

# The savant's drama: two cultures and two shores

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One of the attributes Italo Calvino recommends for writing in the coming millennium is lightness, a provision whose purpose is to clear away the obscurity of the world and to prevent our being crushed by matter, by chaos or by tradition. Lightness is not the same as simplicity, but it is similar. Nor does it, in this case, have the same type of outcome as the struggle between darkness and light or, more recently, between ancient and modern. They are different things, since gravitas is not a sign of the past, but one which is dominant in all centuries and all places. Poetry is the antidote, hence its purgative character. And what about science? Calvino bows down before this venerable icon, and admits that no human undertaking has been so efficient, so methodically and institution-ally efficient, in the effort to scrape the accumulated grime from things and to create the illusion that we can not only understand it but even control it and then possess it.<sup>1</sup>

Our relationship with science is ever-changing. No-one disputes its enormous powers of seduction, nor its undeniable ability to buoy up hopes. For centuries our cultural imagery has been full of images produced by this inexhaustible factory of dreams. It would seem that its ideal is self-sufficiency, the conquest of all types of knowledge and free unlimited movement. And so it becomes a historical undertaking which is more and more independent, versatile and mobile.<sup>2</sup> Most people trust in its practicability, but many more have misgivings. There is a lightness in science which is associated to its closeness to the mysteries of the world, and it is hard not to yield to its appearance of truthfulness, honesty, freedom, altruism, solidarity and even beauty. But while it is sorting out all our problems and putting the pieces back in order, it is be-coming more and more remote from the people, from the ordinary world. And finally we all find ourselves pushed to the shore of a vast savage continent.<sup>3</sup>

## Illusions of the two cultures

On the 8<sup>th</sup> of May 1794, three months before the downfall of Robespierre, Lavoisier was beheaded. The sentence was carried out after he had been refused

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<sup>1</sup> Italo Calvino, *Seis propuestas para el próximo milenio*. Ediciones Siruela, Madrid, 1989.

<sup>2</sup> Bruno Latour, *Science in action*, Harvard University Press, Cambridge, MA: 1973.

<sup>3</sup> See Bertrand Labasse, *Observations on the Communication of Scientific and Technological Knowledge*, Reportto Directorate-General XII of the European Comission, 1999. Also, Alan Irwin, *Citizen Science, a study of People, Expertise and Sustainable Development*, Routledge, London, 1995.

permission to finish some experiments which would otherwise have been left incomplete. The answer from the appeal court was brief:

"La République n'a pas besoin de savants". From that moment on we have had a perfect symbol to reflect on the difficult historical relationships between the two republics - the republic of letters and that of politicians. And the circumstances surrounding the case are captivating: for example, the presence of the guillotine, Joseph-Ignace Guillotin's dreadful new technique, invented at the request of the National Assembly to ease the work of the executioner, overwhelmed by the enormous number of condemned prisoners swelling the prison population.<sup>4</sup>

Surely what is most striking is the judge's brutal and absurd reply, because the Republic wanted to be enlightened and to set itself up as a structure capable of exercising rational control over the social and natural world. It was not an easy decision to close down the Académie des Sciences, but it was justified by the need to impose upon scientific institutions a form of democratic control more committed to the needs of the nation.<sup>5</sup> Science, as the tiresome rhetoric of the day declared, was no longer an end in itself but an instrument of the new bourgeois state. Not that the revolutionaries invented the argument of the usefulness of science: the argument is as old as knowledge itself, and traces of it can be found as far back as the times of Archimedes. But what was novel now was the central role which the new rhetorical and practical politics gave to the scientists and the institutions. Suffice it to recall the impressive list of mathematicians, astronomers, engineers and physicists who came to power after the French Revolution: Carnot led the Committee of Public Safety, Monge commanded the Navy, Bailly headed the City Council of Paris until he was guillotined, Laplace was a senator, Fourier a prefect, and Arago became a minister. A Geometrician, Bonaparte, seized civil and military power.<sup>6</sup>

The words that condemned Lavoisier confirm that what the Republic needed, in its role as representative of the people, was good republicans; and that, as a result, no branch of knowledge and no scholar could remain outside the control of the new democratic power.

The situation in 1800 represented a turning-point. The road ahead was the right one, but it was full of obstacles. If we look at Tocqueville, the Frenchman who in 1831 travelled round the young American republic, marvelling at the enormous differences he found on either side of the Atlantic, we see someone who laments

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<sup>4</sup> It is nonetheless ironic that we are talking here of the same Guillotin who in 1794, under Franklin's presidency and with the collaboration of Lavoisier himself, was a member of a Royal Commission set up to judge and repress the practice of Mesmerism. Mesmer's theories, based on supposed animal magnetism and hypnosis, had taken root in the popular imagination and were presenting a threat to the medical profession. Few examples so clearly sum up the networks connecting scientific activity with politics. See Lavoisier in European Context: Negotiating a New Language for Chemistry, Bernadette Bensaude-Vincent and F. Abbri (eds.), Science History Publications, Nantucket, Mass.: 1996.

<sup>5</sup> See Roger Hahn, *The Anatomy of Scientific Institution: The Paris Academy of Sciences, 1666-1803*, The University of California Press, Berkeley: 1971.

<sup>6</sup> Michel Serres, "Paris 1800", en Michel Serres (ed.), *Elementos para una historia de las ciencias*, Cátedra, Madrid: 1991.

the lack of liberty in Europe and who unequivocally denounces the oligarchic nature of the French institutions. He was doubtless aware of the existence of the École Polytechnique and of the Musée d'Histoire Naturelle, perhaps the greatest concentrations of talent then existing in the world, but he deplors their élitist organisation. What makes America different is its fascination with utilitarianism: the ability to link technical knowledge to everyday needs, ensuring for the people a level of well-being and consumption unheard of in the Old Continent. And this is the crux of his comparison, for it unites the spirit of practicality with democracy.<sup>7</sup>

Something in this analysis reminds us of another, equally well-known: that of Voltaire and his exile in London. For Voltaire what explained the cultural and scientific hegemony of England and Holland was the development of trade and the generalisation of comfort, as a new social value alongside citizenship. The comparison between the severity of some and the tolerance of others ended in his scathing criticisms of European monarchies. The subject, as we can see, is an old one and, although its form changes, there was always an influential current of opinion in favour of a causal relation between tolerance and learning, and between democracy and science. For Tocqueville and the many intellectuals who came after him the civilising equation was simple: individual liberties encourage practical knowledge, leading to cheaper production and a better standard of living. The formula is completed with another idealisation which sees the citizens in the middle of a mechanised utopia, part of a system which guarantees the combination of collective happiness and individual wellbeing.<sup>8</sup> And the more technology, the greater the wealth and the more democracy. Very naïve, no doubt, but this was how they presented the tale of the little milkmaid defending liberalism and progress. We now have a huge range of examples with which to criticise such naïveté, or rather such utilitarian and industrial optimism. And although we are well aware of the cases of the former Soviet Union and the majority of Asian countries (such as China, India, Japan or Pakistan), the fact is that we are faced with a successful ideology which still has many followers, even in positions of political responsibility.

