Lecture 5. Organisation of science

Application of probability

The statistical hypothesis about probability asserts so little that it cannot be falsified. One could, however, falsify the assertion that the probability of 'tails' is one by just tossing one 'head'; but not if a lower probability is asserted. One could construct mathematical models for all strange sequences, e.g. a regular series 100, 100, 100, 1….. for millions of times, and then suddenly it goes malignant and alters type. Could have a mathematical law covering this behaviour.

This illustrates that a merely statistical hypothesis can never be falsified. It is not scientific, but is metaphysical. It becomes scientific only when we adopt an attitude towards it in order to falsify it. One must use (as in physics) a statistical hypothesis in order to deduce physical effects from it, which can in their turn be tested. Let us take the statistical theory of light. There is a statistical bombardment of photons. Luminosity is just a measurement of the probability of the hits of photons on that point, hence one can deduce effects of relations of distance from source to brightness, or angular relationship, etc. Since these light hits are irregular there is always the probability that the photons will miss the area for a time, etc. The rule in the conversion of a statistical law into a physical law is to convert it into the production of mass effects, and test these effects without the possibility of retreating back into statistical law. If you don't do this, you can explain anything and therefore nothing.

Physicists assert that in any part of the universe there will eventuate a tepid death with temperature uniform and movements uniform. They cannot, however, assert this for the whole universe as they don't know the number of particles in the universe.

Schrödinger's view rests on the idea that, as we have infinite time, the universe will run up in time. He writes that this can be predicted with mathematical certainty. This is true enough, but though this assertion on the surface may be physically correct, it cannot be tested; thus it is metaphysical. The point is not that you cannot wait so long, but that Schrödinger forgets that statistical theory has to be used for prediction of scientific facts and no further. If we accept his view, everything will happen – the world runs up and down in all times and to all degrees. It is a random process. We cannot now, therefore, know where we are – anywhere at any time we may be going up or down. Actually at the back of Schrödinger's view is the conclusion that with mathematical certainty we can predict anything, and moreover with mathematical certainty we cannot predict anything.

Hence one realises the importance of the falsification principle in keeping science to science, and to stop it running away to wild speculation.

Organisation of science

There is a saying of Mussolini: 'Live dangerously'. It is a mean saying, as you always do it at other people's expense. You get into a dangerous situation and rescue parties have the danger too, etc. It is not a good maxim for social life.

There is one field where we can live dangerously, however, and that is in science. If science were a quest for certainty, then we should keep quiet. In science, in living dangerously one need have no scruples. If you make a dangerous hypothesis, then others get a kick out of kicking you; hence it is most exciting for everybody. Children likewise spiritually live dangerously until they get to school.

This leads to an understanding of science which is different from what the inductionists think. James Jeans argued that it is quite wrong to think that science is a revolutionary hypothesis – rather it grows like a library. This idea of growth is false if you look at a practical library. Books are taken from the shelves and put in the cellar at about the same rate as new ones appear. If the scientific library is thus changing, the history of science library grows.

The decisive feature is that science continuously lives in revolutions. I do not believe in social revolutions, for violence and irrationality are predominant there; but in science, revolution is essential to its continued existence; hence we have the colossal liberating influence of science.

Plato had the idea of us living in a cave, etc. with the shadows of reality on the cave wall. We never see reality. He thinks that a few mortals are blessed to see reality, and these can become the spiritual and political dictators of those who don't know. The actual situation in science is similar in part, but also it is totally different. Jeans' view is that the activity of science slowly unchains us and allows us to see more and more of reality. But this may be criticised for we don't know where the light comes from. Our cave is much darker than Plato's ever was. We have no sure direction of light. Our cave is such that by bumping with our heads we can push one of the walls back and the spark so formed illuminates a little; we then bump in another direction, and so on. Some are crushed in the process, but more room is obtained, and so on. There is never any certainty that the whole cave will not tumble down.

Biologically it can be said that science is one of the ways in which man adjusts himself to the world. J.B.S. Haldane and others with eugenicist ideas do not understand the function of thought. Instead of mutations biologically occurring, e.g. longer fingers, we use a pair of pliers, i.e. we develop something outside, by thought. This is a new kind of adaptation to environment, not by changing oneself, not by growing more clever. For example, cave-men may have been as intelligent as Einstein. I see no prospect of eugenics success, but little danger that it will be happen.

Before attempting to eugenise man, one should first understand the nature of science. Science is not just adaptation to environment, for instincts are also this. Spiritual liberation is the main achievement of science, not the adaptation to the environment, for no one would wish to change to an ideally adapted bundle of instincts. This argument tells heavily against the pragmatists, for adaptation by instincts can be amazingly efficient.

A group of pragmatists in London have put forward a movement for planning in science on the basis of the following ideas:

- We cannot tolerate haphazard scientific research – we want more evolution. They are neurotic Darwinists – not only more evolution of science, but faster and faster evolution.
- Science is haphazard as is everything in capitalist society. Therefore we have to organise science for efficiency.
- They insist as pragmatists that this planning should be fundamentally the urging on of applied science. They speak disparagingly of pure science. Their only purpose is evolution for the sake of evolution.

The group contains some influential people. *Nature* is perhaps 65 per cent under the influence of the group. Bernal is a good scientist, and also some other good scientists are in the group.

This method is fundamentally part of the 'bucket theory' of the mind. You can organise research in this way provided that it is a more or less highly skilled technical activity, if you like. The work done is proportional to the time occupied, e.g. 20 hours is twice 10 hours. There is something like this in highly skilled labour, but it is not so with science, where one is working all the time, thinking or sleeping or waking.

In criticism it can be said that there is no obvious way from observation to theory. No way but becoming one with the subject – living with it. It is an attitude which is one of the most personal things in the world. You can organise marriage, but not love. It is just as personal with science. It is an intensely emotional attitude. Science is very largely an emotional affair, but of course it is also rational. The driest mathematical paper ever written is packed with emotion. Emotions are a private affair, and not really science, but cut them off and science stops. Hence pure research cannot be organised.

Real organisation of science

How is it if in your research you strike a problem you are interested in – apart from applied work? Can you go to the boss and say: 'Dear boss, I want to work on this vague idea, I am in love with it. Can I leave my applied problem and work on this for some weeks or months?' The answer to this in New Zealand is always negative. But controllers of research should be able to trust their men, i.e. organised research has to be disorganised research in part.

Of course, it is no use if your man just wants to leave applied work because he is bored with it. Moreover, every man who is doing moderately good research will have the conscience to consider practical points and forego his problem temporarily.

But the whole relationship is important. Does the paymaster say that we only pay you to work for New Zealand agriculture? We don't pay you to make your mark in science, etc.

This freedom is even not uneconomical, because actually one gets more value for money this way. The Kodak laboratories are run in just this way. They give complete freedom and pay also very well. In a way, of course, research must be organised, because one cannot earn money with one's science.

The necessity of this kind of freedom is the direct consequence of the one step in the scientific method – the making of hypotheses. This is not a rational procedure.