ACTOR-NETWORKS: ECOLOGY AND ENTREPRENEURS

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Introduction

The micro-macro controversy has a long history in sociology and within this debate the point of the observability of the macro-social and of the emergence of the macro-actors has a central place. One long-standing tradition of macro-level analysis is Max Weber's (1922) comparative institutional analysis and his central category of *Träger*, the carrier of patterned action orientation. In his account of the formation of western capitalist formation, Weber stressed the carrier role of the doctrine of Calvinist Protestantism, contrasting it with the role of patrimonial bureaucracy in explaining the persistence of Confucianism, and the Brahmin role of stratum carrier in Hinduism. We can hence consider the concept of *Träger* as an antecedent of the actor-network theory notion of "intermediary". Both the *Träger* and the intermediary, in fact, instantiate the actions of macro actor (or a collectivity). When carriers of patterned action instantiate the conduct of macro phenomena, they bring these phenomena to life, i.e. they realize them in *occasioned* ways.

As Jeff Coulter (2001: 39) appropriately wrote: "an adequate appreciation of the role of the 'macro-order' in our everyday lives reveals that such phenomena are variously instantiated in what we say and do and also that our conduct is by no means omnirelevantly linked to 'macro-level' considerations". Discussing the observability of macro phenomena, Coulter (2001) thus suggests that a solution to the "micro-macro" relationship problem could be found in a systematic elucidation of the logic of our communicative practices in our daily circumstances. Accordingly, he recommends putting under scrutiny the usually unproblematic use of "the language of the macro level" in everyday contexts.

In our opinion, this solution should be applied not only to social agents, but to sociologists too, as emphasized by Callon and Latour (1981). In their famous article on the big Leviathan, the two authors called in fact to attention the role of sociologists in "macro structuring" the

reality. In line with their argument, we wish to explore the uses of the language of the macro level within actor-network theory and how this leads to two different versions of ANT.
In the following paragraphs we shall illustrate two versions of actor-network theory - that we labeled “entrepreneurial” and “ecological” – giving an empirical example of their use in two research contexts. By analyzing a technological innovation and an administrative reform, we aim to expose the rhetorical construction of the two macro-actors that can be accounted in the first case for the realization of an energy saving innovation, and, in the second, for the introduction of a managerial accounting system in Italian local administration. We want to argue that the two versions of actor-network theory are constructed around different conceptions of agency: a focused one and a dispersed one. These two versions are not theoretically neutral and in fact they have several methodological implications which lead to different – but not competing – rhetorics of how scientists “macrostructure” the reality they study.

1.1 Two versions of actor-network theory

Actor-network theory’s main concern is both simple and daunting: to find out the implications for sociology and other human sciences stemming from the assumption that “the social” is nothing other than a patterned network of heterogeneous materials – not only people but also machines, animals, texts, money, architectures – kept together by active processes of ordering (Law, 1992).

The approach has never been really codified into a fully-fledged theory and is better described as an interpretive sensitivity and a literary genre. Scholars adopting this approach might be seen as a discursive community connoted by the shared use of a number of concepts and metaphors (e.g., translation, intermediary, actor-network) and the acceptance of two major ontological principles: material relationalism and ontological performativity.

The principle of material relationalism states that all entities (people, concepts and actions) take their form and acquire their attributes as a consequence of their relations with other entities (Law, 1999:3). This claim is hardly new, especially within the non-positivist European tradition of social philosophy. Three tenets, however, make this approach different from other post-structuralist traditions:

a) ANT doesn’t affirm that there are no divisions or that anything goes, but simply that divisions and distinctions (what counts as natural or social, what counts as human and non human, what counts as micro and macro) are to be understood as effects, material and

discursive outcomes and as such they should always investigated empirically using the methodological principle of "following the actors and their actions" (Hughes, 1971);

b) This material semiotic principle applies to all entities and not only to humans and human products; the approach therefore does not limit its focus to language, discourse or human interactions. Instead, it grants equal citizenship to a range of heterogeneous materials (technologies, artifacts, symbols, places) that become active players in the processes of ordering – although not necessarily as volitional and intentional "actors" (Brown and Capdevila, 1999).

c) The principle of ontological performativity states that all entities are *performed* in, by, and through the relationships in which they are involved: stability is the result of an effort, not an intrinsic quality of things (Law, 1999). The order and "nature" of thing is therefore always a reversible and uncertain *outcome*, an effect of operations, maneuvers and processes that keep things in place. All entities (scientific facts, societies, technological systems, and symbolic artifacts) are the effects of a performance, no matter how stable this effect actually may appear at any point in time.

The challenge posed by ANT is therefore how to study and explain how the durable orderings are achieved, how facts become such, how order is performed, how things are put in place and stay that way, and how change comes about. This makes ANT a processual and open-ended sociology, a sort of hologrammatic approach that turns literally everything into a phenomenon worth studying. It is no surprise, then, that the ANT approach, originally focused on the study of science and scientists at work, has been applied to a variety of areas of research, from technology studies to medicine, from organization study to art and architecture.

The notion of *translation* is central for this approach. It has both a geometric and a semiotic meaning: translation is both the movement of an entity in space and time, as well as its translation with from one context to another – as in translating from one language to another, with the necessary transformation of meaning that this always implies. What is important to emphasize, however, is that actor-networks, unlike telephone networks or the World Wide Web, do not pre-exist the process of translation. As Latour (1999) pointed out, one should be speaking of actor-networking rather than actor-networks, to emphasize relational effects that recursively generate and reproduce themselves thanks to the maneuvers and strategies of translation. In other terms translation is performed trough translating practices.

