

John Maynard Keynes (1920)

## Chapter XX of Treatise on Probability

### Pure Induction

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... Pure Induction can be usefully employed to strengthen an argument if, after a certain number of instances have been examined, we have, from some other source, a finite probability in favour of the generalisation, and, assuming the generalisation is false, a finite uncertainty as to its conclusion being satisfied by the next hitherto unexamined instance which satisfies its premise. To take an example, Pure Induction can be used to support the generalisation that the sun will rise every morning for the next million years, provided that with the experience we have actually had there are finite probabilities, however small, *derived from some other source*, first, in favour of the generalisation, and, second, in favour of the sun's not rising to-morrow assuming the generalisation to be false. Given these finite probabilities, obtained otherwise, however small, then the probability can be strengthened and can tend to increase towards certainty by the mere multiplication of instances provided that these instances are so far distinct that they are not inferable one from another.

### 7.

Those supposed proofs of the Inductive Principle, which are based openly or implicitly on an argument in inverse probability, are all vitiated by unjustifiable assumptions relating to the magnitude of the *a priori* probability  $p_0$ . Jevons, for

instance, avowedly assumes that we may, in the absence of -special information, suppose any unexamined hypothesis to be as likely as not. It is difficult to see how such a belief, if even its most immediate implications had been properly apprehended, could have remained plausible to a mind of so sound a practical judgment as his. The arguments against it and the contradictions to which it leads have been dealt with in Chapter IV. The demonstration of Laplace, which depends upon the Rule of Succession, will be discussed in Chapter XXX.

## 8.

The prior probability, which must always be found, before the method of pure induction can be usefully employed to support a substantial argument, is derived, I think, in most ordinary cases - with what justification it remains to discuss - from considerations of Analogy. But the conditions of valid induction as they have been enunciated above, are quite independent of analogy, and might be applicable to other types of argument. In certain cases we might feel justified in assuming *directly* that the necessary conditions are satisfied.

Our belief, for instance, in the validity of a logical scheme is based partly upon inductive grounds - on the *number* of conclusions, each seemingly true on its own account, which can be derived from the axioms - and partly on a degree of self-evidence in the axioms themselves sufficient to give them the initial probability upon which induction can build. We depend upon the initial presumption that, if a proposition appears to us to be true, this is by itself, in the absence of opposing evidence, *some reason* for its *being* as well as appearing true. We cannot deny that what appears true is sometimes false, but, unless we can assume some substantial relation of probability between the appearance and the reality of truth, the possibility of even probable knowledge is at an end.

The conception of our having *some* reason, though not a conclusive one, for certain beliefs, arising out of direct inspection, may prove important to the theory of epistemology. The old metaphysics has been greatly hindered by reason of its having always demanded demonstrative certainty. Much of the cogency of Hume's criticism

arises out of the assumption of methods of certainty on the part of those systems against which it was directed. The earlier realists were hampered by their not perceiving that lesser claims in the beginning might yield them what they wanted in the end. And transcendental philosophy has partly arisen, I believe, through the belief that there is no knowledge on these matters short of certain knowledge, being combined with the belief that such certain knowledge of metaphysical questions is beyond the power of ordinary methods.

When we allow that probable knowledge is, nevertheless, real, a new method of argument can be introduced into metaphysical discussions. The demonstrative method can be laid on one side, and we may attempt to advance the argument by taking account of circumstances which seem to give *some* reason for preferring one alternative to another. Great progress may follow if the nature and reality of objects of perception, for instance, can be usefully investigated by methods not altogether dissimilar from those employed in science and with the prospect of obtaining as high a degree of certainty as that which belongs to some scientific conclusions; and it may conceivably be shown that a belief in the conclusions of science, enunciated in any reasonable manner however restricted, involves a preference for some metaphysical conclusions over others.

## 9.

Apart from analysis, careful reflection would hardly lead us to expect that a conclusion which is based on no other than grounds of pure induction, defined as I have defined them as consisting of repetition of instances merely, could attain in this way to a high degree of probability. To this extent we ought all of us to agree with Hume. We have found that the suggestions of common sense are supported by more precise methods. Moreover, we constantly distinguish between arguments, which we call inductive, upon other grounds than the number of instances upon which they are based; and under certain conditions we regard as crucial an insignificant number of experiments. The method of pure induction may be a useful means of strengthening a probability based on some other ground. In the case, however, of most scientific

arguments, which would commonly be called inductive, the probability that we are right, when we make predictions on the basis of past experience, depends not so much on the number of past experiences upon which we rely, as on the degree in which the circumstances of these experiences resemble the known circumstances in which the prediction is to take effect. Scientific method, indeed, is mainly devoted to discovering means of so heightening the known analogy that we may dispense as far as possible with the methods of pure induction.

When, therefore, our previous knowledge is considerable and the analogy is good, the purely inductive part of the argument may take a very subsidiary place. But when our knowledge of the instances is slight, we may have to depend upon pure induction a good deal. In an advanced science it is a last resort, the least satisfactory of the methods. But sometimes it must be our first resort, the method upon which we must depend in the dawn of knowledge and in fundamental inquiries where we must presuppose nothing.

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