A SYSTEM OF LOGIC
RATIOCINATIVE AND INDUCTIVE

BEING A CONNECTED VIEW OF THE
PRINCIPLES OF EVIDENCE
AND THE
METHODS OF SCIENTIFIC INVESTIGATION

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INTRODUCTION.

§ 1. There is as great diversity among authors in the modes which they have adopted of defining logic, as in their treatment of the details of it. This is what might naturally be expected on any subject on which writers have availed themselves of the same language as a means of delivering different ideas. Ethics and jurisprudence are liable to the remark in common with logic. Almost every writer having taken a different view of some of the particulars which these branches of knowledge are usually understood to include, each has so framed his definition as to indicate beforehand his own peculiar tenets, and sometimes to beg the question in their favour.

This diversity is not so much an evil to be complained of, as an inevitable and in some degree a proper result of the imperfect state of those sciences. It is not to be expected that there should be agreement about the definition of anything, until there is agreement about the thing itself. To define, is to select from among all the properties of a thing, those which shall be understood to be designated and declared by its name; and the properties must be well known to us before we can be competent to determine which of them are fittest to be chosen for this purpose. Accordingly, in the case of so complex an aggregation of particulars as are comprehended in anything which can be called a science, the definition we set out with is seldom that which a more extensive knowledge of the subject shows to be the most appropriate. Until we know the particulars themselves, we cannot fix upon the most correct and compact mode of circumscribing them by a general description. It was not until after an extensive and accurate acquaintance with the details of chemical phenomena, that it was found possible to frame a rational definition of chemistry; and the definition of the science of life and organization is still a matter of dispute. So long as the sciences are imperfect, the definitions must partake of their imperfection; and if the former are progressive, the latter ought to be so too. As much, therefore, as is to be expected from a definition placed at the commencement of a subject, is that it should define the scope of our inquiries: and the definition which I am about to offer of the science of logic, pretends to nothing more, than to be a statement of the question which I have put to myself, and which this book is an attempt to resolve. The reader is at liberty to object to it as a definition of logic; but it is at all events a correct definition of the subject of these volumes.

§ 2. Logic has often been called the Art of Reasoning. A writer* who has done more than any other person to restore this study to the rank from which it had fallen in the estimation of the cultivated class in our own country, has adopted the

* Archbishop Whately.
above definition with an amendment; he has defined Logic to be the Science, as well as the Art, of reasoning; meaning by the former term, the analysis of the mental process which takes place whenever we reason, and by the latter, the rules, grounded on that analysis, for conducting the process correctly. There can be no doubt as to the propriety of the emendation. A right understanding of the mental process itself, of the conditions it depends on, and the steps of which it consists, is the only basis on which a system of rules, fitted for the direction of the process, can possibly be founded. Art necessarily presupposes knowledge; art, in any but its infant state, presupposes scientific knowledge; and if every art does not bear the name of a science, it is only because several sciences are often necessary to form the groundwork of a single art. So complicated are the conditions which govern our practical agency, that to enable one thing to be done, it is often requisite to know the nature and properties of many things.

Logic, then, comprises the science of reasoning, as well as an art, founded on that science. But the word Reasoning, again, like most other scientific terms in popular use, abounds in ambiguities. In one of its acceptations, it means syllogizing; or the mode of inference which may be called (with sufficient accuracy for the present purpose) concluding from generals to particulars. In another of its senses, to reason is simply to infer any assertion, from assertions already admitted: and in this sense induction is as much entitled to be called reasoning as the demonstrations of geometry.

Writers on logic have generally preferred the former acceptation of the term: the latter, and more extensive signification is that in which I mean to use it. I do this by virtue of the right I claim for every author, to give whatever provisional definition he pleases of his own subject. But sufficient reasons will, I believe, unfold themselves as we advance, why this should be not only the provisional but the final definition. It involves, at all events, no arbitrary change in the meaning of the word; for, with the general usage of the English language, the wider signification, I believe, accords better than the more restricted one.

