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Reincarnating the Knowing Subject

Scientific Rationality and the Situated Body

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The new anthropology, history, and sociology of science tend to describe science in terms of action, cultural practice, social construction, or, better still, as an entanglement of multiple actions, practices, and socio-technical realities. In doing so they have eliminated the presuppositions of an implicitly or explicitly recognized epistemology of rationality (and/or a diffusionist model of science) that takes for granted the dichotomy between knowing subject and known object. In short, by offering a new definition of rationality, these studies make it possible to reflect anew upon the nature of the knowing subject. To understand how such a question becomes relevant again, my aim in this essay is to describe the deconstruction of scientific knowledge and simultaneously to suggest ways that we might fruitfully return to—and reassess—our analysis of the knowing subject. Thus, we shall see the omnipotent and bodiless knowing subject of the rationalist tradition brought into the light of day, at the same time that he or she loses his or her monopoly of action. This is the paradox that I wish to explore. Drawing on an empirical study of the practices of an inventor, I shall try to paint a new picture of the subject: a subjectivity not at the origin of the constitution of an object, but emerging from a collective consisting of heterogeneous elements—that is, a subjectivity that is

both distributed and situated in a singular body. Can we talk about incarnation at the heart of science?

The Criteria of Scientificity Called into Question

For the past thirty years or so, one of the pillars of our modernity—the Truth of Science—has come under attack. By investigating laboratory science and following controversies, anthropology, history, and sociology of science have turned away from science as a mirror of nature to study science in action, which is to say, science in the process of being made.[1] We have, moreover, come to see what François Jacob poetically calls "the science of night" characteristic of the context of discovery (a science that "hesitates, stumbles, back tracks, perspires, awakes with a start, doubting everything, . . . which searches for itself, questions itself, constantly corrects itself, . . . a sort of workshop of the possible") spread to the famous context of justification.[2] Contingency has been reintroduced into the production *and* stabilization of scientific knowledge. Our criteria of truth—including the reproduction of experiments, the interpretation of results, the evaluation criteria of proof—now seem matters of negotiation.[3] Science is politics by other means. In short, contrary to rationalist assertions, there is no natural logic of proof, no single, stable, and timeless criterion by which agreement can be reached on the validity and relevance of a statement. Rather, the social is at the core of the interpretation and construction of facts, and the "rational" is inescapably a function of social and historical context.[4]

The question that sociologists and historians now ask themselves is no longer "How can or could an individual invent a theory that is more rational than others?" but instead "Why is the knowledge constructed at one particular moment more effective than another?"[5] Owing to Bloor's principle of symmetry—which obliges us to treat victor and vanquished, failure and success, in the same way—accounts of the construction of knowledge appear less linear, less obvious, and less predictable.[6] We suffer along with the different protagonists and, along with them, try to understand the reasons for their choices. History of science becomes part of history itself.[7]

By tackling the notions of realism and representation, the constructivists and social historians of science attempt to anchor science in the laboratory, the instruments, the local know-how, the institutions, and the ensemble of determinants, which, by the weight of their associations, make it possible to escape the myth of scientific genius: "he won because he was the most rational or because he had immediate access to nature." By refusing to take a stand on truth, these studies make possible a multiplicity of interpretations of the real, yet, in so doing, they deprive Nature of its capacity to stabilize the real. As Trevor Pinch says:

> By studying how scientists themselves can provide different interpretations of Nature, the truth or falsity of scientific findings is rendered as an achievement of scientists rather than of Nature.[8]

Discovery is no longer defined as revealing a hidden Nature, for Nature is no longer the cause but the consequence of discovery. The focus has shifted away from reason as a distinct and asocial category toward the conventions and types of relation that, for a given community, regulate and standardize scientific practices and techniques. We go from the representation of a stable world in which islands of novelty sometimes emerge to a world in perpetual movement in which islands of stability sometimes emerge.

Some sociologists of science have tried to extend this principle of symmetry to a principle of generalized symmetry that implies treating humans and nonhumans in the same way.[9] To be sure, nonhumans cannot always be expected to do what's expected of them. Sometimes they resist. Sometimes they refuse to be translated into the scientists' instruments. We need to give historicity back to objects in order to see how scientists construct a "socio-nature," while avoiding both the myth of the all-powerful discoverer and the naturalization of history. With this new conception of science, all the divisions on which the specificity of scientific knowledge has traditionally been based—for example, the context of discovery versus the context of justification—become consequences of scientists' work. The contributions of Shapin and Schaffer, Callon and Latour, and Hacking converge around the same problematic: to see how the double reality of scientific knowledge is constructed

