

Reasoning

INTRODUCTION

IN the tradition of western thought, certain verbal expressions have become shorthand for the fundamental ideas in the discussion of which they happen to be so often repeated. This may be due to the influence of the textbooks used in the schools, which copy one from another and hand down an easily recited jargon from generation to generation. In most cases the great books themselves are probably the original source, though they have usually suffered oversimplification or distortion when their insights are thus transmitted.

"Featherless biped" and "rational animal" are, for example, stock phrases to illustrate the idea that a definition consists of genus and differentia—the class to which man, in this instance, belongs and the attribute which differentiates him from other members of this class. Statements such as "the whole is greater than the part" or "two plus two equals four" similarly serve to represent axioms or at least statements which, whether or not they can be proved, are usually accepted as true without proof. In the field of reasoning, the familiar verbal landmark is "All men are mortal, Socrates is a man; therefore, Socrates is mortal." Even those who have never heard of syllogisms, or who are thoroughly innocent of the age-old controversies about the theory of the syllogism and the difference between deduction and induction, might offer this sequence of statements if, pressed to say what reasoning is, they tried to answer by giving an example.

The example, shopworn though it is and far from being the perfect paradigm, does convey certain insights into the nature of reasoning which are generally undisputed.

The word "therefore," which connects the

third statement with the first two, signifies a relationship which is sometimes described in terms of cause and effect, as by Aristotle, and sometimes in terms of antecedent and consequent, as by Hobbes. The premises (*i.e.*, the statements which precede the "therefore") cause the conclusion, it is said. We know that Socrates is mortal *because* we know that Socrates is a man and that all men are mortal. The premises are the cause in the sense of the *reason why* the conclusion may be regarded as true.

The conclusion is also said to *follow from* the premises, or the premises are said to *imply* or *yield* the conclusion. *If* the premises are true, *then* the truth of the conclusion can be inferred or proved. The relationship between the premises and the conclusion seems to be the same whether the act of reasoning is called "proof" or "inference." The distinction in meaning between these two words seems to be one of direction. We speak of "proving" a conclusion when we look toward the premises as the foundation for its truth; we speak of "inferring" a conclusion when we look toward it as something which can be drawn from the premises.

The words "if" and "then" indicate that reasoning is a motion of the mind from one statement to another. Sometimes the inference is immediate, as when we argue that if all men are mortal, then some mortals are men. Here only two propositions are involved, one of which is simply the converse of the other. Those who deny that immediate inference is truly inference (because a proposition and its converse are merely two ways of stating the same fact), insist that, implicitly or explicitly, reasoning always involves *at least* three state-

ments. In any case, a single statement like "Socrates is a man," or even a pair of statements connected by "and" rather than "if-then"—e.g., "Socrates is a man and Socrates is mortal"—does not express what is commonly recognized as reasoning. The motion of reasoning does, however, appear in this sequence of statements, "If Socrates is a man, then Socrates is mortal," even though it omits a statement that may be necessary to the validity of the reasoning, namely, "All men are mortal."

Thus, the familiar grammatical distinctions of word (or phrase), sentence, and paragraph do not seem to provide a perfect parallel for the distinctions which the logicians make between terms, propositions, and syllogisms. But this much is clear. Just as a single word or phrase, like "man" or "rational animal," can never express a proposition, but only a term, so a simple sentence expresses only a proposition, and never a syllogism; and a compound sentence, one made up of a number of sentences, expresses a syllogism only if its verbal construction somehow indicates that they form a sequence in which one *follows* from the others, or if they are related in such a way that the truth of one is caused by the truth of the others.

THE CHAPTER ON IDEA (and perhaps also the chapter on DEFINITION) deals with that content or act of the mind—whether a percept or a concept, an image or an abstraction—which is verbally expressed in words or phrases and of which the *term* is the logical representative. The chapter on JUDGMENT (and perhaps also the chapter on PRINCIPLE) deals with the mental act or content that requires a sentence for its expression and is logically represented by the *proposition*. Here we are concerned with mental activity which involves not only two or more ideas, but also two or more judgments so connected that the mind passes from one to another.

