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The alarming erosion of scientific publication
El singular deterioro de la publicación científica
A singular deterioração da publicação científica

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Abstract

Ideas must be public. No knowledge can be built if ideas are not shared. No progress is made if it is not possible to climb on the shoulders of others. Scientific publication is not just convenient or advisable: it is imperative. And yet, this task constitutes an amazingly complex problem with no simple solutions. The scientific community is made up of millions of individuals. Managing the communication and sharing of ideas in this scenario in a correct, fair and functional way is far from being simple. The following text is a brief (and biased) analysis of the current state of the scientific publication system, being discussed how it has hijacked the scientific activity both because of the effort and resources that must be invested in it, and because of how it influences the direction science research must take. And how, together with researchers, journals have participated in the decline and trivialization of scientific communication and the transformation of science into a business.

Keywords: Social alienation, science of science, corruption, selective dissemination of information, text editing, critical thinking, scientific publication.

Resumen

Las ideas deben ser públicas. No se construye conocimiento si no se comparten ideas. No se avanza si no es posible trepar a hombros de otros. La publicación científica no es conveniente o aconsejable: es un imperativo. Y, sin embargo, llevar a cabo esta labor entraña un problema complejo para el que no parece haber soluciones sencillas. Hoy, la comunidad científica está compuesta por millones de individuos. Gestionar la labor de comunicación de ideas en este escenario de forma correcta, justa y funcional, no resulta una tarea fácil. El texto que sigue es un análisis somero, tal vez sesgado y seguramente vehemente, sobre el estado actual de la publicación científica. Se discutirá cómo ésta ha secuestrado la actividad científica tanto por el esfuerzo y recursos que se deben invertir en ella, como por su influencia a la hora de decidir qué se debe investigar. Y cómo, en connivencia con los investigadores, las revistas han participado

del deterioro y banalización de la comunicación científica y la transformación de la ocupación científica en un negocio.

Palabras clave: Alienación social, ciencia de la ciencia, corrupción, difusión selectiva de información, edición de textos, pensamiento crítico, publicación científica.

Resumo

As ideias devem ser públicas. O conhecimento não se constrói se as ideias não forem partilhadas. Não há progresso se não for possível subir para os ombros dos outros. A publicação científica não é conveniente nem aconselhável: é um imperativo. E, no entanto, a realização desta tarefa envolve um problema complexo para o qual não parece haver soluções simples. Hoje a comunidade científica é constituída por milhões de indivíduos. Gerir o trabalho de comunicação de ideias neste cenário de forma correta, justa e funcional não é tarefa fácil. O texto que se segue é uma análise breve, talvez tendenciosa e certamente veemente, do estado actual do sistema de publicação científica. Será discutido como sequestrou a atividade científica tanto pelo esforço e recursos que nela devem ser investidos, como pela sua influência na decisão do que deve ser investigado. E como, em conluio com investigadores, as revistas têm participado na deterioração e banalização da comunicação científica e na transformação da ocupação científica num negócio.

Palavras-chave: Alienação social, ciência da ciência, corrupção, divulgação seletiva de informação, edição de textos, pensamento crítico, publicação científica.

Introduction

The astronomer Edmund Halley wandered through the streets of London during a cloudy autumn evening. A colleague of his had just found the solution to an amazingly complex problem. A problem which had challenged the intelligence of scientists and philosophers for decades. And this solution seemed correct. Edmund had proven it firsthand. Recently the astronomer had studied the trajectory of a comet, and his observations and measurements matched the new theory with surprising precision. It was not only that his friend's theory seemed correct, but it also explained a large number of phenomena. This new idea had the potential to change everything. That autumn evening the world had changed and Halley was the only person who knew it. The astronomer could hardly contain his need to tell the world what only he knew.

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However, Halley was troubled because this brilliant colleague of his did not seem to be aware of the importance of his own discovery, and, for some enigmatic reason, he wanted to keep it a secret. Edmund had to work hard to convince him to write down his new theory and make it public. The astronomer even offered his help in the writing process and promised that he himself would take care of the publication fees, which, at the end of the 17th century, were more than significant. Finally, thanks to Halley's stubbornness, on July 5th, 1687, the *Principia Matematica* was published (Newton, 2022), a work that would change everything from our understanding of the universe to the way we wage war.

