3

Archaeology as a Science

There are both positive and negative views of science. In the positive view, science is wonderful. It has given us modern medicine, transport, a level of material affluence few of us would wish to give up. We know the way the world is because scientists tell us so. Scientists are so powerful, hold such a grip over our beliefs and sentiments, that we believe them even when our strongest intuitions tell us otherwise, when boarding an aeroplane for example. But in the negative view science can be disturbing and alarming. It can be dangerous, it can offend human sensibilities. Science has moral limits: look what happened to Doctor Frankenstein (figure 3.1).

Both positive and negative views of science are culturally loaded. To clarify, *Science is viewed in a certain way within Western culture*. The sociologist Auguste Comte suggested that science is an institution of authority for us in the same way that the Catholic Church was for the people of medieval Europe.

Modern Western society is partly based on the idea of Science with a capital S. We all use the term 'scientific' as a form of approbation, and that of 'unscientific' as one of abuse. But we are less sure what we actually mean by the term 'Science', which I have dignified here with a capital S to distinguish the image from the reality. What is Science, are there different forms of Science, and which forms (if any) can or should archaeology strive to approximate to?

This was one of the problems that faced the New Archaeology as it matured. As we have seen, 'we must be more scientific' was a good slogan, and concentrated appropriate criticism on the implicit and unsystematic nature of much of the work of a previous generation. But New Archaeology found that deciding what it actually meant by its slogan was more difficult.

One of the ways in which archaeology was certainly becoming more 'scientific' was in its techniques. The period after the Second

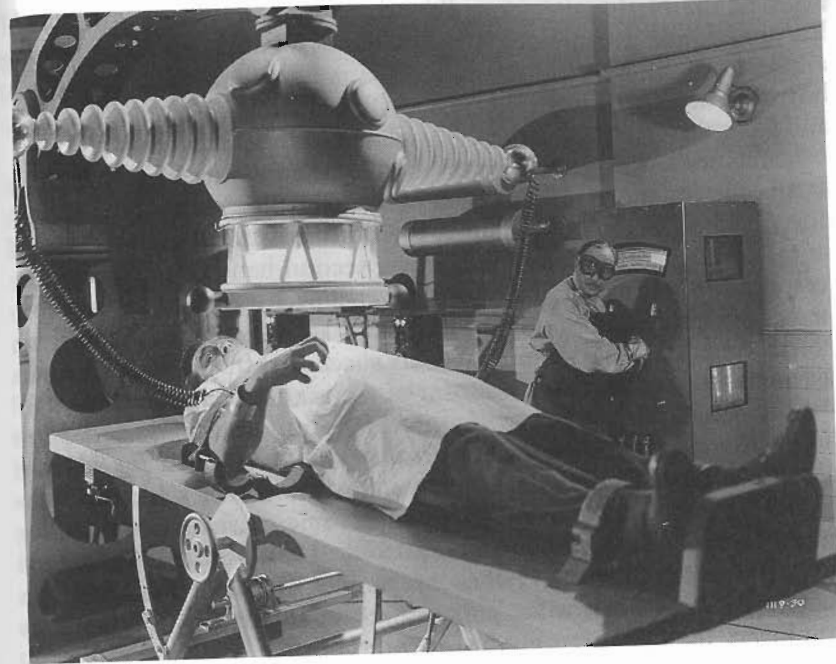

Figure 3.1 Lon Chaney, Jr (left) and Lionel Atwill in *Man Made Monster* (1941, Universal): still from Everson, W. K. 1974 *Classics of the Horror Film* (Secaucus, NJ, The Citadel Press), 152–3.

World War had seen an explosion in the number and range of 'science-based' techniques used in archaeology. These included the use of computers, the study of environmental remains, pollen diagrams, dating techniques such as carbon-14 and dendrochronology, soil geomorphology, paleopathology, and so on. Though I did not discuss these at any length in the last chapter, for many people, such as David Clarke, this development and growth in use of scientific techniques was a central part of the New Archaeology.

