

We have established that historians of science study science as a human institution and as a social institution. It is very important that they do so, because they have things to say and find out about science of which the average practicing technician and professional in the scientific fields will not, quite, have been aware. It is important for every educated person to have a realistic, critical grasp of the nature of science as an institution in society. However, we discovered that there is a problem because there is a barrier around science, which prevents our being able to come to grips with its actual social and political machinery and its actual operations as an institution. That barrier is posed by three interlocking stories, or myths. These myths have been very nicely and very functionally woven around science since the seventeenth century, in order to protect it and to enable it to grow. Those interlocking stories, which we will hear more about as we proceed, are the stories of *'method'*, of the *'autonomy of science'* and of *'progress'*. (fig 1; see fig 1 chapter 1)

According to the commonly believed story about the nature of science, scientists have a single, transferable machinery, technique or tool, for uncovering and validating knowledge of objective facts. This machinery is called 'scientific method'. According to the standard story about how science works, this method is best used when the scientists are left alone and no political, social, religious or ideological biases interfere in the functioning of scientific method. The product of this autonomous (independent) use of method, is objective scientific knowledge. It is the cumulative build-up of such knowledge that constitutes the very definition of 'progress'.

This Chapter focusses on something deeper; on the root cause of our ability to speak about method, objectivity and progress in this way. This deeper cause is what we termed 'the cult of facts'--the common, and seemingly correct idea that there exists out there a world, a system, a set of given objective facts that are just there, waiting for the 'good guys' to find them. The 'good guys' apparently have the method in hand, because when they arrive, they will be able to use the method to uncover and test the facts, turning them into knowledge (provided, of course that these good guys are not obstructed by superstition, by ideology or by social interests).

In the previous Chapter, I indicated that as this book progresses, I would like you to be in a position to believe that facts are not really so 'hard', so 'solid' or so 'given' to us by external reality. We're going to see that facts are more 'constructed' than given. We will see that facts are historically variable, and that facts are different for different people at different points of time. We are going to see, in fact (!), that facts are negotiable and revisable rather than eternal. These are rather odd statements, because if the facts are not quite the way the story says, if they're not so hard -- then the stories of 'method', 'autonomy' and 'progress' need to be reviewed as well. And we might begin to ask what's going on underneath those stories in the social and historical reality of science?

I told you I'm not going to try to persuade you at first that facts are fluid and negotiable and variable in science. We are going to look at the facts of history first of all -- the 'facts' as historians use them. We are going to try to make some points about the sorts of facts that historians and other social scientists deal with. Obviously you'll go along with me here because everybody knows that historians' facts and sociologists' facts and

social scientists' facts in general are 'fluid', 'variable', 'socially influenced' and 'negotiable'. You think it's possible for me to do this (with historians' facts) because science is so different, but we will look at historians' facts and then we'll move on and see that similar points apply to the facts addressed by scientists. (I also have another reason for first dealing with historians' facts and we'll get to this in Chapter 3, when I talk about something called 'Whig history' of science). As you will see, much writing about the history of science is based on a kind of mythical notion of facts. There's a lot of old fashioned writing about the history of science that is based on the cult of facts itself, and based on the idea of method, autonomy, objectivity and naive progress. So we will come full circle by understanding the facts of historians, and we will open up the possibility that scientists' facts do not exist in the way that is usually presented and commonly believed, by nearly everyone, including you at the moment.

Dictionaries are notably uncritical and reflect ordinary usage of language. The *Oxford English Dictionary* (OED) definitions of things like 'objective' and 'fact' are no exception. 'Objective' is defined as 'belonging not to consciousness or the perceiving subject, but to what is presented to the subject; external to the mind, real, exhibiting actual facts, uncoloured by subjects' feelings or opinions'. So, things like 'subjectivity', 'bias' or political, cultural, ideological or religious input get in the way of something being 'objective'. What, then is the dictionary definition of a 'fact'? According to the OED it is a 'thing certainly known to have occurred, or to be true, a datum of experience, the realities of the situation'. Datum, from Latin means, 'a given', given of experience. It is given to us, it is there. If it's given to us, and if it's not distorted, we must then have the realities of the situation. Hence 'objective facts' are true, real, objects, events, situations or properties of such. They exist in the physical world, independently of any intervention by the perceiving subject (the observer) and not at all dependent upon the subject's (his/her) biases, will, theories, emotions, aims, interests or values. The facts are out there in nature, waiting for scientists to come along with the 'scientific method', which is the tool for uncovering the facts, testing the facts and building them into true theories of the universe.

