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HUMAN KNOWLEDGE

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BERTRAND RUSSELL

with a new Introduction by
John G. Slater

Routledge

First published in 1948

Paperback edition first published in 1992
by Routledge
11 New Fetter Lane, London EC4P 4EE

Reprinted 1997, 2000, 2003

Routledge is an imprint of the Taylor & Francis Group

Printed in Great Britain by
St Edmundsbury Press Ltd, Bury St Edmunds, Suffolk

British Library Cataloguing in Publication Data
Russell, Bertrand
Human Knowledge: Its Scope and Limits. –
New ed
I. Title
121

ISBN 0-415-08302-8

INTRODUCTION

In his private correspondence Russell was fond of referring to some of his philosophical projects as aiming at the writing of a "big" book. *Human Knowledge: Its Scope and Limits* is Russell's last big book, and its topic – the problem of non-demonstrative inference – has been of central concern to philosophers ever since Hume undermined inductive arguments. At the beginning of his career Russell focused his interest, his talent, and his energies on trying to determine whether there was any certain knowledge. Since nobody claimed that either inductive arguments or any other non-demonstrative arguments for that matter, yielded certain knowledge, he paid little or no attention to these arguments. Beginning with its use in mathematics, he studied demonstrative inference as the likeliest source of knowledge with any claim to certainty. But the mathematics he had been taught, he soon discovered, was built on fallacious proofs, so he was forced back to logic for his starting point.

A logic freed of hidden assumptions would be a useful tool by which to establish mathematical proof on a firm basis. To his great delight he found that many others shared his belief about the importance of a new logic for mathematics; he avidly studied their works and he was soon ready to make original contributions to the development of symbolic logic. As his work proceeded he gradually became convinced that the new logic was not just a tool to be used in improving mathematical proofs, but was itself the very foundation of mathematics. His conviction, and that of Alfred North Whitehead, who had been one of his teachers at Cambridge, that much of mathematics is a branch of symbolic logic, led them to devote a decade of their lives to developing a proof of their thesis. *Principia Mathematica*, published in three large volumes between 1910 and 1913, reports the results of their research in elaborate detail.

When *Principia Mathematica* was finished Russell turned his attention to exploiting what he had learned during its production. He was convinced that a similar method could be applied to other realms of human knowledge with the result that their a priori (certain) and empirical (merely probable) parts could be disentangled. Physics was his first candidate for analysis using the new

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method. Through a careful study of the writings of physicists, he hoped to discover the minimum vocabulary required in physics, and to state, using only that minimum vocabulary and purely logical terms, the basic relationships of these terms to each other. The model he had in mind is nicely exhibited by the Peano postulates for arithmetic. Using only "zero", "number" and "successor" as undefined mathematical terms, and logical terms, Peano stated five axioms from which, using only logical rules of inference, the ordinary truths of arithmetic are deducible. An important feature of *Principia Mathematica* is the set of definitions that Whitehead and Russell provided for Peano's undefined terms. These definitions are written in purely logical notation, allowing each of them, and, therefore, each of Peano's postulates, to find its proper place in the logical and mathematical system being developed in that book.

Russell expended much thought on this problem of providing a foundation for physics; he called it "the problem of matter". But he did not succeed in cracking it. In the course of his work, he found that progress on the problem of matter required the solution to certain problems in the theory of knowledge, more specifically, the problem of our knowledge of the external world. So he turned his attention in that direction and began to write a "big" book on the theory of knowledge. Wittgenstein turned up during this period and Russell showed him some of his manuscript. The severity of Wittgenstein's criticism led Russell to abandon the book. *Theory of Knowledge: The 1913 Manuscript* was only published in 1984 as Volume 7 of *The Collected Papers of Bertrand Russell*. Although he abandoned one book he soon wrote another dealing with some of the same topics. *Our Knowledge of the External World* was written to be read to a Boston audience during his visit to Harvard in the spring of 1914. Russell had just begun to bring the ideas in that book to bear on the problem of matter, most notably in "The Relation of Sense-Data to Physics" (1914), when the First World War shattered his world.