Whether the logical structure that Aristotle calls a "syllogism" represents all forms of the mental activity called reasoning, is one of the great traditional issues. Hume suggests, for example, that animals reason without making use

of syllogisms; and Descartes and Locke seem to hold that the highest forms of thinking, such as occur in mathematics or philosophy, cannot be reduced to syllogisms, except perhaps by a *tour de force*.

We face a different sort of problem when we compare reasoning with other acts of the mind—with conception (or the having of ideas) and with judgment (or the connecting of ideas with one another in the manner which medieval writers call "composition and division"). No one denies that reasoning is thinking, nor does anyone deny that there are forms of thinking which are not reasoning, since conceiving and judging are generally regarded as kinds of thinking or modes of thought. Reasoning is merely that mode of thought which is a *process*—the going step-by-step from one statement to another.

The problem which arises from the comparison of reasoning with other modes of thought turns on the question whether the mind can learn anything without having to think rationally. Can certain things be known by insight or instinct, by induction or intuition, rather than by reasoning? Are there truths which cannot be known by reasoning at all, but only by some other mode of thought? These questions in turn raise the problem of the priority or superiority of such modes of thought as do not consist in reasoning. The theory discussed in the chapter on INDUCTION—that induction is prior to reasoning because intuitive generalization from experience must provide the starting points for demonstration—indicates one solution of the problem. Our present concern, however, goes beyond the issue concerning induction and deduction to the most general contrast between the intuitive and the rational.

FOR PLOTINUS ANY FORM of thinking—not merely reasoning—signifies a deficiency or weakness. In the scale of intellectual beings man occupies the lowest rank because he reasons. But even the pure intelligences, which know intuitively, rank below the One, because even the simplest act of thought involves some duality of subject and object. The One, according to Plotinus, transcends thought even as it transcends being. "The super-essential,"

he says, "is the supra-cogitative." The One "has no need for intellection, being always self-sufficing."

Other writers do not go as far as this. Christian theologians do, however, contrast the human mind with the angelic intellect and the mind of God by saying that the latter are suprarational, *i.e.*, above the need to reason. They do not, like Plotinus, hold that the transcendent being transcends thought itself—certainly not insofar as they discuss the divine ideas. But the kind of thinking which is not an instantaneous act of vision or an immediate intuition involves the mind in a process thought, somehow akin to change or motion; and this, the theologians hold, cannot take place in any immutable being—the angels or God.

The human intellect, according to Aquinas, gradually comes to know the truth "by a kind of movement and discursive intellectual operation . . . by advancing from one thing known to another. But if from the knowledge of a known principle [men] were straightway to perceive as known all its consequent conclusions, then there would be no place for discursiveness in the human intellect. Such is the condition of the angels, because in the truths which they know naturally, they at once behold all things whatsoever that can be known in them."

That, says Aquinas, is why the angels "are called *intellectual* beings" and men "are called *rational*." Recourse to reasoning on the part of men betrays "the feebleness of their intellectual light. For if they possessed the fullness of intellectual light, like the angels, then in the first grasping of principles they would at once comprehend all that they implied, by perceiving at once whatever could be reasoned out of them."

The type of intuitive apprehension which the angels enjoy is even more perfectly exemplified in God's knowledge. "In the divine knowledge," according to Aquinas, "there is no discursiveness"—no succession, neither the turning from one thought to another, nor the advance from the known to the unknown by reasoning from principles to conclusion. The divine knowledge, Aquinas explains, is a single all-embracing act of vision, in which "God sees

all things in one thing alone, which is Himself," and therefore "sees all things together and not successively." Apart from participation in the vision of God through supernatural light, all human thinking on the natural plane is discursive. Even the conception and the judgment are discursive in the sense that the one involves an act of abstraction or definition and the other involves a composition or division of concepts. But though it is always discursive, human thinking is not, according to Aquinas, always involved in the *motion* of reasoning, that is, the transition from one thought to another. "Reasoning," he says, "is compared to understanding"—*i.e.*, the act of judgment by which we affirm or deny a single proposition—"as movement is to rest, or acquisition to possession."

DESCARTES USES THE WORD "intuition" to name the way in which we know certain truths immediately and with certitude. He distinguishes "intuition from deduction by the fact that into the conception of the latter there enters a certain movement or succession, into that of the former there does not . . . The first principles are given by intuition alone, while, on the contrary, the remote conclusions are furnished only by deduction." But while deduction, which Descartes says he understands to be "all necessary inference from other facts that are known with certainty," supplements intuition, it is never at any stage of the reasoning process independent of intuition.