The publication of ideas and results is a key part of science. A new idea has no value if it is not disseminated so that it can be tested, criticized or verified by others and, ultimately, learned from. Would it have been catastrophic if a surly and antisocial Newton had not published his work? Or if the *Principia* instead of being published, had been lost, forgotten in a drawer in a farmhouse in Lincolnshire? Newton's laws would now be called something else and our understanding of them would have been delayed by 20 or 30 years. It would not have been catastrophic but all of Newton's work, majestically housed in his British skull, would have been useless and would have contributed nothing to human knowledge.

An unusual system

It is hard to diagnose the state of health of the scientific publishing system today. However, it could be said that the vast majority of researchers agree that it is far from being acceptable. Others less moderate would say that it is a disaster in the making. And I say, currently, not to fall into nostalgia but to narrow the issue: I doubt that scientific publishing has ever been healthy.

It might be useful to describe the process of publishing a scientific paper. Not everyone knows about this process and even when it is explained, it is difficult to believe that such a thing exists and works the way it does.

Researchers carry out their work laboriously, funded by public or private institutions. Once they consider that they have accumulated enough knowledge about a particular problem, the time comes to communicate their results. And the first thing they must do is to choose which journal to publish in. This decision depends essentially on two factors: the area of science to which said result belongs and its relevance.

The first problem has an easy solution. Finding a journal that covers your area of expertise is easy. Scientific journals have proliferated like well-fed bacteria and today we have as many as we may need. And they continue to multiply. There is a journal for you, no matter how specialized your area of research is (Hanson et al., 2024; Ghasemi et al., 2022).

The second problem is a little more difficult to handle. What is the relevance of the result that has been obtained? Is it worth trying to publish it in an important journal? Or is it a minor result? It is hard to know. However, over time researchers develop a sort of sixth sense that allows them to decide which journal to send an article to, with a high probability of it being published.

The early choice of journal is also important for a much more mundane reason: while preparing the text of our article, we must adhere to the aesthetic and formal specifications of the chosen journal. Each publication has its own guidelines that authors should review and that inform them of how they should present the articles, such as the length of the text, its structure, its sections, how to prepare figures, tables or equations, or what is the appropriate format for bibliographic citations. Once the researcher has written, formatted and laid out the paper following the journal's instructions to the letter, he sends it to the editor.

The role of the editor is sometimes obscure and enigmatic. He will act first as a filter. He will check, for example, if the subject dealt with in the article coincides with the area of interest of the journal. And after a quick and superficial reading, the editors of some important journals also decide whether the value of the submitted article is sufficient to be included in their publication. This constitutes the first step.

If the editor thinks it is interesting enough, the paper will enter the next phase: the famous peer review. The diligent editor will search a database for scientists working in the same area covered by the article (the peers) and send the text to them. The peers will read it carefully, analyze it, critique it and prepare an evaluation that will help the editor decide whether what has been written is correct and whether it has any value. Peer review is a process of variable duration that can extend to years. Peers point out errors, argue with authors, request that theories be revised, ask for ideas to be elaborated more clearly or, in certain cases, suggest that further experiments be carried out to support the conclusions. The final result of this long process may be a recommendation that the work be published or rejected.

An essential function that the editor must carry out is to play the role of mediator: to avoid possible influence peddling, favoritism, and other undesirable activities, the authors must ignore who their reviewers are. And the editor, in the middle, allows this process to be carried out anonymously. These peers we are talking about are other researchers, just like the authors, workers whom the journal asks, for the good of science, to work for the journal. Of course, for free. Thus, among all the infinite tasks that researchers must perform, there is the far from trivial task of reviewing the work of their peers. We might ask ourselves if this work should be remunerated. I have no answer to that, but of course, the introduction of compensations in the peer review process would also introduce a whole series of ethical issues. It’s not possible to fix one thing without breaking another.

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The editors of many journals, like their peers, are also researchers who combine their scientific work with this task. Again, for free. This would explain why their work is perceived as obscure, enigmatic and irregular. However, in journals such as *Nature*, the editor is a professional in the pay of a company. While in the former, editors, not being paid, have a certain margin to impose their personal criteria and try to maintain certain ethical standards, in the latter they are nothing more than the voice of their master.

