Carveth Read

Logic: Deductive and Inductive

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Содержание

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PREFACE

In this edition of my *Logic*, the text has been revised throughout, several passages have been rewritten, and some sections added. The chief alterations and additions occur in cc. i., v., ix., xiii., xvi., xvii., xx.

The work may be considered, on the whole, as attached to the school of Mill; to whose *System of Logic*, and to Bain's *Logic*, it is deeply indebted. Amongst the works of living writers, the *Empirical Logic* of Dr. Venn and the *Formal Logic* of Dr. Keynes have given me most assistance. To some others acknowledgments have been made as occasion arose.

For the further study of contemporary opinion, accessible in English, one may turn to such works as Mr. Bradley's *Principles of Logic*, Dr. Bosanquet's *Logic; or the Morphology of Knowledge*, Prof. Hobhouse's *Theory of Knowledge*, Jevon's *Principles of Science*, and Sigwart's *Logic*. Ueberweg's *Logic, and History of Logical Doctrine* is invaluable for the history of our subject. The attitude toward Logic of the Pragmatists or

Humanists may best be studied in Dr. Schiller's *Formal Logic*, and in Mr. Alfred Sidgwick's *Process of Argument* and recent *Elementary Logic*. The second part of this last work, on the "Risks of Reasoning," gives an admirably succinct account of their position. I agree with the Humanists that, in all argument, the important thing to attend to is the meaning, and that the most serious difficulties of reasoning occur in dealing with the matter reasoned about; but I find that a pure science of relation has a necessary place in the system of knowledge, and that the formulæ known as laws of contradiction, syllogism and causation are useful guides in the framing and testing of arguments and experiments concerning matters of fact. Incisive criticism of traditionary doctrines, with some remarkable reconstructions, may be read in Dr. Mercier's *New Logic*.

In preparing successive editions of this book, I have profited by the comments of my friends: Mr. Thomas Whittaker, Prof. Claude Thompson, Dr. Armitage Smith, Mr. Alfred Sidgwick, Dr. Schiller, Prof. Spearman, and Prof. Sully, have made important suggestions; and I might have profited more by them, if the frame of my book, or my principles, had been more elastic.

As to the present edition, useful criticisms have been received from Mr. S.C. Dutt, of Cotton College, Assam, and from Prof. M.A. Roy, of Midnapore; and, especially, I must heartily thank my colleague, Dr. Wolf, for communications that have left their impress upon nearly every chapter.

Carveth Read.

London,
August, 1914

CHAPTER I
INTRODUCTORY

§ 1. Logic is the science that explains what conditions must be fulfilled in order that a proposition may be proved, if it admits of proof. Not, indeed, every such proposition; for as to those that declare the equality or inequality of numbers or other magnitudes, to explain the conditions of their proof belongs to Mathematics: they are said to be *quantitative*. But as to all other propositions, called *qualitative*, like most of those that we meet with in conversation, in literature, in politics, and even in sciences so far as they are not treated mathematically (say, Botany and Psychology); propositions that merely tell us that something happens (as that *salt dissolves in water*), or that something has a certain property (as that *ice is cold*): as to these, it belongs to Logic to show how we may judge whether they are true, or false, or doubtful. When propositions are expressed with the universality and definiteness that belong to scientific statements, they are called laws; and laws, so far as they are not laws of quantity, are tested by the principles of Logic, if they at all admit of proof.

But it is plain that the process of proving cannot go on for ever; something must be taken for granted; and this is usually considered to be the case (1) with particular facts that can only be perceived and observed, and (2) with those highest laws that are called 'axioms' or 'first principles,' of which we can only say that we know of no exceptions to them, that we cannot help believing them, and that they are indispensable to science and to consistent thought. Logic, then, may be briefly defined as the science of proof with respect to *qualitative* laws and propositions, except those that are axiomatic.

§ 2. Proof may be of different degrees or stages of completeness. Absolute proof would require that a proposition should be shown to agree with all experience and with the systematic explanation of experience, to be a necessary part of an all-embracing and self-consistent philosophy or theory of the universe; but as no one hitherto has been able to frame such a philosophy, we must at present put up with something less than absolute proof. Logic, assuming certain principles to be true of experience, or at least to be conditions of consistent discourse, distinguishes the kinds of propositions that can be shown to agree with these principles, and explains by what means the agreement can best be exhibited. Such principles are those of Contradiction (chap. vi.), the Syllogism (chap. ix.), Causation (chap. xiv.), and Probabilities (chap. xx.). To bring a proposition or an argument under them, or to show that it agrees with them, is logical proof.

The extent to which proof is requisite, again, depends upon the present purpose: if our aim be general truth for its own sake, a systematic investigation is necessary; but if our object be merely to remove some occasional doubt that has occurred to ourselves or to others, it may be enough to appeal to any evidence that is admitted or not questioned. Thus, if a man doubts that *some acids are compounds of oxygen*, but grants that *some compounds of oxygen are acids*, he may agree to the former proposition when you point out that it has the same meaning as the latter, differing from it only in the order of the words. This is called proof by immediate inference.

Again, suppose that a man holds in his hand a piece of yellow metal, which he asserts to be copper, and that we doubt this, perhaps suggesting that it is really gold. Then he may propose to dip it in vinegar; whilst we agree that, if it then turns green, it is copper and not gold. On trying this experiment the metal does turn green; so that we may put his argument in this way:—

> Whatever yellow metal turns green in vinegar is copper;
> This yellow metal turns green in vinegar;
> Therefore, this yellow metal is copper.

Such an argument is called proof by mediate inference; because one cannot see directly that the yellow metal is copper; but it is admitted that any yellow metal is copper that turns green in vinegar, and we are shown that this yellow metal has that property.

Now, however, it may occur to us, that the liquid in which the metal was dipped was not vinegar, or not pure vinegar, and that the greenness was due to the impurity. Our friend must thereupon show by some means that the vinegar was pure; and then his argument will be that, since nothing but the vinegar came in contact with the metal, the greenness was due to the vinegar; or, in other words, that contact with that vinegar was the cause of the metal turning green.

Still, on second thoughts, we may suspect that we had formerly conceded too much; we may reflect that, although it had often been shown that copper turned green in vinegar, whilst gold did not, yet the same might not always happen. May it not be, we might ask, that just at this moment, and perhaps always for the future gold turns, and will turn green in vinegar, whilst copper does not and never will again? He will probably reply that this is to doubt the uniformity of causation: he may hope that we are not serious: he may point out to us that in every action of our life we take such uniformity for granted. But he will be obliged to admit that, whatever he may say to induce us to assent to the principle of Nature's uniformity, his arguments will not amount to logical proof, because every argument in some way assumes that principle. He has come, in fact, to the limits of Logic. Just as Euclid does not try to prove that 'two magnitudes equal to the same third are equal to one another,' so the Logician (as such) does not attempt to prove the uniformity of causation and the other principles of his science.

Even when our purpose is to ascertain some general truth, the results of systematic inquiry may have various degrees of certainty. If Logic were confined to strict demonstration, it would cover a narrow field. The greater part of our conclusions can only be more or less probable. It may, indeed, be maintained, not unreasonably, that no judgments concerning matters of fact can be more than probable. Some say that all scientific results should be considered as giving the average of cases, from which deviations are to be expected. Many matters can only be treated statistically and by the methods of Probability. Our ordinary beliefs are adopted without any methodical examination. But it is the aim, and it is characteristic, of a rational mind to distinguish degrees of certainty, and to hold each judgment with the degree of confidence that it deserves, considering the evidence for and against it. It takes a long time, and much self-discipline, to make some progress toward rationality; for there are many causes of belief that are not good grounds for it—have no value as evidence. Evidence consists of (1) observation; (2) reasoning checked by observation and by logical principles; (3) memory—often inaccurate; (4) testimony—often untrustworthy, but indispensable, since all we learn from books or from other men is taken on testimony; (5) the agreement of all our results. On the other hand, belief is caused by many influences that are not evidence at all: such are (1) desire, which makes us believe in whatever serves our purpose; fear and suspicion, which (paradoxically) make us believe in whatever seems dangerous; (2) habit, which resists whatever disturbs our prejudices; (3) vanity, which delights to think oneself always right and consistent and disowns fallibility; (4) imitativeness, suggestibility, fashion, which carry us along with the crowd. All these, and nobler things, such as love and fidelity, fix our attention upon whatever seems to support our prejudices, and prevent our attending to any facts or arguments that threaten to overthrow them.

§ 3. Two departments of Logic are usually recognised, Deduction and Induction; that is, to describe them briefly, proof from principles, and proof from facts. Classification is sometimes made a third department; sometimes its topics are distributed amongst those of the former two. In the present work the order adopted is, Deduction in chaps. ii. to xiii.; Induction in chaps. xiii. to xx.; and, lastly, Classification. But such divisions do not represent fundamentally distinct and opposed aspects of the science. For although, in discussing any question with an opponent who makes admissions, it may be possible to combat his views with merely deductive arguments based upon his admissions; yet in any question of general truth, Induction and Deduction are mutually dependent and imply one another.

This may be seen in one of the above examples. It was argued that a certain metal must be copper, because every metal is copper that turns green when dipped in vinegar. So far the proof appealed to a general proposition, and was deductive. But when we ask how the general proposition is known to be true, experiments or facts must be alleged; and this is inductive evidence. Deduction then depends on Induction. But if we ask, again, how any number of past experiments can prove a general proposition, which must be good for the future as well as for the past, the uniformity of causation is invoked; that is, appeal is made to a principle, and that again is deductive proof. Induction then depends upon Deduction.

We may put it in this way: Deduction depends on Induction, if general propositions are only known to us through the facts: Induction depends on Deduction, because one fact can never prove another, except so far as what is true of the one is true of the other and of any other of the same kind; and because, to exhibit this resemblance of the facts, it must be stated in a general proposition.

§ 4. The use of Logic is often disputed: those who have not studied it, often feel confident of their ability to do without it; those who have studied it, are sometimes disgusted with what they consider to be its superficial analysis of the grounds of evidence, or needless technicality in the discussion of details. As to those who, not having studied Logic, yet despise it, there will be time enough to discuss its utility with them, when they know something about it; and as for those who, having studied it, turn away in disgust, whether they are justified every man must judge for himself, when he has attained to equal proficiency in the subject. Meanwhile, the following considerations may be offered in its favour:

Logic states, and partly explains and applies, certain abstract principles which all other sciences take for granted; namely, the axioms above mentioned—the principles of Contradiction, of the Syllogism and of Causation. By exercising the student in the apprehension of these truths, and in the application of them to particular propositions, it educates the power of abstract thought.

Every science is a model of method, a discipline in close and consecutive thinking; and this merit Logic ought to possess in a high degree.

For ages Logic has served as an introduction to Philosophy that is, to Metaphysics and speculative Ethics. It is of old and honourable descent: a man studies Logic in very good company. It is the warp upon which nearly the whole web of ancient, mediæval and modern Philosophy is woven. The history of thought is hardly intelligible without it.

As the science of proof, Logic gives an account of the *general* nature of evidence deductive and inductive, as applied in the physical and social sciences and in the affairs of life. The *general* nature of such evidence: it would be absurd of the logician to pretend to instruct the chemist, economist and merchant, as to the *special* character of the evidence requisite in their several spheres of judgment. Still, by investigating the general conditions of proof, he sets every man upon his guard against the insufficiency of evidence.

One application of the science of proof deserves special mention: namely, to that department of Rhetoric which has been the most developed, relating to persuasion by means of oratory, leader-writing, or pamphleteering. It is usually said that Logic is useful to convince the judgment, not to persuade the will: but one way of persuading the will is to convince the judgment that a certain course is advantageous; and although this is not always the readiest way, it is the most honourable, and leads to the most enduring results. Logic is the backbone of Rhetoric.

It has been disputed whether Logic is a science or an art; and, in fact, it may be considered in both ways. As a statement of general truths, of their relations to one another, and especially to the first principles, it is a science; but it is an art when, regarding truth as an end desired, it points out some of the means of attaining it—namely, to proceed by a regular method, to test every judgment by the principles of Logic, and to distrust whatever cannot be made consistent with them. Logic does not, in the first place, teach us to reason. We learn to reason as we learn to walk and talk, by the natural growth of our powers with some assistance from friends and neighbours. The way to develop one's power of reasoning is, first, to set oneself problems and try to solve them. Secondly, since the solving of a problem depends upon one's ability to call to mind parallel cases, one must learn as many facts as possible, and keep on learning all one's life; for nobody ever knew enough. Thirdly one must check all results by the principles of Logic. It is because of this checking, verifying, corrective function of Logic that it is sometimes called a Regulative or Normative Science. It cannot give any one originality or fertility of invention; but it enables us to check our inferences, revise our conclusions, and chasten the vagaries of ambitious speculation. It quickens our sense of bad reasoning both in others and in ourselves. A man who reasons deliberately, manages it better after studying Logic than he could before, if he is sincere about it and has common sense.

§ 5. The relation of Logic to other sciences:

(*a*) Logic is regarded by Spencer as co-ordinate with Mathematics, both being Abstract Sciences—that is, sciences of the *relations* in which things stand to one another, whatever the particular things may be that are so related; and this view seems to be, on the whole, just—subject, however, to qualifications that will appear presently.

Mathematics treats of the relations of all sorts of things considered as quantities, namely, as equal to, or greater or less than, one another. Things may be quantitatively equal or unequal in *degree*, as in comparing the temperature of bodies; or in *duration*; or in *spatial magnitude*, as with lines, superficies, solids; or in *number*. And it is assumed that the equality or inequality of things that cannot be directly compared, may be proved indirectly on the assumption that 'things equal to the same thing are equal,' etc.

Logic also treats of the relations of all sorts of things, but not as to their quantity. It considers (i) that one thing may be like or unlike another in certain attributes, as that iron is in many ways like tin or lead, and in many ways unlike carbon or sulphur: (ii) that attributes co-exist or coinhere (or do not) in the same subject, as metallic lustre, hardness, a certain atomic weight and a certain specific gravity coinhere in iron: and (iii) that one event follows another (or is the effect of it), as that the placing of iron in water causes it to rust. The relations of likeness and of coinherence are the ground of Classification;

for it is by resemblance of coinhering attributes that things form classes: coinherence is the ground of judgments concerning Substance and Attribute, as that iron is metallic; and the relation of succession, in the mode of Causation, is the chief subject of the department of Induction. It is usual to group together these relations of attributes and of order in time, and call them qualitative, in order to contrast them with the quantitative relations which belong to Mathematics. And it is assumed that qualitative relations of things, when they cannot be directly perceived, may be proved indirectly by assuming the axiom of the Syllogism (chap. ix.) and the law of Causation (chap. xiv.).

So far, then, Logic and Mathematics appear to be co-ordinate and distinct sciences. But we shall see hereafter that the satisfactory treatment of that special order of events in time which constitutes Causation, requires a combination of Logic with Mathematics; and so does the treatment of Probability. And, again, Logic may be said to be, in a certain sense, 'prior to' or 'above' Mathematics as usually treated. For the Mathematics assume that one magnitude must be either equal or unequal to another, and that it cannot be both equal and unequal to it, and thus take for granted the principles of Contradiction and Excluded Middle; but the statement and elucidation of these Principles are left to Logic (chap. vi.). The Mathematics also classify and define magnitudes, as (in Geometry) triangles, squares, cubes, spheres; but the principles of classification and definition remain for Logic to discuss.

(*b*) As to the concrete Sciences, such as Astronomy, Chemistry, Zoology, Sociology—Logic (as well as Mathematics) is implied in them all; for all the propositions of which they consist involve causation, co-existence, and class-likeness. Logic is therefore said to be prior to them or above them: meaning by 'prior' not that it should be studied earlier, for that is not a good plan; meaning by 'above' not in dignity, for distinctions of dignity amongst liberal studies are absurd. But it is a philosophical idiom to call the abstract 'prior to,' or 'higher than,' the concrete (see Porphyry's Tree, chap. xxii. § 8); and Logic is more abstract than Astronomy or Sociology. Philosophy may thank that idiom for many a foolish notion.

(*c*) But, as we have seen, Logic does not investigate the truth, trustworthiness, or validity of its own principles; nor does Mathematics: this task belongs to Metaphysics, or Epistemology, the criticism of knowledge and beliefs.

Logic assumes, for example, that things are what to a careful scrutiny they seem to be; that animals, trees, mountains, planets, are bodies with various attributes, existing in space and changing in time; and that certain principles, such as Contradiction and Causation, are true of things and events. But Metaphysicians have raised many plausible objections to these assumptions. It has been urged that natural objects do not really exist on their own account, but only in dependence on some mind that contemplates them, and that even space and time are only our way of perceiving things; or, again, that although things do really exist on their own account, it is in an entirely different way from that in which we know them. As to the principle of Contradiction—that if an object has an attribute, it cannot at the same time and in the same way be without it (*e.g.*, if an animal is conscious, it is false that it is not conscious)—it has been contended that the speciousness of this principle is only due to the obtuseness of our minds, or even to the poverty of language, which cannot make the fine distinctions that exist in Nature. And as to Causation, it is sometimes doubted whether events always have physical causes; and it is often suggested that, granting they have physical causes, yet these are such as we can neither perceive nor conceive; belonging not to the order of Nature as we know it, but to the secret inwardness and reality of Nature, to the wells and reservoirs of power, not to the spray of the fountain that glitters in our eyes—'occult causes,' in short. Now these doubts and surmises are metaphysical spectres which it remains for Metaphysics to lay. Logic has no direct concern with them (although, of course, metaphysical discussion is expected to be logical), but keeps the plain path of plain beliefs, level with the comprehension of plain men. Metaphysics, as examining the grounds of Logic itself, is sometimes regarded as 'the higher Logic'; and, certainly, the study of Metaphysics is necessary to every one who would comprehend the nature and functions of Logic, or the place of his own mind and of Reason in the world.

(*d*) The relation of Logic to Psychology will be discussed in the next section.

(*e*) As a Regulative Science, pointing out the conditions of true inference (within its own sphere), Logic is co-ordinate with (i) Ethics, considered as assigning the conditions of right conduct, and with (ii) Æsthetics, considered as determining the principles of criticism and good taste.

§ 6. Three principal schools of Logicians are commonly recognised: Nominalist, Conceptualist, and Materialist, who differ as to what it is that Logic really treats of: the Nominalists say, 'of language'; the Conceptualists, 'of thought'; the Materialists, 'of relations of fact.' To illustrate these positions let us take authors who, if some of them are now neglected, have the merit of stating their contrasted views with a distinctness that later refinements tend to obscure.