Not only does intuition, according to Descartes, supply the first principles or ultimate premises of reasoning, but it also certifies each step in the process. He asks us to "consider this consequence: 2 and 2 amount to the same as 3 and 1. Now we need to see intuitively not only that 2 and 2 make 4, and that likewise 3 and 1 make 4, but further that the third of the above statements is a necessary conclusion from these two."

If in addition to knowing the premises by intuition, the drawing of a conclusion from them is, as Descartes says, itself "effected by intuition"—if the act of inference rests on the intuition that the conclusion follows logically from the premises—in what way does

deduction or reasoning supplement intuition? To this question, Descartes replies that though the mind "has a clear vision of each step in the process," it cannot comprehend in one intuition all the connections involved in a long chain of reasoning. Only by taking the steps one after another can we "know that the last link in a long chain is connected with the first, even though we do not take in by means of one and the same act of vision all the intermediate links on which that connection depends, but only remember that we have taken them successively under review."

Like Descartes, Locke contrasts intuition and reasoning, or intuitive and demonstrative knowledge. "Sometimes the mind perceives the agreement or disagreement of two ideas immediately by themselves, without the intervention of any other: and this," says Locke, "we may call intuitive knowledge . . . When the mind cannot so bring its ideas together, as by their immediate comparison . . . to perceive their agreement or disagreement, it is fain by the intervention of other ideas . . . to discover the agreement or disagreement which it searches; and this is that which we call reasoning."

Again like Descartes, Locke asks, "What need is there of reason?" It is necessary, he thinks, "both for the enlargement of our knowledge and regulating our assent . . . Sense and intuition reach but very little of the way. The greatest part of our knowledge depends upon deductions and intermediate ideas; and in those cases where we are fain to substitute assent instead of knowledge, and take propositions for true without being certain they are so, we have need to find out, examine, and compare the grounds of their probability." But though reasoning enlarges our knowledge beyond what can be known intuitively, reasoning produces certain knowledge, according to Locke, only if "every step in reasoning . . . has intuitive certainty . . . To make anything a demonstration, it is necessary to perceive the immediate agreement of the intervening ideas, whereby the agreement or disagreement of the two ideas under examination (whereof the one is always the first, and the other the last, in the account) is found."

On this view of reasoning, nothing can be known demonstratively or by proof unless some things can be known intuitively, *i.e.*, without inference or proof. Locke and Descartes seem to agree with Aquinas and Aristotle that demonstration depends upon indemonstrable truths, whether these are called axioms, immediate propositions, first principles, or self-evident maxims. Locke and Descartes, on the one hand, stress the point that in reasoning the logical connection between premises and conclusion is also indemonstrable and must be intuitively perceived. Aquinas and Aristotle, on the other, repeatedly observe that the truth of the conclusion is implicitly contained in the truth of the premises, so that the advance which reasoning appears to make from the known to the unknown consists in coming to know actually what is already potentially known. Nevertheless they, unlike Descartes and Locke, maintain that reasoning extends knowledge, even though it may not be the method of initial discovery.

A somewhat contrary view seems to be taken by Hume. If the objects under consideration are matters of fact rather than the relations between our own ideas, the kind of reasoning which goes from premises to conclusion avails not at all. The beliefs we hold about such matters, according to Hume, result from mental operations which are "a species of natural instinct . . . which no reasoning or process of thought is able either to produce or to prevent." What he calls "experimental reasoning" or "reasoning concerning matters of fact" is founded, he says, "on a species of Analogy, which leads us to expect from any cause the same events which we have observed to result from similar causes."

Not only men, but also animals reason in this way. But Hume thinks "it is impossible that this inference of the animal can be founded on any process of argument or reasoning by which he concludes that like events must follow like objects . . . The experimental reasoning itself, which we possess in common with beasts, and on which the whole conduct of life depends, is nothing but a species of instinct or mechanical power, that acts in us

unknown to ourselves; and in its chief operations is not directed by any such relations or comparisons of ideas, as are the proper objects of our intellectual faculties."