Moving on to the publication process, we will assume at this point that the peer review has been successfully completed. The editor will then inform us that he will be kind enough to publish our article and will remind us that we now owe the journal a certain amount of money, which to give an order of magnitude we will set at €1000 (Morrison, 2021).

After this obscenely asymmetric process, in which researchers bear most of the work and also pay to carry it out, do they receive any compensation for this work? Of course not. Do they receive any payment in the form of royalties or copyright for the use of their work in the journal itself or later in the media? No. Not only that, but the authors must also give up all their intellectual property rights relating to the article to transfer them to the journal. But at least, the work will be public... or not? The researcher has made sacrifices and financed the publication of the article (often with public money) so that it is accessible to his colleagues and to society in general, right? Not necessarily, or at least not by default. In principle, anyone who wants to read that paper, and this includes the author himself, must buy the journal (or the article individually) or must work for an institution that pays the subscription to said journal.

In short, researchers carry out the research, write the paper, format and create the layout, design the figures, correct each other's papers and (in many cases) act as editors. And after all this work, they pay for their article to be published. And finally, they pay again to read their own article or that of their colleagues. You could say that they pay twice for a job that they themselves have done. They pay, for what specific issue? Printing costs? The meager work of the editor? The maintenance of the journal's website? We don't know yet.

This whole process is delusional. The existence of a scientific publishing system is based on a indispensable need: information must be freely shared for knowledge to advance. Journals should be the vehicle for this need to be met, not an obstacle. One might, for example, wonder how this system of prices and payments affects different researchers, at different stages of their scientific careers, with different budgets in different countries with different levels of wealth.[1]

[1] It is worth noting that some journals have adapted prices for developing countries.

In any case, payment for publishing, payment for the purchase of the journal or (in some cases) advertising, are not the only ways in which scientific publishers make money. It could happen, for example, that a journal, after having accepted our article, sends us a second email in which, while praising our recent scientific achievements, they propose that we send them an image to appear on the cover. Having an article featured on the cover of a journal is an appealing idea for authors. It means more visibility for their work and a certain recognition that the article is uniquely relevant. Of course, this hypnotic email is not sent only to one researcher. If there are 10 or 20 articles in a particular issue of the journal, it is very possible that this email will reach all or a large part of the authors. And at this point, who will be responsible for making said image or paying a designer to create this image for the cover? The researchers, naturally, as with all the rest of the work. The general response is that most authors who receive this second email, bewitched by this siren song, prepare or ask for such an image to be prepared. The journal, now with several designs for its cover, will choose one. And so it will be that the researcher, owner of the lucky image, will receive a third email congratulating him because his work will now appear on the cover using the design that he himself has sent and announcing that he now owes the journal an amount that can range from €1,500 to €5,000, depending on the journal.

The researcher spends time or money (or both) preparing an image and then pays to have it published. This is complete nonsense. But it doesn't stop there. If this system of obtaining free covers not only saves the journal the salary of a photographer or a designer, but also brings in copious profits, what prevents them from filling the journal with extra covers? Said and done. Thus, today some journals not only have a front cover but also an inside cover, a back cover and an inside back cover. In the world of scientific publishing, just as in Wonderland, no known logic operates.

Taking care of business

In fairness, it must be clarified that among all the vast ecosystem of scientific journals, not all of them charge for publishing. A large number of journals do not impose fees and others only request them as a voluntary donation to support the scientific society under which the journal is published. Likewise, some journals belong to private companies and others to foundations or associations (also private) that are supported by the dues of their members. However, in 2017 it was estimated that the publishing business had total global profits of 20 billion dollars. And in 2010, the important publisher Elsevier declared profits of 700 million dollars on total revenues of just over 2 billion dollars (Buranyi, 2017). Large publishers have high turnovers. On the other hand, according to a 2019 study, of the money spent on scientific publications in Europe, 75% is spent on just 5 publishing groups (Mehta, 2019). Four of them are private companies. And statistics indicate that “authors prefer to publish in expensive journals” (Morrison, 2021).

One might wonder why researchers, in this case Europeans, voluntarily decide to submit to this form of extortion. I will try to give a possible answer.

