Lecture 4. Probability

Application of probability to story of induction

Consideration of probability is necessary to finish up the case against induction.

If we say that a certain hypothesis is probable, we may mean:

- I think this hypothesis good (a subjective judgement), or I hope this hypothesis may not be falsified pretty soon;

- probability in a more technical sense, i.e. something which follows laws of mathematical probability theory. For example, the probability of an event happening plus probability of an event not happening – 1 (probability of an event happening is never greater than one), e.g. dice throwing.

Right back to Hume we find the idea that inductively one cannot derive a law, but just a high probability of a law, i.e. it seems that one can have a watering down of law. For example, we could determine say 90 per cent of all men drink tea, Socrates is a man, therefore a 90 per cent conclusion that Socrates drinks tea. This is the simplest way to show that there is a *prima facie* view that by inductivism we could establish the probability of a hypothesis.

However, this method does not play a role in practical scientific method. For example, a scientist never says: 'This hypothesis is 50% probable' (unless he is spoilt by philosophy); he just says: 'I think this hypothesis is a good one'. Hence one takes a slightly suspicious view of the probability story.

But there are more serous objections:

Probability depends on a situation not found in induction, i.e. on a statistical sentence – not on a series of observations – hence it is no wonder that the conclusion contains a probability. A sentence containing probability cannot be derived if you don't put probability in, i.e. you never get in logic something in conclusion that you didn't put in premises. Let us say then, not a definite numerical probability, say merely that it is probable that all men are mortal. But still one can't say it is even probable, as one can't investigate the majority of men. Similarly, one cannot say that it is probable, as one is thereby getting out of the logical system more than one put into it, i.e. putting in something one did not know about. Thus the situation leads to an infinite regress: 'It is probable that….., it is probable that it is probable…., and so on. Thus the attempt to introduce the word probable in no way is allowable. This is a negative approach.

The positive aspect: Question: 'How far has a hypothesis stood up to tests?' Does the answer to this give the probability of a hypothesis? The better test is the one from investigation, and it therefore gives the better hypothesis. We should therefore substitute for probability, the degree of confirmation possible. The hypothesis which has the higher degree of 'potential confirmation', i.e. testability, is initially the more improbable hypothesis, for it gives the greater opportunity for falsification. Similarly, after test the hypothesis that is the better confirmed is the more sweeping one, or the one having the higher precision in its predictions. In other words, the one with the higher degree of falsifiability is the one eventually with the higher degree of confirmation. Thus the strange situation is always that the better testable the hypothesis is, the least probable it is initially, i.e. the goodness of a hypothesis is utterly different from its probability; or, expressed in another way, the more precise the prediction the greater the degree of improbability. For example, it is a more probable hypothesis that asserts one will throw a dice and score 2 to 5, than that which asserts one will throw 4.

Thus we come to the result that the people who speak of the probability of science went contrary to the whole spirit of science. To be more probable you have to be more vague, but what we want in science is not probability but precision; the degree of confirmation is what is of value to science.

How is it that this probability of hypothesis has become so important? With both Hume and Locke it had the same vague use as 'I hope', 'I like', etc., but later people use probability more definitely, e.g. the school of atomic physicists.

There are two kinds of law: (i) statistical for the whole of a population, (ii) laws valid for every individual in a population. These latter laws are of causal character, e.g. the laws of falling bodies.

The statistical laws have become very important in physics, and one can speak of probability phenomena in physics. So people have mixed up a hypothesis about a probability with the probability of a hypothesis. These are obviously entirely contrary, but the confusion has been made and defended for a long time, and has not finally be given up with a good grace and clearly.

Final problem relating to probability

What about a probability hypothesis? Can it easily be falsified? The logical position is that if one makes a statistical hypothesis, how can one falsify it? It implies auxiliary hypotheses that can always be used to back out from a falsification. Hence the problem is, how is this reconcilable with the view that opportunity for falsification is essential if we are to preserve the scientific character of a statistical hypothesis?

However, if we proceed always to invent auxiliary hypotheses, then actually we are not scientists. For example, in tossing heads and tails we have the hypothesis that we get half of each. This can never be disproved by going on long enough and scoring heads only, etc., for one can always say that if we go on still longer it will come all right. As scientists we have to say that in disproof we must go only to a certain extent. Schrodinger recently said that the world would wind itself up again (contrary to the 2nd law of thermodynamics), but he was then speaking metaphysically, not scientifically, for he disregarded this limitation to a series which is essential if its scientific character is to be retained.

Teaching of science

Our system is based on the passive view of science, i.e. 'the bucket theory' of the mind. This theory holds that our minds are passive receptacles like buckets into which information is poured through the various orifices provided by the sense organs. It implies that the mind is passive in learning, and entirely

neglects the essential part of learning, namely knowledge in action. This 'bucket theory' is so widespread that it overwhelms teaching entirely and threatens even the organisation of research. In spite of the psychologists' view that we are teaching better, we have still the idea that the more hours you teach the better, i.e. our system is based on the 'bucket theory' of the mind.

The proper method is that everything depends on the degree of activity and not on passivity, i.e. on an active enquiry by students posing problems and looking for answers. We would get close to this if we just cut down intake, for we are always answering questions that are not asked. In fact we overwhelm pupils so much that questions are not asked. In a way the educational system is based on natural selection – only those with first class minds and bodies survive complete damage.

Especially in the secondary school, and still more so at the university level, they are taught to become intellectually dishonest. Here there is the simple belief in the theory that scientific method consists in careful observation and then the derivation of the law; that is, in generalisation. But the actual result is not obtained in this way, for the theoretical conclusion is suggested by the teacher or book and so the process is dishonest. If it were honest, we should get no result – a series of observations, remaining just a series of observations. What can one do?

- Pose problems: Say, 'How could that be solved?' Then say that the following theories have been suggested, and then students could suggest experiments. For example, the phlogiston theory could be shown first before the modern theory of combustion, then experiments that falsified the phlogiston theory, i.e. the historical method.

- One could also show the thrill of science: As long as one feeds results one can get no enthusiasm – that only comes when one shows the human element in it – men erring and quarrelling.

There is a distinction between the arts and science faculties in our universities. The arts faculties, miserable as they are, are more human than the science faculties. But science should become the most human of activities. The great adventure of the search for truth is one of the most fundamental moral activities of man – the search for truth without the lure of knowing if one ever gets there.