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THE SYMBIOSIS BETWEEN EXPERIMENTATION AND TECHNIQUE

It is more and more difficult today to make a distinction between science and technology. Fields like biotechnology present themselves with claims and ambitions that make them look like authentic sciences, together with grandiose promises of creating synthetic life – that is, playing God. Nanotechnology, we are told, is dividing human history in two, with the new age starting today. Humans have been able to manipulate matter from the beginning, but now we are supposed to be witnessing the dawn of a new epoch: as humans become able to manipulate atoms one by one, the usual divide between the old chemical crafts and modern scientific chemistry is fading into prehistory. Technological triumph, it seems, is the culmination of the scientific adventure.

The meaning of the word "technology" is, however, rather indeterminate. In the dictionary, you may find many definitions. One of these is non-problematic: "the study, description and characterization of techniques," a rather neglected field, many of its scholars complain – curiously, given the obvious importance of techniques in the history of humankind. Another definition I found is "the application of science, especially to industrial or commercial objectives." Here, science – obviously, what is meant is what we call modern science, starting in the seventeenth century – appears at the command post. "Technology" designates the explosive development of finalized techniques as they are endowed with a scientific Logos, or reason.

However, the word "technology" as it was used by molecular biologists when they discovered they could mobilize living vectors to produce genetic modifications, was directly connected to the thesis that this transformation of biology that was occurring should be celebrated as the emancipation of science from the outdated belief that it was some pure quest for disinterested knowledge. Modern experimental science was "technoscience" from the beginning, aimed not at understanding the world but at achieving mastery over it. The idea of technology as an "application of science" is, then, deeply misleading, as it would ignore the fundamental homogeneity of "techno" and "science," so-called applications being the very point of scientific knowledge.

It thus appears that the famous Baconian dictum "Nature, to be commanded, must be obeyed" may be read in two ways. Either "obeying nature" – that is, producing a knowledge whose value is its faithfulness to nature's own reasons and laws, without imposing our own all-too-human meaning – is the condition for useful and fruitful applications, or there is a determinant interconnection between obeying and commanding. That is, the nature modern science addresses and claims to obey is nothing else but nature as it can be commanded. Scientific experimental evidence is in fact only a verification of the ability to command.

This double reading is of great importance, all the more so since we are entering the epoch of what is called the knowledge economy, in which industrial and commercial interests have gained the power to pilot scientific research. If the technoscientific interpretation is the correct one, scientists are wrong to lament the loss of autonomy in scientific research. The knowledge economy is just the finally lucid accomplishment of the very truth of modern science. There was never anything like a disinterested scientific knowledge anyway.

In speaking of a symbiosis between experimentation and technique, I made it clear that my project entails resisting a technoscientific interpretation of science. Symbiosis is

indeed a relation that takes place between heterogeneous entities. Symbiotic living beings can come to be so dependent upon each other that they die if separated. Yet in connecting with the other, each entity was pursuing its own distinct interest. But, as we know, "interest" derives from the Latin *interesse*, which, heard as *inter-esse*, can mean "to be situated between." In this sense, the event of a symbiotic connection does not just satisfy preexistent interests; it is also the creation of a "between," a new interest connecting previously independent entities.

Hyphenation can have results that are not trivial. Speaking of "techno-science" would indicate an event of connection, not the hidden truth of modern science. The same operation on the word "technology" opens new perspectives, since what is articulated may then refer to the two registers of technique and language rather than technique and reason. Suddenly, the horizon is no longer restricted by that rather recent event, the birth of modern science. Even modern neurophysiology is of help here. In a recent study, archeologists skilled in making Stone Age tools underwent brain scans while practicing their craft. It was found that parts of the brain that became active corresponded to areas vital for language. The researchers concluded that putting together a complicated sentence and making a tool seemed to be similar challenges that mobilized the same areas of the brain[1].

The idea that cognitive-linguistic and technical skills are related is not astounding. But recalling it also means recalling that techno-logy must then be understood in terms of a continuum of divergent practices. My own practice, philosophy, for instance, implies and requires writing not just as a technical means but as an integral part of its production process. I am quite sure that the rather lonely exercise of the writing philosopher, struggling with recalcitrant sentences that never produce quite what she intended them to produce but sometimes provoke possibilities that open onto questions she did not foresee and will have to order and tame, has as its counterpart an area of the brain different from that involved in the judge's writing of a ruling or the thinker's contemplation. And perhaps it involves a brain structure different from that of people belonging to oral traditions. I would refer here to David Abram's fascinating *The Spell of the Sensuous*[2] and his hypothesis connecting alphabetic writing with the very possibility of defining meaning without reference to the world, that is, also denying meaning and agency to the world. What if we had been unable to entertain the living presence of both things and words? We create our tools, but our tools also create us, and create us in ways that overflow their intended use.

It is important to point out that talking about a continuum does not at all mean talking about some kind of primordial lack of differentiation, about a seamless tissue making up the unspoiled truth of the human condition. Rather, it is meant to invite the question of plurality: the plurality of distinct practices that each culture came to actualize. It is meant to oppose reduction in terms of some unified "cognitive" theory authorized by the common techno-logical character of these actualizations. Cognitive theories are one form of actualization among others and must be characterized, like the others, in terms of their divergence, of the creation of their own line of correlation between language production and technical production.

