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Edited by
Paola Rebughini and Enzo Colombo



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Contemporary Social Sciences

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and Enzo Colombo

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Technoscience

Federico Neresini

Science and Technology Studies (STS) has made the word ‘and’, which is often considered of little relevance, into a very important one, although not as a conjunction but exactly the opposite: what it requires as a premise is actually a disjunction, since a separation is needed for allowing the construction of a link. It indeed makes a considerable difference whether this ‘and’ is a comparison between two substantives or otherwise. For example, saying ‘science and technology’ or ‘science and society’ means framing science, technology and society as objects to be analysed by the social sciences from a very specific perspective. What is tacitly accepted, in fact, is that these three elements are assumed to be ontologically separated and this starting point orients the analysis in a very specific way: how can we describe their relationship? Which is the *explanans* and which is the *explanandum*? Is society transformed by technology? Does technological innovation derive from scientific discoveries? Is science conditioned by society? Is there too much technology within scientific laboratories?

But seeing science, technology and society as three separate bodies is not compulsory; quite the opposite, the fact that we usually consider them distinct aspects of reality should be explained.

Dropping the ‘and’ from the expression ‘science and technology’, hence, means rejecting such a distinction and affirming that they cannot be regarded separately, at least as a starting point.

The long journey of technoscience

The term *technoscience* has required quite some time to take up its place in the STS field and become part of the latter’s ordinary lexicon. It is not my intention to examine the history of this process in too much depth here and I will limit myself to noting that the word’s use in the first edition of the *Handbook of Science and Technology Studies* (Jasanoff et al., 1995) was extremely sporadic, whilst it had been entirely absent from the first systematic collection of studies on science and technology around 20 years previously (Spiege-Roesing and de Solla Price, 1977). In this latter, in fact, science and technology were discussed mostly as

separate objects, although their increasing connections and mutual dependency were repeatedly examined.

It was not until the 2008 *Handbook* that *technoscience* was accorded many index entries (Hackett et al., 2008), showing that the concept had now entered the language of the field, its diverse and not always compatible nuances notwithstanding. This state of affairs persisted in the years that followed, as the next edition of the *Handbook* (Felt et al., 2017) confirms.

Meanwhile, *technoscience* began to expand well beyond the confines of STS. In a quick search on Scopus or Web Of Science repositories, the term crops up in a range of research areas from linguistics to medical anthropology, sociology to organizational studies, cultural studies to design, geography to communication, to cite just a few. As might have been expected *technoscience*'s success has not brought with it corresponding shared, established affirmation as a concept and, even in the STS context itself, discussion on its meaning is ongoing so that 'science and technology' remains an expression often used as a synonym of *technoscience*, and vice versa.

The word has anyway been around for some time. Certain scholars have, in fact, found traces of its use well before the advent of STS and attribute its first use to Heidegger, Lyotard or the Belgian philosopher Hottois (Cozza, 2021). There is no doubt, however, that its popularity as a concept designed to get past the distinction between science and technology remains an outcome of Latour's work.

In the STS, in fact, Latour uses the concept for an extremely clear purpose, that is looking for a way out of the impasse the social sciences find themselves in when they address the problem of scientific knowledge on the basis of the assumption that science and technology are to be considered two ontologically distinct entities. It is only by observing what goes on in research laboratories not constrained by such an initial preconception that at least two features become fairly visible. In the first place, that the scientists are 'only a tiny group among the armies of people who do science' (Latour, 1987: 173) and, secondly, that science is in no way confined to the laboratories and develops by generating networks whose heterogeneity stands out right away. The extent of these networks varies, but their breadth is always in any case such as to make them impossible to contain within the narrow confines of a laboratory.