Such, then, are the common definitions of objectivity and facts. They support the common view of the history of science, in which, broadly speaking, there are 'good guys', the heroes of science, the winners, who have struggled to forge the scientific method. They have then used the method to uncover the facts, gradually and progressively assembling them into bigger and better theories. This common view says this leads to our present wonderful state of knowledge, a state that will continue to progress, provided scientists continue to use the method correctly, to uncover and test the true facts. Of course, in history, other 'bad guys' have opposed the scientists -- religious bigots, jealous advocates of outdated theories or theories based on bias. But fortunately, the story takes long range view and ultimately the meaning of the history of science (really the history of the West in a sense) is that the good guys won! It's exhilarating. It's exciting. It's easy. That's the story. (And in fact that is the kernel of the Whig history of science that I will be talking about, in Chapter 3).

But are facts like this, do they exist as such, in science? Leaving that one for the time being, let's look at history (and social science in general) instead. Here, in the field of history, we already suspect these objective 'real' facts are hard to come by and perhaps do not exist at all (that is, can we really know a historical fact unless we were there, and so on).

Let's look at some history. Let's see what 'facts' are there. We know it's going to be difficult to locate 'facts' in the social sciences, but maybe we'll learn something about

facts, and maybe we'll be surprised later and see that science 'facts' really aren't that much different from these history 'facts'.

Clearly when an historian wants to explain something, he or she needs some 'low level facts' to start with. Those basic facts are left to us in so-called primary sources: reports, letters, illustrations, documents, statements or whatever, from the time that we're studying. In this chapter we are going to study a very particular time and place for purposes of illustration. It is Tiananmen Square in Beijing, China on 4 June 1989, when a very famous political event occurred. Let's start by looking for basic facts about this event.

Below we have statements 1 and 2 - which are two eyewitness accounts. They were made by a Western journalist standing in Tiananmen Square, and by a Chinese Central Police Intelligence agent who stood next to him, looking from the same angle. So they were both getting virtually the same retinal images of the scene unfolding in Tiananmen Square. After the events, they both wrote their documents, and these documents themselves now constitute some of the basic 'facts' of history. If we go into the archives, we find what the Western newspapers published the next day and if we are lucky what the Chinese state archives contain. Now here are the two accounts:

Account 1: (Eyewitness account by Western Journalist)

On the night of 4 June 1989 heavily armed regular troops of the Chinese Army forcibly and with considerable loss of life broke up the peaceful gathering of students and workers who had been demanding democratic reform.

Account 2: (Eyewitness account for State Security Officer for Official Archives)

On the night of 4 June 1989 the Chinese Government was reluctantly forced to disperse an unruly gang of counter-revolutionaries who had been disrupting the public life of the capital with demagogic calls for the pseudo-liberty sprouted by Western Imperialists.

Both of these accounts are the kinds of things that pass for basic, low level facts in History (or Sociology or any kind of enquiry about society). They both go considerably beyond what struck the retinas and the optic nerves of the two eyewitnesses who stood there side by side at the scene. They were there at the same time, arrived at the same time, left at the same time, stood next to each other; and so those patterns of electromagnetic disturbance that danced upon their retinas and optic nerves were virtually identical. There is clearly something about both these statements, 1 and 2, that goes beyond what the men's retinal images recorded. These accounts are shaped and formed by the background values and theories, aims and beliefs of those two different observers, and the resulting 'facts' of the two observers are shaped by both the retinal information and those background values theories beliefs and aims. And, if you think about it, it is not really a question of real information on the retina plus a bias -- a bias one way or a bias the other way -- it's that you can't make a humanly interesting statement or report about a situation without bringing in your own background knowledge, beliefs, aims and values (fig 2).

Not to put too fine a point on it, we don't stand around and report the state of our retinas to each other. Note also that these statements are not simply individual, or one-off remarks, because, on the one hand, the Western journalist has uttered his statement because he *is* a Western journalist and he expects other Westerners to find his story a

plausible 'fact'. And, on the other hand the State servant hasn't uttered his statement because he's an idiosyncratic individual, but because he is a State servant, and expects this 'fact' to be reported to his superiors and colleagues, who are in the State security business. As far as State Security is concerned those are 'the facts'. The resulting 'facts' of both men are likely to be accepted by their respective professional colleagues as a reasonably accurate basis for further analysis and explanation of the situation. Facts are functions of social interactions and communication networks.