This development of scientific techniques led to a problem of technical specialization. An archaeologist in 1945 had to have an understanding of some statistics, and the principles of geology; by 1980 she or he had to know how to use a pollen diagram, how to manipulate statistical packages on computers, and at the very least how to understand and use the findings of a range of other very complex and specialized techniques.

It also led to changes in the pattern of funding of academic archaeology. In the USA, archaeology was increasingly funded under the

aegis of the National Science Foundation. In Britain as in much of Europe, funding remained predominantly 'humanistic'. Increasing amounts of money for scientific techniques were made available, however, at first through the Science-Based Archaeology Committee, and later through the Natural Environment Research Council.

In this sense the general atmosphere of the practice of archaeology was becoming more 'scientific'. Where archaeologists used to work in dusty backrooms full of old junk, their offices were often now part of suites of laboratories (often taken over second-hand from other, more 'respectable' physicists, biologists or chemists who had moved into newer, smarter accommodation). In many universities, particularly in North America, smart white labcoats succeeded frayed tweed jackets with elbow-patches as the uniform of the academic archaeologist.

In its essentials, however, *the use of scientific techniques did not imply the use of 'science' as a distinctive approach to finding out about the past*. David Clarke wrote that the use of scientific techniques 'no more make archaeology into a science than a wooden leg turns a man into a tree' (Clarke, 1978: 465). For the traditional archaeologist Jacquetta Hawkes, archaeology remained essentially a humanistic, not a scientific, pursuit: 'however scientific the methods employed, the final aims are historical' (Hawkes, 1968: 257).

To clarify, we use an increasing battery of techniques to assist in dating, the environment, geophysical techniques, and so on. These techniques have given us more and more data of potential use in the study of the past. But we are still left with the gulf between present and past discussed in chapter 2 and presented in figure 2.1. Our 'science-based' techniques accumulate even more data in the present. If that gulf between present and past remains unbridgeable, then the statements we make about the past remain 'unscientific' however clean our white coats are or how much money we spend on the many machines that go ping! in our laboratories. If, on the other hand, the gulf can be bridged securely, using the methods of the natural sciences as New Archaeology argued, then archaeology really can be called scientific, regardless of whether or not we wear white coats and use lots of expensive equipment.

Definitions of Science

New Archaeology suggested the use of 'science' as the solution to the *problem of inference*, then, discussed in the last chapter. If archaeologists had no reliable means of assessing how valid their arguments really were, it was only natural to look at how natural scientists did it.

The natural sciences of physics, chemistry, biology, after all, appeared to have demonstrable and spectacular success in terms of their ability to accurately describe and explain the world when compared with other forms of thought such as religion or mysticism.

Such an argument was reinforced by the disciplinary success of science. Whatever one's views of science as a theory, there was no disputing its success as a discipline. Scientists were well funded, they had the ear of government.

Positivism

In one sense there is no argument about whether archaeologists should be scientific. If science is about the rational accumulation of knowledge, assessed in rigorous, systematic ways, then we are all scientists. (At least, we would all claim to be scientists, though our opponents always seem to be lacking in rigour, system or method.) Science in this broad sense is often referred to by the German term *Wissenschaft*. Even the most fervent opponent of 'archaeology-as-science' would probably consider themselves scientists in this sense.

There are, however, more narrow definitions of what science is (figure 3.2). One of these definitions is called *positivism*, which is another word with several meanings. Theorists confusingly use the word 'positivism' in different senses in different contexts. Here, I shall isolate two.

