SCIENCE IN ACTION

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literature to suit its needs, all deformations are fair. A given paper may be cited by others for completely different reasons in a manner far from its own interests. It may be cited without being read, that is perfunctorily; or to support a claim which is exactly the opposite of what its author intended; or for technical details so minute that they escaped their author's attention; or because of intentions attributed to the authors but not explicitly stated in the text; or for many other reasons. We cannot say that these deformations are unfair and that each paper should be read honestly as it is; these deformations are simply a consequence of what I called the activity of the papers on the literature; they all manage to do the same carving out of the literature to put their claims into as favourable as possible a state. If any of these operations is taken up and accepted by the others as a fact, then that's it; it is a fact and not a deformation, however much the author may protest. (Any reader who has ever written a quotable article in any discipline will understand what I mean.)

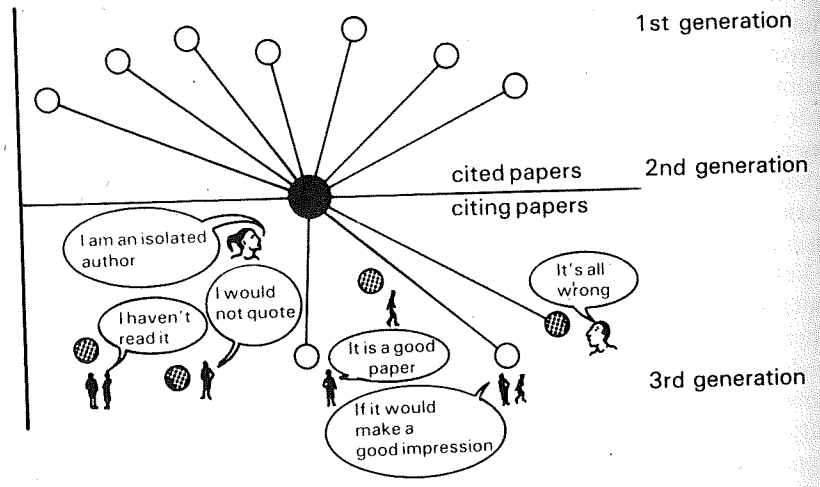

Figure 1.4

There is something still worse, however, than being either criticised or dismantled by careless readers: it is being *ignored*. Since the status of a claim depends on later users' insertions, what if there are *no* later users whatsoever? This is the point that people who never come close to the fabrication of science have the greatest difficulty in grasping. They imagine that all scientific articles are equal and arrayed in lines like soldiers, to be carefully inspected one by one. However, most papers are never read at all. No matter what a paper did to the former literature, if no one else does anything with it, then it is as if it never existed at all. You may have written a paper that settles a fierce controversy once and for all, but if readers ignore it, it cannot be turned into a fact; it simply *cannot*.

You may protest against the injustice; you may treasure the certitude of being right in your inner heart; but it will never go further than your inner heart; you will never go further in certitude without the help of others. Fact construction is so much a collective process that an isolated person builds only dreams, claims and feelings, not facts. As we will see later in Chapter 3, one of the main problems to solve is to interest someone enough to be read at all; compared to this problem, that of being believed is, so to speak, a minor task.

In the turmoil generated by more and more papers acting on more and more papers, it would be wrong to imagine that everything fluctuates. Locally, it happens that a few papers are always referred to by later articles with similar positive modalities, not only for one generation of articles but for several. This event – extremely rare by all standards – is visible every time a claim made by one article is borrowed without any qualification by many others. This means that anything it did to the former literature is turned into fact by whoever borrows it later on. The discussion, at least on this point, is ended. A black box has been produced. This is the case of the sentence 'fuel cells are the future of electric cars' inserted inside statements (8), (9) and (10). It is also the case for the control by the hypothalamus of growth hormone. Although Schally and Guillemin disagree on many things, this claim is borrowed by both without any qualification or misgivings – see sentences (19) and (20). In Figure 1.5 illustrating the context of