The continuum thus has the character of Gilles Deleuze's virtual, not allowing for contradictions among its actualizations. From a techno-logical continuum point of view, there is no contradiction, for instance, between the practice of a physicist and that of a

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[1] Andy Coghlan, "How Culture Made Your Modern Mind," *New Scientist*, No. 2656, May 14, 2008.
[2] David Abram, *The Spell of the Sensuous: Perception and Language in a More-Than-Human World*, New York, Vintage, 2007.

shaman. The scandalous character of this proposition militates instead for a division, that is, for the capture of the Logos as it has been polemically associated with claims of rationality.

"Technology" spelled as one uncut word – that is, referring in one way or another to an event celebrated as a groundbreaking new starting point, i.e., the birth of modern science – could, then, be given a new definition that takes into account this operation of capture. This would first mean breaking the continuum of techno-logical practices into two categories: those that can claim a direct connection with scientific intelligibility and those that cannot. On the one hand, we would have the "old" techniques, or crafts, cultivated for instance by healers, stone workers, metallurgists, perfumers and poisoners, which may have had efficacy but were empirical, unable to explain their effects or giving to these effects explanations we cannot take seriously today. And on the other hand, we would have modern industrial processes derived from scientific research producing new possibilities of transformation, accompanied by at last rational explanations.

In order to take some measure of what happened with this division and to resist the feeling of familiar normality it can produce, it is important to envisage the techno-logical continuum in its full scope. We easily recognize metallurgy as a technique, but it may well be that we have also to take into account those crafts we usually call "magic," which make full use of skills both of language and of making things. More generally, if the term "Logos" no longer designates the privileged realm of reason but rather any use of language whose effect is to produce or exhibit a connection, it may also refer to poetic, rhetorical, bewitching or ritual uses of language. (The Greek word *poiein* refers to both the art of language – it gave us the English word "poet" – and that of material fabrication.)

The capture of the ancient Greek term *logos*, that is, its polemical association with claims of rationality, largely antedates the definition of technology as an application of science. While the Pythagoreans worshipped the mathematical Logoi as something like the esoteric music of the world, the appropriation capture can be associated with Plato. Logos became a public affair when Plato used it to oppose the Sophists, those artists of language who compared themselves to healers and their practices to the art of medicine. For Plato, the efficacy of the Sophists' rhetorical practice should not and never would be able to claim kinship with rationality or intelligibility.

We can follow this operation of capture in Plato's famous dialogue, the Gorgias, in which Socrates makes his Sophist interlocutors recognize the difference between the two fields he opposes under the names of "art" and "experience."[3] Cookery is only a matter of experience, irrational in a double, correlated sense. First, it is unable to explain or give a reason for its own operations. Second, it only aims at producing an effect, pleasure; it "flatters" the consumer's taste without considering his or her health. In contrast, medicine would apply principles and act in the patient's best interest even when it meant prescribing distasteful remedies. Along the same lines, rhetoric, as another form of flattery, can be opposed to philosophy, as a rational art having the soul's interest as its only concern.

This opposition is very familiar and still in full use today. When talking about arts that produce effects without being able to give the reason for their efficacy, we no longer invoke "flattery" but often use the word "suggestion," or "placebo" (Latin for "I shall

[3] See Bruno Latour's analysis in *Pandora Hope*, Cambridge, Mass., Harvard University Press, 1999.

please"). These words are particularly widely used to explain away the relative efficacy of healing techniques whose reasons we do not recognize as "true" reasons – that is, compatible with science.

It could be said that Plato was overoptimistic in taking both medicine and philosophy as examples of practices legitimized by rational principles but that his opposition brilliantly anticipated the modern one. It could also be said that modern material techniques claiming derivation from sciences have come to occupy a place that was already prepared, and in doing so have revitalized Plato's opposition against the much more conciliatory thesis of Aristotle, for whom empirical observation was a sound ground for knowledge. What must be said, in any case, is that the modern difference between the ancient crafts and the new technology is not only one of rhythm of development. Like Plato's, it is also an ethical-political one. It cannot be separated from the figure of the modern autonomous subject facing a world he can explain and subjugate, while both fearing and disqualifying as irrational the arts and crafts of "influence." We are dealing not only with contempt but also with suspicion. The suspicion is currently justified by such techniques being associated, and catastrophically so, with dark episodes of our epoch (Nazi rituals), psychological torture, and manipulation, including the manipulative messages of marketers and political spin doctors. But this association only confirms the situation, because it means the use of such techniques was left to those who were quite indifferent indeed to the ideal of an autonomous human subject, able to produce the reasons for his or her own actions, or to the use of artists and performers, the only modern "legitimate" heirs of the old magical and ritual crafts and also the only ones who cannot claim indifference to the way they use the power that can be associated with them. Their position becomes all the more difficult as they, like everybody else, inherit a public language in terms of which the assignment of agency to things is metaphorical only, a matter of poetic license and not of thought.

