



SCIENCE ON THE ROPES

DECLINE OF
SCIENTIFIC CULTURE
IN THE ERA
OF FAKE NEWS

—
CARLOS ELÍAS
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Writing this book has been a goal pursued for years. I have been making progress little by little in my free time, since the lack of STEM vocations and their relationship with the media and the rise of anti-scientific culture in Western universities are not topics to be found in financial, scientific, or engineering discourses and belong more to the social sciences. However, since the approach I wanted to explore implied “blaming” the social sciences and the humanities in some way, it was not easy for those responsible for sponsoring projects in these areas to support my work. While researching more orthodox issues in media communication to fulfill the requirements of my academic career, I still tried to find time to investigate on my own this fascinating issue, namely how the war between Snow’s two cultures—science and humanities—was still alive and was influencing not only the decline in STEM vocations but also the rise of post-truth, alternative facts, and fake news. And, in short, in a decline of Western culture related to rationality, empiricism and facts.

I have not had financial help, but I have had many encouragements to write an informative—and controversial—essay analyzing this problem in such a way that it is accessible not only for university experts but also, and above all, for secondary school teachers, scientists, and engineers who are reluctant to read reports from the social sciences. My purpose is to encourage debate, not to “be right.”

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1

Introduction

Two worrisome themes are currently running through the West: a disturbing rise in fake news and an alarming loss of vocations in science, technology, engineering and mathematics, the so-called STEM subjects. These two streams run parallel, threatening to erode the culture of searching for truth through rationality and the scientific method. The cultural particularity that has favoured this type of European thought, rationality, originated in ancient Greece and was rediscovered and improved in Renaissance Europe. This led to the Enlightenment and, with it, an unprecedented improvement in the understanding of how the world works.

Each of the two streams has its analysts, yet few have stopped to reflect that, perhaps, each arises from the same source: that rationality has been increasingly questioned in a process that began in the 1960s. What began as a departmental culture war in the university has spread to society, because for the most part the anti-scientific departments are the ones that prepare those who have taken over the discourse on science policy and politics itself in the mass media.

The university and its influence on the media have fostered a celebrity culture that puts the emotional before the rational. They have established university degrees in which literature about magic is studied more than physics and chemistry. These two problems, which as yet nobody connects but in which I, modestly, claim to see a relationship, have led on the one hand to the rise of post-truth, fake news or alternative facts in Western public communication, and on the other hand to an alarming drop in young people taking up a vocation in STEM-related professions.

Without science and technology creators, there will be a loss of cultural and economic influence. With the rise of fake news, democracy will be restricted. To the latter is added an increase in the content of magic at the expense of

science in the media, as well as extolling irrational thinking and, in some ways, criticizing scientific method thus, ultimately, scientists and technologists.

The result of the first trend includes, among others, the referendum by which the United Kingdom opted to leave the European Union (Brexit) and the election, against all rational odds, of Donald Trump as the president of the United States. In 2017, the *Oxford English Dictionary* considered ‘fake news’ to be the word of the year. It was reported that its use increased by 365%, and in January 2018 the French president Emmanuel Macron announced in the traditional presidential speech on his wishes for the press that France would legislate against false news.

The change had begun in 2016 Germany. The Christian Democratic Union had suffered a heavy defeat and its president, Angela Merkel, had uttered a phrase that would define the era: ‘Lately,’ she had said, ‘we live in post-factual times. This means that people are no longer interested in facts, but in feelings’ (Schaarschidt 2017).¹ After Merkel’s reflection, the term ‘post-factual’ became so important that the German Language Society unanimously chose it as its word of the year in 2016. Also in 2016, the *Oxford English Dictionary* selected the US/UK ‘post-factual approach’—that is, post-truth—as its word of the year.

The issue of STEM vocations is less noticed by the general public and the media, but has for years been the focus of intellectual debate by—and a main concern of—scientists and university and secondary school teachers around the world: why are young people not interested in studying science in Western and Westernized countries? In 2011, the President of the United States, Barack Obama, and the country’s leading business leaders had launched the STEM—Science, Technology, Engineering and Mathematics—initiative, with the aim of graduating 10,000 more scientists and engineers each year in the United States and obtaining 100,000 new STEM teachers. The proposal had been picked up by the media.² The goal was that the United States—and the West in general—should not lag behind the emerging Asian countries in science and technology.

The disturbing question is why this situation had arisen. Why do young Americans—and Europeans—not decide to study science, technology, engineering and mathematics (STEM), but aim for social sciences or media careers? Does mainstream popular culture have anything to do with it? What about the social networking culture? Or does it have something to do with the fact that

¹T. Schaarschmidt. (2017). ‘La era de la posverdad’, *Mente y Cerebro [Spanish edition of Mind Scientific American]*, 87, 22–28.

²Among others, *New York Times*, 4 November 2011: ‘Why science majors change their minds (it’s just so darn hard)’. http://www.nytimes.com/2011/11/06/education/edlife/why-science-majors-change-their-mind-its-just-so-darn-hard.html?pagewanted=all&_r=0.

these youngsters' high school teachers of social sciences and humanities have studied at universities where the practice of questioning science has become a legitimate intellectual option? It is less easy for a high school student than a scientist to refute an anti-scientific sociologist, historian, journalist or philosopher. Many believe that science is what their humanity and social science teachers have told them about science.

According to scholars, the STEM vocation crisis may cause the West to fall behind the Asian countries, leading to significant adverse economic effects for Europe, the United States, Australia, and so on. Above all, it may be the beginning of the decline of the West's cultural hegemony, which is based on rationality in decision-making (the decisions that Trump is making—about climate change, for example—are not rational).