(*a*) Whately, a well-known Nominalist, regarded Logic as the Science and Art of Reasoning, but at the same time as "entirely conversant about language"; that is to say, it is the business of Logic to discover those modes of statement which shall ensure the cogency of an argument, no matter what may be the subject under discussion. Thus, *All fish are cold-blooded*, ∴ *some cold-blooded things are fish:* this is a sound inference by the mere manner of expression; and equally sound is the inference, *All fish are warm-blooded*, ∴ *some warm-blooded things are fish*. The latter proposition may be false, but it follows; and (according to this doctrine) Logic is only concerned with the consistent use of words: the truth or falsity of the proposition itself is a question for Zoology. The short-coming of extreme Nominalism lies in speaking of language as if its meaning were unimportant. But Whately did not intend this: he was a man of great penetration and common-sense.

(*b*) Hamilton, our best-known Conceptualist, defined Logic as the science of the "formal laws of thought," and "of thought as thought," that is, without regard to the matter thought about. Just as Whately regarded Logic as concerned merely with cogent forms of statement, so Hamilton treated it as concerned merely with the necessary relations of thought. This doctrine is called Conceptualism, because the simplest element of thought is the Concept; that is, an abstract idea, such as is signified by the word *man, planet, colour, virtue*; not a representative or generic image, but the thought of all attributes common to any class of things. Men, planets, colours, virtuous actions or characters, have, severally, something in common on account of which they bear these general names; and the thought of what they have in common, as the ground of these names, is a Concept. To affirm or deny one concept of another, as *Some men are virtuous*, or *No man is perfectly virtuous*, is to form a Judgment, corresponding to the Proposition of which the other schools of Logic discourse. Conceptualism, then, investigates the conditions of consistent judgment.

To distinguish Logic from Psychology is most important in connection with Conceptualism. Concepts and Judgments being mental acts, or products of mental activity, it is often thought that Logic must be a department of Psychology. It is recognised of course, that Psychology deals with much more than Logic does, with sensation, pleasure and pain, emotion, volition; but in the region of the intellect, especially in its most deliberate and elaborate processes, namely, conception, judgment, and reasoning, Logic and Psychology seem to occupy common ground. In fact, however, the two sciences have little in common except a few general terms, and even these they employ in different senses. It is usual to point out that Psychology tries to explain the subjective *processes* of conception, judgment and reasoning, and to give their natural history; but that Logic is wholly concerned with the *results* of such processes, with concepts, judgments and reasonings, and merely with the validity of the results, that is, with their truth or consistency; whilst Psychology has nothing to do with their validity, but only with their causes. Besides, the logical judgment (in Formal Logic at least) is quite a different thing from the psychological: the latter involves feeling and belief, whereas the former is merely a given relation of concepts. *S is P*: that is a model logical judgment; there can be no question of believing it; but it is logically valid if *M is P* and *S is M*. When, again, in Logic, one deals with belief, it depends upon evidence; whereas, in Psychology belief is shown to depend upon causes which may have evidentiary value or may not; for Psychology explains quite impartially the growth of scientific insight and the growth of prejudice.

(*c*) Mill, Bain, and Venn are the chief Materialist logicians; and to guard against the error of confounding Materialism in Logic with the ontological doctrine that nothing exists but Matter, it may suffice to remember that in Metaphysics all these philosophers are Idealists. Materialism in Logic consists in regarding propositions as affirming or denying relations (*cf.* § 5) between matters-of-fact in the widest sense; not only physical facts, but ideas, social and moral relations; it consists, in short, in attending to the meaning of propositions. It treats the first principles of Contradiction and Causation as true of things so far as they are known to us, and not merely as conditions or tendencies of thought; and it takes these principles as conditions of right thinking, because they seem to hold good of Nature and human life.

To these differences of opinion it will be necessary to recur in the next chapter (§ 4); but here I may observe that it is easy to exaggerate their importance in Logic. There is really little at issue between schools of logicians as such, and as far as their doctrines run parallel; it is on the metaphysical grounds of their study, or as to its scope and comprehension, that they find a battle-field. The present work generally proceeds upon the third, or Materialist doctrine. If Deduction and Induction are regarded as mutually dependent parts of one science, uniting the discipline of consistent discourse with the method of investigating laws of physical phenomena, the Materialist doctrine, that the principles of Logic are founded on fact, seems to be the most natural way of thinking. But if the unity of Deduction and Induction is not disputed by the other schools, the Materialist may regard them as allies exhibiting in their own way the same body of truths. The Nominalist may certainly claim that his doctrine is indispensable: consistently cogent forms of statement are necessary both to the Conceptualist and to the Materialist; neither the relations of thought nor those of fact can be arrested or presented without the aid of language or some equivalent system of signs. The Conceptualist may urge that the Nominalist's forms of statement and argument exist for the sake of their meaning, namely, judgments and reasonings; and that the Materialist's laws of Nature are only judgments founded upon our conceptions of Nature; that the truth of observations and experiments depends upon our powers of perception; that perception is inseparable from understanding, and that a system of Induction may be constructed upon the axiom of Causation, regarded as a principle of Reason, just as well as by considering it as a law of Nature, and upon much the same lines. The Materialist, admitting all this, may say that a judgment is only the proximate meaning of a proposition, and that the ultimate meaning, the meaning of the judgment itself, is always some matter-of-fact; that the other schools have not hitherto been eager to recognise the unity of Deduction and Induction or to investigate the conditions of trustworthy experiments and observations within the limits of human understanding; that thought is itself a sort of fact, as complex in its structure, as profound in its relations, as subtle in its changes as any other fact, and therefore at least as hard to know; that to turn away from the full reality of thought in perception, and to confine Logic to artificially limited concepts, is to abandon the effort to push method to the utmost and to get as near truth as possible; and that as to Causation being a principle of Reason rather than of Nature, the distinction escapes his apprehension, since Nature seems to be that to which our private minds turn upon questions of Causation for correction and instruction; so that if he does not call Nature the Universal Reason, it is because he loves severity of style.

CHAPTER II
GENERAL ANALYSIS OF PROPOSITIONS

§ 1. Since Logic discusses the proof or disproof, or (briefly) the testing of propositions, we must begin by explaining their nature. A proposition, then, may first be described in the language of grammar as *a sentence indicative*; and it is usually expressed in the present tense.

It is true that other kinds of sentences, optative, imperative, interrogative, exclamatory, if they express or imply an assertion, are not beyond the view of Logic; but before treating such sentences, Logic, for greater precision, reduces them to their equivalent sentences indicative. Thus, *I wish it were summer* may be understood to mean, *The coming of summer is an object of my desire*. *Thou shalt not kill* may be interpreted as *Murderers are in danger of the judgment*. Interrogatories, when used in argument, if their form is affirmative, have negative force, and affirmative force if their form is negative. Thus, *Do hypocrites love virtue?* anticipates the answer, *No*. *Are not traitors the vilest of mankind?* anticipates the answer, *Yes*. So that the logical form of these sentences is, *Hypocrites are not lovers of virtue*; *Traitors are the vilest of mankind*. Impersonal propositions, such as *It rains*, are easily rendered into logical forms of equivalent meaning, thus:

Rain is falling; or (if that be tautology), *The clouds are raining*. Exclamations may seem capricious, but are often part of the argument. *Shade of Chatham!* usually means *Chatham, being aware of our present foreign policy, is much disgusted*. It is in fact, an appeal to authority, without the inconvenience of stating what exactly it is that the authority declares.

§ 2. But even sentences indicative may not be expressed in the way most convenient to logicians. *Salt dissolves in water* is a plain enough statement; but the logician prefers to have it thus: *Salt is soluble in water*. For he says that a proposition is analysable into three elements: (1) a Subject (as *Salt*) about which something is asserted or denied; (2) a Predicate (as *soluble in water*) which is asserted or denied of the Subject, and (3) the Copula (*is* or *are*, or *is not* or *are not*), the sign of relation between the Subject and Predicate. The Subject and Predicate are called the Terms of the proposition: and the Copula may be called the sign of predication, using the verb 'to predicate' indefinitely for either 'to affirm' or 'to deny.' Thus *S is P* means that the term *P* is given as related in some way to the term *S*. We may, therefore, further define a Proposition as 'a sentence in which one term is predicated of another.'

In such a proposition as *Salt dissolves*, the copula (*is*) is contained in the predicate, and, besides the subject, only one element is exhibited: it is therefore said to be *secundi adjacentis*. When all three parts are exhibited, as in *Salt is soluble*, the proposition is said to be *tertii adjacentis*.

For the ordinary purposes of Logic, in predicating attributes of a thing or class of things, the copula *is*, or *is not*, sufficiently represents the relation of subject and predicate; but when it is desirable to realise fully the nature of the relation involved, it may be better to use a more explicit form. Instead of saying *Salt—is—soluble*, we may say *Solubility—coinheres with—the nature of salt*, or *The putting of salt in water—is a cause of—its dissolving*: thus expanding the copula into a full expression of the relation we have in view, whether coinherence or causation.

§ 3. The sentences of ordinary discourse are, indeed, for the most part, longer and more complicated than the logical form of propositions; it is in order to prove them, or to use them in the proof of other propositions, that they are in Logic reduced as nearly as possible to such simple but explicit expressions as the above (*tertii adjacentis*). A Compound Proposition, reducible to two or more simple ones, is said to be exponible.

The modes of compounding sentences are explained in every grammar-book. One of the commonest forms is the copulative, such as *Salt is both savoury and wholesome*, equivalent to two simple propositions: *Salt is savoury; Salt is wholesome. Pure water is neither sapid nor odorous*, equivalent to *Water is not sapid; Water is not odorous*. Or, again, *Tobacco is injurious, but not when used in moderation*, equivalent to *Much tobacco is injurious; a little is not*.

Another form of Exponible is the Exceptive, as *Kladderadatsch is published daily, except on week-days*, equivalent to *Kladderadatsch is published on Sunday; it is not published any other day*. Still another Exponible is the Exclusive, as *Only men use fire*, equivalent to *Men are users of fire; No other animals are*. Exceptive and exclusive sentences are, however, equivalent forms; for we may say, *Kladderadatsch is published only on Sunday*; and *No animals use fire, except men*.

There are other compound sentences that are not exponible, since, though they contain two or more verbal clauses, the construction shows that these are inseparable. Thus, *If cats are scarce, mice are plentiful*, contains two verbal clauses; but *if cats are scarce* is conditional, not indicative; and *mice are plentiful* is subject to the condition that *cats are scarce*. Hence the whole sentence is called a Conditional Proposition. For the various forms of Conditional Propositions see chap. v. § 4.

But, in fact, to find the logical force of recognised grammatical forms is the least of a logician's difficulties in bringing the discourses of men to a plain issue. Metaphors, epigrams, innuendoes and other figures of speech present far greater obstacles to a lucid reduction whether for approval or refutation. No rules can be given for finding everybody's meaning. The poets have their own way of expressing themselves; sophists, too, have their own way. And the point often lies in what is unexpressed. Thus, "barbarous nations make, the civilised write history," means that civilised nations do not make history, which none is so brazen as openly to assert. Or, again, "Alcibiades is dead, but X is still with us"; the whole meaning of this 'exponible' is that X would be the lesser loss to society. Even an epithet or a suffix may imply a proposition: *This personage* may mean *X is a pretentious nobody*.

How shall we interpret such illusive predications except by cultivating our literary perceptions, by reading the most significant authors until we are at home with them? But, no doubt, to disentangle the compound propositions, and to expand the abbreviations of literature and conversation, is a useful logical exercise. And if it seem a laborious task thus to reduce to its logical elements a long argument in a speech or treatise, it should be observed that, as a rule, in a long discourse only a few sentences are of principal importance to the reasoning, the rest being explanatory or illustrative digression, and that a close scrutiny of these cardinal sentences will frequently dispense us from giving much attention to the rest.

§ 4. But now, returning to the definition of a Proposition given in § 2, that it is 'a sentence in which one term is predicated of another,' we must consider what is the import of such predication. For the definition, as it stands, seems to be purely Nominalist. Is a proposition nothing more than a certain synthesis of words; or, is it meant to correspond with something further, a synthesis of ideas, or a relation of facts?

Conceptualist logicians, who speak of judgments instead of propositions, of course define the judgment in their own language. According to Hamilton, it is "a recognition of the relation of congruence or confliction in which two concepts stand to each other." To lighten the sentence, I have omitted one or two qualifications (Hamilton's *Lectures on Logic*, xiii.). "Thus," he goes on "if we compare the thoughts *water*, *iron*, and *rusting*, we find them congruent, and connect them into a single thought, thus: *water rusts iron*—in that case we form a judgment." When a judgment is expressed in words, he says, it is called a proposition.

But has a proposition no meaning beyond the judgment it expresses? Mill, who defines it as "a portion of discourse in which a predicate is affirmed or denied of a subject" (*Logic*, Book 1., chap. iv. § 1.), proceeds to inquire into the import of propositions (Book 1., chap. v.), and finds three classes of them: (*a*) those in which one proper name is predicated of another; and of these Hobbes's Nominalist definition is adequate, namely, that a proposition asserts or denies that the predicate is a name for the same thing as the subject, as *Tully is Cicero*.

(*b*) Propositions in which the predicate means a part (or the whole) of what the subject means, as *Horses are animals*, *Man is a rational animal*. These are Verbal Propositions (see below: chap. v. § 6), and their import consists in affirming or denying a coincidence between the meanings of names, as *The meaning of 'animal' is part of the meaning of 'horse.'* They are partial or complete definitions.

But (*c*) there are also Real Propositions, whose predicates do not mean the same as their subjects, and whose import consists in affirming or denying one of five different kinds of matter of fact: (1) That the subject exists, or does not; as if we say *The* *bison exists*, *The great auk is extinct*. (2) Co-existence, as *Man is mortal*; that is, *the being subject to death coinheres with the qualities on account of which we call certain objects men*. (3) Succession, as *Night follows day*. (4) Causation (a particular kind of Succession), as *Water rusts iron*. (5) Resemblance, as *The colour of this geranium is like that of a soldier's coat*, or *A* = *B*.

On comparing this list of real predications with the list of logical relations given above (chap. i. § 5 (*a*)), it will be seen that the two differ only in this, that I have there omitted simple Existence. Nothing simply exists, unrelated either in Nature or in knowledge. Such a proposition as *The bison exists* may, no doubt, be used in Logic (subject to interpretation) for the sake of custom or for the sake of brevity; but it means that some specimens are still to be found in N. America, or in Zoological gardens.

Controversy as to the Import of Propositions really turns upon a difference of opinion as to the scope of Logic and the foundations of knowledge. Mill was dissatisfied with the "congruity" of concepts as the basis of a judgment. Clearly, mere congruity does not justify belief. In the proposition *Water rusts iron*, the concepts *water, rust* and *iron* may be congruous, but does any one assert their connection on that ground? In the proposition *Murderers are haunted by the ghosts of their victims*, the concepts *victim, murderer, ghost* have a high degree of congruity; yet, unfortunately, I cannot believe it: there seems to be no such cheap defence of innocence. Now, Mill held that Logic is concerned with the grounds of belief, and that the scope of Logic includes Induction as well as Deduction; whereas, according to Hamilton, Induction is only Modified Logic, a mere appendix to the theory of the "forms of thought as thought." Indeed, Mill endeavoured in his *Logic* to probe the grounds of belief deeper than usual, and introduced a good deal of Metaphysics—either too much or not enough—concerning the ground of axioms. But, at any rate, his great point was that belief, and therefore (for the most part) the Real Proposition, is concerned not merely with the relations of words, or even of ideas, but with matters of fact; that is, both propositions and judgments point to something further, to the relations of things which we can examine, not merely by thinking about them (comparing them in thought), but by observing them with the united powers of thought and perception. This is what convinces us that *water rusts iron*: and the difficulty of doing this is what prevents our feeling sure that *murderers are haunted by the ghosts of their victims*. Hence, although Mill's definition of a proposition, given above, is adequate for propositions in general; yet that kind of proposition (the Real) with regard to which Logic (in Mill's view) investigates the conditions of proof, may be more explicitly and pertinently defined as 'a predication concerning the relation of matters of fact.'

§ 5. This leads to a very important distinction to which we shall often have to refer in subsequent pages—namely, the distinction between the Form and the Matter of a proposition or of an argument. The distinction between Form and Matter, as it is ordinarily employed, is easily understood. An apple growing in the orchard and a waxen apple on the table may have the same shape or form, but they consist of different materials; two real apples may have the same shape, but contain distinct ounces of apple-stuff, so that after one is eaten the other remains to be eaten. Similarly, tables may have the same shape, though one be made of marble, another of oak, another of iron. The form is common to several things, the matter is peculiar to each. Metaphysicians have carried the distinction further: apples, they say, may have not only the same outward shape, but the same inward constitution, which, therefore, may be called the Form of apple-stuff itself—namely, a certain pulpiness, juiciness, sweetness, *etc.*; qualities common to all dessert apples: yet their Matter is different, one being here, another there—differing in place or time, if in nothing else. The definition of a species is the form of every specimen of it.

To apply this distinction to the things of Logic: it is easy to see how two propositions may have the same Form but different Matter: not using 'Form' in the sense of 'shape,' but for that which is common to many things, in contrast with that which is peculiar to each. Thus, *All male lions are tawny* and *All water is liquid at 50° Fahrenheit*, are two propositions that have the same form, though their matter is entirely different. They both predicate something of the whole of their subjects, though their subjects are different, and so are the things predicated of them. Again, *All male lions have tufted tails* and *All male lions have manes*, are two propositions having the same form and, in their subjects, the same matter, but different matter in their predicates. If, however, we take two such propositions as these: *All male lions have manes* and *Some male lions have manes*, here the matter is the same in both, but the form is different—in the first, predication is made concerning *every* male lion; in the second of only *some* male lions; the first is *universal*, the second is *particular*. Or, again, if we take *Some tigers are man-eaters* and *Some tigers are not man-eaters*, here too the matter is the same, but the form is different; for the first proposition is *affirmative*, whilst the second is *negative*.

§ 6. Now, according to Hamilton and Whately, pure Logic has to do only with the Form of propositions and arguments. As to their Matter, whether they are really true in fact, that is a question, they said, not for Logic, but for experience, or for the special sciences. But Mill desired so to extend logical method as to test the material truth of propositions: he thought that he could expound a method by which experience itself and the conclusions of the special sciences may be examined.

To this method it may be objected, that the claim to determine Material Truth takes for granted that the order of Nature will remain unchanged, that (for example) water not only at present is a liquid at 50° Fahrenheit, but will always be so; whereas (although we have no reason to expect such a thing) the order of Nature may alter—it is at least supposable—and in that event water may freeze at such a temperature.

Any matter of fact, again, must depend on observation, either directly, or by inference—as when something is asserted about atoms or ether. But observation and material inference are subject to the limitations of our faculties; and however we may aid observation by microscopes and micrometers, it is still observation; and however we may correct our observations by repetition, comparison and refined mathematical methods of making allowances, the correction of error is only an approximation to accuracy. Outside of Formal Reasoning, suspense of judgment is your only attitude.