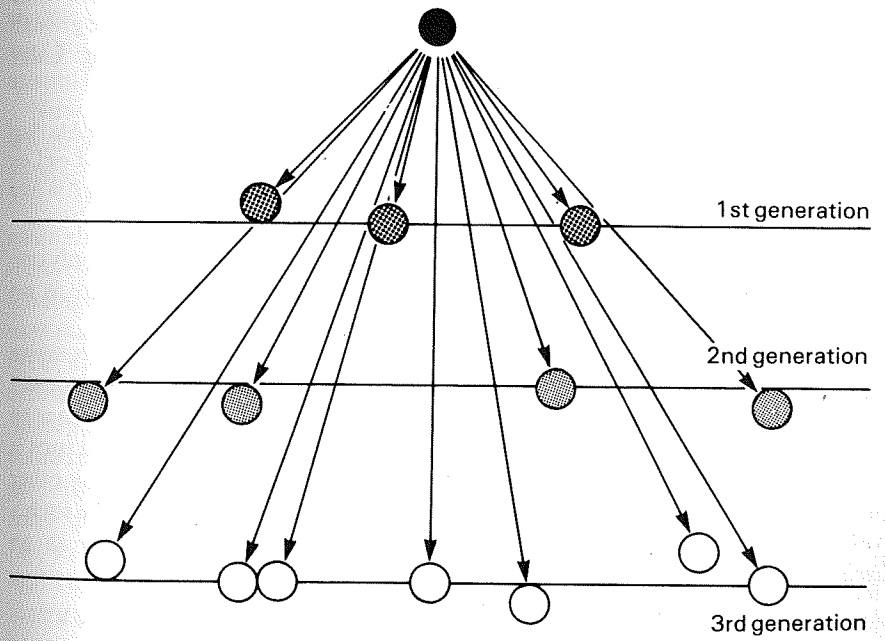

Figure 1.5

citations such an event will be seen as a regular flow of arrows all aligned in the same direction and leading to more and more papers. Every new paper getting into the fray pushes it one step further, adding its little force to the force of the already established fact, rather than reversing the trend.

This rare event is what people usually have in mind when they talk of a 'fact'. I hope it is clear by now that this event does not make it qualitatively different from fiction; a fact is what is collectively stabilised from the midst of controversies when the activity of later papers does not consist only of criticism or deformation but also of confirmation. The strength of the original statement does not lie in itself, but is derived from any of the papers that incorporate it. In principle, any of the papers could reject it. The control of growth hormone by the hypothalamus could be disputed, it has been, it will be disputed; but to do so the dissenter will be faced not with one claim in one paper, but with the same claims incorporated in hundreds of papers. It is not impossible in principle; it is just enormously difficult in practice. Each claim comes to the future author with its history, that is with itself plus all the papers that did something with it or to it.

This activity of each of the papers that makes up the strength of a given article is made visible not by any criticism – since in this case there is none – but by the erosion the original statement submits to. Even in the very rare cases where a statement is continuously believed by many later texts and borrowed as a matter of fact, it does not stay the same. The more people believe it and use it as a black box the more it undergoes transformations. The first of these transformations is an extreme *stylisation*. There is a mass of literature on the control of growth hormone, and Guillemin's article which I referred to is five pages long. Later papers, taking his article as a fact, turn it into one sentence:

> (24) Guillemin et al. (ref.) have determined the sequence of GRF: H Tyr Ala Asp Ala Ile Phe Thr Asn Ser Tyr Arg Lys Val Leu Gly Gln Leu Ser Ala Arg Lys Leu Leu Gln Asp Ile Met Ser Arg Gln Gln Gly Gly Ser Asn Gln Glu Arg Gly Ala Arg Ala Arg Leu NH2.

Later on this sentence itself is turned into a one-line long statement with only one simplified positive modality: 'X (the author) has shown that Y.' There is no longer any dispute.