Applied to study of innovations, ANT approach means that the weaving of the network, the

constitution of the innovation and its circulation cannot be considered separately at any point of the life cycle of the innovation. While the process is easily visible early in the history of any technology, it is often forgotten that translations continue throughout its existence. The fact that they become invisible or taken for granted should not obscure the fact that they are kept in existence by a heterogeneous network of people and artifacts. Any translation is the result of the active work of heterogeneous "carriers" (intermediaries or *Träger*) that in the process find a place or are locked into place.

In ANT intermediaries play a fundamental role and intermediary is anything that circulates between actors and helps define the relation between them. The notion of intermediary covers diverse and heterogeneous materials such as drawings, texts and inscriptions (reports, scientific articles, laws and regulations, stories, etc), software, disciplined bodies, contracts, money. An intermediary is the visible effect of the work of assembling heterogeneous materials performed by any actor that seeks to impose its own version of reality on others. It represents that actor in the double sense of "standing for" and "acting on behalf of" it because the actor who/that has constituted the intermediary uses it to achieve an effect from a distance. For example, every artifact distributes specific roles to humans and non-humans comprised in the network that it institutes. Who is its probable user? How should the artifact be used? What other artifacts or intermediaries must be mobilized to make it usable? Who attends to its maintenance? What types of interaction are permissible for the user and the artifact? (Akrich, 1993). The artifact thus becomes the intermediary of the desires, expectations and control efforts of those who have created it. But the designers can only do their best to impose their vision on the users: once inserted in the network that they themselves have created, the artifact/intermediary will be interpreted according to the needs of the local situation of use (Callon, 1980; Suchman, 1987; Law and Callon, 1992).

When an actor places an intermediary in circulation, it seeks to define, from its own point of view, the number of other actors, their place in the world, their characteristics, the nature of their relations, and their position vis-à-vis the actor attempting the translation. ANT investigates and describes the strategies, tricks, maneuvers, actions and enterprises with which individual or collective actors undertake translations in order to consolidate the network that supports them and to make it as permanent as possible.

Different authors within ANT tackle this issue in slightly different ways. Latour (1987, 1988), Callon (1986a), Lea et al. (1995), and Graham (1998), adopt and describe the emergence of actor-networks in heroic stories of ordering in which individual people or small

groups of actors – scientists, technologists or engineers – actively carry out the task of assembling the network and making it into a centre of authority. The rhetoric used to narrate these stories of translation may be defined "entrepreneurial" since it rests on the role of powerful actors and their capacity to mobilize relevant resources.

Other authors, usually with a symbolic-interactionist background, embrace a more ecological approach, and describe the process in terms of "ecology of action", the partially planned and partially fortuitous coming together and alignment of "social worlds" (Star and Greisemer, 1989; Collins and Yearly, 1992; Fujimura, 1995; Suchman, 2000). Apart from the term "intermediaries", more specific terms are used to describe intermediaries with special qualities, such as "boundary objects" (Star and Greisemer, 1989) and "standardized package" (Fujimura, 1995). The rhetoric used to narrate these stories of translation may be defined "ecological" since it rests on the intricacies of actors' relationships and pay a greater attention to powerless actors or "dissidents" within the enrolled actors.

All authors, however, agree that a critical condition for the emergence of an actor-network is the creation of intermediaries that are sufficiently defined and durable to travel in the world as recognizable entities and that can connect actors. These intermediaries, however, need also to be sufficiently plastic to change locally in order to suit the situated conditions of the interests of those who become part of the network. Nevertheless, the two rhetorics differ in the way they identify the protagonist actors and how their existence is related to the construction of the macro actor.

In fact, Star (1991) and Michael (1996) point out that the classic version of ANT has a tendency to focus on powerful actors disregarding how dissidents contribute to the stabilization of the network (see also Vickers and Fox, and Halverson and Keller, in this volume). Star (1991:43) intends to illuminate the danger of describing the actor network from the point of view of the big and powerful actors: "A stabilized network is only stable for some, and that is for those who are members of the community of practice who form/use/maintain it. And part of the public stability of a standardized network often involves the private suffering of those who are not standard, who must use the standard network, but are also non-members of the community of practice". Michael (1996) goes even further, arguing that trivial actors who are both insiders and outsiders make it possible to stabilize an actor network. The difference with Latour or Callon is subtle but relevant.

In his study of the domestication of the scallops at St Brieuc Bay Callon (1986a) does not illustrate how the un-enrolled actors are generated and whether the dissidents play a role. In a

similar fashion, Latour (1987) suggests that entities that have been offered to be enrolled may give three possible responses to the proposition: they can accept, dispute, or disregard the offer. The first response denotes that actors to be enrolled submit, willingly or reluctantly, to the enrolling actors; the second means that in rejecting the proposition by enrolling actors, they are looking for other actors interested to develop an anti-program; and the third response means that they disregard the proposition without entering in a conflict with the enrolling actors. Since Latour and Callon's rhetoric focuses on the protagonist actors, they scarcely consider the contribution to the stabilization of the actor network by those who dispute or disregard the enrolling actors' propositions. As we shall show, this has several methodological consequences. We wish to address them in the light of two research projects that we shall describe using in turn the entrepreneurial and the ecological rhetoric.

