On actor-network theory

A few clarifications

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I.

Exploring the properties of actor-networks is the task that the Paris group of science and technology studies has set itself to tackle since the beginning of the 1980s (Callon/Law/Rip 1986). However, this theory has often been misunderstood and hence much abused. In this paper I would like to list some of the interesting properties of networks and explain some of the misunderstandings that have arisen. I will not concern myself here with the quantitative studies, especially the so-called "co-word analysis", since they are themselves misunderstood because of the difficulty of exactly grasping the social theory and quaint ontology entailed by actor-network (but see Callon/Courtial/Lavergne 1989a; b).

Three misunderstandings are due to common usages of the word network itself and the connotations they imply.

The first mistake would be to give it a common *technical* meaning in the sense of a sewage, or train, or subway, or telephone "network". Recent technologies often have the character of a network, that is, of exclusively related yet very distant elements with the circulation between nodes being made compulsory through a set of rigorous paths giving to a few nodes a strategic character. Nothing is more intensely connected, more distant, more compulsory, and more strategically organized than a computer network. Such is not however the basic metaphor of an actor-network. A technical network in the engineer's sense is only one of the possible *final* and *stabilized* states of an actor-network. An actor-network may lack all the characteristics of a technical network — it may be local, it may have no compulsory paths, no strategically positioned nodes. Tom Hughes's "networks of power" (1983), to give a historical example, are actor-networks at the beginning of the story, and only some of their stabilized elements end up being networks in the engineer's sense, that is the electrical grid. Even at this later stage the engineering definition of networks is still a partial projection of an actor-network.

The second misunderstanding is easy to lift: the actor-network theory (hence ANT) has very little to do with the study of social networks. These studies, no matter how interesting, concern themselves with the *social* relations of *individual human* actors — their frequency, distribution, homogeneity, proximity. It was devised as a reaction to the often too global concepts like those of institutions, organizations, states and nations, adding to them a more realistic and smaller set of associations. Although ANT shares this distrust for such vague all-encompassing sociological terms, it also aims at describing the very nature of societies. But to do so it does not limit itself to human individual actors, but extends the word actor — or actant — to *non-human*, *non-individual* entities. Whereas social network adds information on the relations of humans in a social and natural world which is left untouched by the analysis, ANT aims at accounting for the very essence of societies and natures. It does not wish to add social networks to social theory, but to rebuild social theory out of networks. It is as much an ontology or a metaphysics as a sociology (Mol/Law 1994). Social networks

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will of course be included in the description, but they will have no privilege nor prominence (and very few of their quantitative tools have been deemed reusable).

Why then use the word network, since it is open to such misunderstandings? The use of the word comes from Diderot. The word "réseau" was used from the beginning by Diderot to describe matter and bodies in order to avoid the Cartesian divide between matter and spirit. Thus, the word has had a strong ontological component from the beginning (Anderson 1990). Put too simply, ANT is a change of metaphors to describe essences: instead of surfaces one gets filaments (or rhyzomes in Deleuze's parlance Deleuze/Guattari 1980)). More precisely it is a change of topology. Instead of thinking in terms of surfaces — two dimensions — or spheres — three dimensions — one is asked to think in terms of nodes that have *as many dimensions* as they have connections. As a first approximation, ANT claims that modern societies cannot be described without recognizing them as having a fibrous, thread-like, wiry, stringy, ropy, capillary character that is never captured by the notions of levels, layers, territories, spheres, categories, structures, systems. It aims at explaining the *effects* accounted for by those traditional words without having to buy the ontology, topology and politics that go with them. ANT has been developed by students of science and technology, and its claim is that it is utterly impossible to understand what holds society together without reinjecting in its fabric the facts manufactured by natural and social sciences and the artefacts designed by engineers. As a second approximation, ANT is thus the claim that the only way to achieve this reinjection of things into our understanding of social fabrics is through a network-like ontology and social theory.