The awareness of the power of science is not new. But it never reached such sublime heights as in the middle of the 19<sup>th</sup> century. And we are not just thinking of its military and industrial applications, but its more broadly cultural aspect. We are talking about the religion of progress which not only promised more efficient machines and panaceas for all ills, but the very vision of a truth revealed and not inherited. While positivism gained followers and organised spectacular propaganda coups, like the Universal Exhibitions which drew huge crowds—the Paris Exhibition of 1900 attracted some 50 million visitors—the first misgivings began to be felt. Machines, once seen by the working class as a threat to the stability of their Jobs, stopped burning. They would be worshipped by the masses now that they

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<sup>7</sup> Eda Kranakis, *Constructing a Bridge. An Exploration of Engineering Culture, Design, and Research in Nineteenth-Century France and America*, The MIT Press, Cambridge: 1997.

<sup>8</sup> See Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America*. Oxford UP, New York: 1964. David Nye, *American Technological Sublime*. Cambridge, MIT Press, MA: 1994.

had been won over to the cause of progress.<sup>9</sup> Some intellectuals, however, were not so easily seduced and they imagined new dangers: Frankenstein is the symbol of this new trend. But who was this character? Most people would reply that it was a fictional monster created by Mary Shelley, and the subject of a host of films. Some may even remember that its deformation was due to a sudden electrical failure seconds before the corpse on which experiments were being done came back to life. And, finally, there will be the vague image of a nightmarish laboratory, the horrified people, or the innocence of a little girl who is not frightened off by the difference of aesthetic values. But no. Frankenstein was the doctor who thought up the experiment, and not the result of the operations. It is strange, is it not, this transfer of identity between the subject of the action to the object he creates. Clearly, here is a novel which invites us to think about the dangers of this new emerging power which science represents. But the cultural turmoil is not caused by the results, since the risk lies in certain irresponsible scientists who unleash forces or processes which later they cannot, or will not, control.<sup>10</sup> Mary Shelley seems to be saying to her readers that some scientists may become perverted, even by their own stupidity. But what the people, the public, remember is less high-minded, and it is scientific activity itself which bears the stigma. And this is one of the key arguments of the theory of two cultures, for while scientists "carry the future in their bones", traditional intellectuals such as Yeats, Pound and, for example, Orwell, were accused by Snow of being born Luddites: deaf to the good news of science and blind to technical progress. All the same it is interesting that the sect of the reactionaries, initially formed by laymen of the industrial and urban working class, should grow, according to Snow, to include the humanists a hundred years later.<sup>11</sup> The shadows which began to appear in this 19<sup>th</sup> century literature become predominant in the rupturist works of Wells, for whom the novum announced by science is not a machine paradise but a night-mare in which beings from other worlds or devastating wars drag Humanity back to early brutish stages of their evolution. In Wells the story is normally built around an unexpected superhuman force which must be fought by the selfless and philanthropic hero, free of the usual self-righteousness and self-satisfaction, and who has to resist this disastrous biological regression towards destruction. In this sense all of Wells' work is an argument against the mindless Victorian society and against the arrogant and diabolical scientist, capable of unleashing forces which he then cannot control. With it comes the end of the brilliant certainties of Newtonian physics, and we begin to see terrible portents of wars between worlds, genetic alchemy or evolutionary accidents.

This is the world which will slowly come to dominate in the literature of our century. Socialist paradises, described by William Morris and others, enlightened by

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<sup>9</sup> Paul Greenhalgh, *Ephemeral Vistas. The Expositions Universales, Great Exhibitions and World's Fairs, 1851-1939*, Manchester University Press, 1988.

<sup>10</sup> Antonio Lafuente and Alberto Elena, "Los científicos ante su imagen y su público", *Claves de razón práctica*, 67, November 1996, pp. 48-55.

<sup>11</sup> Roger Kimball, "The two cultures today", *The New Criterion*, on line, February 1994. [www.newcriterion.com](http://www.newcriterion.com).

socially-conscious and generous scientists, are replaced in films like Fritz Lang's *Metropolis* or novels like Aldous Huxley's *Brave New World* by oppressive societies inhabited by robots or beings with no memory, manipulated by pseudo-Prometheuses promising happiness at the expense of freedom. While novels and the cinema soon began to be wary of science, and advised caution against the Faustian myth, throughout this century public opinion on science and technology has kept a basically ambivalent attitude where, in the words of Marcel LaFollette: "The message appears clear: science gives, and science takes away".<sup>12</sup>

Without a shadow of doubt the most wide-spread stereotype in popular culture is the mad scientist, the evil being who —for the most varied of reasons— wants to dominate the world or, failing that, to destroy it with the amazing powers that his knowledge bestows upon him.<sup>13</sup> Innumerable versions of this Faustian figure fill the pages of as many comics and popular novels, as well as the pictures of countless films and TV series. In all of these media the scientist's only role seems to be that of an opponent to the hero, and his intrinsic wickedness (or in other variations, his access to special powers which finally get out of control) separate him from the popular image of the typical man in the street with which one could perhaps identify. But, even without taking into account this extreme case —albeit the most typical in popular culture— other more neutral or even positive depictions of scientists also underline this *difference* from what is implicitly considered *normal*. Who could forget Sinclair Lewis' magnificent and idealised description in his famous *Doctor Arrowsmith*, one of the masterpieces of the genre in question? "h-le had never lunched with a duchess, never received an award, he had never been interviewed, never done anything the public could understand nor, since his school-boy crushes, had he ever had any experience which people might consider romantic. He was, indeed, a true scientist". A description which recreates and updates the image *par excellence* of the isolation of the scientist from his social environment, a legend which winds throughout all the historiography based on the *Big Picture*.

Between the case of Lavoisier and the others we have mentioned, there is one major difference. In the nineteenth century mistrust grew up like the myth of Faust. And although Jonathan Swift, too, in *Gulliver's Travels* distances himself from scientific fashion, his criticism is no more than irony towards certain types of pedantry. Swift is irritated by the petulance of the scholar, but he still does not accuse him of arrogance. Which is exactly what Dumas, the judge who sentenced Lavoisier, was to do later. And so the conflict between science and politics now takes the form of a certain tension between scientists and humanists, which

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<sup>12</sup> Marcel C. LaFollette, *Making Science Our Own. Public Images of Science, 1910-1955* (Chicago, 1990), p. 175.

