

One More Turn after the Social Turn: Easing Science Studies into the Non-Modern World

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Like Antony, I could say to philosophers, uncertain whether to stone or welcome the young domain of social studies of science, “I come to bury those studies, not to praise them”. After years of swift progress, social studies of science are at a standstill. Cornered in what appeared to be a dead alley, its main scholars are disputing with one another on where to go next.

Many of them advocate a return to common sense and claim that we should shun extreme radicalism and take on the classic sociology of scientists (not of science) spiced with a speck of constructivism. Through meetings and journals I feel a reactionary one: “Let’s abandon the crazy schools and take over serious matters of science policy and the impact of technology on society. The field has suffered enough from extremism; let’s go back to the happy medium.” The most generous believe that political relevance for our field will be achieved more if we stop dabbling with esoteric theories and instead seize traditional concepts off the shelf. A few, who call themselves reflexivists, are delighted at being in a blind alley; for fifteen years they had said that social studies of science could not go anywhere if it did not apply its own tool to itself; now that it goes nowhere and is threaten to be struck by sterility, they feel vindicated. A few others, among the most serious, stick to their trade, deny that they are in a blind alley and go on with business as usual, without realising that the law of diminishing returns is at work here as

elsewhere and that professional loyalties are no guarantee against obsolescence. But, fortunately, dozens of researchers are looking for ways out of the deadlock: in literary theory, biology, cognitive science, cultural history, ethnology, ethnography of skills, moral economics, interactionism, network theories. That their moves do not appear more principled or straight than those of a disturbed anthill does not mean that they are not going to find the way. Quite the contrary.

Being one of those ants, accused of being not only frantic but also French, I wish to explore in this paper one of the possible ways out of the dead alley that would not force us to retrace our steps. Instead of being less extreme I want to show that by being a little more radical we would end up in a productive and commonsensical research program that would allow us to capitalise on the last twenty years' work and resume our swift pace.

1. The trap we built for ourselves

But first we have to survey the path that led the field of social studies of science to its present quandary. Like any summary it will appear unfair to everyone's work—including my own—but the aim of this paper is the future of our field, not its past.

The name of the domain “Sociology of Scientific Knowledge” tells it all (not to mention the name of this volume). So far, it has been the application of social sciences—mainly sociology but also anthropology—to the practice of science. The decisive advance occurred when it was realized that, contrary to what traditional sociology of knowledge and Mertonian sociology of science told us, the content of science is thoroughly studiable and that the implementation of this research program is a single task for historians, sociologists, philosophers and economists. I take those two points as being established beyond doubt (Shapin, 1982; Latour, 1987).

Doubts are back, however, as soon as we look at the explanatory resources mobilised to account for the practice of science. Our domain is a battlefield littered with interrupted explanations. All the efforts at using macro-sociology to account for the micro-content of science are fraught with difficulties; only very broad features like styles, world-views, cultures have been explained. The only research programs that have been successful are those which put to use a fine-grained sociology: ethnomethodology, micro-sociology, symbolic interactionism, cognitive anthropology, cultural history, history of practices. The problem with those programs is that they, indeed, account nicely for the details of scientific practice but entirely lose track of

the main goals of macro-sociology —that is, an account of what holds the society together. They have all been accused (and rightly) of cranking out nice case-studies without even the beginnings of social theory or political relevance. It seems that either the social science is subtle enough to explain the content of science but the making of a global society is left in the dark, or that macro-sociology is back in but the details of science disappear from view. When literary studies are included it is often worse since we now have fine-grained studies of scientific rhetoric but even the mere idea of a social explanation is given up. When cognitive sciences are brought in, it is worse still, since social scientists have to renounce any interest in non-cognitive explanations or be relegated to an appendix. It is as if we cannot have sociology and the content of science under the same gaze at once.

Another way to sum up the diagnosis is to say that most of the so-called social studies of science are largely internalist studies. They did not appear so to the English-speaking world because of the very abstract way in which philosophy of science had been carried on in the Anglo-American tradition before we began to work. When, for instance, Harry Collins added to the gravitation waves, animals such as replication, negotiation, styles, core-sets, and authority, philosophers of science mistook that zoo for the social (and so did Collins (1985)). Viewed, however from a Continental point of view, most of the “sociological” points could have been made —and indeed had been made— by internalist philosophers informed by the history of scientific practice, like Duhem, Mach, Bachelard or Canguilhem. Social studies of science were not adding society to science but were adding some historical flesh to the often barren English-speaking philosophy of science. It is now clear that it is as difficult to tie the main concerns of sociology and politics to the micro-sociological studies of science as it was in the past to tie them to rabid internalism. Most of the good case studies, if we look at them dispassionately, are internalist explanations sandwiched in between macro- or meso- sociological explanations without much connection between the two. The reason why this recipe did not appear so clearly at first was that we all had to fight against the dictates of Mertonian sociology, rational reconstruction of science, and history of ideas, all claiming that study of scientific practice was infeasible in principle. Their stubbornness forced us to a polemical stand. Now that this battle has been more or less won, and we can examine in peace the quality of the explanations given for the social construction of the contents of science, it is fair to say that they are found wanting. Few of them convincingly tie the fabric of macro-society to the contents of science, and most follow up bits and pieces of networks, the ends

of which are left loose. What the best studies achieve is to spread successive levels on top of one another, the first of which is distinctively “macro” while the last one is clearly technical. They fix club sandwiches instead of hamburgers!

