

BRUNO LATOUR

WHERE ARE THE MISSING MASSES?

The sociology of a few mundane artifacts

Edited by

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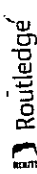
The New Media and Technocultures Reader

BRUNO LATOUR IS A sociologist of science and technology. In this essay he takes an everyday and banal occurrence as the launching pad for an entertaining and playful enquiry into what he calls the 'missing masses'. These are the innumerable nonhuman devices and objects that, he asserts, make up the 'dark matter' of society – unobservable using established sociological lenses, but necessary to the existence of human relationships and activities. He sometimes refers to these nonhumans as *lieutenants* (from the French – holding the place of, or for, another). He argues that the idea that society is made up only of human agents is as bizarre as the idea that technology is determined only by technological relations. In its insistence on the agency of nonhuman entities, this model of technosocial relations mounts a fundamental challenge to many underlying assumptions of the humanities and social sciences, from sociology and cultural studies to economics and history.

For the purposes of his argument Latour takes at face value the wry anthropomorphism of a notice on a faulty door. The sign notes that the 'groom' (the sprung arm that automatically closes the door) is 'on strike', so Latour imagines a world in which humans and nonhumans work (or refuse to work) together. He asks the reader to think about the hinged door as an invention, inviting them to compare the effort of getting through a wall with and without a door. The hinged door is then an elegant solution to the 'hole-wall dilemma', a way of getting through a wall with minimal effort, yet preserving the wall's qualities or function as security or shelter (i.e. once the door is closed again). This is a simple illustration of Latour's key term 'delegation' (or displacement, translation, shifting), a 'transformation of a major effort into a minor one'. So, the human effort of getting through the wall (presumably of knocking a hole in a wall and then bricking it up again) is delegated to the hinged door. A human activity is delegated to a nonhuman and is, in the process, transformed. As he puts it, 'every time you want to know what a nonhuman does, simply imagine what other humans or other nonhumans would have to do were this character not present'.

Latour points out that this particular delegation is characteristic of reciprocal delegations in the configuring of users by technologies. When it is working, a door-closer efficiently stops draughts, but it also replaces a human concierge, and, depending on the power or speed of the spring it may 'discriminate' against some groups of humans, the disabled or children for example. Behaviour then is imposed back onto the human by nonhuman delegates, and this

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Imposition can be moral or political, 'the nonhumans take over the selective attitudes of those who engineered them'.

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[...]

Description of a door

I will start my inquiry by following a little script written by anonymous hands.¹ On a freezing day in February, posted on the door of La Halle aux Cuirs at La Villette, in Paris, where Robert Fox's group was trying to convince the French to take up social history of science, could be seen a small handwritten notice: "The Groom is On Strike, For God's Sake, Keep The Door Closed" ("groom" is Franglais for an automated door-closer or butler). This fusion of labor relations, religion, advertisement, and technique in one insignificant fact is exactly the sort of thing I want to describe² in order to discover the missing masses of our society. As a technologist teaching in the School of Mines, an engineering institution, I want to challenge some of the assumptions sociologists often hold about the social context of machines.

Walls are a nice invention, but if there were no holes in them there would be no way to get in or out—they would be mausoleums or tombs. The problem is that if you make holes in the walls, anything and anyone can get in and out (cows, visitors, dust, rats, noise—La Halle aux Cuirs is ten meters from the Paris ring road—and, worst of all, cold—La Halle aux Cuirs is far to the north of Paris). So architects invented this hybrid: a wall hole, often called a door, which although common enough has always struck me as a miracle of technology. The cleverness of the invention hinges upon the hinge-pin: instead of driving a hole through walls with a sledgehammer or a pick, you simply gently push the door (I am supposing here that the lock has not been invented—this would overcomplicate the already highly complex story of La Villette's door); furthermore—and here is the real trick—once you have passed through the door, you do not have to find trowel and cement to rebuild the wall you have just destroyed: you simply push the door gently back (I ignore for now the added complication of the "pull" and "push" signs).

So, to size up the work done by hinges, you simply have to imagine that every time you want to get in or out of the building you have to do the same work as a prisoner trying to escape or as a gangster trying to rob a bank, plus the work of those who rebuild either the prison's or the bank's walls. If you do not want to imagine people destroying walls and rebuilding them every time they wish to leave or enter a building, then imagine the work that would have to be done to keep inside or outside all the things and people that, left to themselves, would go the wrong way.³ As Maxwell never said, imagine his demon working *without* a door. Anything could escape from or penetrate into La Halle aux Cuirs, and soon there would be complete equilibrium between the depressing and noisy surrounding area and the inside of the building. Some technologists, including the present writer in *Material Resistance, A Textbook* (1984), have written that techniques are always involved when asymmetry or irreversibility are the goal; it might appear that doors are a striking counterexample because they maintain the wall hole in a reversible state; the allusion to Maxwell's demon clearly shows, however, that such is not the case; the reversible door is the only way to trap irreversibly inside La Halle aux Cuirs a differential accumulation of warm historians, knowledge, and also, alas, a lot of paperwork; the hinged door allows a selection of what gets in and what gets out so as

to locally increase order, or information. If you let the drafts get inside (these renowned "courants-d'air" so dangerous to French health), the paper-drafts may never get outside to the publishers.