§ 3. But Reasoning, even in the widest sense of which the word is susceptible, does not seem to comprehend all that is included, either in the best, or even in the most current, conception of the scope and province of our science. The employment of the word Logic to denote the theory of Argumentation, is derived from the Aristotelian, or, as they are commonly termed, the scholastic, logicians. Yet even with them, in their systematic treatises, Argumentation was the subject only of the third part: the two former treated of Terms, and of Propositions; under one or other of which heads were also included Definition and Division. By some, indeed, these previous topics were professedly introduced only on account of their connexion with reasoning, and as a preparation for the doctrine and rules of the syllogism. Yet they were treated with greater minuteness, and dwelt on at greater length, than was required for that purpose alone. More recent writers on logic have generally understood the term as it was employed by the able author of the Fort Royal Logic; viz., as equivalent to the Art of Thinking. Nor is this acceptation confined to books, and scientific inquiries. Even in ordinary conversation, the ideas connected with the word Logic include at least precision of language, and accuracy of classification: and we perhaps oftener hear persons speak of a logical arrangement, or of expressions logically defined, than of conclusions logically deduced from premises. Again, a man is often called a great logician, or a man of powerful logic, not for
the accuracy of his deductions, but for the extent of his command over premises; because the general propositions required for explaining a difficulty or refuting a sophism, copiously and promptly occur to him; because, in short, his knowledge, besides being ample, is well under his command for argumentative use. Whether, therefore, we conform to the practice of those who have made the subject their particular study, or to that of popular writers and common discourse, the province of logic will include several operations of the intellect not usually considered to fall within the meaning of the terms Reasoning and Argumentation.

These various operations might be brought within the compass of the science, and the additional advantage be obtained of a very simple definition, if, by an extension of the term, sanctioned by high authorities, we were to define logic as the science which treats of the operations of the human understanding in the pursuit of truth. For to this ultimate end, naming, classification, definition, and all other operations over which logic has ever claimed jurisdiction, are essentially subsidiary. They may all be regarded as contrivances for enabling a person to know the truths which are needful to him, and to know them at the precise moment at which they are needful. Other purposes, indeed, are also served by these operations; for instance, that of imparting our knowledge to others. But, viewed with regard to this purpose, they have never been considered as within the province of the logician. The sole object of Logic is the guidance of one's own thoughts: the communication of those thoughts to others falls under the consideration of Rhetoric, in the large sense in which that art was conceived by the ancients; or of the still more extensive art of Education. Logic takes cognizance of our intellectual operations, only as they conduce to our own knowledge, and to our command over that knowledge for our own uses. If there were but one rational being in the universe, that being might be a perfect logician; and the science and art of logic would be the same for that one person as for the whole human race.

§ 4. But, if the definition which we formerly examined included too little, that which is now suggested has the opposite fault of including too much.

Truths are known to us in two ways: some are known directly, and of themselves; some through the medium of other truths. The former are the subject of Intuition, or Consciousness;* the latter, of Inference. The truths known by intuition are the original premises from which all others are inferred. Our assent to the conclusion being grounded on the truth of the premises, we never could arrive at any knowledge by reasoning, unless something could be known antecedently to all reasoning.

Examples of truths known to us by immediate consciousness, are our own bodily sensations and mental feelings. I know directly, and of my own knowledge, that I was vexed yesterday, or that I am hungry to-day. Examples of truths which we know only by way of inference, are occurrences which took place while we were absent, the events recorded in history, or the theorems of mathematics. The two former we infer from the testimony adduced, or from the traces of those past occurrences which still exist; the latter, from the premises laid down in books of geometry, under the title of definitions and axioms. Whatever we are capable of knowing must belong to the one class or to

* I use these terms indiscriminately, because, for the purpose in view, there is no need for making any distinction between them. But metaphysicians usually restrict the name Intuition to the direct knowledge we are supposed to have of things external to our minds, and Consciousness to our knowledge of our own mental phenomena.
the other; must be in the number of the primitive data, or of the conclusions which can be drawn from these.

With the original data, or ultimate premises of our knowledge; with their number or nature, the mode in which they are obtained, or the tests by which they may be distinguished; logic, in a direct way at least, has, in the sense in which I conceive the science, nothing to do. These questions are partly not a subject of science at all, partly that of a very different science.

Whatever is known to us by consciousness, is known beyond possibility of question. What one sees or feels, whether bodily or mentally, one cannot but be sure that one sees or feels. No science is required for the purpose of establishing such truths; no rules of art can render our knowledge of them more certain than it is in itself. There is no logic for this portion of our knowledge.