At this point most people want to make some kind of move that will save the idea of pure or "nuggety" objective facts. There are groups that want to do this for each man and for his respective colleague network. Every philosopher of science and epistemologist since Aristotle and Descartes down to the twentieth century has wanted to do the same thing. One wants to say, "But there's a more basic level of the facts without all these 'polluting' social and historical 'additives'". However, I am going to insist that there simply is no interesting, significant, useable 'ground-zero' level fact here. There is no fact that's at ground level, and not shaped by some sort of background theory. Remember that, because that is true of facts in science as well!

So, let's now consider Statement 3 -- this is an attempt at a really neutral, unbiased statement.

Account 3:

On the night of 4 June 1989 some men came and killed a batch of some other people.

This is very interesting, very worthwhile, very useable, is it not? It is of tremendous interest to future historians, future State civil servants, journalists, everybody, is it not? No, of course it isn't; and the reason it lacks interest and utility is that it has no serious human meaning. It's what a five year old might say, because a five year old has no rich background of aims, beliefs, theories, and values. We could agree with the statement, that 'some men came and killed and bashed up some other people'. We could agree on it, but we wouldn't use it as a basic fact. We would immediately start pumping it up with further 'meaning' and 'content' before we would start to use it. What would the journalist's head office say if he said 'some men came and bashed and killed some others?' Head Office would want to ask him, 'How did it happen? How did they react? What was going on? What really happened?'

To repeat, account 3 is not a good account for any human purpose, any social purpose, any institutional purpose, any communicational purpose. We might all agree with this fact, but it is a singularly trivial, unimportant, unusable fact. If we try to make sense of it--use it in a larger explanation -- we wind up pumping more prior theory, value and aim back into it - *reshaping* it into something significant. Moreover, even this trivial fact uses all kinds of theoretical and value assumptions -- for example, that humans were involved--rather than, say, psychotic killers, somewhat 'less than human'. Also, this statement is rich in theory and assumptions compared to, say, viewing a video or picture of the situation. A video or picture in itself --without decoding by our own values and theories and aims--would be virtually meaningless. The journalist would view the video and utter the statement (1); the state official would view the video and utter statement (2). Nobody would find statement (3) very interesting in light of the video.

We can further appreciate the non-existence of basic, absolutely neutral facts by articulating the video gambit: Someone who wants some ultimately neutral basis might

say that we should record the Tiananmen incident on videotape, then we'll get what really happened, at some neutral and basic level of objective fact. But surely we have all noticed that news footage always has a 'voice over', the authoritative speaker. Some discourse from a news speaker tells you how to 'read' meaning into the pictures you are being shown. If we just played a videotape of what these men saw, there would not be any facts useable by any state security agency or any newspaper or any historian, until there was added some interpretation, some covering discourse or talk. You would have to answer questions like: 'Who are they?', 'Did they do that all over this Square?', 'Do they do that often?' 'Who are these other people?', 'What were they doing just before?' These questions are already answered to a certain degree, but in different ways in Statements 1 and 2.

So a videotape of the Tiananmen incident is really not that elusive, basic, neutral sort of fact we are looking for. The videotape is just trivial. It's below the level of meaning. It has to be investigated and interpreted before any 'facts' emerge. As we have seen, those facts are variable, because their 'makers' vary in outlook, values, ideas and goals. In other words, the beliefs, values and interests of the journalist, and of the intelligence agent do not 'distort' the 'basic facts'. The beliefs, the aims and the interests of the journalist and of the security agent constitute the particular version of the facts that each one respectively gives. The aims theories and beliefs make this fact or they make that fact. There is not some little kernel of fact there before this interpretative work is accomplished (cf fig 2).

Now let's look at what historians do in cases such as this, for historians have to work with 'facts' like Statements 1 and 2. First of all, the historian has to select amongst archival facts like statement 1 or 2. So the selection is based on the historian's belief, aims, interests, values. But more than that, the historian might want to reshape the facts he selects, and as an example of a 'slight' reshaping of Statement 1 look at Statement 1A.

Account 1A:

On the night of 2 June 1989 heavily armed regular troops of the Chinese Army forcibly and with considerable loss of life broke up the peaceful gathering of students and works which had been demanding democratic reforms, *the authorities exercising force excessive by the standards of Western police forces, but constrained compared to the anti-crowd tactics of Fascist Italy and Nazi Germany in the 1930s.*

Here the historian comes along and elaborates what he thinks is true about Fact 1. He says all the things that the journalist said, and if we suppose this is a Western liberal historian, he adds the part in italics. This is a reshaping of Statement 1, not based on objective knowledge of other raw, basic facts, but based on his value-laden judgements about the meaning of whole masses of other equally shaped reports, as well as generalisations, ('big facts'), advanced by other professional historians.