Entrepreneurial tactics of translation

Michel Callon identified a recurrent pattern of maneuvers used for translating an innovation (Callon, 1986a; b; see also Holms tom and Robe in this volume). The pattern consists of four typical phases and it delineates a methodology for empirical research:

> *Problematization*, in which an initial set of actors define (or redefine) a problem and offer itself as a solution. The goal is to make the new definition recognizable for others, makes its acceptance *an obligatory passage point* for entering the network, and become indispensable in the process.
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> *Interessement*: by which each entity that passed through the obligatory passage point is locked into place so that their reciprocal relations are invested by some interest. The process of interessement always begins with an interruption maneuver, which eliminates alternative problematizations and enrolments. Once the relations have been specified, a pattern of exchange emerges establishing what each of the entities will get in return for getting itself involved in the network.
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> *Enrolment*: in which the entities in emerging network are coordinated and aligned. Every enrolment always involves some sort of negotiation, and it proceeds by trial and error.
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> *Mobilization*: in which the network starts to speak as one, so to say. In this way the network starts to operate as a recognizable "actor" and can produce some effect in the world through its intermediaries.

Callon's methodology may be interpreted also as a narrative trajectory (Czarniawska, 2003) in which the plot is organized around the main characters: the emergence of each actor-network is by definition a unique and unrepeatable chain of events, a situated process that must be investigated empirically according to its historical and contextual circumstances; actor networks grow incrementally, gathering the necessary resources and convincing a sufficient number of others to take up and pass on whatever is at stake (a scientific fact, a technological innovation, a new managerial practice); at some points it imposes itself as a "macro actor ". Callon's model give rise to a version of ANT based on a rhetoric which values the entrepreneurial action and bears a conception of agency that we can label "focused" around the protagonist actors.

In what follows, we will show how an entrepreneurial model of translation may be applied to describe the take-up of an advanced energy-efficient technology. In our example, an innovation in an Italian SME (Holti and Nicolini, 1999; Gherardi et al., 1999; Nicolini and Gherardi, 2001) we shall focus on how people and other entities associate into a stable actor network and make the innovation happen in practice.[1]

Introducing Wasser

"Wasser" is the pseudonym for one of the leading producers of mineral water and carbonated beverages in Italy. Founded in 1981 and purchased in the mid-1990s by a multinational group operating in the food sector, Wasser is a striking example of business success. Thanks to its large number of innovative products and an aggressive marketing strategy, for more than a decade the company has achieved an extraordinary rate of growth, with an average increase in gross turnover of 45% per year.

At the time of the study, Wasser employed around 200 people, with a further 200-300 people involved in the sub-contracted handling, transport, and supply of materials and components. The business is divided into two formally independent companies, although they are closely integrated both functionally and physically. One of these companies produces the plastic bottles, while the other handles the bottling and marketing of the products. The production of PET (polyurethane) bottles is a crucial for Wasser and one of the main reasons for the company's success. PET is particularly suited to the packaging of food products because of its

1 The Wasser case study was conducted as part of the SORGET project (Holti and Nicolini, 1998) funded in part by the European commission in the framework of JOULE III.

chemical stability, resistance and hygiene. Wasser was one of the first companies in Italy to realize the material's versatility and to use it for carbonated beverages, after introducing a number of modifications to the shape of the bottle and to the packaging process.

At the beginning of the 1990s Wasser entered a phase of rapid expansion: general growth of demand and a substantial increase in the company's market share enabled it to double its turnover and output every two years. However, in the same period Wasser reached saturation point in its productive capacity, especially as regards the manufacture of PET bottles. Market forecasts predicted further growth, which the company was unable to meet. It therefore rapidly put plans in place to purchase new machinery, but increased production was thwarted by another fundamental problem: the company did not have access to sufficient quantities of energy to sustain the production process.

The company first sought to undertake a well-grounded and institutionalized transaction by applying to ENEL, the national electricity grid. However, the translation failed because ENEL was unable to complete construction of a 15 MW power line, a project by now in progress for years: it failed to mobilize and align the relative network, which comprised, among others, local administrations, landowners and environmentalist movements incapable of reaching agreement.

Wasser was therefore compelled to fall back on a different solution and to devise a different approach, this time also creating an actor-network capable of sustaining it. The management of the company instructed the technical director and gave him broad decision-making powers. He was a problem in search of a solution.

As he set about building the network, a first important element appeared that suggested a strategy to mobilize the network centered on the content of the project. This was the Italian government in its intermediate form of recent legislation (laws 9/91 and 10/91) that, for the first time in decades, allowed companies to self-produce electricity to meet their energy requirements.

Since the end of the 1950s, energy production in Italy had been monopolized by the state through the existence of ENEL, the national grid and power agency. The nationalization of the system came about through a set of laws regulating exemptions to the monopoly, which invariably imposed heavy fiscal and legal impediments on those who decided to purchase electricity from sources other than ENEL. During the late 1980s, however, the governments of the time began to modify the system in an attempt to reduce the energy bill, one of the most

costly items in the country's foreign trade balance. In 1991 the regulations on energy production and delivery were modified: self-production was liberalized and it was allowed to use the publicly owned grid to deliver electricity produced by private companies. Incentives were also put in place to encourage the construction of co-generation plants, for example in the form of reduced charges for methane gas and tax relief on fuel and electricity. However, the law imposed specific obligations and complex application procedures for the grants, among them the obligation to notify and document the beginning and completion of construction work, regulations on maintenance and operation, as well as an obligation on companies using more than 10000 TEP/year (which was the case of Wasser) to appoint an "energy manager".

