Equity and Inclusion Journal Club, July 4th 2023

Serendipity, talent and innovation

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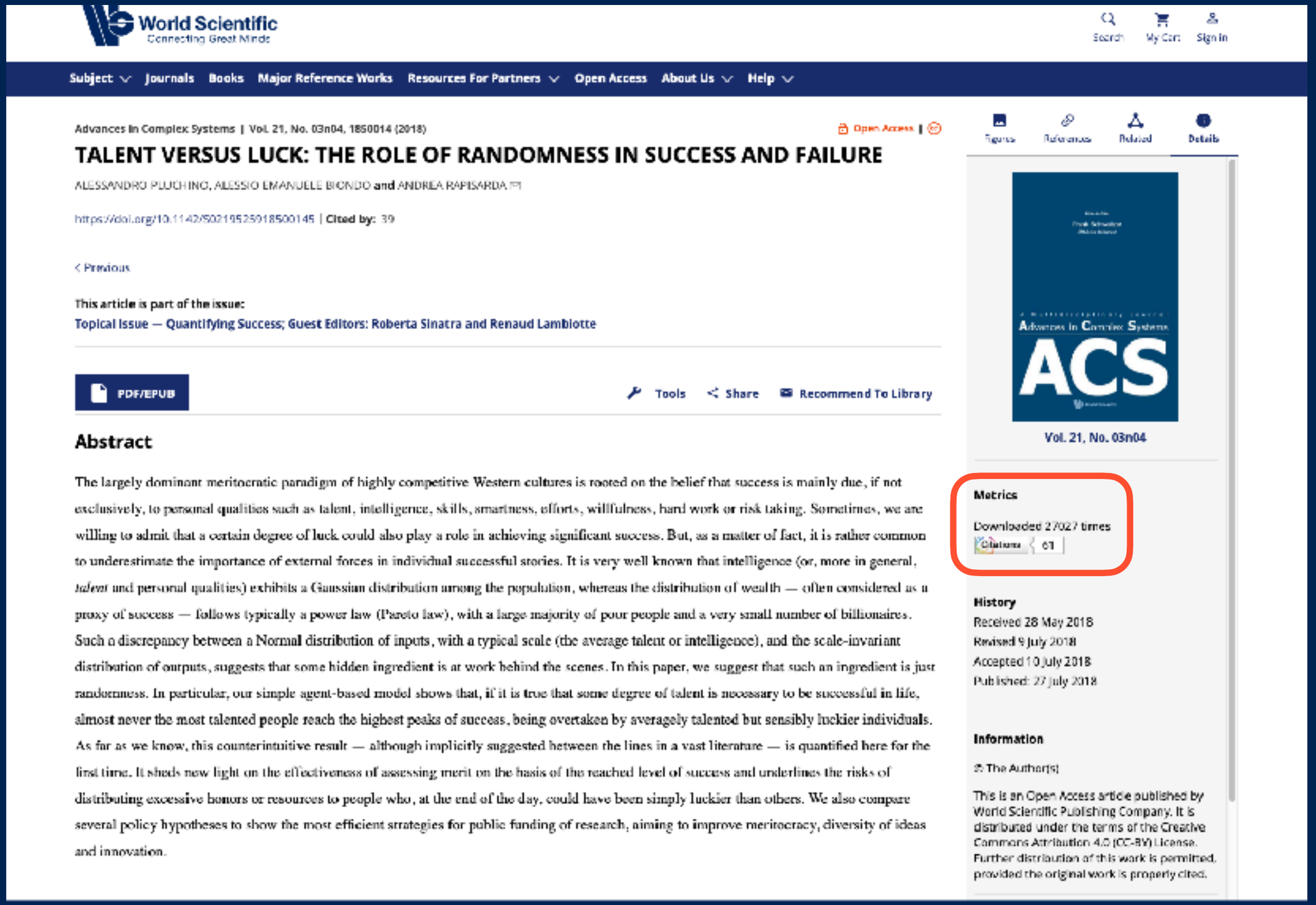
I will present the results of this paper (published in 2018)

on the role of talent and luck in getting success in life and science

Results are related to science funding, but also on equity and inclusion



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TALENT VERSUS LUCK: THE ROLE OF RANDOMNESS IN SUCCESS AND FAILURE

ALESSANDRO PLUCHINO, ALESSIO EMANUELE BIONDO and ANDREA RAPISARDA

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This article is part of the issue:
Topical Issue — Quantifying Success; Guest Editors: Roberta Sinatra and Renaud Lambiotte

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Abstract

The largely dominant meritocratic paradigm of highly competitive Western cultures is rooted on the belief that success is mainly due, if not exclusively, to personal qualities such as talent, intelligence, skills, smartness, efforts, willfulness, hard work or risk taking. Sometimes, we are willing to admit that a certain degree of luck could also play a role in achieving significant success. But, as a matter of fact, it is rather common to underestimate the importance of external forces in individual successful stories. It is very well known that intelligence (or, more in general, *talent* and personal qualities) exhibits a Gaussian distribution among the population, whereas the distribution of wealth — often considered as a proxy of success — follows typically a power law (Pareto law), with a large majority of poor people and a very small number of billionaires. Such a discrepancy between a Normal distribution of inputs, with a typical scale (the average talent or intelligence), and the scale-invariant distribution of outputs, suggests that some hidden ingredient is at work behind the scenes. In this paper, we suggest that such an ingredient is just randomness. In particular, our simple agent-based model shows that, if it is true that some degree of talent is necessary to be successful in life, almost never the most talented people reach the highest peaks of success, being overtaken by averagely talented but sensibly luckier individuals. As far as we know, this counterintuitive result — although implicitly suggested between the lines in a vast literature — is quantified here for the first time. It sheds new light on the effectiveness of assessing merit on the basis of the reached level of success and underlines the risks of distributing excessive honors or resources to people who, at the end of the day, could have been simply luckier than others. We also compare several policy hypotheses to show the most efficient strategies for public funding of research, aiming to improve meritocracy, diversity of ideas and innovation.

Figures | References | Related | Details

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History

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Information

Motivations and introduction

1. *Is chance important in scientific discoveries?*

2. *What is the role of luck / randomness in our life?*

3. *Are the most successful people also the most talented ones?*

4. *What can we do to improve the efficiency of science and society?*

In Science there is a well-known phenomenon called

"*Serendipity*"

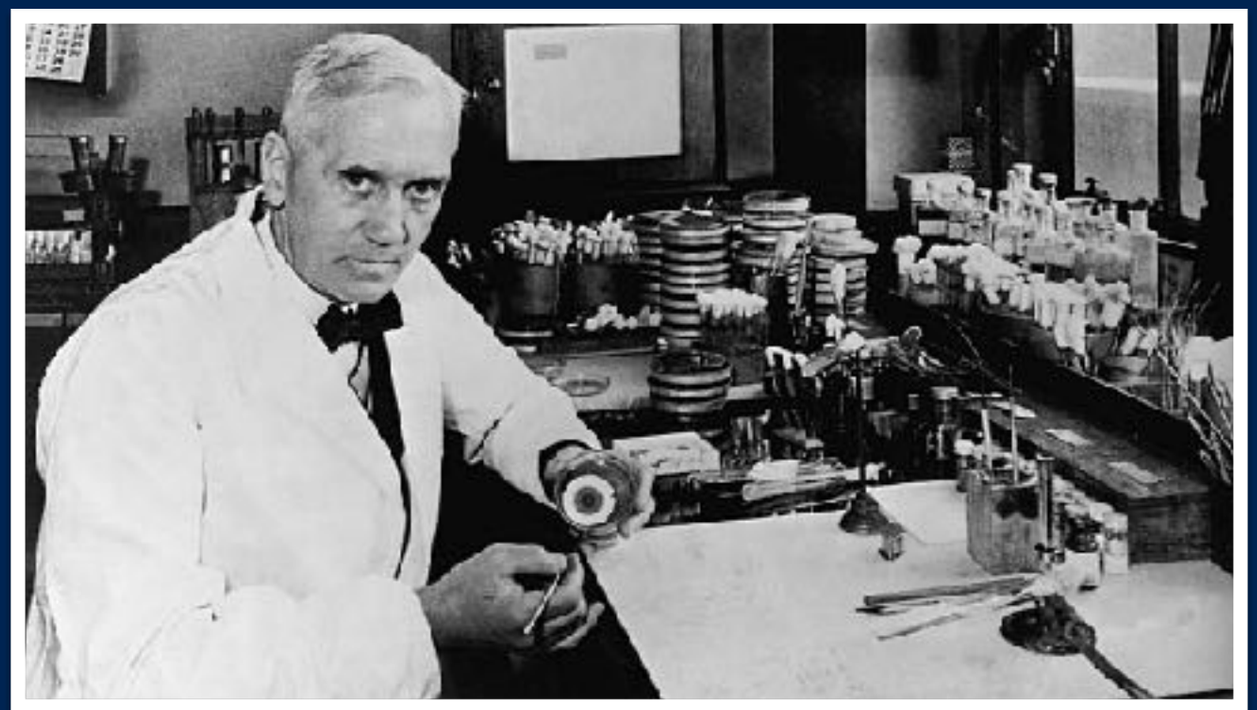
i.e. discovery *by chance* *

Of course one must be a
smart and talented scientist
to recognize and exploit
a lucky opportunity !

* The *Oxford English Dictionary* defines it, as "the faculty of making happy and unexpected discoveries by accident,"

Serendipity, i.e. discovery by chance: a few examples

In 1928 Alexander Fleming discovered Penicilin *by chance* … because he forgot to close a window of his lab before going on vacation: during his absence one of his staphylococcus culture plates was contaminated by a Penicillium mold spore that weakened and killed the bacteria on the Petri dish



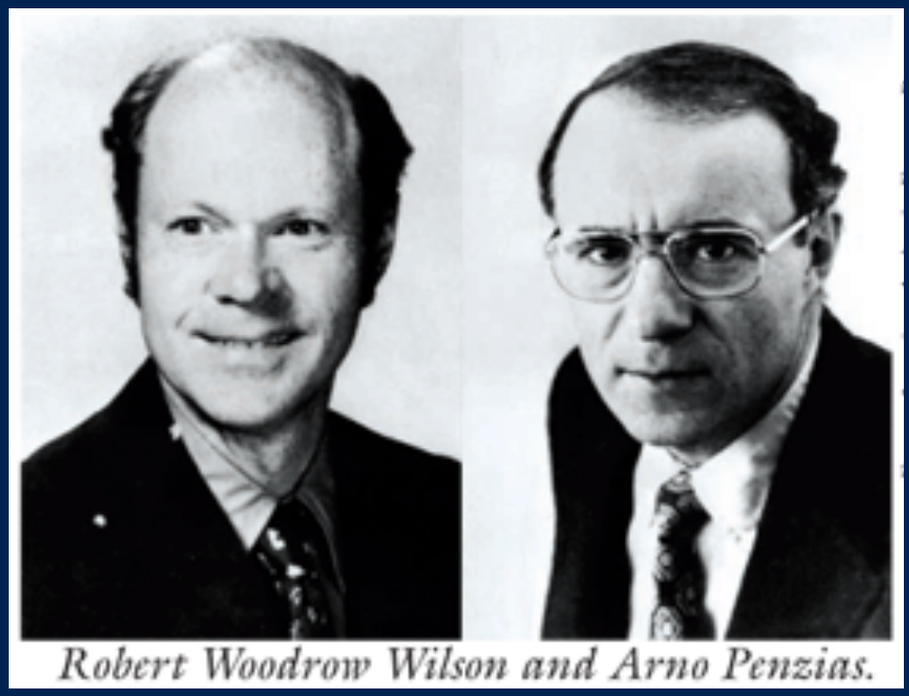
In 1945 he got the Nobel prize in Medicine for this discovery together with Chain and Florey

Actually Alexander Fleming was lucky twice… or better someone before him was not so lucky …