This diagnosis is not new. It was, on the contrary, the starting point of the radical brands of “social” (now in quotation marks) studies of science. Reflexivists have argued all along that it was not desirable to provide a social explanation of scientific content since it would mean that sociology was immune to the critical treatment that it applied to chemistry or physics (Woolgar, 1988; Ashmore, 1989). Ethnomethodologists went much further by denying any relevance to sociology and claiming that social explanations should not be provided at all. It is, on the contrary, they claim, the local technical content of the practitioners that should be used to explain their own world. “There is no other metalanguage to use but the language of the sciences themselves” is Garfinkel-Lynch’s principle in which a new brand of internalism and radical sociology have become barely distinguishable (Lynch, 1985). The same could be said of us, the so-called actor-network theorists. We extend the principle of symmetry to social sciences and we claim that they too are part of our problem, not of our solution. Networks of associations replace both the content of science and society. The growth of networks through translations replaces the differences of scale between micro-, meso-, and macro-levels. Exactly as for reflexivists and ethnomethodologists, the question of a social explanation is dissolved (Callon, 1989; Law, 1986a; Latour, 1987). But so are also the resources for understanding our own position. Networks may be “seamless webs”, but they appear to our colleagues and nevertheless friends as a catch-all concept, where everything being possible, nothing is clear and distinct any more. Everything being a network, nothing is (Shapin, 1988; Collins and Yearley, 1990).

Somber diagnosis indeed! The more conservative schools have failed to provide a continuous tie between the contents of science and the concerns of sociology. And the radical groups who deconstructed the very aim of a social explanation, end in sterility, in jargon or in a maze of entangled networks. The Gordian knot that tied science and society together before Alexander’s sword cut them asunder is still there awaiting for someone patient enough to tie it again!

Even if I have overdramatised our quandary, it remains true that outsiders to the field see us like that. Whatever we write or say, the field of social studies of science is recast by friends and enemies alike as the “merely

social” argument (Star, 1988). Then, it is not difficult for them to argue that to the “merely social” or “socio-historical” explanation should now be added another explanation, a more internalist one. No wonder if many of our critics, feeling vindicated, rejoice and claim that science is indeed thoroughly incapable of analysis in social terms, that they had long ago shown this impossibility from first principles, and that their graduate students should return to the study of scientists (or of science), or delve into the fashionable cognitive sciences or turn to normative philosophy or science policy. Back to common sense! Down with constructivism! Enough of theory! As for many atheoretical historians, unsettled for a moment, they might believe that since boxes of archives are waiting to be ransacked they no longer need the help of all those crazy sociologists.

Here is the blind alley. Here is the trap that we built for ourselves, from which we should escape and resume our quick progress without accepting those reactionary research programs that represent themselves as commonsense or claim to rest comfortably in the golden medium between internalism and externalism.

2. One-dimensional Science

‘Radical’, ‘progressist’, ‘conservative’, ‘reactionary’, ‘golden medium’, I used these political adjectives on purpose because they all retrace the same line that is the cause of our deadlock and from which I want to escape. A radical is someone who claims that scientific knowledge is entirely constructed ‘out of’ social relations; a progressist is someone who would say that it is ‘partially’ constructed out of social relations but that nature somehow ‘leaks in’ at the end. At the other side of this tug-of-war, a reactionary is someone who would claim science becomes really scientific only when it finally sheds any trace of social construction; while a conservative would say that although science escapes from society there are still factors from society that ‘leak in’ and influence its development. In the middle, would be the marsh of wishy-washy scholars who add a little bit of nature to a little bit of society and shun the two extremes. This is the yastick along which we can log most of our debates. If one goes from left to right then one has to be a social constructivist; if, on the contrary, one goes from right to left, then one has to be a closet realist. As indicated by the two arrows in the diagram below explanations in this frame of reference are accepted only if they start from one of the two extremities, Nature or Society, and move toward the other. Either one is a ‘natural realist’ and one explains

the evolution of society, the establishment of consensus by the state of Nature, or one is a 'social realist' and explains by social factors how it is that humans settle on matters of fact, or one alternate between the two (Collins and Yearley, 1990). All the intermediary cases are seen as a mixture of these two pure forms, Nature and Society.

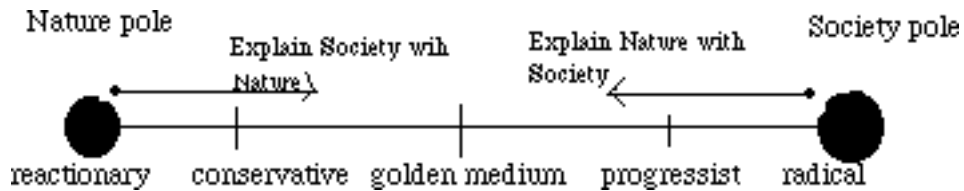


Figure 1

This tug-of-war is played in one dimension. It is fun to play but after twenty years of it we might shift to other games, especially since it makes incomprehensible the very linkages between Nature and Society we wish to account for. I claim that the only way to go on with our work is to abandon this frame of reference and to set up another standard, all the more so if other scholars go on to make it more subtle, more precise by adding finer divisions and other labels to the same one-dimensional yardstick (Giere, 1988). We do not want finer divisions and new schools of philosophy of science. We want philosophy to do its job and discover the origin of the yardstick in order for us to overcome it.

The yardstick of our debates was set up by Kant for polemical reasons and since then sociologists, as well as philosophers of science, have adopted it without misgiving. Kant rejected at the two poles — Things-in-themselves on the one hand, Transcendental Ego, on the other — the resources that, when put together, would account for knowledge. This was the foundation of the Critique that made us modern, more modernⁱ. To be sure, empirical scientific knowledge appeared in the middle, but this middle, the phenomenon, was understood only as the meeting-point of the two purified sets of resources coming from the subject-pole or from the object-pole.