The amended legislation therefore introduced an initial frame of problematization by suggesting the option of electricity self-production. The purpose of the monetary incentive introduced by the law was precisely to promote some socio-technical configurations over others in view of the political and economic interests represented by the policy makers.

A framework of problematization

This emerging framework of problematization was reinforced by the Wasser manager's encounter with ITALGAS, a recently privatized company that supplied natural gas. The ITALGAS business consultancy office acted as intermediary between its network of people and that represented by the Wasser Technical Director, offering two types of support: limited-period price reductions, and access to a large stock of expertise, contacts and experience in the use of gas generators for the self-production of electricity.

ITALGAS consultants were interested in pursuing problematization of Wasser's needs, since this would create greater demand for their product. Based on this Problematization, the project would constitute an enduring obligatory passage point between Wasser and ITALGAS, with Wasser being enrolled as a client – so that a fair exchange would result from the process.

Once a framework of problematization was put in place, Wasser's Technical Director – who thus far had operated as a solitary entrepreneur – turned his attention to potential allies, who could perform the successful translation of the innovation. He assumed the role of a "client", the entity that defines a space of negotiation within a frame of problematization for other to fill. His task was now to find another actor capable of acting as the "engine" providing the energy and turning the existing problematization into an innovative practice.

The Technical Director first tried to exploit a previous translation and consulted one of Wasser's machinery suppliers (existing contacts required less effort and had already proved to be reliable). The supplier in question had in the past been able to constitute a dependable and aligned network – which in business terms means being able to deliver the product/service promised. However, it turned out that the solution resulting from the supplier's mobilization of the appropriate configuration (a medium-sized generator) would not have resolved Wasser's future difficulties, and was therefore judged impracticable. The process of interessement had failed to succeed. The Technical Director was consequently compelled to abandon familiar routes and to establish new relations. He reverted to the most rudimentary and least effective process of interessement: a competitive tender. This process, unlike a partnership, for example, requires both parties to speculate on the nature of the outcome of the translation and commit upfront to the necessary resources. As a consequence of this uncertainty, risk is generated and prices are artificially increased.

The results of the initial framework of problematization and the configuration the emerging national network (the laws 9/91 and 10/91 and ITALGAS) were reflected in the tender that prefigured content of the project as an innovative technology for combined electricity/steam self-production (co-generation) using natural gas. On this basis Wasser sought a supplier capable of assembling all the pieces of the local system (gas, turbine, funding).

How interessement is performed

One of the suppliers invited by Wasser to submit a tender was "Motor", the fictitious name of a medium-sized co-operative for industrial installations. Motor had considerable experience in co-generation and had installed a variety of systems, developing distinctive competence in the use of small gas-driven engines for co-generation systems and also in the formal and bureaucratic procedures required to obtain all the benefits available.

Motor initially responded by submitting a tender for a natural gas turbine, which was still the most viable solution within the framework set by Wasser. However, this meant that Motor would have to compete against a number of other highly experienced companies producing the same type of system. Unlike its competitors, however, Motor could also offer an alternative to the turbine, namely its natural gas engine and it therefore had a broader range of options in which to "construct" Wasser's problem.

Motor then sought to impose a new problematization that, if successful, would enable it to act

as the obligatory passage point, thereby cutting out other alternatives and obtaining a decisive advantage over its competitors. If Wasser decided to adopt the gas engine rather than the turbine, Motor would become the only actor able to perform the translation. Motor's position as obligatory passage point depended, however, on its ability to mobilize the gas engine, or in other words, to construct an actor-network predicated on its problematization. In fact, the viability of the socio-material hybrid was still largely hypothetical: no other company in Europe had developed a gas engine of the size needed by Wasser. This required extension of the interessement to include a further actor: a Norwegian manufacturer of marine engines with which Motor had collaborated in the past. The Norwegian company understood that the project was an opportunity to develop a new market for its engines. The company therefore co-operated to the fullest extent, but with a view of an investment rather than an immediate monetary return. It offered a set of intermediaries of its own that enabled Wasser to mobilize the gas engine as if it was a docile and malleable entity (although, as we shall shortly see, this was not entirely the case).

Using a new set of intermediaries (statistics, technical drawings, and plans), Motor simulated a different translation, which promised specific results in exchange for a "possibility space" and the necessary resources. Among the latter was an undertaking to obtain grants under Act 10/91: the possibility space consisted of a space of constraints and possibilities. Having received every assurance, the Wasser Technical Director gave the go-ahead for adoption of the gas-engine co-generation system.

Trials and failures of enrolment

Now that Motor had put in place a potential regime of interests within the actor network, it set about engineering heterogeneous elements to create a network able to produce the co-generation system.

Besides Motor, the actor-network comprised a variety of other human and non-human agents: Wasser's production cycles, the Norwegian marine engine company with its network of suppliers, the gas engine, local planning regulations, the expert consultant on government financing, building firms, a particularly rainy winter, the transport system between the South and North of Europe, the government bureaucracy, the gas company, and finally Wasser's already-existing plant, which could not be easily adapted to the new system. The collective creator of the co-generation system was the actor-network composed of these elements and

their complex interactions and translations orchestrated, but only in part, by Motor. Motor's task was to align and interest the network's various social elements, human and non-human.