The contrast between the techniques of influence and what is promoted as "rational knowledge" is vividly exhibited in the fact that some of those techniques flourish in business as means of enhancing motivation or creativity, while in the academic world they are mainly a matter of social psychology, which takes them as demonstrations of the way humans can be irrationally influenced and deviate from the standard of acting and choosing in terms of their own knowledge and interests. As a final dramatic illustration of the double standard for evaluating these techniques, I would cite the possible creation of prosthetics to enhance human cognitive abilities, an eventuality that is a matter of serious ethical concern today. If this eventuality were to be actualized, we would have the most extraordinary example of the bifurcation that has affected techno-logy: on the one hand, a "revolution" brought about by a material technique with a great scientific pedigree since it addresses neuronal mechanisms, and on the other, the human institution whose mission is to develop and enhance cognitive abilities, that is, the school, going on in its perpetual regime of crisis and disappointment, unable to produce the equality among thinking humans that we defined as its aim. This aim is to be pursued by "rational" means only, as defined by the sad science called pedagogy.

My first conclusion is that the symbiosis between science and technique cannot be disentangled from the polemical opposition initiated by Plato between Logos, or rationality, and mere opinion, which demands to be flattered – as if the Platonic dream, linking the question of knowledge with the political question of legitimacy, had come true at last with rational science.

Admittedly, it did not come true in the domain Plato had anticipated – that of city governance, which demands a science of good and evil, just and unjust laws, and rational and irrational behaviors – but in the domain of material behaviors, which never interested Plato. Admittedly, also, philosophers were not the winners. When Galileo Galilei announced the birth of the new science, he expelled both the theologians and the philosophers from the territory of knowledge, claiming it exclusively for this science. And finally, experience, empirical routine knowledge, was not defeated by the rational art of deducing from principles. Galileo claimed instead the demonstrative power of facts to do this. These powerful facts, however, were not facts as usual but experimental facts, the kind that are not observed but carefully produced in those very particular places we call research laboratories.

As a result, we have now a bifurcated perspective on the thesis Plato developed in the Gorgias. Philosophers still read the text and may think they are still responsible for defending rationality against opinion, flattery and superstition. But scientists, and primarily physicists, who would never dream of reading Plato, have claimed for their own his staging of the opposition between Socrates and Callicles, between right and might. According to them, agreement between scientists owes nothing to might and everything to the legitimate authority of facts and logic, an authority before which any rational being must bow down. This is why science must be autonomous, free from any political interference. Politics deals with undecidable questions involving values and debates, while questions that have been made scientifically decidable are not subject to public debate.

Such a situation cannot be reduced to the stable and reassuring coexistence of what Stephen Jay Gould called the two non-overlapping "magisteria": the one dealing with "how" questions, which have scientific answers, and the one he characterized as related to religion, which we can expand to include the ensemble of "why" questions, implying meaning and values. The old Platonic polemics is still at work: whenever a question can be reframed to become a "how" question, or to look like one, the event is celebrated as a triumph of reason, an irreversible victory of science over the domain of arbitrary opinions.

The way Stephen Hawking closes his book *A Brief History of Time* beautifully exemplifies this dissymmetry between the two magisteria as they are conceived from a scientific perspective. Hawking imagines a time when physics finally will have produced the answer to the "how" question about the universe, a complete theoretical explanation of what the universe is, that is, how it functions. Then, he writes, we will be able to convene scientists, theologians, philosophers, and even ordinary people to discuss the "whys" of the universe and our own existence. It seems a beautiful prospect, but what it affirms is that the "whys" are defined as what remains once scientists have completed their work. "Why" may be asked only after "how" has been scientifically identified. And Hawking's proposition that there should be a free-for-all discussion open to everyone, which seems very democratic, really means that the scientific answer will already have absorbed everything that cannot be reduced to a matter of free – that is, in this case, arbitrary – opinion. Theologians and philosophers must know that when the time comes for their intervention, it will be on a par with anyone's. Science is indeed the only magisterium.

A magisterium does not mean power, only legitimacy. The prospect of an irreversible conquest by scientific rationality of the domain of arbitrary opinion, which is also the domain of political debate and decision, should not be taken at face value. Scientists are

not on their way to ruling the city. Rather, what is happening is a progressive displacement, with the questions that matter escaping politics as soon as they are framed in terms that seem "rational" or "objective," with public debate then being restricted to the acceptability of the corresponding proposed solution. Scientists are certainly the privileged spokespersons of this displacement, which they will proudly present as the prevalence of reason over human passion and illusion. However, we should refrain from attributing to scientists the power to make it happen. What scientists think, believe, or define as rational would, like Hawking's proposition, be nothing more than dreams if not for the expropriation of public questions, of questions of collective concern, by what we can globally call capitalism and the state, recalling that the state was never a friend of political debate. When a public question concerning our collective future gets formulated in terms that allow for a "rational" solution, capitalism and the state are the winners, while politics retreats: acceptance now depends on "values" only. As a result, ethics is progressively replacing politics, and ethics committees, which accept the formulation of the problem whose solution they review, are certainly much more disciplined than a questioning public.

We can observe this process in the GMO debate. There is no place for debating the public, political issues of the role played by corporations like Monsanto, the consequences of the intellectual property rights imperium's extension to agriculture, and the social and ecological consequences of the transformation of agricultural practices. The only official answer to contestation has been an attempt to reconcile the public to an innovation it perceives as "wrong," to address fears and misgivings or consumers' right to choose the kind of products they buy and eat. As for the GMO promoters' sharply criticized claim that GMOs offer a technoscientific solution to the challenge of feeding a growing human population, it was not treated as a political issue. The conflict was reduced to a matter of opinion, opposing those who believe in GMOs to those who do not.