Now, draw two columns (if I am not allowed to give orders to the reader, then I offer it as a piece of strongly worded advice): in the right-hand column, list the work people would have to do if they had no door; in the left-hand column write down the gentle pushing (or pulling) they have to do to fulfill the same tasks. Compare the two columns: the enormous effort on the right is balanced by the small one on the left, and this is all thanks to hinges. I will define this transformation of a major effort into a minor one by the words *displacement* or *translation* or *delegation* or *shifting*.⁴ I will say that we have delegated (or translated or displaced or shifted down) to the hinge the work of reversibly solving the wall-hole dilemma. Calling on Robert Fox, I do not have to do this work nor even think about it; it was delegated by the carpenter to a character, the hinge, which I will call a *nonhuman*. I simply enter La Halle aux Cuirs. As a more general descriptive rule, every time you want to know what a non-human does, simply imagine what other humans or other nonhumans would have to do were this character not present. This imaginary substitution exactly sizes up the role, or function, of this little character.

Before going on, let me point out one of the side benefits of this table: in effect, we have drawn a scale where tiny efforts balance out mighty weights; the scale we drew reproduces the very leverage allowed by hinges. That the small be made stronger than the large is a very moral story indeed (think of David and Goliath); by the same token, it is also, since at least Archimedes' days, a very good definition of a lever and of power: what is the minimum you need to hold and deploy astutely to produce the maximum effect? Am I alluding to machines or to Syracuse's King? I don't know, and it does not matter, because the King and Archimedes fused the two "mini-masses" into a single story told by Plutarch: the defense of Syracuse through levers and war machines.⁵ I contend that this reversal of forces is what sociologists should look at in order to understand the social construction of techniques, and not a hypothetical "social context" that they are not equipped to grasp. This little point having been made, let me go on with the story (we will understand later why I do not really need your permission to go on and why, nevertheless, you are free not to go on, although only *relatively* so).

Delegation to humans

There is a problem with doors. Visitors push them to get in or pull on them to get out (or vice versa), but then the door remains open. That is, instead of the door you have a gaping hole in the wall through which, for instance, cold rushes in and heat rushes out. Of course, you could imagine that people living in the building or visiting the Centre d'Histoire des Sciences et des Techniques would be a well-disciplined lot (after all, historians are meticulous people). They will learn to close the door behind them and retransform the momentary hole into a well-sealed wall. The problem is that discipline is not the main characteristic of La Villette's people; also you might have more sociologists visiting the building, or even pedagogues from the nearby Centre de Formation. Are they all going to be so well trained? Closing doors would appear to be a simple enough piece of know-how once hinges have been invented, but, considering the amount of work, innovations, sign-posts, and recriminations that go on endlessly everywhere to keep them closed (at least in northern regions), it seems to be rather poorly disseminated.

This is where the age-old Mumfordian choice is offered to you: either to discipline the people or to substitute for the unreliable people another delegated human character whose

only function is to open and close the door. This is called a *groom* or a porter (from the French word for door), or a gatekeeper, or a janitor, or a concierge, or a turnkey, or a jaller. The advantage is that you now have to discipline only one human and may safely leave the others (bellboys included) to their erratic behavior. No matter who they are and where they come from—polite or rude, quick or slow, friends or foes—the nonhuman groom will always take care of the door in any weather and at any time of the day. A nonhuman (hinges) plus another nonhuman (groom) have solved the wall-hole dilemma.

Solved? Not quite. First of all, if La Halle aux Cuirs pays for a porter, they will have no money left to buy coffee or books, or to invite eminent foreigners to give lectures. If they give the poor little boy other duties besides that of porter, then he will not be present most of the time and the door will stay open. Even if they had money to keep him there, we are now faced with a problem that two hundred years of capitalism has not completely solved: how to discipline a youngster to reliably fulfill a boring and underpaid duty? Although there is now only one human to be disciplined instead of hundreds, the weak point of the tactic can be seen: if this one lad is unreliable, then the whole chain breaks down; if he falls asleep on the job or goes walkabout, there will be no appeal: the door will stay open (remember that locking it is no solution because this would turn it into a wall, and then providing everyone with the right key is a difficult task that would not ensure that key holders will lock it back). Of course, the porter may be punished. But disciplining a groom—Foucault notwithstanding—is an enormous and costly task that only large hotels can tackle, and then for other reasons that have nothing to do with keeping the door properly closed.