<sup>13</sup> Concerning this, see Spencer Weart, "The Physicist as Mad Scientist" (*Physics Today* [June 1988]), pp. 28-37, and Andrew Tudor, *Monsters and Mad Scientists. A Cultural History of the Horror Movie* (Oxford, 1989), specially pp. 133-157. Also Joan Bassa & Ramón Freixas, *El cine de ciencia ficción. Una aproximación*, Paidós, Barcelona, 1993.

disguises what the public sees and remembers: that is, the split between elite and popular culture.<sup>14</sup>

### **The misanthropy of the scholar**

It was not always so. In earlier times, when there was still no clear distinction between a philosopher, a politician, an engineer or an astronomer, there was no tension between people of the Arts and those of Science. The roles alternated, since a good intellectual had to be a jack of many trades, unless he was prepared to renounce the idea that every-thing was the expression of one unique principle, that every part of the Universe could only be understood as a microcosm; that is, that each individual thing contained everything within it, being no more than a specific reflection of one great universal harmony. In the centuries to which we refer the essential tension was between learned and laymen, between the refinement of the elitist culture and the barbarism rife among servants and peasants, and which also affected practically all public officials, soldiers and clergy. And we have three stories to tell in order to illustrate this change. We cannot reconstruct them documentally, because, as in Lavoisier's case, they deal with things which everyone knows but which never actually happened. They are historic, but there were no witnesses. And, of course, we know so much about them that they are more real and more relevant than most of what we find in history books. They are real myths and give off the rosy glow of dawn: they are founding myths. And here they are. First we shall talk of Galileo's *EPPUR SI MUOVE*, then of Archimedes' *EUREKA* and, finally, of the laughter of the Thracian woman, the story of the well of Thales of Miletus.

The bare facts of the legend about the difficulties of Copernicanism can be quickly told.<sup>15</sup> Galileo has just renounced his Copernican beliefs before the Inquisitional court. He is more angry than frightened, and between his teeth he mutters *Eppur si muove, And yet it moves*. What has happened? The greatest courtier, the most outstanding scientist, the greatest prose-writer in the Italian language has misjudged his strength, and against the advice of friends and enemies he has not recanted in time. He knows that the Earth moves round the Sun and declares that he has proved it. He fights to the end, but finally realises that torture and maybe even death at the stake await him. His judges are not prepared to negotiate, and obstinately they all turn up for this fascinating appointment with fate. They are making history, they are going to humiliate Galileo and the astronomer, former friend of the powerful, shining star of the Florentine court of the Medicis, confidant

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<sup>14</sup> See Roger Cooter and Stephen Pumfrey, "Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular Culture", *History of Science*, 32, 1994, pp. 237-267.

<sup>15</sup> Mario Biagioli, *Galileo, courtier: the practice of Science in the culture of Absolutism*, University of Chicago Press, Chicago: 1 993. Dava Sobel, *La hija de Catiteo: una nueva visión de la vida y obra de Galileo*, Debate, Barcelona: 1999.

of popes and cardinals, is on his knees reading a text which they have prepared for him.:

I, Galileo Galilei, [...] seventy years of age [...] and kneeling before you [...] swear that I have always believed and now believe, and with the help of God shall always believe in all that which the Holy Catholic Apostolic Roman Church holds to be true, preaches and teaches [...] Insofar as I have written and caused to be printed a book in which I expound this condemned doctrine [...] With sincere spirit and true faith I abjure all my errors, and reject and abominate them...

And this is what the documents show. But the story does not end there because somebody at some time explained that Galileo, as proud as ever, muttered between his teeth the phrase which fits in so well with our need for myths. "Yet it moves" resounds in our collective imagination like a rebel cry against Church's authoritarianism, as a gesture meant to remind us of superiority of scientific reason over the reasons of state, a sublime affirmation of individual freedom against social conventions. How could we fail to identify these words of rage as ours, still bursting with emotion? These are "facts" which we manufacture through necessity and which give dignity to our ever-threatened human condition.

But let us go back a little. The extensive historiography about Galileo available — some 5 000 titles—, seems to confirm the theory that his misfortune was due to his Copernican convictions, but that the basic motive was something else. His enemies, the Jesuits, managed to persuade the Supreme Pontiff that the character Simplicio who appeared in the *Dialogues* was a caricature of the Pope of Rome. The evidence was elusive, as indirect and shaky as that adduced by Galileo in defence of the movement of the Earth, but the tense atmosphere made it credible. And from that moment, the die was cast. For the argument ceased to be about astronomy or theology, to become instead a crude exercise of power aimed at discouraging anyone who imagined that political power should be subject to scientific authority. Furthermore, since Simplicio spoke like an ordinary man, putting forward all the common sense arguments, the trial in a sense dramatises a revolt of laymen against scholars. It is not clear who was the first to tell this story, but there is a version which adds a surprising new character: it was to his dog that he addressed his *Eppur si muove*.<sup>16</sup> This may seem absurd, and indeed it is. But, as we have said, it is not a matter of justifying one version or another, but of extracting the cultural consequences. It seems that in this context we are being told that even dogs, unprejudiced brutes creatures, could understand him better. Galileo's conviction, like Lavoisier's later, meant his immediate promotion to divine status. His disciples fabricated his biography, insofar as it includes other inventions

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<sup>16</sup> Galileo Galilei, *Consideraciones y demostraciones matemáticas sobre dos nuevas ciencias*, by Carlos Solís and Javier Sádaba (eds.), Editora nacional, Madrid: 1976, see reference in introduction, p. 32.

which are no less significant and widely-known.<sup>17</sup> For example, his birth certificate was forged to show that he came into the world on the day after the death of the great Michelangelo. It was also considered a fact that he had climbed to the top of the Tower of Pisa to drop two spheres of different weight which reached the bottom at the same time, thus destroying Aristotelian physics. But nobody has ever found a document proving the existence of this famous and crucial experiment. And we could go on, because the greater the myths, the better embroidered are the narratives describing them.

The jump we now make takes us to Sicily, nineteen centuries before. We are in the third century BC to talk about Archimedes.<sup>18</sup> We know very little of his biography, and almost all of it would fit into a few lines. Born in 287 BC, son of a rich patrician astronomer, he lived for 75 years until 212 BC. His fame, like Galileo's, is legendary and also like the Pisan he maintained close relationships with those in power. Archimedes was a sort of palace counsellor of the tyrant Hieron II of Syracuse. His death was a martyrdom, although he was killed by human stupidity rather than hate. Linceus, Plutarch, Valerius and Maximus, among others, tell that at the end of the lengthy siege of Syracuse ordered by the Roman Consul Marcellus our sage was in the garden of his house (others say he was on the beach) resolving an intricate geometrical problem whose lines he had drawn in the sand. Then a Roman soldier trod on his "manuscript", enraging the scientist. And that was that: at one blow the vulgar soldier ended the man's life and turned him into a myth. Once again we have the struggle between the scholar and the layman, and once again ignorance prevails by brute force over genius. And everyone was deeply sorry, because the Consul had ordered his troops to respect the scholar. This is no mere detail, because the chronicles tell that Archimedes invented some engineering devices which delayed the end of the siege and seriously annoyed the invading troops. They talk of marvels such as colossal catapults or a system of mirrors capable of concentrating light on the sails of ships and setting them alight. Much has been written of these marvels, but we have no choice, we have to say that they are fictional. Seven centuries later Procius finds another gem to delight the believers. We do not know where he found it, but who would dare to say it was false? The Archimedes he shows us is the greatest of magicians, and he addresses the king: "Give me but one firm spot on which to stand, and I will move the earth". Fantastic! So they ask him to demonstrate this stroke of genius. Then after many calculations and much hard work he builds a gigantic system of pulleys and out of the water he drags the *Syracusae*, a three-masted ship of some fifty feet in length, full of cargo. What more could they ask for? All the crowd stood open-mouthed as they watched the amazing spectacle: science could dominate nature or, in other words, the control of science gave great power.