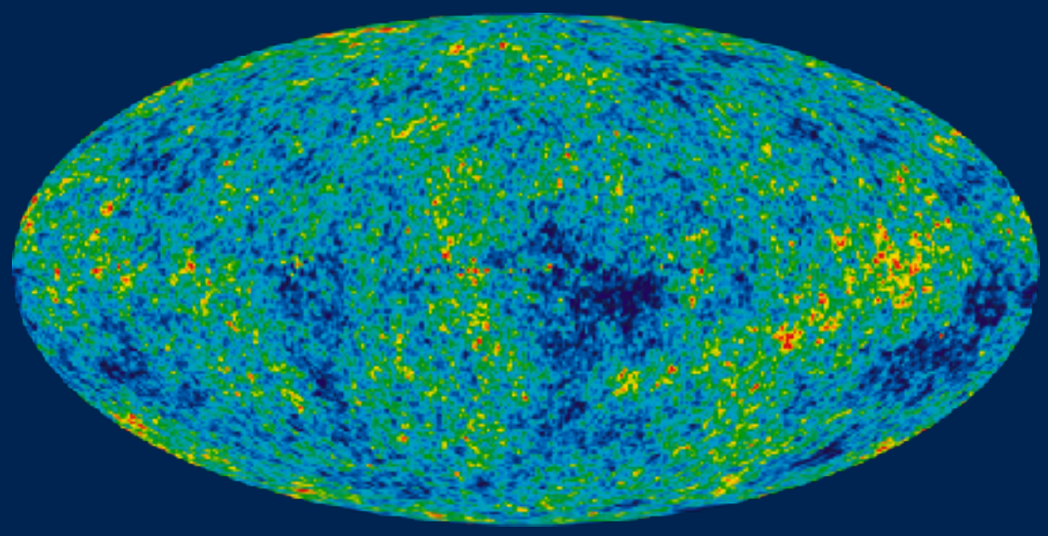
In fact 35 years before Fleming discovery, the young Italian doctor Vincenzo Tiberio discovered also Penicilin *by chance* …

But Tiberio was a young doctor living in Naples. His research in the faculty aroused little interest and only in 1895, after graduation, he published his research "On the extracts of some molds" on the Italian journal "Annali di Igiene sperimentale" …. Nobody paid attention to Tiberio's paper and he was soon forgotten !

Serendipity, i.e. discovery by chance: a few examples



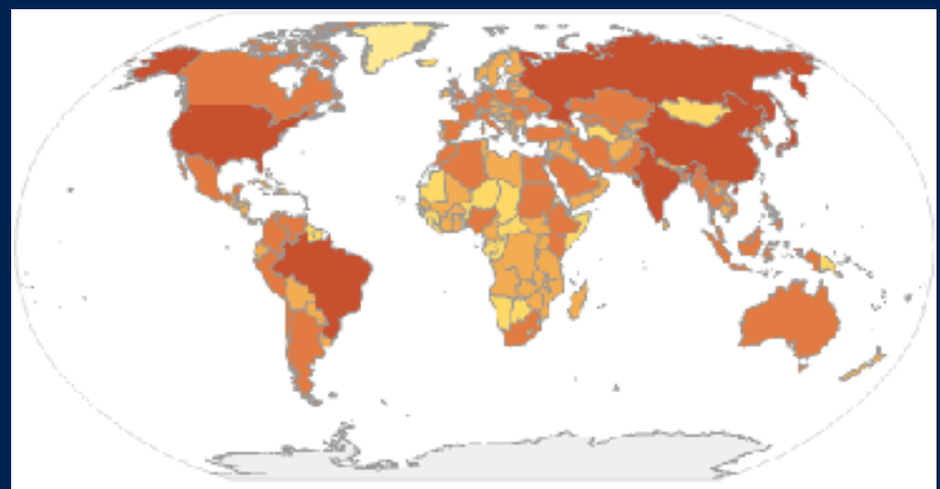
Robert Woodrow Wilson and Arno Penzias.



In 1964, while working at a new type of antenna, the Horn Antenna, at the Bell's Labs, Arno Penzias and Robert Wilson discovered *by chance* the cosmic microwave background radiation that permeates the universe after the Big Bang

They got the Nobel Prize for Physics in 1978

Serendipity, is also related to the difficulties in predicting the impact and the applications of an idea, of an invention or of a discovery



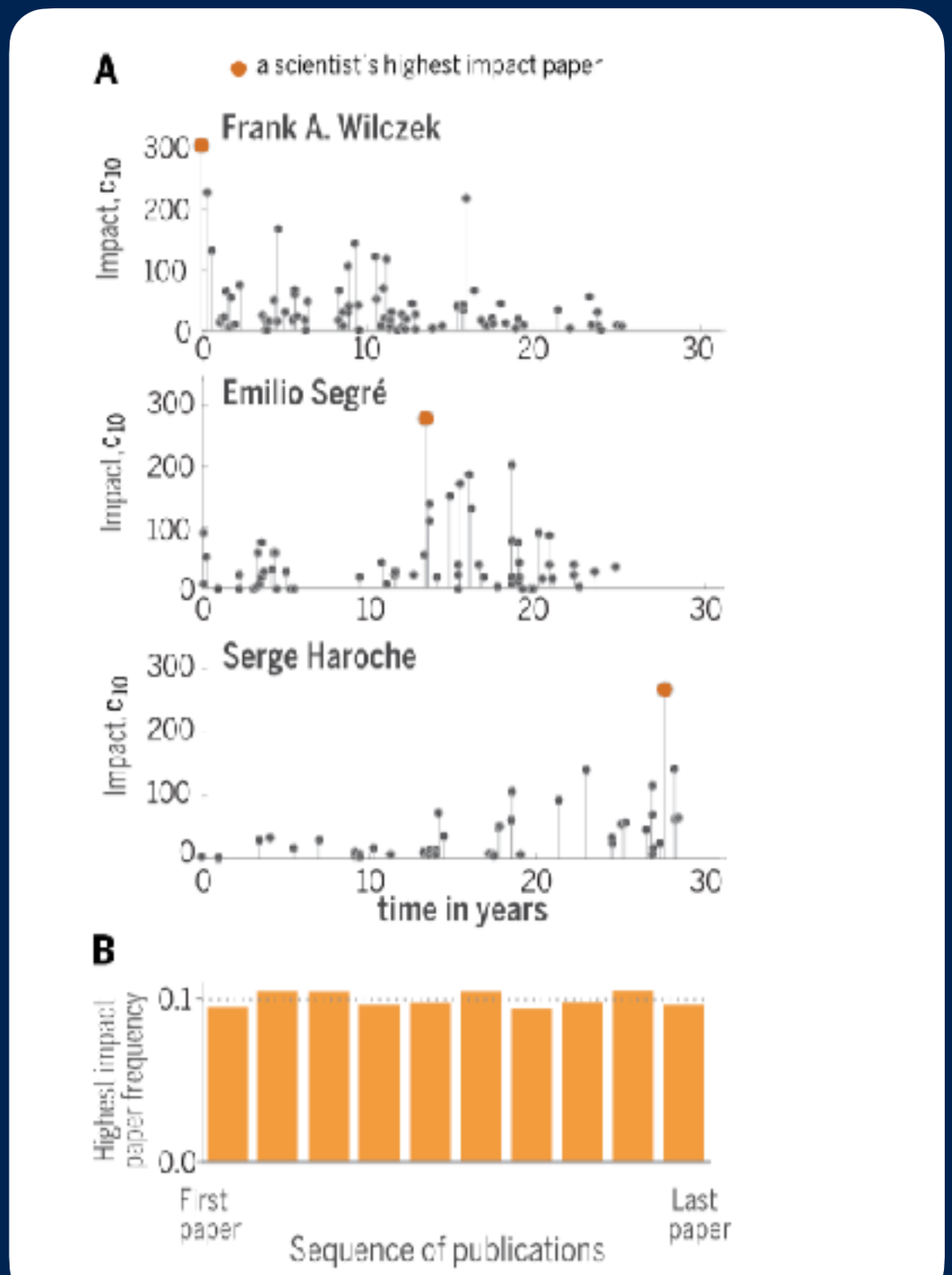
3.19 billion people use internet today, i.e. around 57 % of total world population, excluding children !!

In 1989, while he was working at Cern, Tim Bernes-Lee invented the WWW protocol for linking documents and exchanging data more easily among Cern scientists all over the world.

No one could imagine at that time that, *by chance*, it would have become so popular among common people: *today almost everyone use it for everything !*

He got the A.M. Turing Award in 2016

Chance is important also for publishing your best paper: *your top article can occur at any time, even at the end of your career !*



(A) Publication record of three Nobel laureates in physics. The horizontal axis indicates the number of years after a laureate's first publication, each circle corresponds to a research paper. The height of the circle represents the paper's impact, quantified by C10, the number of citations after 10 years. The highest-impact paper of a laureate is denoted with an orange circle.

(B) Histogram of the occurrence of the highest-impact paper in a scientist's sequence of publications, calculated for 10,000 scientists. *The flatness of the histogram indicates that the highest-impact work can be, with the same probability, anywhere in the sequence of papers published by a scientist.*

see Fortunato et al., Science 359, 1007 (2018)

So luck/randomness/chance is important, but…

- *Is it possible to be successful without luck or talent ?*
- *Are the most successful/famous people also the most talented ones ?*

J.K. ROWLING

She is the famous author of the Henry Potter saga and according to Forbes among the richest persons in UK. Her books have won multiple awards, and sold more than 400 million copies.

After her divorce, she began a teacher training course in 1995 in Edinburg and she mainly lived on state benefits. She wrote in many cafés, wherever she could get her small daughter Jessica to fall asleep.

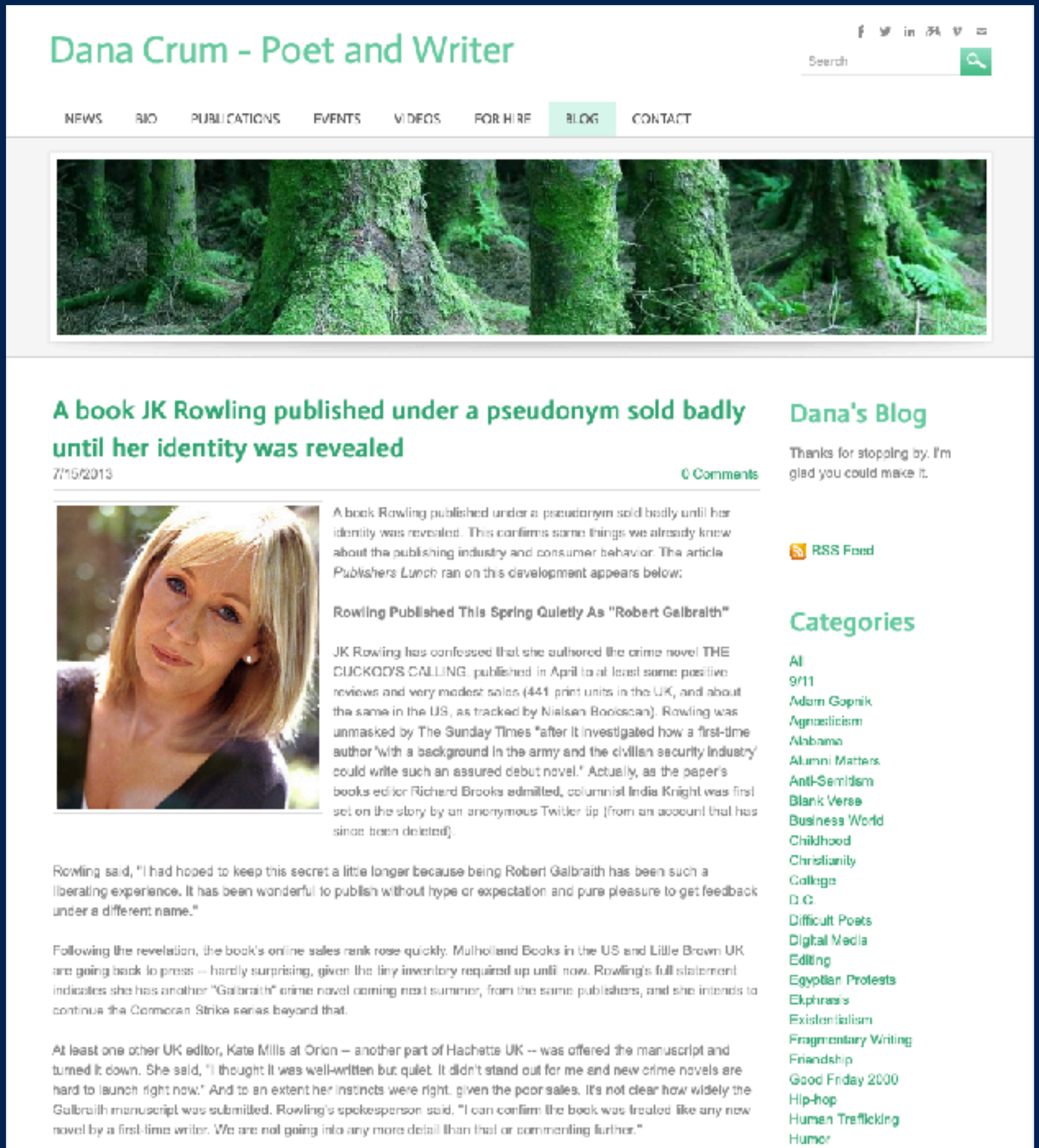
In 1995 she finished her manuscript *Harry Potter and the Philosopher's Stone*. **The book was submitted to twelve publishing houses, all of which rejected the manuscript!!**

In 1996 the book was finally accepted by editor Barry Cunningham from Bloomsbury, a publishing house in London.