It should be clear by now that my aim is not to pacify Plato's opposition and to insist on the necessity of a respectful coexistence between the two magisteria. To recognize some kind of "technological" magisterium, be it understood in terms of application or derivation from science or in terms of technoscientific homogeneity, would ratify the division between the "how" and the "why" questions, that is, the dismemberment of the techno-logical continuum, which includes politics. My aim is to recover, against any version of the Platonic dream, the idea of divergent actualization I associated with the techno-logical continuum, taking experimental science and techniques as divergent heterogeneous actualizations.

My proposal to describe the technique/science connection as a case of symbiosis is not merely meant to make a purely epistemological point. It certainly opposes associating modern science with any kind of fulfillment of the Platonic dream of rational knowledge eliding politics, but the power to elide never belonged to science as identified with rational knowledge. It has always been that of those who benefit from this definition and its Plato-derived polemical implications. My aim is thus to shift attention from those who dream a Platonic dream to those who take advantage of this dream to give commanding, consensual power to words such as "rationalization" and "modernization."

Correlatively, it is important to emphasize that the heterogeneity symbiosis entails cannot be reduced to a binary opposition such as pure/finalized or disinterested/interested. I am designating a divergence that cannot be tamed into a term and its negative. It is a positive, ahierarchical one, based on what experimental scientists

and technicians respectively define as achievement, that is, what makes these two distinct kinds of practitioners think, envisage, evaluate, hesitate. In other words, my thesis is that the divergence the technoscience interpretation failed to identify may be exhibited if one asks questions like "What is an achievement?" and thus "How does the eventuality of an achievement orient scientific and technical practices?"

What began with Galileo? For many scientists and philosophers, Galileo symbolizes the rise of reason against tradition or obscurantism, or the power of well-established facts against human convictions. I will associate Galileo with the discovery of a strange and unusual possibility: some facts, those we call experimental facts, are able to force agreement. Such facts define the experimental achievement: Galileo was the first to create facts that are able to act as reliable witnesses about the way they should be interpreted.

To characterize this achievement, I will refer to the definition I gave in *The Invention of Modern Science*: "the invention of the power to confer on things the power of conferring on the experimenter the power to speak in their name[4]". Contrary to legend, Galileo was never able to speak in the name of the earth, to make the earth a reliable witness of its motion around the sun. His astronomical facts were rhetorically and heuristically powerful ones, but their interpretation left room for disagreement. However, this is not true of the achievement still taught in schools today: Galileo's definition of heavy bodies' frictionless motion of falling. Here, for the first time in human history, an experimental device, Galileo's inclined plane, conferred on falling bodies the power to produce Galileo as their spokesperson.

The inclined plane was the first experimental device. Deciphering Galileo's barely readable working notes, historians of science have located the moment of its entry onto the stage of human knowledge in 1608, when Galileo scribbled down an enigmatic scheme of numbers and calculations, the folio 116v[5]. This humble sheet may be characterized as a "relic," the remnant of a major event in human history: for the first time a human has staged a natural phenomenon knowing that if it "answers" – if the rolling ball verifies his anticipation and falls on the ground where he has calculated it will, starting from different heights on the inclined plane – it will confirm the truth of his definition – here the mathematical definition of the way heavy bodies accelerate when falling. This is the kind of achievement experimenters still celebrate today when they announce that "nature has spoken," when they equate the production of a fact with a verdict that will force any competent, interested person to bow down and agree. And in the folio, we find written four times, for the four different heights, the defining word of the experiment, *doveria* – "should" – that is, "Here is where the ball should hit the ground if I am right."

That experimental facts are not just well-established facts is well known to all experimental scientists but very often forgotten as soon they leave the experimental realm to speak about scientific data and methods in general as able to settle issues of common concern. I will give one example of such a settlement: the clinical tests that today determine if a molecule will become a drug. I have selected this example because clinical tests are what today supports the "Platonic" polemical opposition between rational, data-based medicine and other therapeutic propositions. More generally, they

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[4] Isabelle Stengers, *The Invention of Modern Science*, Minneapolis, University of Minnesota Press, 2000, p. 88.
[5] See Stillman Drake, *Galileo at Work*, Chicago, University of Chicago Press, 1978. I propose that the folio be reproduced, if you wish an illustration. It is at the Biblioteca Nationale of Firenze.

are representative of a statistically governed, at last rational method for deciding questions of public concern.

Yet whatever their usefulness, the results clinical tests produce have nothing to do with experimental achievement. Their data are in no way reliable witnesses for the way they should be interpreted; they are mute about the reason for the verdict, whether failure or success. Such tests merely ascertain that the statistical correlation between the absorption of the tested molecule and eventual therapeutic improvement or recovery is stronger than the rival correlation when other members of the patient sample unknowingly receive a placebo.

In other words, clinical tests lead us back to medicine as an art of observed effects, with the difference that now those effects are ruled by the demands of statistics. The assimilation of the two kinds of facts, experimental ones and methodologically well-defined ones, is a simple lie. It is true that both are produced in purified, well-controlled settings. Galileo's experimental device, the inclined plane, demands that as much friction as possible be eliminated. Clinical correlations must be obtained in a blind environment devoid of cues and free of any potentially active therapeutic relationship in order for statistics to rule. But if the test succeeds, the new drug leaves the purified environment as soon as possible, as its intended future is outside.