such that it is the product of human practices at the same time that it appears to be entirely detached from them. For Shapin and Schaffer, the origin is historical, even archaeological; they argue that in the quarrel between Thomas Hobbes and Robert Boyle, we can see the construction of the characteristically modern distinction between "science" and "its context" (see *LA*). For Callon and Latour, it is sociological, even ontological: we study what scientists actually do, and not what they say they do. We thus see the dual process of mediation and purification operating.[10] For Hacking it is philosophical: one should not try, like armchair philosophers, to define objectivity or rationality "as such," but rather to understand how such concepts operate in our daily practice. He suggests, for example, that we observe what we are doing when we measure the performance of an athlete.[11] We discern three common points: first, we ground the realism of science in practice, know-how, and instruments; second, we situate ourselves in the in-between where this dual reality—nature and society—is constructed rather than starting from one of the two extremes; finally, we localize and historicize our scientific practices. But if historicity, situation, localization, and contingency are reassimilated in the explanation or even in the description of this practice, might we be in the grips of an illusion? Does truth exist? The answer, of course, is yes; however, scientific rationality is not distinguished, in the standard conception as described by George Levine, "by the 'objectivity' . . . of its procedures, and the disinterest of its practitioners; by its rigorous requirements of verification, by replication of results; by the universal validity of its conclusions; by its capacity to represent adequately a non verbal and nonsymbolic reality, . . . by the results . . . not affected by rhetorical manipulation of arguments . . . nor by the social contexts from which it emerges, nor by the psychology or personality of the experimenter."[12] It is just the opposite: the more rationality is mixed, historicized, and anchored in practices, the more it is true (see *SA*).

The universality, rationality, and objectivity of science that Descartes and Kant grounded, respectively, in the *cogito* and in transcendental categories, or that Popper grounded in method, are henceforth rooted in multiple collective and situated practices.

Thus, as science is repopulated, the subject is emptied of its innate properties while assuming the appearance of a "flesh and blood" human being. Historians and sociologists of science, by questioning the established divisions between context of discovery and context of justification, subject and object, internal and external, not only deconstruct the definition of scientific rationality but also displace the knowing subject, the site where rationality was to be found.

The Subject Overthrown

Philosophically, the objectivity of science was in fact constructed in relation to a conception of the subject.[13] To establish and maintain the specificity of this universal knowledge, it was necessary to construct a universal subject—a subject devoid of subjectivity, or rather, a subjectivity that has been excluded, contained in a method or in a consensus, or constructed by methods of objectification. This subject was capable of guaranteeing the truth of science: the new Galilean mathematical science of nature for Descartes, or the Newtonian paradigm for Kant. Indeed, it was in our subjectivity that Descartes sought the foundations upon which to construct the edifice of sure—rational—knowledge. Yet this subjectivity has been "deprived of its dimension of radical interiority, reduced to a 'seeing,' to a condition of objectivity and representation." Thus, "the subjectivity of the subject is henceforth nothing but the objectivity of the object."[14] This definition of transparent representation and of a bodiless subject has profoundly affected our vision of rationality. Idealism brooks no obscurity in being, for the truth of the content of a discovery is guaranteed by the purity of its origin. An essential dichotomy was thus established: conscience, reason, intuition, intellect, and psyche were pushed to one side while the unconscious, sensibility, imagination, and the physical remained on the other. This Cartesian conception of rationality based on the conscience established the status of the scientist. Free of all that could encumber the knowing mind—"anticipations, prejudices, idols"—the investigator was now in a position to question nature and to obtain her answers directly. The genesis of reason reduced to pure intellectuality must return us to original truths. Henceforward, we could

speak about disembodied rationality.[15] The *cogito*, the first of all truths, the locus of truth and its model,

> promises a virtually instant solution to the problem of representation. Liberated from its bodily locus, the knowing subject needs no physical vantage point in order to be near to God, to stand over and above the object of H/his knowledge. From such a transcendent vantage point, simultaneously everywhere and nowhere, it seemed possible to see the entire universe, including not only the moons of Jupiter that Galileo had espied through his telescope, but also: "the digesting of food, the beating of the heart and arteries, nourishment and growth, respiration, waking, and sleeping, the reception of light, sounds, odors, tastes, warmth."[16]

With Kant, the theory of rational principles tends to substitute itself for that of innate ideas. But the task is similar, for Kant tries to describe the subject's experience such that it constitutes the basis for rational knowledge. We find universal categories common to all rational beings, categories imposed on subjective and confused impressions and thereby endowing them with objectivity. With Kant, we have an active subjectivity, but one that is neither personal nor idiosyncratic.[17] Reason cannot have a history. Kant did not conceive of changes in scientific knowledge equivalent to the Copernican revolution that he himself established in philosophy. As Blanché says:

> Modern rationalism, by rejecting the idea of innate knowledge and by limiting the *a priori* to certain rules of apprehension and exploitation of the empirical datum, thought it could thus preserve . . . the immutability of a reason henceforth conceived as simply structuring. . . . By completely emptying it and reducing it to a system of formal principles, the perpetuation of reason was guaranteed.[18]

How is it then possible to produce new theories in a field that is said to differ from others because the strict frames of the rationality of subjects resound in it? Scientific revolutions imply a concomitant revolution in the conception of the subject. Popper abandoned

all concern for foundations and replaced it with an idea of the growth of knowledge. Following Kant, he celebrated the rational form that is critical thought. But with Popper, the effacement of the subject, discovered as the reference point of the irrational, becomes the condition of possibility of rational science. Descartes' distinction between a subject's reason (the source of real knowledge) and his imagination (the source of errors and ideas whose constitution cannot be rationally controlled) is reified with Popper on the level of method, that is, in the distinction between the context of discovery and the context of justification. Hence the subject, which is the defining feature of rationality, disappears, to be replaced by methodology alone, that is, by the rational justification for the acceptance or rejection of our theories.

The criterion of scientific demarcation thus shifts from synthetic judgment with Kant to a collective, critical, and rationally controlled judgment with Popper. Among the first sociologists of science, such as Merton, we see a further shift, this time to an *ethos* upheld through mechanisms of regulation of knowledge. Either the scientist is rational and transparent, or his irrationality is rationally controlled by the group and he becomes a collective actor. As long as the content of science was not deconstructed, it was necessary to have an ascetic scientist, or a method to constrain him. In short, either the validity of a scientific theory is guaranteed by the purity and rationality of its origin—science is inscribed in the nature of rational knowledge, and novelty (that is, the introduction, through an act of thought, of something not yet present) is unthinkable—or science as a dynamic process is thinkable, but a break is thereby introduced between the context of discovery and that of justification. The impure context of discovery is thus placed outside the field of scientific rationality and at the same time outside any rational explanation. The validity of a statement no longer has anything to do with its origin. We are trapped in an opposition: objectivity and the rationality of science versus subjectivity and the irrationality of subjects. We find this dichotomy reproduced in many studies of discovery. On the one hand, with the epistemological study of scientific statements, we find the object; on the other, we study the conditions of their emergence: the explanatory principle thus lies in either the subject or the social.

Philosophers have tried to think through the unavoidable paradox between Nature governed by universal laws and Nature known (discovered) by idiosyncratic individuals. This resulted in a conception of a subject at the center of knowledge production, but simultaneously absent because transparent or removed. Keller, by analogy with the classical perspective, traces the construction of a scientific subject that becomes increasingly abstract and dispersed. The viewer is named by his or her position, but at the same time is rendered anonymous: "What Brian Rotman calls a 'metasubject'—invisible, autonomous, virtual" ("PS," 320).

Sociologists of science have struggled against individualism attached to rationalism and to realism anchored in the writings of philosophers of knowledge. For Barnes,

> [t]hey have assumed, incorrectly, that an isolated individual is in a position to identify correct applications of knowledge simply by reference to reality and by the use of her rational capabilities. Reality as apprehended by the individual mind and rationality as manifested in individual cognition are *sufficient* to determine which applications are correct and which not.[19]

Thus sociologists, by attacking the criterion of scientific demarcation —which is to be found neither in the subject, nor in a method, nor in normative rules—depose the knowing subject (the all-powerful, rational producer of ideas that is nonetheless absent, that is, without a body) not by eliminating it, but, paradoxically, by bringing it into sharp focus.

If we consider the founding principles of the sociology of science, we can see the following implications regarding the subject's status. The principle of symmetry largely destabilized the heroic image of the scientist-discoverer. The subject was replaced by a community of scientists, and from this community emerged properties of nature. We no longer have *a* knowing subject but rather *some* individuals. It is not the scientific object but society that crosses through these individuals; their behavior is interpreted through the social interests driving them. The principle of generalized symmetry was the coup de grace—in the tradition of Copernicus, Darwin, and Freud—to the predominance of the subject, which is reduced

here to the rank of the nonhuman. The social constructivists fought against methodological individualism, while sociologists of actor network theory (Callon and Latour) jettisoned the belief in a preexisting social reality that constrains the behavior of individuals, and reintroduced the role of nonhumans in the social fabric.[20] Our humanity does not derive from our sociality (from our subjectivity) but from our capacity to construct objects (to objectify our relations), hence the importance of giving them weight.[21] While the view of a subject disembodied and crushed by scientific and technical objects is the object of anti-modern critiques, we discover with these sociologists that objects have a grip on our lives just as they, in turn, are themselves inhabited by our social practices.