When he returned to philosophical work after the war his thinking was still dominated by the axiomatic model of *Principia Mathematica*. While studying William James with the intention of refuting him, Russell persuaded himself that James's theory of neutral monism – that both mind and matter are constituted of entities of only one sort, for James it was "experience", for

Russell, "events" – was correct. Mind and matter were merely different configurations of the same basic stuff. With somewhat less persistence than he had shown in mathematics, Russell attempted during the 1920s to discover minimum vocabularies for discussing mind and matter and to propose analyses of some, at least, of these terms in the language of events. Two books, *The Analysis of Mind* (1921) and *The Analysis of Matter* (1927), serve to record his achievements in these projects.

Throughout these studies Russell tended to push questions of empirical knowledge aside. The real gold was a priori knowledge; on such a rock one could build one's philosophy. Empirical knowledge had its uses, but, since it could never be certain, it was outranked by the a priori kind. The axiomatic method, therefore, tended to dominate his thinking. Whenever he tackled a problem, he tried, first of all, to discover its minimum vocabulary, and then, when he experienced some success on that front, he would attempt to formulate the basic propositions linking the various terms of the minimum vocabulary with one another. Success in such an enterprise provides one with a starting point, a set of axioms, from which other truths can be deduced. One's knowledge of the subject being investigated derives from the small set of propositions which serve as premisses in every demonstration. This set of propositions is, in effect, a hostage for the truth of the derived propositions. If a derived proposition is found to be in error, one knows where to look for the source of the error. For most of his life, Russell, like Plato and many later philosophers, fell under the seductive charms of this model of human knowledge.

During the Second World War, which he spent in the United States, Russell came to the conclusion that he could no longer put off dealing with the problem of empirical knowledge. One reason for this change had been simmering in his mind for a long time. During the period he was working on deductive logic he was convinced that the propositions of logic were not only true but also significant. Mathematics was true of the world. His faith in this position had been undermined by Wittgenstein who argued very strenuously that the propositions of logic and mathematics were tautologies, merely formal truths, and, therefore, told us nothing about the world. For a man of Russell's philosophical disposition this was a bitter pill to swallow, and it is doubtful that he ever did swallow it. One immediate consequence of regarding formal truths as tautologies is to increase the importance of contingent truths, for they do refer to the world, and hence are significant.

A second reason has to do with scepticism. Although Russell always prized a sceptical frame of mind, he was not a sceptic in the philosophical sense. Pyrrhonian or Humean scepticism was an insincere philosophy, he believed, because its partisans always preferred bread to stones at meal time. Application of the scientific method has resulted in knowledge about which only theoretical doubt is possible, but Hume's doubts about induction appeared at first glance to taint these results. Since everybody uses induction and other forms of non-demonstrative inference, and everyone has beliefs about the future, what is needed is a canon of non-demonstrative inference; such a canon would serve as a justification for our faith in non-demonstrative inference. In 1943, in an outline which he entitled "Project of Future Work", Russell raised what he regarded as the "main question": "In what circumstances does scientific method allow us to infer the existence of something unobserved from what is observed?" Such an inference is never legitimate in deductive, or demonstrative, logic, but it is in science and in everyday life. A careful analytical study of the actual use of scientific method ought to lead to the formulation of a set of principles which would, collectively, serve as a canon to justify our use of non-demonstrative inference.

Closely related to the second reason is a third: it concerns empiricism as a philosophy. After about 1912 Russell regarded himself as carrying on the work of the great British empiricists, Locke, Berkeley, Hume and Mill, but most of his philosophical work, as we have seen, had to do with the problem of a priori knowledge. The rise of the logical positivists in the 1930s forced him to reconsider his position. They claimed him, along with Hume and Mach and Wittgenstein, as their philosophical ancestor, but, after reading a number of their works and finding some of their positions too extreme for his taste, Russell realized that he had work to do to distinguish his position from logical positivism. The unifying thread he hit upon was an examination of all of those arguments whose conclusions are never certain, given the truth of the premisses, but only probable.

At the end of a long study of the use of non-demonstrative arguments in both science and ordinary life, Russell concluded that five postulates are required to validate arguments of this sort.

They are brought together at the end of the book and the justification for including each of them is summarized. What surprised Russell, and will astonish some readers, is that the principle of induction is not a member of this set of postulates. Russell came to the conclusion, after an extensive study of the role of probability theory in scientific method, that the form of induction used there is demonstrable in probability theory. Therefore, it is unnecessary to assume it as a postulate.