Technoscience works in this way: its predictable character 'is entirely dependent on its ability to spread further networks' that take shape in and around laboratories. Thus, 'facts and machines are like trains, electricity, packages of computer bytes or frozen vegetables: they can go everywhere as long as the track along which they travel is not interrupted in the slightest' (Latour, 1987: 249–250). For this reason 'every time a fact is verified and a machine runs, it means that the lab or shop conditions have been extended in some way'. For example, 'you can very well claim that Ohm's law . . . is universally applicable in principle; try in practice to demonstrate it without a voltmeter, a wattmeter and an ammeter' (Latour, 1987: 250) and outside the practices associated with its use.

Now, it is crucial to keep the difference between two mechanisms in mind, Latour observes, as mechanisms which work on different planes while remaining complementary to a scientific fact's successful consolidation. The primary mechanism is that which progressively builds up networks by marshalling and aligning actors via translation processes, namely stratagems, compromises, agreement or forcing, through which these assemblages act coherently despite the various actors' sometimes very different, even conflicting, motives and interests.

The second mechanism is a matter of attributing responsibility to a few, if not just one, of the actors emerging from the primary mechanism, as occurs, for example, when it is said that Pasteur discovered microbes or Edison invented the incandescent light bulb. The outcome thus turns the proportions between the forces deployed on the field:

among the million people enlisted by scientists or enlisting them, and among the hundreds of scientists doing applied research and development for defence and industry, only a few hundreds are considered, and to them alone is attributed the power to make all the others believe and behave. Although scientists are successful only when they follow the multitude, the multitude appears successful only when it follows this handful of scientists!

(Latour, 1987: 174)

The expression 'science and technology' is thus a deceptive one because it implies attributing

the whole responsibility for producing facts to a happy few. . . Then, when one accepts the notion of 'science and technology', one accepts a package made by a few scientists to settle responsibilities, to exclude the work of the outsiders, and to keep a few leaders.

(Latour, 1987: 175)

This, then, is the basis on which the introduction of the *technoscience* neologism as well as the decision to treat the science and technology pairing as a contingent expression in the ongoing network in which a multitude of heterogeneous actors take part is justified. Citing Latour once again,

I will use the word technoscience from now on, to describe all the elements tied to the scientific contents no matter how dirty, unexpected or foreign they seem, and the expression 'science' and technology', in quotation marks, to designate what is kept of technoscience once all the trials of responsibility have been settled.

(Latour, 1987: 174)

Note the subtlety: the distinction between science and technology is not fully denied and its use is allowed social scientists solely when it is accompanied by an

awareness that they are dealing with a product and not two starting elements. If this distinction is markedly prevalent in everyday parlance, then it is clear not only that it exists, but also that whilst it is a construct its consequences are real. All this is in homage to Thomas's principle and the need not to confuse the meaning of the adjective 'constructed' with that of 'ephemeral'. Everything that is constructed can, in fact, become solid and resist change, and this applies equally to a house or a rental contract (Hacking, 1999).

Technoscience is hence the right word for social scientists interested in science and technology, but it cannot be denied that science and technology are regarded as two separate domains in our culture and that we act consequently.¹ This is also a profound act of humility by the social sciences to their 'object of study': from many points of view, all social analysts do is what the people they study do, that is, build and incessantly re-construct the social, although 'with different instruments and for different professional callings' (Latour, 2005: 34).² In any case, modesty comes at a cost, because it exposes social scientists to the risk of getting entangled in the network and the point of view of its actors. Consequently, 'it becomes difficult to sustain any kind of critical distance from them. We take on their categories. We see the world through their eyes' (Law, 1991: 11).

At the same time, this downsizing of the social sciences and their claim to a privileged position from which to observe social phenomena is the premise that correctly frames another of *technoscience* scholars' programmatic declarations: 'following the actors'. If *technoscience* refers to assemblages in which many heterogeneous actors can be seen to be involved in reciprocal relationships, we should, first and foremost, reconstruct these assemblages and doing this requires following what actors do within their networks. This methodological suggestion 'is a way of generating surprises, of making oneself aware of the mysterious. This is because it tends to break down "natural" categories – I mean some of those distinctions and distributions "natural" to the sociologist' (Law, 1991: 11).