For example, their endeavor to align one of the key translations – the gas engine – revealed the precariousness and risk involved in every investment in form: the engine components refused to allow themselves to be mobilized and aligned as the Norwegian company and Motor had envisaged. Like all the other heterogeneous elements that made up the actor-network, the gas engine was in its turn a socio-technical system held together by processes and mechanisms that, having been strategically concealed under the label " large engine", suddenly became visible when a breakdown occurred. In the case of the gas engine, for example, it became evident that it was not possible to find a shaft of the necessary dimensions, nor could one be produced within the time allocated to the network. The engine shaft, in fact, was in its turn the product/result of a further association of actors that now came to the fore because it, too, resisted mobilization and alignment.

The first enrolment therefore failed and Motor was obliged to re-negotiate the results promised, in effect reiterating the whole process: through a new problematization it persuaded Wasser to utilize not one but two gas engines, since a pair of them would give greater flexibility to the system (when one was switched off for maintenance the other could continue to produce energy). The installation of two engines would also mean that smaller engine shafts could be used, and these were readily available following the failure of another project. The negotiation only involved Wasser, so the change did not affect the interests of the other actors in the network. Wasser accepted the new conditions as the regime of interests was still convenient, and the local network was able to continue with its work of constructing the innovation.

Despite this re-problematization, however, the engine still resisted enrolment with the other elements: the cylinders had been designed for diesel, and they tended to crack when gas was used. The Norwegian company began further negotiations, this time directly with the engine in the form of a set of technical drawings and resistance graphs. After several attempts, the elements were repositioned and interested, and the system was re-designed and modified in order to render the socio-technical system sufficiently docile and predictable, ready to be aligned with the other elements of the actor-network.

The next stage involved a further series of negotiations within the actor-network. The various delays had in fact shifted the starting date for the construction work to a period of bad weather, during which, amongst other things, the firm contracted to build the masonry

infrastructure had other commitments. Any postponement, however, was out of the question, given Wasser's production schedules. Once again, the negotiation involved a heterogeneous set of both social (the engineers and managers of Motor and the building firm) and material elements (Wasser's production system, the weather). As in all ANT stories, the narration could be taken to a further level of detail. For the purpose of the present paper, however, we'll stop here.

Mobilization and closure

Our story has a happy ending. After some months, Motor delivered the advanced 5.2 MW co-generation system to Wasser. The plant generated electricity by means of two natural-gas-driven 8-cycle engines adapted from marine use (rather than turbines); hot water for sanitary use (from the engine cooling system); steam for technological and productive uses and for refrigeration by means of a steam heat exchanger (from exhaust gases); and finally further hot water, which traversed another water exchange to produce further refrigeration (evaporation towers). The overall yield was more than 70 per cent.

The system translated into practice the notion of energy efficient technology promoted by the law. At organizational level, the translation was anchored in Wasser by the appointment of an "Energy Manager", a young engineer hired to supervise the co-generation system but also to implement the company's energy-saving policy. On the basis of his mandate, and because he worked in the Wasser network, the engineer had no difficulty in mobilizing resources and influence to promote the adoption of other advanced energy technologies. By adopting the co-generator, Wasser acquired a new means with which to cope with its energy problems and institutionalized an energy-saving culture.

The entrepreneurial version of ANT

As illustrated by the Wasser case, the narrative trajectory outlined by Callon's methodology, and performed through the heroic rhetoric, focuses on the protagonist actors, who/which instantiate the action model of the entrepreneur. At the core of the entrepreneurial version of ANT there is a conception of agency restricted to a bounded set of actors, whose actions create associations, mobilize intermediaries, and stabilize a macro actor. It should be noted that not all the networks become macro-actors, but only *the successful one*s: only the

networks whose program won the resistance of the anti-program were able to stabilize the associations and convincingly present themselves as a macro actors.

We wish to label this conception of agency "focused". "Focused agency" is based on a restricted number of actants and a conception of action as a direct doing. In this way, focused agency has all the characteristics of the idealtypical entrepreneurial undertaking.

In contrast to this entrepreneurial version of ANT, in the next session we illustrate its ecological counterpart.

1.2 Ecological tactics of translation

A second version of ANT which accounts for the construction of actor networks can be found in the research carried out by Joan Fujimura (1995), who studied the take-up of the proto-oncogene approach to the study and diagnosis of cancer in the 1970s and 1980s. She suggested that the process through which "an innovation becomes the ruler over a realm" includes a number of typical steps or phases such as:

- The labeling of the innovation,
- The establishment of the innovation as a obligatory point of passage,
- The emergence of the innovation as a distributed centre of authority,
- The establishment of mutual interest within the network,
- The search for and the enrolment of new allies,
- The standardization of the innovation,
- The closure of the translation and the institutionalization of the relative actor-network.

In our second case[2], we apply Fujimura's model to understand how innovations are shaped by the actor network in which they occur, how such network tries to impose itself as a "bandwagon", and how it convinces others to get on board. The case describes the introduction of a new management accounting system in the Italian local government (Lippi, 1998; 2000; Gherardi 1998; Gherardi and Lippi, 2000).