Thus, the constructivists, by repopulating our collective world with the practices, instruments, bodies, and skills that had been removed by the rationalist tradition, reintroduced subjectivity and the "social." But what becomes of singularity? With the sociologists of actor network theory, we discover a distributed actor, an actor who is the spokesperson of all the humans and nonhumans with whom he or she has associated, that is, a form. Are we not thereby reverting to a subject who is invisible and autonomous, that is, a disembodied knowing subject—one suspended above the real, situated world? Unlike numerous studies, which stop at the construction of objectification or at the studies of practices of disembodiment of the subject, I would like to pursue this movement (we will see that they are not contradictory) and focus on reincarnation and the individualization of a subject by a collective. Accordingly, I begin with the assumption that the individual and the collective are not two stable entities, two poles constituting an irreducible tension, but products of a process.[22] The identity of a subject is constructed. The question I wish to consider, then, is the following: how can we define a subject that becomes singular because it transcends its conditions of existence, that is, its own body?

To this end, I draw on an empirical study undertaken in the international corporation Elf Aquitaine (now Total), the idea being not to study "a genius" in history but the case of an individual doing his daily work in our contemporary world, which is to say, in a locus of knowledge that is neither mythical nor glorified. I arrived at

the firm when a specialist in thermodynamics was emerging from a process of knowledge production as a leader—and an expert—and who was to become a symbol of innovation for the entire group. By focusing on this individual, whose name is François Montel, we are able to grasp the inter-relations between three points that constitute invention: the role of narrative accounts of the invention/inventor, the object (the invention, i.e., the model constructed), and the actor (the inventor).[23]

A Reconfigured Subject; or, The Subject's Body

François Montel is the head of the Thermodynamic Section of the Oil-Field Department, which is in turn part of the Research and Development Division at Elf Aquitaine's Scientific and Technological Research Center. His section consists of four engineers and three technicians. Montel has three functions: development and management of research programs; in-house services; and research for subsidiaries. His field of study is the characterization of oil fluids, and his main job is to explain the origins and behavior of oil or gas deposits. Understanding the way in which fluids move and change, and determining the different phases through which they go (an oil can become a gas and vice versa) has a direct consequence on drilling and on the way in which the oil is processed above ground. The researcher's knowledge and know-how is thermodynamics; his operative tool is computer modeling. He is said to be the inventor of a new type of modeling, an achievement for which he was awarded a prize by his industrial group. In doing this ethnographic research I thus witnessed the narrativization, the objectification, and the socialization of a subject. These mediations are the necessary conditions enabling an actor to transcend the limits of his own body. In describing the daily work of the researcher in this institution, we can see him use the institution both to construct a collective and to single himself out. The hypothesis that I would like to test is the following: the more an actor is socialized, distributed, and linked to heterogeneous elements, the more he becomes a singularity, an ego, an uninterchangeable body, an irreducibility. Subjectivity emerges from a heterogeneous collective and roots itself in a situated body. This is what I call the distributed-centered subject.

By deconstructing a process of discovery, I "discovered," in the tradition of sociologists of science, a collective inhabited by heterogeneous elements working and producing invention. Invention is distributed simultaneously in the following procedures: colleagues' judgments (processes of attribution, repertoires of discourse, criteria of qualification of novelty), institutional constraints (procedures of institutionalized recognition, action programs, and research protocols), modeling practices (the inventor's relationship with his model, others' relationships with this object), oil (how matter is socialized, or the required processes of transformation needed for oil to be assimilated to the inventor's model), and theoretical tools (how they function, what they require, and what they do extra). But I also discovered a point where this social construction stops. The driving force, the agency of invention, as they say, emerges in the body of a particular actor. We then witness a dialectic of the production of a subject through the redistribution of competencies in space and time, owing to the introduction of a new object. In this case, an individual becomes a new kind of subject through the process of redistribution of competencies that follows from the birth of the new computer model he has written. Or, to paraphrase François Dagognet, we can see how "the object concretizes the man."

We cannot understand this individual's creative capacities without understanding what this model does, in what sense it is new, how the inventor appropriates it, and how he plays on it. In fact we even confuse the two; an object takes on the same properties as its inventor. Yet they are different. One is a flesh and blood body, the other silicon. That which acts in the hands of others is equations and models. The computer is both an extension of the inventor's body and at the same time completely exceeds it, for it is not made of the same matter. More durable, the computer is connected to all the others; it can act in a far broader spatial field (it is needed at different points in the oil-drilling process) and extend its field of action. This equation enables the inventor to control stormy seas and colleagues' assessments. We have gone from an uncontrollable situation to a simpler one in which roles seem to be stabilized and strengthened during action. The program is an actant in its own

right—acting on the social world, although it has characteristics different from the bodies surrounding it. "Every time an interaction lasts in time and expands in space, it is because it is shared with nonhumans."[24] The narrative constructed around this inventor—e.g., "One day he had this idea"—also plays a fundamental role insofar as it permits this individual to exist in time. It is clearly the narrative that allows certain forms of being to persist. This is also the case with awards.