Even if the 'following the actors' precept is unavoidably problematic (Collins and Yearley, 1992; Callon and Latour, 1992; Waytt, 2008; Jansen, 2017), it should not be forgotten that its primary function is to invite social scientists to take actors' points of view seriously in their approach to *technoscience* and allow them to show how their networks function instead of imposing interpretative categories on them from the outside. Focusing on 'science in action' implies 'follow scientists and engineers through society' (Latour, 1987) in an attempt to discover how society is made, how technoscience is 'society made durable' (Latour, 1991), instead of explaining technoscience through society. Therefore, STS's argument in favour of leaving the distinction between science and technology behind in favour of a nonhyphenated *technoscience* also works for another taken-for-granted separation, that between science and society.

Technoscience is thus revealed to be a relevant concept on two levels: that of the processes through which scientific knowledge and technological artefacts are constructed, and that concerning the general relationship between science, technology and society. This is not solely because social relationships – however

structured – are fully innervated by technoscience, but also because such relationships are also constitutive of what happens within laboratories or in the R&D departments of industries in such a way that they are intrinsically bound up with what is going on outside their walls.

In fact, the term technoscience refers to the need to tackle scientific knowledge issues on the basis of the seamless network formation between human and non-human actors – for example scientific and other artefacts of various sorts present in laboratories – assuming that the only admissibly distinctions among science, technology and society are those of common parlance. But an approach of this sort offers interesting opportunities also for the analysis of other social phenomena as well and casts doubt on facile assumptions taken too much for granted by the social sciences (Latour, 2004). Getting past viewing sociology as the ‘science of the social’ and seeing it as the study of association processes (Latour, 2005) is, in fact, one of the main aims of Latour’s theoretical approach, encompassing the concept of *technoscience*.

Heterogeneous networks

It is clear, at this point, that no discussion of *technoscience* can be complete without reference to the *network* concept, as the former necessarily implies an approach to the social from the perspective of the latter. On the other hand, analysis of *technoscience* within the STS context, as well as its dissemination as a concept outside this latter, have contributed to the network approach’s success within the social sciences. But exactly for this reason, some caution is required in any examination of the networks bound up with *technoscience* as the meaning accorded this term by the social sciences varies significantly in accordance with the theoretical context within which it is used (Latour, 2005; Venturini et al., 2019). As we know in the case of *technoscience*, this context is primarily that of Actor-Network Theory (ANT). The primordial bond between *technoscience* and ANT once again shines the spotlight on the word ‘and’, which is yet again an element of disturbance or rather distortion in the social sciences vision.

One of the key ideas marking out the theories of Callon, Latour and Law relates, in fact, to the inopportune nature of separating out actors and networks in any analysis of their interaction. In this way, ANT moves away ‘from a simple network because its elements are both heterogeneous and are mutually defined in the course of their association’ (Callon, 1986: 32). There are thus neither actors nor networks, but only actor-networks. At least two further aspects worthy of further attention thus emerge.

In the first place, arguing that actors are inseparable from the relationship networks they belong to implies the predominantly process-related nature of the two: if there are only actor-networks then it is the relationship process which is the basis for their existence, which ‘collapses’ them into one another. As Venturini has observed, in the actor-network expression ‘the hyphen stands for an equal: actor=network’ (Venturini et al., 2019: 8) and obviously vice-versa. To use

another of Latour's analogies, it could be said that actor-network is like dance: 'if a dancer stops dancing, the dance is finished. No inertia will carry the show forward' (Latour, 2005: 37). The same is true for social groups or categories; so 'if you stop making and remaking groups, you stop having groups' (Latour, 2005: 35). And, it is also worth noting that social scientists are deeply involved in this process of assembling what they consider the objects to be analysed, that is, social phenomena, as well.