If we compare the work of disciplining the groom with the work he substitutes for, according to the list defined above, we see that this delegated character has the opposite effect to that of the hinge: a simple task—forcing people to close the door—is now performed at an incredible cost; the minimum effect is obtained with maximum spending and discipline. We also notice, when drawing the two lists, an interesting difference: in the first relationship (hinges *vis-à-vis* the work of many people), you not only had a reversal of forces (the lever allows gentle manipulations to displace heavy weights) but also a modification of *time schedule*: once the hinges are in place, nothing more has to be done apart from maintenance (oiling them from time to time). In the second set of relations (groom's work versus many people's work), not only do you fail to reverse the forces but you also fail to modify the time schedule: nothing can be done to prevent the groom who has been reliable for two months from failing on the sixty-second day; at this point it is not maintenance work that has to be done but the *same work* as on the first day—apart from the few habits that you might have been able to *incorporate* into his body. Although they appear to be two similar delegations, the first one is concentrated at the time of installation, whereas the other is continuous; more exactly, the first one creates clear-cut distinctions between production, installation, and maintenance, whereas in the other the distinction between training and keeping in operation is either fuzzy or nil. The first one evokes the past perfect ("once hinges had been installed . . ."), the second the present tense ("when the groom is at his post . . ."). There is a built-in inertia in the first that is largely lacking in the second. The first one is Newtonian, the second Aristotelian (which is simply a way of repeating that the second is nonhuman and the other human). A profound temporal shift takes place when nonhumans are appealed to; time is *folded*.

Delegation to nonhumans

It is at this point that you have a relatively new choice: either to discipline the people or to substitute for the unreliable humans a *delegated nonhuman character* whose only function is to open and close the door. This is called a door-closer or a groom ("groom" is a French trademark

that is now part of the common language). The advantage is that you now have to discipline only one nonhuman and may safely leave the others (bellboys included) to their erratic behavior. No matter who they are and where they come from—polite or rude, quick or slow, friends or foes—the nonhuman groom will always take care of the door in any weather and at any time of the day. A nonhuman (hinges) plus another nonhuman (groom) have solved the wall-hole dilemma.

Solved? Well, not quite. Here comes the deskilling question so dear to social historians of technology: thousands of human grooms have been put on the dole by their nonhuman brethren. Have they been replaced? This depends on the kind of action that has been translated or delegated to them. In other words, when humans are displaced and deskilled, nonhumans have to be upgraded and re-skilled. This is not an easy task, as we shall now see.

We have all experienced having a door with a powerful spring mechanism slam in our faces. For sure, springs do the job of replacing grooms, but they play the role of a very rude, uneducated, and dumb porter who obviously prefers the wall version of the door to its hole version. They simply slam the door shut. The interesting thing with such impolite doors is this: if they slam shut so violently, it means that you, the visitor, have to be very quick in passing through and that you should not be at someone else's heels, otherwise your nose will get shorter and bloody. An unskilled nonhuman groom thus presupposes a skilled human user. It is always a trade-off. I will call, after Madeleine Alrich, the behavior imposed back onto the human by nonhuman delegates *prescription*.⁶ Prescription is the moral and ethical dimension of mechanisms. In spite of the constant weeping of moralists, no human is as relentlessly moral as a machine, especially if it is (she is, he is, they are) as "user friendly" as my Macintosh computer. We have been able to delegate to nonhumans not only force as we have known it for centuries but also values, duties, and ethics. It is because of this morality that we, humans, behave so ethically, no matter how weak and wicked we feel we are. The sum of morality does not only remain stable but increases enormously with the population of nonhumans. It is at this time, funnily enough, that moralists who focus on isolated socialized humans despair of us—us meaning of course humans and their retinue of nonhumans.

How can the prescriptions encoded in the mechanism be brought out in words? By replacing them by strings of sentences (often in the imperative) that are uttered (silently and continuously) by the mechanisms for the benefit of those who are mechanized: do this, do that, behave this way, don't go that way, you may do so, be allowed to go there. Such sentences look very much like a programming language. This substitution of words for silence can be made in the analyst's thought experiments, but also by instruction booklets, or explicitly, in any training session, through the voice of a demonstrator or instructor or teacher. The military are especially good at shouting them out through the mouthpiece of human instructors who delegate back to themselves the task of explaining, in the rifle's name, the characteristics of the rifle's ideal user. Another way of hearing what the machines silently did and said are the accidents. When the space shuttle exploded, thousands of pages of transcripts suddenly covered every detail of the silent machine, and hundreds of inspectors, members of congress, and engineers retrieved from NASA dozens of thousands of pages of drafts and orders. This description of a machine—whatever the means—retraces the steps made by the engineers to transform texts, drafts, and projects into things. The impression given to those who are obsessed by human behavior that there is a missing mass of morality is due to the fact that they do not follow this path that leads from text to things and from things to texts. They draw a strong distinction between these two worlds, whereas the job of engineers, instructors, project managers, and analysts is to continually cross this divide. Parts of a program of action may be delegated to a human, or to a nonhuman.

The results of such *distribution of competences* between humans and nonhumans is that competent members of La Halle aux Cuirs will safely pass through the slamming door-at-a-good distance from one another while visitors, unaware of the local cultural condition, will crowd through the door and get bloody noses. The nonhumans take over the selective attitudes of those who engineered them. To avoid this discrimination, inventors get back to their drawing board and try to imagine a nonhuman character that will not *prescribe* the same rare local cultural skills to its human users. A weak spring might appear to be a good solution. Such is not the case, because it would substitute for another type of very unskilled and undecided groom who is never sure about the door's (or his own) status: is it a hole or a wall? Am I a closer or an opener? If it is both at once, you can forget about the heat. In computer parlance, a door is an exclusive OR, not an AND gate.