There are two reasons why this standard did not appear so bad at first. To begin with, philosophers and sociologists fought so violently to occupy the subject pole designated by Kant — the focus of the Sun in his Copernican Revolution — that no one realised that it did not make much differenceⁱⁱ whether the elected ruler was Kant's Ego, Durkheim's macro-Society, Foucault's *epistemes*, Dewey's praxis, Wittgenstein's language games, collectives of scientists, brains and neurones, minds or cognitive structures — as long as this one ruler capitalized all the explanatory resources and had the object turning around it. Where they came from — transcendence, evolution,

practice, innate structures— did not matter too much either, as long as phenomena were shaped, in the end, by the foremost authority of this Sun pole. The internal rivalry among schools hid the identity of the position to be so strenuously occupied. When compared to the weight of the Critique framework, the debates that oppose innate categories to collective *epistemes*, individual mind to groups of scientists, neuronal pathways to social structures, appear minor.

The second reason why this framework had such a great weight is that it was strongly asymmetric. The Sun focus was what counted, not the object circling around it, and thus there were no comparable squabbles about how to modify the status of the object. It really seemed that if one could occupy the right-hand side of the yardstick, much of the left hand side would be explained. From Kant onwards, the Things-in-themselves were left indeed to themselves, without initiative, without activity, passively shaped and framed by the various models or categories pressed upon them. Their only task was to guarantee the transcendental non-human character of our knowledge in order to avoid the dire consequences of idealism. Paradoxically, the beautiful movement of Copernic's Revolution was used by the Critique to describe an anthropocentric (or sociocentric or logocentric) enterprise.

In our small field, Bloor's book (1976) was the high tide mark of this asymmetrical philosophy. As an obedient child of the Critique, Bloor designated Durkheimian social structures to occupy the Sun's focus and gave the name 'symmetry' to the principle that required us to explain successes and failures in the development of science with the same sociological terms. This was, to be sure, a major advance, since until then only good science was explained by appealing to Nature and only bad science by appealing to Society. However the very success of this principle of symmetry disguised the complete asymmetry of Bloor's argument. Society was supposed to explain Nature! We start from one of the poles to account for the other.

If the one-dimensional diagram I have drawn appear simple-minded and sketchy even after Bloor's 'strong program', it might very well be that our implicit philosophy is indeed as simple-minded and as sketchy as that. It is certainly as one-dimensional as that and this is enough to explain our previous deadlock: if any move away from one of the poles is a move toward the other, it means that every new position —whatever its originality, direction and trajectory— will be logged, obsessively, along this single line as a particular combination of the object pole and the subject/collective pole. The two attractors at the extremity of the line are so strong that no new position is tenable since it will be seen as giving strength to one of the two

teams engaged in this tug-of-war. The Wall of Berlin has fallen, ideologies are said to be gone, but realists and constructivists are still positioning one another as if we were in the worst days of the sixties when our opinions had to be pigeon-holed as Left or Right.

Fortunately, the two factors that rendered the one-dimensional frame of reference inevitable are now gone: from the relative failures of the social studies of science we learned that the various schools that strive to occupy the Subject/Society position make no difference to the general structure of the explanation. We also learned the historical origin of this philosophical asymmetry between the two poles, between the representation of things and the representation of humans (Shapin and Schaffer, 1985; Serres, 1987 ; Latour, 1990b). To this day, Bloor has not realized that his principle cannot be implemented if another much more radical symmetry is not introduced, a symmetry that treats this time the subject/society pole in the same way as the object pole (Callon, 1985). This 90° shift is what I call “one more turn after the social turn” (**Figure 2**). But in order to make this turn and thus free our field from its deadlock, we need to set up another yardstick that will give us another dimension.

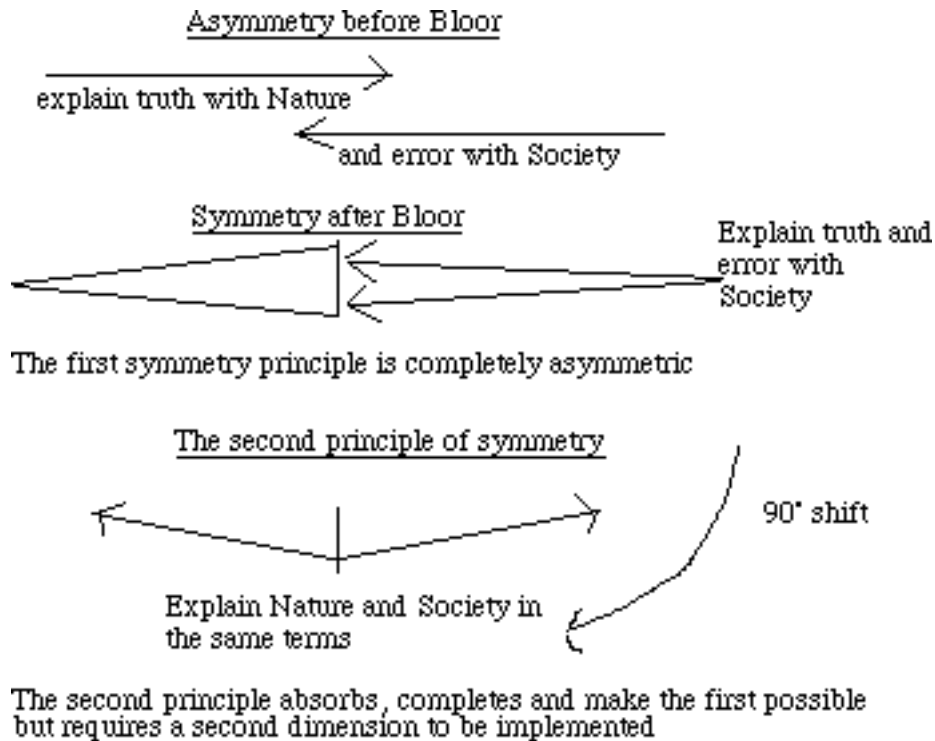


Figure 2

3. A counter-Copernican revolution

At least the problem is now well defined. Is it possible to modify the respective position of the two attractors, the object-pole and the subject/collective-pole? Is it possible to modify their number: one, three, many? Is it possible to construct another scale that would allow us to evaluate works and arguments in a second dimension not reducible to the single one described above? Is it possible to do all of that without jargon that would add obscurity to obscurity and without leaving the solid ground of empirical case-studies of scientific practice, the ground that I said is the only stable certainty of this new field common to sociologists, philosophers and historians of science?