The decision to publish Rowling's book owes much to Alice Newton, the eight-year-old daughter of Bloomsbury's chairman, who was given the first chapter to review by her father and immediately demanded the next.

In 2017 she was named the most highly paid author in the world with earnings of £72 million ($95 million) a year by Forbes magazine.

J.K. ROWLING

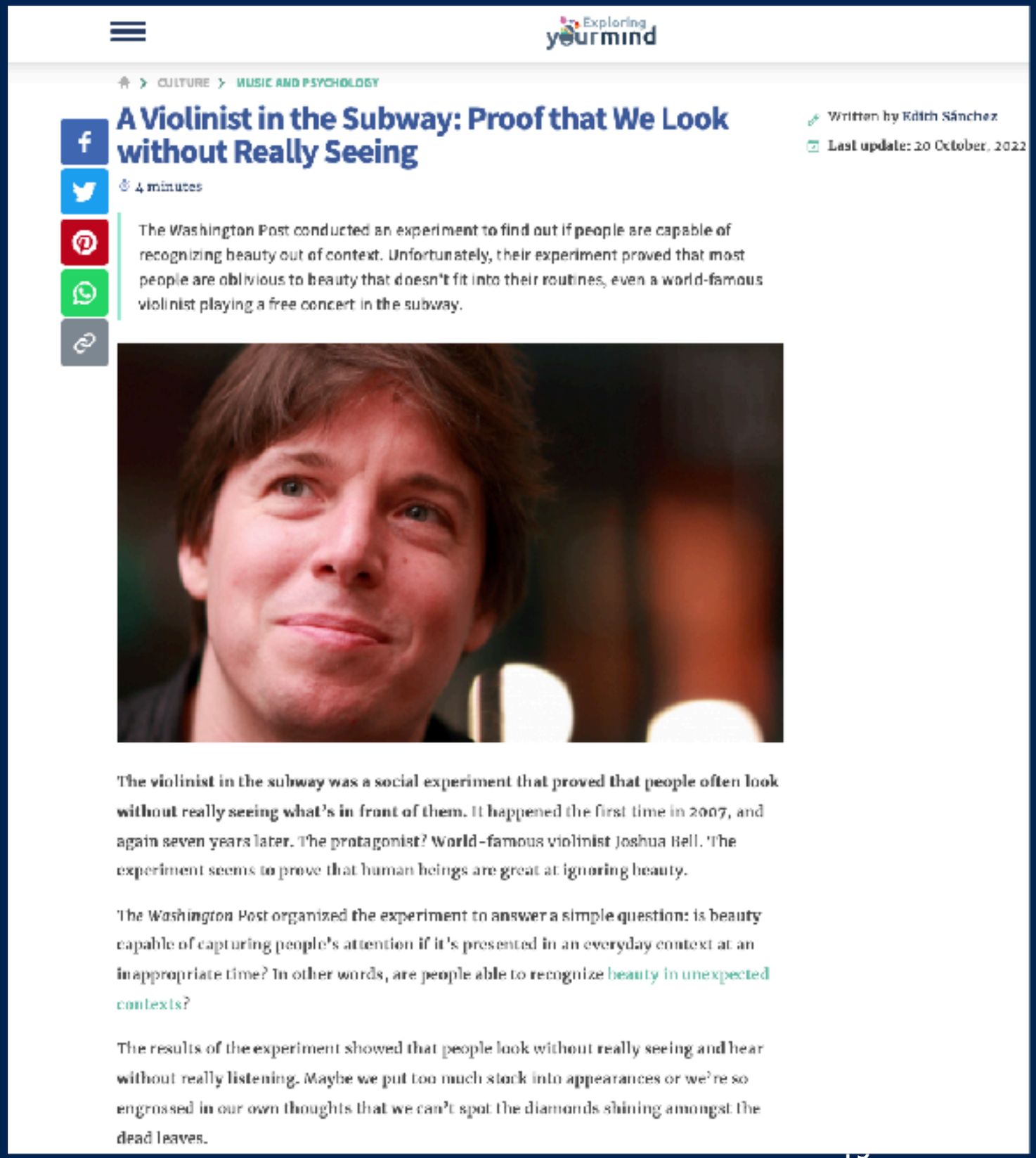


After this huge success, in 2013 she published another book,

"the Cuckoo's calling", with a pseudonym.

The book didn't sell until she revealed to be the real author and then it was a success !

HOW GOOD ARE WE IN RECOGNIZING TALENT?



Exploring yourmind

CULTURE > MUSIC AND PSYCHOLOGY

A Violinist in the Subway: Proof that We Look without Really Seeing

Written by Edith Sánchez

Last update: 20 October, 2022

4 minutes

The Washington Post conducted an experiment to find out if people are capable of recognizing beauty out of context. Unfortunately, their experiment proved that most people are oblivious to beauty that doesn't fit into their routines, even a world-famous violinist playing a free concert in the subway.

The violinist in the subway was a social experiment that proved that people often look without really seeing what's in front of them. It happened the first time in 2007, and again seven years later. The protagonist? World-famous violinist Joshua Bell. The experiment seems to prove that human beings are great at ignoring beauty.

The *Washington Post* organized the experiment to answer a simple question: is beauty capable of capturing people's attention if it's presented in an everyday context at an inappropriate time? In other words, are people able to recognize beauty in unexpected contexts?

The results of the experiment showed that people look without really seeing and hear without really listening. Maybe we put too much stock into appearances or we're so engrossed in our own thoughts that we can't spot the diamonds shining amongst the dead leaves.

This is an interesting experiment which shows how much the environment influences our judgements

In the 2007 experiment by the Washington Post, premier violinist and Grammy-winning musician, Joshua Bell, using his violin worth $3.5 million, played six of the most intricate pieces ever written for violin in the Washington D.C. metro station. Two days prior he had sold out a theater in Boston where a seat on average cost $100. However, in the 45 minutes Bell played his violin, one thousand people came within close proximity of him with only seven stopping to listen.

Names are important

In a New York University study, researchers found that people with easier-to-pronounce names often have higher-status positions at work. One of the psychologists, Adam Alter, explains to Wired, "When we can process a piece of information more easily, when it's easier to comprehend, we come to like it more." In a further study, Alter also found that companies with simpler names and ticker symbols tended to perform better in the stock market.

If your name is easy to pronounce, people will favour you more

Someone named Jane is easy to like.

Journal of Experimental Social Psychology 48 (2012) 752–756

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Report

The name-pronunciation effect: Why people like Mr. Smith more than Mr. Colquhoun

Simon M. Laham [a,*], Peter Koval [a,b], Adam L. Alter [c]

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ABSTRACT

Names are rich sources of information. They can signal gender, ethnicity, or class; they may connote personality characteristics ranging from warmth and cheerfulness to morality. But names also differ in a much more fundamental way: some are simply easier to pronounce than others. Five studies provide evidence for the *name-pronunciation effect*: easy-to-pronounce names (and their bearers) are judged more positively than difficult-to-pronounce names. Studies 1–3 demonstrate that people form more positive impressions of easy-to-pronounce names than of difficult-to-pronounce names. Study 4 finds this effect generalizable to ingroup targets. Study 5 highlights an important real-world implication of the name-pronunciation effect: people with easier-to-pronounce surnames occupy higher status positions in law firms. These effects obtain independent of name length, unusualness, typicality, foreignness, and orthographic regularity. This work demonstrates the potency of processing fluency in the information rich context of impression formation.

Names are important

Journal of Economic Perspectives—Volume 20, Number 1—Winter 2006—Pages 175–188

What's in a Surname? The Effects of Surname Initials on Academic Success

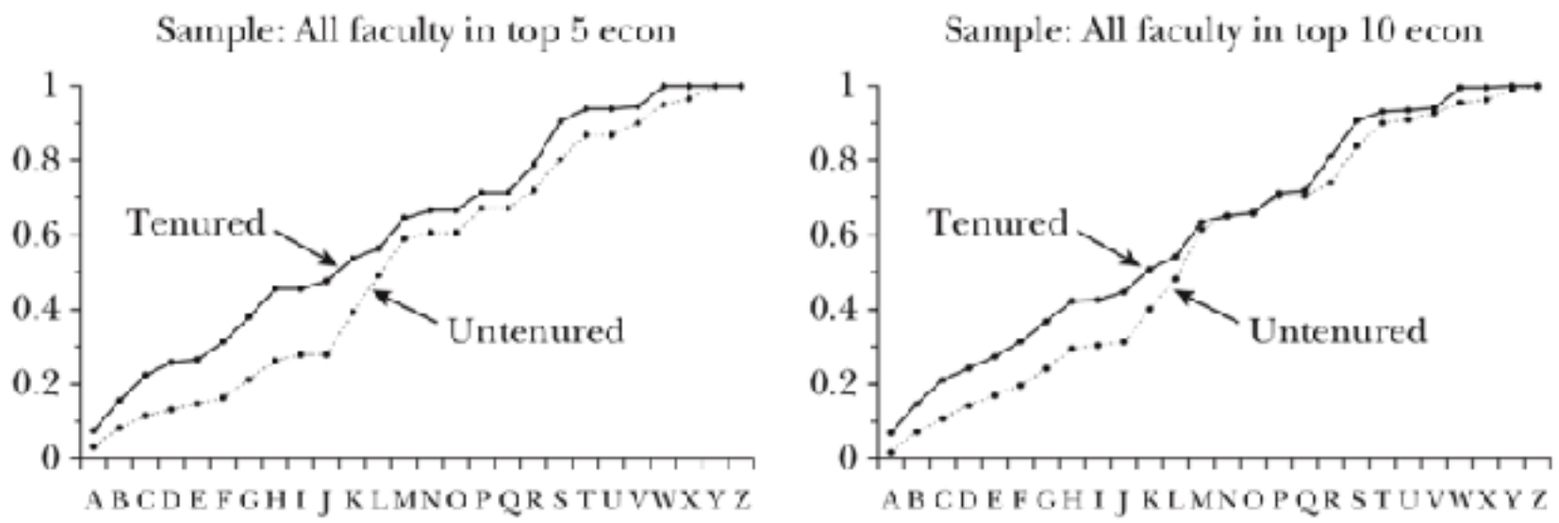
Liran Einav and Leeat Yariv

There is abundant research identifying external characteristics (race, gender, adolescent height) that affect labor market outcomes; for recent contributions, see Bertrand and Mullainathan (2004) and Persico, Postlewaite and Silverman (2004). In this paper, we focus on the effects of surname initials on professional outcomes in the academic labor market for economists.