If sentence (24) is to continue to be believed, as opposed to (5), each successive paper is going to add to this stylisation. The activity of all the later papers will result in the name of the author soon being dropped, and only the reference to Guillemin's paper will mark the origin of the sequence. This sequence in turn is still too long to write. If it becomes a fact, it will be included in so many other papers that soon it would not be necessary to write it at all or even to cite such a well-known paper. After a few dozen papers using statement (24) as an incontrovertible fact, it will be transformed into something like:

> (25) We injected sixty 20-day-old Swiss albino male mice with synthetic GRF ... etc.

The accepted statement is, so to speak, eroded and polished by those who accept it. We are back to the single sentence statements with which I started this chapter – see (1), (5) and (8). Retrospectively, we realise that a lot of work went into this stylisation and that a one-phrase fact is never at the beginning of the process (as I had to imply in order to get our discussion going) but is already a semi-final product. Soon, however, the reference itself will become redundant. Who refers to Lavoisier's paper when writing the formula H_2O for water? If positive modalities continue acting on the same sentence (24), then it will become so well known that it will not be necessary even to talk about it. The original discovery will have become *tacit knowledge*. GRF will be one of the many vials of chemicals that any first year university student takes from the shelf at some point in his or her training. This erosion and stylisation happens only when all goes well; each successive paper takes the original sentence as a fact and encapsulates it, thereby pushing it, so to speak, one step further. The opposite happens, as we saw earlier, when negative modalities proliferate. Schally's sentence (5) about a new GHRH was not stylised and was still less incorporated into tacit practice. On the contrary, more and more elements he would have liked to maintain as tacit emerge and are talked about, like the purification procedures of statement (7) or his previous failures in (13). Thus, depending on whether the other articles push a given statement downstream or upstream, it will be incorporated into tacit knowledge with no mark of its having been produced by anyone, or it will be opened up and many specific conditions of production will be added. This double move with which we are now familiar is summarised in Figure 1.6 and allows us to take our bearings in any controversy depending on which stage the statement we chose as our point of departure happens to be and in which direction other scientists are pushing it.

Now we start to understand the kind of world into which the reader of scientific or technical literature is gradually led. Doubting the accuracy of Soviet missiles, (1), or Schally's discovery of GHRH, (5), or the best way to build fuel cells, (8), was at first an easy task. However, if the controversy lasts, more and more elements are brought in, and it is no longer a simple verbal challenge. We go from conversation between a few people to texts that soon fortify themselves, fending off opposition by enrolling many other allies. Each of these allies itself uses many different tactics on many other texts enlisted in the dispute. If no one takes up a paper, it is lost forever, no matter what it did and what it cost. If an article claims to finish the dispute once and for all it might be immediately dismembered, quoted for completely different reasons, *adding* one more empty claim to the turmoil. In the meantime, hundreds of abstracts, reports and posters get into the fray, adding to the confusion, while long review papers strive to put some order into the debates though often on the contrary simply adding more fuel to the fire. Sometimes a few stable statements are borrowed over and over again by many papers but even in these rare cases, the statement is slowly eroded, losing its original shape, encapsulated into more and more foreign statements, becoming so familiar and routinised that it becomes part of tacit practice and disappears from view!