A look at the literature of our field shows that these questions are not at the same level of difficulty. Paradoxically, the last two appear more difficult, since no one, to my knowledge, has offered a clear standard for evaluating works and arguments, a standard at least as fine graded as the one we wish to discard, and since the many philosophies which have tried to ‘overcome the subject/object dichotomy’ have been unable to offer us a precise description of scientific practice and are often shrouded in a thick fog.

Let us start at the relatively ‘easy’ part, the ontological one. The first move is a counter-Copernican revolution that forces the two poles Nature and Society to shift to the centre and to fuse into one another. This fusing, however, is no simple matter and the properties of the two poles have to be completely redistributed, since it was their separation that defined them. The main property of the object-pole was to guarantee that our world of knowledge not be human-made (whatever the definition of human we chose: self, mind, brain, collective); while the main property of the subject-pole was, on the contrary, to guarantee that our knowledge be human made (whichever definition of human activity one sticks to: transcendental ego, society, subject, mind, brain, *epistemes*, language games, praxis, labor). In addition, the very distinction between the two poles —the distinction which Kant made so sharp— warranted that those two contradictory guarantees would not be confused, because the two transcendences —that of the object “out there” and that of the Subject/Society “up there”— are sources of authority only if they are as far apart as possible (Shapin and Schaffer, 1985). They should not mingle with one another any more than the Executive Branch of government with the Judiciary Branch.ⁱⁱⁱ

The word ‘fact’ sums up this threefold system of guarantees. A fact is at once what is fabricated and what is not fabricated by anyone. But the two

meanings of the word are never simultaneously present, so that we always feel it necessary to alternate between two asymmetric explanations for the solidity of reality—constructivism or realism.

How can we fuse the two poles together and still retain their three main properties?

- a) the non-human origin of knowledge;
- b) its human origin;
- c) the complete separation between the two.

If we retain the three at once, it is impossible to move on, since the three together defines the Critique on which the whole field of science studies is based. If we abandon the first one, we fall into various brands of social constructivism, forced to build our world with social relations. If we abandon the second, we fall into various brands of realism and are led to build Society with Nature. The only one that might be discarded is the third. Is it proven that the first two guarantees are enforced only by the Critique or the Modern Constitution that imposes their complete separation and classifies all explanations in two asymmetrical repertoires? As soon as the question is raised, the point of view is shifted along a new dimension, orthogonal to the first one, and a striking mirror symmetry appears: the two asymmetrical repertoires of realism and constructivism are mirror images of one another. Their symmetry is so exact that a completely coherent framework may be provided if we retain the first two guarantees and discard the third. To be sure there is a price to pay and that is to abandon the Critique or in other word to rewrite the Modern Constitution.

To be sure, the two remaining guarantees are strongly affected by the abandonment of the third. As with all other tight-knit structures, taking away one component alters the position of the others.

First modification. Instead of the two opposite transcendences of Nature^{iv} and Society—not to mention that of the bracketed-out God—we have only one transcendence left. We live in a Society we did not make, individually or collectively, and in a Nature which is not of our fabrication. But Nature “out there” and Society “up there” are no longer ontologically different. We do not make Society, more than we do Nature, and their opposition is no longer necessary.

Second modification. Instead of providing the explanatory resources in order to account for empirical phenomena, this common transcendence becomes what is to be explained. Instead of being the opposite causes of our knowledge, the two poles are a single consequence of a common practice that is now the only focus of our analysis. Society (or Subject, or Mind, or

Brain,...) cannot be used to explain the practice of science and, of course, Nature cannot either, since both are the results of the practice of science- and technology making (Latour, 1987, rule 3 and 4). Contrary to the expectation of the “social” students of science —and contrary to the fear of their opponents— the two realisms (social and natural) have to be discarded together if either one is to go, since they are one and the same. Or else, both have to be kept. This new generalized principle of symmetry flows directly from the development of science studies and, in my view, is their most important philosophical discovery. As long as the social sciences did not apply their tools to Nature and to Society at once the identity of the two transcendences and its common constructed character was left in the dark. Even when established science and stable society were studied together, their common production was still not visible. Only when science in action and society in the making were studied simultaneously, did this essential phenomenon become observable. This is why the intermediary solution — social realism alternating with natural relativism— advocated for many years by colleagues like David Bloor or Harry Collins are, in the long run, counterproductive for the field as well as for their own program (Callon and Latour, 1990).

Third modification: this is a direct corollary of the two others. Instead of always being explained by a mixture of the two ‘pure’ transcendences, the activity of nature/society making becomes the source from which societies and natures originate. In the modern Constitution, nothing interesting happened at the meeting-point of the two poles —the phenomenon— since it was just that: at best a meeting point, at worst a confusing boundary. In what I call for want of the better term non-modern Constitution, everything interesting begins at what is no longer a meeting point but the origin of reality. In the modern Constitution, one could only say that this production was a hybrid of two pure forms; in the non-modern one it is an understatement to talk of hybrids or of monsters. Collins’s gravity waves, Shapin’s and Schaffer’s air-pump, Callon’s scallops, Geison’s microbes, to take just a few examples, are not to be defined as being half natural, half social. They are neither objects, nor subjects, nor a mixture of the two. This is why after Serres (1987) I call them quasi-objects. It is out of their production and circulation that something originates that looks somewhat like Nature ‘out there’, as well as somewhat like Society ‘up there’. What metaphor could express this reversal? Pure Nature and pure Society may exist but they would be like two solid tectonic plates cooling from the hot

liquid magma emerging at the seams. Our work aim at exploring this seam and at taking into account the temperature and the direction of the flow.