Adopting a perspective in which 'reality is a process' (Callon, 1986: 207) might perhaps suggest potential correspondences with other theoretical approaches developed by the social sciences, such as, for instance, Simmel's formal sociology. For the latter, in fact, society is not substance but event, what happens when individuals associate, with the destiny and form of each depending on the others (Simmel, 1917). But these similarities between Simmel and ANT are actually misleading, especially in consideration of the fact that Simmel's sociology remains a 'dual level' perspective with a sociological analysis assuming that

a basic dualism pervades the fundamental form of all sociation. The dualism consists in the fact that a relation, which is a fluctuating, constantly developing life-process, nevertheless receives a relatively stable external form. . . . These two layers, relation and form, have different tempi of development; or it often is the nature of the external form not to develop properly at all.
(Simmel, 1908: 527)

ANT, by contrast, underlines that

by presupposing that there exist two levels, they might have solved too quickly the very questions they should have left open to inquiry: What is an element? What is an aggregate? Is there really a difference between the two? What is meant by a collective entity lasting in time?
(Latour et al., 2012: 591)

Hence *technoscience* is not an established network connecting multiple previously existing elements but rather a label with which to refer generically to many different – and therefore contingent – instantiations that are continuously shaped and reshaped as assemblages of heterogeneous elements, except that such elements exist only within that network (Law and Hassard, 1999; Law, 2004). And, at the same time, each network owes its existence to the interaction of these elements. This is why ANT suggests the adoption of 'the one-level stand point', so that the problem of what comes first – elements or networks, individuals or collectives, subjects or objects – is not solved, but simply bypassed. This is how the statement 'reality is a process' by Callon is to be understood, namely as a constant invitation not to exchange its stability with a sort of crystallization of the relationships from which it is incessantly constructed and reconstructed. This foundational character of the relationship is also to be found in Barad's suggestion

that inter-action should be replaced with intra-action, with this latter referring to ‘mutual constitution of entangled agencies’. That is, in contrast to the usual ‘interaction’ which assumes that separate individual agencies precede interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through their relationship. It is important to note that the ‘distinct’ agencies are only distinct in a relational, not absolute, sense, that is, ‘agencies are only distinct in relation to their mutual entanglement; they don’t exist as individual elements’ (Barad, 2007: 33).

In some ways, Latour’s return to Tarde’s sociology would seem to move in the same direction, in the sense that it is an attempt to give a processual foundation to the phenomena observed by the social science. What especially attracted Latour to Tarde’s work was, in fact, the latter’s sociological rereading of Leibnitz’s monad concept and the consequent idea by which society is a matter of ‘reciprocal possession in many highly varied forms of every other’ (Tarde, 1893: 149). What defines each element in a relationship is thus an ownership whole conferred by the whole of relationships it forms part of but, at the same time, the network of relations is made up of the attributions it is subjected to by its elements. The hollow abstraction we call being someone or something becomes, in Tarde’s perspective, ‘property of something, of some other being, which is itself composed of properties and so on to infinity. . . . Being is having’ (Tarde, 1893: 150, 159).

Thus, in Latour’s interpretation, each of the elements identifiable within an actor-network is to be understood as a monad which, however, ‘is not a part of a whole, but a point of view on all the other entities taken severally and not as a totality’. It can similarly be said that ‘the whole is always smaller than its parts’ since an aggregate is contained in each of its parts and ‘each attribute is nothing but the list of actors making it up’ (Latour et al., 2012: 598, 599). Still following Latour, therefore,

agents cannot be said, strictly speaking, to ‘interact’ with one another: they are one another, or, better, they own one another to begin with, since every item listed to define one entity might also be an item in the list defining another agent. . . . In other words, association is not what happens after individuals have been defined with few properties, but what characterize entities in the first place.

(Latour et al., 2012: 598)

Thus, the elements interacting in a network are themselves the network because they are defined on a case-by-case basis by the characteristics attributed them in virtue of their belonging to a network. The actor-network can thus be envisaged as a social media profile (Latour et al., 2012), which does not exist per se and prior to or outside the network, but embodies a point of view on the network defined by the characteristics of the network itself such as, to remain with the social media metaphor, the links, followers, friends and likes which reiterate its existence and measure its reputation.