[2] The research on the introduction of management accounting in the Italian Local government was conducted with the support of a CNR grant (n.9601336. CT10).

The bandwagon is put in motion

For many years all European public administrations have been the subject of an increasing drive toward homogenization and alignment (Metcalfe, 1993). Central to the effort to change the culture and practices of many European bureaucracies is the introduction of innovative management accounting systems and languages (Gherardi and Jacobsson, 2000). As many authors note, the introduction of these systems is nothing short of a hidden revolution. These practices attempt in fact to substitute the traditional administrative logic of action, based on the notion of execution and fulfillment, with another, based on the notion of goals, results, and accountability. Following an increasing pressure both from the European Commission and from sectors of the public, in the early 1990's even the proverbially conservative Italian public administration started the process of introducing new accounting systems in local government.

Two major laws (142/90 and implementation law 29/93) officially marked the beginning of this process. Prior to the issuing of the laws, however, a number of isolated attempts to introduce these techniques had already taken place. These were the work of pioneers, who developed experimental local systems of management accounting on the basis of the ideas of some administrators or academics, accountants or consultants keen to implement innovations already in place elsewhere (Lippi, 1998; 2000).

The two laws, and especially 29/93, had the effect of putting a common label on all these isolated experiments thus creating a *quasi-object*, equivocally named "internal control systems" that all local administrations had to take up. The name was intentionally chosen as contrast to the traditional "external controls" of legitimacy and legal compliance to which all local authorities in Italy are subject. The emphasis was to be put on the calculus of costs and benefits in the work of local authorities. According to Fujimura's model, this was the phase when the labeling of the innovation took place.

The emergence of heterogeneous actors

The Act of Parliament had a twofold effect: it instituted relations between the previously unrelated experiences through a labeling process, and established the internal control system

as an obligatory point of passage. In response, a small community experimenting in management accounting started to attract the interest of potential allies. These were the Central School of Administration, interested to acquire more centrality and clout in the public sector; selected professionals and consultants, who envisioned an outstanding business opportunity; and policy makers, who hoped to generate reform that they could ride for electoral purposes. Together they formed a still scarcely visible interest group that nevertheless managed to generate a few further experimental implementations of the new laws.

The translation of the law in actual accounting practices became possible, however, only through the recruitment of a number of new members to the growing network, both human and non-human: accountants in the local authorities, consultants, new accounting solutions, and software. Local authority chief accountants and accounting managers came on board in hoping for the increased centrality of their work. They brought to the network their situated knowledge of how accounting systems work in their contexts, as well as the capacity to navigate and operate within the labyrinths of existing documents and legal constraints. From the network, they received access to a new practice, and the opportunity to form a community of practice that would give them the chance to feel and behave differently from their colleagues and in this way possibly obtain career and prestige advantage.

Consultants (and practice-oriented academics) played a central role by brokering know-how from the private to the public sector and circulating the results of the experiences of the diverse local authorities. In return, they secured project work and improved their market position thanks to their association with innovative practices.

Non-humans also played a central role in the process. The existing balance sheet had been specifically created to support financial budgetary activities and for this reasons it was bound to constitute a hinder to change. It was necessary to generate a new type of balance sheets that would comply with the existing regulations and legal constraints while, at the same time, introducing a rudimentary budgetary process, albeit limited to some of the services provided by the local authorities. New accounting software needed to be written to allow classification of existing data in two separate categories, financial and economic, depending on the specific local objectives and constraints. Better versions of such software were intensively circulated within the network and often customized and rewritten locally, so that it became an active intermediary between the human members of the network.

Taken together, these human and non-human entities formed a heterogeneous network that

literally constituted the overall accounting innovation while circulating it. Through the comparison between solutions developed in one administration or in another, their adaptation, and the circulation of locally developed software and documentation, the network created the innovation while the innovation sustained the network and its components. The emergence of similar practices in different locations started to connote the network as a "distributed center of authority" that provided the network, its knowledge and its innovation with increasing legitimacy. At the same time, the originally empty label "internal control" started to acquire a practical and material sense, and to assume the characteristic of a standardized practice that could cement relations within the network responsible for its generation and circulation.

The actor-network fails to produce a standardized practice: the obligatory point of passage is not that obligatory after all

In spite of all the above, the number of local translations of the internal control practice was still very limited, in that one year after the law, only 40 local authorities, over a total number of several thousands, moved toward practical application of the new laws. The circulation of the innovation promoted by the small bandwagon was in fact bumping into a number of more or less active obstacles put up by other actors, practices and artifacts.

For example, other human actors, both politicians and bureaucrats, resisted or sabotaged the innovation because of the threat it posed to their discretionary power and because of the extra workload it would introduce. They used a number of strategies to subtract energy from the network that was actively translating the innovation. First, the issue was simply downplayed and didn't make its way in the management agenda. Second, in local authorities where the matter was brought to the attention of the political forum, it was relegated as a "staff issue" and thus marginalized, both geographically and cognitively, within the administrations. Third, in many cases the innovation was reduced to a ritualistic practice, e.g., in local authorities where data were collected but not used.