Fourth modification. History which was locked away, according to the Modern Constitution is back in the centre. Since whatever happened had to be either the discovery of nature ‘out there’ or the construction by society ‘up there’, history had to be a zero-sum game to be explained by two lists of ingredients one coming from nature, the other from society. Now, on the contrary, it is the experimental scene that produces and shapes new actants^v that then increase the long list of ingredients that make up our world. Historicity is back, and it flows from the experiments, from the trials of force (Latour, 1990a). We do not have, on the one hand, a history of contingent human events and, on the other, a science of necessary laws, but a common history of societies and of things. Pasteur’s microbes are neither timeless entities discovered by Pasteur, nor political domination imposed onto the laboratory by the Second Empire social structure, not are they a careful mixture of ‘purely’ social elements and ‘strictly’ natural forces. They are a new social link that redefines at once what nature is made of and what society is made of.

Fifth and final (?) modification. The ontological activity that is no longer capitalized at the two extremities may be redistributed among all the actants. It was the necessity of the dual system of appeal either to nature or to society that in the Kantian framework caused all the agencies to be assigned to two and only two lists. Now that we are freed from this necessity, we are allowed to have as many poles as there are actors. This irreductionist principle is probably the most counter-intuitive consequence of science studies but it is a necessary and a coherent one (Latour, 1988, part II). Monsters that the Modern Constitution wished to cleave into two pure forms (entelechies, monads, fields, forces, networks) are back, claiming an ontological status that does not resemble that of the forlorn and passive things-in-themselves, nor does it resemble that of humans-among-themselves either. Too social to look like the former, they remain too non-human to resemble the latter. Dignity, activity, world-making ability are reclaimed by those actants that are, nevertheless, fully non-human, and fully real. Mere intermediaries in the modern Constitution, they become full blown mediators in the non-modern, more democratic, one. Yes, the Gordian knot is tied once again and tightly so.^{vi}

The problem with this counter-Copernican revolution is that it seems absurd if logged onto the realist-constructivist frame of reference since every reading of the new object-subject production will appear as yet another

‘golden-medium’ solution. Worse, since the new frame does not make reference to the two extremes, Nature and Society, that previously allowed a coherent interpretation to be drawn, it seems as if commonsense were abandoned and a completely obscure field of studies of science were to replace a narrow-minded but at least well-defined one. If I begin, for instance, granting activity to the non-humans once again, sociologists of science (Collins and Yearley, 1990) begin protest that outmoded realist positions are back, even though the new active non-humans are utterly different from the boring inactive things-in-themselves of the realists’s plot. Conversely, if I speak of a history of things, realist philosophers immediately start accusing me of denying the non-human reality of Nature, as if I were asking actors to play the equally tedious role of humans-among-themselves so common in the stories of the sociologists. On the other hand, their joint indignation is understandable since they have no other frame of reference than the Modern one and thus they cannot locate our position on their instruments. After having written three books to show the impossibility of a social explanation of science and having being praised (and more often castigated) for providing a social explanation, I am now convinced that no further progress will be made if we do not change our touchstone.

4. Adding a second dimension

Now that the ontology of a viable substitute for the modern Constitution has been sketched, the next goal is to set up a clearcut standard to locate the various positions and to differentiate nuances of argument at least as finely as with the old instrument —and more finely, if possible. If I sketch the new yardstick I obtain a diagram that is admittedly crude, but let us remember that the philosophy implicit in science studies might be as crude as that. The one-dimensional yardstick allowed to position any entity along the object-subject line. I showed that although this was useful it did not do justice to most of the discoveries of science studies: objects and subjects are belated consequences of an experimental and historical activity that does not clearly differentiate if an entity is 'out there' in nature or 'up there' in society. This means that any entity should also be logged according to its degree of stabilization.

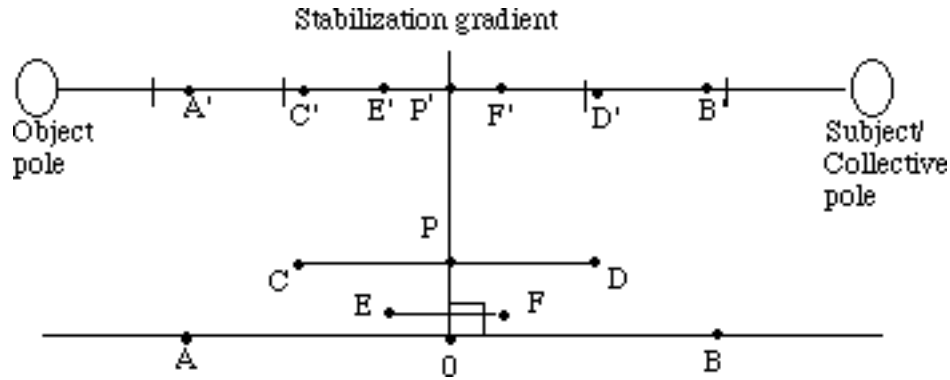
**Figure 3**

Figure 3 is an attempt to define any entity by two sets of coordinates instead of one. One line is the distance to P, the locus of phenomenon in Kant's scenario, and goes either to the subject/collective pole or to the object pole. The other is the degree of stabilization going from 0 to P', from unstability to stability. It is clear from the diagram that the one dimensional yardstick I criticized above corresponds to only one value of the stabilization gradient. When everything is settled there is indeed a clearcut difference between A' "out there", and B' "up there". Pasteur's microbes are clearly discovered or constructed out of natural and material actants that lie outside the control of our human wishes; hygienic ideas about asepsis and antisepsis are sure means of settling the dispute between Health and Wealth during the Second Empire. For this value of OP' science students are torn in between those two alternative transcendences: a nature that is not of our social making; a society that is not of natural origin. They then have to explain Pasteur achievements by what nature is like, or to account for his discoveries by what society is made of, or to chose any intermediary mixture of pure nature and pure society, or to alternate at will between extreme naturalism and, should I say?, extreme socialism.