But such objections imply that nothing short of absolute truth has any value; that all our discussions and investigations in science or social affairs are without logical criteria; that Logic must be confined to symbols, and considered entirely as mental gymnastics. In this book prominence will be given to the character of Logic as a formal science, and it will also be shown that Induction itself may be treated formally; but it will be assumed that logical forms are valuable as representing the actual relations of natural and social phenomena.

§ 7. Symbols are often used in Logic instead of concrete terms, not only in Symbolic Logic where the science is treated algebraically (as by Dr. Venn in his *Symbolic Logic*), but in ordinary manuals; so that it may be well to explain the use of them before going further.

It is a common and convenient practice to illustrate logical doctrines by examples: to show what is meant by a Proposition we may give *salt is soluble*, or *water rusts iron:* the copulative exponible is exemplified by *salt is savoury and wholesome*; and so on. But this procedure has some disadvantages: it is often cumbrous; and it may distract the reader's attention from the point to be explained by exciting his interest in the special fact of the illustration. Clearly, too, so far as Logic is formal, no particular matter of fact can adequately illustrate any of its doctrines. Accordingly, writers on Logic employ letters of the alphabet instead of concrete terms, (say) *X* instead of *salt* or instead of *iron*, and (say) *Y* instead of *soluble* or instead of *rusted by water*; and then a proposition may be represented by *X is Y*. It is still more usual to represent a proposition by *S is (or is not) P, S* being the initial of Subject and *P* of Predicate; though this has the drawback that if we argue—*S is P*, therefore *P is S*, the symbols in the latter proposition no longer have the same significance, since the former subject is now the predicate.

Again, negative terms frequently occur in Logic, such as *not-water*, or *not-iron*, and then if *water* or *iron* be expressed by *X*, the corresponding negative may be expressed by *x*; or, generally, if a capital letter stand for a positive term, the corresponding small letter represents the negative. The same device may be adopted to express contradictory terms: either of them being *X*, the other is *x* (see chap. iv., §§ 7-8); or the contradictory terms may be expressed by x and $\bar{x}$, y and $\bar{y}$.

And as terms are often compounded, it may be convenient to express them by a combination of letters: instead of illustrating such a case by *boiling water* or *water that is boiling*, we may write *XY*; or since positive and negative terms may be compounded, instead of illustrating this by *water that is not boiling*, we may write *Xy*.

The convenience of this is obvious; but it is more than convenient; for, if one of the uses of Logic be to discipline the power of abstract thought, this can be done far more effectually by symbolic than by concrete examples; and if such discipline were the only use of Logic it might be best to discard concrete illustrations altogether, at least in advanced text-books, though no doubt the practice would be too severe for elementary manuals. On the other hand, to show the practical applicability of Logic to the arguments and proofs of actual life, or even of the concrete sciences, merely symbolic illustration may be not only useless but even misleading. When we speak of politics, or poetry, or species, or the weather, the terms that must be used can rarely have the distinctness and isolation of X and Y; so that the perfunctory use of symbolic illustration makes argument and proof appear to be much simpler and easier matters than they really are. Our belief in any proposition never rests on the proposition itself, nor merely upon one or two others, but upon the immense background of our general knowledge and beliefs, full of circumstances and analogies, in relation to which alone any given proposition is intelligible. Indeed, for this reason, it is impossible to illustrate Logic sufficiently: the reader who is in earnest about the cogency of arguments and the limitation of proofs, and is scrupulous as to the degrees of assent that they require, must constantly look for illustrations in his own knowledge and experience and rely at last upon his own sagacity.

CHAPTER III
OF TERMS AND THEIR DENOTATION

§ 1. In treating of Deductive Logic it is usual to recognise three divisions of the subject: first, the doctrine of Terms, words, or other signs used as subjects or predicates; secondly, the doctrine of Propositions, analysed into terms related; and, thirdly, the doctrine of the Syllogism in which propositions appear as the grounds of a conclusion.

The terms employed are either letters of the alphabet, or the words of common language, or the technicalities of science; and since the words of common language are most in use, it is necessary to give some account of common language as subserving the purposes of Logic. It has been urged that we cannot think or reason at all without words, or some substitute for them, such as the signs of algebra; but this is an exaggeration. Minds greatly differ, and some think by the aid of definite and comprehensive picturings, especially in dealing with problems concerning objects in space, as in playing chess blindfold, inventing a machine, planning a tour on an imagined map. Most people draw many simple inferences by means of perceptions, or of mental imagery. On the other hand, some men think a good deal without any continuum of words and without any imagery, or with none that seems relevant to the purpose. Still the more elaborate sort of thinking, the grouping and concatenation of inferences, which we call reasoning, cannot be carried far without language or some equivalent system of signs. It is not merely that we need language to express our reasonings and communicate them to others: in solitary thought we often depend on words—'talk to ourselves,' in fact; though the words or sentences that then pass through our minds are not always fully formed or articulated. In Logic, moreover, we have carefully to examine the grounds (at least the proximate grounds) of our conclusions; and plainly this cannot be done unless the conclusions in question are explicitly stated and recorded.

Conceptualists say that Logic deals not with the process of thinking (which belongs to Psychology) but with its results; not with conceiving but with concepts; not with judging but with judgments. Is the concept self-consistent or adequate? Logic asks; is the judgment capable of proof? Now, it is only by recording our thoughts in language that it becomes possible to distinguish between the process and the result of thought. Without language, the act and the product of thinking would be identical and equally evanescent. But by carrying on the process in language and remembering or otherwise recording it, we obtain a result which may be examined according to the principles of Logic.

§ 2. As Logic, then, must give some account of language, it seems desirable to explain how its treatment of language differs from that of Grammar and from that of Rhetoric.

Grammar is the study of the words of some language, their classification and derivation, and of the rules of combining them, according to the usage at any time recognised and followed by those who are considered correct writers or speakers. Composition may be faultless in its grammar, though dull and absurd.

Rhetoric is the study of language with a view to obtaining some special effect in the communication of ideas or feelings, such as picturesqueness in description, vivacity in narration, lucidity in exposition, vehemence in persuasion, or literary charm. Some of these ends are often gained in spite of faulty syntax or faulty logic; but since the few whom bad grammar saddens or incoherent arguments divert are not carried away, as they else might be, by an unsophisticated orator, Grammar and Logic are necessary to the perfection of Rhetoric. Not that Rhetoric is in bondage to those other sciences; for foreign idioms and such figures as the ellipsis, the anacoluthon, the oxymoron, the hyperbole, and violent inversions have their place in the magnificent style; but authors unacquainted with Grammar and Logic are not likely to place such figures well and wisely. Indeed, common idioms, though both grammatically and rhetorically justifiable, both correct and effective, often seem illogical. 'To fall asleep,' for example, is a perfect English phrase; yet if we examine severally the words it consists of, it may seem strange that their combination should mean anything at all.

But Logic only studies language so far as necessary in order to state, understand, and check the evidence and reasonings that are usually embodied in language. And as long as meanings are clear, good Logic is compatible with false concords and inelegance of style.

§ 3. Terms are either Simple or Composite: that is to say, they may consist either of a single word, as 'Chaucer,' 'civilisation'; or of more than one, as 'the father of English poetry,' or 'modern civilised nations.' Logicians classify words according to their uses in forming propositions; or, rather, they classify the uses of words as terms, not the words themselves; for the same word may fall into different classes of terms according to the way in which it is used. (*Cf.* Mr. Alfred Sidgwick's *Distinction and the Criticism of Beliefs*, chap. xiv.)

Thus words are classified as Categorematic or Syncategorematic. A word is Categorematic if used singly as a term without the support of other words: it is Syncategorematic when joined with other words in order to constitute the subject or predicate of a proposition. If we say *Venus is a planet whose orbit is inside the Earth's*, the subject, 'Venus,' is a word used categorematically as a simple term; the predicate is a composite term whose constituent words (whether substantive, relative, verb, or preposition) are used syncategorematically.

Prepositions, conjunctions, articles, adverbs, relative pronouns, in their ordinary use, can only enter into terms along with other words having a substantive, adjectival or participial force; but when they are themselves the things spoken of and are used substantively (*suppositio materialis*), they are categorematic. In the proposition, *'Of' was used more indefinitely three hundred years ago than it is now*, 'of' is categorematic. On the other hand, all substantives may be used categorematically; and the same self-sufficiency is usually recognised in adjectives and participles. Some, however, hold that the categorematic use of adjectives and participles is due to an ellipsis which the logician should fill up; that instead of *Gold is heavy*, he should say *Gold is a heavy metal*; instead of *The sun is shining*, *The sun is a body shining*. But in these cases the words 'metal' and 'body' are unmistakable tautology, since 'metal' is implied in gold and 'body' in sun. But, as we have seen, any of these kinds of word, substantive, adjective, or participle, may occur syncategorematically in connection with others to form a composite term.

§ 4. Most terms (the exceptions and doubtful cases will be discussed hereafter) have two functions, a denotative and a connotative. A term's denotative function is, to be the name or sign of something or some multitude of things, which are said to be called or denoted by the term. Its connotative function is, to suggest certain qualities and characteristics of the things denoted, so that it cannot be used literally as the name of any other things; which qualities and characteristics are said to be implied or connoted by the term. Thus 'sheep' is the name of certain animals, and its connotation prevents its being used of any others.

That which a term directly indicates, then, is its *Denotation*; that sense or customary use of it which limits the Denotation is its *Connotation* (ch. iv.). Hamilton and others use 'Extension' in the sense of Denotation, and 'Intension' or 'Comprehension' in the sense of Connotation. Now, terms may be classified, first according to what they stand for or denote; that is, according to their *Denotation*. In this respect, the use of a term is said to be either Concrete or Abstract.

A term is Concrete when it denotes a 'thing'; that is, any person, object, fact, event, feeling or imagination, considered as capable of having (or consisting of) qualities and a determinate existence. Thus 'cricket ball' denotes any object having a certain size, weight, shape, colour, *etc.* (which are its qualities), and being at any given time in some place and related to other objects—in the bowler's hands, on the grass, in a shop window. Any 'feeling of heat' has a certain intensity, is pleasurable or painful, occurs at a certain time, and affects some part or the whole of some animal. An imagination, indeed (say, of a fairy), cannot be said in the same sense to have locality; but it depends on the thinking of some man who has locality, and is definitely related to his other thoughts and feelings.

A term is Abstract, on the other hand, when it denotes a quality (or qualities), considered by itself and without determinate existence in time, place, or relation to other things. 'Size,' 'shape,' 'weight,' 'colour,' 'intensity,' 'pleasurableness,' are terms used to denote such qualities, and are then abstract in their denotation. 'Weight' is not something with a determinate existence at a given time; it exists not merely in some particular place, but wherever there is a heavy thing; and, as to relation, at the same moment it combines in iron with solidity and in mercury with liquidity. In fact, a quality is a point of agreement in a multitude of different things; all heavy things agree in weight, all round things in roundness, all red things in redness; and an abstract term denotes such a point (or points) of agreement among the things denoted by concrete terms. Abstract terms result from the analysis of concrete things into their qualities; and conversely a concrete term may be viewed as denoting the synthesis of qualities into an individual thing. When several things agree in more than one quality, there may be an abstract term denoting the union of qualities in which they agree, and omitting their peculiarities; as 'human nature' denotes the common qualities of men, 'civilisation' the common conditions of civilised peoples.

Every general name, if used as a concrete term, has, or may have, a corresponding abstract term. Sometimes the concrete term is modified to form the abstract, as 'greedy—greediness'; sometimes a word is adapted from another language, as 'man—humanity'; sometimes a composite term is used, as 'mercury—the nature of mercury,' *etc.* The same concrete may have several abstract correlatives, as 'man—manhood, humanity, human nature'; 'heavy—weight, gravity, ponderosity'; but in such cases the abstract terms are not used quite synonymously; that is, they imply different ways of considering the concrete.

Whether a word is used as a concrete or abstract term is in most instances plain from the word itself, the use of most words being pretty regular one way or the other; but sometimes we must judge by the context. 'Weight' may be used in the abstract for 'gravity,' or in the concrete for a measure; but in the latter sense it is syncategorematic (in the singular), needing at least the article 'a (or the) weight.' 'Government' may mean 'supreme political authority,' and is then abstract; or, the men who happen to be ministers, and is then concrete; but in this case, too, the article is usually prefixed. 'The life' of any man may mean his vitality (abstract), as in "Thus following life in creatures we dissect"; or, the series of events through which he passes (concrete), as in 'the life of Nelson as narrated by Southey.'

It has been made a question whether the denotation of an abstract term may itself be the subject of qualities. Apparently 'weight' may be greater or less, 'government' good or bad, 'vitality' intense or dull. But if every subject is modified by a quality, a quality is also modified by making it the subject of another; and, if so, it seems then to become a new quality. The compound terms 'great weight,' 'bad government,' 'dull vitality,' have not the same denotation as the simple terms 'weight, 'government,' 'vitality': they imply, and may be said to connote, more special concrete experience, such as the effort felt in lifting a trunk, disgust at the conduct of officials, sluggish movements of an animal when irritated. It is to such concrete experiences that we have always to refer in order fully to realise the meaning of abstract terms, and therefore, of course, to understand any qualification of them.

§ 5. Concrete terms may be subdivided according to the number of things they denote and the way in which they denote them. A term may denote one thing or many: if one, it is called Singular; if many, it may do so distributively, and then it is General; or, as taken all together, and then it is Collective: one, then; any one of many; many in one.

Among Singular Terms, each denoting a single thing, the most obvious are Proper Names, such as Gibraltar or George Washington, which are merely marks of individual things or persons, and may form no part of the common language of a country. They are thus distinguished from other Singular Terms, which consist of common words so combined as to restrict their denotation to some individual, such as, 'the strongest man on earth.'

Proper Terms are often said to be arbitrary signs, because their use does not depend upon any reason that may be given for them. Gibraltar had a meaning among the Moors when originally conferred; but no one now knows what it was, unless he happens to have learned it; yet the name serves its purpose as well as if it were "Rooke's Nest." Every Newton or Newport year by year grows old, but to alter the name would cause only confusion. If such names were given by mere caprice it would make no difference; and they could not be more cumbrous, ugly, or absurd than many of those that are given 'for reasons.'

The remaining kinds of Singular Terms are drawn from the common resources of the language. Thus the pronouns 'he,' 'she,' 'it,' are singular terms, whose present denotation is determined by the occasion and context of discourse: so with demonstrative phrases—'the man,' 'that horse.' Descriptive names may be more complex, as 'the wisest man of Gotham,' which is limited to some individual by the superlative suffix; or 'the German Emperor,' which is limited by the definite article—the general term 'German Emperor' being thereby restricted either to the reigning monarch or to the one we happen to be discussing. Instead of the definite, the indefinite article may be used to make general terms singular, as 'a German Emperor was crowned at Versailles' (*individua vaga*).

Abstract Terms are ostensively singular: 'whiteness' (*e.g.*) is one quality. But their full meaning is general: 'whiteness' stands for all white things, so far as white. Abstract terms, in fact, are only formally singular.

General Terms are words, or combinations of words, used to denote any one of many things that resemble one another in certain respects. 'George III.' is a Singular Term denoting one man; but 'King' is a General Term denoting him and all other men of the same rank; whilst the compound 'crowned head' is still more general, denoting kings and also emperors. It is the nature of a general term, then, to be used in the same sense of whatever it denotes; and its most characteristic form is the

Class-name, whether of objects, such as 'king,' 'sheep,' 'ghost'; or of events, such as 'accession,' 'purchase,' 'manifestation.' Things and events are known by their qualities and relations; and every such aspect, being a point of resemblance to some other things, becomes a ground of generalisation, and therefore a ground for the need and use of general terms. Hence general terms are far the most important sort of terms in Logic, since in them general propositions are expressed and, moreover (with rare exceptions), all predicates are general. For, besides these typical class-names, attributive words are general terms, such as 'royal,' 'ruling,' 'woolly,' 'bleating,' 'impalpable,' 'vanishing.'

Infinitives may also be used as general terms, as '*To err is human*'; but for logical purposes they may have to be translated into equivalent substantive forms, as *Foolish actions are characteristic of mankind*. Abstract terms, too, are (as I observed) equivalent to general terms; 'folly' is abstract for 'foolish actions.' '*Honesty is the best policy*' means *people who are honest may hope to find their account in being so*; that is, in the effects of their honest actions, provided they are wise in other ways, and no misfortunes attend them. The abstract form is often much the more succinct and forcible, but for logical treatment it needs to be interpreted in the general form.

By antonomasia proper names may become general terms, as if we say *'A Johnson' would not have written such a book—i.e.*, any man of his genius for elaborate eloquence.

A Collective Term denotes a multitude of similar things considered as forming one whole, as 'regiment,' 'flock,' 'nation': not distributively, that is, not the similar things severally; to denote them we must say 'soldiers of the regiment,' 'sheep of the flock,' and so on. If in a multitude of things there is no resemblance, except the fact of being considered as parts of one whole, as 'the world,' or 'the town of Nottingham' (meaning its streets and houses, open spaces, people, and civic organisation), the term denoting them as a whole is Singular; but 'the world' or 'town of Nottingham,' meaning the inhabitants only, is Collective.

In their strictly collective use, all such expressions are equivalent to singular terms; but many of them may also be used as general terms, as when we speak of 'so many regiments of the line,' or discuss the 'plurality of worlds'; and in this general use they denote any of a multitude of things of the same kind—regiments, or habitable worlds.

Names of substances, such as 'gold,' 'air,' 'water,' may be employed as singular, collective, or general terms; though, perhaps, as singular terms only figuratively, as when we say *Gold is king*. If we say with Thales, '*Water is the source of all things*,' 'water' seems to be used collectively. But substantive names are frequently used as general terms. For example, *Gold is heavy* means 'in comparison with other things,' such as water. And, plainly, it does not mean that the aggregate of gold is heavier than the aggregate of water, but only that its specific gravity is greater; that is, bulk for bulk, any piece of gold is heavier than water.

Finally, any class-name may be used collectively if we wish to assert something of the things denoted by it, not distributively but altogether, as that *Sheep are more numerous than wolves*.

CHAPTER IV
THE CONNOTATION OF TERMS

§ 1. Terms are next to be classified according to their Connotation—that is, according to what they imply as characteristic of the things denoted. We have seen that general names are used to denote many things in the same sense, because the things denoted resemble one another in certain ways: it is this resemblance in certain points that leads us to class the things together and call them by the same name; and therefore the points of resemblance constitute the sense or meaning of the name, or its Connotation, and limit its applicability to such things as have these characteristic qualities. 'Sheep' for example, is used in the same sense, to denote any of a multitude of animals that resemble one another: their size, shape, woolly coats, cloven hoofs, innocent ways and edibility are well known. When we apply to anything the term 'sheep,' we imply that it has these qualities: 'sheep,' denoting the animal, connotes its possessing these characteristics; and, of course, it cannot, without a figure of speech or a blunder, be used to denote anything that does not possess all these qualities. It is by a figure of speech that the term 'sheep' is applied to some men; and to apply it to goats would be a blunder.