To remain at this very intuitive level, ANT is a simple material resistance argument. Strength does not come from concentration, purity and unity, but from dissemination, heterogeneity and the careful plaiting of weak ties. This feeling that resistance, obduracy and sturdiness are more easily achieved through netting, lacing, weaving, twisting of ties that are weak by themselves, and that each tie, no matter how strong, is itself woven out of still weaker threads, permeates for instance Foucault's analysis of micro-powers as well as recent sociology of technology. But the less intuitive philosophical basis for accepting ANT is a background/foreground reversal: instead of starting from universal laws — social or natural — and taking local contingencies as so many queer particularities that should be either eliminated or protected, it starts from irreducible, incommensurable, unconnected localities which then, at a great price, sometimes end into provisionally commensurable connections. Through this foreground/background reversal ANT has some affinity with the order out of disorder or chaos philosophy (Serres 1983; Prigogine/Stengers 1979) and many practical links with ethnomethodology (Garfinkel and Lynch's principle in Lynch 1985). Universality or order are not the rule but the exceptions that have to be accounted for. Loci, contingencies or clusters are more like archipelagos on a sea than like lakes dotting a solid land. Less metaphorically, whereas universalists have to *fill in* the whole surface either with order or with contingencies, ANT does not attempt to fill in what is *in between* local pockets of orders or *in between* the filaments relating these contingencies.

This is the most counter-intuitive aspect of ANT. Literally there is nothing but networks, there is nothing in between them, or, to use a metaphor from the history of physics, there is no aether in which networks should be immersed. In this sense ANT is a reductionist and relativist theory, but, as I shall demonstrate, this is the first necessary step towards an irreductionist and relationist ontology.

II.

ANT makes use of some of the simplest properties of nets and then adds to it an *actor* that does some *work*; the addition of such an ontological ingredient deeply modifies it. I will start out with the simplest properties common to all networks.

Far/close: the first advantage of thinking in terms of networks is that we get rid of "the tyranny of distance" or proximity. Elements which are close when disconnected may be infinitely remote when their connections are analyzed; conversely, elements which would appear as infinitely distant may be close when their connections are brought back into the picture. I can be one metre away from someone in the next telephone booth and nevertheless be more closely connected to my mother 6000 miles away; an Alaskan reindeer might be ten metres away from another one and they might nevertheless be cut off by a pipeline of 800 miles that makes their mating for ever impossible; my son may sit at school with a young arab of his age, but in spite of this close proximity in first grade they might drift apart in worlds that will become incommensurable later; a gas pipe may lie in the ground close to a cable television glass fiber and nearby a sewage pipe, and each of them will nevertheless continuously ignore the parallel worlds lying around them. The difficulty we have in defining all associations in terms of networks is due to the prevalence of geography. It seems obvious that we can oppose proximity and connections. However, geographical proximity is the result of a science — geography —, of a profession — geographers —, of a practice — mapping system, measuring, triangulating. Their definition of proximity and distance is useless for ANT — or it should be included as one type of connections, one type of networks, as we will see below. All definitions in terms of surface and territories come from our reading of maps drawn and filled in by geographers. Out of geographers and geography, "in between" their own networks, there is no such thing as a proximity or a distance which would not be defined by connectibility. The geographical notion is simply another connection to a grid defining a metrics and a scale (Jacob 1990). The notion of network helps us to lift the tyranny of geographers in defining space and offers us a notion which is neither social nor "real" space, but associations.

Small scale/large scale: the notion of network allows us to dissolve the micro-macro-distinction that has plagued social theory from its inception. The whole metaphor of scales going from the individual to the nation state, through family, extended kin, groups, institutions etc. is replaced by a metaphor of connections. A network is never *bigger* than another one, it is simply *longer* or *more intensely* connected. The small scale/large scale model has three features which have proven devastating for social theory: it is tied to an order relation that goes from top to bottom or from bottom to top — as if society really had a top and a bottom; it implies that an element "b" being macro-scale is of a different nature and should thus be studied differently from an element "a" which is micro-scale; it is utterly unable to follow how an element goes from being individual — a — to collective — b — and back.

The network notion implies a deeply different social theory: it has no a priori order relation; it is not tied to the axiological myth of a top and a bottom of society; it makes absolutely no assumption whether a specific locus is macro- or micro- and does not modify the tools to study element "a" or element "b"; thus, it has no difficulty in following the transformation of a poorly connected element into a highly connected one *and back*. The network notion is ideally suited to follow the change of scales, since it does not require the analyst to partition her world with any a priori scale. The scale, that is, the type, number and topography of connections, is left to the actors themselves.