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<sup>17</sup> Michael Segre, *Nel segno di Galileo. La scuola galileiana tra storia e mito*, il Mulino, Bologna: 1993.

<sup>18</sup> Michel Authier, "Arquímedes o el canon del sabio", in *Elementos para una historia de las ciencias*, Michel Serres (ed.), Cátedra, Madrid: 1991.

And the best is yet to come. Once again we have Hieron II —power is still at centre stage— and our man. This time the problem is nothing to do with matters of war, but with the court. The King —recounts the great Vitruvius— has received a crown and suspects that all that glisters is not gold. What is more, he is convinced that he has been cheated with an alloy which is an offence to his dignity. He goes to Archimedes for help, who racks his brain to find a way of solving the enigma without destroying the symbol. In the next scene we see him in a bath full of water which overflows as he gets in. What could be more normal? Perhaps, but it is all Archimedes needs. *Eureka! I've got it!* he is said to have shouted, running naked down the street. He had discovered the famous Archimedes' principle, where a body submerged in water experiences a vertical upwards force equal to the weight of water displaced. It would then be possible to construct a hydrostatic scale and check whether the crown displaced the same amount of water as if it was of pure gold. He built it and confirmed the suspicions. While there was much merit in doing so, it is only fair to say that it is always easier to prove what "is already known" than the opposite. This is where Galileo went wrong before a court which "already knew" what was true, however much some-of the evidence might point in another direction.. The Simplicio of this story is no longer in disguise, nor is he a parody of anybody. This time it is the people who witness the scholar's eccentric behaviour, the unsettling evidence of genius. The nudity in which the discovery is clothed is important, and the subliminal message is clear: a scientist only needs his brain, all the rest is incidental. And there is another exciting thing about this story: the overwhelming joy, the unbounded satisfaction. And as nothing is comparable to the pleasure of discovery, we get the explosion of glee with which he runs through streets before the once more astonished citizens of Syracuse.

A bathtub is all that it needed. War, ships, these are overcomplicated affairs. But science is simple. It is very difficult, it is the province of the chosen few, but a great discovery only needs great curiosity. It is the same as the story of Newton's apple, another doubtful fact which has been handed down to us by tradition and which we cannot prove.<sup>19</sup> It was his niece who claimed to have been a witness, and she went

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<sup>19</sup> The history of the novel, of poetry, painting or music is full of references to muses responsible for the miracle of creation. And nobody is surprised to see how many artists become tongue-tied when asked where this brilliant idea came from, or what produced that particular feeling. And muses are like witches: they don't exist, of course, but they are about somewhere.

The history of science is in every way as good as that of art. Hefty volumes are dedicated to collections of all sorts of discoveries, often trifling, which have been made by chance. There are all types, including some made by ordinary folk who did not expect to make any contribution to knowledge. It is said, for example, that there was a Peruvian Indian who, burning with the fever of malaria, dived into a river very close to a forest of cinchona trees. He drank and drank, believing his death was imminent, but he survived. Nobody was safe, and when he told the story in his village, the remedy became popular. Then, much later, the Countess of Chinchón, wife of the Viceroy of Peru, also fell ill with malaria, an illness which European medicine was powerless to treat, but which was cured by traditional Inca herbalists. Legend says it that it was she who sent back samples of the tree-bark to Europe, bringing the first proven anti-fever drug in history. A century later the news reached Linnaeus, who in classifying it as *Cinchona* committed two errors at once. The first was not calling it "Chinchona" if, as it seems, he wished to give credit for the initial discovery, and the second attributing it to a woman who never returned to Europe and who had done no more than to admit that the

around telling the story until it finally reached the ears of Voltaire, who was able to play "Vitruvius" and to make up a good story. What both cases have in common is that a genius converts a vulgar and commonplace event into a far-reaching scientific fact. These two myths are telling us that a scholar is someone very special who can put everything to use, whose sight and sensitivity are very far from ordinary. He is different; he lives among us but he sees other things. His world and ours are the same only in outward appearance.

Let us get back into our time-machine and call at Miletus. It is the end of the sixth century BC and Thales, for the Greeks one of the seven great sages of antiquity, founder of Philosophy and astronomy, goes out of his house to look at the sky. Absorbed in his thoughts he doesn't see the well which is in his way, and he plunges to the bottom. Plato tells us the story through the mouth of Socrates; the only witness is his Thracian servant, an ignorant woman and, like all Thracians, obsessed by the worship of her many gods. And Thales had just the opposite obsession because in his opinion there were too many gods in the minds of his contemporaries. It was enough for him to open his eyes in that harbour town to be convinced that everything came from water, that water was the primordial element at the origin of everything that exists. And so was born philosophy, for it was Thales who had the distinction of first looking for the reason of things in nature and not in the capricious world of the gods. And again, as in the case of Newton and Archimedes, his discovery was a response to the simplicity of the formulas which led to success, and also has its origins in his curiosity about things which could happen, about his surroundings, about everyday things.

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natives might possess more effective medicines than the palace doctors. So who made the discovery? The legendary Inca, the Countess in the fable or the historical botanist who transformed a series of mistakes into a famous breakthrough?

No mistake had greater consequences than the discovery, accidental finding, or invention of America, which at all events has been called the Columbian breakthrough. Columbus was looking for the Indies and found America and, as such, deserved to be included as yet another character in Walpole's tale "The Three Princes of Serendip". Archimedes and Newton were enjoying a rest when something pulled them out of the everyday run of things and raised them to the status of discoverers. We remember Jenner for discovering smallpox inoculation and he relates the story that a simple milkmaid told him that she would never catch such a virulent disease because she has had already the cowpox —*vaccinia*. The story was remembered years later and became the origin of the methodical research programme which the scientist carried out until the discovery was made. Once again we have a day-to-day fact becoming a scientific breakthrough. In the same way, many stories have circulated about the discovery of penicillin by Fleming, rubber vulcanisation by Goodyear, the Rosetta stone by Champollion, radioactivity by Becquerel, or the positron by Anderson. Chance is a common factor in all these cases, although it is highly debatable whether they may rightly be attributed to common or garden luck or to prestigious serendipity. Certainly, to say that luck was important gives a certain aura to the scientist, as shown in the case of the discovery of benzene, a molecule which chemists could not understand. The story that Kekulé told thirty years later turned out to be a fraudulent lie, since he said that he dreamt that a snake coiled round itself, which enabled him to devise the hexagonal form. But it was not true, since it was then shown that he had not been inspired by dreams but by reading the work of his predecessors. For more tales, see Sven Ortoli and Nicolás Witkowski, *La baignoire d'Arquimède*, Seuil, Paris: 1996, and also Federico di Trocchio, *Las mentiras de la ciencia. ¿Por qué y cómo engañan los científicos?*, Alianza Editorial, Madrid: 1995.