This book is the result of trying to answer two questions that, I believe, are related: why irrationality is emerging in the media and in society; and why there is a decrease in the number of vocations using the most rational degrees: science, technology, engineering and mathematics.

This work is the by-product, not the main research objective, of my two stays at very different universities to find out firstly 'the state of the art' and secondly its evolution over time. I say it is a by-product because I've never had the funding to undertake it. In the natural sciences and engineering, academics believe that this problem is not one that they should fund research into since it concerns the social sciences and the humanities. On the other hand, in social sciences and humanities the academics regard it as a problem for science and engineering, areas that have far more economic resources. There is a huge lack of knowledge on the part of those from the social sciences and the humanities about how science works (and even what science is) and its importance in Western culture.

As an anecdote, when I applied for a start-up grant from the European Research Council to study the phenomenon of pseudoscience's and the media, one of the evaluators wrote, without blushing, that one of the problems with the project that I had proposed was that it put disciplines such as palmistry and tarot reading on the same level as homeopathy. Apparently this evaluator, who was from the social sciences, considered homeopathy to be a valid study. I keep in my mind the (negative) resolution of this project, because it shows that the level of natural science knowledge among the elite of European social scientists and those from the humanities is rather lower than that of mediaeval intellectuals about nature.

But there is something even worse: academics without the slightest scientific knowledge or scientific method have more and more power. Basically, this is because their disciplines are attracting more and more students and, in many

Western universities, if you have students, you have power (enrolments, votes, money...).

The first phase of this investigation was the result of my year-long stay at the London School of Economics (LSE) from 2005 to 2006. From that period a book emerged—*The Strangled Reason*—on the crisis of science in contemporary society (Penguin/Random House 2008, 2014, 2015), which had considerable impact on Spanish media because, among other elements, it warned that the same thing could be happening to the West as happened in Spain during the seventeenth century in the Counter-Reformation. The contempt and intolerance of science by the elite was one of the factors behind the decline of Spanish imperial power and the rise of those countries that did embrace the new scientific ideas and, from them, the newly created technology, the seed of the industrial revolution.

As Margaret Jacob, a professor of the history of science, so eloquently says:³

The writings of Galileo, and his subsequent trial and condemnation, moved the new science into the forefront of learned discourse throughout Europe. Anyone attracted by the ideas of Copernicus, if living in Catholic as opposed to Protestant Europe, now had to think very carefully about how to announce that support. In France, for instance, the clerical opponents of papal intervention in the affairs of the French Church saw in Copernicanism a new weapon in their struggle; the Jesuits, with their strongly ultramontane (propapal) conception of religious authority, sided with the Inquisition's condemnation. In Protestant countries, on the other hand, support for Copernicanism could now be constructed as antipapal and hostile to the power of the Catholic clergy. What a splendid incentive for its adoption. The ideological linkage was to prove critical in creating the alliance between Protestantism and the new science. (Jacob 1988, 24–25)

The role that Spain, the Jesuits and the Catholic clergy played against science could be taken on these days by many humanities academics and social scientists, who are highly critical of science (like the Catholic clergy of the time), while countries such as Great Britain, Germany and the United States had the key to scientific and technological progress. As a result, the latter obtained scientific, and also cultural and linguistic, hegemony.

In fact, as we shall see below, young people in the West now no longer see science and technology as the best way to obtain real answers to the eternal questions of philosophy, about who we are and where we come from, but as a threat. The scarcity of science graduates in the West also means that these subjects are taught less and less every day and, furthermore, that those who teach them may not have been the best prepared. There is a lack of enthusiasm

³Margaret Jacob. (1988). *The Cultural Meaning of the Scientific Revolution*. New York: Alfred Knopf.

to proclaim that science and technology are the most elaborate and sublime cultural products of humanity. Science, for many young Westerners, is no longer the way to solve problems—from environmental to health—or seek the truth, but a cultural tool that is imperialist and totalizing. These ideas, if not similar, are as opposed to scientific thought as those that were put forward by the Spanish Inquisition to reject science in Hispanic culture until almost the twentieth century.

If Latin is no longer a relevant language, it is because scientists, starting with Galileo, preferred to write in their native language. In the nineteenth and early twentieth centuries, the best science was written in German and English. From World War II onwards, it has been English. Scientists' revenge on the clergy, who were so reluctant to accept science, was to stop using Latin. But the anti-scientific clergy, now converted into 'secular humanists'—that is, academics from the humanities and social scientists who are opposed to science and technology—have not yet lost the war.

What is more, in the West, they are winning battles. Their most important wins have been the establishment of an anti-scientific prejudice in parts of the university (in the departments of arts and social sciences), the loss of vocations, the domination of the media, praise for the irrational and mystical in the face of scientific fact and evidence and, above all, influence over the minds of young people. These youngsters will one day have power, yet their scientific training is at a lower level than that of educated people in the pre-scientific era.

The level of mathematics and physics possessed by cardinals, policy-makers and artists in the pre-scientific era is hard to find in such groupings in the West in our twenty-first century. It is hard enough to follow the discussions in the Renaissance about the fall of bodies, optics or planetary orbits. Nonetheless, many of today's academics from the humanities have dug the trench of Snow's 'two cultures' and consider that one can indeed be educated without knowing what matter is like, as if it had somehow been demonstrated that human beings and the whole environment around them are something other than matter.