The notion of network allows us to lift the tyranny of social theorists, to regain some margin of manoeuvres between the ingredients of society — its vertical space, its hierarchy, its layering, its macro-scale, its wholeness, its overarching character — and to see how these features are achieved and what stuff they are made of. Instead of having to choose between the local and the global view, the notion of network allows us to think of a global entity — a highly connected one — which nevertheless remains continuously local . . . Instead of opposing the individual level to the mass, or agency to structure, we simply follow how a given element becomes strategic through the number of connections it commands, and how it loses its importance when losing its connections.

Inside/outside: the notion of network allows us to get rid of a third spatial dimension after those of far/close and big/small. A surface has an inside and an outside separated by a boundary. A network is all boundary without inside and outside. The only question one may ask is whether or not a connection is established between two elements. The surface "in between" networks is either connected — but then the network is expanding — or non-existing. Literally, a network has no outside. It is not a foreground over a background, nor a crack onto a solid soil, it is like Deleuze's lightning rod that creates by the same stroke the background and the foreground (Deleuze 1968). The great economy of thinking allowed by the notion of network is that we are no longer obliged to fill in the space in between the connections — to use a computer metaphor, we do not need the little paint box familiar to MacPaint users to "fill in" the interspace. A network is a positive notion which does not need negativity to be understood. It has no shadow.

The notion of network, in its barest topological outline, already allows us to reshuffle spatial metaphors that have rendered the study of society-nature so difficult: close and far, up and down, local and global, inside and outside. They are replaced by associations and connections (which ANT does not have to qualify as being either social or natural or technical as I will show below). This is not to say that there is nothing like "macro" society or "outside" nature as ANT is often accused of, but that in order to obtain the *effects* of distance, proximity, hierarchies, connectedness, outsiderness and surfaces an enormous *supplementary* work has to be done (Latour 1996a). This work, however, is not captured by the topological notion of network, no matter how sophisticated we wish to make it. This is why ANT adds to the mathematical notion of network a completely foreign notion, that of actor. The new hybrid "actor-network" leads us away from mathematical properties into a world which has not yet been so neatly charted. To sketch these properties we should now move on from static and topological properties to dynamic and ontological ones.

III.

A network in mathematics or in engineering is something that is traced or inscribed by some other entity — the mathematician, the engineer. An actor-network is an entity that *does* the tracing and the inscribing. It is an ontological definition and not a piece of inert matter in the hands of others, especially of human planners or designers. It was in order to point out this essential feature that the word "actor" was added to it.

Now, the word actor has been open to the same misunderstanding as the word network. "Actor" in the Anglo-Saxon tradition is always a human intentional individual actor and is most often contrasted with mere "behaviour". If one adds this definition of an actor to the social definition of a network, then the bottom of misunderstanding is reached: an individual human — usually male — who wishes to grab power makes a

network of allies and extends his power — doing some "networking" or "liaising" as the Americans say ... Alas, this is the way ANT is most often represented, which is about as accurate as saying that the night sky is black because the astrophysicists have shown there is a big black hole in it. An "actor" in ANT is a semiotic definition — an actant —, that is something that acts or to which activity is granted by others. It implies *no* special motivation of *human individual* actors, nor of humans in general. An actant can literally be anything provided it is granted to be the source of an action. Although this point has been made over and over again, anthropocentrism and sociocentrism are so strong in social sciences (as well as in the critiques of social explanations) that each use of ANT has been construed as if it talked of a few superhumans longing for power and stopping at nothing to achieve their ruthless goals ... Even my own network study of Pasteur (Latour 1988a) — in spite of the lengthy ontological second part — has often been understood as a Madison Avenue version of science — which is unfair not only to my account but also to Madison Avenue ... If a criticism can be levelled at ANT it is, on the contrary, its complete indifference for providing a model of human competence. There is no model of (human) actor in ANT nor any basic list of competences that have to be set at the beginning, because the human, the self and the social actor of traditional social theory is not on its agenda.