Clinical tests are undoubtedly an answer to a legitimate concern. But today they are hailed as a general imperative: every therapy must be "objectively evaluated." This imperative transforms clinical tests into a war machine, devastating the techno-logical continuum to which therapies belong. Such tests are indeed adequate for "modern drugs," whose efficacy, it is claimed, can be abstracted from the therapeutic relationship. But they reduce to suggestion or placebo effect the efficacy of active therapeutic relationships as they are cultivated by human cultures and traditions.

In contrast, the definition of the way heavy bodies' velocity increases as they fall in a frictionless environment was certainly a problem for some medieval philosophers but emphatically not a matter of common concern. In other words, what Galileo achieved cannot be described through an opposition between rationality and arbitrary or subjective human opinion. What Galileo actually did was to identify and isolate a phenomenon that he was able to transform into a reliable experimental witness, out of a huge, uncountable population of phenomena that can be described as precisely and quantitatively as one likes and that are operative in techniques or technically produced but nevertheless remain mute about the way one should explain them – healing, for instance.

Correlatively, Galileo's achievement is unable to make humans rationally accept that an experimental verdict transcends their conflicts or values. This is not because they wish to disagree or are excluded from the game but because what has been recognized as a reliable witness has nothing to tell that concerns them, that answers their questions or arbitrates their conflicts. Its real, and great, interest is to produce agreement in a very restricted segment of the population, those for whom what matters is the event that some facts have got the power to prove, and that some definitions are not just convenient or useful but able, because of the experimental device, to silence other possible definitions.

To this real and great interest corresponds the social fabric of scientific communities, made up of competent colleagues assembled for the task of verifying, producing objections, testing the eventual power of an experimental fact to force their agreement – that is, to silence other possible interpretations – and also by the envisagement of the new experimental devices and questions that could become

possible: an experimental achievement has as its first value not "truth" but consequences. As an art of verification and consequences, the experimental practice demands, and depends upon, such a collective concern. Scientific propositions have no future if they fail to attract the critical attention of colleagues who will use their imaginations to test and criticize a claim, whatever its interest and promises. Scientists thus need each other. If a scientific claim can be trusted as reliable, it is because of the way it has assembled concerned scientists, whose objections and counterpropositions must be considered as legitimate, and not because of a general norm of rationality.

However, as soon as one leaves the network of research laboratories and concerned colleagues to implement a technical achievement, the very nature of that achievement radically changes, and changes in a way that should never be reduced to any kind of derivation. Technical achievement means leaving the space where purification rules, the space of the research lab. What has been purified away is waiting at the door of the lab, and the experimental witness's reliability, and even its relevance, is no longer warranted.

Scientific achievements are not robust and are not as such able to "authorize" derived applications, even if they make them a possibility. However, what is at stake with a technique is not only an eventual loss of reliability that will often lead to so-called unexpected side effects. Rather, what is at stake is another kind of achievement: the coming into existence of something new, which must make sense in its working environment, an environment that cannot be purified at will. The word "make" is important, as it refers to a fabrication. It is not by chance that Hermes, the god of the arts of writing and calculation, was also the god of merchants and thieves, a trickster god. To make sense, to fabricate sense, means to incorporate disparate constraints and requirements that matter in the new environment in which the technique will function, and it is a tricky achievement indeed. To incorporate does not mean to respect; rather, it typically involves a double correlative process of abstraction and concretization. What matters in the environment must be abstracted away from any ready-made meaning or definition about "how" it must matter, because this "how," the way a technique "makes sense," is produced in the very process that transforms the constraints and requirements into ingredients of the new concrete technical existent.

Indeed, the point is not simple adaptation, if adaptation is to mean that constraints and requirements would explain the difference between scientific and technical achievements. Such an explanation can certainly be formulated, but only after the achievement. A stabilized technique in a stable environment can always be disentangled into its scientific ingredient, its function as defined in terms of needs or market demand, and its adaptation to social, economic, legal and ethical conditions. But, as the French philosopher of techniques and of life, Gilbert Simondon, insisted, one should never characterize a process of individuation, the coming into existence of an individuated being, in terms that are relevant only when the process is over and we are dealing with the individual. The achievement of a technical innovation means the coming into existence of something that is not just "obeying" disparate constraints, from gods to patents, but is determining how these constraints will matter. Some may have to be obeyed, and some may be bypassed through lobbying pressure, but many will receive their meaning in the process that produces their interrelation and incorporation into the new existent. This is why a new technique transforms the world it succeeds in inhabiting.