In a way, this type of argument would hardly shock advocates of a certain kind of rationalism. They might see it as the necessary process of disembodiment of the scientist: the scientist's body disappears while objects have to live without him. Without a doubt, "by considering objects, we reflect on the mind."[25] Sociologists of science (Actor Network Theory), on the other hand, might propose a different reading. This subject is naturally composed of heterogeneous materials, and its/his force derives from the ensemble of associations that it/he creates. We thus have an actor-network. Callon and Law write, referring to *The Pasteurization of France*:

> In the Pasteur-network, we do find a laboratory, docile strains, notebooks, statistics, the Pouilly-le-Fort farm, journalists witnessing spectacular experiments organized by Pasteur, cows dying in infected fields, the French electorate that he strives to convince . . . A human being is an envelope in so far as s/he is simultaneously distributed in all the elements of which s/he is composed and which at any moment might regain their independence. The vaccinated cows, the microbes, the Pouillly le Fort farm, the dumbfounded witnesses, the Ecole Normale laboratory: all these elements are members of Pasteur.[26]

The laboratory is equally the body and mind of Pasteur. Both approaches, on one side the rationalists, on the other the sociologists of science (ANT), deny, for totally different reasons, a need for the specificity of the *situated* body of the scientist. Either the object in question is the proof that we no longer need the scientist's body, or it is another piece of that body. In short, we have an extended body, but we do not need a situated body; there is no body more important than the elements it combines (with which it is associ-

ated). When there is reference to a driving force or to a specific direction, it is the fruit of a process of arbitrary attribution. I want to show, on the contrary, that with this extension of the scientist's body to other materials, we are again in the presence of a situated body—a body that acts.

To be sure, we have an actor-network that assumes different forms. He is a representation in the discourse of others, applied in a computer (the moment Montel's colleague manipulates the model, the idea of the person who created it comes into being), and this requalifies him (and the model) at the same time. The more the model is applied and the invention changed, the more significant the inventor becomes. He is a model that performs intellectual operations (what the model does is reattributed to his intellectual competences). When we study the procedures of institutional recognition, we discover that he *is* a scientific award—that is, he becomes an institutional model through the circulation of brochures boasting of the merits of innovators and their exemplarity. The intention behind the brochure is to prompt others to want to become innovators too, and to show them how to do so. He is, so to speak, a "big budget" in research program reports. He is an expert with maximum recognition, the head of a department, and a colleague. He is oil (he *is* the essence of oil, for it—the oil—comprises the inventor's competencies insofar as it is he who is responsible for defining and representing it, and insofar as other people, in a variety of different sectors, depend upon this new representation to work). He is a name—a brand. As his divisional head says, "we need Montels." He is a body. But it is through the different procedures that I have just mentioned—narratives, models, an award, a status, and a name—that we see the singular competencies of that particular body emerge. And it is also because it is recounted—made into a narrative—because it has become an award, a model, a status, and a name, that it/he is distributed, that his competencies are fragmented and thus multiplied and reattributed to his person, to his *presence*.

By reintroducing the role of objects, nonhumans, in the understanding of the modification of an environment, we can follow the process of the distribution *and* singularization of an individual. In

effect, we thought that it was possible, by focusing on an individual, to find individuality again. But, on the contrary, it is by dispersing ourselves *in things and in others* that we are going to discover the singularity of an individual. Taking into account the operationality of things does not mean losing the subject; rather, he or she appears to be more present. We see how a body extends to other materials, how a "self" lasts and, above all, how objects point to the one that created them. Presently, I will discuss the ensemble of procedures that singularize the scientist's body and allow it to emerge. Through an analysis of these "processes of subjectification" we will see a subject constituted as the original locus of action in the Foucauldian sense of the construction of the author; at the same time, however, we will also see how a specific body functions, bringing us closer to the role of the body in *Discipline and Punish*, that is, to the body as a marker of something more extensive in which it participates.