So what is on its agenda? The attribution of human, unhuman, nonhuman, inhuman characteristics; the distribution of properties among these entities; the connections established between them; the circulation entailed by these attributions, distributions and connections; the transformation of those attributions, distributions and connections of the many elements that circulate, and of the few ways through which they are sent.

The difficulty of grasping ANT is that it has been made by the fusion of three hitherto unrelated strands of preoccupations:

— a semiotic definition of entity building;
— a methodological framework to record the heterogeneity of such a building;
— an ontological claim on the "networky" character of actants themselves.

ANT asserts that the limits of these three unrelated interests are solved when, and only when, they are fused into an integrated practice of study.

Semiotics is a necessary step in this venture, since when you bracket out the question of reference and that of the social conditions of productions — that is nature "out there" and society "up there" — what remains is, in a first approximation, meaning production, or discourse, or text. This is the major achievement of the sixties and of their "linguistic turn" or "semiotic turn". Instead of being means of communications between human actors and nature, meaning productions became the only important thing to study. Instead of being unproblematic, they became opaque. The task was no longer to make them more transparent, but to recognize and relish their thick, rich, layered and complex matter. Instead of being mere *intermediaries*, they had become *mediators*. From a means, meaning has been made an end in itself. For twenty years the best minds have been busy exploring all the consequences of this major turn away from the naïve model of communication. Their often structuralist interpretations have been dismantled, but what remains is a toolbox to study meaning productions. ANT sorts out from this toolbox what is useful to understand the construction of entities. The key point is that every entity, including the self, society, nature, every relation, every action, can be understood as a "choice" or a "selection" of finer and finer embranchments going from abstract structure — actants — to concrete ones — actors. The generative path that is thus retraced gives an extraordinary liberty of analysis compared

to the empoverished "social vocabulary" that was used earlier — and is now in fashion again. Of course the structural rendering of these choices — differences — and embranchments — dichotomies — are not kept by ANT, but essential traits of semiotics are kept. First, the *granting* of humanity to an individual actor, or the granting of collectivity, or the granting of anonymity, of a zoomorphic appearance, of amorphousness, of materiality, requires paying the *same semiotic price*. The effects will be different, the genres will be different, but not the *work* of attributing, imputing, distributing action, competences, performances and relations. Secondly, actors are not conceived as fixed entities but as flows, as circulating objects undergoing trials, and their stability, continuity, isotopy has to be obtained by other actions and other trials. Finally, what is kept from semiotics is the crucial practice to grant texts and discourses the ability to define also their context, their authors — in the text —, their readers — in fabula — and even their own demarcation and metalanguage. All the problems of the analyst are shifted to the "text itself" without ever being allowed to escape into the context (Greimas 1976). Down with interpretation! Down with the context! The slogans of the the 60s and 70s "everything is a text", "there is only discourse", "narratives exist by themselves", "we have no access to anything but accounts" are kept in ANT but saved from their ontological consequences. This salvation, however, does not come by falling back on the pre-deconstruction common sense — "after all, there is a social context up there and a nature out there" — but by extending the semiotic turn to this famous nature and this famous context it has bracketed out in the first place.

A major transformation of these slogans occurred when semiotics was turned to scientific and technical discourse by ANT — and especially to scientific texts. As long as one studied fictions, myths, popular cultures, fashions, religions, political discourse, one could hold to the "semiotic turn" and take them as so many "texts". Scholars did not seriously believe in them anyway, and thus the intellectual distance and scepticism was easy to achieve while the double treasury of "scientism" and "socialism" was kept intact in their heart. But what about scientific truth and material efficiency? What about the reference "out there" in hard scientific texts? This was the real test for semiotics, and although it passed the trial a price had to be payed. In the practice of ANT semiotics was extended to define a completely empty frame that enabled to follow any assemblage of heterogeneous entities — including now the "natural" entities of science and the "material" entities of technology. This is the second strand of ANT: it is a *method* to describe the deployment of associations like semiotics; it is a method to describe the generative path of any narration. It does not say anything about the shape of entities and actions, but only what the recording device should be that would allow entities to be described in all their details. ANT places the burden of theory on the *recording*, not on the specific shape that is recorded. When it says that actors may be human or unhuman, that they are infinitely pliable, heterogeneous, that they are free associationists, know no differences of scale, that there is no inertia, no order, that they build their own temporality, this does not qualify any real *observed* actor, but is the necessary condition for the observation and the recording of actors to be possible. Instead of constantly predicting how an actor should behave and which associations are allowed a priori, ANT makes no assumption at all, and in order to remain uncommitted it needs to set its instrument by insisting on infinite pliability and absolute freedom. In itself ANT is *not* a theory of action, no more than cartography is a theory on the shape of coast lines and deep sea ridges; it just qualifies what the observer should suppose in order for the coast lines to be recorded in their fine fractal patterns. Any shape is possible provided it is obsessively coded as longitude and