THE FOREGOING considerations indicate how diverse theories of the role of reasoning arise from diverse theories of the nature and kinds of knowledge in animals, men, angels, and God. According as various distinctions are made between human knowledge and opinion, or between the way in which different objects can be known, or between speculative and practical interests, so, too, different formulations are given of the nature of reasoning.

Aristotle's distinction, for example, between scientific and dialectical or rhetorical reasoning turns upon his understanding of the difference between the objects of certain knowledge and the objects of probable opinion. This difference, he says, makes it "equally foolish to accept probable reasoning from a mathematician and to demand from a rhetorician scientific proofs." Hume's distinction between *a priori* and *a posteriori* reasoning—*i.e.*, between reasoning from principles and reasoning from experience—depends upon his understanding of what matters must be submitted to experience and of the manner in which experience generates belief. The distinction which Aquinas makes between demonstrations *propter quid* and demonstrations *quia*—*i.e.*, between proving *what* something is from its causes and proving *that* it is from its effects—depends upon his understanding of the difference between essence and existence as objects of rational knowledge.

To take an example in the opposite vein, Locke's theory that the same type of demonstration is possible in both mathematics and the moral sciences, seems to rest upon his view that all knowledge consists in the comparison of ideas. In contrast to this, other theories, which hold that the mode of reasoning differs in different disciplines (especially in mathematics and morals, or in metaphysics and the natural sciences), seem to arise from the contrary view that, in these different fields of inquiry, the objects and conditions of knowledge are different.

Sometimes a distinction in the modes of reasoning is based upon the same considerations, but the distinction itself is expressed by different writers in different terms. The role of causes in reasoning appears to underlie Aquinas' distinction between *a priori* and *a posteriori* reasoning, or reasoning from cause to effect as opposed to reasoning from effect to cause. "Demonstration can be made in two ways," he writes; "one is through the cause and is called *a priori*, and this is to argue from what is prior absolutely. The other is through the effect, and is called a demonstration *a posteriori*; this is to argue from what is prior relatively only to us." Descartes appears to make a parallel distinction, though he makes it in different terms. "The method of proof is twofold," he says, "one being analytic, the other synthetic. Analysis shows the true way by which a thing was methodically discovered, as it were effect from cause . . . Synthesis employs an opposite procedure, one in which the search goes as it were from effect to cause." For both mathematical and metaphysical reasoning, Descartes prefers the analytic to the synthetic method.

According to Newton, the method of analysis, in natural science as well as mathematics, consists in going from effects to causes, while the method of synthesis goes from causes to effects. Newton relates the difference between analysis and synthesis to the difference between inductive and deductive reasoning. This way of distinguishing between inductive and deductive reasoning, in terms of going from effects to causes or from causes to effects, would also seem to be related to the distinction Aquinas makes between demonstration *quia* (*i.e.*, reasoning which proves only *that* something exists) and demonstration *propter quid* (*i.e.*, reasoning which proves *what* something is—its nature or properties). The proof that God exists is, according to Aquinas, a demonstration *quia*; it is also a *posteriori* reasoning or reasoning from effect to cause. But he would not call it "inductive." In one passage at least, he seems to regard induction as the method whereby we can come to some knowledge of what God is. "From natural things," he writes, "one does not come by a

demonstration of reason to know non-natural things, but by the induction of reason one may know something above nature, since the natural bears a certain resemblance to the supernatural."

This sense of the word "induction," however, is like that in which Aristotle opposes induction to reasoning, not like that in which he distinguishes between inductive and deductive reasoning according to the order of terms in the inductive and deductive syllogism. In the ordinary deductive syllogism, the middle term establishes the connection between the two extreme terms (for example, 'being a man' establishes the connection between 'Socrates' and 'being mortal'). But "the syllogism which springs out of induction," according to Aristotle, establishes "a relation between one extreme and the middle by means of the other extreme, e.g., if B is the middle term between A and C, it consists in proving through C that A belongs to B." Starting from C (particular cases of long-lived animals, such as man, horse, mule), we can argue inductively from the fact that these long-lived animals are bileless, to the general connection between B (being bileless) and A (being long-lived). Such reasoning is valid, Aristotle adds, only if we can treat C "as made up of all the particulars; for induction proceeds through an enumeration of all the cases."