I am a great fan of hinges, but I must confess that I admire hydraulic door closers much more, especially the old heavy copper-plated one that slowly closed the main door of our house in Aloxé-Corton. I am enchanted by the addition to the spring of a hydraulic piston, which easily draws up the energy of those who open the door, retains it, and then gives it back slowly with a subtle type of implacable firmness that one could expect from a well-trained butler. Especially clever is its way of extracting energy from each unwilling, unwitting passerby. My sociologist friends at the School of Mines call such a clever extraction an "obligatory passage point," which is a very fitting name for a door. No matter what you feel, think, or do, you have to leave a bit of your energy, literally, at the door. This is as clever as a toll booth.⁹

This does not quite solve all of the problems, though. To be sure, the hydraulic door closer does not bang the noses of those unaware of local conditions, so its prescriptions may be said to be less restrictive, but it still leaves aside segments of human populations: neither my little nephews nor my grandmother could get in unaided because our groom needed the force of an able-bodied person to accumulate enough energy to close the door later. To use Langdon Winner's classic motto (1980): Because of their prescriptions, these doors *discriminate* against very little and very old persons. Also, if there is no way to keep them open for good, they discriminate against furniture removers and in general everyone with packages, which usually means, in our late capitalist society, working- or lower-middle-class employees. (Who, even among those from higher strata, has not been cornered by an automated butler when they had their hands full of packages?)

There are solutions, though: the groom's delegation may be written off (usually by blocking its arm) or, more prosaically, its delegated action may be opposed by a foot (salesmen are said to be expert at this). The foot may in turn be delegated to a carpet or anything that keeps the butler in check (although I am always amazed by the number of objects that *fail* this trial of force and I have very often seen the door I just wedged open politely closing when I turned my back to it).

Anthropomorphism

As a technologist, I could claim that provided you put aside the work of installing the groom and maintaining it, and agree to ignore the few sectors of the population that are discriminated against, the hydraulic groom does its job well, closing the door behind you, firmly and slowly. It shows in its humble way how three rows of delegated nonhuman actants¹⁰ (hinges, springs, and hydraulic pistons) replace, 90 percent of the time, either an undisciplined bellboy who is never there when needed or, for the general public, the program instructions that have to do with remembering-to-close-the-door-when-it-is-cold.

The hinge plus the groom is the technologist's dream of efficient action, at least until the sad day when I saw the note posted on La Villette's door with which I started this meditation: "The groom is on strike." So not only have we been able to delegate the act of closing the door from the human to the nonhuman, we have also been able to delegate the human lack of discipline (and maybe the union that goes with it). On strike . . . ¹⁰ Fancy that! Nonhumans stopping work and claiming what? Pension payments? Time off? Landslapped offices? Yet it is no use being indignant, because it is very true that nonhumans are not so reliable that the irreversibility we would like to grant them is always complete. We did not want ever to have to think about this door again—apart from regularly scheduled routine maintenance (which is another way of saying that we did not have to bother about it)—and here we are, worrying again about how to keep the door closed and drafts outside.

What is interesting in this note is the humor of attributing a human characteristic to a failure that is usually considered "purely technical." This humor, however, is more profound than in the notice they could have posted: "The groom is not working." I constantly talk with my computer, who answers back; I am sure you swear at your old car; we are constantly granting mysterious facilities to gremlins inside every conceivable home appliance, not to mention cracks in the concrete belt of our nuclear plants. Yet, this behavior is considered by sociologists as a scandalous breach of natural barriers. When you write that a groom is "on strike," this is only seen as a "projection," as they say, of a human behavior onto a nonhuman, cold, technical object, one by nature impervious to any feeling. This is *anthropomorphism*, which for them is a sin akin to zoophilily but much worse.

It is this sort of moralizing that is so irritating for technologists, because the automatic groom is already anthropomorphic through and through. It is well known that the French like etymology; well, here is another one: *anthropos* and *morphos* together mean either that which has human shape or that which *gives shape* to humans. The groom is indeed anthropomorphic, in three senses: first, it has been made by humans; second, it substitutes for the actions of people and is a delegate that permanently occupies the position of a human; and third, it shapes human action by prescribing back what sort of people should pass through the door. And yet some would forbid us to ascribe feelings to this thoroughly anthropomorphic creature, to delegate labor relations, to "project"—that is, to translate—other human properties to the groom. What of those many other innovations that have endowed much more sophisticated doors with the ability to see you arrive in advance (electronic eyes), to ask for your identity (electronic passes), or to slam shut in case of danger? But anyway, who are sociologists to decide the real and final shape (*morphos*) of humans (*anthropos*)? To trace with confidence the boundary between what is a "real" delegation and what is a "mere" projection? To sort out forever and without due inquiry the three different kinds of anthropomorphism I listed above? Are we not shaped by nonhuman grooms, although I admit only a very little bit? Are they not our brethren? Do they not deserve consideration? With your self-serving and self-righteous social studies of technology, you always plead against machines and for deskilled workers—are you aware of your discriminatory biases? You discriminate between the human and the inhuman. I do not hold this bias (this one at least) and see only actors—some human, some nonhuman, some skilled, some unskilled—that exchange their properties. So the note posted on the door is accurate; it gives with humor an exact rendering of the groom's behavior: it is not working, it is on strike (notice, that the word "strike" is a rationalization carried from the nonhuman repertoire to the human one, which proves again that the divide is untenable).