latitude. Similarly, any association is possible provided it is obsessively coded as a heterogeneous association through translations. It is more an infralanguage than a metalanguage. It is even less than a descriptive vocabulary; it simply opens, *against* all a priori reductions, the possibility of describing irreductions (Latour 1988a, part II). ANT is not merely empiricist though, since in order to define such an irreducible space in which to deploy entities sturdy theoretical commitments have to be made and a strong polemical stance has to be taken, so as to forbid the analyst to dictate actors what they should do. Such a distribution of a strong theory for the recording frame and no middle range theory for the the description is another source of many misunderstandings, since ANT is accused of either being dogmatic or of providing mere descriptions. For the same reason it is also accused of claiming that actors are "really" infinitely pliable and free or, inversely, of not telling what a human actor really is after (Lee/Brown 1994).

The first two strands — the semiotic and the methodological one — by themselves will be open to criticism. The first because there is no way to consider that bracketing out social context and reference solves the problem of meaning — in spite of the now dated claims of the swinging seventies —, and the second because merely deploying shapes of associations might be a worthwhile descriptive task but does not offer any explanation. It is only when a third strand is added to those two and ontological claims on networks are made that ANT escapes criticism. This move, however, is so devious that it has escaped the attention of many users of ANT. Which is a pity, since once it is made, ANT loses its radical character and soon appears commensensical enough.

The weakness of semiotics has always been to consider meaning production away from what the nature of entities really is; when semiotics is turned to nature however and unhuman entities are allowed to enter into the picture, it soon appears that the words "discourse" or "meaning" may be dropped altogether without any danger of going back to naïve realism or naïve naturalism. It is only because semioticians studied texts — and literary ones at that — instead of things that they felt obliged to limit themselves to "meaning". In effect they scientistically believed in the existence of things in addition to meaning (not mentioning their belief in the existence of a good old social context whenever it suited them). But a semiotics of things is easy, one simply has to drop the meaning bit from semiotics . . .

If one now translates semiotics by path-building or order-making or creation of directions, one does not have to specify if it is language or objects one is analyzing. Such a move gives a new continuity to practices that were deemed different when one dealt with language and "symbols", or with skills, work and matter. This move can be said either to elevate things to the dignity of texts or to elevate texts to the ontological status of things. What really matters is that it is an elevation and not a reduction, and that the new hybrid status gives *to all entities* both the action, variety and circulating existence recognized in the study of textual characters *and* the reality, solidity, externality that was recognized in things "out of" our representations. What is lost is the absolute distinction between representation and things — but this is exactly what ANT wishes to redistribute through what I have called a counter-copernican revolution.

Once settled this first solution — extending semiotics to things instead of limiting it to meaning —, the second difficulty falls with it — building an empty methodological frame to register description. Actor-networks do connect, and by connecting with one another provide an explanation of themselves, the only one there is for ANT. What is an explanation? The attachment of a set of practices that control or interfere in one another. No explanation is stronger or more powerful than providing connections among unrelated elements or showing how one element holds many others. This is not