DIFFERENT THEORIES of definition also affect the place which is assigned to definition in reasoning. Hobbes, for example, regards reasoning as a kind of calculation with names, which wholly depends upon the determination of their meanings. The operations of addition and subtraction when done with words rather than with numbers are, he thinks, equivalent to "conceiving of the consequence of the names of all the parts, to the name of the whole; or from the names of the whole and one part, to the name of the other part." It is "nothing but *reckoning* (that is, adding and subtracting) of the consequences of general names agreed upon." Aristotle, with the theory that definitions state the essential natures of things, not just the meanings of words, holds that a definition may be "the conclusion

of a demonstration giving essential nature," as well as "an indemonstrable statement of essential nature." In the latter case, the definition functions as a principle in demonstration.

According to William James, reasoning, like definition, is "a selective activity of the mind" which serves an individual's interest or purpose. "My thinking," he says, "is first, last, and always for the sake of my doing . . . Reasoning is always for a subjective interest, to attain some particular conclusion, or to gratify some special curiosity." It makes no difference whether the interest is practical or the curiosity speculative. The process of reasoning will be the same, though the element which provides a solution to the problem in any emergency will be called a "reason" if the emergency be theoretical, a 'means' if it be practical."

Those writers who, like Aristotle and Aquinas, regard the speculative and the practical as distinct though related orders of thought and knowledge, seem to think that practical reasoning has its own syllogistic form. Practical deliberations for them are different from theoretical demonstrations. The conclusion of theoretical reasoning is an assertion that something is either true or false, whereas the conclusion of practical deliberation is a judgment that something is good or evil, and therefore should either be done or avoided. According to Aristotle, practical reasoning of the sort which ends in a decision that leads to action, takes the form of a syllogism which has one universal and one particular premise. The major premise is a general rule of conduct, the minor premise a particular perception of fact. In the example Aristotle gives of the practical syllogism, the major premise is the rule that *everything sweet ought to be tasted*, and the minor premise is the perception that *this particular thing is sweet*. These two premises lead to the practical conclusion that *this particular thing ought to be tasted*.

Not all practical reasoning, however, is concerned with reaching decisions or prompting action in particular cases. The rules of conduct which decisions and actions apply may themselves be the products of practical reasoning. The process by which general rules are de-

rived from even more general principles—the precepts of law or morality—involves, according to Aquinas, a form of thinking distinctly different from the theoretical or speculative sort. He points out in his *Treatise on Law* that we are able to formulate certain practical rules only by making particular determinations of universal principles, not by drawing deductions from them. “Something may be derived from the natural law in two ways,” he writes: “first, as a conclusion from premises; secondly, by way of determination of certain generalities. The first way is like that by which, in the speculative sciences, demonstrated conclusions are drawn from the principles; while the second mode is likened to that whereby, in the arts, general forms are particularized as to details.” Of these two ways of thinking in the field of law, it would appear that it is only the second type which is peculiar to the practical as opposed to the speculative order.

THE DISCUSSION OF reasoning in relation to knowledge, opinion, and action, or in relation to different disciplines and sciences, usually presupposes a theory of the form which reasoning takes regardless of its subject matter or use. This fact is most explicitly attested by the order of three great books concerned with reasoning. Aristotle’s *Posterior Analytics* deals with the theory of demonstration in the sciences. His *Topics* deals with the theory of probable argument or reasoning in the sphere of opinion. Both are preceded by his *Prior Analytics* which treats of the syllogism in terms of its purely formal structure and its various forms. In the later tradition, the distinction between the problems of the *Prior* and the *Posterior Analytics* comes to be represented by the separation between what are called “formal” and “material” logic.

The formal analysis of reasoning centers on the problem of its cogency. Quite apart from any consideration of the truth of its premises or conclusions, reasoning is true or false according as it is valid or invalid on purely logical grounds. From premises which are in fact false, a conclusion, which may be either true or false, can be truly inferred if the structure of the reasoning is formally valid—

that is, if the form of the premises stands in a certain logically prescribed relation to the form of the conclusion. The logical problem, then, is to prescribe the formal relationships among propositions which permit valid inference from certain propositions to others, without regard to the content of the propositions or their truth in fact.