But we may fancy that we see or feel what we in reality infer. A truth, or supposed truth, which is really the result of a very rapid inference, may seem to be apprehended intuitively. It has long been agreed by thinkers of the most opposite schools, that this mistake is actually made in so familiar an instance as that of the eyesight. There is nothing of which we appear to ourselves to be more directly conscious, than the distance of an object from us. Yet it has long been ascertained, that what is perceived by the eye, is at most nothing more than a variously coloured surface; that when we fancy we see distance, all we really see is certain variations of apparent size, and degrees of faintness of colour; that our estimate of the object's distance from us is the result partly of a rapid inference from the muscular sensations accompanying the adjustment of the focal distance of the eye to objects unequally remote from us, and partly of a comparison (made with so much rapidity that we are unconscious of making it) between the size and colour of the object as they appear at the time, and the size and colour of the same or of similar objects as they appeared when close at hand, or when their degree of remoteness was known by other evidence. The perception of distance by the eye, which seems so like intuition, is thus, in reality, an inference grounded on experience; an inference, too, which we learn to make; and which we make with more and more correctness as our experience increases; though in familiar cases it takes place so rapidly as to appear exactly on a par with those perceptions of sight which are really intuitive, our perceptions of colour.

Of the science, therefore, which expounds the operations of the human understanding in the pursuit of truth, one essential part is the inquiry: What are the facts which are the objects of intuition or consciousness, and what are these which we merely infer? But this inquiry has never been considered a portion of logic. Its place is in another and a perfectly distinct department of science, to which the name metaphysics more particularly belongs: that portion of mental philosophy which attempts to determine what part of the furniture of the mind belongs to it originally, and what part is constructed out of materials furnished to it from without.

To this science appertain the great and much debated questions of the existence of matter; the existence of spirit, and of a distinction between it and matter; the reality of time and space, as things without the mind, and distinguishable from the objects which are said to exist in them. For in the present state of the discussion *This important theory has of late been called in question by a writer of deserved reputation, Mr. Samuel Bailey; but I do not conceive that the grounds on which it has been admitted as an established doctrine for a century past, have been at all shaken by that gentleman's objections. I have elsewhere said what appeared to me necessary in reply to his arguments. (Westminster Review for October 1842; reprinted in Dissertations and Discussions, vol. ii.)
on these topics, it is almost universally allowed that the existence of matter or of spirit, of space or of time, is in its nature unsusceptible of being proved; and that if anything is known of them, it must be by immediate intuition. To the same science belong the inquiries into the nature of Conception, Perception, Memory, and Belief; all of which are operations of the understanding in the pursuit of truth; but with which, as phenomena of the mind, or with the possibility which may or may not exist of analysing any of them into simpler phenomena, the logician as such has no concern. To this science must also be referred the following, and all analogous questions: To what extent our intellectual faculties and our emotions are innate—to what extent the result of association: Whether God, and duty, are realities, the existence of which is manifest to us à priori by the constitution of our rational faculty; or whether our ideas of them are acquired notions, the origin of which we are able to trace and explain; and the reality of the objects themselves a question not of consciousness or intuition, but of evidence and reasoning.

The province of logic must be restricted to that portion of our knowledge which consists of inferences from truths previously known; whether those antecedent data be general propositions, or particular observations and perceptions. Logic is not the science of Belief, but the science of Proof or Evidence. In so far as belief professes to be founded on proof, the office of logic is to supply a test for ascertaining whether or not the belief is well grounded. With the claims which any proposition has to belief on the evidence of consciousness, that is, without evidence in the proper sense of the word, logic has nothing to do.

§ 5. By far the greatest portion of our knowledge, whether of general truths or of particular facts, being avowedly matter of inference, nearly the whole, not only of science, but of human conduct, is amenable to the authority of logic. To draw inferences has been said to be the great business of life. Every one has daily, hourly, and momentary need of ascertaining facts which he has not directly observed; not from any general purpose of adding to his stock of knowledge, but because the facts themselves are of importance to his interests or to his occupations. The business of the magistrate, of the military commander, of the navigator, of the physician, of the agriculturist, is merely to judge of evidence, and to act accordingly. They all have to ascertain certain facts, in order that they may afterwards apply certain rules, either devised by themselves, or prescribed for their guidance by others; and as they do this well or ill, so they discharge well or ill the duties of their several callings. It is the only occupation in which the mind never ceases to be engaged; and is the subject, not of logic, but of knowledge in general.

Logic, however, is not the same thing with knowledge, though the field of logic is coextensive with the field of knowledge. Logic is the common judge and arbiter of all particular investigations. It does not undertake to find evidence, but to determine whether it has been found. Logic neither observes, nor invents, nor discovers; but judges. It is no part of the business of logic to inform the surgeon what appearances are found to accompany a violent death. This he must learn from his own experience and observation, or from that of others, his predecessors in his peculiar pursuit. But logic sits in judgment on the sufficiency of that observation and experience to justify his rules, and on the sufficiency of his rules to justify his conduct. It does not give him proofs, but teaches him what makes them proofs, and how he is to judge of them. It does not teach that any particular fact proves
any other, but points out to what conditions all facts must conform, in order that they may prove other facts. To decide whether any given fact fulfils these conditions, or whether facts can be found which fulfil them in a given case, belongs exclusively to the particular art or science, or to our knowledge of the particular subject.