a property that is *distinct* from networks but one of their essential properties (Latour 1988b). They become more or less explanable as they go and depending on what they do to one another. Actors are cleaning up their own mess, so to speak. Once you grant them everything, they also give you back the explanatory powers you abandoned. The very divide between description and explanation, hows and whys, blind empiricism and high theorizing is as meaningless for ANT as the difference between gravitation and space in relativity theory. Each network, by growing, "binds" the explanatory resources around it, and there is no way they can be detached from its growth. One does not jump outside a network to add an explanation — a cause, a factor, a set of factors, a series of co-occurences; one simply *extends* the network further. Every network surrounds itself with its own frame of reference, its own definition of growth, of refering, of framing, of explaining. In this process the frame of reference of the analyst does not disappear more than the physicist's in Einstein's world; on the contrary, at last it is able to extend itself, but at a price: the frame becomes, as it does in General Relativity, "a mollusc of reference" instead of a detached Galilean frame, and each account has to be recalculated by the ANT equivalent of a Lorentz transformation (Latour 1988c). There is no way to provide an explanation if the network does not extend itself. This is not in contradiction with the scientific task of providing explanation and causality, since we learned from the very studies of hard sciences that no explanation of any scientific phenomenon and no causality could be provided without extending the network itself. By tying the explanation to the network itself ANT does not abandon the goal of science, since it shows that this goal has never been achieved, at least not through the epistemological myth of explanation. ANT can't deprive itself of a resource it shows no one has ever had in the first place. Explanation is ex-plicated, that is unfolded, like gravity in Einstein's curved space, it is still there as an effect, but it is now indistinguishable from the description, the deployment of the net.

This relativistic position — but one should prefer the less loaded term of relationist — solves two other problems: that of historicity and that of reflexivity.

The pre-relativist debate between providing an explanation and "simply" documenting the historical circumstances falls apart: there is no difference between explaining and telling how a network surrounds itself with new resources; if it "escapes socio-historical contingencies", as critics often argue, then this simply means that other, longer lasting resources have been garnered to stay around — the etymology of circumstances. Hughes's networks of power grow (Hughes 1983), and by their very growth they become more and more of an explanation of themselves; you do not need an explanation floating over them *in addition* to their historical growth; Braudel's networks and world economics grow, and they are what the "big causes" are made of. You do not need to add to them Capitalism or *Zeitgeist* except as another summary, another punctualisation of the networks themselves. Either the cause designates a body of practices which is tied to the network under description — and this is what growth of network means —, or it is not related, and then it is just a word added to the description, literally it is the *word* "cause". In this sense, ANT gives history its legitimate place — which is not the place prudent historians like to sit on, as safely away as possible from ontological questions. There is nothing better, sturdier than a circumstancial description of networks. "It just happens to be this way".

But such a summary would be construed as historicism if it were not understood as a definition of the things themselves. The debate between historicism and explanation or theory was not solvable as long as there was, on the one hand, a history of people, of contingencies, of what is "in time" and, on the other hand, a theory or a science of

what is timeless, eternal, necessary. For ANT there is science only of the contingent, as of necessity it is locally achieved only through the growth of a network. If there is also a history of things, then the debate between description and ex-planation, or historicity and theory, is entirely dissolved. For ANT this is not the proof of the weakness of its explanatory powers, since describing or accounting for a network is what an explanation or an explication is and what has always been the case in the so-called hard sciences — or more exactly "progressively hardened sciences" (Latour 1996b).

Although not the main goal of ANT, reflexivity is added as a bonus once the frames of reference are granted back to the actors — and once the actors are granted back the possibility of crossing the sacred dividing line between things and representations (Ashmore 1989). Reflexivity is seen as a problem in relativist theory, because it appears that either the observer requests a status it denies to others, or it is as silent as all the others to which any privileged status is denied. This "problem" falls, however, when the epistemological myth of an outside observer providing an explanation in addition to "mere description" disappears. There is no longer any privilege — but there has never been any need for it either. The observer — whatever it is — finds itself on a par with all the other frames of reference. It is not left to despair or navel-gazing, since the absence of privileged status has never limited the expansion and intelligence of any actor. World builder among world builders, it does not see a dramatic limit on knowledge in its abandonment of Galilean frames, but only resources. To extend from one frame of reference to the next it has to work and pay the price like any other actor. In order to explain, to account, to observe, to prove, to argue, to dominate and to see it has to move around and work (I should say it has to "network"). No privilege also means no a priori limits on knowledge. If actors are able to account for others, so can it. If actors can't, it might still try. History, risks and ventures are also in the observers' own network building. Such is ANT's solution to reflexivity (Stengers 1993).