Defining a syllogism as “discourse in which, certain things being stated, something other than what is stated follows of necessity from their being so,” Aristotle says, “I call that a perfect syllogism which needs nothing other than what has been stated to make plain what necessarily follows; a syllogism is imperfect, if it needs either one or more propositions which are indeed the necessary consequences of the terms set down, but have not been expressly stated as premises.” Using the letters S and P to symbolize the subject and predicate of the conclusion, and the letter M to symbolize the middle term, the term which appears in the premises but not in the conclusion, Aristotle states the form of a perfect syllogism in the following manner: “All M is P, all S is M; therefore all S is P.”

The first of these propositions, the one which contains the predicate of the conclusion, is called the major premise; the second, the one which contains the subject of the conclusion, the minor premise; the subject of the conclusion is called the minor term, the predicate the major term. Aristotle classifies syllogisms into three figures, or formal types, according to the position of the middle term, either as subject of the major premise and predicate of the minor in the first figure, or as predicate in both or as subject in both in the second and third figures respectively. Then according to whether the premises are universal propositions or particular (“All M is P” or “Some S is M”), and each is either affirmative or negative (“All M is P” or “Some S is not M”), he further distinguishes within each figure a number of valid moods, or formally correct patterns of inference.

For example, in no figure can a valid mood be constructed with two particular or two negative premises. No conclusion can be drawn from the two particular statements that some

poisons are liquids and that some liquids are indispensable to life; nor can any conclusion be drawn from the two negative statements that no triangles are parallelograms and no rhomboids are parallelograms. In the first figure, the minor premise can be particular and must be affirmative, the major can be negative and must be universal. In this figure the following combinations of premises—"some figures are not rectangular" with "all rectangular figures are parallelograms," or "all prime numbers are odd" with "some odd numbers are squares"—yield no conclusions. In the second figure, one premise must be negative. Here it is impossible to draw a valid conclusion from two affirmative premises. Nothing follows from the two affirmative statements that all fish swim and all whales swim. In the third figure, only a particular conclusion can be drawn from a pair of premises both of which are universal. From the proposition that no men are wise and the proposition that all men are mortal, we can conclude only that some mortals are not wise.

From these examples it will be seen that Aristotle's rules of the syllogism are rules concerning the quantity and quality of the premises required in each figure to permit a valid inference; and as in the third figure these rules permit only a particular conclusion to be drawn, so for all figures they determine the character of the conclusion which can be drawn from premises of a certain quantity and quality. If one premise is negative, the conclusion must be negative. If one premise is particular, the conclusion must be particular.

There seems to be one universal principle of the syllogism which underlies all these specific rules for the valid moods in different figures. "When one thing is predicated of another," Aristotle says, "all that which is predicable of the predicate will be predicable also of the subject." The negative aspect of this principle is immediately obvious. What cannot be predicated of a predicate, cannot be predicated of its subject. In the tradition of formal logic, this principle is sometimes stated in terms of the relation of classes rather than in terms of subjects and predicates: if one class is included in a second, and that second class is included

in a third, the first is included in the third; and if one class excludes another, the classes which it includes are also excluded from that other.

The principle of the syllogism is traditionally called the *dictum de omni et nullo*. The *dictum de omni*, which Kant in his *Introduction to Logic* calls "the supreme principle of affirmative syllogisms," is thus expressed by him: "Whatever is universally affirmed of a concept is also affirmed of everything contained under it." The *dictum de nullo*, according to Kant, states that "whatever is universally denied of a concept is also denied of everything that is contained under it." Kant appears to think that both these rules follow from even more general principles: that "an attribute of an attribute is an attribute of the thing itself" and that "whatever is inconsistent with the attribute of a thing is inconsistent with the thing itself."

James also attempts to make a more general formulation of the *dictum de omni et nullo*. This law of thought, he says, is "*only the result of the function of comparison* in the mind which has come by some lucky variation to apprehend a series of more than two terms at once." As James states what he calls the "principle of mediate comparison," it appears to be broader than the principle of the syllogism. It applies to any series of related terms—to the relation of equal and unequal quantities in mathematics, as well as to the relation of subjects and predicates in the logic of predication or classes.

James's principle of mediate comparison itself depends on what in mathematical logic and the logic of relations is called the "transitivity" of relations. The relation of *larger than*, for example, is transitive; for if one thing is larger than a second, and the second is larger than a third, it follows that the first is larger than the third. As stated in mathematical logic, the principle of the syllogism is merely a special case of transitivity as it appears in the relation of implication; for if P implies Q, and Q implies R, then P implies R.