In the case of *technoscience* we might say that a scientist's existence depends on citations of his or her work, the grants assigned him/her, his or her belonging to a research group bound up with this, the scientific tools used and the scientific institution belonged to. At the same time, a scientific tool is a specific point of view on other entities identifiable on the network, such as the researchers using it in their experiments and mentioning it in their articles, the firm producing it, the technicians installing it and repairing it when necessary, the functioning standards it accords with which are, in turn, drawn up by other articles in which earlier research set the foundations for the acceptance of this standard.

From this perspective, doubt is cast on the notion of 'social context' too. An expression such as 'technoscience's social context' is thus meaningless as anything technoscientific takes shape as a specific local contingency. However, that there are many local places where technoscience takes place does not mean that what counts is 'the face-to-face encounter between individual, intentional, and purposeful human beings' since the local 'has to be re-dispatched and redistributed' as well (Latour, 2005: 192): *technoscience* is the local configuration of processes that immediately and inevitably lead away from the local. Focusing on situated circumstances or displacing *technoscience* in its local instantiations implies recognizing that

the conditions of the situation are in the situation. There is no such thing as 'context'. The conditional elements of the situation need to be specified in the analysis of the situation itself as they are constitutive of it, not merely surrounding it or framing it or contributing to it. They are it.

(Clarke and Star, 2008: 128)

These locally configured processes can be described, instead, as assemblages in which heterogeneous actors are involved and through which action is distributed. This not only means that action is spread out among several actors (human and non-human, individual and collective), but also that it 'consists of sequences whose order can vary depending on the events (distributed action is organized but cannot be reduced to a preestablished plan)', and that 'none of the participants in the action can be considered independently of the others' (Callon, 2008: 35). Technoscientific assemblages, therefore, can be conceived of as socio-technical *agencements*, where

the word *agencement* has the advantage of being close to the notion of agency: an *agencement* acts, that is, it transforms a situation by producing differences. The modifier 'socio-technical' underscores the fact that the entities which are included in the *agencement* and participate in the actions undertaken are both humans and non-humans.

(Callon, 2008: 38)

From this point of view, *technoscience* can be also interpreted from an ecological perspective, that is ‘by analogy with an ecosystem, and equally important, all the components that constitute the system’ (Star, 1995: 2). It can likewise be regarded as a social world, that is a group of ‘actors “doing things together” . . . and working with shared objects, which in science and technology often include highly specialized tools and technologies’ (Clarke and Star, 2008: 113), even if once a social world is defined as a ‘universe of discourse’, non-humans tend to be marginalized or considered passive instruments depending on humans for their involvement in the action’s processes. On the contrary, technoscience as theoretically framed by ANT recognizes the agency of objects and other non-human actors, despite the fact that such agency is not a quality of the actors but an attribute of the network or, even better, of the actor-network. In this way, the ‘missing masses’ (Latour, 1992) constituted by artefacts, machines, living organisms, cultural products and material elements take up full citizenship within the social phenomena domain. This is why the ‘principle of generalized symmetry’ was brought into STS, that is, the idea that human and not-human must be seen as equally relevant agents within the processes by which actor-networks are assembled (Callon, 1984; Callon and Latour, 1992; Latour, 2005; Law and Hassard, 1999).

It would thus be misleading to see *technoscience* as having the same meaning within different theoretical frames of reference. Nevertheless, the various STS approaches which use the *technoscience* concept – even if with varying scope – share a wider vision designed to recognize the heterogeneity of the elements involved in assembling it. Each of them belongs to different categories with which we have organized and ordered our relationships and built our reality: not only human beings – considered singly or in collectives of various degrees of formality – and their cultural products (norms, texts, artistic work), but also objects, artefacts, machines and natural elements. In sum, everything which can be encompassed by the expression ‘non-human’, whatever the boundary line between this and ‘human’ might be considered to be.³

It is thus not only a matter of recognizing only the ‘proliferation of hybrids’ as a distinctive feature of our society, but also of treating the classifications underpinning this latter as a product rather than a taken-for-granted starting point for sociological analysis.