Built-in users and authors

The debates around anthropomorphism arise because we believe that there exist "humans" and "nonhumans," without realizing that this attribution of roles and action is also a choice.¹¹ The best way to understand this choice is to compare machines with texts, since the inscription of builders and users in a mechanism is very much the same as that of authors and readers in a story. In order to exemplify this point I have now to confess that I am not a technologist. I built in my article a made-up author, and I also invented possible readers whose reactions and beliefs I anticipated. Since the beginning I have many times used the "you" and even "you sociologists." I even asked you to draw up a table, and I also asked your permission to go on with the story. In doing so, I built up an inscribed reader to whom I prescribed qualities and behavior, as surely as a traffic light or a painting prepare a position for those looking at them. Did you *underwrite* or *subscribe* this definition of yourself? Or, worse, is there anyone at all to read this text and occupy the position prepared for the reader? This question is a source of constant difficulties for those who are unaware of the basics of semiotics or of technology. *Nothing in a given scene* can prevent the inscribed user or reader from behaving differently from what was expected (nothing, that is, until the next paragraph). The reader in the flesh may totally ignore my definition of him or her. The user of the traffic light may well cross on the red. Even visitors to La Halle aux Cuirs may never show up because it is too complicated to find the place, *in spite of the fact* that their behavior and trajectory have been perfectly anticipated by the groom. As for the computer user input, the cursor might flash forever without the user being there or knowing what to do. There might be an enormous gap between the prescribed user and the user-in-the-flesh, a difference as big as the one between the "I" of a novel and the novelist.¹² It is exactly this difference that upset the authors of the anonymous appeal on which I comment. On other occasions, however, the gap between the two may be nil: the prescribed user is so well anticipated, so carefully nested inside the scenes, so exactly dovetailed, that it does what is expected.¹³

The problem with scenes is that they are usually well prepared for anticipating users or readers who are at close quarters. For instance, the groom is quite good in its anticipation that people will push the door open and give it the energy to reclose it. It is very bad at doing anything to help people arrive there. After fifty centimeters, it is helpless and cannot act, for example, on the maps spread around La Villette to explain where La Halle aux Cuirs is. Still, no scene is prepared without a preconceived idea of what sort of actors will come to occupy the prescribed positions.

This is why I said that although you were free not to go on with this paper, you were only "relatively" so. Why? Because I know that, because you bought this book, you are hard-working, serious, English-speaking technologists or readers committed to understanding new development in the social studies of machines. So my injunction to "read the paper, you sociologist" is not very risky (but I would have taken no chance with a French audience, especially with a paper written in English). This way of counting on earlier distribution of skills to help narrow the gap between built-in users or readers and users- or readers-in-the-flesh is like a *pre-inscription*.¹⁴ The fascinating thing in text as well as in artifact is that they have to thoroughly organize the relation between what is inscribed in them and what can/could/should be pre-inscribed in the users. Each setup is surrounded by various arenas interrupted by different types of walls. A text, for instance, is clearly *circumscribed*¹⁵—the dust cover, the title page, the hard back—but so is a computer—the plugs, the screen, the disk drive, the user's input. What is nicely called "interface" allows any setup to be connected to another through so many carefully designed entry points. Sophisticated mechanisms build up a whole gradient of concentric circles around

themselves. For instance, in most modern photocopy machines there are troubles that even rather incompetent users may solve themselves like "ADD PAPER," but then there are trickier ones that require a bit of explanation: "ADD TONER. SEE MANUAL, PAGE 30." This instruction might be backed up by homemade labels: "DON'T ADD THE TONER YOURSELF. CALL THE SECRETARY," which limit still further the number of people able to troubleshoot. But then other more serious crises are addressed by labels like "CALL THE TECHNICAL STAFF AT THIS NUMBER," while there are parts of the machine that are sealed off entirely with red labels such as "DO NOT OPEN—DANGER, HIGH VOLTAGE, HEAT" or "CALL THE POLICE." Each of these messages addresses a different audience, from the widest (everyone with the rather largely disseminated competence of using photocopying machines) to the narrowest (the rare bird able to troubleshoot and who, of course, is never there).¹⁶ Circumscription only defines how a setup itself has built-in plugs and interfaces; as the name indicates, this tracing of circles, walls, and entry points inside the text or the machine does not prove that readers and users will obey. There is nothing sadder than an obsolete computer with all its nice interfaces, but no one on earth to plug them in.