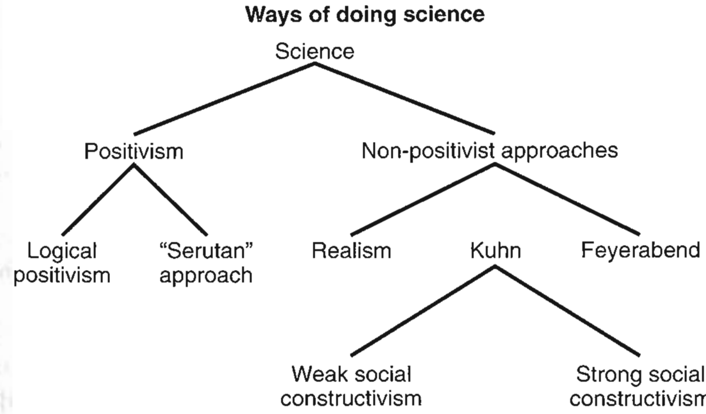

Figure 3.2 A selective diagram showing some schools within the philosophy of science.

1 *A set of beliefs about how we should conduct scientific enquiry*

These beliefs include:

(a) The idea that we should separate theory from method. If we have two or more competing theories to explain a phenomenon, then we have to have some kind of independent and neutral method to judge which theory is the better. It is no good trying to conduct such an independent test if our method is not independent and neutral, but is predicated on one of the theories being true.

(b) The separation of the *context of the discovery of an idea from the context of its evaluation*. It doesn't matter whether the law of gravity came to us sitting under an apple tree or in a book-lined office or in a drug-crazed hallucination; what is important is that the existence of such a law is evaluated scientifically separately from this context. Again, we might get some perfectly good ideas about processes in the prehistoric past from comparative ethnography or from a novel or a dream; what is important, in this view, is that we then test the ideas against the archaeological record to see whether they are valid or not.

Archaeologists will often claim, therefore, that they are using a particular idea or model only for *heuristic* or learning purposes; that is, they find the model of value in throwing up new hypotheses or possible interpretations. They might well insist that such hypotheses or interpretations need then to be formally tested.

(c) *A generalizing explanation is the only valid form*. Here, generality is closely linked to the importance of predictability and testability. Results have to be predictable and repeated for scientific validity. We can test the law of gravity by observing apples dropping from trees again and again and again. The law of gravity is framed as a general proposition that has predictable consequences, all other things being equal.

If an explanation is not generalizing, if it cannot suggest a consistent pattern of results, it will not be predictable and therefore will not be amenable to testing again and again.

(d) *Untestable statements are outside the domain of science*. In less extreme forms of positivism, this does not mean that untestable statements are unimportant. For example, moral and metaphysical questions may be untestable but central to our lives. Whether God exists or whether slavery or child labour are morally wrong are clearly important issues for us to discuss

and act upon as human beings; but they are not scientifically testable one way or the other. Science therefore, in this view, has nothing to say about them.

(e) It follows from (d) that *scientific thought should be independent of value judgements* and political action. The threat to use nuclear weapons or investment in countries with repressive regimes may or may not be morally or politically wrong; we all, scientists or non-scientists, make value judgements concerning these matters as human beings living in the world today. But the scientist cannot bring these judgements into his or her work. She or he might comment on them in other spheres, even campaign against nuclear weapons or repressive regimes, but must draw a clear line between (morally neutral) scientific knowledge and moral judgement and action.

Positivism in this sense has tended to be linked with a specific method of testing propositions, called the *Hypothetico-deductive-nomological* model, or HDN for short. The HDN model suggests that one proceeds as a scientist by taking a specific hypothesis and testing it. The deductions one makes from the result of the test should then be used to produce generalizing explanations ('nomothetic' or 'nomological' means generalizing). The need to test specific hypotheses, rather than just dig sites because we might find something interesting, was an issue we saw in the last chapter.

But positivism also, confusingly, has a second set of meanings attached to it:

2 *The belief that the social sciences, including archaeology, should try to follow the historical path of development of the natural sciences*

This argument was advanced for sociology by Auguste Comte, who was one of the key figures in the development of the human sciences in general. Comte looked to the example of biology. Before the eighteenth century, biology had, in Comte's view, been a speculative and unsystematic pursuit at a time when the scientific techniques and methods of physics and chemistry were already established. By modelling its disciplinary rules on the 'hard sciences' of physics and chemistry, however, biology had freed itself from the shackles of prescientific beliefs and become a rigorous science. Comte suggested that social sciences like sociology could follow a similar route, moving from their present unscientific state to that of a natural science.