We begin our analysis with data on faculty in all top 35 U.S. economics

If your surname starts with the first letters of the alphabet, it is more likely to get a tenured position

Cumulative Distributions of Surname Initials in Economics by Tenure Status



***Luck / randomness / chance** is important, also in our every day life*

a car accident, a disease or a heritage

can occur to everyone in any moment

changing our life completely !

Random factors (bad luck) in cellular replications can cause a cancer even if one follows the best rules to avoid it

RESEARCH Tomasetti et al., Science 355, 1330–1334 (2017) 24 March 2017

REPORT

CANCER ETIOLOGY

Stem cell divisions, somatic mutations, cancer etiology, and cancer prevention

Cristian Tomasetti,[1,2]* Lu Li,[2] Bert Vogelstein[3]*

Cancers are caused by mutations that may be inherited, induced by environmental factors, or result from DNA replication errors (R). We studied the relationship between the number of normal stem cell divisions and the risk of 17 cancer types in 69 countries throughout the world. The data revealed a strong correlation (median = 0.80) between cancer incidence and normal stem cell divisions in all countries, regardless of their environment. The major role of R mutations in cancer etiology was supported by an independent approach, based solely on cancer genome sequencing and epidemiological data, which suggested that R mutations are responsible for two-thirds of the mutations in human cancers. All of these results are consistent with epidemiological estimates of the fraction of cancers that can be prevented by changes in the environment. Moreover, they accentuate the importance of early detection and intervention to reduce deaths from the many cancers arising from unavoidable R mutations.

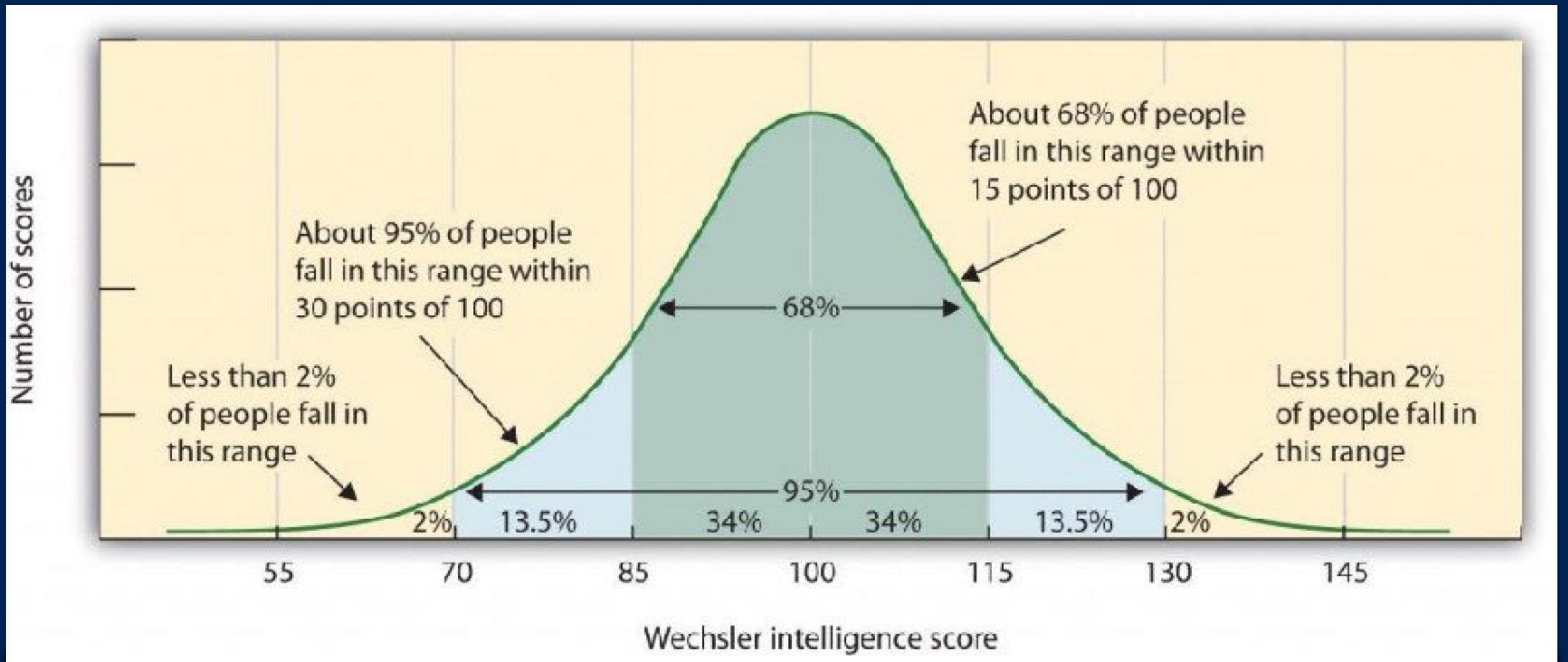
…using health records from 69 countries, they conclude that *66 percent* of cancer-causing genetic mutations arise from the "bad luck" of a healthy, dividing cell making a random mistake when it copies its DNA.

In our study

we started from two well-known facts

1st fact

It is well known that the distribution of **IQ** (intelligence quotient) has a Gaussian (normal) shape



The term IQ test actually refers to a number of different standardized tests designed to measure human intelligence. These tests focus on non-specific knowledge and skills, rather than facts and calculations. For example, most IQ tests include visual-based and verbal-based questions that highlight reasoning skills, rationality, mathematics, spatial skills, problem-solving, pattern recognition, retention and memory, multi-tasking, and logic. This broad scope of examination is intended to exclude or disadvantage as few test-takers as possible.

Wechsler, David (1939). *The Measurement of Adult Intelligence*. Baltimore (MD): Williams &

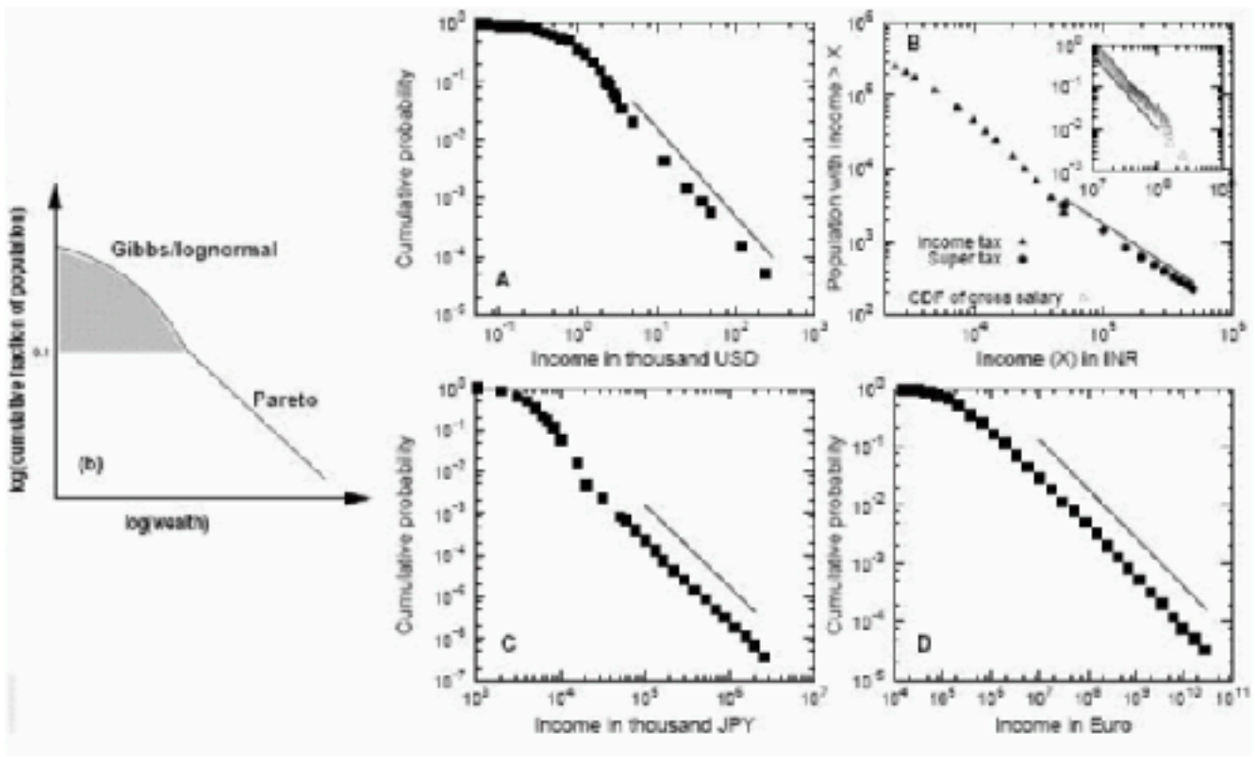
Kaufman, Alan S.; Lichtenberger, Elizabeth (2006). *Assessing Adolescent and Adult Intelligence* (3rd ed.). Hoboken (NJ):

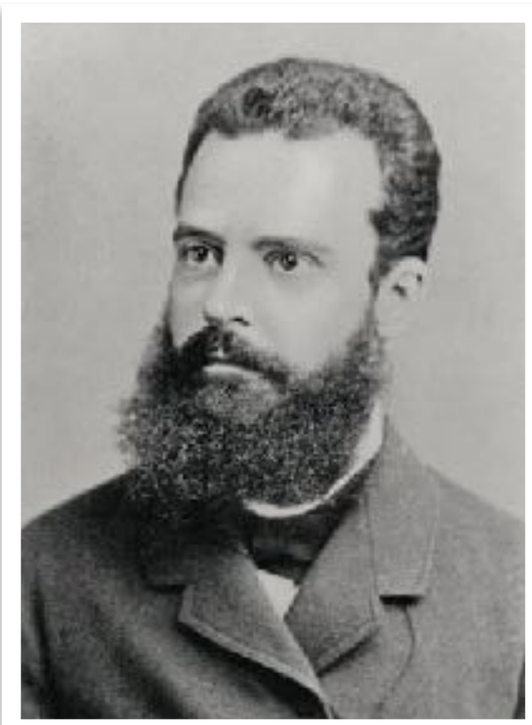
2nd fact

The distribution of wealth: *Pareto law* or 80:20 rule

Vilfredo Federico Damaso Pareto, born in Italy in 1848, was a famous economist.
He noticed that 20% of the pea plants in his garden generated 80% of the healthy pea pods. This observation caused him to think about uneven distribution. He thought about wealth and discovered in 1906 that 80% of the land in Italy was owned by just 20% of the population. He investigated different industries and found that 80% of production typically came from just 20% of the companies.

The Pareto law is an illustration of a "power law" relationship, which also occurs in phenomena such as forest fires, avalanches, earthquakes and other natural phenomena close to criticality





The graph at left shows how 90% of a population follows a log-normal wealth distribution, while the richest 10% veers off in a tail following a Pareto power law distribution. Examples of this model with data from different countries are shown at right. Credit: Chatterjee, *et al.*

Our *Talent* vs *Luck* model

- Working life period of **40 years**
- **1000 agents** considered and uniformly distributed in a square lattice
- Agents have a **normal (Gaussian) distribution of talent**
- Agents during their life period can encounter **lucky** (green points) or **unlucky** events (red points) uniformly distributed and with equal probability of occurrence
- **Check** of lucky or unlucky event occurrence **every 6 months**
- All agents have the same **initial capital of 10 units**

Dynamics of the model

1. **A lucky event intercepts the position of agent A_k:** this means that a lucky event has occurred during the last six month; as a consequence, agent A_k doubles her capital/success with a probability proportional to her talent T_k.

   It will be $\mathbf{C_k(t) = 2C_k(t-1)}$ only if rand[0,1] < T_k,

   i.e. if the agent is smart enough to profit from her luck.

2. **An unlucky event intercepts the position of agent A_k:** this means that an unlucky event has occurred during the last six month; as a consequence, agent A_k halves her capital/success, i.e.