It is important to emphasize the disparate character of the constraints "from gods to patents" that a technique must satisfy, as it leads us to include in the same category technical practices that are usually conceived of in oppositional terms. It is also not a question of introducing a suspicion that contemporary respect for the sacred character of intellectual property rights might be analogous to respect for rituals involved in traditional techniques. The point is to emphasize that technical achievements are indifferent to our habit of opposing the scientific to matters of opinion, religion or value. Rather, they grant all the importance to the question of how to interrelate the relevant actors, factors and constraints, whatever they may be. For instance, drugs that have passed clinical tests have actively incorporated a reference to the possibility that other factors than drugs may have therapeutic efficacy. But these factors are defined as mattering in a negative way. The tests were first introduced as a new demand upon the pharmaceutical industry, activated by the suspicion that most recognized drugs only worked as placebos. The new "tested" drug is a new kind of existent, which has the power to respond to this suspicion and produce an agreement connecting diverging interests, those of industries, physicians, public health administrations and private insurance companies, each giving their own distinct consequences to the decision that the new drug may be put on the market. But this agreement gives no voice to those who would insist that general, placebo explanations are unable to account for their cures.

Scientific and technical innovations maintain relations whose fecundity and importance are crucial. The term "technology" may well be used to designate the difference experimental innovations have produced in the history of techniques, and the term "technoscience" to emphasize that experimental sciences today depend on impressive technical feats. We are far away today from Galileo's inclined plane, the first experimental device, the making of which demanded only care and patience. But to characterize the science-technique relationship as symbiotic is to emphasize that the Logos of technology does not mean our techniques are finally equipped with rational principles explaining their efficacy. Nor does the "techno-" in "technoscience" mean experimental science's primary aim is to master what it manipulates.

We may understand why scientists were interested in describing the modern symbiotic relation between science and technique in terms of derivation that echo Plato's opposition between rational art and empirical knowhow. Indeed, this provides them with a powerful argument for claiming public support. But what of technicians? They certainly know better, and there are many private jokes about the naivety of scientists who seem to believe that their knowledge is in the commanding position. However, what we today call technology is not in the hands of technicians. It deals not with technical but industrial innovation, and industry's interest in presenting an innovation as the direct consequence of scientific progress is quite clear. As I have already emphasized, this allows it to claim and appropriate the great theme of progress. But it also allows it to claim the authority of science in order to frame a disjunction between what does and does not matter.

Technology presenting itself as derived from science typically addresses a question as considered "from a technical point of view," as if what is technical had inherited the power attributed to science to transcend disagreement, as if a technical point of view would purify the question of conflicting or selfish interests. To emphasize the specificity of technical achievements, as I have characterized them, is to emphasize that their specific grandeur lies precisely in their lack of a point of view about what does and does not matter. Their grandeur lies in the fact that they invent a way to take into

account and turn into an ingredient any feature that may be defined by others as mattering in a situation. In this sense, technology is a denial of the grandeur of techniques.

Turning again to the case of GMOs, what is striking is that the technical ingredients in their production were indeed systematically downplayed, as if the seeds were going straight from the research lab to the fields of grateful farmers. Genetically modified seeds were presented as a direct consequence of progress in molecular biology, with silence around the fact that the main part of the industrial research was concerned with the traditional empirical testing and selection of those modified strains, in order to satisfy the requirements defining commercial seeds. Activists who destroyed fields dedicated to open-air GMO experimentation were often accused of irrationality, of destroying the very possibility of a better understanding of GMOs and how they might endanger the environment. But this accusation was a simple lie, because the open field tests were not designed for the purpose of understanding GMOs but merely to fulfill requirements for the commercial homologation of any seed, genetically modified or not – that is, to incorporate in their definition a technologically necessary ingredient.

The GMO case also exemplifies the difference established between what modern technology actively takes into account and what is to be left undetermined, as external, contingent consequences. New objections are now slowly taken into account in the technological definition of GMOs, adding to their initial laboratory and commercial definitions some regulatory conditions bearing on their capacity to contaminate other species. But questions of social and economic consequences are still firmly rejected as non-decidable matters of opinion that elude sound science and would politically contaminate something that should transcend political conflict.

This is why it is so important to emphasize that technical achievements do not in themselves involve any such double standard or claim such transcendence. Instead, those features qualify technology as it refers to scientific rationality and objectivity in order to mute public debate and justify reorganizing our world in the name of a supposedly necessary modernization – that is, a "progress" that transcends political and social objections. Given this power of the scientific reference, it is normal that anything that can claim the title of science will. I will not enter into this question, but I will state that the technological connection has been highly operative in the contemporary downgrading of the demands scientific evidence must satisfy. In many fields, indeed, evidence is no longer the event of an achievement but the end result of some methodological procedure meant to ensure a predetermined definition of objectivity.

I began this essay by invoking a techno-logical continuum to which belong crafts we easily disqualify away, using terms like "suggestion," "belief in magic," "charismatic influence" and other blind characterizations. Emphasizing the symbiotic character of the science-technique connection, I have proposed resisting the idea that the opposition between technology and the crafts we disqualify is justified by the claim that technology has a rational, scientific foundation. But, as we have now seen, this claim is not just an illusion to be dispelled. It is part and parcel of modern technology as distinct from techniques. Indeed, it turns the specific achievement of the experimental sciences – conferring to experimental facts the power to arbitrate interpretation – into the definition of an objective, rational point of view on a situation, authorizing a claim of transcendence with regards to what it defines as "not to be taken into account."

If the so-called human factor is eventually taken into account, it is only after a situation has been objectively defined. Then, human ways of thinking, behaving and

feeling will be defined as constraints to be respected or obstacles to be overcome. But they will always be characterized in terms of habits – that is, as essentially average and passive, as in marketing surveys. So-called modernization and rationalization thus frame humans as users, who benefit from the progress of technology, even if they sometimes irrationally resist it.