Although the argument of this book proceeds in much the same way as the arguments to be found in his earlier philosophical works, there is one statement in the Preface which seems to call into question the philosophical method which he advocated in "Scientific Method in Philosophy" (1914), written in the flush of the success of *Principia Mathematica*. In that essay, after arguing that "philosophy is the science of the possible", he went on to amplify: "Philosophy, if what has been said is correct, becomes indistinguishable from logic as that word has now come to be used." And there can be no doubt that by "logic" he meant the logic developed in *Principia Mathematica*. It is, therefore, astonishing to find, in the first paragraph of his Preface to *Human Knowledge: Its Scope and Limits*, this long-standing position unceremoniously abandoned: "Logic, it must be admitted, is technical in the same way as mathematics is, but logic, I maintain, is not part of philosophy. Philosophy proper deals with matters of interest to the general educated public, and loses much of its value if only a few professionals can understand what is said." His style of writing often leads him into making statements with more sweep than he probably intends, and in this case he probably intends less than meets the eye. Whatever the truth is on this point, the reader of this book will soon discover that Russell has not abandoned logical analysis as his preferred method, for one finds it used on every page, although, in consideration of those readers unacquainted with modern symbolic logic, he does keep the use of special symbols to a bare minimum. A member of "the general educated public" should, therefore, be able to follow his argument and learn a great deal about the many problems upon which Russell turns his formidable philosophical talent in this important book.

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PREFACE

THE following pages are addressed, not only or primarily to professional philosophers, but to that much larger public which is interested in philosophical questions without being willing or able to devote more than a limited amount of time to considering them. Descartes, Leibniz, Locke, Berkeley, and Hume wrote for a public of this sort, and I think it is unfortunate that during the last hundred and sixty years or so philosophy has come to be regarded as almost as technical as mathematics. Logic, it must be admitted, is technical in the same way as mathematics is, but logic, I maintain, is not part of philosophy. Philosophy proper deals with matters of interest to the general educated public, and loses much of its value if only a few professionals can understand what is said.

In this book I have sought to deal, as comprehensively as I am able, with a very large question: how comes it that human beings, whose contacts with the world are brief and personal and limited, are nevertheless able to know as much as they do know? Is the belief in our knowledge partly illusory? And, if not, what must we know otherwise than through the senses? Since I have dealt in earlier books with some parts of this problem, I am compelled to repeat, in a larger context, discussions of certain matters which I have considered elsewhere, but I have reduced such repetition to the minimum compatible with my purpose.

One of the difficulties of the subject with which I am concerned is that we must employ words which are common in ordinary speech, such as "belief", "truth", "knowledge", and "perception". Since these words, in their every-day uses, are vague and unprecise, and since no precise words are ready to hand by which to replace them, it is inevitable that everything said in the earlier stages of our inquiry should be unsatisfactory from the point of view that we hope to arrive at in the end. Our increase of knowledge, assuming that we are successful, is like that of a traveller approaching a mountain through a haze: at first only certain large features are discernible, and even they have indistinct boundaries, but gradually more detail becomes visible and edges become sharper. So, in our discussions, it is impossible first to clear up one problem and then proceed to another, for the intervening haze envelops all alike. At every stage, though one part of our problem may be in the focus of attention, all parts are more or less relevant. The different key words that we must use are all interconnected, and so long as some remain vague, others must, more or less, share this defect. It follows that what is said at first is liable to require emendation later. The Prophet announced that if two texts of the Koran appeared inconsistent, the later text was to be taken as authoritative, and I should wish the reader to apply a similar principle in interpreting what is said in this book.

The book has been read in typescript by my friend and pupil Mr. C. K. Hill, and I am indebted to him for many valuable criticisms, suggestions, and emendations. Large parts of the typescript have also been read by Mr. Hiram J. McLendon, who has made a number of useful suggestions.

Part III, Chapter IV, on "Physics and Experience", is a reprint, with few alterations, of a little book with the above title, published by the Cambridge University Press, to whom I owe thanks for permission to reprint it.

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PART IV. *SCIENTIFIC CONCEPTS*

PART V. *PROBABILITY*

PART VI. *POSTULATES OF SCIENTIFIC INFERENCE*

INTRODUCTION

The central purpose of this book is to examine the relation between individual experience and the general body of scientific knowledge. It is taken for granted that scientific knowledge, in its broad outlines, is to be accepted. Scepticism, while logically impeccable, is psychologically impossible, and there is an element of frivolous insincerity in any philosophy which pretends to accept it. Moreover, if scepticism is to be theoretically defensible it must reject *all* inferences from what is experienced; a partial scepticism, such as the denial of physical events experienced by no one, or a solipsism which allows events in my future or in my unremembered past, has no logical justification, since it must admit principles of inference which lead to beliefs that it rejects.

