

Dunbar, R. I. M. The social brain hypothesis. *Evol. Anthropol.* 6, 178-190 (1998).

“the whole is more than the sum of its parts”
Aristotle.

Matlab Experiment

Protocol

NP-Hard problem (6x)

goal : find fastest algorithm

each submission is tested & scored from CPU time

after submission the code is made available to all other competitors

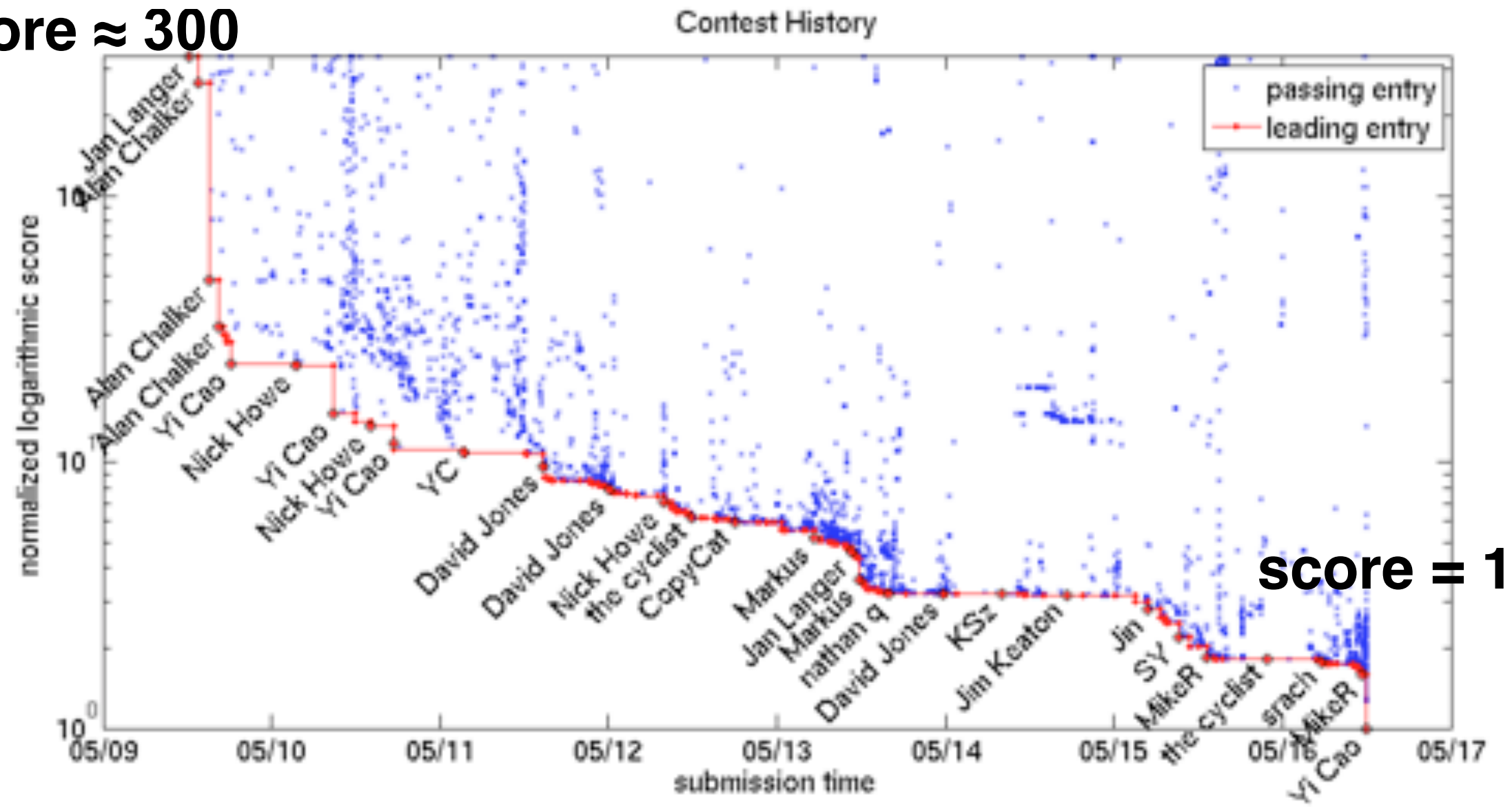
everyone can reuse any piece of submitted code