This operation of defining a subject in relation to the object that he or she created, performed by both Descartes and Kant, must be put back into the actors' hands. Accordingly, we see the way that individuals, to the extent that they qualify the model they use, also qualify the one who developed them. They construct a subject endowed with the same qualities as the technics he produced. Instead of trying to separate one from the other, subject from technics, we need to understand the operations constitutive of a subject. What Stengers says of Galileo's inclined plane can be transposed to the invention that I studied:

> no one can have anything to do with Galileo's inclined plane without "becoming Galileo" again, without being in the presence of the device that imposes the way of describing the movement it displays.[27]

Narratives are thus continuously imprinted in practices and requalify the inventor and the invention. We can see how, when individuals or colleagues work with the model, they form a representation of the person who developed it. And the more they apply this model, the more they change the invention. As it is transformed and applied, both model and inventor simultaneously assume more im-

portance. But for this inventor to become important, he must have done and continue to do something. What exactly does he do? He acts, produces, and negotiates, for, as Hacking writes, "experiment is not stating or reporting but doing—and not doing things with words."[28] The scientist is thus not only a thinker, a writer, a producer of statements, of theories and ideas; he is also a body, a mediator among other mediators with whom he interacts.

Let us see exactly how this scientist's body functions. We are reaching a stage in the process in which we see a flesh and blood inventor intervene when the system malfunctions. It is precisely when a problem is submitted to him that we witness this process of subjectivization, for the fact of solving a problem performs the qualification of the inventor. We see a shift in the qualification of an environment requalified on a subject. The competencies of the researcher are multiplied by computers and by the different models he uses. These models allow certain operations and simplifications; these are then reattributed to the researcher's capacities after he has performed certain operations (other than stabilizing the network that enables him to carry out these operations). This body distributed in the different materials that he combines is the only one that can sense certain problems. What does he do or, rather, what does it sense? To give a description of the behavior of the fluid, the scientist identifies himself totally with his research object. He takes on its properties; he changes completely; he himself becomes an oil fluid; he "merges," he says, with the fluid. He says he is shocked when he does not understand a problem. Disturbances in this body trigger emotions. This individual has a particular way of experiencing change. He submerges himself in the oil, and if he feels a change, it means that the oil is no longer in the same place. This causes tension; as oil, he suffers. If there is an inconsistency his extended, distributed body is touched. It is a way of being in the world, in a given world; he is out of tune. This moment in which the subject and the object melt into one another is a principle of individuation from which a radical singularity emerges. But for this operation to be performed, it is necessary to have a place, instruments, and practices. This individual must have been able to "send himself," as semioticians say, or distribute himself in all

these places so that this exchange of properties can take place. The fact of being able to send himself into these different places enables him to do things that others cannot.

In short, by placing himself at the intersection of different fields, he is able to translate problems from one field to another, and thus constantly to feed his inventive mechanisms and his status. Researchers from other related departments consult him when they encounter thermodynamic problems. By consolidating his group from the inside—that is, by making it participate in the creation, and by delegating to it his know-how—he extends his recognition. By placing doctoral students—whom he eventually brings back to his lab—in well-known research laboratories, he gives himself the possibility of fuelling his theories with new information, and also of spreading his field of influence. In short, the more distributed he is, the more he becomes singular, and the more he can effect transformations and new associations. This brain is all the more innovative when linked to a large number of elements. Instead of opposing the network and the actor, the agent and the structure, we see an actor-network whose intelligence is distributed even to the point of identifying himself partly with the company's oil fields. In short, we discover a distributed actor, but one who is closer to the actor of psychology in his capacity to transpose problems, to emerge himself in objects and to be metamorphosed, than to the actor-network of the sociology of science.

This type of description also enables us to move beyond Cartesian dualism. We are not faced with an idea and matter, the single and the multiple, mind and body. Nor is this a radical opposition between humans with ideas and nonhumans as inert substances without ideas. The scientist is a body among others. In this sense, talking about nonhumans does not seem so shocking. We are in the presence of specific bodies sharing the same properties. Knowledge spreads throughout the body, precisely in the sense of Descartes' notion of extended substance. We cannot dissociate emotions from values. Moreover, as Kant showed, it is not when there is a maximum distance between subject and object that there is knowledge; it is when they are one. It is because this body is attached to all the materials comprising it that it can sense discord that others do

not perceive. In this sense we clearly have a body that is extended, but situated and non-interchangeable, sharing properties with matter (can we still talk of matter?) and not a spokesperson floating around or above the materials comprising it—that is, a distributed-centered subject.[29]