How is the quality of a scientific researcher is evaluated? If one wants to award a civil servant position, or a contract in a research center, or a good sum of money to a researcher in the form of a project, one must evaluate their CV. And in a typical CV, merits such as projects or theses supervised, teaching work, management tasks, conferences and presentations attended, or dissemination tasks will be listed. But the main characters in a researcher's CV, what distinguishes the good ones from the average ones, is the number and importance of their scientific publications.

And how do you assess the quality of a scientific publication? One possible way is to count the number of times it is cited, which would be like assessing the commotion that such a publication causes. If a paper attracts the attention of the scientific community, and for example, opens a field of research, it will be cited abundantly in other publications. The number of times an article is cited gives us a measure of its relevance, its popularity and, perhaps, how much science is being built around it. And finally, a journal whose articles are highly cited will become an important journal.

What seems to have happened is that the scientific community, unconsciously and collectively, has decided where relevant articles should be published, and with that, which are the important journals, in which "good scientists" publish. And which publications in which journals will end up rewarding us with a contract or with a research project or simply with a modest career in science. And these journals, aware of this power and how it is in their hands to affect the curriculum of a certain researcher, can establish this surreal system in which scientists pay to work for them. This would explain, for instance, why the cost of publication is proportional to the perceived importance of the journal (Solomon and Björk, 2012).

It is therefore the case that these private entities end up receiving tremendous amounts of money from public and private research centers, first, in the publication process and, second, in the purchase and subscription to such journals. And not only that, but we have that private companies decide who receives public funds in the form of grants, projects or contracts and end up dictating the direction in which scientific research must flow.

Scientific publishing has thus become a business, in the worst sense of the word. One of those dark businesses that turn out to be good bedfellows of public structures, in strange and convoluted ways. A kind of tumor that, due to its ramifications, can no longer be removed without damaging healthy tissue.

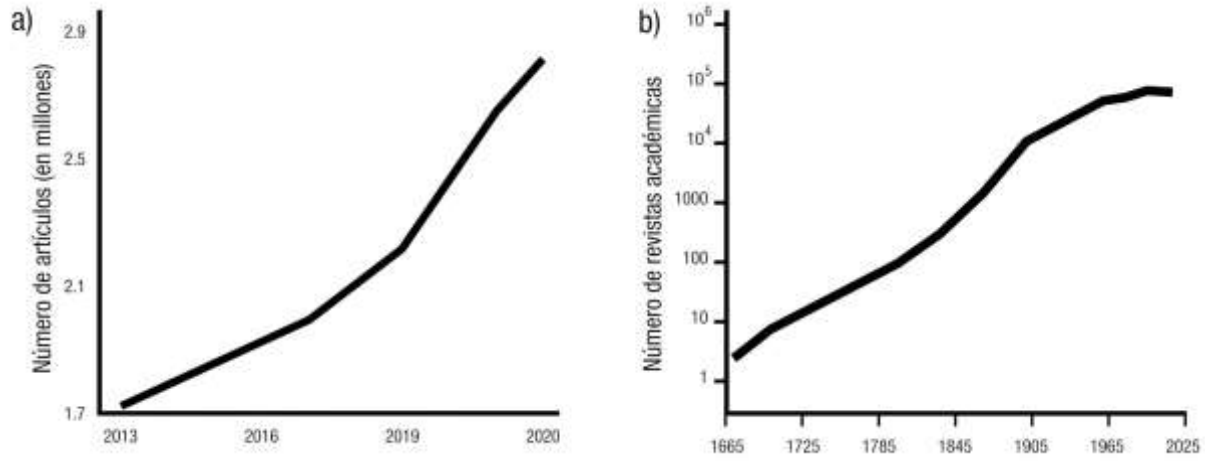
And as businesses (or tumors) that they are, they must grow.

For example, if the number of covers in a journal can be multiplied, can't the number of journals also be multiplied? Since their appearance in the 17th century, the number of scientific journals has only increased, partly due to the increase in the complexity and specificity of scientific knowledge and also to the increase in the number of researchers. But partly also catalyzing this mad rush to improve CVs because of which researchers today try to publish as much as they can (Delgado-López-Cózar and Martín-Martín, 2019). And along the way, feeding the greed and power of the publishing monster. This is also connected to the overly competitive/ difficult academic job market which necessitates publishing as many articles as possible to try to get one of the few tenure-track jobs available.