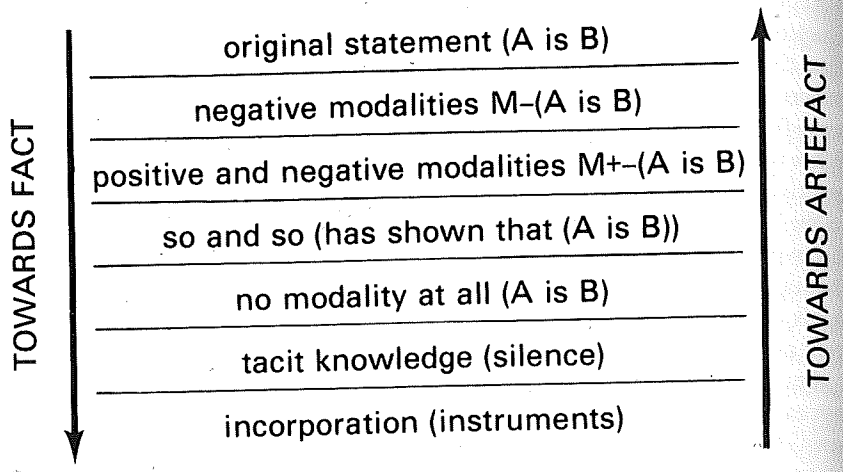

Figure 1.6

This is the world with which someone who wishes to dissent and make a contribution to the debates will be confronted. The paper he or she is reading has braced itself for survival in this world. What must it do in order to be read, to be believed, to avoid being misunderstood, destroyed, dismembered, ignored? How can it ensure that it is taken up by others, incorporated into later statements as a matter of fact, quoted, remembered and acknowledged? This is what has to be sought by the authors of a new technical paper. They have been led by the heated controversy into reading more and more articles. Now they have to *write* a new one in order to put to rest whichever issue they started from: the MX affair, the GHRH blunder, the fuel cell fiasco. Needless to say that, by now, *most dissenters will have given up.* Bringing friends in, launching many references, acting on all these quoted articles, visibly deploying this battlefield, is already enough to intimidate or to force most people out. For instance, if we wish to dispute the accuracy of Soviet missiles as in (1), the discovery of GHRH as in (5) or the right way to get at fuel cells as in (8), we will be very, very isolated. I do not say that because the literature *is too technical* it puts people off, but that, on the contrary, we feel it necessary to call technical or scientific a literature that is made to isolate the reader by bringing in many more resources. The 'average man who happens to hit the truth', naively postulated by Galileo, will have no chance to win over the thousands of articles, referees, supporters and granting bodies who oppose his claim. The power of rhetoric lies in making the dissenter feel lonely. This is indeed what happens to the 'average man' (or woman) reading the masses of reports on the controversies we so innocently started from.

Part C
Writing texts that withstand the assaults of a hostile environment

Although most people will have been driven away by the external allies invoked by the texts, Galileo is still right, because a few people may not be willing to give up. They may stick to their position and not be impressed by the title of the journal, the names of authors, or by the number of references. They will read the articles and still dispute them. The image of the scientific David fighting against the rhetorical Goliath reappears and gives some credence to Galileo's position. No matter how impressive the allies of a scientific text are, this is not enough to convince. Something else is needed. To find this something else, let us continue our anatomy of scientific papers.

(1) Articles fortify themselves

For a few obstinate readers, already published articles are not enough: more elements have to be brought in. The mobilisation of these new elements transforms deeply the manner in which texts are written: they become more technical and, to make a metaphor, **stratified**. In sentence (21), I quoted the beginning of a paper written by Guillemin. First, this sentence mobilised a two-decade-old fact, the control by the hypothalamus of the release of growth hormone, and then a decade-old fact, the existence of a substance, somatostatin, that inhibits the release of growth hormone. In addition, Schally's claim about this new substance was dismissed. But this is not enough to make us believe that Guillemin has done better than Schally and that his claim should be taken more seriously than that of Schally. If the beginning of his paper was playing on the existing literature in the manner I analysed above, it soon becomes very different. The text announces, for instance, more material from which to extract these elusive substances. The authors found a patient with enormous tumours formed in the course of a rare disease, acromegaly, these tumours producing large quantities of the sought-for substance.[9]

> (26) At surgery, two separate tumors were found in the pancreas (ref. 6); the tumor tissues were diced and collected in liquid nitrogen within 2 or 5 minutes of resection with the intent to extract them for GRF. (. . .) The extract of both tumors contained growth hormone releasing activity with the same elution volume as that of hypothalamic GRF (Kav=0,43, where Kav is the elution on constant (ref. 8). The amounts of GRF activity (ref. 9) were minute in one of the tumors (0.06 GRF unit per milligram (net weight), but extremely high in the other (1500 GRF units per milligram (net weight), 5000 times more than we had found in rat hypothalamus (ref. 8).