Most people are very imperfectly aware of the connotation of the words they use, and are guided in using them merely by the custom of the language. A man who employs a word quite correctly may be sadly posed by a request to explain or define it. Moreover, so far as we are aware of the connotation of terms, the number and the kind of attributes we think of, in any given case, vary with the depth of our interest, and with the nature of our interest in the things denoted. 'Sheep' has one meaning to a touring townsman, a much fuller one to a farmer, and yet a different one to a zoologist. But this does not prevent them agreeing in the use of the word, as long as the qualities they severally include in its meaning are not incompatible.

All general names, and therefore not only class-names, like 'sheep,' but all attributives, have some connotation. 'Woolly' denotes anything that bears wool, and connotes the fact of bearing wool; 'innocent' denotes anything that habitually and by its disposition does no harm (or has not been guilty of a particular offence), and connotes a harmless character (or freedom from particular guilt); 'edible' denotes whatever can be eaten with good results, and connotes its suitability for mastication, deglutition, digestion, and assimilation.

§ 2. But whether all terms must connote as well as denote something, has been much debated. Proper names, according to what seems the better opinion, are, in their ordinary use, not connotative. To say that they have no meaning may seem violent: if any one is called John Doe, this name, no doubt, means a great deal to his friends and neighbours, reminding them of his stature and physiognomy, his air and gait, his wit and wisdom, some queer stories, and an indefinite number of other things. But all this significance is local or accidental; it only exists for those who know the individual or have heard him described: whereas a general name gives information about any thing or person it denotes to everybody who understands the language, without any particular knowledge of the individual.

We must distinguish, in fact, between the peculiar associations of the proper name and the commonly recognised meaning of the general name. This is why proper names are not in the dictionary. Such a name as London, to be sure, or Napoleon Buonaparte, has a significance not merely local; still, it is accidental. These names are borne by other places and persons than those that have rendered them famous. There are Londons in various latitudes, and, no doubt, many Napoleon Buonapartes in Louisiana; and each name has in its several denotations an altogether different suggestiveness. For its suggestiveness is in each application determined by the peculiarities of the place or person denoted; it is not given to the different places (or to the different persons) because they have certain characteristics in common.

However, the scientific grounds of the doctrine that proper names are non-connotative, are these: The peculiarities that distinguish an individual person or thing are admitted to be infinite, and anything less than a complete enumeration of these peculiarities may fail to distinguish and identify the individual. For, short of a complete enumeration of them, the description may be satisfied by two or more individuals; and in that case the term denoting them, if limited by such a description, is not a proper but a general name, since it is applicable to two or more in the same sense. The existence of other individuals to whom it applies may be highly improbable; but, if it be logically possible, that is enough. On the other hand, the enumeration of infinite peculiarities is certainly impossible. Therefore proper names have no assignable connotation. The only escape from this reasoning lies in falling back upon time and place, the principles of individuation, as constituting the connotation of proper names. Two things cannot be at the same time in the same place: hence 'the man who was at a certain spot on the bridge of Lodi at a certain instant in a certain year' suffices to identify Napoleon Buonaparte for that instant. Supposing no one else to have borne the name, then, is this its connotation? No one has ever thought so. And, at any rate, time and place are only extrinsic determinations (suitable indeed to events like the battle of Lodi, or to places themselves like London); whereas the connotation of a general term, such as 'sheep,' consists of intrinsic qualities. Hence, then, the scholastic doctrine 'that individuals have no essence' (see chap. xxii. § 9), and Hamilton's dictum 'that every concept is inadequate to the individual,' are justified.

General names, when used as proper names, lose their connotation, as Euxine or Newfoundland.

Singular terms, other than Proper, have connotation; either in themselves, like the singular pronouns 'he,' 'she,' 'it,' which are general in their applicability, though singular in application; or, derivatively, from the general names that combine to form them, as in 'the first Emperor of the French' or the 'Capital of the British Empire.'

§ 3. Whether Abstract Terms have any connotation is another disputed question. We have seen that they denote a quality or qualities of something, and that is precisely what general terms connote: 'honesty' denotes a quality of some men; 'honest' connotes the same quality, whilst denoting the men who have it.

The denotation of abstract terms thus seems to exhaust their force or meaning. It has been proposed, however, to regard them as connoting the qualities they directly stand for, and not denoting anything; but surely this is too violent. To denote something is the same as to be the name of something (whether real or unreal), which every term must be. It is a better proposal to regard their denotation and connotation as coinciding; though open to the objection that 'connote' means 'to mark along with' something else, and this plan leaves nothing else. Mill thought that abstract terms are connotative when, besides denoting a quality, they suggest a quality of that quality (as 'fault' implies 'hurtfulness'); but against this it may be urged that one quality cannot bear another, since every qualification of a quality constitutes a distinct quality in the total ('milk-whiteness' is distinct from 'whiteness,' *cf.* chap. iii. § 4). After all, if it is the most consistent plan, why not say that abstract, like proper, terms have no connotation?

But if abstract terms must be made to connote something, should it not be those things, indefinitely suggested, to which the qualities belong? Thus 'whiteness' may be considered to connote either snow or vapour, or any white thing, apart from one or other of which the quality has no existence; whose existence therefore it implies. By this course the denotation and connotation of abstract and of general names would be exactly reversed. Whilst the denotation of a general name is limited by the qualities connoted, the connotation of an abstract name includes all the things in which its denotation is realised. But the whole difficulty may be avoided by making it a rule to translate, for logical purposes, all abstract into the corresponding general terms.

§ 4. If we ask how the connotation of a term is to be known, the answer depends upon how it is used. If used scientifically, its connotation is determined by, and is the same as, its definition; and the definition is determined by examining the things to be denoted, as we shall see in chap. xxii. If the same word is used as a term in different sciences, as 'property' in Law and in Logic, it will be differently defined by them, and will have, in each use, a correspondingly different connotation. But terms used in popular discourse should, as far as possible, have their connotations determined by classical usage, *i.e.*, by the sense in which they are used by writers and speakers who are acknowledged masters of the language, such as Dryden and Burke. In this case the classical connotation determines the definition; so that to define terms thus used is nothing else than to analyse their accepted meanings.

It must not, however, be supposed that in popular use the connotation of any word is invariable. Logicians have attempted to classify terms into Univocal (having only one meaning) and Æquivocal (or ambiguous); and no doubt some words (like 'civil,' 'natural,' 'proud,' 'liberal,' 'humorous') are more manifestly liable to ambiguous use than some others. But in truth all general terms are popularly and classically used in somewhat different senses.

Figurative or tropical language chiefly consists in the transfer of words to new senses, as by metaphor or metonymy. In the course of years, too, words change their meanings; and before the time of Dryden our whole vocabulary was much more fluid and adaptable than it has since become. Such authors as Bacon, Milton, and Sir Thomas Browne often used words derived from the Latin in some sense they originally had in Latin, though in English they had acquired another meaning. Spenser and Shakespeare, besides this practice, sometimes use words in a way that can only be justified by their choosing to have it so; whilst their contemporaries, Beaumont and Fletcher, write the perfect modern language, as Dryden observed. Lapse of time, however, is not the chief cause of variation in the sense of words. The matters which terms are used to denote are often so complicated or so refined in the assemblage, interfusion, or gradation of their qualities, that terms do not exist in sufficient abundance and discriminativeness to denote the things and, at the same time, to convey by connotation a determinate sense of their agreements and differences. In discussing politics, religion, ethics, æsthetics, this imperfection of language is continually felt; and the only escape from it, short of coining new words, is to use such words as we have, now in one sense, now in another somewhat different, and to trust to the context, or to the resources of the literary art, in order to convey the true meaning. Against this evil the having been born since Dryden is no protection. It behoves us, then, to remember that terms are not classifiable into Univocal and Æquivocal, but that all terms are susceptible of being used æquivocally, and that honesty and lucidity require us to try, as well as we can, to use each term univocally in the same context.

The context of any proposition always proceeds upon some assumption or understanding as to the scope of the discussion, which controls the interpretation of every statement and of every word. This was called by De Morgan the "universe of discourse": an older name for it, revived by Dr. Venn, and surely a better one, is *suppositio*. If we are talking of children, and 'play' is mentioned, the *suppositio* limits the suggestiveness of the word in one way; whilst if Monaco is the subject of conversation, the same word 'play,' under the influence of a different *suppositio*, excites altogether different ideas. Hence to ignore the *suppositio* is a great source of fallacies of equivocation. 'Man' is generally defined as a kind of animal; but 'animal' is often used as opposed to and excluding man. 'Liberal' has one meaning under the *suppositio* of politics, another with regard to culture, and still another as to the disposal of one's private means. Clearly, therefore, the connotation of general terms is relative to the *suppositio*, or "universe of discourse."

§ 5. Relative and Absolute Terms.—Some words go in couples or groups: like 'up-down,' 'former-latter,' 'father-mother-children,' 'hunter-prey,' 'cause-effect,' *etc.* These are called Relative Terms, and their nature, as explained by Mill, is that the connotations of the members of such a pair or group are derived from the same set of facts (the *fundamentum relationis*). There cannot be an 'up' without a 'down,' a 'father' without a 'mother' and 'child'; there cannot be a 'hunter' without something hunted, nor 'prey' without a pursuer. What makes a man a 'hunter' is his activities in pursuit; and what turns a chamois into 'prey' is its interest in these activities. The meaning of both terms, therefore, is derived from the same set of facts; neither term can be explained without explaining the other, because the relation between them is connoted by both; and neither can with propriety be used without reference to the other, or to some equivalent, as 'game' for 'prey.'

In contrast with such Relative Terms, others have been called Absolute or Non-relative. Whilst 'hunter' and 'prey' are relative, 'man' and 'chamois' have been considered absolute, as we may use them without thinking of any special connection between their meanings. However, if we believe in the unity of Nature and in the relativity of knowledge (that is, that all knowledge depends upon comparison, or a perception of the resemblances and differences of things), it follows that nothing can be completely understood except through its agreements or contrasts with everything else, and that all terms derive their connotation from the same set of facts, namely, from general experience. Thus both man and chamois are animals; this fact is an important part of the meaning of both terms, and to that extent they are relative terms. 'Five yards' and 'five minutes' are very different notions, yet they are profoundly related; for their very difference helps to make both notions distinct; and their intimate connection is shown in this, that five yards are traversed in a certain time, and that five minutes are measured by the motion of an index over some fraction of a yard upon the dial.

The distinction, then, between relative and non-relative terms must rest, not upon a fundamental difference between them (since, in fact, all words are relative), but upon the way in which words are used. We have seen that some words, such as 'up-down,' 'cause-effect,' can only be used relatively; and these may, for distinction, be called Correlatives. But other words, whose meanings are only partially interdependent, may often be used without attending to their relativity, and may then be considered as Absolute. We cannot say 'the hunter returned empty handed,' without implying that 'the prey escaped'; but we may say 'the man went supperless to bed,' without implying that 'the chamois rejoiced upon the mountain.' Such words as 'man' and 'chamois' may, then, in their use, be, as to one another, non-relative.

To illustrate further the relativity of terms, we may mention some of the chief classes of them.

Numerical order: 1st, 2nd, 3rd, *etc.*; 1st implies 2nd, and 2nd

1st; and 3rd implies 1st and 2nd, but these do not imply 3rd; and so on.

Order in Time or Place: before-after; early-punctual-late; right-middle-left; North-South, *etc*.

As to Extent, Volume, and Degree: greater-equal-less; large-medium-small; whole and part.

Genus and Species are a peculiar case of whole and part (*cf.* chaps. xxi.-ii.-iii.). Sometimes a term connotes all the attributes that another does, and more besides, which, as distinguishing it, are called differential. Thus 'man' connotes all that 'animal' does, and also (as *differentiæ*) the erect gait, articulate speech, and other attributes. In such a case as this, where there are well-marked classes, the term whose connotation is included in the others' is called a Genus of that Species. We have a Genus, triangle; and a Species, isosceles, marked off from all other triangles by the differential quality of having two equal sides: again—Genus, book; Species, quarto; Difference, having each sheet folded into four leaves.

There are other cases where these expressions 'genus' and 'species' cannot be so applied without a departure from usage, as, *e.g.*, if we call snow a species of the genus 'white,' for 'white' is not a recognised class. The connotation of white (*i.e.*, whiteness) is, however, part of the connotation of snow, just as the qualities of 'animal' are amongst those of 'man'; and for logical purposes it is desirable to use 'genus and species' to express that relativity of terms which consists in the connotation of one being part of the connotation of the other.

Two or more terms whose connotations severally include that of another term, whilst at the same time exceeding it, are (in relation to that other term) called Co-ordinate. Thus in relation to 'white,' snow and silver are co-ordinate; in relation to colour, yellow and red and blue are co-ordinate. And when all the terms thus related stand for recognised natural classes, the co-ordinate terms are called co-ordinate species; thus man and chamois are (in Logic) co-ordinate species of the genus animal.

§ 6. From such examples of terms whose connotations are related as whole and part, it is easy to see the general truth of the doctrine that as connotation decreases, denotation increases: for 'animal,' with less connotation than man or chamois, denotes many more objects; 'white,' with less connotation than snow or silver, denotes many more things, It is not, however, certain that this doctrine is always true in the concrete: since there may be a term connoting two or more qualities, all of which qualities are peculiar to all the things it denotes; and, if so, by subtracting one of the qualities from its connotation, we should not increase its denotation. If 'man,' for example, has among mammals the two peculiar attributes of erect gait and articulate speech, then, by omitting 'articulate speech' from the connotation of man, we could not apply the name to any more of the existing mammalia than we can at present. Still we might have been able to do so; there might have been an erect inarticulate ape, and perhaps there once was one; and, if so, to omit 'articulate' from the connotation of man would make the term 'man' denote that animal (supposing that there was no other difference to exclude it). Hence, potentially, an increase of the connotation of any term implies a decrease of its denotation. And, on the other hand, we can only increase the denotation of a term, or apply it to more objects, by decreasing its connotation; for, if the new things denoted by the term had already possessed its whole connotation, they must already have been denoted by it. However, we may increase the *known* denotation without decreasing the connotation, if we can discover the full connotation in things not formerly supposed to have it, as when dolphins were discovered to be mammals; or if we can impose the requisite qualities upon new individuals, as when by annexing some millions of Africans we extend the denotation of 'British subject' without altering its connotation.

Many of the things noticed in this chapter, especially in this section and the preceding, will be discussed at greater length in the chapters on Classification and Definition.

§ 7. Contradictory Relative Terms.—Every term has, or may have, another corresponding with it in such a way that, whatever differential qualities (§ 5) it connotes, this other connotes merely their absence; so that one or the other is always formally predicable of any Subject, but both these terms are never predicable of the same Subject in the same relation: such pairs of terms are called Contradictories. Whatever Subject we take, it is either visible or invisible, but not both; either human or non-human, but not both.

This at least is true formally, though in practice we should think ourselves trifled with if any one told us that 'A mountain is either human or non-human, but not both.' It is symbolic terms, such as X and x, that are properly said to be contradictories in relation to any subject whatever, S or M. For, as we have seen, the ordinary use of terms is limited by some *suppositio*, and this is true of Contradictories. 'Human' and 'non-human' may refer to zoological classification, or to the scope of physical, mental, or moral powers—as if we ask whether to flourish a dumbbell of a ton weight, or to know the future by intuition, or impeccability, be human or non-human. Similarly, 'visible' and 'invisible' refer either to the power of emitting or reflecting light, so that the words have no hold upon a sound or a scent, or else to power of vision and such qualifications as 'with the naked eye' or 'with a microscope.'

Again, the above definition of Contradictories tells us that they cannot be predicated of the same Subject "in the same relation"; that is, at the same time or place, or under the same conditions. The lamp is visible to me now, but will be invisible if I turn it out; one side of it is now visible, but the other is not: therefore without this restriction, "in the same relation," few or no terms would be contradictory.

If a man is called wise, it may mean 'on the whole' or 'in a certain action'; and clearly a man may for once be wise (or act wisely) who, on the whole, is not-wise. So that here again, by this ambiguity, terms that seem contradictory are predicable of the same subject, but not "in the same relation." In order to avoid the ambiguity, however, we have only to construct the term so as to express the relation, as 'wise on the whole'; and this immediately generates the contradictory 'not-wise on the whole.' Similarly, at one age a man may have black hair, at another not-black hair; but the difficulty is practically removable by stating the age referred to.

Still, this case easily leads us to a real difficulty in the use of contradictory terms, a difficulty arising from the continuous change or 'flux' of natural phenomena. If things are continually changing, it may be urged that contradictory terms are always applicable to the same subject, at least as fast as we can utter them: for if we have just said that a man's hair is black, since (like everything else) his hair is changing, it must now be not-black, though (to be sure) it may still seem black. The difficulty, such as it is, lies in this, that the human mind and its instrument language are not equal to the subtlety of Nature. All things flow, but the terms of human discourse assume a certain fixity of things; everything at every moment changes, but for the most part we can neither perceive this change nor express it in ordinary language.

This paradox, however, may, I suppose, be easily over-stated. The change that continually agitates Nature consists in the movements of masses or molecules, and such movements of things are compatible with a considerable persistence of their qualities. Not only are the molecular changes always going on in a piece of gold compatible with its remaining yellow, but its persistent yellowness depends on the continuance of some of those changes. Similarly, a man's hair may remain black for some years; though, no doubt, at a certain age its colour may begin to be problematical, and the applicability to it of 'black' or 'not-black' may become a matter of genuine anxiety. Whilst being on our guard, then, against fallacies of contradiction arising from the imperfect correspondence of fact with thought and language, we shall often have to put up with it. Candour and humility having been satisfied by the above acknowledgment of the subtlety of Nature, we may henceforward proceed upon the postulate—that it is possible to use contradictory terms such as cannot both be predicated of the same subject in the same relation, though one of them may be; that, for example, it may be truly said of a man for some years that his hair is black; and, if so, that during those years to call it not-black is false or extremely misleading.

The most opposed terms of the literary vocabulary, however, such as 'wise-foolish,' 'old-young,' 'sweet-bitter,' are rarely true contradictories: wise and foolish, indeed, cannot be predicated of the same man in the same relation; but there are many middling men, of whom neither can be predicated on the whole. For the comparison of quantities, again, we have three correlative terms, 'greater—equal—less,' and none of these is the contradictory of either of the others. In fact, the contradictory of any term is one that denotes the sum of its co-ordinates (§ 6); and to obtain a contradictory, the surest way is to coin one by prefixing to the given term the particle 'not' or (sometimes) 'non': as 'wise, not-wise,' 'human, non-human,' 'greater, not-greater.'