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New Archaeology can clearly be identified with positivism in both the senses outlined above. New Archaeology tried to generalize; it tried to adopt an HDN model of testing; its whole project was that of Comte's, that of leading archaeology along an analogous path to that of the natural sciences to a mature, rigorous, self-critical discipline. For David Clarke (1973), this was part of archaeology's 'loss of innocence'.

Logical Positivism

This was where confusion started. Some New Archaeologists, searching through the libraries for advice from philosophers on how to do science, came across an extreme version of positivism called *logical-positivism*. For logical-positivists, untestable statements were not only outside the domain of Science; they were utterly valueless. Logical-positivism was in this sense *scientistic*. Scientism is the belief that scientific thought is inherently superior to other modes of thinking. So moral, religious or political judgements were not merely outside the domain of science; they were inferior modes of thought. Explanation did not merely have to be generalizing: it had to be expressed in terms of a tightly worded 'covering law' applicable in all times and places.

Logical-positivism was a dead end. How many covering laws do you know of in archaeology? Watson, Redman and LeBlanc wrote their book *Explanation in Archaeology: An Explicitly Scientific Approach* in 1971. In it, they adopted a logical-positivist framework and spilt much ink discussing precisely what this was. By the second edition of the book in 1984 this position had been considerably 'softened'.

I mention logical-positivism here because it is a cautionary tale. It shows that a little learning in other disciplines can be a dangerous thing in archaeology. Archaeologists read about logical-positivism without understanding that it was very much a minority view within the philosophy of science. We shall see in other chapters how borrowing concepts from other disciplines can be very fruitful, but can also be the source of much confusion.

Examples

For New Archaeology, then, and later for 'processual archaeology', we should adopt a broadly positivist definition of what we do. We should be trying to test hypotheses about the past, and to draw generalizations from those hypotheses.

Such a model might proceed as follows:

1 Hypothesis: early states involve differential access to resources, in other words that élites have greater access to basic goods (a hypothesis suggested maybe by political anthropologists).
2 Test: dig a cemetery from an early state society and chemically analyse the bones.
3 Deduction: the élite ate more meat, so we deduce that they did indeed have greater access to nutrition.
4 Generalization: early states do have such differential access, subject to further testing, other examples from other cultures at the same phase of social development, etc.

Another example might be hunter-gatherers and social complexity:

1 Hypothesis: that hunter-gatherer groups adapt to marginal environments in part through greater economic specialization and social complexity (suggested perhaps by study of modern ethnographies).
2 Test: take a marginal environment such as Upper Palaeolithic Europe in the last Ice Age, and look for different types of site suggesting task differentiation, the presence or absence of trade goods suggesting social alliances, etc.
3 Deduction: that social alliance and logistical hunting strategies are responses to harsher climates.
4 Generalization: there is a positive correlation between increasingly marginal environments and greater social complexity.

Note that in both these examples there is a *tendency to generalize*. General statements tend to emerge from the discussion: for example, that increasing complexity of trading networks tends to be linked to élites and thus to development of social ranking, whether this is in late prehistoric Europe, Mesoamerica or Polynesia. Look at the titles of some typical edited volumes in the processual mould, in which different articles often based on data sets from around the world and different time periods focus on certain processes which are held to be general and cross-cultural: *Ranking, Resource and Exchange*... *Specialisation, Exchange and Complex Societies*... *Peer Polity Interaction and Socio-Political Change*...

Such generalizations are what is meant by a 'softer' approach to covering laws than that taken by logical-positivism. Kent Flannery called this the 'Serutan' approach, a phrase that needs explaining to a non-American audience – Serutan is a laxative that promotes 'natural regularities'.

To clarify, New Archaeologists soon found that the development of formal covering laws that were true for human populations in all