Drawing a side conclusion in passing, we can call *sociologism* the claim that, given the competence, *pre-inscription*, and *circumscription* of human users and authors, you can read out the scripts nonhuman actors have to play; and *technologism* the symmetric claim that, given the competences and *pre-inscription* of nonhuman actors, you can easily read out and deduce the behavior prescribed to authors and users. From now on, these two absurdities will, I hope, disappear from the scene, because the actors at any point may be human or nonhuman, and the displacement (or translation, or transcription) makes impossible the easy reading out of one repertoire and into the next. The bizarre idea that society might be made up of human relations is a mirror image of the other no less bizarre idea that techniques might be made up of nonhuman relations. We deal with characters, delegates, representatives, lieutenants (from the French "lieu" plus "tenant," i.e., holding the place of, for, someone else)—some figurative, others nonfigurative; some human, others nonhuman; some competent, others incompetent. Do you want to cut through this rich diversity of delegates and artificially create two heaps of refuse, "society" on one side and "technology" on the other? That is your privilege, but I have a less bungled task in mind.

A scene, a text, an automatism can do a lot of things to their prescribed users at the range—close or far—that is defined by the circumscription, but most of the effect finally ascribed¹⁷ to them depends on lines of other setups being aligned. For instance, the groom closes the door only if there are people reaching the Centre d'Histoire des Sciences; these people arrive in front of the door only if they have found maps (another delegate, with the built-in prescription I like most: "you are here" circled in red on the map) and only if there are roads leading under the Paris ring road to the Halle (which is a condition not always fulfilled); and of course people will start bothering about reading the maps, getting their feet muddy and pushing the door open only if they are convinced that the group is worth visiting (this is about the only condition in La Villette that is fulfilled). This gradient of aligned setups that endow actors with the pre-inscribed competences to find its users is very much like Waddington's "chreod":¹⁸ people effortlessly flow through the door of La Halle aux Cuirs and the groom, hundreds of times a day, recloses the door—when it is not stuck. The result of such an alignment of setups¹⁹ is to decrease the number of occasions in which words are used; most of the actions are silent, familiar, incorporated (in human or in nonhuman bodies)—making the analyst's job so much harder. Even the classic debates about freedom, determination, predetermination, brute force, or efficient will—debates that are the twelfth-century version of seventeenth-century discussions on grace—will be slowly eroded. (Because you have reached

this point, it means I was right in saying that you were not at all free to stop reading the paper: positioning myself cleverly along a chreod, and adding a few other tricks of my own, I led you here . . . or did I? Maybe you skipped most of it, maybe you did not understand a word of it, o you, undisciplined readers.)

[. . .]

The distinctions between humans and nonhumans, embodied or disembodied skills, impersonation or "machination," are less interesting than the complete chain along which competences and actions are distributed. For instance, on the freeway the other day I slowed down because a guy in a yellow suit and red helmet was waving a red flag. Well, the guy's moves were so regular and he was located so dangerously and had such a pale though smiling face that, when I passed by, I recognized it to be a machine (it failed the Turing test, a cognitivist would say). Not only was the red flag delegated; not only was the arm waving the flag also delegated; but the body appearance was also added to the machine. We road engineers (see? I can do it again and carve out another author) could move much further in the direction of figuration, although at a cost: we could have given him electronic eyes to wave only when a car approaches, or have regulated the movement so that it is faster when cars do not obey. We could also have added (why not?) a furious stare or a recognizable face like a mask of Mrs. Thatcher or President Mitterand—which would have certainly slowed drivers very efficiently.²⁰ But we could also have moved the other way, to a *less* figurative delegation: the flag by itself could have done the job. And why a flag? Why not simply a sign "work in progress"? And why a sign at all? Drivers, if they are circumspect, disciplined, and watchful will see for themselves that there is work in progress and will slow down. But there is another radical, nonfigurative solution: the road bumper, or a speed trap that we call in French "un gendarme couché," a laid policeman. It is impossible for us not to slow down, or else we break our suspension. Depending on where we stand along this chain of delegation, we get classic moral human beings endowed with self-respect and able to speak and obey laws, or we get stubborn and efficient machines and mechanisms; halfway through we get the usual power of signs and symbols. It is the complete chain that makes up the missing masses, not either of its extremities. The paradox of technology is that it is thought to be at one of the extremes, whereas it is the ability of the engineer to travel easily along the whole gradient and substitute one type of delegation for another that is inherent to the job.²¹

[. . .]