Reflexivity is not a "problem", a stumbling block along the path to knowledge, the prison in which all enterprises would be locked, it is the land of opportunity at last opened to actors which are primus inter pares, or strive for parity or primacy like any other. Of course reusable metalangage is abandoned, but this is not giving up much, since observers who displayed their rich metalanguage were usally small points limited to very specific loci — campuses, studios, corporate rooms. The price ANT pays to move from one locus to the next is that there are as many metalanguages as there are frames of reference — the only metalanguage required (see above strand 2) being more adequately called an *infralanguage* which has to be poor, limited, short and simple — the equivalent of a Lorentz transformation being called "translation" in ANT (Latour 1988c). This infralanguage is enough to move from one net to the other, and the specific explication will always be a one-shot account exclusively tailored to the problem at hand (Lynch's principle, Callon's "disposable explanations", Serres's "cross over between explanandum and explanans" (Serres 1995)). If it is more generally applicable, it means that it is riding over a network that expands itself.

This solution becomes commonsense once it is accepted that an account or an explication or a proof is always added to the world; that it does not subtract anything from the world. Reflexivists as well as their pre-relativist enemies dream of subtracting knowledge from the things in themselves. ANT keeps adding things to the world, and its selection principle is no longer whether or not there is a fit between account and reality — this dual illusion has been dissolved away —, but whether or not one travels from a net to another. No metalanguage allows you to do this travel. By abandoning the dreams of epistemology ANT is not reduced to moral relativism, but gets back a

stronger deontological commitment: either an account leads you to all the other accounts — and it is good —, or it constantly interrupts the movement, letting frames of reference distant and foreign — and it is bad. Either it multiplies the mediating points between any two elements — and it is good —, or it deletes and conflates mediators — and it is bad. Either it is reductionist — and that's bad news —, or irreductionist — and that's the highest ethical standard for ANT. We will see that this touchstone is much more discriminating than the quest for epistemological purity, or for foundations, or for moral norms. Demarcation is in fact an enemy of differentiation.

Building on the semiotic turn, ANT first brackets out society and nature to consider only meaning-productions; then, breaking with the limits of semiotics without losing its toolbox, it grants activity to the semiotic actors turning them into new ontological hybrids, world making entities; by doing such a counter-copernican revolution it builds a completely empty frame for describing how any entity builds its world; finally, it retains from the descriptive project only very few terms — its infralanguage — which are just enough to sail in between frames of reference, and grants back to the actors themselves the ability to build precise accounts of one another by the very way they behave; the goal of building an overarching explanation — that is, for ANT, a centre of calculation that would hold or replace or punctuate all the others — is displaced by the search for ex-plications, that is for the deployment of as many elements as possible accounted for through as many metalanguages as possible.

IV.

Now that the basic topological properties of networks have been sketched — second section — and that the basic ontological features of actors have been outlined — section above —, there is no difficulty in seeing that ANT is not about *traced* networks, but about a network-*tracing* activity. As I said above, there is not a net and an actor laying down the net, but there is an actor whose definition of the world outlines, traces, delineates, describes, files, lists, records, marks or tags a trajectory that is called a network. No net exists independently of the very act of tracing it, and no tracing is done by an actor exterior to the net. A network is not a thing, but the recorded movement of a thing. The questions ANT addresses now have changed. It is no longer whether a net is a representation or a thing, a part of society or a part of discourse or a part of nature, but what moves and how this movement is recorded.

We cannot say that what moves *inside* networks are pieces of information, genes, cars, bytes, salutations, words, forces, opinions, claims, bodies, energy etc., since ANT also wants to reconstruct nets before there is any distinction between what circulates inside and what keeps them on track, so to speak, from the outside. Again, as I said at the beginning, the technical metaphor of networks is a latecomer for ANT and does not capture the tracing activity. No, what circulates has to be defined like the circulating object in the semiotics of texts — especially scientific texts (Bastide 1990). It is defined by the competence it is endowed with, the trials it undergoes, the performances it is allowed to display, the associations it is made to bear upon, the sanctions it receives, the background in which it is circulating etc. Its isotopy — that is its persistence in time and space — is not a property of its essence, but the result of the decisions taken through the narrative programmes and the narrative paths.