It is in this sense that logic is, what it was so expressly called by the schoolmen and by Bacon, *ars artium*; the science of science itself. All science consists of data and conclusions from those data, of proofs and what they prove: now logic points out what relations must subsist between data and whatever can be concluded from them, between proof and everything which it can prove. If there be any such indispensable relations, and if these can be precisely determined, every particular branch of science, as well as every individual in the guidance of his conduct, is bound to conform to those relations, under the penalty of making false inferences—of drawing conclusions which are not grounded in the realities of things. Whatever has at any time been concluded justly, whatever knowledge has been acquired otherwise than by immediate intuition, depended on the observance of the laws which it is the province of logic to investigate. If the conclusions are just, and the knowledge real, those laws, whether known or not, have been observed.

§ 6. We need not, therefore, seek any farther for a solution of the question, so often agitated, respecting the utility of logic. If a science of logic exists, or is capable of existing, it must be useful. If there be rules to which every mind consciously or unconsciously conforms in every instance in which it infers rightly, there seems little necessity for discussing whether a person is more likely to observe those rules, when he knows the rules, than when he is unacquainted with them.

A science may undoubtedly be brought to a certain, not inconsiderable, stage of advancement, without the application of any other logic to it than what all persons, who are said to have a sound understanding, acquire empirically in the course of their studies. Mankind judged of evidence, and often correctly, before logic was a science, or they never could have made it one. And they executed great mechanical works before they understood the laws of mechanics. But there are limits both to what mechanicians can do without principles of mechanics, and to what thinkers can do without principles of logic. A few individuals, by extraordinary genius, or by the accidental acquisition of a good set of intellectual habits, may work without principles in the same way, or nearly the same way, in which they would have worked if they had been in possession of principles. But the bulk of mankind require either to understand the theory of what they are doing, or to have rules laid down for them by those who have understood the theory. In the progress of science from its easiest to its more difficult problems, each great step in advance has usually had either as its precursor, or as its accompaniment and necessary condition, a corresponding improvement in the notions and principles of logic received among the most advanced thinkers. And if several of the more difficult sciences are still in so defective a state; if not only so little is proved, but disputation has not terminated even about the little which seemed to be so; the reason perhaps is, that men's logical notions have not yet acquired the degree of extension, or of accuracy, requisite for the estimation of the evidence proper to those particular departments of knowledge.

§ 7. Logic, then, is the science of the operations of the understanding which are subservient to the estimation of evidence: both the process itself of advancing from known truths
to unknown, and all other intellectual operations in so far as auxiliary to this. It includes, therefore, the operation of Naming; for language is an instrument of thought, as well as a means of communicating our thoughts. It includes, also, Definition, and Classification. For, the use of these operations (putting all other minds than one's own out of consideration) is to serve not only for keeping our evidences and the conclusions from them permanent and readily accessible in the memory, but for so marshalling the facts which we may at any time be engaged in investigating, as to enable us to perceive more clearly what evidence there is, and to judge with fewer chances of error whether it be sufficient. These, therefore, are operations specially instrumental to the estimation of evidence, and, as such, are within the province of Logic. There are other more elementary processes, concerned in all thinking, such as Conception, Memory, and the like; but of these it is not necessary that Logic should take any peculiar cognizance, since they have no special connexion with the problem of Evidence, further than that, like all other problems addressed to the understanding, it presupposes them.

Our object, then, will be, to attempt a correct analysis of the intellectual process called Reasoning or Inference, and of such other mental operations as are intended to facilitate this: as well as, on the foundation of this analysis, and pari passu with it, to bring together or frame a set of rules or canons for testing the sufficiency of any given evidence to prove any given proposition.

With respect to the first part of this undertaking, I do not attempt to decompose the mental operations in question into their ultimate elements. It is enough if the analysis as far as it goes is correct, and if it goes far enough for the practical purposes of logic considered as an art. The separation of a complicated phenomenon into its component parts is not like a connected and interdependent chain of proof. If one link of an argument breaks, the whole drops to the ground; but one step toward an analysis holds good and has an independent value, though we should never be able to make a second. The results which have been obtained by analytical chemistry are not the less valuable, though it should be discovered that all which we now call simple substances are really compounds. All other things are at any rate compounded of those elements: whether the elements themselves admit of decomposition, is an important inquiry, but does not affect the certainty of the science up to that point.