But what part does this woman play in the story? She is there to laugh; the servant mocks the fact that someone looking so far above him fails to notice what is at his feet: if you look at the sky, you are unaware of the ground. The Thracian woman not only evokes the intellectuals' loss of a sense of reality, but she reproaches them for their lack of concern for worldly things —perhaps even their disdain for popular religious beliefs— and for the concerns of ordinary folk. Plato tells us a fable, probably borrowed from Aesop, which is far from innocent, since Thales' action anticipated what was to become normal in Socrates, and which finally became intolerable to the Greek polis. Scholars interfered in their affairs, questioning everything, rummaging around their refined traditions, and rather than the solution they were the real problem faced by the fragile social structure. If Thales was a victim, Socrates ended as a martyr. The myth has been told a thousand times and changed as often. Its shadow stretches as far as our own time, because the accusation that the philosopher is a waste of time and a social parasite is a platitude which is far from exhausted, even though he was born at the same time as astronomy. And there are versions for all tastes: Montaigne brands the Thracian woman as the enemy of knowledge because she did nothing to prevent his fall, Serres angrily asserts that the well was none other than an astronomical observatory and that the scientist was working down there, something which the coarse servant was unable to understand.<sup>20</sup>

But there is another story worth recalling. Aristotle recounts that Thales was very angry because people laughed at him for being so poor, even though he was so wise. More laughter. And in order to disabuse his fellow-citizens he offered them proof that his situation was voluntary and not imposed. His knowledge of astronomy enabled him to forecast a splendid olive harvest, and he then rented all the mills in order to organise a monopoly from which he could speculate and make fat profits. He did so and then got rid of all the wealth he had made. Scholars have no time for trivia, and if they seem shabby or idle, it is not because they hate the world or cannot enjoy life, but because no passion is the equal of passion for knowledge, and no success so great as that of discovery.

Who has the last laugh? In other words, who can afford to laugh at whom? Scholars or laymen? Let us leave the answer for a moment, and not fall into the trap lurking behind such apparently innocent questions. The problem we pose is an old one, but what our wise guests are talking about is right up-to-date, problems yet to be solved. Thales and Archimedes are still alive, but we have to resume our journey. And from most ancient to most modern times. Barely a second passes and we are back with Snow, who in 1959 wrote a book whose success is still a mystery to many of us. Snow says that the West is rushing headlong towards a terrible crisis. The problem is the communication gap between the two cultures — traditional or literary and liberal or positivist— a tragedy which threatens the very idea of democracy and which, if true, would be bemoaned by all the Tocquevilles travelling round America. The solution he proposes is simple, and consists in fusing

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<sup>20</sup> Hans Blumenberg, *La risa de la muchacha tracia. Una protohistoria de la teoría*, *Pre-Textos*, Valencia: 2000.

into a single, third, culture knowledge of nature and knowledge of conscience, common speech with learned language. Snow, like Frank Oppenheimer before him with his paradigmatic popularising project in the San Francisco *Exploratorium*, disappointed like his brother Robert by the circum-stances surrounding the bombing of Hiroshima and Nagasaki, wants better republicans, citizens involved in culture and science. And for this he seeks an army of intermediaries to build a bridge between the two shores.

At the end of the Second World War Vannevar Bush, Director of the Federal Office for Science and Technology, president of the Carnegie Foundation and former architect of the Manhattan project, published a text entitled *Science: the Endless Frontier* to remind politicians and citizens that America's strength lay in its capacity for scientific and technical innovation.<sup>21</sup> And this enthusiasm continued unabated until the Soviets overtook them in the space race. Then began the drama and the Americans suffered an identity crisis: they could not believe, it was absurd, that the Communists, in the typical language of the cold war, could go forward more quickly in the march to progress. And among the many diagnoses of this supposed decadence that of Snow, pointing out the tragedy of the two cultures, gained credibility. And thus arose the myth. However, our opinion differs, for the problem continues to be the gulf between scholars and laymen, or between the elite and the people.

## Popular Scientists

We have already quoted Voltaire who, for Snow, would have personified the paradigm of the intellectual bridge and who, as is well-known, played an important part in the introduction of Newtonianism into France. The publication of his *Elements de Philosophie de Newton* was praised unreservedly by the Jesuits themselves, his old teachers : "Behold, all that which seemed difficult or impenetrable in Newton is here, how-ever, within our grasp... Everyone wishes to read at least a chapter, to glance at the titles, to feast their eyes upon the book [...] /e tout *Paris* is buzzing with the name of Newton, is prattling about Newton, is studying and understanding Newton".<sup>22</sup>

Lo and behold, the dilemma of the two cultures is apparently resolved. A man of letters, the Poet of France, explains science to all, and nobody who aspires to be enlightened can be unfamiliar with Newton. Sir Peter Medawar, winner of the Nobel Prize for medicine, protested two centuries later that not reading Shakespeare was tantamount to being an ignoramus, whereas total ignorance of the theory of relativity was still forgiven. In the eighteenth century, however, to talk of the theory

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<sup>21</sup> Roy MacLeod, "A Ciência e a Democracia: Reflexões Históricas sobre Descontentamentos Actuais", in María Eduarda Goncalves, *Ciência e democracia*, Venda Nova: Bertrand Editora, 1996, pp. 31-61

<sup>22</sup> Antonio Lafuente, "Newton a la carta", introduction to the edition of the *Elementos de la filosofía de Newton*, by Voltaire, Círculo de lectores, Barcelona: 1996.

of gravity or the refraction of light through prisms was the frontier which had to be passed before entering the salons of Madame de Pompadour or Madame de Châtelet.<sup>23</sup> The dream of science within everyone's reach seemed to have come true, and was the precursor of such astounding facts as the Great Exhibitions or the Cité des Sciences et de l'Industrie de la Villette in Paris.