One might retort that the fact of arriving at a key moment when an object is detached from the one who created it enables us to see the inventor's own body acting. As I have just pointed out, the inventor did not delegate all his competencies to this object and to those who utilize it. He forces them to go through him when they encounter problems. We also see him maintain the invention daily, by galvanizing his group, and his capacity to be the only one to answer certain questions. He sorts relevant information. He consolidates his know-how by trying to nurture his inventive capacities. He creates new links. He refuses to be translated into the procedures of the institution. Lastly, he extends his expertise beyond the institution and in so doing singularizes himself. But this body is going to disappear. To be sure, we can assert that the knowing subject remains a singular body whatever happens to him, for the presence of his own body is replaced *by the idea that* his body exists. I have outlined this process in the practice of modeling. I can also identify it in the texts of scientists who refer to the use of practices or theories in the present: "Einstein says that . . . ," "Newton therefore affirms . . ." Laboratories are inhabited by the dead who still talk through the evocation of their names. If we cannot deconstruct these theories indefinitely, it is because we believe in the authority of a specific body that acted and spoke rightly. We are in the heart of science, or in the heart of religion. This is the Eucharist. We need to believe in the existence of the scientist's body to make the process of discovery function, just like we need to believe in the existence of the body of Christ for there to be revelation. The principle of construction of subjectivity is incarnation (not the principle of negation of the scientist's body as the rationalists claimed) and the emergence of a situated point of view (contrary to what the sociologists of science argue).

Thus, this new figure of the subject, emerging from this work of redistribution of competencies (all the elements entered into this

process of innovation are modified: oil, colleagues, researcher), is a form inscribed in a situated body. This individual does not emerge from a fixed picture, no more than his behavior can be interpreted through his interests, since they are constructed through trials, and he has redefined his context. We have an idiosyncratic figure: the more he extends himself to a heterogeneous collective (in other words, the more he becomes oil, an institution, and so on), the more he becomes a self, a unit, a singularity, that is, a presence in which everyone recognizes themselves. He talks on behalf of his company, and that is how he singularizes himself. He talks in the name of a fluid and gives it new properties because he suffers like that fluid, and that too is why he is singular. In short, an individual becomes a subject because he shares with his body the properties of matter and becomes an institution. We see an exchange of properties taking place in a body, through the process of association and distribution, while the resistance, the depth in the network, causes the entire network to function, triggers an event and imposes the *mise en présence* of the body. The presence of the inventor's body is thus indispensable in understanding both how certain exchanges of properties take place and how a process of innovation carries on functioning. Hence, we no longer have an impersonal scientist who is the accelerator of a process of discovery. We see the appearance of a completely idiosyncratic and non-interchangeable subject, a situated and dominant point of view. Without this subject, the fluid would perhaps never have the definition it has today, just as without Einstein, there would not have been Relativity. We have abandoned the idea of necessity, for which we have substituted contingency and opportunity. Another subject, another history.

Notes

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1. Michel Callon and Bruno Latour, eds., *La science telle qu'elle se fait: Une anthologie de la sociologie des sciences de langue anglaise* (Paris: La Découverte, 1991). Also see, for example, Mario Biagioli, ed., *The Science Studies Reader* (New York: Routledge, 1999), and Jan Golin-

ski, *Making Natural Knowledge: Constructivism and the History of Science* (Cambridge: Cambridge University Press, 1998).

2. François Jacob, *Statue intérieure* (Paris: Odile Jacob, 1987), 330 (my translation). I refer here to the distinction between the context of discovery and the context of justification, borrowed from Reichenbach and applied by Popper in both *The Logic of Scientific Discovery* (London: Hutchinson, 1972) and *Conjectures and Refutations: The Growth of Scientific Knowledge* (London: Routledge & Kegan Paul, 1969).
3. See, for example, the classic articles by Harry Collins, "The Seven Sexes: A Study in the Sociology of a Phenomena, or the Replication of Experiments in Physics," *Sociology* 9 (1975): 205–24, and Simon Schaffer, "Glass Works: Newton's Prisms and the Uses of Experiment," in *The Uses of Experiment: Studies in the Natural Sciences*, ed. David Gooding, Trevor Pinch, and Simon Schaffer (Cambridge: Cambridge University Press, 1989), 67–104.
4. On the different conceptions of the social in the sociology of the sciences see Hélène Mialet, "The 'Righteous Wrath' of Pierre Bourdieu," *Social Studies of Science* 33, no. 4 (2003): 613–21.
5. See Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle and the Experimental Life* (Princeton: Princeton University Press, 1989), hereafter cited as *LA*; Andy Pickering, "Against Putting the Phenomena First: The Discovery of the Weak Neutral Current," *Studies in History and Philosophy of Science* 15, no. 2 (1984): 87–117; and Martin Rudwick, *The Great Devonian Controversy: The Shaping of Scientific Knowledge among Gentlemanly Specialists* (Chicago: University of Chicago Press, 1985).
6. David Bloor, *Knowledge and Social Imagery* (London: Routledge, 1976).
7. On this point see Lorraine Daston, "Science Studies and the History of Science," *Critical Inquiry* 35 (Summer 2009): 798–815.
8. Trevor Pinch, *Confronting Nature: The Sociology of Neutrino Detection* (Reidel: Dordrecht, 1986), 20.
9. Bruno Latour, *The Pasteurization of France* (Cambridge, MA: Harvard University Press, 1988); Michel Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay," in *Power, Action and Belief: A New Sociology of Knowledge*, ed. John Law (London: Routledge & Kegan Paul, 1986); and Bruno Latour, *Science in Action* (Cambridge, MA: Harvard University Press, 1987). Hereafter cited as *SA*.