N. Gulley and K. Lakhani, The Determinants of Individual Performance and Collective Value in Private-Collective Software Innovation, *HBS Working Paper* (2010)

Matlab Experiment

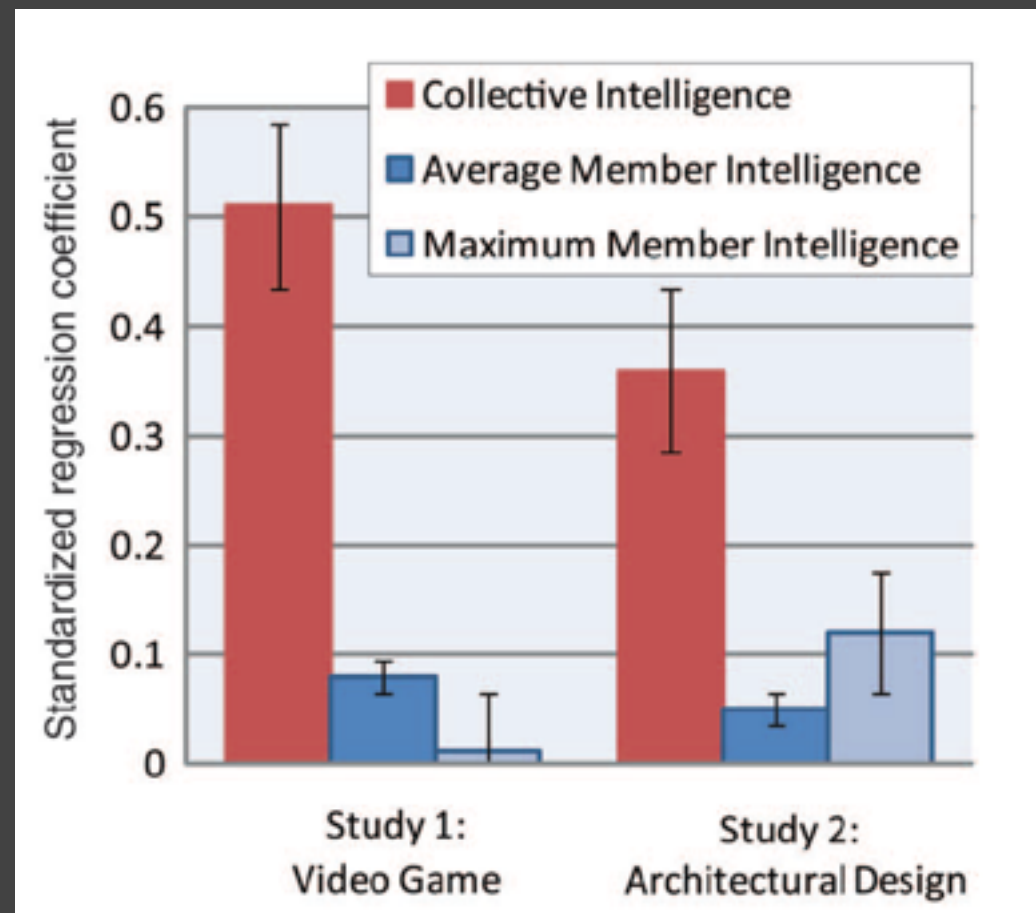
score ≈ 300



Efficiency x300 over 7 days by ≈ 150 developers !
30 % gain per developer per day !

N. Gulley and K. Lakhani, The Determinants of Individual Performance and Collective Value in Private-Collective Software Innovation, *HBS Working Paper* (2010)