James recognizes this when he writes that "*the principle of mediate predication or subsumption* is only the axiom of skipped intermediaries applied to a series of successive

predications. It expresses the fact that any earlier term in the series stands to any later term, in the same relation in which it stands to any intermediate term; in other words, that *whatever has an attribute has all the attributes of that attribute*; or more briefly still, that *whatever is of a kind is of that kind's kind.*" Along with "the *axiom of mediate equality*, 'equals of equals are equal,' " the rule of mediate predication or subsumption is, according to James, a special case of the law that "skipping intermediary terms leaves relations the same. This AXIOM OF SKIPPED INTERMEDIARIES OR OF TRANSFERRED RELATIONS . . . seems to be on the whole the broadest and deepest law of man's thought."

JAMES'S ATTEMPT TO state a law of thought or principle of reasoning which relegates all the rules of the syllogism to the status of a special case represents one type of attack on the syllogism. Whether, for instance, the sample of reasoning which Descartes asks us to consider—that if 2 and 2 make 4, and 3 and 1 make 4, then 2 and 2 amount to the same as 3 and 1—can be reduced to the syllogistic form of subject and predicate, or must be formulated under a more general principle of "transferred relations," illustrates the basic issue here between subject-predicate logic and relational or mathematical logic. In arithmetic, Poincaré tells us, one "cannot conceive its general truths by direct intuition alone; to prove even the smallest theorem [one] must use reasoning by recurrence, for that is the only instrument which enables us to pass from the finite to the infinite."

Another type of criticism of the traditional theory of the syllogism accepts the syllogism as the form of *all* reasoning, but objects, as Kant does, to what he calls "the mistaken subtilty" of the classification of syllogisms according to figures and moods. But Kant does not deny all distinctions among syllogisms. On the contrary, he says that syllogisms are "three-fold, like all judgements, differing from each other in the manner in which they express the relation of knowledge in the understanding, namely, categorical, hypothetical, and disjunctive." Whether the hypothetical and disjunc-

tive syllogisms are distinct types of reasoning, or only special cases which it would be a mistaken subtlety to treat as having principles of their own, is a problem considered in the chapter on HYPOTHESIS.

Of all criticisms, the most severe is that which either rejects the syllogism entirely as of no use in reasoning, or regards the deductive syllogism as useful only in argumentation or debate, not in the process of inquiry or discovery, where inductive reasoning alone is fruitful or instructive. From the conclusion of a syllogism, according to J. S. Mill, one learns nothing more than one already knew in the premises; whereas in inductive reasoning, Mill, like Francis Bacon, thinks that the mind goes beyond anything contained in the premises and genuinely discovers a new truth.

It seems to be Descartes's opinion that "the syllogistic forms are of no aid in perceiving the truth about objects." Locke makes the same point more extensively. Admitting that "all right reasoning may be reduced to [Aristotle's] forms of syllogism," he denies that they are "the best way of reasoning for the leading of those into truth who are willing to find it and desire to make the best use of their reason for the attainment of knowledge . . . The rules of syllogism," he writes, "serve not to furnish the mind with those intermediate ideas that may show the connexion of remote ones. This way of reasoning discovers no new proofs, but is the art of marshalling and ranging the old ones we have already. The forty-seventh proposition of the first book of Euclid, is very true; but the discovery of it, I think, not owing to any rules of common logic. A man knows first, and then he is able to prove syllogistically; so that syllogism comes after knowledge, and then a man has little or no need of it . . . Syllogism, at best, is but the art of fencing with the little knowledge we have, without making any addition to it."

It may be that the critics of the syllogism attribute to its exponents claims they do not make. Aristotle, for example, seems to present the syllogism as a method of expounding arguments rather than of discovering them, and of testing the validity of reasoning rather than of learning the truth about things. "All instruc-

tion given or received by way of argument," he writes, "proceeds from pre-existent knowledge. This becomes evident upon a survey of all the species of instruction. The mathematical sciences, and all other speculative disciplines, are acquired in this way, and so are the two forms of dialectical reasoning, syllogistic and inductive; for each of these latter makes use of old knowledge to impart new, the syllogism assuming an audience that accepts its premises, induction exhibiting the universal as implicit in the clearly known particular."