Moreover, the influence of the media has made the pernicious culture of the celebrity endemic in the West (and in Westernized countries such as Japan, South Korea and Australia), wanting an immediate attainment of goals, disdainful of studies with high academic standards and, above all, preferring disciplines in which, according to the postmodern philosopher Paul Feyerabend, 'anything goes'. Under the auspices of the French Theory of 'Deconstructionism' (Foucault, Derrida, Deleuze & Co.), teachers of humanities and social sciences are obliged to pass almost all of their students. They are afraid of students denouncing them, saying that they feel discriminated against because

the points of view that they defend in their essays are not approved of by their teachers.

Chemical reactions or physical equations are just what they are. They are not discussed, and this implies that you have to study to know and approve them. In the humanities and social sciences, many interpretations and points of view are equally valid. And this makes them careers where almost everyone passes, as opposed to science, mathematics or engineering where there are no multiple answers or creative points of view. This implies that STEM careers require a culture of effort that in social or cultural studies is less vital, and many of which, such as communication, tend also to be very playful. This enables those groups that have effort as part of their cultural identity—such as Asians—to be more successful in universities and STEM studies.

My grant proposal for that first study was to document how, in two paradigmatic countries of Western culture with scientific traditions as disparate as Spain and Great Britain, there is a similar phenomenon of a lack of vocations. On that basis, using figures from other countries, it may be concluded that this claim is well founded. My proposal was also to examine another curious fact: while the number of science students is decreasing, the number of journalism, film or media studies students is increasing. And not only do the numbers increase. In these disciplines, thought is dominated by the postmodern philosophy that holds that everything has the same validity, that science is just another ideology (but with the added sin of being dangerous for society and totalitarian for thought) or that alternative facts are equally valid. What is even worse than their increasing enrolment is that those who study them do not later work on an assembly line or in a supermarket, restocking the shelves: on the contrary, they have infiltrated all key positions in Western society.

While scientists are locked up in their laboratories, the non-scientists of cultural studies or media studies work in the media, indoctrinating the masses, or are advisors to politicians—or themselves politicians—or even policy-makers in science and technology management agencies. That someone who believes that homeopathy deserves to be regarded differently from palmistry is now evaluating research projects in the European Union and putting their ideas into writing in their evaluations, in my opinion, is the clearest indicator that Europe is in decline and that rigorous thinking has disappeared from an important part of its academy.

The second part of this research was carried out at Harvard, in its History of Science Department. There I spent the academic year 2013–2014 researching this phenomenon in the United States, the leading country (so far) in science and technology. There I discovered that, in a way, in academia it was taboo or at least politically incorrect to address the decline of scientific vocations.

There were several factors. The first was like the elephant in the corner that nobody wanted to see: an excessive number of some minority races, such as Asians, in STEM compared to other minorities, such as African Americans and Hispanics. There was also concern about the shortage of women in science and engineering, but this was not a feature of social studies or the humanities, where they were in the majority.

I was very interested in the underground debate in the departments of history, philosophy or sociology of science in the United States about whether their academics should come from the natural sciences, or whether they need not have any idea about them yet should talk on them. The influence of French Theory—French postmodern philosophers such as Derrida, Lyotard, Foucault, and so on—which maintains that scientific interpretation is just another cultural form and should not be hegemonic, has had such a bad influence that it has led to Donald Trump being chosen as president, with his questioning of science and, above all, his defence of ‘alternative facts’ or alternative realities, beginning with his questioning of climate change. There are more and more researchers who approach science from the theory of literature or cultural studies and who are highly critical of scientific work.

Donald Trump is a great follower—perhaps unwittingly—of the French postmodern philosophers, who point out that everyone has their own reality and that no point of view—not even a scientific one or one of facts or data—should prevail over others. Authentic mediaeval mysticism and obscurantism were elevated to epic status by another of the great destroyers of Western science: the film and television industry. Fiction, in general, despises science and yet defends not only mediaeval aesthetics but magic in arguments that are presumed to be coherent. One of the latest examples is the television series, *Game of Thrones*.

My proposal is a question of exploring the hypothesis that the only feature that these Western and Westernized countries share is a culture that is dominated by the media. It proposes a tour of all the fields—which are possibly responsible for this decline in rationality—that connect science and the media. These range from the image of science and scientists that is portrayed by film, television and the press, to how media culture influences scientific journals themselves, which are also media, and how science is produced. Nor does it forget other channels of communication that are less massive yet highly influential in the media, such as literature and art, while at the same time asking why irrational thinking is advancing so much in our digital-age society.

This book aims to explore something that I consider very important: what humanities and social science graduates think about science. There is an academic struggle between science and the arts, and the sciences are suffering in

certain areas. These areas include the paucity of students, politicians, intellectuals, actors, media experts, academic and social leaders with a solid scientific background. This is not the case, as we shall see, in countries such as China.

Why does cinema prefer the archetype of a mad, cold scientist? Why does Western television give more space to a sorcerer than a physicist? Why does a newspaper pay more attention to an athlete or actor than a researcher? Why does a graduate with a Master's degree in business earn more than a Doctor of Science? Why does *Nature* publish studies on topics such as how most of us turn to the right to kiss? Why do some people hate science so much? Why does the mystical *X-Files* triumph over portrayal of the scientific? Why don't law students study genetics, or film students mathematics or the physics of light?