Emulating the well-known aphorism “swim or sink” associated with capitalism, in science the no less well-known “publish or perish” is used. Data indicate that in 2013, 1.7 million scientific papers were published worldwide. In 2022, this number was close to 3 million. Similarly, the number of scientific journals is estimated to have increased until reaching almost the hundreds of thousands [Figure 1]. And paradoxically, this steady growth in the number of journals and articles published does not seem to be producing anything but negative effects on the scientific ecosystem (Hanson et al., 2024).

Figure 1.

Number of papers and academic journals per year.[2]



Note. In 1b) the vertical axis is insolently presented in logarithmic scale (Hanson et al., 2024; Ghasemi et al., 2022).

[2] Translation: a) number of papers in millions; b) number of academic journals.

A huge amount of what?

The publication rate today is producing an amount of papers that researchers cannot possibly understand, read or analyze. The rush to publish has led, for example, to the fact that it is becoming more common to find short articles that are increasingly insubstantial, and it hardly matters that no one ever reads them. It is preferable to publish a result spread over ten empty short papers over a year, than to prepare a complete article with relevant content. The latter would have the cost of twelve endless months without publishing. A year without publishing (whatever the reason) raises an eyebrow among other researchers and it terribly damages the prestige and possibilities of advancement of scientists. And, for this reason, it is important to maintain the pace of publications even if that means that occasionally we have to write an empty article that no one will read.

One might wonder whether these millions of scientific articles we are producing are generating a proportional amount of knowledge or are simply a waste of paper, ink and hard drive space. Are scientists becoming a tautological entity, so that their only purpose is to maintain their professional status, and not to generate knowledge, as is assumed?

For example, continuing with this line of reasoning, for scientific articles to be part of this building of knowledge that we are supposedly creating, they must be at least read by other researchers (remember Halley's tribulations). It is difficult to establish whether an article has been read or not and by how many people. But one piece of data that we can access is the number of times it has been cited in other articles. A 2018 study indicates that the number of uncited articles ranges from 12% in medical sciences to 70% in the area of arts and humanities (Sugimoto and Larivière, 2018). Another study from 2002 concluded that of the 4300 citations that a major article had received in condensed matter physics, only 20% of the authors citing the article appeared to have read the article. The remaining 80% cited it incorrectly, assuming that the article said something that it did not actually say (Simkin and Roychowdhury, 2002).

This information must be interpreted with caution. The reasons for citing an article (or not) can be very diverse. A scientific publication may be highly cited because what is communicated in it is tremendously disruptive. Or because what is said in it is wrong. Or it may happen that an absolutely unknown article becomes relevant 20 years after its publication. Or that a work goes under the radar because editors of different journals have failed to predict its importance and it has ended up being published in a little-known

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journal. And finally, and probably most frequently, an article may not be cited because it is completely irrelevant, which reminds us of the aphorism "this isn't even wrong."[3]

In any case, these metrics that indicate that there seem to be more and more uncited articles could be talking about a certain dilution in the amount of knowledge that is deposited in published articles. A possible tendency towards banality in science.

On the other hand, if the articles are going to be empty of content, and nobody expects them to be read, writing them is not very difficult. With enough skill, an article can be prepared abusing commonplaces and hackneyed ideas, while the text is seasoned with some irrelevant graph, part of a research still half-baked. In this landfill, deficient generative AIs have come to add more mud, saving us some of that writing time, which we can now use to generate more hollow ideas (Haider, Söderström, and Ekström, 2024). Guillaume Cabanac (Kwon, 2021), a researcher at the University of Toulouse, spends a lot of his time detecting anomalies of this kind: meaningless articles, auto-generated translations, clumsy uses of AI in writing papers or in their translation into English, or simply, Frankenstein-like texts composed of pieces of other articles. Clues, in short, that point to “garbage" articles that have been written with the sole purpose of adding an item to the CV of a researcher who has known how to take advantage of the weaknesses of the editorial system.

The peer review process has also been affected by this insane increase in the number of publications. Researchers do not have the physical time to correct, with the attention that this task requires, the millions of articles that are published each year. Errors, oversights, repetitions, contradictions or scientific fraud, for example, elements that could be detected during the peer review phase, do not seem to be decreasing. In 2023, a new record was set for retracted articles (Van Noorden, 2023). It is obvious that neither editors nor reviewers are able to cope with this task effectively. And the journals, in another example of shamelessness that is no longer surprising, do not take even the slightest responsibility for it.