But suppose that I now wish to write a book on Pasteur's microbes where I change the value of this whole debate along the "stabilization gradient" (Latour, 1988). Let say that I now explore the line CD instead of the line A'B', or even the line EF. The complete gamut of positions is now squeezed in the middle and a different account of the entities Pasteur is struggling becomes possible. Is the microbe a living entity, a chemical one, a physical one, a social one? This is still uncertain. Is nature large enough to accommodate invisible powerful microbes? We will learn it from Pasteur's experiments. Is the Second Empire and the Third Republic, able to absorb or be redefined by new social links that will add the multitude of microbes to the normal social relations? We are learning it from Pasteur's laboratories. Whereas for higher value of the "stabilization gradient" it is important to

decide whether or not something is social or natural, it is meaningless for lower values since this is where is defined what natures and what societies are.

Naturally, as the diagram nicely indicates, if I now project the state of nature/society building I am studying onto the one-dimensional yardstick, my analysis will be completely misunderstood. C' will be taken to mean the emergence of a stabilized natural actant —the non-human microbe plays a big role in my story—, and D' will be taken to mean that I give too much activity to stabilized social groups (or too little depending on who is reviewing the book). Worse still, if EF are projected on the same line. E' and F' are now seen as wishy-washy solutions to the problem of realism versus constructivism! I am now seen as attempting to escape the internalist/externalist quandary by squeezing my entities around P' the safe and golden medium, the meeting point of nature and society. But I am not interested in P' only, I am interested in all the values taken along the orthogonal dimension. Instead of having endless discussions on social constructivism, is it asking too much to focus our debates on a few other values of the stabilization gradient?

There is another major advantage in unfolding our debates on two instead of one dimension: points becomes lines. As soon as we consider two set of coordinates for every single entity —its degree of naturalness or socialness on the one hand, and its degree of stabilization on the other— we become able to do justice to the variable ontology of the entities we all studied in our case studies. Boyle's air pump, Pasteur's microbes, Millikan's electrons, do not have to be defined as points in the one dimensional diagram, but as trajectories in the two-dimensional one. The "same" microbe may be close to E, then to F, then to B', then to A', then to C, depending on its history. The "same" entity may occupy many states, being impurely social, then purely social, then purely natural, then impurely natural. The "same" actant will be immanent and then transcendent, made and non-made, human made and discovered, freely decided and imposed upon us as a *Fatum*. To use still other words, essences become existences and then essences again. Quasi-objects may alternate and become objects, or subjects, or quasi-objects again or disappear altogether. The main philosophical interest of science studies, I contend, is in habituating us to consider those variable ontologies. Every actant has an original signature in the diagram above and you will have as many "microbes" as there are points along the trajectory.

Many words have been offered recently to define such a trajectory. Serres (1987) use the word 'quasi-object' to designate what circulates in the collective and shapes it by its very circulation. Callon (1985) has offered the word 'actor-network' to convey the same double function of Nature-building and Society-building. In a more restricted way, Shapin and Schaffer (1985) have proposed 'forms of life' and Lynch (1985) 'experimental practice' to designate this activity that turns on the silent laboratory-made or society-making experiment. I have played with the words 'allies', 'collective things', 'entelechies', 'actants', 'networks' 'modalities'. All these words however since they designate either state, or process, or actions, may be misunderstood when they are seen as one pole in the one-dimensional frame or as the mere combination of the two. In order to be adequate, they themselves have to be adjusted to this new two-dimensional yardstick. As soon as they are meant to designate points, they become meaningless. Their meaning comes only when they are used to stretch the ontological variations of those bizarre monsters we have uncovered.

'Monsters', 'imbroglios', 'mixtures' are themselves ambiguous terms. The paradox is that with the one-dimensional yardstick, science students are unable to account for their own discoveries. The reason why we all went studying laboratories, active controversies, skills, instrument making, emerging entities, was to encounter unstable state of nature/society and to document what happen in those extreme and novel situations. On the other hand, most philosophies of science and all of the social sciences, were on the contrary considering either stabilized sets of natures facing stabilized sets of societies or letting only one of them be unstable at once. The misunderstanding was complete since what is the rule for us is the exception for them. We see only emerging society/nature, they consider only purely social or strictly natural entities. What is the rule for them, purity, is the exception for us. Whereas they are obsessed by the debates between "out there" and "up there", we focus on a region hitherto unknown which I would call "down there". Had we possessed the one-dimensional yardsitck only, considered the two sides apart, inspected the lines from the two extremities, and tried to explain an agent by using Nature and Society as causes, we would have been unable even to suspect the existence of the basic phenomenon discovered by science studies, that is the co-production of collective things. All the entities from the bottom half of figure 3 would be squeezed around P', the place for wishy-washy interpretations. Thus the framework that the whole field employs to calibrate its evaluations of case-studies is totally unable to do justice to what the case-studies reveal. The only

thing it can convey about entities is that they are tangle of science and society or a little bit of both... No wonder that the domain is in a blind alley; it is not even able to define the instrument that would allow us to read its own results!