Ever since Kant, or perhaps it would be more just to say ever since Berkeley, there has been what I regard as a mistaken tendency among philosophers to allow the description of the world to be influenced unduly by considerations derived from the nature of human knowledge. To scientific common sense (which I accept) it is plain that only an infinitesimal part of the universe is known, that there were countless ages during which there was no knowledge, and that there probably will be countless ages without knowledge in the future. Cosmically and causally, knowledge is an unimportant feature of the universe; a science which omitted to mention its occurrence might, from an impersonal point of view, suffer only from a very trivial imperfection. In describing the world, subjectivity is a vice. Kant spoke of himself as having effected a "Copernican revolution", but he would have been more accurate if he had spoken of a "Ptolemaic counter-revolution", since he put Man back at the centre from which Copernicus had dethroned him.

But when we ask, not "what sort of world do we live in?" but "how do we come by our knowledge about the world?" subjectivity is in order. What each man knows is, in an important sense, dependent upon his own individual experience: he knows what he has seen and heard, what he has read and what he has been told, and also what, from these data, he has been able to infer. It is individual, not collective, experience that is here in

question, for an inference is required to pass from my data to the acceptance of testimony. If I believe that there is such a place as Semipalatinsk, I believe it because of things that have happened to *me*; and unless certain substantial principles of inference are accepted, I shall have to admit that all these things might have happened to me without there being any such place.

The desire to escape from subjectivity in the description of the world (which I share) has led some modern philosophers astray—at least so it seems to me—in relation to theory of knowledge. Finding its problems distasteful, they have tried to deny that these problems exist. That data are private and individual is a thesis which has been familiar since the time of Protagoras. This thesis has been denied because it has been thought, as Protagoras thought, that, if admitted, it must lead to the conclusion that all knowledge is private and individual. For my part, while I admit the thesis, I deny the conclusion; how and why, the following pages are intended to show.

In virtue of certain events in my own life, I have a number of beliefs about events that I do not experience—the thoughts and feelings of other people, the physical objects that surround me, the historical and geological past of the earth, and the remote regions of the universe that are studied in astronomy. For my part, I accept these beliefs as valid, apart from errors of detail. By this acceptance I commit myself to the view that there are valid processes of inference from events to other events—more particularly, from events of which I am aware without inference to events of which I have no such awareness. To discover what these processes are is a matter of analysis of scientific and common-sense procedure, in so far as such procedure is generally accepted as scientifically valid.

Inference from a group of events to other events can only be justified if the world has certain characteristics which are not logically necessary. So far as deductive logic can show, any collection of events might be the whole universe; if, then, I am ever to be able to infer events, I must accept principles of inference which lie outside deductive logic. All inference from events to events demands some kind of interconnection between different occurrences. Such interconnection is traditionally asserted in the principle of causality or natural law. It is implied, as we shall find, in whatever limited validity may be assigned to

induction by simple enumeration. But the traditional ways of formulating the kind of interconnection that must be postulated are in many ways defective, some being too stringent and some not sufficiently so. To discover the minimum principles required to justify scientific inferences is one of the main purposes of this book.

It is a commonplace to say that the substantial inferences of science, as opposed to those of logic and mathematics, are only *probable*—that is to say, when the premisses are true and the inference correct, the conclusion is only *likely* to be true. It is therefore necessary to examine what is meant by "probability". It will be found that there are two different concepts that may be meant. On the one hand, there is mathematical probability: if a class has n members, and m of them have a certain characteristic, the mathematical probability that an unspecified member of this class will have the characteristic in question is m/n. On the other hand, there is a wider and vaguer concept, which I call "degree of credibility", which is the amount of credence that it is rational to assign to a more or less uncertain proposition. Both kinds of probability are involved in stating the principles of scientific inference.

The course of our inquiry, in broad outline, will be as follows.

Part I, on the world of science, describes some of the main features of the universe which scientific investigation has made probable. This Part may be taken as setting the goal which inference must be able to reach, if our data and our principles of inference are to justify scientific practice.