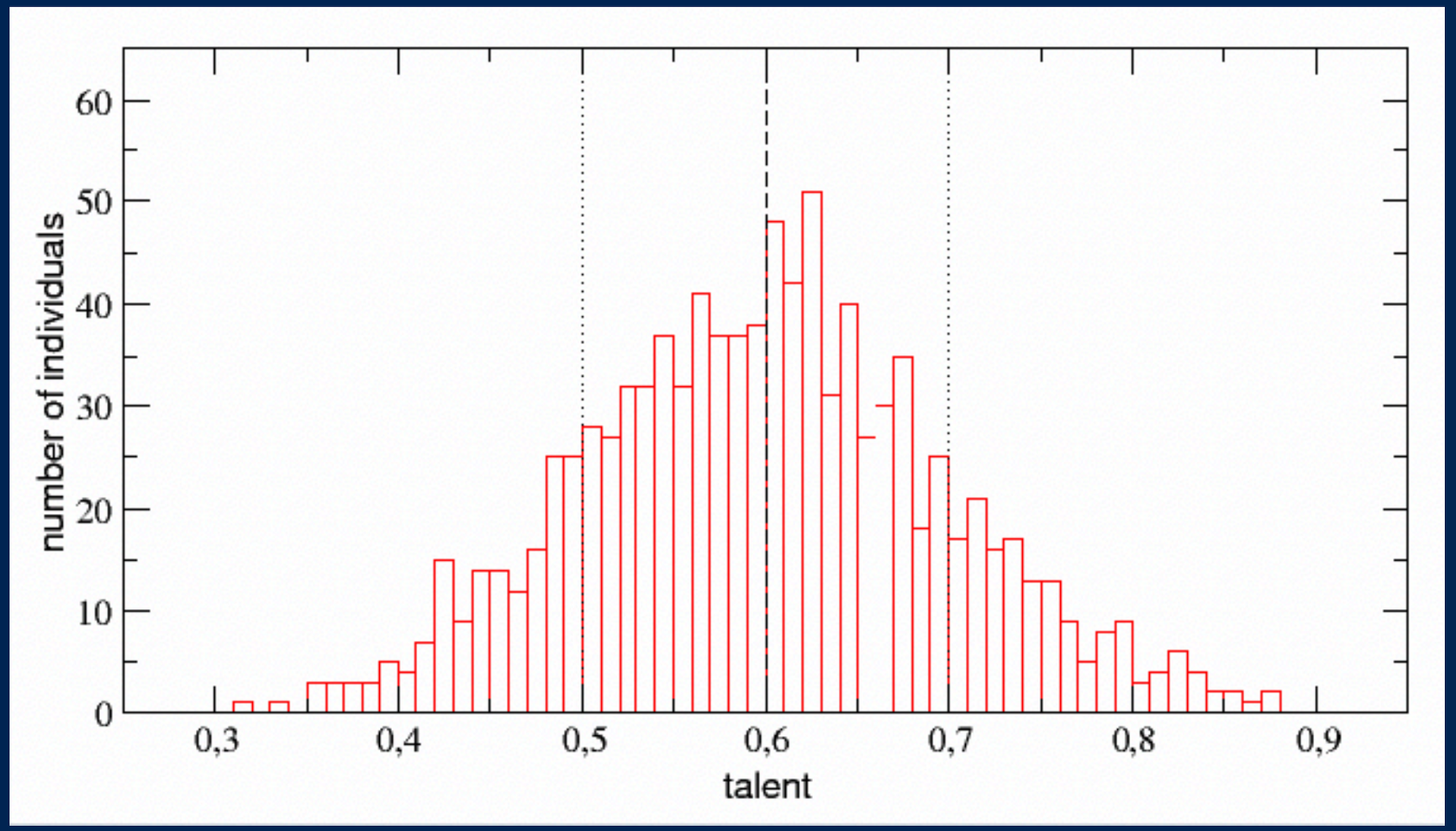
   $$\mathbf{C_k(t) = C_k(t-1)/2}$$

Talent vs Luck (TvL) model

N = 1000 individuals (agents), with different degrees of talent (intelligence, skills, endurance, etc.), are randomly located in fixed positions within a square world.

During each simulation, which covers 40 years, they are exposed to a certain number N_E of lucky (green circles) and unlucky (red circles) events, which move across the world following random trajectories (random walks).

Normal distribution of *talent* (*skill, endurance, hard work, etc*)

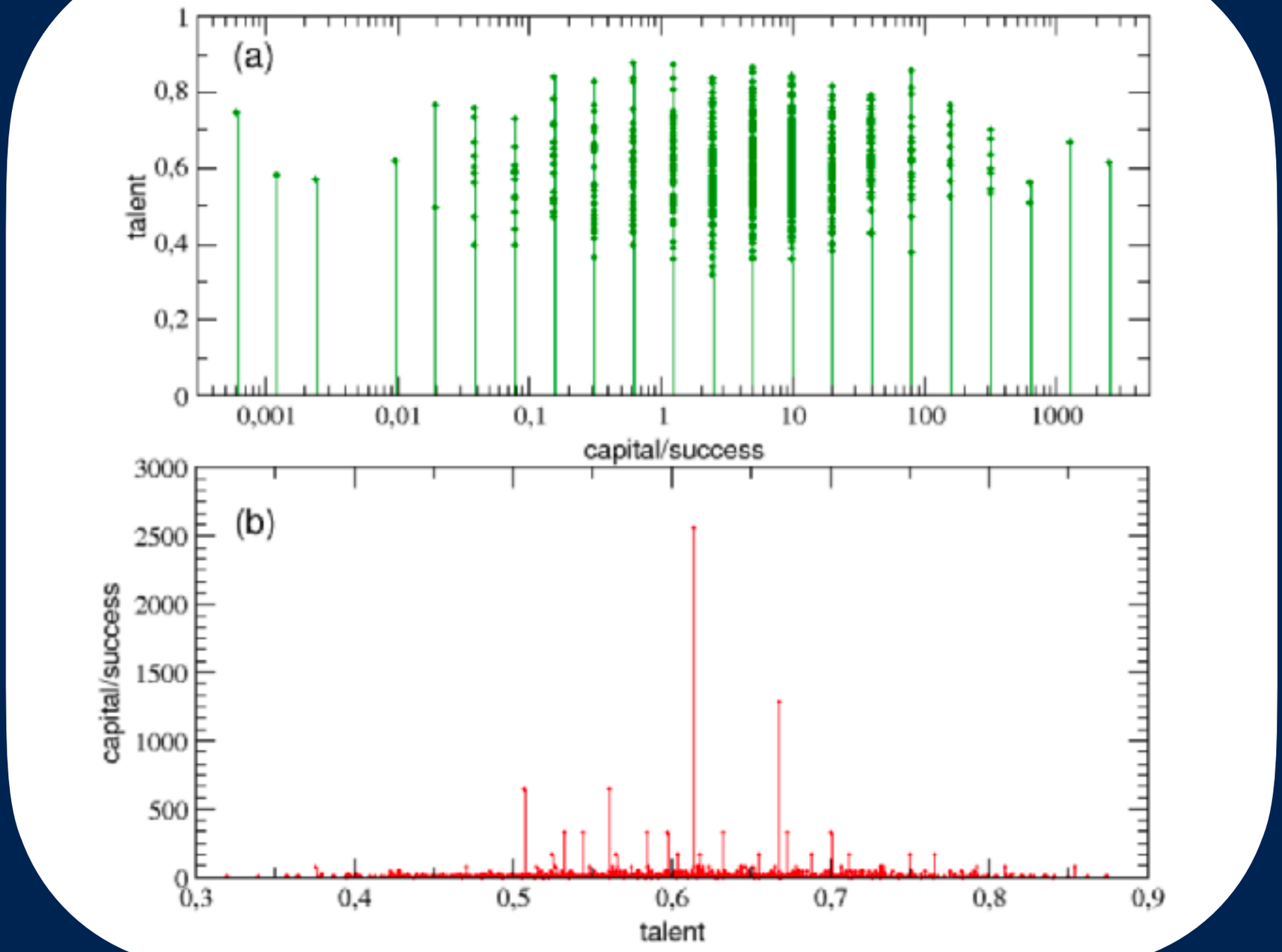


Normal distribution of talent among the population with mean $m_T = 0.6$, and standard deviation $\sigma_T = 0.1$

The values $m_T \pm \sigma_T$ are indicated by two dotted vertical lines

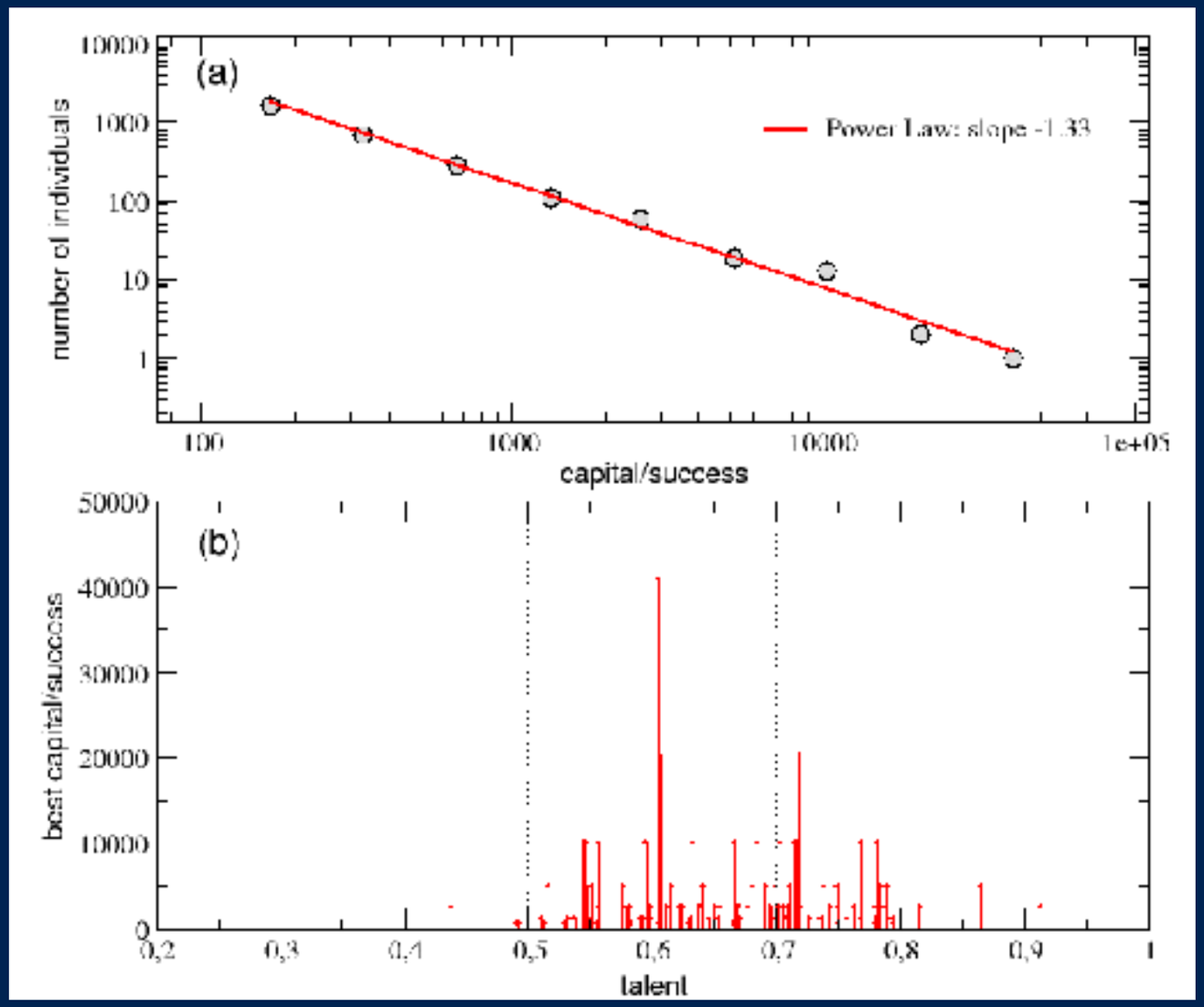
This distribution does not change during the simulation

First Results



The most successful individuals are not the most talented ones, but those with an average talent !