5. A Non-Modern world for science-studies

Science students all too often either believe they should shun philosophy or that they should borrow whatever philosophy there is off the shelf. It is my contention that in order to make sense of quasi-objects science students will have to take philosophy much more seriously; they even might have to redefine their own metaphysics in order to deal with the bizarre ontological puzzles revealed by their discoveries of the collective-things. The originality of this discovery cannot, in my view, be overstated. To use again the terms I have defined above, science-studies ease us into the non-modern (or a-modern) world. Until then, we have been shaped by the idea that we were modern. What we are witnessing, and what explains the present interest in science-studies, is the end of this belief, the end of the two Enlighenments. The first Enlightenment used the nature pole in order to debunk the false pretence of the social one. Natural sciences were at last unveiling nature and destroying obscurantism, domination, and bigotry. The second Enlightenment used also the social pole in order to debunk the false pretence of the natural one. The social sciences —economics, psychoanalysis, sociology, semiotics— were at last debunking the false claims of naturalism and scientism. Marxism, of course, was so strong because it appeared to join the two Enlighenments together: the natural sciences helped us to criticize powers and dominations; the social sciences allowed us to criticize the natural sciences, and their naturalised powers and dominations. When it was painfully realized how untenable Marxism was, we were then moved to what is called “postmodernism”. We were still modern, we still wished to debunk, and criticize, and unveil, but the solid grounds that guaranteed the strenght of our attack had failed us. It seems that without a belief in a solid state of society, or a solid state of science, there was only despair and cynicism. It is at this historical moment that science-studies entered the field. For them an unstable state of society and nature was a normal state of affairs. What explains, in my view, the present limitations of our field is that we have not yet reconciled our discoveries with our philosophical framework. We still believe necessary to be modern or postmodern, when our own field studies point to another historical moment: we have become non-modern, that is we have never been modern. Suddenly, we look at our sciences, our

technologies, our societies, and they are at a par with what anthropology has taught us of the other cultures.

With such a realization, the Modern framework that made unthinkable the discoveries of science studies is now entirely dissolved. The two poles on the horizontal line in the modern yardstick were used to differentiate between the few collectives which had access to Nature because they could break away from the constraints of Society, and others —the primitives, the ancients, the poor— which were for ever inhabiting the prison of their symbols or their social categories. Such was the great divide between Us and Them, a divide that is nothing but the anthropological rendering of the divide between the Object pole and the Subject/Collective pole, the exportation abroad, so to speak, of our Civil strife. It is the two divides taken together that made us modern. Not only did we completely separate the representation of things from the representation of humans —not to mention the bracketing out of God— but this separation set us apart from any other society of the past and any non-Western society, since we were the only one doing so. The non-modern representation is that neither of those two divides is necessary. There is no separation between the object and the society; we Westerners go on doing what every one has always been doing, that is growing “down there” collective-things that may end up being nature “out there” and society “up there”. There has never been any modern world (Latour, 1988). Still, there are many differences between various productions of collective-things, but they are probably no more than differences of scale like so many loops of a spiral (Serres, 1987); to “bigger” collectives more “objective” natures; to “smaller” collectives, more “subjective” natures. Comparative anthropology may start from good, and may at last be symmetric.

Once we enter the non-modern world (and again this is not a new era but only the retrospective discovery that we never entered the modern eras, that no Copernican revolution has ever taken place) we are able to understand why the main philosophical schools are so inadequate to help us doing our empirical field studies of science- society-making. Everything hinges upon what to do with the point P’ in figure 3. What was in the 17th century the settlement of a dispute over the authority of humans and non-humans, a mere distinction between two regimes of representation (Shapin and Schaffer, 1985), became a separation with Kant’s Copernican Revolution. Kant had not finished writing up his modern Constitution, when dialectical philosophers tried to overcome the radical distinction between the object-pole and the subject-pole he had proposed. Instead of retracing his

steps, however, they pushed the Critique further. Not only did they maintain the ternary structure Kant had offered, they elevated the distinction between object/subject to the rank of a contradiction. This contradiction was then “solved” by letting the object and the subject overcoming each other in turn, making a synthesis out of the two. The strength of the spring, the strength that made the whole dialectical machine tick, was directly related to the distance between the pure object and the pure subject. Far from dissolving the two opposing positions, dialectics made good use of absolute contradiction to produce history out of it. The worst thing that could happen to a dialectician would have been to dissolve for good the dichotomy that made us modern. While, with Kant, a trace was left clearly visible of the radical move that built up the separation between object and subject, no such trace remained in dialectics. “Overcoming” the distinction made it invisible and for ever impossible to overcome. The power of negativity became a fantastic denegation of this quandary.

Dialectics at least tried to span all the ontological states and to embrace nature and society in a single narrative. Not so later, with the many schools of phenomenology and with existentialism. Although intentionality was supposed to do away with the object-subject dichotomy, it was more like someone whose legs are stretched between two boats that are pulling apart. The tension was so extreme that, in effect, intentionality was allotted to humans. As to things out there, emptied of any meaning, will, intentionality, or even being, they had to fend for themselves. They had to wait for meaning to be granted to them by an intentional consciousness. Of course, in a well-balanced minuet, the other side was taken over by the many schools of thought who naturalized the whole question and transformed collectives, cultures, languages and ideas into parts of the material world of mindless things. Materialism, biologism, evolutionary theory, behaviorism, evolutionary epistemology, neurosciences, all these attempts, no matter how interesting, are nothing more, according to the geometry of our diagram, than a folding along the vertical plane of symmetry. The distance to P' remains the same. For science students, not much is gained by merging the Subject/Collective pole into the Nature pole. The practice of science, its historical production, remains as invisible as it does with phenomenology (Bradie, 1986).