Part II, on language, is still concerned with preliminaries. These are mainly of two sorts. On the one hand, it is important to make clear the meanings of certain fundamental terms, such as "fact" and "truth". On the other hand, it is necessary to examine the relation of sensible experience to empirical concepts such as "red", "hard", "metre", or "second". In addition, we shall examine the relation of words having an essential reference to the speaker, such as "here" and "now", to impersonal words, such as those assigning latitude, longitude, and date. This raises problems, of considerable importance and some difficulty, which are concerned with the relation of individual experience to the socially recognized body of general knowledge.

In Part III, on Science and Perception, we begin our main inquiry. We are concerned, here, to disentangle data from inferences in what ordinarily passes for empirical knowledge.

We are not yet concerned to justify inferences, or to investigate the principles according to which they are made, but we are concerned to show that inferences (as opposed to logical constructions) are necessary to science. We are concerned also to distinguish between two kinds of space and time, one subjective and appertaining to data, the other objective and inferred. Incidentally we shall contend that solipsism, except in an extreme form in which it has never been entertained, is an illogical half-way house between the fragmentary world of data and the complete world of science.

Part IV, on scientific concepts, is concerned to analyse the fundamental concepts of the inferred scientific world, more especially physical space, historical time, and causal laws. The terms employed in mathematical physics are required to fulfil two kinds of conditions: on the one hand, they must satisfy certain formulae; on the other hand, they must be so interpreted as to yield results that can be confirmed or confuted by observation. Through the latter condition they are linked to data, though somewhat loosely; through the former they become determinate as regards certain structural properties. But considerable latitude of interpretation remains. It is prudent to use this latitude in such a way as to minimize the part played by inference as opposed to construction; on this ground, for example, point-instants in space-time are constructed as groups of events or of qualities. Throughout this Part the two concepts of space-time structure and causal chains assume a gradually increasing importance. As Part III was concerned to discover what can be counted as data, so Part IV is concerned to set forth, in a general way, what, if science is to be justified, we must be able to infer from our data.

Since it is admitted that scientific inferences, as a rule, only confer probability on their conclusions, Part V proceeds to the examination of Probability. This term is capable of various interpretations, and has been differently defined by different authors. These interpretations and definitions are examined, and so are the attempts to connect induction with probability. In this matter the conclusion reached is, in the main, that advocated by Keynes: that inductions do not make their conclusions probable unless certain conditions are fulfilled, and that experience alone can never prove that these conditions are fulfilled.

Part VI, on the postulates of scientific inference, endeavours to discover what are the minimum assumptions, anterior to experience, that are required to justify us in inferring laws from a collection of data; and further, to inquire in what sense, if any, we can be said to know that these assumptions are valid. The main logical function that the assumptions have to fulfil is that of conferring a high probability on the conclusions of inductions that satisfy certain conditions. For this purpose, since only probability is in question, we do not need to assume that such-and-such a connection of events occurs always, but only that it occurs frequently. For example, one of the assumptions that appear necessary is that of separable causal chains, such as are exhibited by light-rays or sound-waves. This assumption can be stated as follows: when an event having a complex space-time structure occurs, it frequently happens that it is one of a train of events having the same or a very similar structure. (A more exact statement will be found in Chapter VI of this Part.) This is part of a wider assumption of regularity, or natural law, which, however, requires to be stated in more specific forms than is usual, for in its usual form it turns out to be a tautology.

That scientific inference requires, for its validity, principles which experience cannot render even probable, is, I believe, an inescapable conclusion from the logic of probability. For empiricism, it is an awkward conclusion. But I think it can be rendered somewhat more palatable by the analysis of the concept of "knowledge" undertaken in Part II. "Knowledge", in my opinion, is a much less precise concept than is generally thought, and has its roots more deeply embedded in unverbalized animal behaviour than most philosophers have been willing to admit. The logically basic assumptions to which our analysis leads us are psychologically the end of a long series of refinements which start from habits of expectation in animals, such as that what has a certain kind of smell will be good to eat. To ask, therefore, whether we "know" the postulates of scientific inference, is not so definite a question as it seems. The answer must be: in one sense, yes, in another sense, no; but in the sense in which "no" is the right answer we know nothing whatever, and "knowledge" in this sense is a delusive vision. The perplexities of philosophers are due, in a large measure, to their unwillingness to awaken from this blissful dream.