The historian is going to use the basic fact 1A to build his larger explanation of the events. Just as the journalist and the state servant shaped their facts, the historian also shaped the facts. He's shaping them, not by some deeper knowledge of what really happened, but by what he thinks he knows about types of State repression and other large 'facts' and comparisons. He's making a comparative judgement--a huge one--'the Nazis tended to do this', 'the Chicago police tend to do this', and 'the Chinese authorities tend to do this. And he's using that knowledge or 'theory' to form a comparison which he uses to shape and sculpt Fact 1 into Fact 1A. Fact 1A is a little bit different to Fact 1

because it takes a little bit of the edge off Fact 1 by saying in effect “they’re not as bad as the Nazis you know”. It involves a non trivial addition to Fact 1 to **construct** Fact 1A. A lot of time could be spent doing this kind of literary criticism of how historians can re-appraise the facts in this manner.

Next we must consider that ultimately the historian is interested in an explanation of the situation, in which his version of the ‘basic facts’, provides the basis and evidence. So the ‘basic facts’ are ‘shaped up’ and used as the evidence for the big explanation the historian wants to give (fig 3). We see this in his move from Fact 1 to Fact 1A. The game of explanation involves marshalling already shaped ‘basic facts’, like 1A, and then merging them with other basic facts, assumptions, generalisations, comparisons and theories into what could be called explanations. [Or ‘big facts’:An accepted explanation is a big fact.] The historian is after basic facts that mean something--that can be used to build up or support an explanation of the situation--a bigger fact. Here are two explanations.

Account 4:

The reaction of the Chinese authorities basically grew from their own political experience and perceptions, forged in the long struggle with reactionary quasi-feudal, Western-backed forces in their own country. They see calls for Western style ‘reform’ as Trojan horses for a comeback of internal opponents, likely leading to internal chaos and loss of their hard-won social and material gains.

Here is another explanation, and note that these are not strictly mutually contradictory, because they actually they describe slightly different things.

Account 5:

The students' lack of success is understandable, given the fact that reform, especially in China, needs to be backed by mass movement and perhaps even the threat of armed uprising and moreover even in the West students acting alone have always been politically defeated.

Now, first of all, these explanations (big facts, theories) are big interpretations, related to masses of other selected and shaped ‘facts’ and based on claimed comparisons and analogies between sets of such judgmental generalisations. Secondly, one, both or neither of these explanations (theories, big facts) might be used by the historian to give meaning to his selection (and shaping) of more ‘basic facts’ (like 1, 2 or 1A); the selected and shaped basic facts being part of the ‘evidence’ or support for his explanation (cf. fig 3). Thirdly, the historian will have to argue and negotiate with his professional colleagues to see whether, or how far, they accept his selection/shaping of ‘basic facts’ and his explanations (big facts, theories) and his claims about the strength of the relation between the explanations and the basic facts. The ‘movement’ in China was not a ‘mass movement’, but the French Revolution was - Why? We can argue about it. Maybe the ‘agricultural peasantry’ has to be involved in a ‘mass movement’. Historians will proceed to argue about when a ‘mass movement’ is a ‘mass movement’. Obviously this is a huge set of shaped facts, interpretations comparisons, analogies. They’re all put together to become ‘the explanation’, the explanation of ‘the facts’.

The historian who wants to construct an explanation has a number of problems: (1) he has to form an explanation; and (2) he has to select and shape his basic facts; and (3) he has to argue for the clear connection of these basic facts to the explanation. He might say about the strength of this connection, ‘I think I have a possible explanation of why

the Chinese Guards acted'; or, more firmly he could say, 'I'm very sure I know why they acted this way and I think in future our policy should be based on this assumption.'

So the historian's facts are shaped, selected constructs; his explanation is a shaped construct related to those 'facts'; and his claim about the strength of the relationship between the facts and the explanation is also shaped and moulded by his aims, goals, values and position in the field of history-writing. Historians do all this for the benefit and approval of their professional colleagues in order to gain credit with each other for 'knowing the facts' and 'explaining them well'. Historians, as a group, actually exist in a set of partially overlapping sub-groups, or 'schools'. Historians are constantly negotiating with each other and jockeying for position and approval, within and across schools. If your explanation of some facts, and your construction of the facts themselves win wide approval then you have gained professional credit and helped build the currently accepted body of historical knowledge. In addition, of course, the community of historians as a whole is just one community in society, and society exerts various and complex pressures on how historians construct and negotiate facts and explanations. (By the way, we will soon see that scientists must be looked at in precisely these ways as well.)