However, such a classic definition would limit ANT to the world of text and discourse. What happens when a circulating object leaves the boundary of a text? The traditional answer is that there is a yawning gap in between the text and the context. At the interface a dramatic trial is supposed to abruptly intervene through which the

circulating object is assessed either by checking its referential fit or its social interest. Not so for ANT, which does not believe in this distinction, since it has extended meaning productions to all productions. For ANT the gap is no more than a slight bump along the net; the yawn is an artefact caused by a previous divide between nature, society and discourse. For ANT on the contrary, there is a continuity, a multiplicity of plugs between the circulating objects in the text, the claims outside the text in the "social", and what the actants themselves really do in "nature". The circulating object goes on circulating and goes on getting its isotopy from what other actors do to it. "Society" has the same net-like properties as have texts, and so has "nature". But it would be more accurate for ANT to say that these three categories are arbitrary cutting points on a continuous tracing of action, and still more accurate to show how these categories themselves are part of the many trials and events and resources that are used along the paths to attribute "textuality" or "sociality" or "naturality" to this or that actor. They are part of what is distributed — not part of what makes the distribution.

There is no off-the-shelf word to describe this common movement. To say that it is a generalized narrative path would immediately mean that texts are extended to everything; to say that it is a force or an energy or a gene or a culture-gene would mean that everything would be naturalized, including society and discourse; to say that it is a social interest, a social action or labour would extend society to nature and to texts. It was to get out of this essential difficulty that ANT played with a generalized symmetry (Callon 1986) and made a principle of using whichever words are connoted in one of the former realms to describe the others, thus showing the continuity of networks and the complete disregard for the artefactual gaps introduced by pre-relativist arguments. However, this solution is rather tricky, since it may combine all the misunderstandings — and this is indeed what happened to ANT, readers and users alike saying *at once* that it is a social constructivist argument, the return of naturalism, or a typically French belief in the overall extension of texts ... Which of course it is in a sense, but only insofar as ANT is the simultaneous rejection of natural*isation*, social*isation* and textual*isation*. ANT claims that these "(x)-isations" have to be dissolved all at once and that the job is not done better if one of them gains hegemony or if the three are carefully circumscribed. All (x)-isations are the filling in of what is "in between" the networks; and which one is chosen or rejected makes no practical difference, since nets have no "in between" to be filled in.

If choosing words for the network-tracing activity has to be done, *quasi-objects* (Serres 1987) or *tokens* might be the best candidates so far. It is crucial for the definition of the term that what circulates and what makes the circulation be both co-determined and transformed. A ball going from hand to hand is a poor example of a quasi-object, since, although it does trace the collective and although the playing team would not exist without the moving token, the latter is not modified by the passings. Conversely, what I called the first principle of science studies (Latour 1987) — that a claim is in the hands of others — is equally an approximation, since it entails human locutors endowed with hands and mouths who pass a claim without themselves undergoing dramatic changes. As a rule, a quasi-object should be thought of as a moving actant that transforms those who do the moving, because they transform the moving object. When the token remains stable or when the movers are kept intact, these are *exceptional* circumstances which have to be accounted for. This definition of what is the rule and what are the exceptions would be enough to tell ANT from all models of communications that, on the contrary, begin with well defined movers and moving objects and view obstacles to exchanges as so many exceptions to be explained. But another feature forbids any confusion of ANT with human-centered, or language-centered, or praxis-centered models.

As a rule, what is doing the moving and what is moved have no specific homogeneous *morphism*. They can be anthropo-morphic, but also zoo-morphic, physi-morphic, logo-morphic, techno-morphic, ideo-morphic, that is "(x)-morphic". It might happen that a generative path has limited actants to a homogeneous repertoire of humans or of mechanism or of signs or of ideas or of collective social entities, but these are exceptions which should be accounted for (Latour 1996c).

ANT is a powerful tool to destroy spheres and domains, to regain the sense of heterogeneity, and to bring interobjectivity back into the centre of attention (Latour 1994). Yet it is an extremely bad tool for differentiating associations. It gives a black and white picture, not a coloured and contrasted one. Thus it is necessary, after having traced the actor-networks, to specify the types of trajectories that are obtained by highly different mediations. This is a different task, and the one that will make ANT scholars busy for a number of years to come.

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