From nonhumans to superhumans

The most interesting (and saddest) lesson of the note posted on the door at La Villette is that people are not circumspect, disciplined, and watchful, especially not French drivers doing 180 kilometers an hour on a freeway on a rainy Sunday morning when the speed limit is 130 (I inscribe the legal limit in this article because this is about the only place where you could see it printed in black and white; no one else seems to bother, except the mourning families). Well, that is exactly the point of the note: "The groom is on strike, for God's sake, keep the door closed." In our societies there are two systems of appeal: nonhuman and superhuman—that is, machines and gods. This note indicates how desperate its anonymous frozen authors were (I have never been able to trace and honor them as they deserved). They first relied on the inner morality and common sense of humans; this failed, the door was always left open. Then they appealed to what we technologists consider the supreme court of appeal, that is, to a nonhuman who regularly and conveniently does the job in place of unfaithful humans; to our shame, we must confess that it also failed after a while, the door was again left open. How poignant their line

of thought! They moved up and backward to the oldest and firmest court of appeal there is, there was, and ever-will-be: If humans and nonhuman have failed, certainly God will not deceive them. I am ashamed to say that when I crossed the hallway this February day, the door was open. Do not accuse God, though, because the note did not make a direct appeal; God is not accessible without mediators—the anonymous authors knew their catechisms well—so instead of asking for a direct miracle (God holding the door firmly closed or doing so through the mediation of an angel, as has happened on several occasions, for instance when Saint Peter was delivered from his prison) they appealed to the respect for God in human hearts. This was their mistake. In our secular times, this is no longer enough.

Nothing seems to do the job nowadays of disciplining men and women to close doors in cold weather. It is a similar despair that pushed the road engineer to add a golem to the red flag to force drivers to beware—although the only way to slow French drivers is still a good traffic jam. You seem to need more and more of these figurated delegates, aligned in rows. It is the same with delegates as with drugs: You start with soft ones and end up shooting up. There is an inflation for delegated characters, too. After a while they weaken. [. . .]

Students of technology are never faced with people on the one hand and things on the other, they are faced with programs of action, sections of which are endowed to parts of humans, while other sections are entrusted to parts of nonhumans. This is the only thing they can observe: how a negotiation to associate dissident elements requires more and more elements to be tied together and more and more shifts to other matters. We are now witnessing in technology studies the same displacement that has happened in science studies during the last ten years. It is not that society and social relations invade the certainty of science or the efficiency of machines. It is that society itself is to be rethought from top to bottom once we add to it the facts and the artifacts that make up large sections of our social ties. What appears in the place of the two ghosts—society and technology—is not simply a hybrid object, a little bit of efficiency and a little bit of sociologizing, but a *sui generis* object: the collective thing, the trajectory of the front line between programs and anti-programs. It is too full of humans to look like the technology of old, but it is too full of nonhumans to look like the social theory of the past. The missing masses are in our traditional social theories, not in the supposedly cold, efficient, and inhuman technologies.

Notes

This paper owes to many discussions held at the Centre de Sociologie de l'Innovation, especially with John Law, the honorary member from Keele, and Madeleine Akrich. It is particularly indebted to Françoise Bastide, who was still working on these questions of semiotics of technology a few months before her death. I had no room to incorporate a lengthy dispute with Harry Collins about this article (but see Collins and Yearley 1992, and Callon and Latour 1992).

Trevor Pinch and John Law kindly corrected the English.

- 1 Following Madeleine Akrich's lead (this volume), we will speak only in terms of *scripts* or scenes or scenarios, or scripts as John Law says (this volume), played by human or nonhuman actants, which may be either figurative or nonfigurative.
- 2 After Akrich, I will call the retrieval of the script from the situation *description*. They define actants, endow them with competences, make them do things, and evaluate the sanction of these actions like the *narrative program* of semioticians.
- 3 Although most of the scripts are in practice silent, either because they are intra- or extrasomatic, the written descriptions are not an artifact of the analyst (technologist, sociologist, or semiotician), because there exist many states of affairs in which they are explicitly uttered. The gradient going from intrasomatic to extrasomatic skills through discourse is never fully stabilized and allows many entries revealing the

process of transition: user manuals, instruction, demonstration or drilling situations, practical thought experiments ("what would happen if, instead of the red light, a police officer were there"). To this should be added the innovator's workshop, where most of the objects to be devised are still at the stage of projects committed to paper ("if we had a device doing this and that, we could then do this and that"); market analysis in which consumers are confronted with the new device; and, naturally, the exotic situation studied by anthropologists in which people faced with a foreign device talk to themselves while trying out various combinations ("what will happen if I attach this lead here to the mains?"). The analyst has to empirically capture these situations to write down the scripts. When none is available, the analyst may still make a thought experiment by comparing presence/absence tables and collating the list of all the actions taken by actors ("I take this one away, this and that other action will be modified"). There are dangers in such a counterfactual method, as Collins has pointed out (Collins and Yearley 1992), but it is used here only to outline the semiotics of artifacts. In practice, as Akriich (this volume) shows, the scripts are explicit and accountable.

4 We call the translation of any script from one repertoire to a more durable one transcription, inscription, or encoding. This definition does not imply that the direction always goes from soft bodies to hard machines, but simply that it goes from a provisional, less reliable one to a longer-lasting, more faithful one. For instance, the embodiment in cultural tradition of the user manual of a car is a transcription, but so is the replacement of a police officer by a traffic light; one goes from machines to bodies, whereas the other goes the opposite way. Specialists of robotics have abandoned the pipe dream of total automation; they learned the hard way that many skills are better delegated to humans than to nonhumans, whereas others may be taken away from incompetent humans.