For example, not too many historians at the conservative Georgetown University in Washington DC are going to start with basic Fact 2 and then form an explanation of it. They might take basic Fact 2 as something that the 'biased, prejudiced' Chinese authorities said, and then try to explain why the biased, prejudiced Chinese authorities would say it. Of course, at the University of Beijing the historians might tend to work with Fact 2 and build up explanations. So there are social pressures on the historians' selection and shaping of basic facts and formulation of explanations of them.

In summary: (a) there are no ground level, raw, neutral facts of any meaning or interest whatsoever; (b) those accounts that are taken as 'basic facts' are already meaning-laden; that is they are highly interpreted descriptions/explanations shaped by prior theories, values and aims. (That's what we saw with 1 and 2); (c) even such basic facts themselves only acquire real meaning in a serious research discipline (like history) when they are placed in a context of claimed 'big facts' (explanations, explicit theories); (d) even then, only negotiation, politics and social interaction can, if at all, produce professional consensus about the big facts and basic facts. And, if consensus is reached, it can always be reopened, if someone is willing to take some professional risks and pay some professional costs.

What you need to appreciate now is that everything I've just said about facts in history holds true about facts in natural science. Below are listed some points about scientific facts, which ultimately we are going to accept. They are strictly analogous to the ones just made about historians' facts.

- Facts in science are never naked eye perceptions. What's on the retina. What's on the optic nerve.
- Facts in science are verbal/symbolic reports.
- These reports are shaped by the language in which they are reported, and by the values, prior theories and aims of the reporter.
- Low level facts in science are accepted/stabilised in the professional scientific community as a result of argument, persuasion, politics and

negotiation. No agreement is necessary, and any agreement reached can later be revised.

- Low level facts in science are not mere descriptions; they are already partly explanations, because they have been shaped by prior theories/values and aims.

- Low level facts only acquire meaning and importance when placed in the context of bigger facts (theories, explanations), which are even more the product of negotiation, politics and social interaction, and which are even more revisable and fluid than the low level facts.

There doesn't have to be consensus about the facts in science. If there is consensus, it can be questioned and reopened later by the same social processes. Here is a hint: **All of the history and sociology of science in principle is contained in these statements. The question is to understand them and put them to work.**

Figure 1

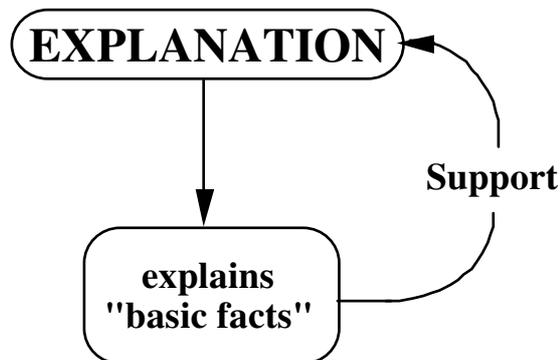


Figure 2a Two Views of Facts I

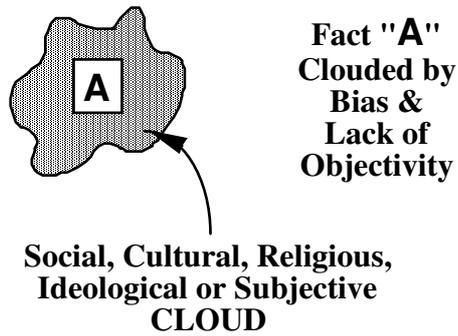
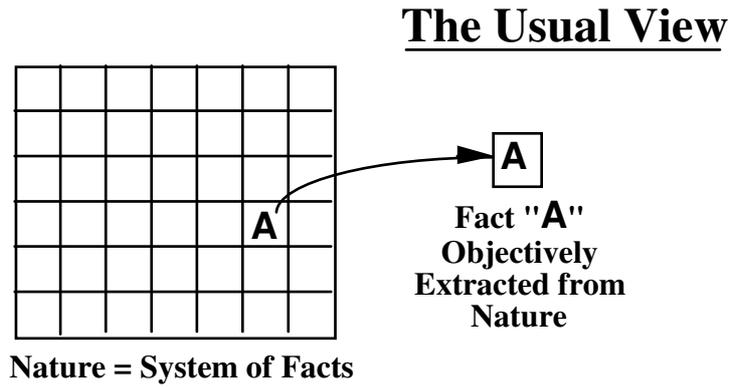


Figure 2b Two Views of Facts II

Humans' Facts
as Cultural Constructs