The separate word 'not' is surer to constitute a contradictory than the usual prefixes of negation, 'un-' or 'in-,' or even 'non'; since compounds of these are generally warped by common use from a purely negative meaning. Thus, 'Nonconformist' does not denote everybody who fails to conform. 'Unwise' is not equivalent to 'not-wise,' but means 'rather foolish'; a very foolish action is not-wise, but can only be called unwise by meiosis or irony. Still, negatives formed by 'in' or 'un' or 'non' are sometimes really contradictory of their positives; as 'visible, invisible,' 'equal, unequal.'

§ 8. The distinction between Positive and Negative terms is not of much value in Logic, what importance would else attach to it being absorbed by the more definite distinction of contradictories. For contradictories are positive and negative in essence and, when least ambiguously stated, also in form. And, on the other hand, as we have seen, when positive and negative terms are not contradictory, they are misleading. As with 'wise-unwise,' so with many others, such as 'happy-unhappy'; which are not contradictories; since a man may be neither happy nor unhappy, but indifferent, or (again) so miserable that he can only be called unhappy by a figure of speech. In fact, in the common vocabulary a formal negative often has a limited positive sense; and this is the case with unhappy, signifying the state of feeling in the milder shades of Purgatory.

When a Negative term is fully contradictory of its Positive it is said to be Infinite; because it denotes an unascertained multitude of things, a multitude only limited by the positive term and the *suppositio*; thus 'not-wise' denotes all except the wise, within the *suppositio* of 'intelligent beings.' Formally (disregarding any *suppositio*), such a negative term stands for all possible terms except its positive: x denotes everything but X; and 'not-wise' may be taken to include stones, triangles and hippogriffs. And even in this sense, a negative term has some positive meaning, though a very indefinite one, not a specific positive force like 'unwise' or 'unhappy': it denotes any and everything that has not the attributes connoted by the corresponding positive term.

Privative Terms connote the absence of a quality that normally belongs to the kind of thing denoted, as 'blind' or 'deaf.' We may predicate 'blind' or 'deaf' of a man, dog or cow that happens not to be able to see or hear, because the powers of seeing and hearing generally belong to those species; but of a stone or idol these terms can only be used figuratively. Indeed, since the contradictory of a privative carries with it the privative limitation, a stone is strictly 'not-blind': that is, it is 'not-something-that-normally-having-sight-wants-it.'

Contrary Terms are those that (within a certain genus or *suppositio*) severally connote differential qualities that are, in fact, mutually incompatible in the same relation to the same thing, and therefore cannot be predicated of the same subject in the same relation; and, so far, they resemble Contradictory Terms: but they differ from contradictory terms in this, that the differential quality connoted by each of them is definitely positive; no Contrary Term is infinite, but is limited to part of the *suppositio* excluded by the others; so that, possibly, neither of two Contraries is truly predicable of a given subject. Thus 'blue' and 'red' are Contraries, for they cannot both be predicated of the same thing in the same relation; but are not Contradictories, since, in a given case, neither may be predicable: if a flower is blue in a certain part, it cannot in the same part be red; but it may be neither blue nor red, but yellow; though it is certainly either blue or not-blue. All co-ordinate terms are formal Contraries; but if, in fact, a series of co-ordinates comprises only two (as male-female), they are empirical Contradictories; since each includes all that area of the *suppositio* which the other excludes.

The extremes of a series of co-ordinate terms are Opposites; as, in a list of colours, white and black, the most strongly contrasted, are said to be opposites, or as among moods of feeling, rapture and misery are opposites. But this distinction is of slight logical importance. Imperfect Positive and Negative couples, like 'happy and unhappy,' which (as we have seen) are not contradictories, are often called Opposites.

The members of any series of Contraries are all included by any one of them and its contradictory, as all colours come under 'red' and 'not-red,' all moods of feeling under 'happy' and 'not-happy.'

CHAPTER V
THE CLASSIFICATION OF PROPOSITIONS

§ 1. Logicians classify Propositions according to Quantity, Quality, Relation and Modality.

As to Quantity, propositions are either Universal or Particular; that is to say, the predicate is affirmed or denied either of the whole subject or of a part of it—of *All* or of *Some S*.

All S is P (that is, *P* is predicated of *all S*).
Some S is P (that is, *P* is predicated of *some S*).

An Universal Proposition may have for its subject a singular term, a collective, a general term distributed, or an abstract term.

(1) A proposition having a singular term for its subject, as *The Queen has gone to France*, is called a Singular Proposition; and some Logicians regard this as a third species of proposition with respect to quantity, distinct from the Universal and Particular; but that is needless.

(2) A collective term may be the subject, as *The Black Watch is ordered to India*. In this case, as well as in singular propositions, a predication is made concerning the whole subject as a whole.

(3) The subject may be a general term taken in its full denotation, as *All apes are sagacious*; and in this case a

Predication is made concerning the whole subject distributively; that is, of each and everything the subject stands for.

(4) Propositions whose subjects are abstract terms, though they may seem to be formally Singular, are really as to their meaning distributive Universals; since whatever is true of a quality is true of whatever thing has that quality so far as that quality is concerned. *Truth will prevail* means that *All true propositions are accepted at last* (by sheer force of being true, in spite of interests, prejudices, ignorance and indifference). To bear this in mind may make one cautious in the use of abstract terms.

In the above paragraphs a distinction is implied between Singular and Distributive Universals; but, technically, every term, whether subject or predicate, when taken in its full denotation (or universally), is said to be 'distributed,' although this word, in its ordinary sense, would be directly applicable only to general terms. In the above examples, then, 'Queen,' 'Black Watch,' 'apes,' and 'truth' are all distributed terms. Indeed, a simple definition of the Universal Proposition is 'one whose subject is distributed.'

A Particular Proposition is one that has a general term for its subject, whilst its predicate is not affirmed or denied of everything the subject denotes; in other words, it is one whose subject is not distributed: as *Some lions inhabit Africa*.

In ordinary discourse it is not always explicitly stated whether predication is universal or particular; it would be very natural to say *Lions inhabit Africa*, leaving it, as far as the words go, uncertain whether we mean *all* or *some* lions. Propositions whose quantity is thus left indefinite are technically called 'preindesignate,' their quantity not being stated or designated by any introductory expression; whilst propositions whose quantity is expressed, as *All foundling-hospitals have a high death-rate*, or *Some wine is made from grapes*, are said to be 'predesignate.' Now, the rule is that preindesignate propositions are, for logical purposes, to be treated as particular; since it is an obvious precaution of the science of proof, in any practical application, *not to go beyond the evidence*. Still, the rule may be relaxed if the universal quantity of a preindesignate proposition is well known or admitted, as in *Planets shine with reflected light*—understood of the planets of our solar system at the present time. Again, such a proposition as *Man is the paragon of animals* is not a preindesignate, but an abstract proposition; the subject being elliptical for *Man according to his proper nature*; and the translation of it into a predesignate proposition is not *All men are paragons*; nor can *Some men* be sufficient, since an abstract can only be adequately rendered by a distributed term; but we must say, *All men who approach the ideal*. Universal real propositions, true without qualification, are very scarce; and we often substitute for them *general* propositions, saying perhaps—*generally, though not universally, S is P*. Such general propositions are, in strictness, particular; and the logical rules concerning universals cannot be applied to them without careful scrutiny of the facts.

The marks or predesignations of Quantity commonly used in Logic are: for Universals, *All*, *Any*, *Every*, *Whatever* (in the negative *No* or *No one*, see next §); for Particulars, *Some*.

Now *Some*, technically used, does not mean *Some only,* but *Some at least* (it may be one, or more, or all). If it meant '*Some only*,' every particular proposition would be an exclusive exponible (chap. ii. § 3); since *Only some men are wise* implies that *Some men are not wise*. Besides, it may often happen in an investigation that all the instances we have observed come under a certain rule, though we do not yet feel justified in regarding the rule as universal; and this situation is exactly met by the expression *Some* (*it may be all*).

The words *Many*, *Most*, *Few* are generally interpreted to mean *Some*; but as *Most* signifies that exceptions are known, and *Few* that the exceptions are the more numerous, propositions thus predesignate are in fact exponibles, mounting to *Some are* and *Some are not*. If to work with both forms be too cumbrous, so that we must choose one, apparently *Few are* should be treated as *Some are not*. The scientific course to adopt with propositions predesignate by *Most* or *Few*, is to collect statistics and determine the percentage; thus, *Few men are wise*—say 2 per cent.

The Quantity of a proposition, then, is usually determined entirely by the quantity of the subject, whether *all* or *some*. Still, the quantity of the predicate is often an important consideration; and though in ordinary usage the predicate is seldom predesignate, Logicians agree that in every Negative Proposition (see § 2) the predicate is 'distributed,' that is to say, is denied altogether of the subject, and that this is involved in the form of denial. To say *Some men are not brave*, is to declare that the quality for which men may be called brave is not found in any of the *Some men* referred to: and to say *No men are proof against flattery*, cuts off the being 'proof against flattery' entirely from the list of human attributes. On the other hand, every Affirmative Proposition is regarded as having an undistributed predicate; that is to say, its predicate is not affirmed exclusively of the subject. *Some men are wise* does not mean that 'wise' cannot be predicated of any other beings; it is equivalent to *Some men are wise* (*whoever else may be*). And *All elephants are sagacious* does not limit sagacity to elephants: regarding 'sagacious' as possibly denoting many animals of many species that exhibit the quality, this proposition is equivalent to '*All elephants are* some *sagacious animals*.' The affirmative predication of a quality does not imply exclusive possession of it as denial implies its complete absence; and, therefore, to regard the predicate of an affirmative proposition as distributed would be to go beyond the evidence and to take for granted what had never been alleged.

Some Logicians, seeing that the quantity of predicates, though not distinctly expressed, is recognised, and holding that it is the part of Logic "to make explicit in language whatever is implicit in thought," have proposed to exhibit the quantity of predicates by predesignation, thus: 'Some men are *some* wise (beings)';

'some men are not *any* brave (beings)'; *etc.* This is called the Quantification of the Predicate, and leads to some modifications of Deductive Logic which will be referred to hereafter. (See § 5; chap. vii. § 4, and chap. viii. § 3.)

§ 2. As to Quality, Propositions are either Affirmative or Negative. An Affirmative Proposition is, formally, one whose copula is affirmative (or, has no negative sign), as *S—is—P, All men—are—partial to themselves*. A Negative Proposition is one whose copula is negative (or, has a negative sign), as *S—is not—P, Some men—are not—proof against flattery*. When, indeed, a Negative Proposition is of Universal Quantity, it is stated thus: *No S is P, No men are proof against flattery*; but, in this case, the detachment of the negative sign from the copula and its association with the subject is merely an accident of our idiom; the proposition is the same as *All men—are not—proof against flattery*. It must be distinguished, therefore, from such an expression as *Not every man is proof against flattery*; for here the negative sign really restricts the subject; so that the meaning is —*Some men at most* (it may be *none) are proof against flattery*; and thus the proposition is Particular, and is rendered—*Some men—are not—proof against flattery*.

When the negative sign is associated with the predicate, so as to make this an Infinite Term (chap. iv. § 8), the proposition is called an Infinite Proposition, as *S is not-P* (or *p), All men are—incapable of resisting flattery*, or *are—not-proof against flattery*.

Infinite propositions, when the copula is affirmative, are formally, themselves affirmative, although their force is chiefly negative; for, as the last example shows, the difference between an infinite and a negative proposition may depend upon a hyphen. It has been proposed, indeed, with a view to superficial simplification, to turn all Negatives into Infinites, and thus render all propositions Affirmative in Quality. But although every proposition both affirms and denies something according to the aspect in which you regard it (as *Snow is white* denies that it is any other colour, and *Snow is not blue* affirms that it is some other colour), yet there is a great difference between the definite affirmation of a genuine affirmative and the vague affirmation of a negative or infinite; so that materially an affirmative infinite is the same as a negative.

Generally Mill's remark is true, that affirmation and denial stand for distinctions of fact that cannot be got rid of by manipulation of words. Whether granite sinks in water, or not; whether the rook lives a hundred years, or not; whether a man has a hundred dollars in his pocket, or not; whether human bones have ever been found in Pliocene strata, or not; such alternatives require distinct forms of expression. At the same time, it may be granted that many facts admit of being stated with nearly equal propriety in either Quality, as *No man is proof against flattery*, or *All men are open to flattery*.

But whatever advantage there is in occasionally changing the Quality of a proposition may be gained by the process of Obversion (chap. vii. § 5); whilst to use only one Quality would impair the elasticity of logical expression. It is a postulate of Logic that the negative sign may be transferred from the copula to the predicate, or from the predicate to the copula, without altering the sense of a proposition; and this is justified by the experience that not to have an attribute and to be without it are the same thing.

§ 3. A. I. E. O.—Combining the two kinds of Quantity, Universal and Particular, with the two kinds of Quality, Affirmative and Negative, we get four simple types of proposition, which it is usual to symbolise by the letters A. I. E. O., thus:

A.	Universal Affirmative	— All S is P.
I.	Particular Affirmative	— Some S is P.
E.	Universal Negative	— No S is P.
O.	Particular Negative	— Some S is not P.

As an aid to the remembering of these symbols we may observe that A. and I. are the first two vowels in *affirmo* and that E. and O. are the vowels in *nego*.

It must be acknowledged that these four kinds of proposition recognised by Formal Logic constitute a very meagre selection from the list of propositions actually used in judgment and reasoning.

Those Logicians who explicitly quantify the predicate obtain, in all, eight forms of proposition according to Quantity and Quality:

U.	Toto-total Affirmative	— All X is all Y.
A.	Toto-partial Affirmative	— All X is some Y.
Y.	Parti-total Affirmative	— Some X is all Y.
I.	Parti-partial Affirmative	— Some X is some Y.
E.	Toto-total Negative	— No X is any Y.
η.	Toto-partial Negative	— No X is some Y.
O.	Parti-total Negative	— Some X is not any Y.
ω.	Parti-partial Negative	— Some X is not some Y.

Here A. I. E. O. correspond with those similarly symbolised in the usual list, merely designating in the predicates the quantity which was formerly treated as implicit.

§ 4. As to Relation, propositions are either Categorical or

Conditional. A Categorical Proposition is one in which the predicate is directly affirmed or denied of the subject without any limitation of time, place, or circumstance, extraneous to the subject, as *All men in England are secure of justice*; in which proposition, though there is a limitation of place ('in England'), it is included in the subject. Of this kind are nearly all the examples that have yet been given, according to the form *S is P*.

A Conditional Proposition is so called because the predication is made under some limitation or condition not included in the subject, as *If a man live in England, he is secure of justice*. Here the limitation 'living in England' is put into a conditional sentence extraneous to the subject, 'he,' representing any man.

Conditional propositions, again, are of two kinds—Hypothetical and Disjunctive. Hypothetical propositions are those that are limited by an explicit conditional sentence, as above, or thus: *If Joe Smith was a prophet, his followers have been unjustly persecuted*. Or in symbols thus:

> If A is, B is;
> If A is B, A is C;
> If A is B, C is D.

Disjunctive propositions are those in which the condition under which predication is made is not explicit but only implied under the disguise of an alternative proposition, as *Joe Smith was either a prophet or an impostor*. Here there is no direct predication concerning Joe Smith, but only a predication of one of the alternatives conditionally on the other being denied, as, *If*

Joe Smith was not a prophet he was an impostor; or, *If he was not an impostor, he was a prophet*. Symbolically, Disjunctives may be represented thus:

A is either B or C,
Either A is B or C is D.

Formally, every Conditional may be expressed as a Categorical. For our last example shows how a Disjunctive may be reduced to two Hypotheticals (of which one is redundant, being the contrapositive of the other; see chap. vii. § 10). And a Hypothetical is reducible to a Categorical thus: *If the sky is clear, the night is cold* may be read—*The case of the sky being clear is a case of the night being cold*; and this, though a clumsy plan, is sometimes convenient. It would be better to say *The sky being clear is a sign of the night being cold*, or a condition of it. For, as Mill says, the essence of a Hypothetical is to state that one clause of it (the indicative) may be inferred from the other (the conditional). Similarly, we might write: *Proof of Joe Smith's not being a prophet is a proof of his being an impostor*.

This turning of Conditionals into Categoricals is called a Change of Relation; and the process may be reversed: *All the wise are virtuous* may be written, *If any man is wise he is virtuous*; or, again, *Either a man is not-wise or he is virtuous*. But the categorical form is usually the simplest.

If, then, as substitutes for the corresponding conditionals, categoricals are formally adequate, though sometimes inelegant, it may be urged that Logic has nothing to do with elegance; or that, at any rate, the chief elegance of science is economy, and that therefore, for scientific purposes, whatever we may write further about conditionals must be an ugly excrescence. The scientific purpose of Logic is to assign the conditions of proof. Can we, then, in the conditional form prove anything that cannot be proved in the categorical? Or does a conditional require to be itself proved by any method not applicable to the Categorical? If not, why go on with the discussion of Conditionals? For all laws of Nature, however stated, are essentially categorical. 'If a straight line falls on another straight line, the adjacent angles are together equal to two right angles'; 'If a body is unsupported, it falls'; 'If population increases, rents tend to rise': here 'if' means 'whenever' or 'all cases in which'; for to raise a doubt whether a straight line is ever conceived to fall upon another, whether bodies are ever unsupported, or population ever increases, is a superfluity of scepticism; and plainly the hypothetical form has nothing to do with the proof of such propositions, nor with inference from them.

Still, the disjunctive form is necessary in setting out the relation of contradictory terms, and in stating a Division (chap. xxi.), whether formal (*as A is B or not-B*) or material (as *Cats are white, or black, or tortoiseshell, or tabby*). And in some cases the hypothetical form is useful. One of these occurs where it is important to draw attention to the condition, as something doubtful or especially requiring examination. *If there is a resisting medium in space, the earth will fall into the sun; If the Corn Laws* *are to be re-enacted, we had better sell railways and buy land*: here the hypothetical form draws attention to the questions whether there is a resisting medium in space, whether the Corn Laws are likely to be re-enacted; but as to methods of inference and proof, the hypothetical form has nothing to do with them. The propositions predicate causation: *A resisting medium in space is a condition of the earth's falling into the sun; A Corn Law is a condition of the rise of rents, and of the fall of railway profits*.

A second case in which the hypothetical is a specially appropriate form of statement occurs where a proposition relates to a particular matter and to future time, as *If there be a storm to-morrow, we shall miss our picnic*. Such cases are of very slight logical interest. It is as exercises in formal thinking that hypotheticals are of most value; inasmuch as many people find them more difficult than categoricals to manipulate.