And so runs the well-established propaganda, concealing a reality which is not quite so obvious. How did the grim Mr. Newton reach the hearts of all these wise ladies? Voltaire had to invent the genre of popularisation. The facts articulating his tale of mathematical laws and principles of physics are no more than a collection of anecdotes which, by being entangled with everyday events, mean a new way of expressing collective experience and thus common sense. And when he could not find the right metaphor he did what has always been done: he re-sorted to the authority of the divine Newton and asked his reader for an act of faith... When he does not know what to say he attacks Descartes and rather than prove the *dictum* of the new science he ridicules the principles of the old. He contrasts the absurdity of the Cartesian ether with the simplicity of the vacuum, and always with a rhetoric which creates the illusion that Descartes was cunning and Newton straightforward. It is absurd to admit the concept of action-at-a-distance, but his rhetoric was successful. Voltaire knew that it was impossible to become Newtonian without an act of faith and so he asked help from his friend Maupertuis in the following forceful and revealing terms: "I await your reply to know whether or not I should believe in attraction [...] My faith will depend on you". And a few days later, after receiving the reply, he writes back enthusiastically: "You have banished my doubts... Behold, I am a Newtonian like yourself. I am your disciple and I put my profession of faith in your hands".<sup>24</sup> There is no doubt. Voltaire, who knew little of science, needed to be converted. This is the trap into which anyone trying to enlighten the ignorant will fall. Science, intended as an activity for privileged brains, is spread to the ignorant using a style which needs the literary wiles of a great seducer.

Voltaire was great, but Georges-Louis Leclerc, Conde de Buffon, was in no way inferior. Author of the monumental 90-volume Natural History and a sworn enemy of Voltaire, he proposes other ways to understand the relation between science and public.<sup>25</sup> The change, however, demands a new approach. And again we have the same rhetoric which always tries to ally itself with common sense. Is it not absurd, says Buffon, that the dog, which "...customarily follows the horse in real life", should appear, according to Linnaeus, immediately before the horse in his system of zoological classification? The Creator cannot be a Great Geometrician, as Voltaire had it, but a Sublime Gardener who has ordered nature in accordance

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<sup>23</sup> Georges Rousseau, "Los libros científicos y sus lectores en el siglo XVIII", in Javier Ordoñez and Alberto Elena (eds.), *La ciencia y su público: perspectivas históricas*, CSIC, Madrid: 1990, pp. 147-224.

<sup>24</sup> See Antonio Lafuente, "Newton a la carta.... Op. c:t.

<sup>25</sup> Our comments on the case of Buffon are based on our own work, Antonio Lafuente and Javier Moscoso, "El sensire aude de Buffon. Escritura y público de la ciencia popular de la Ilustración", introduction to the edition of texts *Georges-Louis Leclerc, conde de Buffon (1707-1788)*, CSIC, Madrid: 1999.

with what we are and, of course, what we could be. But this "we" to whom Buffon addresses his words is not the thinking logos of Descartes and Newton, but the collective subject which emerges as spokesman of public opinion. Buffon's Natural History requires a radical expansion of the sensory universe, capable of "following... the order of relationships which things seem to have to have with us". Rather than create complicated systems of classification it is more important to "look and look again". Not such an easy task, unless we can open our eyes to look as if for the first time. In order to know nature, we have to shake off a heavy inheritance: we have to be re-born, or invent a new *res publica* to restore our atrophied sensitivity. And the battle must be fought in the field of public opinion, without whose expansion there can be neither civil history nor natural history.

Buffon then appears as the awaited prophet, he comes to fulfill a long-deferred promise: the creation of popular science. Not elitist and then popularised, but totally woven into the warp of society and, nevertheless, endorsed by Royal Privilege or authorised by the Academy of Sciences of Paris. Buffon represents the possibility that the knowledge of nature, of its order and distribution, its culture as its generation, may be ours by right. And the French love him. His books were bought with great delight, until they became the greatest publishing success of all time. Yes, they love him because his rejection of a mechanical-geometric concept of nature opens the way to new ways of understanding within the grasp of the ordinary intellect. There is a direct contact between the scientist and the public which does not need the intervention of the intellectual. The strength of his Natural History lies precisely in his ability to address the reader directly, without a need for go-betweens, and to teach him that there is no more order in nature than we ourselves want to find in it. Thus the reader takes a decisive role. The knowledge described by Buffon avoids the simplifications introduced by all the other systems and, without scorching biological diversity with abstract laws, takes as much pleasure in feeling it as in reading about it. The history of Nature cannot be excluded from the history of the ways in which we feel it and therefore write about it.

If Voltaire and his scheme of popularisation can be seen as the realisation of the dreams of Snow, Oppenheimer or Medawar, Buffon seems to embody Brockman's aspirations. In what may be considered the manifesto of "The emerging third culture", John Brockman declares that the scientists of the third culture communicate directly with the public, without need of philosophers or popularisers, and so acquire their status as the new public intellectuals.<sup>26</sup> They call Daniel Dennett the new Bertrand Russell, Tom Wolfe describes Edward O. Wilson as the new Darwin, and Richard Dawkins is now one of the most sought-after writers in Great Britain. Science is posing challenges which affect the fundamental values of our social order and which involve the very survival of the species. People have been seduced by this message and now they demand that these tensions should be brought into the open. And Brockman, who has read the signs of the times, confirms that "his" authors, converted into sexy *scientists*, have at least a tenth as

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<sup>26</sup> John Brockman, *La tercera cultura*, Tusquets, Barcelona: 1996.

many readers as those who follow the writings of the Pope. So, as well as being a great propaganda exercise, the third culture is also a big business which nobody is quite sure how to interpret.<sup>27</sup>

What characterises the science produced by this third culture is its ability to create objects which were previously unthinkable within the traditional scientific world. It is not just that we are talking of problems of an interdisciplinary nature made up of a greater number of variables, nor that they need any greater understanding of chance as a motor for change, nor even that they include theories relating to human consciousness or behaviour: but it is the combination of all these difficulties which make them unmanageable. Not all problems are automatically accessible. Each discipline has its traditions, and its own way of reducing phenomena to observable and quantifiable parameters. So to pin down an object in a laboratory requires a scale more suited to the mathematical and experimental styles of a "fact factory" which is used to theoretical and technical simplifications. These have split nature up into disciplines and, above all, have kept her isolated from the contagion of the realm of the so-called social sciences. What the new historiography has taught us about the Scientific revolution now echoes what the scientists of the third culture are demanding: to be in possession of tools in order to work with objects which cannot be created artificially, in order later to manipulate them in the laboratory. So that in order to isolate them they have to operate as Galileo, Newton, Linnaeus or Lavoisier did: first, to imagine them as a synthesis of different traditions; second, to fix them by *ad hoc* experimental means developed in the laboratory; and third, to disseminate them by means of propaganda aimed at increasing their presence in the public awareness.<sup>28</sup> It is far from easy, as *science studies* show, but the iconoclasts are in luck. Literature abounds, but few have shown such mastery as Steven Shapin,<sup>29</sup> expert in the great superproductions of Hollywood's Golden Age, but who shows us a view of science and scientists which does not follow in the wake of Cecil B. de Mille but rather the models of Woody Allen or Robert Guediguian. And the change is as great as that which took place in the cinema, all that we lose in spectacle and glitz we gain in truthfulness and freshness. The actors are ordinary people who cook ordinary food, although they still hesitate about what spice to use for seasoning and sometimes they venture on vague projects. So are scientists also like us? Yes, and in two senses. First, because they are human beings; they live in society, they feel passions and they make lots of mistakes. But Shapin also draws a picture which, without detriment to historical accuracy, is relevant to the reader who is trying to understand the world of today. The scientists of the 16<sup>th</sup> and 17<sup>th</sup> century are invited to join in as our

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<sup>27</sup> Marek Kohn, "Laboratories against the literati", article on Brockman in *The In-dependent*, 24th March 2000.