Results averaged over 100 runs



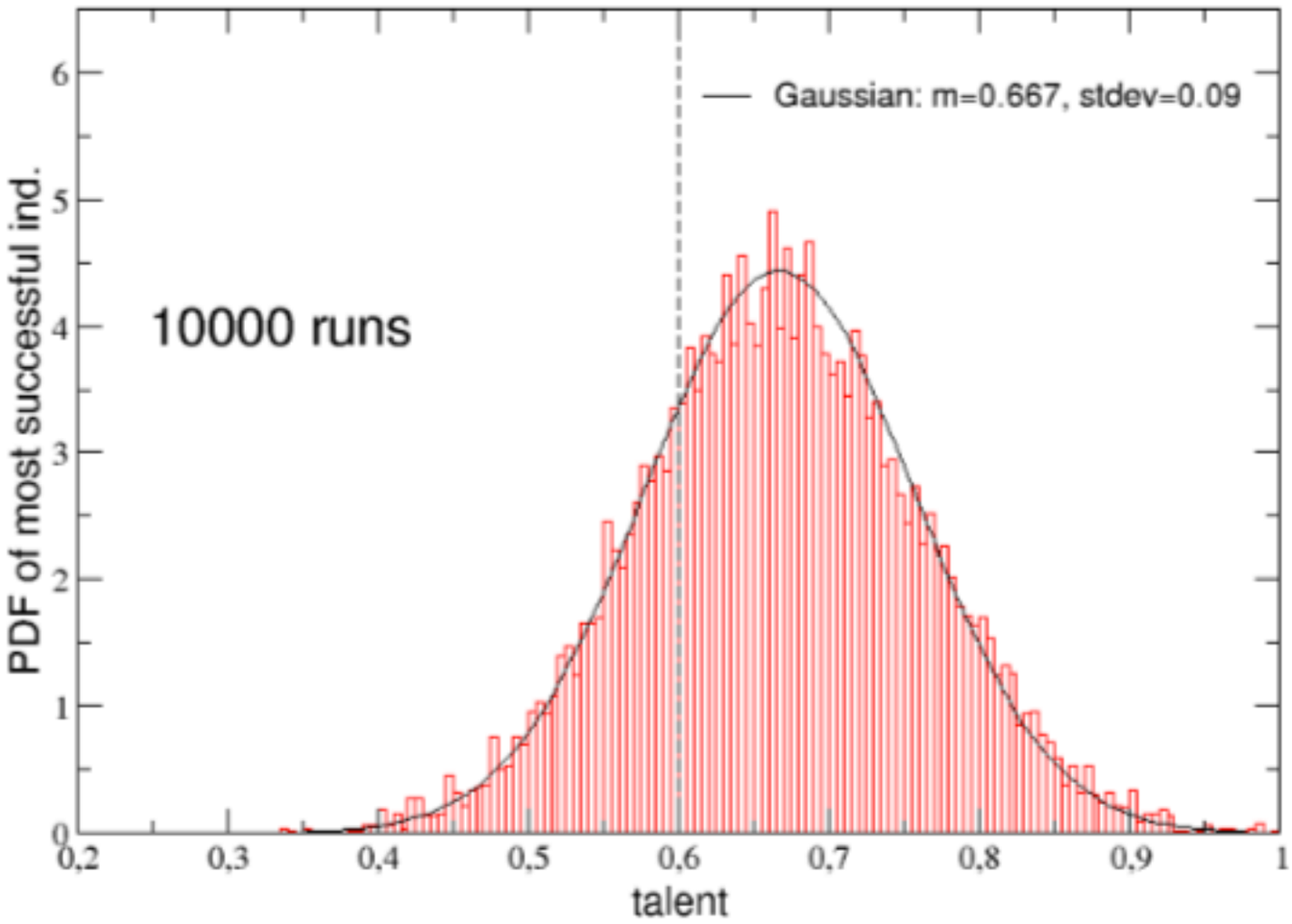
Panel (a): Distribution of the final capital/ success, *averaged over 100 runs* for a population with different random initial conditions. The distribution can be well fitted with a power-law curve with a slope -1.33.

Panel (b): The final capital of the most successful individuals in each of the 100 runs is reported as function of their talent.

Agents with a medium-high talent result to be, on average, more successful than people with low or medium-low talent.

Very often the most successful individual is a moderately gifted agent and only rarely the most talented one !

Distribution of most successful agents



The most successful individuals over 10000 runs are almost never the most talented ones !

So there is a Big Problem :

if we use *Success/Capital* as a proxy for *Talent* ,
we risk to give funds, rewards, honors, etc.

NOT to the *most talented individuals,*

BUT to the *luckiest ones* *("naive meritocracy")*

Question

Is it possible to distribute funds periodically in order

to give another possibility to the most talented agents

to be able to emerge and be successful?

$$Eff = \frac{\text{Increment of talented people (T>0.7) with respect to the no funding case}}{\text{Total given funding}}$$

Best strategies to distribute new funds to agents

FUNDING-TARGET	E_{norm}	P_T	$P^*_T = P_T - P_{T0}$	F_T
ALL EQUAL 1u	1,00	69,48	37,43	8000
10% RANDOM 5u	0,85	49,83	17,78	4000
25% RANDOM 5u	0,79	68,00	35,95	10000
ALL EQUAL 2u	0,74	84,02	51,97	16000
50% RANDOM 5u	0,58	82,91	50,86	20000
25% BEST 5u, OTHERS 1u	0,55	70,83	38,78	16000
25% BEST 10u, OTHERS 1u	0,37	73,44	41,39	26000
ALL EQUAL 5u	0,37	94,40	62,35	40000
25% RANDOM 20u	0,31	84,74	52,69	40000
50% BEST 5u	0,25	54,26	22,21	20000
25% BEST 10u, OTHERS 5u	0,21	94,82	62,77	70000
25% BEST 5u	0,20	41,08	9,03	10000
25% BEST 10u	0,12	42,33	10,28	20000
10% BEST 5u	0,10	34,14	2,09	4000
25% BEST 15u	0,09	43,51	11,46	30000
25% BEST 20u	0,07	44,26	12,21	40000
10% BEST 10u	0,06	34,41	2,36	8000
10% BEST 20u	0,04	34,98	2,93	16000
NO FUNDING	0,00	32,05	0,00	0

P_T= Percentange of talented people ($T>0.7$) with a final capital greater than the initial one

P^*_T= Percentange of talented people ($T>0.7$) with a final capital greater than the initial one with respect to the case of no funding P_{T0}

funds given every five years

Funding strategy table with the efficiency index Enorm (averaged over 100 runs) in decreasing order and for different total capital distributed FT

The egalitarian and the random strategies are the most efficient ones!

Best strategies to distribute funds to agents

FUNDING-TARGET	E_{norm}	P_T	$P^*_T = P_T - P_{T0}$	F_T
ALL EQUAL	1,00	98,14	67,68	80000
50% RANDOM	0,98	97,12	66,66	80000
HALF 25% BEST, HALF TO OTHERS	0,97	96,13	65,67	80000
25% RANDOM	0,85	87,67	57,21	80000
10% RANDOM	0,54	66,73	36,27	80000
50% BEST	0,45	61,19	30,73	80000
25% BEST	0,22	45,31	14,85	80000
10% BEST	0,06	34,83	4,37	80000
NO FUNDING	0,00	30,46	0,00	0

Funding strategy table with a fixed quantity of funds $F_T = 80000$ units

Also in this case the egalitarian strategy and the random one are at the top of the ranking!

Giving funds and resources to those most successful in the past , "naive meritocracy", is not only unfair (since these are often only the most lucky ones), but it does not pay in terms of further success and innovation

OPEN ACCESS Freely available online

PLOS ONE

Big Science vs. Little Science: How Scientific Impact Scales with Funding

Jean-Michel Fortin, David J. Currie*

Ottawa-Carleton Institute of Biology, University of Ottawa, Ottawa, Ontario, Canada

Abstract

Agencies that fund scientific research must choose: is it more effective to give large grants to a few elite researchers, or small grants to many researchers? Large grants would be more effective only if scientific impact increases as an accelerating function of grant size. Here, we examine the scientific impact of individual university-based researchers in three disciplines funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). We considered four indices of scientific impact: numbers of articles published, numbers of citations to those articles, the most cited article, and the number of highly cited articles, each measured over a four-year period. We related these to the amount of NSERC funding received. Impact is positively, but only weakly, related to funding. Researchers who received additional funds from a second federal granting council, the Canadian Institutes for Health Research, were not more productive than those who received only NSERC funding. Impact was generally a decelerating function of funding. Impact per dollar was therefore lower for large grant-holders. This is inconsistent with the hypothesis that larger grants lead to larger discoveries. Further, the impact of researchers who received increases in funding did not predictably increase. We conclude that scientific impact (as reflected by publications) is only weakly limited by funding. We suggest that funding strategies that target diversity, rather than "excellence", are likely to prove to be more productive.

Citation: Fortin J-M, Currie DJ (2013) Big Science vs. Little Science: How Scientific Impact Scales with Funding. PLoS ONE 8(6): e65263. doi:10.1371/journal.pone.0065263

Editor: Vincent Larivière, Université de Montréal, Canada

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Encouraging diVeRsity instead of Excellence or Conformism produces a better research !

MENU nature

EDITORIAL · 06 JUNE 2018

Science benefits from diversity

Improving the participation of under-represented groups is not just fairer — it could produce better research.

Institutions have a moral and ethical duty to make scientific research more diverse and representative. Credit: CIST

Lab groups, departments, universities and national funders should encourage participation in science from as many sectors of the population as possible. It's the right thing to do — both morally and to help build a sustainable future for research that truly represents society.

PDF version

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Strength in diversity

that needs to be in place to deliver the drugs".

To remedy these disparities, she says she would like to see health officials engage with local communities and expand access to testing centres to ensure equal access to the drug. Health officials have successfully narrowed similar disparities in the number of people who received their primary COVID-19 vaccination series by bringing vaccines "to people in the areas they live, work and play".

COVID-19 isn't going away, says Smith, so it's important to develop other antiviral drugs. Paxlovid could soon have competition: in November, Japan authorized ensitrelvir, a once-daily antiviral made by the Japanese pharmaceutical company Shionogi, based in Osaka, and Hokkaido University in Japan. And in July, China authorized the use of an HIV drug to treat COVID-19.

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'DISRUPTIVE' SCIENCE HAS DECLINED — EVEN AS PAPERS PROLIFERATE

The proportion of publications that send a field in a new direction has plummeted since the 1940s.

By Max Kozlov

The number of science and technology research papers published has skyrocketed over the past few decades — but the 'disruptiveness' of those papers has dropped, according to an analysis of how radically papers depart from the previous literature[1].

Data from millions of manuscripts show that, compared with mid-twentieth-century research, that done in the 2000s was much more likely to push science forward incrementally than to veer off in a new direction and render previous work obsolete. Analysis of patents from 1976 to 2010 showed the same trend.

"The data suggest something is changing," says Russell Funk, a sociologist at the University of Minnesota in Minneapolis and a co-author of the analysis, which was published on 4 January in *Nature*. "You don't have quite the same intensity of breakthrough discoveries you once had."

Telltale citations

The authors reasoned that if a study was highly disruptive, subsequent research would be less likely to cite the study's references, and instead would cite the study itself. Using the citation data from 45 million manuscripts and 3.9 million patents, the researchers calculated a measure of disruptiveness, called the CD index, in which values ranged from −1 for the least disruptive work to 1 for the most disruptive.

The average CD index declined by more than 90% between 1945 and 2010 for research manuscripts (see 'Disruptive science dwindles'), and by more than 78% from 1980 to 2010 for patents. Disruptiveness declined in all of the analysed research fields and patent types.