In 2012, Amgen, a company dedicated to developing medical treatments, conducted a study on 53 scientific articles in the field of oncology (Baker, 2016). The most relevant recent articles in the area were chosen for this study. Amgen repeated the experiments carried out on these 53 articles. After months of work, the company found that in only six of these articles (11%), the results were reproducible. In a similar study, this time in the area of social psychology, of the 100 works analyzed, the level of reproducibility turned out to be 30% (Baker, 2015).

[3] *Das ist nicht nur nicht richtig; es ist nicht einmal falsch!* , “This is not, not even right. This is not even wrong." attributed to theoretical physicist Wolfgang Pauli, used to indicate the lack of relevance or interest of an idea.

There are numerous reasons why it might be difficult to reproduce an experimental result, but these numbers are outrageous. And they suggest all kinds of bad practices ranging from mere carelessness in experimentation to scientific fraud.

Predatory journals appeared on the scene, to increase the problem. These journals are defined as those in which you can buy the publication of an article (Elmore and Weston, 2020; “Write-Only Publication”, 2008). You can forget about long peer review processes or annoying quality controls. Your article may be wrong, include obvious falsehoods or be a simple accumulation of meaningless words, but it can still be published. Recent lists tell us of no less than 3,000 of these journals (Predatory Journals, 2024).

Recently, article factories or paper mills have also appeared: companies that write fake articles and whose authorship can be bought (Singh, 2024). Other companies offer us to increase the number of citations to our articles for a certain amount of money (Richardson, 2024).

Determining responsibilities

The state of things is as heartbreaking as it is difficult to repair. The solutions, if there are any, do not seem straightforward. One would say that there is a clear culprit: the journals. Or at least, certain publishing groups and the environment they’ve created. And a second actor that is both victim and executioner: the community of researchers who dance to the tune. Sometimes they have no choice, played by these multinational companies. I suppose it is fair to say that we are all responsible for this state of affairs.

Researchers are absolutely aware of the situation, whether they agree with it or not. What has been described here is learned during the first year of a doctoral thesis. And I would say that most of the scientists with whom I currently have contact, who, due to my professional occupation, are many and from multiple areas of science, are to some extent uncomfortable, if not horrified, with the situation. But they are all individually horrified. And it is very difficult to make a one person revolution.

And yet, scientists, who are generally very rebellious, regularly show their dissatisfaction and their intention to correct this nonsense, because, at the end of the day, it is realistic to say that most researchers are good workers armed with a reasonable amount of professional ethics.

To give some examples, the state of scientific publication is regularly discussed within the community. We can cite the communication work of Sabine Hossenfelder, a doctor in physics and science communicator who fiercely attacks bad practices in science and in particular those related to publication. Also interesting is the work of biologist Elisabeth Bik, who dedicates much of her time to the detection and pointing out of

fraud in the form of manipulated images in scientific articles (Bik, 2024). Along the same lines, the researchers behind the blog Data Colada (Simonsohn et al., 2013) make use of data analysis to check the veracity of articles published in the social sciences. By carrying out this type of second peer review, they have discovered resounding cases of fraud in their area of study (Baek, Isaac and Writers, 2024; Lewis, 2023; Simonsohn et al., 2021).

This very broad movement of discontent, of which I have only given a few examples, highlights the emptiness of the editorial function as well as the deteriorating state of health of the publication system. And I would like to point out that once again, this almost police-like responsibility for maintaining the sanctity of science has fallen back into the hands of the researchers themselves.

This constant malaise regularly leads to the emergence of initiatives with the aim of solving or at least alleviate the problem. A good example of this is the Arxiv project (ArXiv, 2024). A project that, having been born as a simple repository through which to share preprints of papers, has become the place where researchers present new works, even before they are published in journals. Today, the platform hosts 2.4 million works, covering multiple areas of science and despite not having a peer review system yet, there are filters to maintain certain standards of relevance and seriousness. The fact that texts are freely accessible on Arxiv has produced important collaborations. It has served as a platform for researchers to ask questions to the community about puzzling observations (Boyajian et al., 2016). It has even allowed for early detection of fraud (Ball, 2023) and the platform has facilitated numerous fruitful debates.