Now, we are in business! Sentence (26) appears to be the most difficult sentence

not being equal, it is possible to win with many other resources than articles and laboratories. It is possible, for instance, never to encounter any dissenter, never to interest anyone, never to accept the superior strength of the others. In other words, the possession of many strongholds has first to be secured for the stronger rhetoric of science to gain any strength at all.

To picture this preliminary groundwork we have to remember our first principle: the fate of a statement depends on others' behaviour. You may have written the definitive paper proving that the earth is hollow and that the moon is made of green cheese but this paper will not become definitive if others do not take it up and use it as a matter of fact later on. You need *them* to make *your* paper a decisive one. If they laugh at you, if they are indifferent, if they shrug it off, that is the end of your paper. A statement is thus always in jeopardy, much like the ball in a game of rugby. If no player takes it up, it simply sits on the grass. To have it move again you need an action, for someone to seize and throw it; but the throw depends in turn on the hostility, speed, deftness or tactics of the others. At any point, the trajectory of the ball may be interrupted, deflected or diverted by the other team – playing here the role of the dissenters – and interrupted, deflected or diverted by the players of your own team. The total movement of the ball, of a statement, of an artefact, will depend to some extent on your action but to a much greater extent on that of a crowd over which you have little control. The construction of facts, like a game of rugby, is thus a collective process.

Each element in the chain of individuals needed to pass the black box along may act in multifarious ways: the people in question may drop it altogether, or accept it as it is, or shift the modalities that accompany it, or modify the statement, or appropriate it and put it in a completely different context. Instead of being conductors, or semi-conductors, they are all *multi-conductors*, and unpredictable ones at that. To picture the task of someone who wishes to establish a fact, you have to imagine a chain of the thousands of people necessary to turn the first statement into a black box and where each of them may or may not unpredictably transmit the statement, modify it, alter it or turn it into an artefact. How is it possible to master the future fate of a statement that is the outcome of the behaviour of all these faithless allies?

This question is all the more difficult since all the actors are doing something to the black box. Even in the best of cases, they do not simply transmit it, but add elements of their own by modifying the argument, strengthening it and incorporating it into new contexts. The metaphor of the rugby game soon breaks down since the ball remains the same – apart from a few abrasions – all along, whereas in this technoscience game we are watching, the object is modified as it goes along from hand to hand. It is not only collectively transmitted from one actor to the next, it is collectively *composed* by actors. This collective action then raises two more questions. To whom can the responsibility for the game be attributed? What is the object that has been passed along?

An example will make the fact-builder's problem easier to grasp. Diesel is known as the father of the diesel engine.[2] This fatherhood, however, is not as

direct as that of Athena from Zeus' head. The engine did not emerge one morning from Diesel's mind. What emerged was an idea of a perfect engine working according to Carnot's thermodynamic principles. This was an engine where ignition could occur without an increase in temperature, a paradox that Diesel solved by inventing new ways of injecting and burning fuel. At this point in the story, we have a book he published and a patent he took out; thus, we have a paper world similar to those we studied earlier. A few reviewers, including Lord Kelvin, were convinced while others found the idea impracticable.