Non-humans also posed serious obstacles. In order for the new, double (financial and economic) system to work, the old financial accounts needed to be literally taken apart so that their blocks could be re-assembled for a different purpose. This required an effort and clarity of purpose that in many circumstances was beyond the thrust provided by the existing administrators. In other cases, the old budgetary system and practices proved so resilient that the new economic categories were build as a mirror to the old financial ones, so that the

transposition of data was highly simplified, although this meant diluting the innovative purpose of the new accounting system. Finally, in many cases data were simply not available in a format compatible with the new software, and the production of the correct data required a complete redesign of the internal structure of the organization that was beyond the reach of the local administrators.

In all cases, the governmental innovation network failed to create alliances with locally critical actors, both humans and non-humans. The result was often a superficial and ritualistic adoption that allowed the officials to preserve the formal accountability without allowing for substantial change.

These local forms of counter programs were compounded by a fragmentation of the constituency within the actor network. Different actors, such as consultants, newly born associations of controllers, and software houses, actively promoted different (and to a certain extent incompatible) version of the innovation, with the result of preventing the network from producing a stable, standardized new accounting practice. This weakened considerably the position of the network as a center of authority. As a consequence, the action network failed to gain the necessary legitimacy: the caravan never got enough momentum to force others to get on board hence failing to attract people.

Twice around

At this point, the energy put in place by the initial bandwagon could not overcome the existing counteracting forces. The Government, who had pulled out of the process hoping that it could develop its own momentum, intervened again by issuing a new law in 1995. This time the law was very detailed and contained precise implementation routes and prescriptions that incorporated some of the lessons learned in the first wave of implementations. Most important, it clearly set the new accounting system within the context of a wider attempt to introduce a culture of management control within local authorities. In tune with the new approach to the budgeting process, local authorities were now required to develop formal "business plans" that the new accounting system would help to monitor.

The 1995 law constituted a new obligatory point of passage that strengthened the relations within the existing actors in the caravan, providing it with new legitimacy and visibility. Moreover, by linking accounting to strategic planning it turned the politicians from potential

opponents into allies of the new accounting system.

Pressed by the new law, a growing number of local authorities embarked on an effort to translate its prescriptions into practice. Their first move was to turn to the first generation of implementers for guidance and direction. The interest to enter an alliance was reciprocal: newcomers wanted to avoid costly mistakes and speed up the implementation, while the pioneers could increase their centrality and bring their previous efforts to fruition. Nevertheless, the ensuing process was far from a "transfer of lesson learned" from the former to the latter. The bandwagon that was emerging around the new wave of innovative accounting systems consisted of a *different* endowment of intermediaries (tools, practices, software, documents) from the existing "internal controls". In particular, the nature of this second generation of "local authority management accounting systems" was strongly influenced by the emergence of a new, critical human actor: the controller.

"Controller" was the name that the local practitioners involved in the translation of the new accounting systems adopted for distinguishing themselves from the "old" accountants. This attempt to gain a semi-professional status went hand-in-hand with an attempt to clarify the nature and common characteristics of the innovation upon which their identity was based. In so doing, they personified the consolidation of the innovation and sped up its standardization and closure.

As in the first wave, the process of translation of the laws at local level gave rise to different approaches ("schools of thought"); a number of variations developed to suit specific needs and constraints kept together by relationships between controllers and by a set of material intermediaries that constituted a mix of the first and second generation of translations. The intense negotiation and exchange within (and between) the two networks, made possible by the circulation of material and human intermediaries, and by meetings and conferences, allowed the incremental emergence of a defined and standardized practice. This was a reduced version of a management accounting system, which associated and integrated the lessons learned during the first generation, the constraints put forward by the new 1995 law, the compromises necessary to enlist politicians, the old budgetary processes and the existing software. It was also very different from the "internal controls". Nevertheless, the emerging new accounting practice permitted to enroll yet more allies. It was in fact this minimalist approach, the relative simplicity of the processes involved, and the adherence to the existing bureaucratic practices that were the basis of its (moderate) success.

Closure and its enemies

Thus, the enlarged bandwagon needed to impose itself as a distributed center of authority, which in turn required standardization of the innovation for it to function as an intermediary between the different actors. The new, more consolidated actor network could make the new accounting practice, and this practice would give the more power to the network. Unfortunately, the process of enrolling local allies and circulating the innovation to enlarge the basis of consensus also constituted a continuous risk for the survival of the actor network itself. Each implementation in a local administration became an opportunity to pry open the existing alliances, and to weaken the authority of the distributed center, by making the innovation more ambiguous and undefined. The very nature of the translation contains the seed of its possible failure, in the form of an enduring risk of unraveling of the network of associations already in place. In fact, this is exactly what started to happen with the second-generation implementation of the "minimal controls" version of the management accounting system. The innovation was still too weak to become an irresistible force of attraction, and to generate anxiety over non-compliance in non-adopters. Its weakness lay in part in the ambiguity deriving from its persistent non-standardization: it translation into practice still required too much effort and local activity of coalition–building, so that uninterested or suspicious officials had an easy task in putting in place any of the counter-strategies described above.

Unlike in the success story told by Fujimura (1995), in which the closure and institutionalization of the innovative "oncogene", i.e. standardized package of theory and practice of cancer research was sanctioned by the award of the Nobel price for one of the leading network builders, in our case the innovation did not achieve such a neat final closure. After almost ten years of attempts and drawbacks, the actor network was still in the making. In order to prevent a decrease in the utilization of innovative management accounting and planning practices, in 1999 the parliament intervened yet again issuing a new law (law 286/99) which established that all local authorities had to implement at least the version of management accounting emerging from the second generation of translations. In this way, one may say, the Parliament operated a closure and finally cemented existing alliances. The result was a consolidation of the network and a new injection of energy into the process that is very much still in progress as we write.