<sup>28</sup> See Larry Stewart, *The Rise of Public Science. Rethoric, Technology and Natural Philosophy in Newtonian Britain, 1660-1750*, Cambridge University Press, Cambridge: 1992. And also Christian Licoppe, *La formación de la pratique scientifique. Le discours de l'expérience en France et en Angleterre (1630-1820)*, La Découverte, Paris: 1996.

<sup>29</sup> See Steven Shapin, *La Revolución Científica. Una interpretación alternativa*, Paidós, Barcelona: 2000.

contemporaries in this feast of words and gestures which we call culture.<sup>30</sup> To be sure, they speak about their affairs, their world, their dreams, their favourite books and their contacts; but they speak our language, they know about our interests, they are not autistic. And they do indeed need the conversation we offer them. The image they have been landed with is uncomfortable, they wear grandioso clothes, they look like brains stuck onto a sphinx, and they don't want to waste any more of the life they have left in feeding our insatiable hunger for myths and legends. And they are quite right.

This strategy was always plagued with controversy and theoretical or experimental difficulties. Looking for the protagonists of these procedures with Nanni Moretti's hand-held camera teaches us to see them smuggling instruments designed for other purposes, acting without a script, with histrionic gestures and with dynastic ambitions. What is new about the aims which are behind the third culture is that they are fusing together problems whose scientific and humanistic nature is no longer dual, as Snow describes the drama of our culture, but unique and indistinguishable. Systems as complex as the brain and the consciousness, matter and life, the biosphere and culture, are not pairs of independent problems, but are all subject to a common evolutionary process. And to think of them as interdependent we need a whole arsenal of new metaphors which will transform our culture into something hitherto unimaginable, and of course as revolutionary as the change which took place in the Renaissance.<sup>31</sup>

And we are not only talking of books. Another of the characteristics of the third culture is that the frontiers between scientists and amateurs are breaking down more and more. The very notion of science and academia has become something too abstract or else too political and worldly. The reasonable thing is to talk of research, a term which simply describes a single activity which is not encumbered with dense clinging utopian or ideological values. To accentuate the contrasts, it seems that the commitment is no longer so much with truth as with the wish to make things work. Old-style scientists would measure and test the mind or the intelligence, while those of the third culture would try to make something that worked well, or seemed to. In order to answer the question of how the mind works, the solution which would meet with most approval would be to build something which tried to replicate it. And we could generalise this change of direction into all topics characteristic of the third culture, for the answers always take the form of new technologies. What is reality? What is life? What is consciousness? The third culture makes use of supercomputing and replies with artificial reality, artificial life and artificial consciousness.

For Popper science transcends culture. Something which Polanyi expressed more radically when he considered it the epitome of transculturalism, a production capable of overcoming the multiplicity of races and cultures. But what happens

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<sup>30</sup> See Andrew Cunningham and Perry Williams, "De-centring the 'big picture': The Origins of Modern Science and the modern origins of science", *British journal for the History of Science*, 26, 1 993, pp. 407-32.

<sup>31</sup> Boaventura de Sousa Santos, *A Crítica da razão indolente. Contra o desperdício da experiência*, Ed. Afrontamento, Oporto: 2000.

when tension arises between people of different levels of access to education, between rich and poor, between centre and fringe? Here Snow, fascinated like other armchair leftists by the Soviet education system, hesitates between sending an army of engineers to impose modernisation in all corners of the planet, and recruiting battalions of scientific teachers to banish the local culture. But all these points now seem archaic. Today the culture which transcends all others is technology. We are talking not of the missionary experts that Snow visualised in mid-century, but of the masses of Internet users. The PC is the greatest symbol of the third culture. More than a tool it is a destiny: its millennium lies in the promises of nanotechnology, and its acolytes keep swelling the ranks of the technopagans.<sup>32</sup> Computers, said MacLuhan, are LSD for the leaders of the New Economy. Their heaven is in Silicon Valley and in innovation-oriented capital-intensive industries. Their spokespersons have no great respect for scientific credentials and rather favour free initiative and amateur-ism. Understanding is less important to them than innovation. Many of the protagonists make up a sort of pop science, full of people whose culture is their technology. It is the generation of the Nintendo or Tamagoshi kids: it is the generation of the nerd, a popular term to describe those eternal adolescents who dress without style, who can't get a girl and who are obsessed by computers, the noisiest electric guitars, and science - fiction B-movies. Any teenager can get hold of a powerful PC and keep a virtual farm and develop software until he produces something never seen before. It was nerds who created the dinosaurs in *Jurassic Park*, inventing a whole virtual structure of bones and muscles under a simulated skin, which showed aspects of the movement of dinosaurs which no palaeontologist could ever have imagined. The nerd is an explosive hybrid born of the convergence between ease of access to Internet and the proliferation of unqualified experts who roam the net. And this is not a Hollywood scenario, and it is not just for "gringos" -for nerds are everywhere, they are an international phenomenon.<sup>33</sup>

Their heroes are hackers, those computer pirates who, after a spectacular attack, are hired by some multinational for astronomical sums. The hackers respect nothing and nobody, they break into the Pentagon and shop with Bill Gates' credit card. With their home computers they laugh at official experts. Once again, laughter, only this time those who laugh are fans of Internet II, unclassifiable people with great influence. Even if history meant anything to them, they would admire neither Newton nor Einstein. Perhaps their mythological hero would be Edison, some-one without university degrees who improvised tools as he needed them and who, like a good nerd, had certain business ambitions. Edison did not stop to think of the possible perverse or wicked uses of his inventions. What concerned him was whether the gadgets worked, and incidentally to increase his income.

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<sup>32</sup> See "Technoculture: Ghost in the Machine", interview with Erik Davis (March, 1999), author de TechGnosis: Myth, magic and Mysticism in the Age of Information, published on the Web: [www.redindustries.conri/portfolio/spicer/dtf/1999/11/feature1\\_a.html](http://www.redindustries.conri/portfolio/spicer/dtf/1999/11/feature1_a.html).