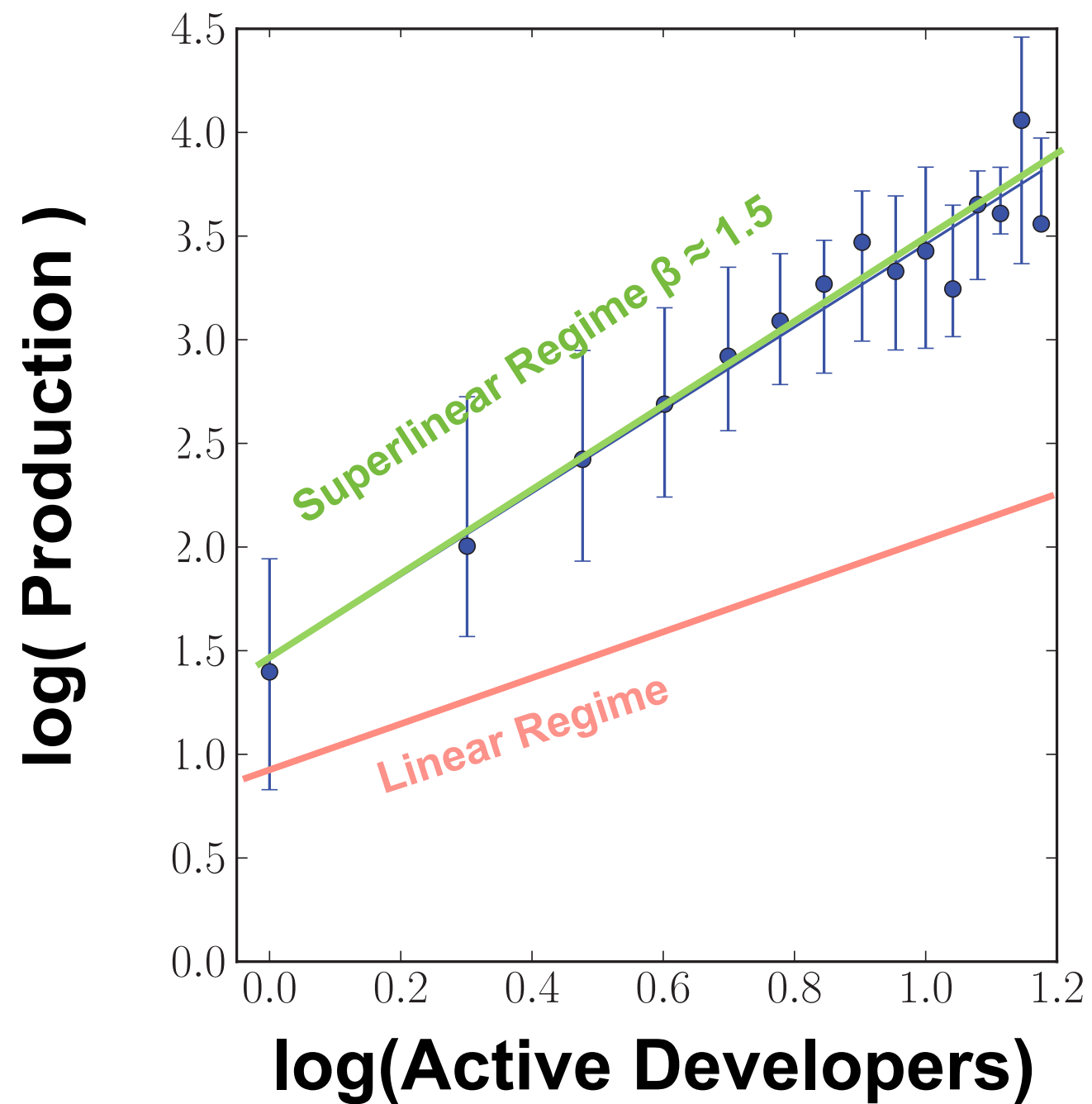
“c factor” = Collective IQ



This “C factor” is not strongly correlated with the average or maximum individual intelligence of group members but is correlated with the average social sensitivity of group members, the equality in distribution of conversational turn-taking, and the proportion of females in the group.

Woolley, A. W., Chabris, C. F., Pentland, A., Hashmi, N. & Malone, T. W. Evidence for a collective intelligence factor in the performance of human groups. *Science* **330**, 686-688 (2010).

$$1 \oplus 1 \approx 2.8$$



Maillart, T. , D. Sornette, A. Saichev, G. Ghezzi, *working paper* (2013)

Summary

Competition

Technology vs. labor

Penguin and Leviathan

Evolutionary Pressure

Impression that open collaboration and peer-production
play a central role for the adaptation of society

Evidence of the power of collective intelligence & production