An important difference from 2007, when I started the research, to my update for this book in 2018 is the presence of social networks. Trump's victory in 2016 shocked political scientists, sociologists and, above all, journalists: in university departments, how do we explain that a candidate won despite having all the influential media against him—from the *New York Times* to the *Washington Post*, the *Huffington Post*, CNN, NBC, ABC, MSNBC, *USA Today* and *Atlantic*, among many others? Rarely have Right, Left, and centre media united in an 'anti-someone' campaign such as this; yet that enemy won. Are the 'influential' media no longer influential?

Once he was elected, it was easy to argue why Trump had won, although some of us had been afraid of him for a while. We had warned that the decline of the traditional press and the rise of social networks, of search engines such as Google or of phenomena like Wikipedia—a real ideological battleground—have led to a fragmentation of the majority opinion states, which we now call media tribes. These often feed on what Damian Thompson calls counter-knowledge and lead to a credulity pandemic. 'Ideas that in their original and gross form flourished only in the outskirts of society today are seriously considered by even educated people in the Western world,'⁴ says Thompson. This is the strategy of Trump's populist parties, who slipped into the campaign that American Muslims applauded the 9/11 attack or that Clinton was a follower of Satan. The same applies to Venezuelan Chavism, whose social networks and state media—VIVE, the channel of popular power—promoted the idea that the United States caused the 2010 Haiti earthquake.

These hoaxes and uncontested news are sent and forwarded via Facebook, Twitter and WhatsApp. But they also appear on Google, if we look for 'Haiti-Chávez earthquake' or Clinton-Satan'. Some entries confirm them and others deny them, and readers will always click on those that reinforce their previous

⁴Damian Thompson. (2008). *Counterknowledge: How we surrendered to conspiracy theories, quack medicine, bogus science and fake history*. London: Atlantic Books.

belief, thus they will no longer be alone in their extravagant conjecture. What social psychologists call ‘confirmation bias’, whereby we humans tend to consider only ideas that confirm our previous beliefs, has now become a major problem: while in the 1960s it was virtually impossible to find anti-vaccine information, it is now within everyone’s reach.

Social media create echo chambers in which you receive only information that confirms your ideas, so that you become more radical (in favour of magic and against science and technology, for example). ‘Many of us seem to feel trapped in a filter bubble created by the personalization algorithms owned by Facebook, Twitter, and Google. Echo chambers are obviously problematic; social discourse suffers when people have a narrow information base with little in common with one another (Hosangar 2016)’.⁵ This confirmation bias also flourishes in Western universities, which, in theory, should prepare people to avoid such bias. At the moment, those from the humanities and social sciences who are critical of science and who analyse only its negative side are more likely to prosper in their academic careers, in which they will teach those students who do not learn chemistry, physics or biology at university level. These students may well end up as jurists, politicians, journalists, filmmakers, political scientists and philosophers.

Causing an intoxication with counter-knowledge, alternative facts or fake news is an unethical yet effective strategy: it is about having an army of trolls that sends hoaxes to the media tribes. These tribes send them back to their relatives and internet news portals—blogs, websites, and so on—without any deontological control, and well designed and linked to the search engines. We know of the best techniques for a hoax to work on the net: counter-hegemonic narratives; small distortions of real facts; contempt for scientific method; use of scientific terminology to support the story; and, in general, a panic to obtain the truth. This is based on the idea that it is impossible to lie if the truth is not known. Suddenly, the alternative not only has a good image but has found a place to flourish. And anti-science has become fashionable in the West.

Journalism was an ‘invention’ to fight hoaxes. Its aim—the same as that of modern science—has been to seek the truth and make it public, but both systems have been perverted. The search for truth leads us to a better knowledge of reality, which, in a system of freedoms, that is to say of decision-making—political, business, labour, medical, and so on—offers us a great competitive advantage. Along with the scientific method, journalism defines contemporary Western culture. To be more precise, even if this seems contradictory, it is necessary to generalize: it is not only journalism that defines

⁵Kartik Hosangar (*Wired*, 25 November 2016). ‘Blame the echo chamber on Facebook. But blame yourself, too’, <https://www.wired.com/2016/11/facebook-echo-chamber/>.

contemporary Western society but the entire system of mass communication, which has included cinema, radio and television since the twentieth century. Its result has been the rise of our celebrity culture and the ethics of the easy and the achievable with little effort. Until the emergence of mass media, public opinion was shaped in the churches.

In the twenty-first century, in addition to traditional media, the influence of social networks has to be reckoned with. A human is, above all, a social being who cannot stand isolation. Therefore, apart from a small group of recalcitrants, most of us will accept dominant thinking in order to be socially tolerated. This is what Noelle Neumann called the 'spiral of silence'. She studied this when television (mass media) already existed and stated that it helped to consolidate a climate of opinion. In these environments, polls can work, yet if there is even the slightest loophole to confirm our ideas, even if they are absurd, so as not to feel lonely they will be consolidated and we will form our own ideological tribe, now with social media support.

The theory of the spiral of silence also states that the socio-economic and cultural elite—academics, artists, journalists, politicians, writers, bankers—dares to speak out with non-dominant thoughts and that, ultimately, these permeate society. This has happened since the acceptance of science versus religion, right up to the defence of civil rights. The traditional and serious media have played an important role in social progress: it is true that they are not anti-capitalist, as some would like, yet neither are they racist, nor do they defend dictatorships or pseudosciences. Up to now, they have been of great value.

The media—and the establishment among those who were politicians and, in a prominent place, the university—established what is 'politically correct': globalization is positive, immigration is valuable, xenophobia is repugnant... And those who do not agree, according to the laws of the spiral of silence, are silent. Hillary Clinton had the support of dominant thinking opinion-formers: university professors, artists and the media. That's why, in classical theory, it was unthinkable for Trump to win.