Hybrids and cyborgs

The progressive affirmation of the *technoscience* concept in the social sciences can also be interpreted as an exemplary case of the *translation* mechanisms to which ANT attributes the assemblages within which both scientific knowledge and technological innovation take shape and consolidate (Callon, 1984; Callon et al., 2001; Latour, 1987, 2005; Law and Hassard, 1999). Essentially, a concept’s success also depends on its capacity to shift from one field of application to another and the interpretive adaptability it has subjected itself to precisely in order

to be usable in ways differing from those initially conceived of by its designer. Its original meaning is thus ‘betrayed’ in a more or less marked way, but this betrayal is the basis of its success.

One of the principal *technoscience* translations is due to Donna Haraway, who declared an interest in using such a concept, ten years on from its advent in STS, ‘to designate dense nodes of human and nonhuman actors that are brought into alliance by the material, social, and semiotic technologies through which what will count as nature and as matters of fact get constituted for – and by – many millions of people’ (Haraway, 1997: 50). The feminist scholar highlighted, however, that, in the context of her thinking on modernity this term ‘also designates a condensation in space and time, a speeding up and concentrating of effects in the webs of knowledge and power’ (Haraway, 1997: 51). In doing so, Haraway moves in some regards away from ANT. She clarifies that

shaped by feminist and left science studies, my own usage works both with and against Latour’s. In Susan Leigh Star’s terms, I believe it less epistemologically, politically, and emotionally powerful to see that there are startling hybrids of the human and nonhuman in technoscience – although I admit to no small amount of fascination – than to ask for whom and how these hybrids work.

(Haraway, 1997: 50)

That is to say that *technoscience* analysis should not remain confined to a descriptive level, simply observing the formation of the networks for which the engagement of heterogeneous actors is required, but has to move on to more politically relevant questions such as those capable of showing that such networks are neither neutral nor what we might call ‘flat’.

Moreover, as *technoscience* entails a call for both human and non-humans to be considered actors in networks, it also contributes to setting up the premises on which Haraway developed her well-known *cyborg* figure. In her words, in fact,

the cyborg is a cybernetic organism, a fusion of the organic and the technical forged in particular, historical, cultural practices. Cyborgs are not about the Machine and the Human, as if such Things and Subjects universally existed. Instead, cyborgs are about specific historical machines and people in intraaction that often turns out to be painfully counterintuitive for the analyst of technoscience.

(Haraway, 1997: 51)

On the basis of such a definition, she is able to show that the landscape of our everyday life is populated by many cyborgs, and therefore that these supposedly ‘strange creatures’ are not solely a matter of science fiction but, on the contrary, a lively demonstration that the categories usually taken-for-granted by modern societies are constantly blurred, as happens in the case of *technoscience*.

As well as *technoscience*, the cyborg is thus a particular instantiation of hybridity, that is, the general topos which occupies a preeminent position within the STS conceptual pantheon. Hybrids echo the proliferation in post-modern societies of entities which are difficult to categorize. This is the case, for example, of artificial intelligence, genetically modified organisms and bodies increasingly enmeshed with technoscientific devices, both mechanical – not only implanted prostheses, but also smartphones, to cite just one of many – and chemical – like drugs – or those shaped through surgery or genome editing techniques. *Technoscience* is thus a concept capable of shedding new light on the fundamental problem of human identity too, thereby intersecting with many other sociological issues, some of which are discussed in other chapters of this book.

‘Flattening’ technoscience

But putting things together – that is, overcoming any distinctions resulting from socially constructed categories, and therefore assuming that technology and science cannot be regarded as separate realms – should not be confused with saying that everything is the same, that matter and cognition, or nature and knowledge, or being, so to speak, at the centre of the network or at its periphery, are the same or that everything can be considered equal. This issue, one that can usefully be labelled ‘the flatness problem’, has been attributed by many authors and in many ways to STS, and to ANT in particular.