As we know, the modern human condition has often been characterized by a dramatic time lag, with humans remaining about the same while living in an ever-changing technological environment. I would claim that we are not dealing with a time lag but the direct result of the distorted development of techniques. Modern technology is intrinsically distorted by the way it differentiates between objective and subjective dimensions, a differentiation that has no meaning for technical achievement. And those techniques that cannot enact this differentiation, that cannot present themselves in terms of objective, scientific reasons, are disqualified.

I will now turn towards the last meaning I wish to associate with technology – that is, with a potential destruction of the symbiosis between experimentation and techniques, meaning not their disconnection but a destruction of the heterogeneity any symbiosis implies. This emphatically would not mean reducing experimental achievement to a "technique." Both kinds of achievement are equally concerned. We are talking about a process that is indifferent to what I have characterized as achievement: an expanding process that can be characterized as turning whatever it succeeds in mobilizing into as many flexible means as possible (in the name of rationalization and competitiveness).

Technology, in this case, no longer has a privileged relationship with either scientific or technical practices. Rather, it creates a new network environment, one that mobilizes sciences and techniques among other active ingredients. It can be characterized as something that "happens" to scientific or technical practices, binding them into what transcends them. We are no longer talking about something that could invoke the Platonic "capture of the Logos" breaking the techno-logical continuum. If there is a Logos, it is immanent to the process, its changing imperatives having only one constant: to ignore divergences, or requalify them as "lack of flexibility." As a result, the meaning and importance mobilized practitioners may give to their achievements, whether scientific or technical, are redefined in terms of potential resistance against the network's ongoing operations. They are "irrational" habits to be overcome. Practitioners must accept modernization – that is, the fact that they function as part of a network that gives meaning and importance to what they do: that is, the only master where the definition of an achievement is concerned.

This is what some IT practitioners endeavored to resist when they invented the free software principle, as covered by the famous GNU license. They understood that the ongoing private appropriation of software through intellectual property rights would mean the destruction of their practice, as it would become determined by the possibility or impossibility of using certain lines of code. They would become part of the war games of private companies, which define the possession of IP rights in terms of strategy, using them not only to produce and protect their own products but also to prevent the development of others. The very meaning of their practice would be confiscated, and the relationship of trust and cooperation they enjoyed with each other would become impossible as they became mobilized by conflicting interests.

The same prospect of destructive redefinition, which has been described by those who resisted it in terms of new "enclosures," of private appropriation of common knowledge, is associated with the so-called knowledge economy's mobilization of a good

part of scientific research. It received its main impetus in 1980, with the United States Bayh-Dole Act. This legislation allowed universities to claim intellectual property rights to federally funded research, and in so doing, it encouraged them to commercialize what previously had been defined as discoveries, as products of disinterested science. As some of us may remember, the aim of the move was to boost American productivity, which was seen as threatened by Japanese industries' exploitation of the results of U.S. academic research. But it was a typical case of the means overshooting the aim, at least the stated aim, and becoming an end in itself. Under knowledge economy rules, scientific research must now be assessed in terms of the competitive economic advantage it will provide. They define knowledge production as too serious a stake in our competitive world to be left to scientists.

In Europe, as usual, we were a bit late compared to the so-called New World, but the European authorities are now urging experimental scientists to come to terms with the overwhelming fact that knowledge production must be understood as a decisive part of economic production. This means scientists must accept that the importance and value of public academic research are related to the number of patents and new innovative startup ventures it is able to spawn. Scientists must learn that they, like everybody else, must accept mobilization in the competition for productivity and the conquest of new market shares.

Mobilization by the knowledge economy does not mean the scientific enterprise will lose its neutrality. It was never neutral. Indeed, since the beginning, experimental scientists have taken an active, even entrepreneurial, part in promoting and eventually participating in the technical and industrial developments made conceivable by their work. Rather, what is at risk is the very specific social fabric of scientific reliability, that is, the relationship between experimental achievement and what I have called competent colleagues – colleagues brought together by the issue of verifying and critically testing a proposed fact's claimed power to force their agreement.

The knowledge economy may well spell the end of this specificity. Indeed, that which links scientists may dissolve if they are tied to competing industrial interests and have to keep relevant aspects of their work secret because of those interests, or if their research choices and strategies are narrowed by the landscape of intellectual property rights, excluding questions whose answers are of no industrial interest because of already existing patents. In brief, scientists will no longer depend upon concerned colleagues; rather, interest in their work will depend on how well it fulfills the promises that attracted investors and on the patentable character of the promised results. It is predictable that what will then prevail will be the general wisdom that one does not saw off the branch on which one is sitting together with everybody else. Nobody will object too much when objection could lead to a general weakening of the promises of a field. Dissenting voices will be disqualified as minority views that need not be taken into account, as they spell unnecessary trouble.

Some of the results of this new situation are already perceptible in biotechnology – for instance, when genes get patented along with their relation to an interesting biological function. The identification of this relation usually has nothing to do with an experimental achievement. Rather, it is a mark of ownership whose consequence will be industrial strategy, not new questions. As for reliability, the case of GMOs is illustrative. There are studies on the impact of GMOs, but the dispute is not about to be settled, as it is hard to know whether those studies can be trusted, whether their claims are industrial propaganda or reliable results.