The authors also analysed the most common verbs used in manuscripts and found that whereas research in the 1950s was more likely to use words evoking creation or discovery, such as 'produce', that done in the 2010s was more likely to refer to incremental progress, using terms such as 'improve' or 'enhance'.

"It's great to see this [phenomenon] documented in such a meticulous manner," says Dashun Wang, a computational social scientist at Northwestern University in Evanston, Illinois, who studies disruptiveness in science. "They look at this in 100 different ways, and I find it very convincing overall."

Other research[2] has suggested that scientific innovation has slowed in recent decades, too, says Yian Yin, also a computational social scientist at Northwestern. But this study offers a "new start to a data-driven way to investigate how science changes", he adds.

Disruptiveness is not inherently good, and incremental science is not necessarily bad, says Wang. The first direct observation of gravitational waves, for example, was both revolutionary and the product of incremental science, he says.

The ideal is a healthy mix of incremental and disruptive research, says John Walsh, a specialist in science and technology policy at the Georgia Institute of Technology in Atlanta. "In a world where we're concerned with the validity of findings, it might be a good thing to have more replication and reproduction," he says.

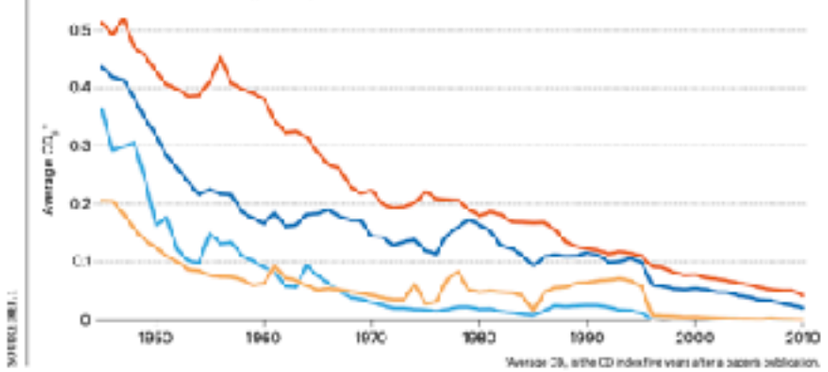
Why the slide?

The drastic change might stem in part from changes in the scientific enterprise. For example, large research teams have become more common, and Wang and his colleagues have found[3] that big teams are more likely to produce incremental than disruptive science.

Finding an explanation for the decline won't be easy, Walsh says. Although the proportion of disruptive research dropped significantly between 1945 and 2010, the number of highly disruptive studies has remained about the same. The rate of decline is also puzzling: CD indices fell steeply from 1945 to 1970, then more gradually from the late 1990s to 2010. "Whatever explanation you have for disruptiveness dropping off, you need to also make sense of it levelling off" in the 2000s, he says.

DISRUPTIVE SCIENCE DWINDLES

To quantify how much a paper shakes up a field, researchers used a metric called a CD index, which ranges from 1 for the most disruptive papers to −1 for the least disruptive. Analysis of millions of papers shows that disruptiveness has fallen over time in all analysed fields.



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On the other hand, it has recently been realized that, notwithstanding the huge proliferation of publications, there are several indications of conformity…and decline of disruptiveness in Science in the last decades

(See Nature paper January 2023)

Recently the suggestion to give funds by using a random selection of projects with a minimum level of quality prerequisites has been advanced by several parts !

PLOS BIOLOGY

META-RESEARCH ARTICLE

Contest models highlight inherent inefficiencies of scientific funding competitions

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Abstract

Scientific research funding is allocated largely through a system of soliciting and ranking competitive grant proposals. In these competitions, the proposals themselves are not the deliverables that the funder seeks, but instead are used by the funder to screen for the most promising research ideas. Consequently, some of the funding program's impact on science is squandered because applying researchers must spend time writing proposals instead of doing science. To what extent does the community's aggregate investment in proposal preparation negate the scientific impact of the funding program? Are there alternative mechanisms for awarding funds that advance science more efficiently? We use the economic theory of contests to analyze how efficiently grant proposal competitions advance science, and compare them with recently proposed, partially randomized alternatives such as lotteries. We find that the effort researchers waste in writing proposals may be comparable to the total scientific value of the research that the funding supports, especially when only a few proposals can be funded. Moreover, when professional pressures motivate investigators to seek funding for reasons that extend beyond the value of the proposed science (e.g., promotion, prestige), the entire program can actually hamper scientific progress when the number of awards is small. We suggest that lost efficiency may be restored either by partial lotteries for funding or by funding researchers based on past scientific success instead of proposals for future work.

Recently the suggestion to give funds by using a random selection of projects with a minimum level of prerequisites has been advanced by several parts !

TheScientist
EXPLORING LIFE, INSPIRING INNOVATION

Q&A: A Randomized Approach to Awarding Grants

Denmark's Novo Nordisk Foundation says it hopes that adding a randomization step to its award process will reduce implicit biases in selection and lead to funding more innovative, impactful research.

Natalia Mesa
Feb 25, 2022

PDF VERSIC

The Novo Nordisk Foundation, one of the largest private scientific research funders in the world, announced last month that it would begin employing a partial randomization system to fund some types of research projects. I the next three years, the Copenhagen-based funding agency will use a combination of committee selection and a lottery system to choose some of the awardees of its $500,000 Project Grants in t fields of biomedicine, biotechnology, and natural and technical sciences, as well as its $800,000 Exploratory Interdisciplinary Synergy Grants. Together, these grants comprise roughly 10 percer the organization's total research project funding, says Lene Oddershede, the senior vice presiden natural and technical sciences at the Novo Nordisk Foundation, who oversees the grant funding process. She says she hopes that the partial randomization system will reduce conscious and unconscious bias in the committee selection process and improve funding inequities.

ABOVE:
NOVO NORDISK FOUNDATION

"I think most researchers want to see that the applications are treated in a fair manner and in a transparent manner," says Oddershede. Scientists also want to ensure "that the best research is funded, of course," she says, "but what is best research?"

In Denmark, 90 percent of the funding goes to just 20 percent of researchers, and a similar concentration exists in many countries. According to recent studies in the United States, for instance, funding inequities have increased in the past decade. In 2020, the top 1 percent most

Recently the suggestion to give funds by using a random selection of projects with a minimum level of prerequisites has been advanced by several parts !

The international journal of science / 22 September 2022

nature

The case for lotteries as a tiebreaker in research funding

More funders should consider using randomization to choose grant recipients when decisions are too close to call.

Earlier this month, the British Academy, the United Kingdom's national academy for humanities and social sciences, introduced an innovative process for awarding small research grants. The academy will use the equivalent of a lottery to decide between funding applications that its grant-review panels consider to be equal on other criteria, such as the quality of research methodology and study design.

Using randomization to decide between grant applications is relatively new, and the British Academy is in a small group of funders to trial it, led by the Volkswagen Foundation in Germany, the Austrian Science Fund and the Health Research Council of New Zealand. The Swiss National Science Foundation (SNSF) has arguably gone the furthest: it decided in late 2021 to use randomization in all tiebreaker cases across its entire grant portfolio of around 880 million Swiss francs (US$910 million).

Other funders should consider whether they should now follow in these footsteps. That's because it is becoming clear that randomization is a fairer way to allocate grants when applications are too close to call, as a study from the Research on Research Institute in London shows (see go.nature.com/3s54tgw). Doing so would go some way to assuage concerns, especially in early-career researchers and those from historically marginalized communities, about the lack of fairness when grants are allocated using peer review.

The British Academy/Leverhulme small-grants scheme distributes around £1.5 million (US$1.7 million) each year in grants of up to £10,000 each. These are valuable despite their relatively small size, especially for researchers starting out. The academy's grants can be used only for direct research expenses, but small grants are also typically used to fund conference travel or to purchase computer equipment or software. Funders also use them to spot promising research talent for future (or larger) schemes. For these reasons and more, small grants are competitive — the British Academy says it is able to fund only 20–30% of applications in each funding round.

The academy's problem is that its grant reviewers say that twice as many applications as this pass the quality threshold, but the academy lacks the funds to say yes to them all. So it is forced to make choices about who to fund and who to reject — a process prone to human biases.

> "Deciding who to fund by entering applicants into a lottery is one way to reduce unfairness."

Deciding who to fund by entering tie-breaker applicants into a lottery is one way to reduce unfairness. The fix isn't perfect: studies show that biases still exist during grant review[1,2]. But biases, such as recognizing more senior researchers, people with recognizable names, or people at better-known institutions, are more likely to creep in and influence the final decision when cases are too close to call.

It is good to see research-informed innovation in grant-giving — even a decade ago, it's highly unlikely that lotteries would have become part of the conversation. That they have now, is in large part down to research, and in particular to findings from studies of research funding. Funders must now turn to the impact of their changes — assessing in particular whether lotteries have increased the diversity of applicants or made changes to reviewer workload. At the same time, researchers (and funders) need to test other models for grant allocation. One such model is what researchers call 'egalitarian' funding, by which grants are distributed more equally and less competitively[3].

Innovating, testing and evaluating are all crucial to reducing bias in grant-giving. Using lotteries to decide in tie-breaker cases is a promising start.

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Cut fast fashion's staggering environmental impact

The textiles industry urgently needs input from researchers to help it to embrace the circular economy.

Clothes were once used until they fell apart — repaired and patched to be re-used, ending their lives as dishcloths and dirty rags. Not today. In high-income countries in particular, clothing, footwear and upholstered furniture are increasingly frequently bought, discarded and replaced with new fashions, which are themselves soon discarded and replaced.

The proof is there in the data. In 1995, the textiles industry produced 7.6 kilograms of fibre per person on the planet. By 2018, this had nearly doubled to 13.8 kilograms per person — during which time the world's population also increased, from 5.7 billion to 7.6 billion people. More than 60 million tonnes of clothing is now bought every year, a figure that is expected to rise still further, to around 100 million tonnes, by 2030.

Conclusions

- I have presented a simple toy model which is able to reproduce several *stylised facts* about the role of lucky events in order to reach success in life and science.
- The model shows that *the most talented people are rarely the most successful*, the latter being usually those with an average talent
- Risks of *"naive meritocracy"* !
- By adopting funding strategies that give new opportunities to everybody, instead of rewarding only those who were the most successful in the past, it is possible to foster both the emergence of the most talented ones and more innovative ideas with a benefit for the single individuals, but also for science progress and for the entire society

One last point: In order to have a beautiful garden…

…is it better to water only a few beautiful (excellent) plants…

…or to give water to all the plants?

I think you know the answer !

Someone once said…

”He did not know he could not do it, but he did it and he succeeded !!”