Summarising a complex and intriguing debate, it can be said that this problem corresponds to the following question: does refusing to approach technoscience as a set of activities that can be explained, interpreted or simply described as the result of hidden forces – and thus resorting to a more or less sophisticated apparatus of concepts like structure, capitalism, power, interests, domination and so on – mean removing the capability (and willingness) to take a critical stance from the social sciences’ horizon?

This is also a problem with *technoscience* that Haraway addressed, as we have seen.

Here again *technoscience* acts as a sensitizing term, highlighting both a problem and its possible solutions, or at least the importance of taking the issue seriously.

The ‘flatness problem’ has been posed in two main ways. On one hand, it has been disputed that the STS concept of *technoscience* ends up obscuring the fact that society is organized around and through inequalities. Consequently, the traditional line-up of concepts usually deployed by the social sciences to address power cannot be dismissed.⁴ On the other hand, a more subtle critique has been advanced by a number of feminist STS scholars who have observed that the Latourian concept of *technoscience* as a contingent outcome of human and non-human actor assemblage leaves out a truly relevant fact, that is, that something is still lacking even when the ‘ready-made causal explanations’ (Puig de la Bellacasa, 2011: 91) provided by social sciences are recognized as useless if not dangerous for understanding *technoscience* too.

The New Political Sociology of Science (NPSS) can be used as an example of the first kind of criticism towards the analytical flatness supposedly introduced by the STS approaches to *technoscience*. This means that the question comes – we might say – from outside STS. According to these authors,

constructionist approaches in social studies of science have been primarily descriptive, often showing how knowledge practices unfold at the local level. NPSS acknowledges the contingent and constructed character of scientific knowledge but also insists that construction processes are neither random nor randomly distributed.

(Frickel and Moore, 2006: 9)

STS, hence, would not be capable of recognizing that power plays a central role within social processes.

This same line of reasoning has been adopted by others, such as Keller (2017), who stresses the need not to dismiss social science's critical vision, as Latour seems to be doing when he maintains that what we need is not to reveal how facts are constructed by social forces, but to show how they are assembled within a network of actors concerned with being part of it. Or, at least, this is what has been attributed to his well-known plea for moving from 'matter of facts' to 'matter of concerns' (Latour, 2004).

But both critiques would seem to be based on a misleading interpretation of its target.

First and foremost, it can be said that, in general terms, STS analyses *technoscience* by highlighting its situatedness and with a frequently descriptive approach, but this in no way implies that *technoscience* can be understood purely within laboratories or that descriptions of the heterogeneous assemblages it is part of recognize neither differences nor inequalities. If anything, the opposite is true: as we have already stressed, the very notion of *technoscience* leads outside the laboratories right away, demonstrating that what happens within these is closely bound up with a wide network of actors much of which extends outside these. It is precisely in describing the composition of actor-networks that this very internal/external distinction disappears and that, consequently, their heterogeneity necessarily implies diversity.

In particular, what Latour proposes is fundamentally to avoid indulging in easy explanations of social processes, introducing second-level explanations which makes recourse to the conceptual paraphernalia of sociological theory, of the sort that Keller is asking for (Keller, 2017) and which takes us a long way away from these processes, from what actors do and their relationships, to confine them within preconceived interpretative cages and thus hypersimplify our explanations. It is rather a matter of keeping close to the facts (Latour, 2004), namely taking the actors and their relations seriously. Good sociological analysis thus means avoiding the two extremes of scientific determinism on one hand and social determinism on the other.

But how can we keep close to the facts without falling into the determinism or essentialist realism trap? Latour's solution consists in taking what happens and what can be observed seriously without for this reason giving up the peculiarities of the sociological vision which should, however, add facts rather than replacing them with concepts which reduce their relevance – and thus align actors in long relationship chains. The 'facts' we are talking about are thus not 'objective scientific truth' assumed to be valid in an acritical way, but rather a network of relations between 'interested' actors defining what is to be considered 'objective' and what is not, what is to be considered and what excluded, through being 'in relationship'. In this sense, the invitation is to move from a 'matter of thing' to a 'matter of concern'.