In retrospect, it is rather astonishing that such a deep modification of the rules of the game of scientific production, giving power to what is usually called "market pull," was accepted with so little resistance by the scientists concerned. Very often, when I speak to scientists about the specificity of experimental achievement, they reply that this is science as it was done thirty years ago, a thing of the past. Cynicism is growing at full speed, as well as resignation to routine research in which you sell your labor and consent to being "flexible," just as other workers do.

I have described at some length what is happening to experimental practice, but the same is also happening to technical practice. Concern for the consequences of the coming into existence of a new existent has never been very developed in industrial environments. But general flexibility is destroying the very possibility of speaking about "coming into existence" at all. The technician's pride in doing a good job, in satisfying a disparate set of constraints and requirements well, is quickly vanishing, as a "botched job" may do just as well. The difference between pride and shame is of no relevance for the network, which does not know constraints or care about robustness but permanently redefines itself in terms of momentary strategic opportunities.

I will not enter into details, however, as doing so would require better familiarity with manufacturing and service industries Rather, I will emphasize that the same process is redefining the academic world, including fields like philosophy, which have never produced anything that can be of economic interest. Indeed, technology, in the last meaning I associate with the term, does not only concern the destruction of the symbiosis between experimental science and techniques, mobilizing practitioners in a way that destroys them as practitioners. Flexibility has become a general imperative, implemented through the technology of the "objective" evaluation and benchmarking to which researchers and research centers are now submitted, and even universities as they compete in the great market of higher education. Both evaluations and benchmarking may well be derided as blind or denounced as unfair. They are nevertheless in the process of redefining the landscape of knowledge production practices. All researchers must now accept that what their practice defines as important is only a matter of habit to be modernized. What is really important is to publish in "good," highly rated journals: that is, to select subjects and orientations that fit the criteria of these journals. Researchers have to become the "entrepreneurs" of their own careers, selecting fruitful investments, enhancing their attractiveness, speculating about new demands, playing the game of networks whose functioning is constantly redefining what matters and what is a dead end.

This process of general redefinition probably also affects artistic practice. Everybody now has to become an "entrepreneur" and demonstrate entrepreneurial concern, if not skill. Like the academic world, the art world is probably including activities that can generate "real money" and lead to spinoffs and even patents, as well as those that cannot. I would be surprised if the latter were not commanded to pretend. The point is that, for everybody, "la fête est finie," meaning the divergences that actualized the old techno-logical continuum are to be considered relics of the past, to be modernized into attractiveness niches in the general circulation of equivalency.

What is striking is the overall lack of resistance by the practitioners. To me, it bespeaks the vulnerability of practices that successfully survived the breaking of the techno-logical continuum and enjoyed the fact as if it was a birthright. Is it because they do not feel endowed with such a birthright that IT practitioners, who "poetically" craft new connections between the arts of (written) language and the art of material

fabrication and who never considered their "material" as devoid of an agency of its own, have resisted more successfully?

Anyway, insisting on the symbiotic character of the connection between experimentation and technique may well be only a way to say farewell to them both, paying them the respect any victims deserve, even these noninnocent victims who have blessed so many destructions and justified the silencing of so many voices. But it may also be part of today's question, which is a very different one: the question of resistance. Describing the contemporary destruction with terms like "technoscience," "technical rationality" and even "technocracy" runs the risk of mistaking what it is we have to resist, if we wish to do so. It may well be that the challenge is to stop thinking of what is happening to us in terms of rationality, be it technical, instrumental or economic. This is what I will dare now to make explicit, speculating that traditions that cultivated the craft of magic would easily find another name for what is happening under the guise of those commanding words "modernization" and "rationalization": they would call it "sorcery." When I consider the way so many academics accept joining evaluation committees, using objective – that is, blind – criteria, and telling students to shape their work to satisfy those criteria, I consider it relevant indeed to associate our collective lack of resistance against what is happening to us with the power of a spell.

This would mean that if we seem able to do nothing but lament and complain, it may be because when the ancient techno-logical continuum was dismembered, what was destroyed first of all was the art of recognizing spells, naming them, protecting ourselves against them and enabling the relevant means of resisting them.

This last conclusion may be surprising, but naming has always been part of techno-logical crafts, and cultivated as an art of effects. Using such terms as "rationalization" and "sorcery" respectively produces very different effects indeed. While the first invites us to denunciation, that is, to a defensive position, the second may activate a need to dare to reclaim what modernity so proudly disqualified: the full continuum of techno-logy. This may challenge us to learn how to take seriously, without reducing it to a matter of belief or any other blind category, the power that words like "modernization" and "rationalization" command, and eventually to learn what it takes to break the spell wherever it is at work. But the first price is to avoid entertaining all nostalgic regret about the past, when the state respected practitioners and industry kept a distance. My guess and conviction is that we cannot resist if we do not do so as those who survived, and benefited from, the breaking of the techno-logical continuum. This is not a matter of guilt and repentance but of experimenting with new connections, with those whose practices have been disqualified as irrational and also with those who struggle against the dismemberment of what David Abram challengingly calls "a more-than-human world."