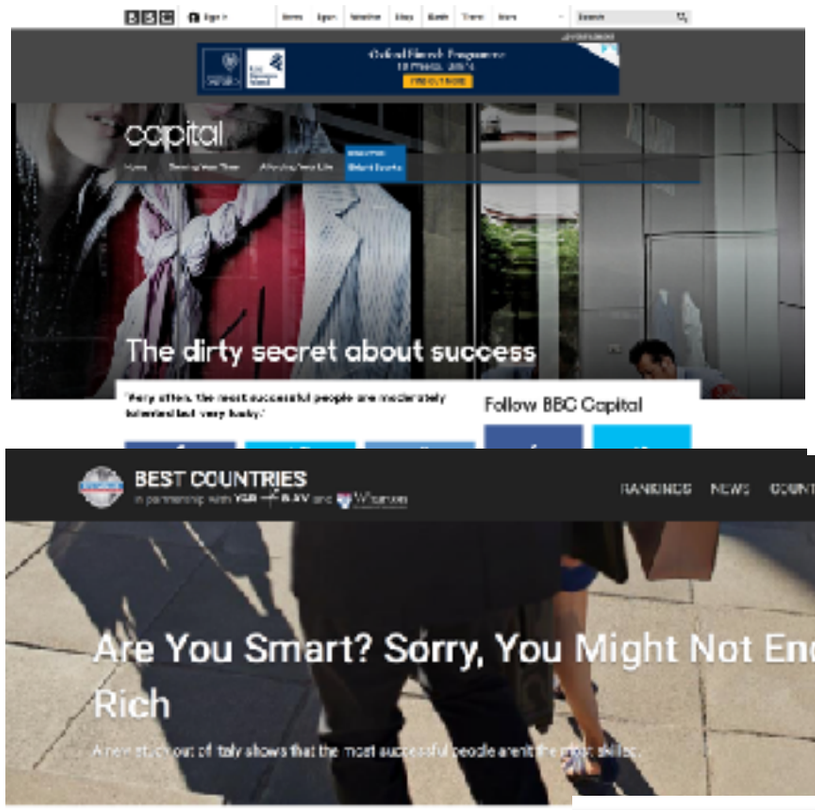
A few decades later…

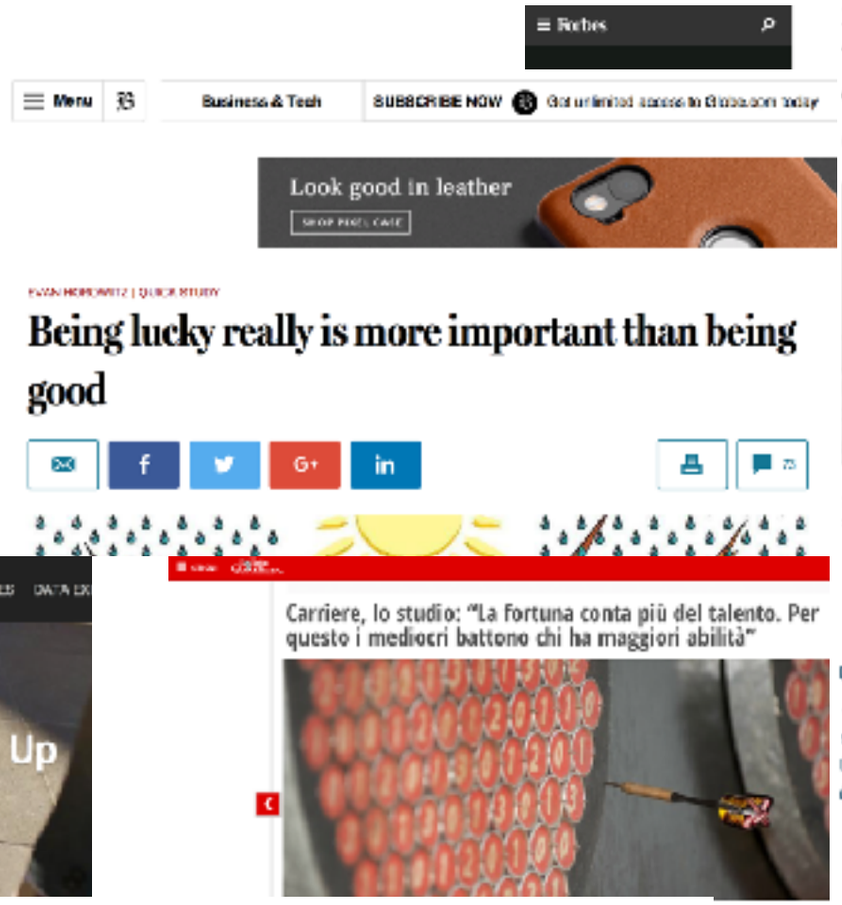
So now and then, it is better to give a chance also to apparently out-of-the box ideas… they may not be so crazy after all.

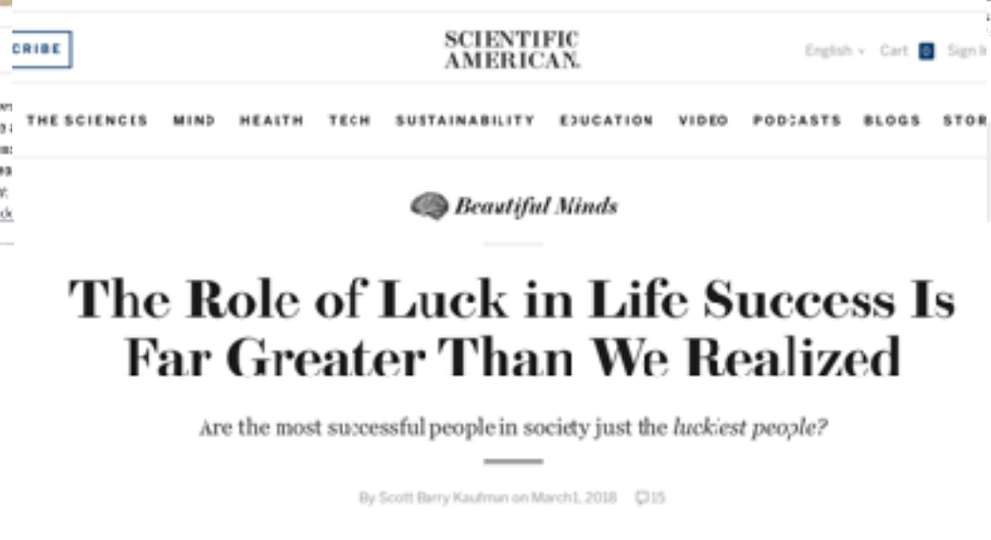
Science funding has to risk in order to foster innovation !!

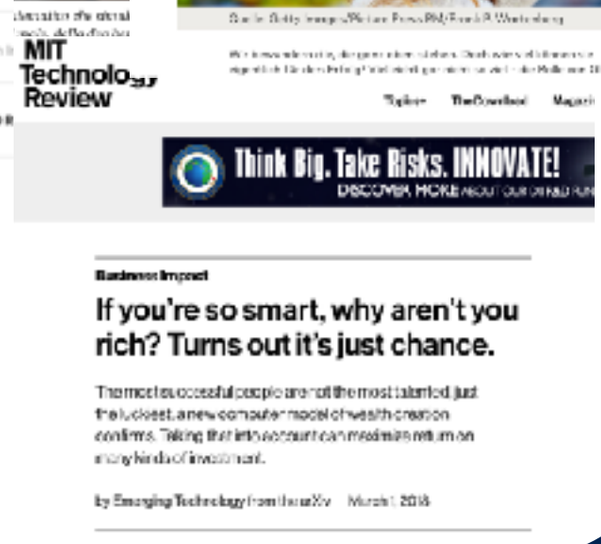
This study was very lucky …and it got a great and unexpected amount of attention among scientists and social media since it was posted online as a preprint in 2018

Social media

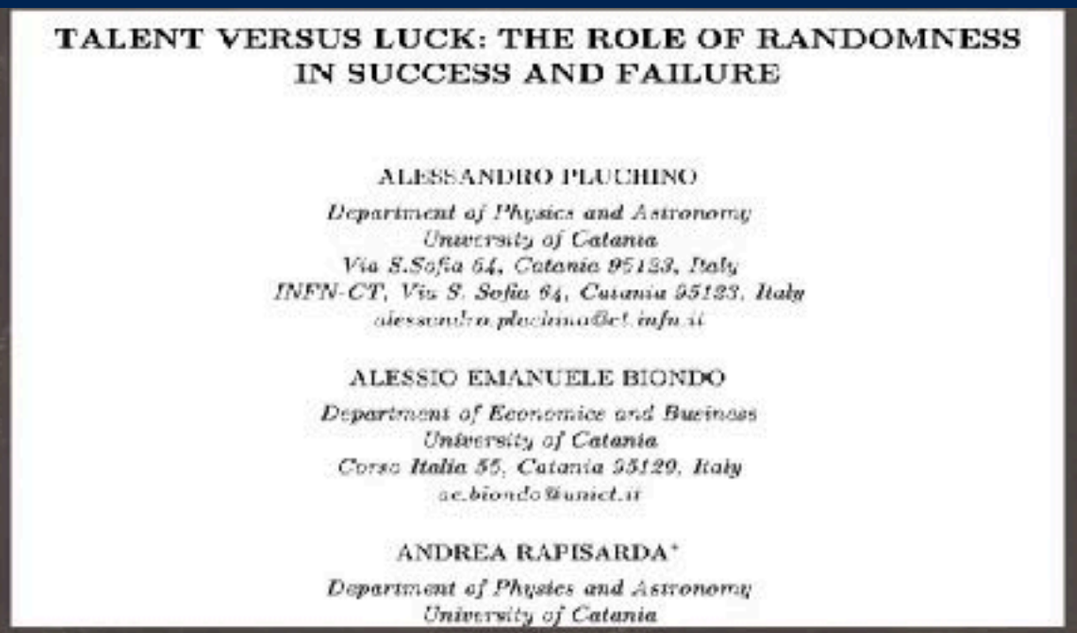








Ig Nobel prize for Economics 2022



TALENT VERSUS LUCK: THE ROLE OF RANDOMNESS IN SUCCESS AND FAILURE

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The 32nd First Annual Ig Nobel Prize Ceremony

You can find more info on this project at following link:
http://www.andrea-rapisarda.it/talent-vs-luck

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Prof . Andrea Rapisarda's home page

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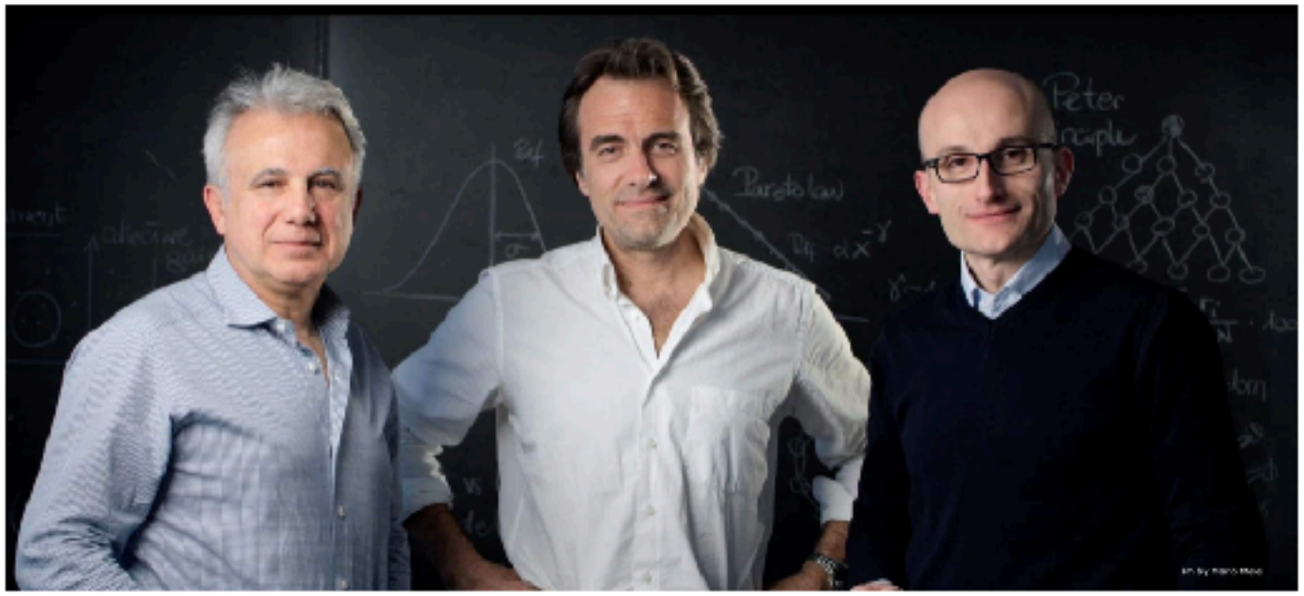

Talent vs Luck

Talent vs Luck: The Role of Randomness in Success and Failure

Our fist paper

Advances in Complex Systems - Vol. 21, No. 03n04, 1850014 (2018)

ALTMETRIC SCORE

On September 15, 2022 the paper was awarded with the
Ig Nobel prize for Economics
(see link)

Thanks for your attention and …