But that changed. Now, controversial television stars such as Trump, and politically incorrect ones, can also be mass media. On the day that Trump won the election, he had 13.5 million followers on Twitter. That was more than the *Wall Street Journal*, considered to be the most influential newspaper in the world, or the *Washington Post* had at the time. So what, then, is Trump, or Lady Gaga: a source or a means of mass communication, in itself? Each is both things, and this dismantles much of the current communication theory. But Trump had an advantage over Clinton: he handled Twitter (although his

team forbade him to, in the final few days), while Hillary used community managers.

On the internet, there are tribes for all tastes: those who believe that aliens have manipulated our DNA, that vaccines are dangerous or that AIDS was created by the CIA. The information has been tribalized, and is no longer mass. And those tribes that are informed by the algorithms that decide on the news that will make them feel good (Facebook, Twitter, and so on) live in parallel worlds, in which they do not listen to other but where their xenophobic, anti-scientific or anti-system ideas are the dominant ideas in their microcosm. That's why the results—from Brexit to Trump—seem incredible to many (those who don't belong to that tribe). They don't dare to confess their ideas in opinion polls, but they do in a secret vote.

Very interesting research published in *Science* has shown that fake news spreads faster on the internet and social networks than real news.⁶ After analysing a data set of rumour cascades on Twitter from 2006 to 2017 (about 126,000 rumours were spread by ~3 million people), it was determined that: 'falsehood diffused significantly farther, faster, deeper, and more broadly than the truth in all categories of information, and the effects were more pronounced for false political news than for false news about terrorism, natural disasters, science, urban legends, or financial information' (Vosoughi et al. 2018). Researchers found that 'false news was more novel than true news, which suggests that people were more likely to share novel information. Whereas false stories inspired fear, disgust, and surprise in replies, true stories inspired anticipation, sadness, joy, and trust' (Vosoughi et al. 2018). It continued: 'contrary to conventional wisdom, robots accelerated the spread of true and false news at the same rate, implying that false news spreads more than the truth because humans, not robots, are more likely to spread it.'

Although it was good to prove this empirically, we have known since ancient times that rumour is more effective than the truth. The book *Fama, la historia del rumor* ('Fame, Rumour's History') by the German journalist Hans-Joachim Neubauer (2013, Madrid: Siruela), the role and power of rumour throughout history explains this perfectly. It would seem that a technological and scientific society is safe from rumour, but Neubauer warns that loose talk has found shelter in new forms of communication.⁷ These tools contribute to its dissemination, understanding it as a voice 'as relevant as it is impossible to corroborate', which spreads the content autonomously and rapidly.

⁶Soroush Vosoughi, Deb Roy and Sinan Ara. (2018). 'The spread of true and false news online'. *Science*, 359, 6380, 1146-1151.

⁷Sergio Delgado. (2013). 'Internet, la nueva era del rumor. Hans Joachim Neubauer aborda la problemática de la habladuría a lo largo de los siglos. [Internet, the new era of rumor. Hans Joachim Neubauer addresses the problem of gossip over the centuries]' *El País* 23 March 2013).

In Neubauer's opinion, the internet and new technologies promote two vital aspects: reaching a large group of people; and appealing to strong feelings such as fear, hatred or uncertainty—something always topical in the face of a crisis. 'The Internet is very fast and any denial is always late. We are facing a new era of rumor,' Neubauer said in an interview with the Spanish newspaper *El País*.⁸ In a Shakespeare extract quoted by Neubauer, rumour is likened to as 'a flute. Guesswork, suspicion, and speculation are the breath that makes it sound, and it's so easy to play that even the common masses—that dim monster with innumerable heads, forever clamoring and wavering—can play it'.

In *The Aeneid*, the Roman poet Virgil (70–19 BC) describes fame as a Greek divinity, a messenger of Jupiter, yet in heaven considered infamous. It is the 'public voice' or rumour that conveys all sorts of truth and slander, and spreads around the world at great speed. The Greeks worshipped fame because they knew the power of this goddess, 'who grows as she spreads'.

Neubauer concluded his interview in *El País* with a highly relevant statement:

(rumour) is a question of power, it allows anyone to be part of a moral discussion without being the person who gives his opinion. The talk focuses on the secret, on the hidden, which is usually a negative thing. People hide their dark side from others (...) Telling something puts you in the role of someone who knows what's behind it, you've discovered something. Rumours like to find out something, it's sexy and everybody wants to have it.

Some journalism professors celebrated the emergence of the internet of alternative media, as opposed to the traditional: they believed that the new forms were going to be all Leftist. They did not foresee that they could also be both Right wing and irrational. Alternative means that it is not massive, and it does not mean a specific ideological or political orientation. Trump won thanks to the Alt-Right. Mainstream media aspire to have the widest possible audience: therefore, they will be neither anti-capitalist nor xenophobic. It is true that, as we will see in this book, from the 1960s onwards mainstream media in the West began to be highly critical of science. To this is now added social networking and tribalization, or ideological hooliganism.

With the tribalization of media and audiences, the spiral of silence no longer works: there are audiences for all tastes, and these that feed off each other, increasing uncertainty. The internet has favoured unscientific information: depending on how you ask Google about vaccines, you will be proffered sites that are to a greater or lesser extent pro- or anti-vaccine, not to mention the

⁸Delgado. (2013). Op. cit.

effect of having ‘friends’ whom you have accepted on Facebook from your anti-vaccine group. If this can happen with something that is scientifically proven, what could happen with something that is ideologically questionable?