<sup>33</sup> Kevin Kelly, "The Third Culture", *Science*, 279 (5353), February 13, 1998, pp. 992-993. Can be found on <http://www.sciencemag.org/feature/data/150essay.shl>.

## Essential tension

The sect of the *Edisonians* is forceful, but they would never manage to win the contest to nominate the person of the century with which Time magazine welcomed the year 2000: the winner was Einstein. Fifty years before the Americans who took part in the same competition choose Roosevelt. A significant fact which emphasises the idea that scientists are special people and that even today they have greater credibility than politicians. Talking about science is not a recent fashion and rarely has a theory aroused such media enthusiasm as that of relativity. Its conclusions were as amazing and incomprehensible as those proposed by Newton. Is it acceptable for the same phenomenon to be described in a different way by two observers? We know that this is normal in human sciences and in café conversations, but the positivists led us to believe that science was different. Well yes, it happens, it is against common sense, but *eppur si muove*. For one you only need to stretch time and for the other to shrink longitudes. Many physicists hesitated, and it was some time before scientists admitted it to their canon.

But where scientists feared to tread, artists rushed in. The former talked cautiously of space and time as mathematical variables included in equations explaining incomprehensible phenomena at the hand of Newton or Maxwell; the latter wanted relativity to be the exaltation of subjectivism, the final assault on the academic spirit, and the greatest Impetus to abstraction in painting, atonality in music, free verse in poetry and moral vagueness in politics. "A silo full of concentrated sin" was the verdict of one of the commentators worried at the end of civilisation portended by Einstein's ideas. Everyone had his say and few of them appeared to listen to what the wise man actually said. In a famous play by Tom Stoppard, a philosopher wonders "If you can no longer believe that a twelve-inch ruler is always a foot long, how can you be sure of things which are relatively less certain?". Einstein protested at this polyphonic flood of banalities, but to no avail. The theory of relativity was a universal potion, to cure all ills, because now every-thing was relative. The image of the person came before that of the scientist, and the more irony he heaped into his comments against so many charlatans and so many pedantic opportunists, the more brilliant he seemed. And relativity? Nothing, for it soon became clear that few were to be able to understand it. Further, such difficulty only served to make the myth more powerful, because the more inaccessible his ideas, the more undeniable was his brilliance.<sup>34</sup>

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<sup>34</sup> The cult of the genius extended to his grey matter. On the 18th April 1955 Thomas Harvey, in charge of the autopsy, left the operating theatre with the genius' brain under his arm. Now the problems began, because the son protested, fearing that such an object might become the focus of popular cults. On the 25th April there was announced a conference of specialists which, after meeting, ended in disarray. Then the army claimed its right to study such a unique specimen, but Harvey refused to hand it over. Pressure mounted. It was a serious matter, and it was to cost him his career first he was expelled from the hospital and later lost his medical certificate. Harvey disappeared for twenty years, until in 1978 he was found by a journalist. And yes, as well

Einstein got tired of correcting those who looked for the myth rather than his theories. And here we find another great joke. Einstein laughed at himself. There are few images more widely-known than that offered to the cameras on his 72<sup>nd</sup> birthday, with his tongue out and the look of a naughty schoolboy, framed by a great mass of unruly hair. He is making fun of himself. There is no hint of animosity between the actor and his audience. The fascination is mutual, but the script is well-known. The press still wants to overwork an image which wavers between distant sphinx and popular hero. Nobody wants to look for another piece of news, for Einstein is not a fashion: he is a necessary myth. No matter what he does, the reporters will not interpret his pose as a gesture of arrogant rejection but as further proof of his incomparable genius.<sup>35</sup>

And before we end, we have another great burst of laughter, whose echoes can still be heard. Now, many centuries earlier, it is Democritus who is laughing. What is the matter with the venerable sage? Some apocryphal letters between the citizens of Abdera (Thrace), his native town and the great Hippocrates tell the story. They are very worried because their Democritus, their much-admired sage, laughs at every-thing, doesn't sleep, sings to himself at midnight, listens to the birds' song, wants to travel to the outer limits, declares that the air is full of shadowy figures. A misfortune which calls for a doctor's opinion, since it threatens to spread to other citizens. Hippocrates, continues the legend discovered by Littré, goes to the town and gives his diagnosis: "I do not think this is an illness: he has just had a surfeit of science, which is really only an excess in the eyes of ordinary citizens". Splendid. If it were not for Einstein's clowning, this would be the antimodel. Now it is the scholar who laughs. He scorns human stupidity and, if he has with-drawn from what the people call the world, or life, it is to inhabit another more forceful and attractive. Here we have one of the scientist's favourite images: the priesthood of truth, reclusion in the exclusive space of the laboratory.<sup>36</sup> Galileo did the same after his conviction: he with-drew in order to write his finest works. And Cicero says that this was a characteristic of Archimedes' life: far from the

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as photo-graphs, he showed him the brain cut into some two hundred and forty cubes. The news caused a media storm. Dozens of scientists ask for a piece to experiment with, and some were successful. But the results were poor and inconclusive: and so Harvey and his prize went back to their game of hide and seek. In 1990 the brain was donated to a pathologist at Princeton hospital.

And that brings us up to date. Because in June 1999 the influential magazine *The Lancet* published an article which claimed to be a definitive study of this priceless relic. There was controversy. Many thought it incredible that efforts could again be made to find a relationship between morphology and intelligence. Of course, the most modern techniques have been used and there are a couple of very notable anomalies in the parietal lobes. S. Pinker was delighted and has announced his happiness to the four corners of the Earth with ringing phrases: "It is a strange coincidence that this brain which brought together the fundamental categories of existence, space and time, matter and energy, gravity and movement, should be helping us to unify the last great dichotomy of the conceptual universe, mind and matter". See *Mundo científico*, 209, special issue, "El cerebro de Einstein" (february, 2000).

<sup>35</sup> Antonio Lafuente, "Albert Einstein, el genio del siglo", *Muy Extra. Biografías*, Summer 2000, pp. 122-129

<sup>36</sup> Bernardette Bensaude-Vincent, *L'opinion publique et la science. A Chacun son ignorance*, Sanofi-Synthélabo, Paris: 2000.

image of an engineer concerned with practical matters, he shows us a timid watcher of the world and its secrets who was not even able to sense the danger he was in when the Romans overran his city. A mistake which cost him his life, but which elevated him to Parnassus.

We began with a martyr and end with a madman. But we have also redeemed a good deal of laughter. What makes them laugh, what makes them die? Sometimes an excess of wisdom and always what they do not understand. Lavoisier, Galileo, Archimedes and Thales died in a reverie. Einstein, Voltaire and Democritus drifted towards disillusionment. Buffon and Brockman have an overdose of academia and, finally Mary Shelley and the woman of Thrace tremble with anxiety. Science is certainly special and all too often creates insuperable distances. The image of the two cultures is a recent illusion which hides a harsher reality: the schism between scholars and laymen.