The meaning of the described process rests in highlighting the issue of power in the construction of an actor network. We can easily see how the State made use of its legislative power and had a direct impact in putting in motion a legitimized bandwagon of innovators who acted as enrolling agents, but what we saw, as the process moved on, was the power of the partially enrolled or dis-enrolled actors – human and non-human- in disputing or disregarding the propositions of the innovators in the bandwagon. Nevertheless the bandwagon moved on, the slow process of negotiation over the meaning of "internal control system" went on and on and the State was forced to issue new laws in a progressive definition of what can legitimately been taken as the proper meaning of "internal control". In fact the last law provides six categories for interpreting what is "control" in a public administration. The power of the dissidents is illustrated both by the emergence of anti-programs which try to enroll new humans and text and technologies into a model of "control system" which fight to achieve the legitimacy of "the proper interpretation" of the spirit of the law, and by the inertia of those who disregard the law and do not do anything at all or do the minimum as a lip service to it. They are not the protagonists but their participation is necessary to stabilize the actor network and in so doing they offer stability and legitimation to the emerging macro actor.

The ecological version of ANT

The case of the accounting practices innovation in the Italian local administrations illustrates a narrative trajectory in which powerful and powerless actants come in contact, mutually define each other and, willingly or reluctantly, are caught in the same process since they are interdependent. We can say that in this case the protagonist in the plot is not a human or a non-human actant as much as the interdependency of activity and passivity. The conception of agency that is at the core of what we termed the ecological version of ANT may be labeled "dispersed agency", meaning that its sources and forms are varied, and that they variably contribute to the emergence of a macro actor both through doing and not doing. The conception of action is accordingly less focused on the model "actors making thing to happen", and more ecological, in the sense of putting emphasis on the context, on the reciprocal change of actors and situations, and on the negotiated nature of social order (even when negotiations are not apparent). The rhetoric that sustains this version of ANT is less

heroic and more quotidian, in the dual sense of unremarkable and daily; it is a rhetoric where actions and actors unfold and take shape in the time dimension of everyday matters.

1.3 Concluding remarks

In portraying two versions of ANT – an entrepreneurial and an ecological one– we want to join those who question the unproblematic use of "the language of the macro level" in the context of writing and researching. ANT has been highly influential in re-opening the micro-macro debate and in forging a research methodology that escapes from the actor/system divide (and other similar dichotomies). In so doing, ANT has focused on the role of the categories that the researcher uses for explaining what s/he is interested in studying and how his/her categorization would construct the object of study. In our opinion, ANT has not been reflexive enough on its language of the macro level. We wish to contribute to this reflection not by contrasting one version to the other, but by questioning their assumptions and exploring where their differences lead.

We argue that these two models are not in conflict, for they focus on different aspects of the emergence of a macro actor. While the entrepreneurial model is based on a research methodology which privileges the protagonists and develops a narrative trajectory and a plot which revolves around their action, the ecological model favors an approach that privileges the actions over the actors. The emergence of a macro actor, in the latter version, depends on the outcomes of a number of local translations, which both expand the existing constituency and contribute to the shaping of the network. The main diversity between them derives from the respective conception of agency: focused versus dispersed. Such difference derives from the adoption of two distinct rhetorics and the use of a specific language regarding the "macro level", but it is also partly related to the portion of reality that the researcher chooses to describe.

In order to illustrate the two versions of ANT, we deliberately used our own field research, but we could have referred directly to Callon and Fujimura for sustaining the same argument. By telling our own story, we put the two models to work and tested whether they are incompatible or rather complementary. Our conclusion is that, while the way in which the research field is delimited implicitly invites one to choose one version over the other, such choice is at the same time a theory laden.

We arrived at the conclusion that the two versions are complementary in reflecting on our

own work. For example, we realized that in the case of the innovation in the accounting system, as soon as we focused on single cases of translation we "automatically" tended to use Callon's model in a sort of uncritical way. In fact, a soon as the focus of the research encompassed a more delimited portion of reality, we found ourselves following the single actors in the organizations and their Machiavellian way of relating in order to perform a reality that holds. On the contrary, when focusing on the networking activities of thousands of local administrations, it was clear that the pattern that we were looking for could not be described in entrepreneurial terms. We can say the same for our second case of technological innovation: even though investigating the local translation was better served by an entrepreneurial approach, when Wasser was put in the frame of the European policies of energy saving, the segment of reality that we tried to describe was better represented in ecological terms. All this is not surprising given that Callon describes the macro actor, which comes to be associated with a single project, while Fujimura illustrates the macro actor around a much wider research field. Should we then conclude that there are macro actors of different size and the researchers chose their methodology according to it? It may be the case. However, more empirically, we prefer to note that, within the elaboration of ANT, the choice of the research field has historically influenced the methodology and the narrative trajectories of the theory.

We would like to add, however, that such choice is far from being theoretically neutral because each version of how a macro actor emerges brings with it a metaphor of how translation is achieved and a particular way to conceptualize translation as a situated practice. Taken together, and only when taken together, the two versions of ANT show the capacity of the translation approach for generating rich, thick and convincing stories of how innovations travel in the world, how they are translated in everyday practice, and how the innovation, the practice and the world are all changed in the process.

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