If we Google ‘Donald Trump’, the first entry will be from Wikipedia. For neutral terms—such as ‘proton’ or ‘Romanesque art’—its definitions may be valid, but for controversial ones such as transgenics or homeopathy, let alone biographies on such as Hugo Chávez or Donald Trump, an army of defenders and detractors are continually editing and republishing. As we journalists have known for a long time, neutrality is a misrepresentation: one cannot give two antagonistic versions of something. One can give them the one that is true—and, while the entry for radioactivity in the *Encyclopaedia Britannica* was written by Marie Curie (Nobel Prize winner for discovering this physical property), we don’t know who wrote the Wikipedia one or what moved them to write it.

Traditional media were not overtly unscientific, but they were highly critical of science, technology and the image of scientists, especially since the 1960s, when this image awakened an anti-enlightened spirit in many humanities departments that trained students who later were to become communicators. To this, we must add diffusion by the internet, where truth coexists with hoax, and neither science, anti-science nor reason can triumph—rather, what succeeds is what is most sent, most linked or most ‘liked’. The West—liberalism—has always defended online freedom, in contrast to countries such as China. Behind Brexit or Trump, there is debate about the freedom to broadcast fake news and whether this is protected by freedom of expression.

I will try to relate these approaches to the crisis of scientific vocations. I am referring not only to a shortage of scientists or engineers—particularly worrying in the case of women—but to something much more serious: an absence of even a minimal scientific culture in many in power in the West, whether political, economic, media, legal.

This did not happen before World War II. It is not a question of wanting more scientists, engineers or mathematicians to work in their respective areas, which is also necessary, but of them occupying many more positions of responsibility in the political, economic, media and social spheres, as happened in the Enlightenment when scientists imposed their criteria on those who wanted religious, magical, mystical or mythological thought.

I have chosen to present this research in the form of an informative essay, because I believe that the issue is important enough not to be simply left in the drawer of some educational leader or university evaluator. I would like to create debate, even controversy, to make this issue a priority in social and political discussion. It’s a rehearsal. I do not seek to be right, but to prompt another

look at what is happening in science and in Western culture in general. In my view, the first step in solving a problem is to make more and more people aware of it.

This book cannot move scientists to lead society, nor even science alone. It cannot make science faculties full again and arrange for young people to study science rather than journalism, sociology or film. But it can try to provide an explanation of why this trend occurs and where it may lead in today's civilization. It can ease the anxiety of scientists by at least providing an explanation of why things happen, which is the basis of science.

Science, the rational explanation of facts, is the most fascinating journey that the human species has ever made. It is an unnatural journey, because the human brain likes emotions and rumours. But science works. The economy, polls, political scientists and sociologists do not always manage that. If the severity with which philosophers or sociologists have scrutinized physics were to be applied to economics or sociology, let alone media studies or cultural studies, these degrees would not be taught at university, just as astrology or palmistry are no longer taught—or, maybe they could be taught, provided that the students contribute.

Scientific method does not tell us the truth, but it is the best way to get to the truth. The rest is just opinion, story or myth. These are important, no doubt, but not comparable to arriving at the truth. Is this way of finding answers in crisis? Is rationality in crisis? I will discuss these issues in the following pages.



2

Science in the Twenty-First Century

The paradox that defines today's world is that every day we depend more and more on science and technology, every day science knows more and more and explains the world to us better, but also every day people feel less and less appreciation for it. Every kid knows every player in the English football league. They read and reread their biographies. The Western media regard them as heroes. But no teenager knows anything about a scientist. They despise them: they think their lives are boring and disappointing compared to those of singers or footballers. Scientific vocations are alarmingly being lost in the West. The gap between what science knows and what 'educated' people know about science is widening to such an extent that the population considers it impossible to follow their progress and literally turns their backs on it. There are people in high places in today's society who still think that it is the Sun that revolves around the Earth or that dinosaurs and man lived at the same time. This contempt for science is a relatively new and unstoppable phenomenon in the Western world, which we do not know where it will lead us. But in any case we must urgently find the origin.

The above ideas are not mine; they are a paraphrased summary of ideas on two similar concerns that were imparted to me by two contrasting characters in interview during my time as a journalist: Sir Martin Rees and David Filkin. They had a common bond: a passion for science.¹

Their reflections on the decline of science could not be published at the time due to restricted space and current events. Journalistically, perhaps, they were

¹The views expressed here are also broadly presented in my book, *La ciencia a través del periodismo*. (2013). Madrid: Nivola. This book is a summary of the articles published during my time as a science reporter, such as those in the scientific part of *El Mundo*.

irrelevant, but the matter seemed to me to be of great importance to Western culture and, at least, worthy of in-depth investigation.

Sir Martin Rees (UK, 1942) is one of our most eminent contemporary scientists. A Royal Astronomer, Knight of the British Empire and Professor Emeritus of Astrophysics at the University of Cambridge, he has suggested interesting theories such as parallel universes. Rees is also an excellent scientific disseminator, and in 2005 he was elected President of the Royal Society (2005–2010).

David Filkin (UK, 1942–2018) was the director of the BBC's science programmes for forty years. He is considered one of the leading figures in the dissemination of science in the media, and these programmes revolutionized the way in which science was transmitted, winning audiences of millions.