Diesel is now faced with a problem. He needs others to transform the two-dimensional project and patent into the form of a three-dimensional working prototype. He ferrets out a few firms that build machines – Maschinenfabrik Augsburg-Nürnberg, known as MAN, and Krupp – which are interested because of the hope of increased efficiency and versatility of a perfect Carnot machine, the efficiency of the steam engine in the 1890s being pitifully low. As we will see, reality has many hues, like objectivity, and entirely depends on the number of elements tied to the claim. For four years, Diesel tried to get *one* engine working, building it with the help of a few engineers and machine tools from MAN. The progressive *realisation* of the engine was made by importing all available resources into the workshop, just as in any laboratory. The skills and tools for making pistons and valves were the result of thirty years of practice at MAN and were all locally available as a matter of routine. The question of fuel combustion soon turned out to be more problematic, since air and fuel have to be mixed in a fraction of a second. A solution entailing compressed air injection was found, but this required huge pumps and new cylinders for the air; the engine became large and expensive, unable to compete in the market of small versatile engines. By modifying the whole design of the engine many times, Diesel drifted away from the original patent and from the principles presented in his book.

The number of elements now tied to Diesel's engine is increasing. First, we had Carnot's thermodynamics plus a book plus a patent plus Lord Kelvin's encouraging comments. We now have in addition MAN plus Krupp plus a few prototypes plus two engineers helping Diesel plus local know-how plus a few interested firms plus a new air injection system, and so on. The second series is much larger, but the perfect engine of the first has been transformed in the process; in particular, constant temperature has been abandoned. It is now a constant pressure engine and in a new edition of his book Diesel has to struggle to reconcile the drift from the first more 'theoretical' engine to the one being slowly realised.

But how real is real? In June 1897 the engine is solemnly presented to the public. The worries of a black box builder now take on a new dimension. Diesel needs others to take up his engine and to turn it into a black box that runs smoothly in thousands of copies all over the world, incorporated as an unproblematic element in factories, ships and lorries. But what are these others going to do with it? How much should the prototype be *transformed* before being *transferred* from Augsburg to Newcastle, Paris or Chicago? At first, Diesel thinks

that it does not have to be transformed at all: it works. Just buy the licence, pay the royalty, and we send you blueprints, a few engineers to help you, a few mechanics to tend the engine, and if you are not satisfied you get your money back! In Diesel's hands the engine is a closed black box in exactly the same way that GRF was a definitively established fact for Schally, simply waiting to be borrowed by later scientific articles (see Chapter 1).

However, this was not the opinion of the firm that had bought the prototypes. They wished it to be unproblematic, but the engine kept faltering, stalling, breaking apart. Instead of remaining closed, the black box fell open, and had to be overhauled every day by puzzled mechanics and engineers arguing with one another, exactly like Schally's readers every time they tried to get his GRF to increase the length of tibias in their own laboratories. One after the other, the licensees returned the prototypes to Diesel and asked for their money back. Diesel went bankrupt and had a nervous breakdown. In 1899, the number of elements tied to the Diesel engine *decreased* instead of increased. The reality of the engine receded instead of progressed. The engine, much like Schally's GRF, became *less* real. From a factual artefact it became, if I may use the two meanings at once, an artefactual artefact, one of those dreams the history of technics is so full of.

A few engineers from MAN, however, continued working on a new prototype. Diesel is no longer in command of their actions. A great number of modifications are made to one exemplar which operates during the day in a match factory and is overhauled every night. Each engineer adds something to the design and pushes it further. The engine is not yet a black box, but it can be made to move through more copies to many more places, undergoing incremental modifications. It is transferred from place to place without having to be redesigned. Around 1908, when Diesel's patent falls into the public domain, MAN is able to offer a diesel engine for sale, which can be bought as an unproblematic, albeit new, item of equipment and incorporated as one piece of industry. Meanwhile, the licensees who had earlier withdrawn from the project take it up, adding their contribution by designing purpose-built engines.

Just before Diesel committed suicide by jumping from a ship on the way to England, diesel engines had at last spread; but were they *Diesel's* engine? So many people had modified it since the 1887 patent that now a polemic developed about who was responsible for the collective action that made the engine real. At a 1912 meeting of the German Society of Naval Architects, Diesel claimed that it was his original engine which had been simply developed by others. However, several of Diesel's colleagues argued at the same meeting that the new real engine and the earlier patent had, at best, a weak relation, and that most of the credit should go to the hundreds of engineers who had been able to transform an unworkable idea into a marketable product. Diesel, they argued, might be the *eponym* for the collective action, but he was not the cause of this action; he was at best the inspiration, not, so to speak, the motor behind his engine.