In discussing Conditional Propositions, the conditional sentence of a Hypothetical, or the first alternative of a Disjunctive, is called the Antecedent; the indicative sentence of a Hypothetical, or the second alternative of a Disjunctive, is called the Consequent.

Hypotheticals, like Categoricals, have been classed according to Quantity and Quality. Premising that the quantity of a Hypothetical depends on the quantity of its Antecedent (which determines its limitation), whilst its quality depends on the quality of its consequent (which makes the predication), we may exhibit four forms:

A. *If A is B, C is D;*
I. *Sometimes when A is B, C is D;*
E. *If A is B, C is not D;*
O. *Sometimes when A is B, C is not D.*

But I. and O. are rarely used.

As for Disjunctives, it is easy to distinguish the two quantities thus:

A. *Either A is B, or C is D;*
I. *Sometimes either A is B or C is D.*

But I. is rarely used. The distinction of quality, however, cannot be made: there are no true negative forms; for if we write—

Neither is A B, nor C D,

there is here no alternative predication, but only an Exponible equivalent to *No A is B, and No C is D*. And if we write—

Either A is not B, or C is not D,

this is affirmative as to the alternation, and is for all methods of treatment equivalent to A.

Logicians are divided in opinion as to the interpretation of the conjunction 'either, or'; some holding that it means 'not both,' others that it means 'it may be both.' Grammatical usage, upon which the question is sometimes argued, does not seem to be established in favour of either view. If we say *A man so precise in his walk and conversation is either a saint or a consummate* *hypocrite*; or, again, *One who is happy in a solitary life is either more or less than man*; we cannot in such cases mean that the subject may be both. On the other hand, if it be said that *the author of 'A Tale of a Tub' is either a misanthrope or a dyspeptic*, the alternatives are not incompatible. Or, again, given that *X. is a lunatic, or a lover, or a poet*, the three predicates have much congruity.

It has been urged that in Logic, language should be made as exact and definite as possible, and that this requires the exclusive interpretation 'not both.' But it seems a better argument, that Logic (1) should be able to express all meanings, and (2), as the science of evidence, must not assume more than is given; to be on the safe side, it must in doubtful cases assume the least, just as it generally assumes a preindesignate term to be of particular quantity; and, therefore 'either, or' means 'one, or the other, or both.'

However, when both the alternative propositions have the same subject, as *Either A is B, or A is C*, if the two predicates are contrary or contradictory terms (as 'saint' and 'hypocrite,' or 'saint' and 'not-saint'), they cannot in their nature be predicable in the same way of the same subject; and, therefore, in such a case 'either, or' means one or the other, but not both in the same relation. Hence it seems necessary to admit that the conjunction 'either, or' may sometimes require one interpretation, sometimes the other; and the rule is that it implies the further possibility 'or both,' except when both alternatives have the same subject whilst the predicates are contrary or contradictory terms.

If, then, the disjunctive *A is either B or C* (*B* and *C* being contraries) implies that both alternatives cannot be true, it can only be adequately rendered in hypotheticals by the two forms —(1) *If A is B, it is not C*, and (2)*If A is not B, it is C*. But if the disjunctive *A is either B or C* (*B* and *C* not being contraries) implies that both may be true, it will be adequately translated into a hypothetical by the single form, *If A is not B, it is C*. We cannot translate it into—*If A is B, it is not C*, for, by our supposition, if '*A is B*' is true, it does not follow that '*A is C*' must be false.

Logicians are also divided in opinion as to the function of the hypothetical form. Some think it expresses doubt; for the consequent depends on the antecedent, and the antecedent, introduced by 'if,' may or may not be realised, as in *If the sky is clear, the night is cold*: whether the sky is, or is not, clear being supposed to be uncertain. And we have seen that some hypothetical propositions seem designed to draw attention to such uncertainty, as—*If there is a resisting medium in space, etc*. But other Logicians lay stress upon the connection of the clauses as the important matter: the statement is, they say, that the consequent may be inferred from the antecedent. Some even declare that it is given as a necessary inference; and on this ground Sigwart rejects particular hypotheticals, such as *Sometimes when A is B, C is D*; for if it happens only sometimes the connexion cannot be necessary. Indeed, it cannot even be probably inferred without further grounds. But this is also true whenever the antecedent and consequent are concerned with different matter. For example, *If the soul is simple, it is indestructible*. How do you know that? Because *Every simple substance is indestructible*. Without this further ground there can be no inference. The fact is that conditional forms often cover assertions that are not true complex propositions but a sort of euthymemes (chap. xi. § 2), arguments abbreviated and rhetorically disguised. Thus: *If patience is a virtue there are painful virtues*—an example from Dr. Keynes. Expanding this we have—

> Patience is painful;
> Patience is a virtue:
> ∴ Some virtue is painful.

And then we see the equivocation of the inference; for though patience be painful *to learn*, it is not painful *as a virtue* to the patient man.

The hypothetical, '*If Plato was not mistaken poets are dangerous citizens*,' may be considered as an argument against the laureateship, and may be expanded (informally) thus: 'All Plato's opinions deserve respect; one of them was that poets are bad citizens; therefore it behoves us to be chary of encouraging poetry.' Or take this disjunctive, '*Either Bacon wrote the works ascribed to Shakespeare, or there were two men of the highest genius in the same age and country*.' This means that it is not likely there should be two such men, that we are sure of Bacon, and therefore ought to give him all the glory. Now, if it is the part of Logic 'to make explicit in language all that is implicit in thought,' or to put arguments into the form in which they can best be examined, such propositions as the above ought to be analysed in the way suggested, and confirmed or refuted according to their real intention.

We may conclude that no single function can be assigned to all hypothetical propositions: each must be treated according to its own meaning in its own context.

§ 5. As to Modality, propositions are divided into Pure and Modal. A Modal proposition is one in which the predicate is affirmed or denied, not simply but *cum modo*, with a qualification. And some Logicians have considered any adverb occurring in the predicate, or any sign of past or future tense, enough to constitute a modal: as 'Petroleum is *dangerously* inflammable'; 'English *will be* the universal language.' But far the most important kind of modality, and the only one we need consider, is that which is signified by some qualification of the predicate as to the degree of certainty with which it is affirmed or denied. Thus, 'The bite of the cobra is *probably* mortal,' is called a Contingent or Problematic Modal: 'Water is *certainly* composed of oxygen and hydrogen' is an Assertory or Certain Modal: 'Two straight lines *cannot* enclose a space' is a Necessary or Apodeictic Modal (the opposite being inconceivable). Propositions not thus qualified are called Pure.

Modal propositions have had a long and eventful history, but they have not been found tractable by the resources of ordinary Logic, and are now generally neglected by the authors of text-books. No doubt such propositions are the commonest in ordinary discourse, and in some rough way we combine them and draw inferences from them. It is understood that a combination of assertory or of apodeictic premises may warrant an assertory or an apodeictic conclusion; but that if we combine either of these with a problematic premise our conclusion becomes problematic; whilst the combination of two problematic premises gives a conclusion less certain than either. But if we ask 'How much less certain?' there is no answer. That the modality of a conclusion follows the less certain of the premises combined, is inadequate for scientific guidance; so that, as Deductive Logic can get no farther than this, it has abandoned the discussion of Modals. To endeavour to determine the degree of certainty attaching to a problematic judgment is not, however, beyond the reach of Induction, by analysing circumstantial evidence, or by collecting statistics with regard to it. Thus, instead of 'The cobra's bite is *probably* fatal,' we might find that it is fatal 80 times in 100. Then, if we know that of those who go to India 3 in 1000 are bitten, we can calculate what the chances are that any one going to India will die of a cobra's bite (chap. xx.).

§ 6. Verbal and Real Propositions.—Another important division of propositions turns upon the relation of the predicate to the subject in respect of their connotations. We saw, when discussing Relative Terms, that the connotation of one term often implies that of another; sometimes reciprocally, like 'master' and 'slave'; or by inclusion, like species and genus; or by exclusion, like contraries and contradictories. When terms so related appear as subject and predicate of the same proposition, the result is often tautology—*e.g.*, *The master has authority over his slave; A horse is an animal; Red is not blue; British is not foreign*. Whoever knows the meaning of 'master,' 'horse,' 'red,' 'British,' learns nothing from these propositions. Hence they are called Verbal propositions, as only expounding the sense of words, or as if they were propositions only by satisfying the forms of language, not by fulfilling the function of propositions in conveying a knowledge of facts. They are also called 'Analytic' and 'Explicative,' when they separate and disengage the elements of the connotation of the subject. Doubtless, such propositions may be useful to one who does not know the language; and Definitions, which are verbal propositions whose predicates analyse the whole connotations of their subjects, are indispensable instruments of science (see chap. xxii.).

Of course, hypothetical propositions may also be verbal, as *If the soul be material it is extended*; for 'extension' is connoted by 'matter'; and, therefore, the corresponding disjunctive is verbal —*Either the soul is not material, or it is extended*. But a true divisional disjunctive can never be verbal (chap. xxi. § 4, rule 1).

On the other hand, when there is no such direct relation between subject and predicate that their connotations imply one another, but the predicate connotes something that cannot be learnt from the connotation of the subject, there is no longer tautology, but an enlargement of meaning—*e.g.*, *Masters are degraded by their slaves; The horse is the noblest animal; Red is the favourite colour of the British army; If the soul is simple, it is indestructible*. Such propositions are called Real, Synthetic, or Ampliative, because they are propositions for which a mere understanding of their subjects would be no substitute, since the predicate adds a meaning of its own concerning matter of fact.

To any one who understands the language, a verbal proposition can never be an inference or conclusion from evidence; nor can a verbal proposition ever furnish grounds for an inference, except as to the meaning of words. The subject of real and verbal propositions will inevitably recur in the chapters on Definition; but tautologies are such common blemishes in composition, and such frequent pitfalls in argument, that attention cannot be drawn to them too early or too often.

CHAPTER VI
CONDITIONS OF IMMEDIATE INFERENCE

§ 1. The word Inference is used in two different senses, which are often confused but should be carefully distinguished. In the first sense, it means a process of thought or reasoning by which the mind passes from facts or statements presented, to some opinion or expectation. The data may be very vague and slight, prompting no more than a guess or surmise; as when we look up at the sky and form some expectation about the weather, or from the trick of a man's face entertain some prejudice as to his character. Or the data may be important and strongly significant, like the footprint that frightened Crusoe into thinking of cannibals, or as when news of war makes the city expect that Consols will fall. These are examples of the act of inferring, or of inference as a process; and with inference in this sense Logic has nothing to do; it belongs to Psychology to explain how it is that our minds pass from one perception or thought to another thought, and how we come to conjecture, conclude and believe (*cf.* chap. i. § 6).

In the second sense, 'inference' means not this process of guessing or opining, but the result of it; the surmise, opinion, or belief when formed; in a word, the conclusion: and it is in this sense that Inference is treated of in Logic. The subject-matter of Logic is an inference, judgment or conclusion concerning facts, embodied in a proposition, which is to be examined in relation to the evidence that may be adduced for it, in order to determine whether, or how far, the evidence amounts to proof. Logic is the science of Reasoning in the sense in which 'reasoning' means giving reasons, for it shows what sort of reasons are good. Whilst Psychology explains how the mind goes forward from data to conclusions, Logic takes a conclusion and goes back to the data, inquiring whether those data, together with any other evidence (facts or principles) that can be collected, are of a nature to warrant the conclusion. If we think that the night will be stormy, that John Doe is of an amiable disposition, that water expands in freezing, or that one means to national prosperity is popular education, and wish to know whether we have evidence sufficient to justify us in holding these opinions, Logic can tell us what form the evidence should assume in order to be conclusive. What *form* the evidence should assume: Logic cannot tell us what kinds of fact are proper evidence in any of these cases; that is a question for the man of special experience in life, or in science, or in business. But whatever facts constitute the evidence, they must, in order to prove the point, admit of being stated in conformity with certain principles or conditions; and of these principles or conditions Logic is the science. It deals, then, not with the subjective process of inferring, but with the objective grounds that justify or discredit the inference.

§ 2. Inferences, in the Logical sense, are divided into two great classes, the Immediate and the Mediate, according to the character of the evidence offered in proof of them. Strictly, to speak of inferences, in the sense of conclusions, as immediate or mediate, is an abuse of language, derived from times before the distinction between inference as process and inference as result was generally felt. No doubt we ought rather to speak of Immediate and Mediate Evidence; but it is of little use to attempt to alter the traditional expressions of the science.

An Immediate Inference, then, is one that depends for its proof upon only one other proposition, which has the same, or more extensive, terms (or matter). Thus that *one means to national prosperity is popular education* is an immediate inference, if the evidence for it is no more than the admission that *popular education is a means to national prosperity:* Similarly, it is an immediate inference that *Some authors are vain*, if it be granted that *All authors are vain*.

An Immediate Inference may seem to be little else than a verbal transformation; some Logicians dispute its claims to be called an inference at all, on the ground that it is identical with the pretended evidence. If we attend to the meaning, say they, an immediate inference does not really express any new judgment; the fact expressed by it is either the same as its evidence, or is even less significant. If from *No men are gods* we prove that *No gods are men*, this is nugatory; if we prove from it that *Some men are not gods*, this is to emasculate the sense, to waste valuable information, to lose the commanding sweep of our universal proposition.

Still, in Logic, it is often found that an immediate inference expresses our knowledge in a more convenient form than that of the evidentiary proposition, as will appear in the chapter on Syllogisms and elsewhere. And by transforming an universal into a particular proposition, as *No men are gods*, therefore, *Some men are not gods*,—we get a statement which, though weaker, is far more easily proved; since a single instance suffices. Moreover, by drawing all possible immediate inferences from a given proposition, we see it in all its aspects, and learn all that is implied in it.

A Mediate Inference, on the other hand, depends for its evidence upon a plurality of other propositions (two or more) which are connected together on logical principles. If we argue—

> No men are gods;
> Alexander the Great is a man;
> ∴ Alexander the Great is not a god:

this is a Mediate Inference. The evidence consists of two propositions connected by the term 'man,' which is common to both (a Middle Term), mediating between 'gods' and 'Alexander.' Mediate Inferences comprise Syllogisms with their developments, and Inductions; and to discuss them further at present would be to anticipate future chapters. We must now deal with the principles or conditions on which Immediate Inferences are valid: commonly called the "Laws of Thought."

§ 3. The Laws of Thought are conditions of the logical statement and criticism of all sorts of evidence; but as to Immediate Inference, they may be regarded as the only conditions it need satisfy. They are often expressed thus: (1) The principle of Identity—'*Whatever is, is*'; (2) The principle of Contradiction—'*It is impossible for the same thing to be and not be*'; (3) The principle of Excluded Middle—'*Anything must either be or not be*.' These principles are manifestly not 'laws' of thought in the sense in which 'law' is used in Psychology; they do not profess to describe the actual mental processes that take place in judgment or reasoning, as the 'laws of association of ideas' account for memory and recollection. They are not natural laws of thought; but, in relation to thought, can only be regarded as laws when stated as precepts, the observance of which (consciously or not) is necessary to clear and consistent thinking: *e.g.*, Never assume that the same thing can both be and not be.

However, treating Logic as the science of thought only as embodied in propositions, in respect of which evidence is to be adduced, or which are to be used as evidence of other propositions, the above laws or principles must be restated as the conditions of consistent argument in such terms as to be directly applicable to propositions. It was shown in the chapter on the connotation of terms, that terms are assumed by Logicians to be capable of definite meaning, and of being used univocally in the same context; if, or in so far as, this is not the case, we cannot understand one another's reasons nor even pursue in solitary meditation any coherent train of argument. We saw, too, that the meanings of terms were related to one another: some being full correlatives; others partially inclusive one of another, as species of genus; others mutually incompatible, as contraries; or alternatively predicable, as contradictories. We now assume that propositions are capable of definite meaning according to the meaning of their component terms and of the relation between them; that the meaning, the fact asserted or denied, is what we are really concerned to prove or disprove; that a mere change in the words that constitute our terms, or of construction, does not affect the truth of a proposition as long as the meaning is not altered, or (rather) as long as no fresh meaning is introduced; and that if the meaning of any proposition is true, any other proposition that denies it is false. This postulate is plainly necessary to consistency of statement and discourse; and consistency is necessary, if our thought or speech is to correspond with the unity and coherence of Nature and experience; and the Laws of Thought or Conditions of Immediate Inference are an analysis of this postulate.

§ 4. The principle of Identity is usually written symbolically thus: *A is A; not-A is not-A*. It assumes that there is something that may be represented by a term; and it requires that, in any discussion, *every relevant term, once used in a definite sense, shall keep that meaning throughout*. Socrates in his father's workshop, at the battle of Delium, and in prison, is assumed to be the same man denotable by the same name; and similarly, 'elephant,' or 'justice,' or 'fairy,' in the same context, is to be understood of the same thing under the same *suppositio*.

But, further, it is assumed that of a given term another term may be predicated again and again in the same sense under the same conditions; that is, we may speak of the identity of meaning in a proposition as well as in a term. To symbolise this we ought to alter the usual formula for Identity and write it thus: *If B is A, B is A; if B is not-A, B is not-A*. If Socrates is wise, he is wise; if fairies frequent the moonlight, they do; if Justice is not of this world, it is not. *Whatever affirmation or denial we make concerning any subject, we are bound to adhere to it for the purposes of the current argument or investigation.* Of course, if our assertion turns out to be false, we must not adhere to it; but then we must repudiate all that we formerly deduced from it.

Again, *whatever is true or false in one form of words is true or false in any other*: this is undeniable, for the important thing is identity of meaning; but in Formal Logic it is not very convenient. If Socrates is wise, is it an identity to say 'Therefore the master of Plato is wise'; or, further that he 'takes enlightened views of life'? If *Every man is fallible*, is it an identical proposition that *Every man is liable to error*? It seems pedantic to demand a separate proposition that *Fallible is liable to error*. But, on the other hand, the insidious substitution of one term for another speciously identical, is a chief occasion of fallacy. How if we go on to argue: therefore, *Every man* *is apt to blunder, prone to confusion of thought, inured to self-contradiction*? Practically, the substitution of identities must be left to candour and good-sense; and may they increase among us. Formal Logic is, no doubt, safest with symbols; should, perhaps, content itself with A and B; or, at least, hardly venture beyond Y and Z.

§ 5. The principle of Contradiction is usually written symbolically, thus: *A is not not-A*. But, since this formula seems to be adapted to a single term, whereas we want one that is applicable to propositions, it may be better to write it thus: *B is not both A and not-A*. That is to say: *if any term may be affirmed of a subject, the contradictory term may, in the same relation, be denied of it*. A leaf that is green on one side of it may be not-green on the other; but it is not both green and not-green on the same surface, at the same time, and in the same light. If a stick is straight, it is false that it is at the same time not-straight: having granted that two angles are equal, we must deny that they are unequal.