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Part IV, on scientific concepts, is concerned to analyse the fundamental concepts of the inferred scientific world, more especially physical space, historical time, and causal laws. The terms employed in mathematical physics are required to fulfil two kinds of conditions: on the one hand, they must satisfy certain formulae; on the other hand, they must be so interpreted as to yield results that can be confirmed or confuted by observation. Through the latter condition they are linked to data, though somewhat loosely; through the former they become determinate as regards certain structural properties. But considerable latitude of interpretation remains. It is prudent to use this latitude in such a way as to minimize the part played by inference as opposed to construction; on this ground, for example, point-instants in space-time are constructed as groups of events or of qualities. Throughout this Part the two concepts of space-time structure and causal chains assume a gradually increasing importance. As Part III was concerned to discover what can be counted as data, so Part IV is concerned to set forth, in a general way, what, if science is to be justified, we must be able to infer from our data.

Since it is admitted that scientific inferences, as a rule, only confer probability on their conclusions, Part V proceeds to the examination of Probability. This term is capable of various interpretations, and has been differently defined by different authors. These interpretations and definitions are examined, and so are the attempts to connect induction with probability. In this matter the conclusion reached is, in the main, that advocated by Keynes: that inductions do not make their conclusions probable unless certain conditions are fulfilled, and that experience alone can never prove that these conditions are fulfilled.

Part VI, on the postulates of scientific inference, endeavours to discover what are the minimum assumptions, anterior to experience, that are required to justify us in inferring laws from a collection of data; and further, to inquire in what sense, if any, we can be said to know that these assumptions are valid. The main logical function that the assumptions have to fulfil is that of conferring a high probability on the conclusions of inductions that satisfy certain conditions. For this purpose, since only probability is in question, we do not need to assume that such-and-such a connection of events occurs always, but only that it occurs frequently. For example, one of the assumptions that appear necessary is that of separable causal chains, such as are exhibited by light-rays or sound-waves. This assumption can be stated as follows: when an event having a complex space-time structure occurs, it frequently happens that it is one of a train of events having the same or a very similar structure. (A more exact statement will be found in Chapter VI of this Part.) This is part of a wider assumption of regularity, or natural law, which, however, requires to be stated in more specific forms than is usual, for in its usual form it turns out to be a tautology.

That scientific inference requires, for its validity, principles which experience cannot render even probable, is, I believe, an inescapable conclusion from the logic of probability. For empiricism, it is an awkward conclusion. But I think it can be rendered somewhat more palatable by the analysis of the concept of "knowledge" undertaken in Part II. "Knowledge", in my opinion, is a much less precise concept than is generally thought, and has its roots more deeply embedded in unverbalized animal behaviour than most philosophers have been willing to admit. The logically basic assumptions to which our analysis leads us are psychologically the end of a long series of refinements which start from habits of expectation in animals, such as that what has a certain kind of smell will be good to eat. To ask, therefore, whether we "know" the postulates of scientific inference, is not so definite a question as it seems. The answer must be: in one sense, yes, in another sense, no; but in the sense in which "no" is the right answer we know nothing whatever, and "knowledge" in this sense is a delusive vision. The perplexities of philosophers are due, in a large measure, to their unwillingness to awaken from this blissful dream.

PART I

THE WORLD OF SCIENCE

Chapter I

INDIVIDUAL AND SOCIAL KNOWLEDGE

SCIENTIFIC knowledge aims at being wholly impersonal, and tries to state what has been discovered by the collective intellect of mankind. In this chapter I shall consider how far it succeeds in this aim, and what elements of individual knowledge have to be sacrificed in order to achieve the measure of success that is possible.

The community knows both more and less than the individual: it knows, in its collective capacity, all the contents of the Encyclopaedia and all the contributions to the Proceedings of learned bodies, but it does not know the warm and intimate things that make up the colour and texture of an individual life. When a man says "I can never convey the horror I felt on seeing Buchenwald" or "no words can express my joy at seeing the sea again after years in a prison camp", he is saying something which is strictly and precisely true: he possesses, through his experience, knowledge not possessed by those whose experience has been different, and not completely capable of verbal expression. If he is a superb literary artist he may create in sensitive readers a state of mind not wholly unlike his own, but if he tries scientific methods the stream of his experience will be lost and dissipated in a dusty desert.