Still, phenomenology and evolutionary theory remained remarkably useful for science studies compared to what was to come later. Modernist philosophers are now trying to save us from the perils of post-modernism by widening still further the gap that Kant already made so large. Habermas,

for instance, strives to render as incommensurable as possible the free speech situation of human actors, on the one hand, and the technical efficacy of mindless non-human agents on the other. Like Kant, he makes it impossible to focus on what is in the middle, to study empirically the fabric of science-society tangles, but what was a tragedy in Kant becomes a farce with the modernists, since the number of quasi-objects thus ignored has become gigantic. Every issue of our world is tying science, society and technology together, but those ties are said to be unlawful. They should not exist. The entire enterprise of the modernists eventually collapses and it is only by carefully abstaining from any sort of empirical work on science and technology that Habermas and his followers have been able to maintain the incommensurability of humans and non-humans. Every minute in laboratories scientists and engineers make them commensurable, but to see this one has to move closer to the centre, closer from “down there”, one, that is, has to become non-modern!

I have not found a word to describe what the relation has become in the hands of the honest Habermas’s critics: the ugly term ‘hyperincommensurability’ might be fitting for the ugliest philosophical movement of the post-moderns who cannot any longer even take their own Critical stand seriously. Disappointed rationalists, they share all the features of rationalism except hope; children of the Critique, they maintain the will to denounce and debunk, but have no longer any grounds to do so, and turn the critical stand against themselves. What all the other schools had desperately striven to maintain, that is, some kind of possible, even nostalgic, relation with the “other side”, is now broken. Scientism and technicism now freely alternate with extravagant claims about societies and language-games, and self-destructive and self-deprecating jokes. Science and technology production, the making of natures and societies, is so far off-camera now, that they cannot even understand what science studies is about.

The only nice thing about post-modernism is that there is nowhere else to go after it, and that it brings to a close the whole modern enterprise. With post-modernism, we have finally reached the breaking point of the whole Critique. Everything happens, as if the main schools of philosophy had tried to avoid the consequences of the growth of science and technology. The more intermediary cases there are, the more distant are the two poles of nature and of society. A distinction becomes a separation then a contradiction then an irreconcilable tension, then an incommensurability, to end up in complete estrangement. Let the tangles of sciences and societies grow and the philosophers will tell you that they should not exist. Enough is

enough! One cannot indefinitely keep at bay the growing numbers of quasi-objects. One cannot indefinitely naturalize the whole collective building of society. One cannot forever ignore the practice of science- and society-making. The Critique was a parenthesis and it is now closing. Nineteen eighty nine might not be a bad date for its demise since it is the very same year that witnessed, on the one hand, the dissolution of socialism and, on the other, the dissolution of naturalism. The two poles of our one-dimensional yardstick have been under attack the same year! The fall of the Berlin Wall and the first conferences on global warming all point to the same transformation as the one I have outlined here: it is impossible to dominate nature and to dominate society separately. The modern Critique was a nice try but it makes less and less sense and now that we have realized that neither Nature nor Society cannot be put at the two opposing poles, it is better to recognize that we have never really been modern, that we have never ceased to do in practice what major schools of philosophy forbade us to do, that is to mix objects and subjects, grant intentionality to things, socialize matter, redefine humans. We, the Westerners, have never been all that different from the Others who were unjustly accused of confusing the representation of nature with Nature as it really is. It is about time to take up again the threads of the many philosophers squeezed out by the Critique in order to create a makeshift philosophy specifically adjusted to the need of our empirical science-studies.

6. Conclusion

I hope to have clarified why it is impossible to escape from our blind alley without doing some philosophical work. The idea that science studies may ignore philosophy altogether, or be content with philosophy of science, or not build up its own metaphysics and ontology is foreign to me. Now that we have a touchstone to evaluate science-studies, not only by their longitude, so to speak —along the realist/relativist axis— but also by their latitude — along the stabilization gradient— and now that we have freed our interpretations from the prejudices of the Critique, the whole task now appears straightforward. We can go on doing what the best scholars among us have tried to do for years, but now we know why and when such efforts are at their best. We do not have to retrace our steps, to recant constructivism, and to become “reasonable” again, falling back on a “golden medium” wishy-washy position.

Like Antony “I have neither wit, nor words, nor worth, action, nor utterance, nor the power of speech” but I hope to have convinced the philosophical reader that the whole domain of science studies, once its “social” attire has been set aside, becomes an exciting domain, not only for understanding science/society but also for easing philosophy out of its modern (and post-modern) predicament.

ⁱ In the remainder of this essay I use modern in a technical sense: it means the political philosophy that separates entirely the representation of things (science) from the representation of humans (politics). Although both are representations their common origin is hidden. I also use the word Critique not to refer only to Kant’s works but to the whole idea of a critical stand starting from one or from the two opposite poles defined by Kant.

ⁱⁱ There are differences indeed to which I cannot pay justice in such a short space but my point is that they will become much more clearly visible when we shift from the one-dimensional yardstick to the other.

ⁱⁱⁱ This is why I called this partition the “modern constitution of truth” (Latour, 1990a). Modernity being defined as the complete separation of the representation of things —science and technology— from the representation of humans —politics and justice— (not to mention the bracketing out of God). A Constitution is the written or unwritten document that settles the organization of power.

^{iv} The use of the word ‘transcendence’ to describe Nature might seem unusual. But once the symmetry is built the use of the term is unescapable: the content of scientific knowledge radically escape from the making of social ties; it is transcendent to society, it is “out there”. Symmetrically, society is not of our own making, as Durkheim has shown long ago, it is transcendent to our own individual construction, it is “up there”. So we live, or rather we used to live in between those two transcendences, Nature and Society, none of them of our making; each of them providing its own explanatory resources.

^v ‘Actant’ is a bit of jargon borrowed from semiotics to make clear that we do not have to chose beforehand between ‘mere things’ and ‘human actors’. The attribution to actants of volition and action (anthropomorphism) is as important to document as the attribution of ‘thingness’ and ‘passivity’ (phusimorphism). Natural forces are no more immediately given than human agents (Latour, 1988, part II).

^{vi} It is on purpose that I turn the metaphor up side down. I am against Alexander and his swift but deadly sword, and I want to rehabilitate the patient work of weaving back science and society, the cart and the horse.

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