

axiom that its truth should be apparent to any rational mind which fully apprehends its meaning. The axiom of Bayes has certainly been fully apprehended by a good many rational minds, including that of its author, without carrying this conviction of necessary truth. This, alone, shows that it cannot be accepted as the axiomatic basis of a rigorous argument.

My third reason is that inverse probability has been only very rarely used in the justification of conclusions from experimental facts, although the theory has been widely taught, and is widespread in the literature of probability. Whatever the reasons are which give experimenters confidence that they can draw valid conclusions from their results, they seem to act just as powerfully whether the experimenter has heard of the theory of inverse probability or not.

4. The Logic of the Laboratory

In fact, in the course of this book, I propose to consider a number of different types of experimentation, with especial reference to their logical structure, and to show that when the appropriate precautions are taken to make this structure complete, entirely valid inferences may be drawn from them, without using the disputed axiom. *If* this can be done, we shall, in the course of studies having directly practical aims, have overcome the theoretical difficulty of inductive inferences.

Inductive inference is the only process known to us by which essentially new knowledge comes into

the world. To make clear the authentic conditions of its validity is the kind of contribution to the intellectual development of mankind which we should expect experimental science would ultimately supply. Men have always been capable of some mental processes of the kind we call "learning by experience." Doubtless this experience was often a very imperfect basis, and the reasoning processes used in interpreting it were very insecure; but there must have been in these processes a sort of embryology of knowledge, by which new knowledge was gradually produced. Experimental observations are only experience carefully planned in advance, and designed to form a secure basis of new knowledge; that is, they are systematically related to the body of knowledge already acquired, and the results are deliberately observed, and put on record accurately. As the art of experimentation advances the principles should become clear by virtue of which this planning and designing achieve their purpose.

It is as well to remember in this connection that the principles and methods of even *deductive* reasoning were probably unknown for several thousand years after the establishment of prosperous and cultured civilisations. We take a knowledge of these principles for granted, only because geometry is universally taught in schools. The method and material taught is essentially that of Euclid's textbook of the third century B.C., and no one can make any progress in that subject without thoroughly familiarising his mind with the requirements of a