Is good social research enough to maintain a critical stance?

Is there thus no room for power, that is, for differences or disparities between actors? There certainly is, but these inequalities are not starting point assumptions but rather analytical finishing lines for social scientists, while the opposite is true for interested actors because for these latter inequalities are taken-for-granted starting points on which to build personal action repertoires (Latour, 2004). Without taking account that ANT has enabled great attention to be paid to *technoscience's* controversial side and staked its claim to be an approach capable not only of describing its characteristics but also of considering its political implications (Callon, Lascoumes and Barthe, 2001; Venturini, 2010).

What the STS approach to technoscience has brought out is a general sociological issue: can an effective analysis of reality alone, according to the ANT approach, for example, bring with it a critical dimension – that is, the ability to highlight non-equal relations, namely power relations – or does it need to be supplemented with a conceptual apparatus concerned with theorizing power relations starting from analysis? Latour tends to the former solution. But others do not. This time they are those who take an STS perspective and rather than adding a second analytical plane they seek to widen the scope of Latour's proposals. Puig de la Bellacasa, for example, is moving in this direction when she proposes an approach to matters of facts/concerns which also encompass the care dimension, with the intention not only of respecting diversity, and what is marginal or even excluded from the contingent configurations potentially assumed by technoscience, but also getting involved in these and their becoming. Her notion of 'matters of care', hence, 'stands for a version of "critical" STS that goes further than assembling existing concerns, yet resists the pitfalls identified by Latour: ready-made explanations, obsessions with power, and the imposition of moral or epistemological norms' (Puig de la Bellacasa, 2011: 100).

This further hybridization between ANT and feminist approaches is designed to achieve a twofold result. On the one hand to recognize the relevance of 'ask[ing] critical questions about who will do the work of care, as well as how to do it and

for whom' and, on the other hand, to pay 'attention and worry for those who can be harmed by an assemblage but whose voices are less valued, as are their concerns and need for care' (Puig de la Bellacasa, 2011: 91–92). But even more important it means not adding ready-made explanation categories but rather extending the analytical gaze by including the awareness that concern should not be structured solely in terms of interests, motivations and worries, but also of care for both others and things. And this would seem to accord fully with the idea of criticism supported by Latour, when he maintains that it is

not the one who debunks, but the one who assembles. The critic is not the one who lifts the rugs from under the feet of the naive believers, but the one who offers the participants arenas in which to gather . . . , the one for whom, if something is constructed, then it means it is fragile and thus in great need of care and caution.

(Latour, 2004: 246)

The question mark over the capacity of the social sciences to continue to exert a critical function regarding what they observe remains open all the same. As argued, among others, by Pellizzoni (2015), we should ask ourselves whether showing the blurring of the distinctions between science, technology and society, between subject and object or language and matter and thus recognizing the processual status of reality in itself implies that we cannot take a distance from what happens and therefore lose the potential for imagining alternative futures together with a less unequal present. But, at least in the case of *technoscience*, it might be enough to recognize that the hybrids generated by *technoscience* raise constant questions about the status and structure of the sociotechnical assemblages they form part of and which they contribute to (re) producing. As a consequence, asking who benefits from such assemblages, who is excluded by them and what stance have the social scientists studying them and thus participating in shaping them should come naturally.

Notes

- 1 The same line of reasoning is to be found in the 'technological determinism' discussion proposed by Sally Wyatt (2008).
- 2 The correspondence with ethnomethodology is here very evident. This communality of perspective and intention between ethnomethodology and ANT is, in fact, explicitly acknowledged by the latter. Ethnomethodology has made a highly significant contribution to the development of STS itself, thanks, for example, to the work of Micheal Lynch and Steve Woolgar.
- 3 Technoscience's especially significant contribution to the development of the debate and research hinging on what is known as 'new materialism' is evident here (Barad, 2007; Braidotti, 2013; Pellizzoni, 2015; Fox and Alldred, 2017).
- 4 But this is a critique that has in general been directed at the STS constructivist approach; see, for example, Winner (1993).

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