When I spoke to them in 2001 and 2002, both had a long history behind them and both were concerned at the growing contempt for science. I must admit that this had passed me by: I had thought that the contempt was restricted to Latin countries, countries like Spain that have historically turned their backs on science. Spain failed to be part of the scientific revolution of the seventeenth, eighteenth and nineteenth centuries, and this still weighs it down like a millstone around its neck. The fact that this reflection came from two Brits such as Rees and Filkin was worrying. Both belong to the country, the United Kingdom, that has contributed the most in the history of science, a country in which the industrial revolution began, founded on technological and scientific elements; to a society that, for centuries, has hosted the most prestigious scientific institution in the world: the Royal Society, presided over, among others, by Isaac Newton.

How could this phenomenon of contempt for science also occur in Great Britain? I could not understand it, because in Great Britain, unlike in Spain, everything that had to do with science and its dissemination had been done well. I kept thinking about the Royal Society. It had been the engine that turned something that was no more than a gentleman's pastime, science, into the profession that would change the world. It was founded in London in 1662, although since 1645 there had already been meetings of a group of people interested in science.

One of the Royal Society's successes was that it introduced a groundbreaking custom: the publication of periodic journals to communicate all scientific results. Faced with the hermeticism of the Egyptian 'wise men' or mediaeval alchemists, everything suddenly changed and the greatest value of it was now to communicate it, to share it and to discuss it. This was an impressive advance. Those Royal Society publications were the forerunners of the current 'impact journals' that we will discuss later, and with this background it is no coincidence

that the scientific (generalist) journal with the greatest impact is the British journal *Nature*, which we will also analyse in this book. The Royal Society also favoured conferences on a particular subject—what today would be called congresses—as well as conferences and information books. If, in the country that produced the Royal Society, science was losing prestige, what was like in the rest of the world?

For the reader to understand the contrast with Spain, I will mention that a similar scientific society, the Royal Academy of Sciences, was not created in Spain until well into the nineteenth century, 1847, during the reign of Isabella II of Spain. This meant two centuries of delay at a time that was foundational to the history of science.

When the Royal Society is mentioned in England, everyone understands that we are talking about science; by contrast, in Spain, when the Royal Academy is mentioned everyone understands the opposite: that we are talking about literature and the arts. It is necessary to specify if one is speaking of the Royal Academy of Sciences, because the Real Academia, without any other term, in Spain refers to the Royal Academy of Spanish Language. Perhaps Spanish is a language only of literature, while English is a language of both literature and science, so perhaps English is more important than Spanish. In any case, the differences between the two countries, in terms of science, are obvious.

It should be noted that during the seventeenth, eighteenth and early nineteenth centuries in Spain the crown opposed the creation of an academy of sciences, although an academy of humanities, thus Royal National Academies of language, history and fine arts were constituted, but not of science. The science historian José Manuel Sánchez Ron stresses: 'Here, too, the arts and literature defeated the sciences.'² Numerous examples can be cited of this triumph in Spain of literature and arts over the natural sciences. One of the most symbolic reminders is that the current Prado Museum building was actually designed to house an academy of sciences. Then the crown decided that it was more convenient to use it to house something 'less revolutionary' for the people and for the monarchy, so the collection of portraits of the country's kings was placed there.

Sánchez Ron recalls that the now well-developed Newtonian science, developed and highly mathematicized, now stripped of its dark initial mathematical clothing, was compelled to enter Spain through its navy, not through any scientists or natural philosophers who were determined to understand, in the final analysis, simply why nature works in the way it does. 'It was not the best way, but it was a way', he adds. In my opinion, the fact that scientific advances were known in Spain only through the military would deprive civil society of

²José Manuel Sánchez Ron. (1999). *Cinzel, martillo y piedra*. Madrid: Taurus (p. 44).

knowledge, and this would later be translated into a lack of appreciation of scientific disciplines in Latin countries. It is condensed in the famous phrase of the Spanish philosopher Miguel de Unamuno: ‘Let them invent others.’ In July 1906, Unamuno, Rector of the University of Salamanca, the oldest in Spain at 800 years, published an essay, ‘*El portico del templo*’ (‘The Door to the Temple’), where, in a dialogue, its characters reflect:

ROMAN: What have we [the Spanish] invented? And what does that do to us? In this way we have spared ourselves the effort and eagerness of having to invent, and the spirit is fresher and fresher.... So, let them invent, and we will take advantage of their inventions. Well, I trust and hope that you will be convinced, as I am, that electric light shines as well here as it did where it was invented.
SABINO: Perhaps better.

This attitude was widely criticized by the only openly pro-scientific Spanish philosopher, Ortega y Gasset (1883–1955). Ortega was convinced that the greatness of Europe was due to science. At the beginning of the twentieth century (1908) he wrote:

Europe = science; everything else is common to it with the rest of the planet. (...) If China travels, it exists and grows today as it did ten centuries or twenty centuries ago, if it soon reached a higher degree of civilization than Greece and stopped there, it was because it lacked science. (...) If we believe that Europe is ‘science’, we will have to symbolize Spain in the ‘unconsciousness’, a terrible secret disease that when it infects a people turns it into one of the slums of the world. (Ortega, *El Imparcial*, 27/07/1908, in Ortega y Gasset 1966, 99–104)³

Likewise, Ortega observed numerous obstacles to Spain becoming a truly European and twentieth-century country. Perhaps the most serious, in his opinion, was its backwards education system, from the configuration of the university right through to its curricula. With regard to these, Ortega noted that Spanish culture and education lack a training in science—in reality, it is not that this training is deficient but that it is totally absent—and that this is a burden on other cultural and educational areas:

The Spanish problem is certainly a pedagogical problem, but the genuine thing, the characteristic of our pedagogical problem, is that we first need to educate a few men of science, to raise even a shadow of scientific concerns. (Ortega, *El Imparcial* 27 July 1908, in Ortega y Gasset 1966, 103).