But is it necessarily false that the stick is 'crooked'; must we deny that either angle is 'greater or less' than the other? How far is it permissible to substitute any other term for the formal contradictory? Clearly, the principle of Contradiction takes for granted the principle of Identity, and is subject to the same difficulties in its practical application. As a matter of fact and common sense, if we affirm any term of a Subject, we are bound to deny of that Subject, in the same relation, not only the contradictory but all synonyms for this, and also all contraries and opposites; which, of course, are included in the contradictory. But who shall determine what these are? Without an authoritative Logical Dictionary to refer to, where all contradictories, synonyms, and contraries may be found on record, Formal Logic will hardly sanction the free play of common sense.

The principle of Excluded Middle may be written: *B is either A or not-A*; that is, *if any term be denied of a subject, the contradictory term may, in the same relation, be affirmed*. Of course, we may deny that a leaf is green on one side without being bound to affirm that it is not-green on the other. But in the same relation a leaf is either green or not-green; at the same time, a stick is either bent or not-bent. If we deny that A is greater than B, we must affirm that it is not-greater than B.

Whilst, then, the principle of Contradiction (that 'of contradictory predicates, one being affirmed, the other is denied ') might seem to leave open a third or middle course, the denying of both contradictories, the principle of Excluded Middle derives its name from the excluding of this middle course, by declaring that the one or the other must be affirmed. Hence the principle of Excluded Middle does not hold good of mere contrary terms. If we deny that a leaf is green, we are not bound to affirm it to be yellow; for it may be red; and then we may deny both contraries, yellow and green. In fact, two contraries do not between them cover the whole predicable area, but contradictories do: the form of their expression is such that (within the *suppositio*) each includes all that the other excludes; so that the subject (if brought within the *suppositio*) must fall under the one or the other. It may seem absurd to say that Mont Blanc is either wise or not-wise; but how comes any mind so ill-organised as to introduce Mont Blanc into this strange company? Being there, however, the principle is inexorable: Mont Blanc is not-wise.

In fact, the principles of Contradiction and Excluded Middle are inseparable; they are implicit in all distinct experience, and may be regarded as indicating the two aspects of Negation. The principle of Contradiction says: *B is not both A and not-A*, as if *not-A* might be nothing at all; this is abstract negation. But the principle of Excluded Middle says: *Granting that B is not A, it is still something*—namely, *not-A*; thus bringing us back to the concrete experience of a continuum in which the absence of one thing implies the presence of something else. Symbolically: to deny that B is A is to affirm that B is not A, and this only differs by a hyphen from B is not-A.

These principles, which were necessarily to some extent anticipated in chap. iv. § 7, the next chapter will further illustrate.

§ 6. But first we must draw attention to a maxim (also already mentioned), which is strictly applicable to Immediate Inferences, though (as we shall see) in other kinds of proof it may be only a formal condition: this is the general caution *not to go beyond the evidence*. An immediate inference ought to contain nothing that is not contained (or formally implied) in the proposition by which it is proved. With respect to quantity in denotation, this caution is embodied in the rule 'not to distribute any term that is not given distributed.' Thus, if there is a predication concerning 'Some S,' or 'Some men,' as in the forms I. and O., we cannot infer anything concerning 'All S.' or 'All men'; and, as we have seen, if a term is given us preindesignate, we are generally to take it as of particular quantity. Similarly, in the case of affirmative propositions, we saw that this rule requires us to assume that their predicates are undistributed.

As to the grounds of this maxim, not to go beyond the evidence, not to distribute a term that is given as undistributed, it is one of the things so plain that to try to justify is only to obscure them. Still, we must here state explicitly what Formal Logic assumes to be contained or implied in the evidence afforded by any proposition, such as 'All S is P.' If we remember that in chap. iv. § 7, it was assumed that every term may have a contradictory; and if we bear in mind the principles of Contradiction and Excluded Middle, it will appear that such a proposition as 'All S is P' tells us something not only about the relations of 'S' and 'P,' but also of their relations to 'not-S' and 'not-P'; as, for example, that 'S is not not-P,' and that 'not-P is not-S.' It will be shown in the next chapter how Logicians have developed these implications in series of Immediate Inferences.

If it be asked whether it is true that every term, itself significant, has a significant contradictory, and not merely a formal contradictory, generated by force of the word 'not,' it is difficult to give any better answer than was indicated in §§ 3-5, without venturing further into Metaphysics. I shall merely say, therefore, that, granting that some such term as 'Universe' or 'Being' may have no significant contradictory, if it stand for 'whatever can be perceived or thought of'; yet every term that stands for less than 'Universe' or 'Being' has, of course, a contradictory which denotes the rest of the universe. And since every argument or train of thought is carried on within a special 'universe of discourse,' or under a certain *suppositio*, we may say that *within the given suppositio every term has a contradictory*, and that every predication concerning a term implies some predication concerning its contradictory. But the name of the *suppositio* itself has no contradictory, except with reference to a wider and inclusive *suppositio*.

The difficulty of actual reasoning, not with symbols, but about matters of fact, does not arise from the principles of Logic, but sometimes from the obscurity or complexity of the facts, sometimes from the ambiguity or clumsiness of language, sometimes from the deficiency of our own minds in penetration, tenacity and lucidity. One must do one's best to study the facts, and not be too easily discouraged.

CHAPTER VII
IMMEDIATE INFERENCES

§ 1. Under the general title of Immediate Inference Logicians discuss three subjects, namely, Opposition, Conversion, and Obversion; to which some writers add other forms, such as Whole and Part in Connotation, Contraposition, Inversion, *etc.* Of Opposition, again, all recognise four modes: Subalternation, Contradiction, Contrariety and Sub-contrariety. The only peculiarities of the exposition upon which we are now entering are, that it follows the lead of the three Laws of Thought, taking first those modes of Immediate Inference in which Identity is most important, then those which plainly involve Contradiction and Excluded Middle; and that this method results in separating the modes of Opposition, connecting Subalternation with Conversion, and the other modes with Obversion. To make up for this departure from usage, the four modes of Opposition will be brought together again in § 9.

§ 2. Subalternation.—Opposition being the relation of propositions that have the same matter and differ only in form (as A., E., I., O.), propositions of the forms A. and I. are said to be Subalterns in relation to one another, and so are E. and O.; the universal of each quality being distinguished as 'subalternans,' and the particular as 'subalternate.'

It follows from the principle of Identity that, the matter of the propositions being the same, if A. is true I. is true, and that if E. is true O. is true; for A. and E. predicate something of *All S* or *All men*; and since I. and O. make the same predication of *Some S* or *Some men*, the sense of these particular propositions has already been predicated in A. or E. If *All S is P, Some S is P*; if *No S is P, Some S is not P*; or, if *All men are fond of laughing, Some men are*; if *No men are exempt from ridicule, Some men are not.*

Similarly, if I. is false A. is false; if O. is false E. is false. If we deny any predication about *Some S*, we must deny it of *All S*; since in denying it of *Some*, we have denied it of at least part of *All*; and whatever is false in one form of words is false in any other.

On the other hand, if I. is true, we do not know that A. is; nor if O. is true, that E. is; for to infer from *Some* to *All* would be going beyond the evidence. We shall see in discussing Induction that the great problem of that part of Logic is, to determine the conditions under which we may in reality transcend this rule and infer from *Some* to *All*; though even there it will appear that, formally, the rule is observed. For the present it is enough that I. is an immediate inference from A., and O. from E.; but that A. is not an immediate inference from I., nor E. from O.

§ 3. Connotative Subalternation.—We have seen (chap. iv. § 6) that if the connotation of one term is only part of another's its denotation is greater and includes that other's. Hence genus and species stand in subaltern relation, and whatever is true of the genus is true of the species: If *All animal life is dependent* *on vegetation, All human life is dependent on vegetation*. On the other hand, whatever is not true of the species or narrower term, cannot be true of the whole genus: If it is false that '*All human life is happy*,' it is false that '*All animal life is happy*.'

Similar inferences may be drawn from the subaltern relation of predicates; affirming the species we affirm the genus. To take Mill's example, if *Socrates is a man, Socrates is a living creature*. On the other hand, denying the genus we deny the species: if *Socrates is not vicious, Socrates is not drunken*.

Such cases as these are recognised by Mill and Bain as immediate inferences under the principle of Identity. But some Logicians might treat them as imperfect syllogisms, requiring another premise to legitimate the conclusion, thus:

> All animal life is dependent on vegetation;
> All human life is animal life;
> ∴ All human life is dependent on vegetation.

Or again:

> All men are living creatures;
> Socrates is a man;
> ∴ Socrates is a living creature.

The decision of this issue turns upon the question (*cf.* chap. vi. § 3) how far a Logician is entitled to assume that the terms he uses are understood, and that the identities involved in their meanings will be recognised. And to this question, for the sake of consistency, one of two answers is required; failing which, there remains the rule of thumb. First, it may be held that no terms are understood except those that are defined in expounding the science, such as 'genus' and 'species,' 'connotation' and 'denotation.' But very few Logicians observe this limitation; few would hesitate to substitute 'not wise' for 'foolish.' Yet by what right? Malvolio being foolish, to prove that he is not-wise, we may construct the following syllogism:

> Foolish is not-wise;
> Malvolio is foolish;
> ∴ Malvolio is not-wise.

Is this necessary? Why not?

Secondly, it may be held that all terms may be assumed as understood unless a definition is challenged. This principle will justify the substitution of 'not-wise' for 'foolish'; but it will also legitimate the above cases (concerning 'human life' and 'Socrates') as immediate inferences, with innumerable others that might be based upon the doctrine of relative terms: for example, *The hunter missed his aim*: therefore, *The prey escaped*. And from this principle it will further follow that all apparent syllogisms, having one premise a verbal proposition, are immediate inferences (*cf.* chap. ix. § 4).

Closely connected with such cases as the above are those mentioned by Archbishop Thomson as "Immediate Inferences by added Determinants" (*Laws of Thought*, § 87). He takes the case: '*A negro is a fellow-creature*: therefore, *A negro in suffering is a fellow-creature in suffering*.' This rests upon the principle that to increase the connotations of two terms by the same attribute or determinant does not affect the relationship of their denotations, since it must equally diminish (if at all) the denotations of both classes, by excluding the same individuals, if any want the given attribute. But this principle is true only when the added attribute is not merely the same verbally, but has the same significance in qualifying both terms. We cannot argue *A mouse is an animal*; therefore, *A large mouse is a large animal*; for 'large' is an attribute relative to the normal magnitude of the thing described.

§ 4. Conversion is Immediate Inference by transposing the terms of a given proposition without altering its quality. If the quantity is also unaltered, the inference is called 'Simple Conversion'; but if the quantity is changed from universal to particular, it is called 'Conversion by limitation' or '*per accidens.*' The given proposition is called the 'convertend'; that which is derived from it, the 'converse.'

Departing from the usual order of exposition, I have taken up Conversion next to Subalternation, because it is generally thought to rest upon the principle of Identity, and because it seems to be a good method to exhaust the forms that come only under Identity before going on to those that involve Contradiction and Excluded Middle. Some, indeed, dispute the claims of Conversion to illustrate the principle of Identity; and if the sufficient statement of that principle be 'A is A,' it may be a question how Conversion or any other mode of inference can be referred to it. But if we state it as above (chap. vi. § 3), that whatever is true in one form of words is true in any other, there is no difficulty in applying it to Conversion.

Thus, to take the simple conversion of I.,

> Some S is P; ∴ Some P is S.
>
> Some poets are business-like; ∴ Some business-like men are poets.

Here the convertend and the converse say the same thing, and this is true if that is.

We have, then, two cases of simple conversion: of I. (as above) and of E. For E.:

> No S is P; ∴ No P is S.
>
> No ruminants are carnivores; ∴ No carnivores are ruminants.

In converting I., the predicate (P) when taken as the new subject, being preindesignate, is treated as particular; and in converting E., the predicate (P), when taken as the new subject, is treated as universal, according to the rule in chap. v. § 1.

A. is the one case of conversion by limitation:

> All S is P; ∴ Some P is S.
>
> All cats are grey in the dark; ∴ Some things grey in the dark are cats.

The predicate is treated as particular, when taking it for the new subject, according to the rule not to go beyond the evidence. To infer that *All things grey in the dark are cats* would be palpably absurd; yet no error of reasoning is commoner than the simple conversion of A. The validity of conversion by limitation may be shown thus: if, *All S is P*, then, by subalternation, *Some S is P*, and therefore, by simple conversion, *Some P is S*.

O. cannot be truly converted. If we take the proposition: *Some S is not P*, to convert this into *No P is S*, or *Some P is not S*, would break the rule in chap. vi. § 6; since *S*, undistributed in the convertend, would be distributed in the converse. If we are told that *Some men are not cooks*, we cannot infer that *Some cooks are not men*. This would be to assume that '*Some men*' are identical with '*All men*.'

By quantifying the predicate, indeed, we may convert O. simply, thus:

Some men are not cooks ∴ No cooks are some men.

And the same plan has some advantage in converting A.; for by the usual method *per accidens*, the converse of A. being I., if we convert this again it is still I., and therefore means less than our original convertend. Thus:

All S is P ∴ Some P is S ∴ Some S is P.

Such knowledge, as that *All S* (the whole of it) *is P*, is too precious a thing to be squandered in pure Logic; and it may be preserved by quantifying the predicate; for if we convert A. to Y., thus—

All S is P ∴ Some P is all S—

we may reconvert Y. to A. without any loss of meaning. It is the chief use of quantifying the predicate that, thereby, every proposition is capable of simple conversion.

The conversion of propositions in which the relation of terms is inadequately expressed (see chap. ii., § 2) by the ordinary copula (*is* or *is not*) needs a special rule. To argue thus—

A is followed by B ∴ Something followed by B is A—

would be clumsy formalism. We usually say, and we ought to say—

A is followed by B ∴ B follows A (or *is preceded by A*).

Now, any relation between two terms may be viewed from either side—*A: B* or *B: A*. It is in both cases the same fact; but, with the altered point of view, it may present a different character. For example, in the Immediate Inference—$A > B \therefore B < A$—a diminishing turns into an increasing ratio, whilst the fact predicated remains the same. Given, then, a relation between two terms as viewed from one to the other, the same relation viewed from the other to the one may be called the Reciprocal. In the cases of Equality, Co-existence and Simultaneity, the given relation and its reciprocal are not only the same fact, but they also have the same character: in the cases of Greater and Less and Sequence, the character alters.

We may, then, state the following rule for the conversion of propositions in which the whole relation explicitly stated is taken as the copula: Transpose the terms, and for the given relation substitute its reciprocal. Thus—

A is the cause of B ∴ B is the effect of A.

The rule assumes that the reciprocal of a given relation is definitely known; and so far as this is true it may be extended to more concrete relations—

A is a genus of B ∴ B is a species of A
A is the father of B ∴ B is a child of A.

But not every relational expression has only one definite reciprocal. If we are told that *A is the brother of B*, we can only infer that *B is either the brother or the sister of A*. A list of all reciprocal relations is a desideratum of Logic.

§ 5. Obversion (otherwise called Permutation or Æquipollence) is Immediate Inference by changing the quality of the given proposition and substituting for its predicate the contradictory term. The given proposition is called the 'obvertend,' and the inference from it the 'obverse.' Thus the obvertend being—*Some philosophers are consistent reasoners*, the obverse will be—*Some philosophers are not inconsistent reasoners*.

The legitimacy of this mode of reasoning follows, in the case of affirmative propositions, from the principle of Contradiction, that if any term be affirmed of a subject, the contradictory term may be denied (chap. vi. § 3). To obvert affirmative propositions, then, the rule is—Insert the negative sign, and for the predicate substitute its contradictory term.

A.	*All S is P ∴ No S is not-P*
	All men are fallible ∴ No men are infallible.
I.	*Some S is P ∴ some S is not-P*
	Some philosophers are consistent ∴ Some philosophers are not inconsistent.

In agreement with this mode of inference, we have the rule of modern English grammar, that 'two negatives make an affirmative.'

Again, by the principle of Excluded Middle, if any term be denied of a subject, its contradictory may be affirmed: to obvert negative propositions, then, the rule is—Remove the negative sign, and for the predicate substitute its contradictory term.

E.	*No S is P ∴ All S is not-P*
	No matter is destructible ∴ All matter is indestructible.
O.	*Some S is not P ∴ Some S is not-P*
	Some ideals are not attainable ∴ Some ideals are unattainable.

Thus, by obversion, each of the four propositions retains its quantity but changes its quality: A. to E., I. to O., E. to A., O. to I. And all the obverses are infinite propositions, the affirmative infinites having the sense of negatives, and the negative infinites having the sense of affirmatives.

Again, having obtained the obverse of a given proposition, it may be desirable to recover the obvertend; or it may at any time be requisite to change a given infinite proposition into the corresponding direct affirmative or negative; and in such cases the process is still obversion. Thus, if *No S is not-P* be given us to recover the obvertend or to find the corresponding affirmative; the proposition being formally negative, we apply the rule for obverting negatives: 'Remove the negative sign, and for the predicate substitute its contradictory.' This yields the affirmative *All S is P*. Similarly, to obtain the obvertend of *All S is not-P*, apply the rule for obverting Affirmatives; and this yields *No S is P*.

§ 6. Contrariety.—We have seen in chap. iv. § 8, that contrary terms are such that no two of them are predicable in the same way of the same subject, whilst perhaps neither may be predicable of it. Similarly, Contrary Propositions may be defined as those of which no two are ever both true together, whilst perhaps neither may be true; or, in other words, both may be false. This is the relation between A. and E. when concerned with the same matter: as A.—*All men are wise*; E.—*No men are wise*. Such propositions cannot both be true; but they may both be false, for some men may be wise and some not. They cannot both be true; for, by the principle of Contradiction, if *wise* may be affirmed of *All men, not-wise* must be denied; but *All men are not-wise* is the obverse of *No men are wise*, which therefore may also be denied.

At the same time we cannot apply to A. and E. the principle of Excluded Middle, so as to show that one of them must be true of the same matter. For if we deny that *All men are wise*, we do not necessarily deny the attribute 'wise' of each and every man: to say that *Not all are wise* may mean no more than that *Some are not*. This gives a proposition in the form of O.; which, as we have seen, does not imply its subalternans, E.

If, however, two Singular Propositions, having the same matter, but differing in quality, are to be treated as universals, and therefore as A. and E., they are, nevertheless, contradictory and not merely contrary; for one of them must be false and the other true.