Language, our sole means of communicating *scientific* knowledge, is essentially social in its origin and in its main functions. It is true that, if a mathematician were wrecked on a desert island with a note-book and a pencil, he would, in all likelihood, seek to make his solitude endurable by calculations using the language of mathematics; it is true also that a man may keep a diary which he intends to conceal from all eyes but his own. On a more everyday plane, most of us use words in solitary thinking. Nevertheless the chief purpose of language is communication, and to serve this purpose it must be public, not a private dialect invented by the speaker. It follows that what is most personal in each individual's experience tends to evaporate during the process of translation into language. What is more, the very publicity of language is in large part a delusion. A given form of words will usually be interpreted by competent hearers in such a way as to be true for all of them or false for all of them, but in spite of this it will not have the same meaning for all of them. Differences which do not affect the truth or falsehood of a statement are usually of little practical importance, and are therefore ignored, with the result that we all believe our private world to be much more like the public world than it really is.

This is easily proved by considering the process of learning to understand language. There are two ways of getting to know what a word means: one is by a definition in terms of other words, which is called *verbal* definition; the other is by frequently hearing the word when the object which it denotes is present, which is called *ostensive* definition. It is obvious that ostensive definition is alone possible in the beginning, since verbal definition presupposes a knowledge of the words used in the *definiens*. You can learn by a verbal definition that a pentagon is a plane figure with five sides, but a child does not learn in this way the meaning of every-day words such as "rain", "sun", "dinner", or "bed". These are taught by using the appropriate word emphatically while the child is noticing the object concerned. Consequently the meaning that the child comes to attach to the word is a product of his personal experience, and varies according to his circumstances and his sensorium. A child who frequently experiences a mild drizzle will attach a different idea to the word "rain" from that formed by a child who has only experienced tropical torrents. A short-sighted and a long-sighted child will connect different images with the word "bed".

It is true that education tries to depersonalize language, and with a certain measure of success. "Rain" is no longer the familiar phenomenon, but "drops of water falling from clouds towards the earth", and "water" is no longer what makes you wet, but H_2O. As for hydrogen and oxygen, they have verbal definitions which have to be learnt by heart; whether you understand them does not matter. And so, as your instruction proceeds, the world of words becomes more and more separated from the world of the senses; you acquire the art of using words correctly, as you might acquire the art of playing the fiddle; in the end you become such a virtuoso in the manipulation of phrases that you need hardly ever remember that words have meanings. You have then become completely a public character, and even your inmost thoughts are

suitable for the encyclopaedia. But you can no longer hope to be a poet, and if you try to be a lover you will find your depersonalized language not very successful in generating the desired emotions. You have sacrificed expression to communication, and what you can communicate turns out to be abstract and dry.

It is an important fact that the nearer we come to the complete abstractness of logic, the less is the unavoidable difference between different people in the meaning attached to a word. I see no reason why there should be any difference at all between two suitably educated persons in the idea conveyed to them by the word "3481". The words "or" and "not" are capable of having exactly the same meaning for two different logicians. Pure mathematics, throughout, works with concepts which are capable of being completely public and impersonal. The reason is that they derive nothing from the senses, and that the senses are the source of privacy. The body is a sensitive recording instrument, constantly transmitting messages from the outside world; the messages reaching one body are never quite the same as those reaching another, though practical and social exigencies have taught us ways of disregarding the differences between the percepts of neighbouring persons. In constructing physics we have emphasized the spatio-temporal aspect of our perceptions, which is the aspect that is most abstract and most nearly akin to logic and mathematics. This we have done in the pursuit of publicity, in order to communicate what is communicable and to cover up the rest in a dark mantle of oblivion.

Space and time, however, as human beings know them, are not in reality so impersonal as science pretends. Theologians conceive God as viewing both space and time from without, impartially, and with a uniform awareness of the whole; science tries to imitate this impartiality with some apparent success, but the success is in part illusory. Human beings differ from the theologians' God in the fact that their space and time have a *here* and *now*. What is here and now is vivid, what is remote has a gradually increasing dimness. All our knowledge of events radiates from a space-time centre, which is the little region that we are occupying at the moment. "Here" is a vague term: in astronomical cosmology the Milky Way may count as "here", in the study of the Milky Way "here" is the solar system, in the study of the solar system "here" is the earth, in geography it is