10. For a more detailed interpretation of this distinction see Bruno Latour, *We Have Never Been Modern* (New York: Harvester Wheatsheaf, 1993). See also Philippe Descola, *Par-delà nature et culture* (Paris: Gallimard, 2006).
11. Ian Hacking, "Historical Epistemology," University of Toronto, Canada (November 1993).
12. George Levine, "Why Science Isn't Literature: The Importance of Differences," in *Rethinking Objectivity*, ed. Allan Megill (Durham: Duke University Press, 1994): 65–79, 68. Hereafter cited as *RO*. Levine presents a detailed study of the standard conception in which the authority of science in the twentieth century was grounded.
13. Concerning the history of the concept of objectivity, see, for example, Lorraine Daston and Peter Galison, *Objectivity* (Boston: Zone Books, 2007); Lorraine Daston, "Objectivity and the Escape from Perspective," *Social Studies of Science* 22, no. 4 (1992): 597–618; Lorraine Daston, "Baconian Facts, Academic Civility, and the Prehistory of Objectivity," in *RO*, 37–64; and Peter Dear, "From Truth to Disinterestedness in the Seventeenth Century," *Social Studies of Science* 22, no. 4 (1992): 619–31.
14. Michel Henry, *Généalogie de la psychanalyse* (Paris: PUF, 1985), 60–61 (my translation).
15. Evelyn Fox Keller, "The Paradox of Scientific Subjectivity," in *RO*, 313–33. Hereafter cited as "PS."
16. "PS," 316. Here Keller quotes from René Descartes, *Oeuvres et lettres*, ed. André Bridoux (Paris: Gallimard, 1953), 873.
17. Allan Megill, "Introduction: Four Senses of Objectivity," in *RO*, 1–21, 10.
18. Robert Blanché, *La science actuelle et le rationalisme* (Paris: PUF, 1967), 117–18.
19. Barry Barnes, "Sociology of Knowledge," in *RO*, 21–37, 23.
20. This principle of generalized symmetry has been extensively discussed and debated. See, for example, the article by Harry Collins and Steven Yearley, "Epistemological Chicken," followed by Bruno Latour and Michel Callon, "Don't Throw the Baby Out with the Bath School! A Reply to Collins and Yearley," both in *Science as Practice and Culture*, ed. Andy Pickering (Chicago: University of Chicago Press, 1992); and also the controversy between Bloor and Latour in *Studies in History and Philosophy of Science* 30A:1 (1999): 81–112, 113–29, and 131–36.
21. On this point see Shirley Strum and Bruno Latour, "The Meanings of

the Social: From Baboons to Humans," *Social Science Information* 26 (1978): 783–802.

22. On this point I follow the actor-network theory, but use it as a means of recovering something that has been purposely dismissed by it.
23. For a detailed exposition and analysis of the empirical material presented only briefly here see Hélène Mialet, *L'Entreprise Créatrice, Le rôle des récits, des objets et de l'acteur dans l'invention* (Paris: Hermès Science, 2008).
24. Bruno Latour, "Une sociologie sans objet? Note théorique sur l'interobjectivité," *Sociologie du Travail* 36, no. 4 (1994): 587–607.
25. George Canguilhem, Claude Debru, Gérard Escat, François Guéry, Jacques Lambert, Yves Michaud, and Anne-Marie Moulin, eds., *Anatomie d'un épistémologue: François Dagognet* (Paris: Vrin, 1984).
26. Michel Callon and John Law, "Des collectifs actifs: Quelques leçons tirées de la sociologie des sciences et des techniques," 1994. Published in English as "After the Individual in Society: Lessons on Collectivity from Science, Technology and Society," *Canadian Journal of Sociology* 22, no. 2 (Spring, 1995): 169.
27. Isabelle Stengers, *L'invention des sciences modernes* (Paris: La Découverte, 1993), 117 (my translation).
28. Ian Hacking, cited in *RO*, 75.
29. See also Hélène Mialet, "Do Angels Have Bodies? Two Stories about Subjectivity in Science: The Cases of William X and Mister H," *Social Studies of Science* 29, no. 4 (August 1999): 551–81; "Les Pratiques de l'Invention," in *Concevoir, Créer, Inventer*, ed. Robert Prost (L'Harmattan: Paris, 1995), 283–300; and "Reading Hawking's Presence: An Interview with a Self-Effacing Man," *Critical Inquiry* 29, no. 4 (Summer, 2003): 571–98.