³J. Ortega y Gasset (1966). *Obras Completas*, vol. I (1902–1916). Revista de Occidente (7th edn). Madrid. All translation are the author’s own.

Unfortunately, the cultural influence that Spain exerted during the sixteenth, seventeenth, eighteenth and nineteenth centuries in America caused scientific activity and the appreciation of science to be also weak in those countries of that continent where Spain exercised its political and cultural power, giving rise to the current technological and economic gap. The German sociologist Max Weber had already demonstrated in 1905, in his book, *The Protestant Ethic and the Spirit of Capitalism* ('Die Protestantische Ethik und der "Geist" des Kapitalismus'), that societies that embraced modern science developed two phenomena that helped them to succeed economically: a process of demagnification (the extolling of matter, the transformation of matter (chemistry) and the material against the mystical and spiritual), together with a rational method (of mathematical logic) in decision-making (political, mercantile, intellectual).

Weber observed that in countries like Germany or France, where Catholics and Protestants coexisted, the latter were not only richer but made more rational decisions and had professions that were more related to the study and transformation of matter: chemistry, engineering, physics. These new professionals, according to Weber, were what made a country powerful, not the contemplative life of Catholic friars and nuns. This is not the case today. Many of the elite Protestant youth prefer art or social and humanities disciplines to science and technology. In this sense, there are hardly any differences between Catholic and Protestant countries.

Still at the end of the nineteenth century, Spanish intellectuals defended the Inquisition. Menéndez Pelayo (1856–1912), with a Spanish public university named after him and a statue that presides over the National Library of Spain, wrote in 1880 in his book *La ciencia española* ('Spanish Science'):⁴

It is a great honour for me that De la Revilla⁵ calls me a neo-Catholic, inquisitorial, defender of barbaric institutions and other nice things. I am Catholic, not new or old, but Catholic to the bone, like my parents and grandparents, and like all of historic Spain, fertile in saints, heroes and sages far more than modern Spain. I am a Catholic, a Roman apostolic without deviation or subterfuge, without making any concession to impiety or heterodoxy.... I consider it a most honourable coat of arms for our country if it did not have heresy rooted in it during the 16th century, and I understand and applaud it, and I even bless the Inquisition as a formula of thought of unity that rules and governs national life throughout the centuries, as a product of the genuine spirit of the Spanish people, and not as an oppressor of it but in very few individuals and very rare occasions. I deny those supposed persecutions of science, that annulment of intellectual activ-

⁴M. Menéndez Pelayo. (1880). *La ciencia española* (vol. LVIII, national edition of the *Complete Works of Menéndez Pelayo* (ed. Rafael de Balbín). Santander: CSIC, 1953.

⁵Manuel de la Revilla (1846–1881) was a Spanish journalist and philosopher who was a supporter of the sciences. He translated Descartes into Spanish.

ity, and all those atrocities that routinely and without foundation are repeated, and I have bad taste, fashionable backwardness and write laborious cogitations like those of De la Revilla... I believe that true civilization is within Catholicism. (Menéndez Pelayo 1880, in 1953, 200–201).

And in the middle of the twentieth century, in the opening ceremony of the Consejo Superior de Investigaciones Científicas⁶ (the most important scientific institution in Spain, then and now), it was stated:

We want a Catholic science, that is, a science which, because it is subject to reason, supreme of the universe, because it is harmonized with faith, in the true light which illuminates every man who comes into this world, reaches its purest universal note. Therefore, at this time, we are liquidating all the scientific heresies that have dried up and exhausted the channels of our national genius and have plunged us into atony and decadence. Our science, the Spanish science of our Empire, the one that wishes to promote the new Spain with maximum vigour, repudiates the Kantian thesis of absolute rationalism. (...) The imperial tree of Spanish science grew lush in the garden of Catholicity and was not disdained to be the essential fiber and nerve of its trunk, the sacred and divine science, from whose juice all the thick branches were nourished in unison. (...) Our present science – in connection with that which in the past centuries defined us as a nation and as an Empire – wants to be above all Catholic. (...) In vain is the science that does not aspire to God. (Ibáñez 1940. Consejo Superior de Investigación Científicas (CSIC) 1942, 32–33)

In Spain, the Counter-Reformation—that is, the Catholic fundamentalism initiated after the Council of Trent in 1545—stifled the promising intellectual development that had begun in Toledo, with its School of Translators (in the twelfth and thirteenth centuries). It is revealing that here not only were mathematics and medicine translated but the astronomical data used by Copernicus (1473–1543), from the Alphonsine tables, the leading astronomy funded by the King of Castile, Alfonso X the Wise (1221–1284), the first tables since Ptolemy (second century AD).

The University of Salamanca was founded in the thirteenth century, yet it has not made any relevant contribution to the history of science, because it turned its back on it. It preferred to defend—and teach—Aristotle against Galileo. And that has been the downfall of Spanish culture. It has not produced Nobel Prize scientists, even among its ex-students and professors. This is still taboo in Spain, and I wonder if the mystical and anti-scientific philosophy from Salamanca is not attacking the entirety of Western universities.

⁶Spanish National Research Council.