Another example of a collective effort to improve the situation is the demand that articles be free and freely accessible. Since researchers finance the publication of their own articles, these should be free (or at least cheaper) and more easily accessible to both researchers and the general public: what is now known as open access (Suber, 2015). Publishing conglomerates, always attentive to the needs of the community, have recently accepted this demand. Thus, today, researchers can choose to have their article published in the traditional way (at the traditional cost), or in an "open access" system (with the traditional cost multiplied by 10). To give just one example, publishing under open access in *Nature* can cost up to €12,000. The price (along with the indecency of the journals) shoots up to exorbitant amounts if one wants to publish under open access.

As before, one might ask, who in their right mind would accept a deal like this? One possible answer would be that a research group has not only the money to publish openly, but also the moral commitment to do so and decides to sacrifice part of its funding to make its work more accessible. Another possible answer would be that today many publicly funded European projects force researchers to publish openly (European

Commission, 2012). And this is how a legitimate claim by scientists and a social improvement (open publication) is transformed into profits for private entities and losses for research (Krawczyk and Kulczycki, 2021).

With these oxen you have to plow

A key point to understand the direction that science has taken is the fact that, recently, its practice has become something where anyone could arrive. This has been one of the many social advances that occurred during the 20th century. The professional situation of researchers has been regularized in almost the entire world and has thus been opened to all strata of society. It is no longer a job for aristocrats or rentiers. This change has allowed a lot of talent to enter science regardless of their social background. And this is good news for the scientific community and society in general.

However, if the scientific activity has become a conventional job, we should not be surprised that this has brought with it, along with the benefits, all the miseries and misconduct that are common in a conventional job: competitiveness understood in the worst sense of the word, influence peddling, lack of scruples, greed, scoundrels, despots, inept people or swindlers. All of these elements share the ecosystem with serious, honest workers with impeccable ethics who respect the dignity of scientific work in an almost religious way. Good workers who maintain their moral standards even though, in this new scenario, this is a burden when competing with less decent colleagues.

It is important not to kid ourselves into thinking that scientific fraud and malpractice are new to science (Russell, 2012). However, the community has not stopped growing since the 17th century. UNESCO estimates that the number of scientists rose from 7.79 to 8.85 million between 2014 and 2018 (UNESCO, 2021) and seems to have exponentially grown since the beginning of the 20th century. So, it is reasonable to conclude that there will be many more scoundrels in science today than 120 years ago. Given the amounts of money that researchers invest in publishers, one would expect that publishers would make an effort to protect science from these scoundrels. Nothing could be further from the truth.

Between 2000 and 2001, an unknown researcher, Jan Hendrik Schön, became the most famous physicist on the planet. In just one year, he made three discoveries of enormous significance in the field of physics. Schön seemed to be living an *annus mirabilis* similar to that of Albert Einstein. During this period, he published 16 articles in *Nature* and *Science*. It is difficult to explain how improbable this is. There are researchers with magnificent careers and who make significant scientific contributions, who manage to never publish in these journals. And Schön, in 2001, hit the bullseye on 16 occasions. In total, he published 38 articles in various journals that same year.

Of course, and to the surprise of no one, in 2002 it was discovered that everything had been a fraud. Schön had invented everything he had published. And how had a 30-year-old young man, almost a newcomer to the scientific world, managed to fool these century-old publishing giants? Now that we have a fair amount of information about what happened, Schön, far from being a criminal genius, seemed more like a clumsy and unstable person, without a clear understanding of the scientific method and who, almost accidentally, knew how to give these conglomerates what they needed: improbable articles and discoveries, which revolutionized the world of physics every two months. Results that benefited the publishing system by increasing the sales of their journals and their presence in the media: “Physics breaks down again! Read it in *Science*!!!”. The almost childish manipulations with which Schön fooled the journals included duplicate graphs and clumsily manipulated data whose falsity could almost be verified with the naked eye.