§ 7. Contradiction is a relation between two propositions analogous to that between contradictory terms (one of which being affirmed of a subject the other is denied)—such, namely, that one of them is false and the other true. This is the case with the forms A. and O., and E. and I., in the same matter. If it be true that *All men are wise*, it is false that *Some men are not wise* (equivalent by obversion to *Some men are not-wise*); or else, since the 'Some men' are included in the 'All men,' we should be predicating of the same men that they are both 'wise' and 'not-wise'; which would violate the principle of Contradiction. Similarly, *No men are wise*, being by obversion equivalent to *All men are not-wise*, is incompatible with *Some men are wise*, by the same principle of Contradiction.

But, again, if it be false that *All men are wise*, it is always true that *Some are not wise*; for though in denying that 'wise' is a predicate of 'All men' we do not deny it of each and every man, yet we deny it of 'Some men.' Of 'Some men,' therefore, by the principle of Excluded Middle, 'not-wise' is to be affirmed; and *Some men are not-wise*, is by obversion equivalent to *Some men are not wise*. Similarly, if it be false that *No men are wise*, which by obversion is equivalent to *All men are not-wise*, then it is true at least that *Some men are wise*.

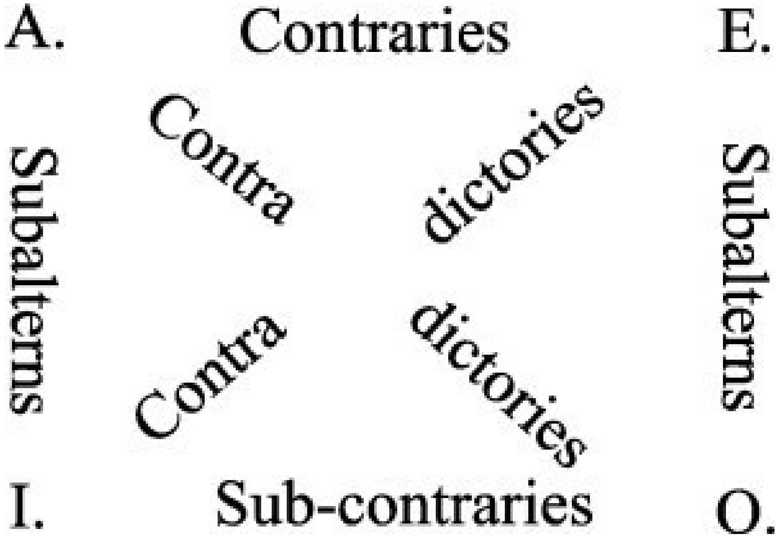
By extending and enforcing the doctrine of relative terms, certain other inferences are implied in the contrary and contradictory relations of propositions. We have seen in chap. iv. that the contradictory of a given term includes all its contraries: 'not-blue,' for example, includes red and yellow. Hence, since *The sky is blue* becomes by obversion, *The sky is not not-blue*, we may also infer *The sky is not red, etc*. From the truth, then, of any proposition predicating a given term, we may infer the falsity of all propositions predicating the contrary terms in the same relation. But, on the other hand, from the falsity of a proposition predicating a given term, we cannot infer the truth of the predication of any particular contrary term. If it be false that *The sky is red*, we cannot formally infer, that *The sky is blue* (*cf.* chap. iv. § 8).

§ 8. Sub-contrariety is the relation of two propositions, concerning the same matter that may both be true but are never both false. This is the case with I. and O. If it be true that *Some men are wise*, it may also be true that *Some (other) men are not* *wise*. This follows from the maxim in chap. vi. § 6, not to go beyond the evidence.

For if it be true that *Some men are wise*, it may indeed be true that *All are* (this being the subalternans): and if *All are*, it is (by contradiction) false that *Some are not*; but as we are only told that *Some men are*, it is illicit to infer the falsity of *Some are not*, which could only be justified by evidence concerning *All men*.

But if it be false that *Some men are wise*, it is true that *Some men are not wise*; for, by contradiction, if *Some men are wise* is false, *No men are wise* is true; and, therefore, by subalternation, *Some men are not wise* is true.

§ 9. The Square of Opposition.—By their relations of Subalternation, Contrariety, Contradiction, and Sub-contrariety, the forms A. I. E. O. (having the same matter) are said to stand in Opposition: and Logicians represent these relations by a square having A. I. E. O. at its corners:



As an aid to the memory, this diagram is useful; but as an attempt to represent the logical relations of propositions, it is misleading. For, standing at corners of the same square, A. and E., A. and I., E. and O., and I. and O., seem to be couples bearing the same relation to one another; whereas we have seen that their relations are entirely different. The following traditional summary of their relations in respect of truth and falsity is much more to the purpose:

(1)	If A. is true,	I. is true,	E. is false,	O. is false.
(2)	If A. is false,	I. is unknown,	E. is unknown,	O. is true.
(3)	If I. is true,	A. is unknown,	E. is false,	O. is unknown.
(4)	If I. is false,	A. is false,	E. is true,	O. is true.
(5)	If E. is true,	A. is false,	I. is false,	O. is true.
(6)	If E. is false,	A. is unknown,	I. is true,	O. is unknown.
(7)	If O. is true,	A. is false,	I. is unknown,	E. is unknown.
(8)	If O. is false,	A. is true,	I. is true,	E. is false.

Where, however, as in cases 2, 3, 6, 7, alleging either the falsity of universals or the truth of particulars, it follows that two of the three Opposites are unknown, we may conclude further that one of them must be true and the other false, because the two unknown are always Contradictories.

§ 10. Secondary modes of Immediate Inference are obtained by applying the process of Conversion or Obversion to the results already obtained by the other process. The best known secondary form of Immediate Inference is the Contrapositive, and this is the converse of the obverse of a given proposition. Thus:

DATUM.	OBVERSE.	CONTRAPOSITIVE.
A. *All S is P*	∴ *No S is not-P*	∴ *No not-P is S*
I. *Some S is P*	∴ *Some S is not not-P*	∴ (none)
E. *No S is P*	∴ *All S is not-P*	∴ *Some not-P is S*
O. *Some S is not P*	∴ *Some S is not-P*	∴ *Some not-P is S*

There is no contrapositive of I., because the obverse of I. is in the form of O., and we have seen that O. cannot be converted. O., however, has a contrapositive (*Some not-P is S*); and this is sometimes given instead of the converse, and called the 'converse by negation.'

Contraposition needs no justification by the Laws of Thought, as it is nothing but a compounding of conversion with obversion, both of which processes have already been justified. I give a table opposite of the other ways of compounding these primary modes of Immediate Inference.

		A.	I.	E.	O.
	1	All A is B.	Some A is B.	No A is B.	Some A is not B.
Obverse.	2	No A is b.	Some A is not b.	All A is b.	Some A is b.
Converse.	3	Some B is A.	Some B is A	No B is A.	—
Obverse of Converse.	4	Some B is not a.	Some B is not a.	All B is a.	—
Contrapositive.	5	No b is A.	—	Some b is A.	Some b is A.
Obverse of Contrapositive.	6	All b is a.	—	Some b is not a.	Some b is not a.
Converse of Obverse of Converse.	7	—	—	Some a is B.	—
Obverse of Converse of Obverse of Converse.	8	—	—	Some a is not b.	—
Converse of Obverse of Contrapositive.	9	Some a is b.	—	—	—
Obverse of Converse of Obverse of Contrapositive.	10	Some a is not B.	—	—	—

In this table *a* and *b* stand for *not-A* and *not-B* and had better be read thus: for *No A is b, No A is not-B*; for *All b is a* (col. 6), *All not-B is not-A*; and so on.

It may not, at first, be obvious why the process of alternately obverting and converting any proposition should ever come to an end; though it will, no doubt, be considered a very fortunate circumstance that it always does end. On examining the results, it will be found that the cause of its ending is the inconvertibility of O. For E., when obverted, becomes A.; every A, when converted, degenerates into I.; every I., when obverted, becomes O.; O cannot be converted, and to obvert it again is merely to restore the former proposition: so that the whole process moves on to inevitable dissolution. I. and O. are exhausted by three transformations, whilst A. and E. will each endure seven.

Except Obversion, Conversion and Contraposition, it has not been usual to bestow special names on these processes or their results. But the form in columns 7 and 10 (*Some a is B—Some a is not B*), where the original predicate is affirmed or denied of the contradictory of the original subject, has been thought by Dr. Keynes to deserve a distinctive title, and he has called it the 'Inverse.' Whilst the Inverse is one form, however, Inversion is not one process, but is obtained by different processes from E. and A. respectively. In this it differs from Obversion, Conversion, and Contraposition, each of which stands for one process.

The Inverse form has been objected to on the ground that the inference *All A is B ∴ Some not-A is not B*, distributes *B* (as predicate of a negative proposition), though it was given as undistributed (as predicate of an affirmative proposition). But Dr. Keynes defends it on the ground that (1) it is obtained by obversions and conversions which are all legitimate and (2) that although *All A is B* does not distribute *B* in relation to *A*, it does distribute *B* in relation to some *not-A* (namely, in relation to whatever *not-A* is *not-B*). This is one reason why, in stating the rule in chap. vi. § 6, I have written: "an immediate inference ought to contain nothing that is not contained, *or formally implied*, in the proposition from which it is inferred"; and have maintained that every term formally implies its contradictory within the *suppositio*.

§ 11. Immediate Inferences from Conditionals are those which consist—(1) in changing a Disjunctive into a Hypothetical, or a Hypothetical into a Disjunctive, or either into a Categorical; and (2) in the relations of Opposition and the equivalences of

Obversion, Conversion, and secondary or compound processes, which we have already examined in respect of Categoricals. As no new principles are involved, it may suffice to exhibit some of the results.

We have already seen (chap. v. § 4) how Disjunctives may be read as Hypotheticals and Hypotheticals as Categoricals. And, as to Opposition, if we recognise four forms of Hypothetical A. I. E. O., these plainly stand to one another in a Square of Opposition, just as Categoricals do. Thus A. and E. (*If A is B, C is D*, and *If A is B, C is not D*) are contraries, but not contradictories; since both may be false (*C* may sometimes be *D*, and sometimes not), though they cannot both be true. And if they are both false, their subalternates are both true, being respectively the contradictories of the universals of opposite quality, namely, I. of E., and O. of A. But in the case of Disjunctives, we cannot set out a satisfactory Square of Opposition; because, as we saw (chap. v. § 4), the forms required for E. and O. are not true Disjunctives, but Exponibles.

The Obverse, Converse, and Contrapositive, of Hypotheticals (admitting the distinction of quality) may be exhibited thus:

DATUM.	OBVERSE.
A. *If A is B, C is D*	*If A is B, C is not d*
I. Sometimes *when A is B, C is D*	Sometimes *when A is B, C is not d*
E. *If A is B, C is not D*	*If A is B, C is d*
O. Sometimes *when A is B, C is not D*	Sometimes *when A is B, C is d*
CONVERSE.	CONTRAPOSITIVE.
Sometimes *when C is D, A is B*	*If C is d, A is not B*
Sometimes *when C is D, A is B*	(none)
If C is D, A is not B	Sometimes *when C is d, A is B*
(none)	Sometimes *when C is d, A is B*

As to Disjunctives, the attempt to put them through these different forms immediately destroys their disjunctive character. Still, given any proposition in the form *A is either B or C*, we can state the propositions that give the sense of obversion, conversion, *etc.*, thus:

Datum.—*A is either B or C;*
Obverse.—*A is not both b and c;*
Converse.—*Something, either B or C, is A;*
Contrapositive.—*Nothing that is both b and c is A.*

For a Disjunctive in I., of course, there is no Contrapositive. Given a Disjunctive in the form *Either A is B or C is D*, we may write for its Obverse—*In no case is A b, and C at the same time* *d*. But no Converse or Contrapositive of such a Disjunctive can be obtained, except by first casting it into the hypothetical or categorical form.

The reader who wishes to pursue this subject further, will find it elaborately treated in Dr. Keynes' *Formal Logic*, Part II.; to which work the above chapter is indebted.

CHAPTER VIII
ORDER OF TERMS, EULER'S DIAGRAMS, LOGICAL EQUATIONS, EXISTENTIAL IMPORT OF PROPOSITIONS

§ 1. Of the terms of a proposition which is the Subject and which the Predicate? In most of the exemplary propositions cited by Logicians it will be found that the subject is a substantive and the predicate an adjective, as in *Men are mortal*. This is the relation of Substance and Attribute which we saw (chap. i. § 5) to be the central type of relations of coinherence; and on this model other predications may be formed in which the subject is not a substance, but is treated as if it were, and could therefore be the ground of attributes; as *Fame is treacherous, The weather is changeable*. But, in literature, sentences in which the adjective comes first are not uncommon, as *Loud was the applause, Dark is the fate of man, Blessed are the peacemakers*, and so on. Here, then, 'loud,' 'dark' and 'blessed' occupy the place of the logical subject. Are they really the subject, or must we alter the order of such sentences into *The applause was loud, etc.*? If we do, and then proceed to convert, we get *Loud was the applause*, or (more scrupulously) *Some loud noise was the applause*. The last form, it is true, gives the subject a substantive word, but 'applause' has become the predicate; and if the substantive 'noise' was not implied in the first form, *Loud is the applause*, by what right is it now inserted? The recognition of Conversion, in fact, requires us to admit that, formally, in a logical proposition, the term preceding the copula is subject and the one following is predicate. And, of course, materially considered, the mere order of terms in a proposition can make no difference in the method of proving it, nor in the inferences that can be drawn from it.

Still, if the question is, how we may best cast a literary sentence into logical form, good grounds for a definite answer may perhaps be found. We must not try to stand upon the naturalness of expression, for *Dark is the fate of man* is quite as natural as *Man is mortal*. When the purpose is not merely to state a fact, but also to express our feelings about it, to place the grammatical predicate first may be perfectly natural and most effective. But the grounds of a logical order of statement must be found in its adaptation to the purposes of proof and inference. Now general propositions are those from which most inferences can be drawn, which, therefore, it is most important to establish, if true; and they are also the easiest to disprove, if false; since a single negative instance suffices to establish the contradictory. It follows that, in re-casting a literary or colloquial sentence for logical purposes, we should try to obtain a form in which the subject is distributed—is either a singular term or a general term predesignate as 'All' or 'No.' Seeing, then, that most adjectives connote a single attribute, whilst most substantives connote more than one attribute; and that therefore the denotation of adjectives is usually wider than that of substantives; in any proposition, one term of which is an adjective and the other a substantive, if either can be distributed in relation to the other, it is nearly sure to be the substantive; so that to take the substantive term for subject is our best chance of obtaining an universal proposition. These considerations seem to justify the practice of Logicians in selecting their examples.

For similar reasons, if both terms of a proposition are substantive, the one with the lesser denotation is (at least in affirmative propositions) the more suitable subject, as *Cats are carnivores*. And if one term is abstract, that is the more suitable subject; for, as we have seen, an abstract term may be interpreted by a corresponding concrete one distributed, as *Kindness is infectious*; that is, *All kind actions suggest imitation*.

If, however, a controvertist has no other object in view than to refute some general proposition laid down by an opponent, a particular proposition is all that he need disentangle from any statement that serves his purpose.

§ 2. Toward understanding clearly the relations of the terms of a proposition, it is often found useful to employ diagrams; and the diagrams most in use are the circles of Euler.

These circles represent the denotation of the terms. Suppose the proposition to be *All hollow-horned animals ruminate*: then, if we could collect all ruminants upon a prairie, and enclose them with a circular palisade; and segregate from amongst them all the hollow-horned beasts, and enclose them with another ring-fence inside the other; one way of interpreting the proposition (namely, in denotation) would be figured to us thus:

Fig. 1.

An Universal Affirmative may also state a relation between two terms whose denotation is co-extensive. A definition always does this, as *Man is a rational animal*; and this, of course, we cannot represent by two distinct circles, but at best by one with a thick circumference, to suggest that two coincide, thus:

Fig. 2.

The Particular Affirmative Proposition may be represented in several ways. In the first place, bearing in mind that 'Some' means 'some at least, it may be all,' an I. proposition may be represented by Figs. 1 and 2; for it is true that *Some horned animals ruminate*, and that *Some men are rational*. Secondly, there is the case in which the 'Some things' of which a predication is made are, in fact, not all; whilst the predicate, though not given as distributed, yet might be so given if we wished to state the whole truth; as if we say *Some men are Chinese*. This case is also represented by Fig. 1, the outside circle representing 'Men,' and the inside one 'Chinese.' Thirdly, the predicate may appertain to some only of the subject, but to a great many other things, as in *Some horned beasts are domestic*; for it is true that some are not, and that certain other kinds of animals are, domestic. This case, therefore, must be illustrated by overlapping circles, thus:

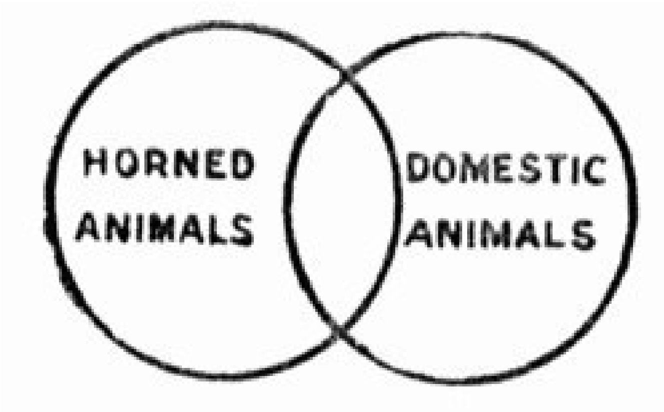


Fig. 3.

The Universal Negative is sufficiently represented by a single Fig. (4): two circles mutually exclusive, thus:

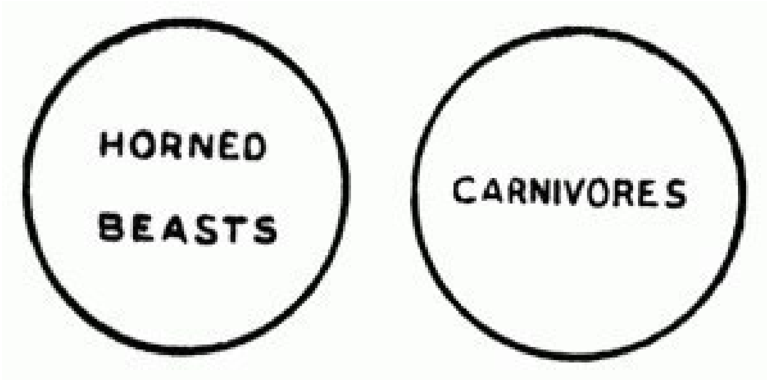


Fig. 4.

That is, *No horned beasts are carnivorous*.

Lastly, the Particular Negative may be represented by any of the Figs. 1, 3, and 4; for it is true that *Some ruminants are not hollow-horned*, that *Some horned animals are not domestic*, and that *Some horned beasts are not carnivorous*

Конец ознакомительного фрагмента.