5 See Authier 1989 on Plutarch's *Archeimedes*.

6 We call prescription whatever a scene presupposes from its transcribed actors and authors (this is very much like "role expectation" in sociology, except that it may be inscribed or encoded in the machine). For instance, a Renaissance Italian painting is designed to be viewed from a specific angle of view prescribed by the vanishing lines, exactly like a traffic light expects that its users will watch it from the street and not sideways (French engineers often hide the lights directed toward the side street so as to hide the state of the signals, thus preventing the strong temptation to rush through the crossing at the first hint that the lights are about to be green; this prescription of who is allowed to watch the signal is very frustrating). "User input" in programming language is another very telling example of this inscription in the automation of a living character whose behavior is both free and predetermined.

7 In this type of analysis there is no effort to attribute forever certain competences to humans and others to nonhumans. The attention is focused on following how any set of competences is distributed through various entities.

8 Interestingly enough, the oldest Greek engineering myth, that of Daedalus, is about cleverness, deviousness. "Daedalion" means something that goes away from the main road, like the French word "bricole." In the mythology, science is represented by a straight line and technology by a detour, science by *epitrimé* and technology by the *metis*. See the excellent essay of Frontisi-Ducroux (1975) on the semantic field of the name Daedalus.

9 We use *actant* to mean anything that acts and *actor* to mean what is made the source of an action. This is a semiotician's definition that is not limited to humans and has no relation whatsoever to the sociological definition of an actor by opposition to mere behavior. For a semiotician, the act of attributing "inert force" to a hinge or the act of attributing it "personality" are comparable in principle and should be studied symmetrically.

10 I have been able to document a case of a five-day student strike at a French school of management (ESSEC) to urge that a door closer be installed in the student cafeteria to keep the freezing cold outside. It is of course another choice to decide who makes such a choice: a man? a spirit? no one? an automated machine? The *scriptor* or designer of all these scripts is itself (himself, herself, themselves) negotiated. This is what Norman (1988) calls the Gulf of Execution. His book is an excellent introduction to the study of the tense relations between inscribed and real users. However, Norman speaks only about dysfunction in the interfaces with the final user and never considers the shaping of the artifact by the engineer themselves.

13 To stay within the same etymological root, we call the way actants (human or nonhuman) tend to extricate themselves from the prescribed behavior *de-inscription* and the way they accept or happily acquiesce to their lot *subscription*.

14 We call *pre-inscription* all the work that has to be done upstream of the scene and all the things assimilated by an actor (human or nonhuman) before coming to the scene as a user or an author. For instance,

how to drive a car is basically pre-inscribed in any (Western) youth years before it comes to passing the driving test; hydraulic pistons were also pre-inscribed for slowly giving back the energy gathered, years before innovators brought them to bear on automated grooms. Engineers can bet on this pre-determination when they draw up their prescriptions. This is what is called "articulation work" (Fujimura 1987).

15 We call *circumscription* the organization in the setting of its own limits and of its own demarcation (doors, plugs, hall, introductions).

16 See Suchman for a description of such a setting (1987).

17 We call *ascription* the attribution of an effect to one aspect of the setup. This new decision about attributing efficiency—for instance, to a person's genius, to workers' efforts, to users, to the economy, to technology—is as important as the others, but it is derivative. It is like the opposition between the primary mechanism—who is allied to whom—and the secondary mechanism—whose leadership is recognized—in history of science (Latour 1987).

18 Waddington's term for "necessary paths"—from the Greek *oros* and *odos*.

19 We call *conscription* this mobilization of well-drilled and well-aligned resources to render the behavior of a human or a nonhuman predictable.

20 Trevor Pinch sent me an article from the *Guardian* (2 September 1988) titled "Cardboard coppers cut speeding by third."

A Danish police spokesman said an advantage of the effigies, apart from cutting manpower costs, was that they could stand for long periods undistracted by other calls of duty. Additional assets are understood to be that they cannot claim overtime, be accused of brutality, or get suspended by their chief constable without explanation. "For God's sake, don't tell the Home Office," Mr. Tony Judge, editor of the *Police Review Magazine* in Britain, said after hearing news of the (Danish) study last night. "We have enough trouble getting sufficient men already." The cut-outs have been placed beside notorious speeding blackspots near the Danish capital. Police said they had yielded "excellent" results. Now they are to be erected at crossings where drivers often jump lights. From time to time, a spokesman added, they would be replaced by real officers.

21 Why did the (automatic) groom go on strike? The answers to this are the same as for the question posed earlier of why no one showed up at La Halle aux Cuirs: it is not because a piece of behavior is prescribed by an inscription that the predetermined characters will show up on time and do the job expected of them. This is true of humans, but it is truer of nonhumans. In this case the hydraulic piston did its job, but not the spring that collaborated with it. Any of the words employed above may be used to describe a setup at any level and not only at the simple one I chose for the sake of clarity. It does not have to be limited to the case where a human deals with a series of nonhuman delegates; it can also be true of relations among nonhumans (yes, you sociologists, there are also relations among things, and social relations at that).