The issue may be even more serious. It is inevitable that in science, as everywhere, there are miscreants who try to hack the system. What was really serious about the matter was the behavior of the journals before, during, and after this humiliating incident. Rumor has it that the journals manipulated the peer review system to favor the publication of these articles as quickly as possible. These rumors circulating might be the most we could get, because the journals, at the very moment the scandal broke, invoked their right not to comment. In a world where transparency should be the law, the journals swept this whole affair under the rug. Embracing this *omertà*, they refused to publish their interactions with Schön in which they apparently called him often to ask if he had anything new to publish. They also negotiated with him to publish in their magazine and not in their competitor's in exchange for who knows what.

According to Eugenie Samuel Reich's book *Plastic Fantastic* (2009), once the enormity of the fraud was revealed, *Nature*'s editors claimed to have lost all evidence of interaction with "this Schön guy you're telling me about." For their part, *Science*'s editors simply refused to reveal any information about it, under the infamous pretext that the relationship between authors, editors and reviewers should be kept secret. Thus, when reviewers appeared claiming to have made negative reports about Schön's articles and how these negative reports had been dismissed by the journals, *Science* reminded them that "any reviewer who speaks publicly about their reviews related to *Science* will be ostracized by the journal." According to Reich, these statements were made by Donald Kennedy (editor-in-chief of *Science* between 2000 and 2008) and were made publicly during talks at scientific conferences.

How reliable is Reich's account in his book? It is difficult to know. Much of the information comes from conversations, appearances at conferences and closed-mic statements. And yet, no one who has worked in science can be surprised that all this is true. The Schön case was only one episode in which this way of proceeding, although usual, was taken to the extreme.

The scandal caused by Schön was such that from then on, many journals required authors to specify what their detailed contribution was in each work and to certify that all participants agreed with what was written in that article. This, which at first glance seems like a way of reinforcing the ethical standards of the community, is in reality a legal trick for the journals to be able to wash their hands, even more freely, of future scandals.

These cases of scientific fraud damage the prestige of universities, research centers and all those who work in them. They provoke reflections and debates about the state of scientific production. Researchers engage in more or less sincere or effective self-criticism and contrition. Meanwhile, no one includes the publishing world as part of the problem. Like a lucky cat, journals always land on their feet. They even allow themselves the impudence of being platforms for such discussion and pointing fingers, as if they were somehow alien to all this and not the main actors in this tragedy.

Sneaks like Schön flourish in a system that rewards speed, excessive competitiveness, sensationalism, quantity over quality and punishes caution, patience, honesty and the slowness required for things to be done correctly. A system that does not care that useful and relevant results are the product of many hours of work, analysis and reflection by many people who stay up all night to complete their research. A system that irresponsibly and driven by a voracious appetite for money, sacrifices the good practices that science requires and invites the community to violate them as well, if possible, with more care than Schön. A system that has stooped to the use of the dirty advertising mechanisms, without caring that this has negative effects. And finally, a system that does not admit criticism and that threatens to ostracize those who do dare to complain.

While the felons who inhabit the scientific ecosystem take advantage of this imperfect and often malicious publication system, the rest of the researchers endure it. Without the system, as a grand finale, caring much about either one thing or the other, as long as the rent is paid punctually. And yet, in this depressing landscape there is room for hope (Woolston, 2021; Villatoro, 2023). The intention of this article, as well as that of the ongoing debate and criticism taking place within the scientific community, is not to dismantle the scientific system but to improve it. An improvement that is possible. Is private initiative the cause of this situation? Of course not. There is nothing intrinsic that prevents the private initiative from carrying out good practices and to operate with decency. We have already said that the blame can be democratically shared among the entire scientific community. After all, the members of these companies and societies are (or have been) part of the community. But is it reasonable that they have exorbitant profits? Or that they enjoy absolute power? Or that they act with such a lack of transparency and responsibility? Or that they dictate the direction that scientific research should take? As you can see, there is enormous room for improvement.

I, on a personal note and as a former and somehow current member of the community, force myself to be optimistic. Scientists have repeatedly shown their ability to reach agreements and collaborate. Their talent for solving problems and overcoming obstacles. I would say that the attribute of honesty is still abundant among those who practice this profession. Otherwise, science would have already collapsed. Perhaps that is already happening and what we hear is just the band playing while the ship is sinking. It is difficult to know. Let us hope not. And let us also hope that sooner or later, whether or not the empire falls, this situation will at least improve.

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