How are we to follow these moving objects that are transformed from hand to hand and which are made up by so many different actors, before ending up as a black box safely concealed beneath the bonnet of a car, activated at the turn of a key by a driver who does not have to know anything about Carnot's thermodynamics. MAN's know-how or Diesel's suicide?

A series of terms are traditionally used to tell these stories. First, one may consider that all diesel engines lie along one *trajectory* going through different phases from ideas to market. These admittedly fuzzy phases are then given different names. Diesel's idea of a perfect engine in his mind is called *invention*. But since, as we saw, the idea needs to be developed into a workable prototype, this new phase is called *development* – hence the expression Research and Development that we will see in Chapter 4. *Innovation* is often the word used for the next phase, through which a few prototypes are prepared so as to be copied in thousands of exemplars sold throughout the world.

However, these terms are of no great use. Right from the start, Diesel had an overall notion not only of his engine, but also of the economic world in which it should work, of the way to sell licenses, of the organisation of the research, of the companies to be set up to build it. In another book Diesel even designed the type of society, based on solidarity, that would be best fit for the sort of technical novelties he wished to introduce. So no clear-cut distinction may be made between invention and innovation. In 1897 the MAN manager, Diesel and the first investors all thought that development had ended and that innovation was starting, even though it took ten more years to reach such a stage, and in the meantime Diesel went bankrupt. Thus this distinction between phases is not immediately given. On the contrary, making separations between the phases and enforcing them is one of the inventor's problems: is the black box really black? When is the dissenting going to stop? Can I now find believers and buyers? Finally, it is not even sure that the first invention should be sought in Diesel's own mind. Hundreds of engineers were looking for a more efficient combustion engine at the same time. The first flash of intuition might not be in one mind, but in many minds.

If the notion of discrete phases is useless, so, too, is that of trajectory. It does not describe anything since it is again one of the problems to be solved. Diesel indeed claimed that there was one trajectory which links his seminal patent to real engines. This is the only way for his patents to be 'seminal'. But this was disputed by hundreds of engineers claiming that the engine's ancestry was different. Anyway, if Diesel was so sure of his offspring, then why not call it a Carnot engine since it is from Carnot that he took the original idea? But since the original patent never worked, why not call it a MAN engine, or, a constant pressure air injection engine? We see that talking of phases in a trajectory is like taking slices from a pâté made from hundreds of morsels of meat. Although it might be palatable, it has no relation whatsoever to the natural joints of the animal. To use another metaphor, employing these terms would be like watching a rugby game on TV where only a phosphorescent ball was shown. All the running, the cunning, the excited players would be replaced by a meaningless zigzagging spot.

No matter how clumsy these traditional terms are in describing the building of facts, they are useful in accounting, that is for measuring how much money and how many people are invested (as we will see in the next chapter). From invention to development and from there to innovation and sale, the *money* to be invested increases exponentially, as does the *time* to be spent on each phase and the *number* of people participating in the construction. The spread in space and time of black boxes is paid for by a fantastic increase in the number of elements to be tied together. Bragg, Diesel or West (see Introduction) may have quick and cheap ideas that keep a few collaborators busy for a few months. But to build an engine or a computer for sale, you need more people, more time, more money. The object of this chapter is to follow this dramatic increase in numbers.