I shall, accordingly, attempt to analyse the process of inference, and the processes subordinate to inference, so far only as may be requisite for ascertaining the difference between a correct and an incorrect performance of those processes. The reason for thus limiting our design, is evident. It has been said by objectors to logic, that we do not learn to use our muscles by studying their anatomy. The fact is not quite fairly stated; for if the action of any of our muscles were vitiated by local weakness, or other physical defect, a knowledge of their anatomy might be very necessary for effecting a cure. But we should be justly liable to the criticism involved in this objection, were we, in a treatise on logic, to carry the analysis of the reasoning process beyond the point at which any inaccuracy which may have crept into it must become visible. In learning bodily exercises (to carry on the same illustration) we do, and must, analyse the bodily motions so far as is necessary for distinguishing those which ought to be performed from those which ought not. To a similar extent, and no further, it is necessary that the logician should analyse the mental processes with which logic is concerned. Logic has no interest in carrying the analysis beyond the point at which it becomes apparent whether
the operations have in any individual case been rightly or wrongly performed: in the same manner as the science of music teaches us to discriminate between musical notes, and to know the combinations of which they are susceptible, but not what number of vibrations in a second correspond to each; which, though useful to be known, is useful for totally different purposes. The extension of Logic as a Science is determined by its necessities as an Art: whatever it does not need for its practical ends, it leaves to the larger science which may be said to correspond, not to any particular art, but to art in general; the science which deals with the constitution of the human faculties; and to which, in the part of our mental nature which concerns Logic, as well as in all other parts, it belongs to decide what are ultimate facts, and what are resolvable into other facts. And I believe it will be found that most of the conclusions arrived at in this work have no necessary connexion with any particular views respecting the ulterior analysis. Logic is common ground on which the partisans of Hartley and of Reid, of Locke and of Kant may meet and join hands. Particular and detached opinions of all these thinkers will no doubt occasionally be controverted, since all of them were logicians as well as metaphysicians; but the field on which their principal battles have been fought, lies beyond the boundaries of our science.

It cannot, indeed, be pretended that logical principles can be altogether irrelevant to those more abstruse discussions; nor is it possible but that the view we are led to take of the problem which logic proposes, must have a tendency favourable to the adoption of some one opinion, on these controverted subjects, rather than another. For metaphysics, in endeavouring to solve its own peculiar problem, must employ means, the validity of which falls under the cognizance of logic. It proceeds, no doubt, as far as possible, merely by a closer and more attentive interrogation of our consciousness, or more properly speaking, of our memory; and so far is not amenable to logic. But wherever this method is insufficient to attain the end of its inquiries, it must proceed, like other sciences, by means of evidence. Now, the moment this science begins to draw inferences from evidence, logic becomes the sovereign judge whether its inferences are well grounded, or what other inferences would be so.

This, however, constitutes no nearer or other relation between logic and metaphysics, than that which exists between logic and every other science. And I can conscientiously affirm, that no one proposition laid down in this work has been adopted for the sake of establishing, or with any reference to its fitness for being employed in establishing, preconceived opinions in any department of knowledge or of inquiry on which the speculative world is still undecided.*

* The view taken in the text, of the definition and purpose of Logic, stands in marked opposition to that of the school of philosophy which, in this country, is represented by the writings of Sir William Hamilton and of his numerous pupils. Logic, as this school conceives it, is "the Science of the Formal Laws of Thought:" a definition framed for the express purpose of excluding, as irrelevant to Logic, whatever relates to Belief and Disbelief, or to the pursuit of truth as such, and restricting the science to that very limited portion of its total province, which has reference to the conditions, not of Truth, but of Consistency. What I have thought it useful to say in opposition to this limitation of the field of Logic, has been said at some length in a separate work, first published in 1865, and entitled An Examination of Sir William Hamilton's Philosophy, and of the Principal Philosophical Questions discussed in his Writings. For the purposes of the present Treatise, I am content that the justification of the larger extension which I gave to the domain of the science, should rest on the sequel of the Treatise itself. Some remarks on the relation which the Logic of Consistency bears to the Logic of Truth, and on the place which that particular part occupies in the whole to which it belongs, will be found in the present volume (Book II. chap. iii. § 9).