This increase in numbers is necessarily linked to the problem of the fact-builder: how to spread out in time and space. If Schally is the only person who believes in GRF, then GRF remains in one place in New Orleans, under the guise of a lot of words in an old reprint. If Diesel is the only person who believes in his perfect engine, the engine sits in an office drawer in Augsburg. In order to spread in space and to become long-lasting they all need (we all need) the actions of others. But what will these actions be? Many things, most of them unpredictable, which will transform the transported object or statement. So we are now in a quandary: either the others will not take up the statement or they will. If they don't, the statement will be limited to a point in time and space, myself, my dreams, my fantasies . . .. But if they do take it up, they might transform it beyond recognition.

To get out of this quandary we need to do two things at once:

to enrol others so that they participate in the construction of the fact;

to control their behaviour in order to make their actions predictable.

At first sight, this solution seems so contradictory as to look unfeasible. If others are enrolled they will transform the claims beyond recognition. Thus the very action of involving them is likely to make control more difficult. The solution to this contradiction is the central notion of **translation**. I will call translation the interpretation given by the fact-builders of their interests and that of the people they enrol. Let us look at these strategies in more detail.

Part A
Translating interests

(1) Translation one: I want what you *want*

We need others to help us transform a claim into a matter of fact. The first and easiest way to find people who will immediately believe the statement, invest in the project, or buy the prototype is to tailor the object in such a way that it caters to these people's **explicit interests**. As the name 'inter-esse' indicates, 'interests' are what lie *in between* actors and their goals, thus creating a tension that will

make actors select only what, in their own eyes, helps them reach these goals amongst many possibilities. In the preceding chapters, for instance, we saw many contenders engaged in polemics. In order to resist their opponents' challenges they needed to fasten their position to less controvertible arguments, to simpler black boxes, to less disputable fields, gathering around themselves huge and efficient laboratories. If you were able to provide a contender with one of these black boxes, it is likely it will be eagerly seized and more rapidly transformed into a fact. Suppose, for instance, that while Diesel tinkers with his prototype, someone comes along with a new instrument that depicts on a simple indicator card how pressure changes with changing volume as the piston moves inside the cylinder so that the area on the diagram measures the work done. Diesel will jump at it, because it offers a neater way of 'seeing' how the invisible piston moves and because it graphically depicts, for everyone to see, that his engine covers a larger area than any other. The point is that, by borrowing the indicator card in order to further his goals, Diesel lends his force to its inventor, fulfilling the latter's goals. The more such elements Diesel is able to link himself to, the more likely he is to transform his own prototype into a working engine. But this movement does the same for the indicator card, which now becomes a routine part of the testing bench. The two interests are moving in the same direction.

Suppose, to take another example, that Boas, the American anthropologist, is engaged in a fierce controversy against eugenicists, who have so convinced the United States Congress of biological determinism that it has cut off the immigration of those with 'defective' genes.[3] Suppose, now, that a young anthropologist demonstrates that, at least in one Samoan island, biology cannot be the cause of crisis in adolescent girls because cultural determinism is too strong. Is not Boas going to be 'interested' in Mead's report – all the more so since he sent her there? Every time eugenicists criticise his cultural determinism, Boas will fasten his threatened position to Mead's counter-example. But every time Boas and other anthropologists do so, they turn Mead's story into more of a fact. You may imagine Mead's report interesting nobody, being picked up by no one, and remaining for ever in the (Pacific) limbo. By linking her thesis to Boas's struggle, Mead forces all the other cultural determinists to become her fellow builders: they all willingly turn her claims into one of the hardest facts of anthropology for many decades. When Freeman, another anthropologist, wished to undermine Mead's fact, he also had to link his struggle to a wider one, that of the sociobiologists. Until then, every time the sociobiologists fought against cultural determinism, they stumbled against this fact of Mead's, which had been made formidable by the collective action of successive generations of anthropologists. Sociobiologists eagerly jumped at Freeman's thesis since it allowed them to get rid of this irritating counter-example, and lent him their formidable forces (their publishing firms, their links with the media). With their help what could have been a 'ludicrous attack' became 'a courageous revolution' that threatened to destroy Mead's reputation.

As I stress in Chapter 2, none of these borrowings will be enough alone to stop