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Rational Philosophy

E LAWS OF THOUGHT ·
OR
FORMAL LOGIC

POLAND

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RATIONAL PHILOSOPHY

THE LAWS OF THOUGHT

OR

FORMAL LOGIC

A BRIEF, COMPREHENSIVE TREATISE ON THE
LAWS AND METHODS OF CORRECT
THINKING

BY

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PREFACE.

It may not be unwise to preface the following pages with a caution regarding their scope and purpose. Such caution may, indeed, be due not only to the writer lest his aim be misunderstood; but also to the reader, who might otherwise seek in this little book for what it does not contain.

This book, then, is not a Psychology. It does not discuss the nature of the soul or of its faculties. It merely enumerates the principal acts of the intellect; and describes them as far as is necessary for the purpose of this book, which is to lay down briefly and clearly the process of right thinking. This requires no encroachment upon the field of psychology.

Questions which should be discussed later on, in the course of philosophical studies, if introduced into an outline of correct thinking, only retard progress: firstly, because they are distracting; but especially because the mind is not prepared for them. Even after long discussions they are not understood by one who is just entering on the study of philosophy.

Many things have been here omitted which would find a fitting place in an exhaustive treatise on Logic.

But they are such things as are not necessary to the purpose of this compendious work. Just as there are many curious combinations of numbers which might be introduced, and sometimes are introduced, into an arithmetic, but which are of no essential service in forming an accurate and rapid accountant; so there are many things — curiosities — which may be introduced into a Logic, but which are in nowise necessary to prepare the mind for accurate and ready thought in the study of philosophy.

On the other hand, this book is not intended as a sort of a "*Logic made easy,*" or "*Logic in twenty lessons without a master.*" In philosophy less than in other things can we profitably dispense with a master.

Finally, attention is called to the fact that terminology is strictly adhered to, both for the sake of brevity, and for the sake of the learner's progress, that he may be obliged to understand each section before passing further.

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THE LAWS OF THOUGHT.

CHAPTER I. INTRODUCTORY.

ARTICLE I. LOGIC.

Logic — Formal and Material Logic — Natural and Artificial Logic.

1. The name **Logic** comes from the Greek, λογος. Λογος signifies *reason, thought;* also *oral speech, a word.* But the oral word, oral speech, is merely a sign of what is in the mind, of the mental word, mental speech, thought. Logic, therefore, has to do with thought.

2. Formal Logic is so called in opposition to **Material Logic**, because it deals solely with the form or structure of thought, of an argument; and not with the matter contained in the structure. In the building of a house there are different persons or sets of persons concerned. Besides the architect there are those who supply and prepare the material, and there are the builders. It is the business of the architect to see that the material is supplied and properly prepared by one set and put together by the other. The builders have not to question the nature, value or strength of the material. They have only to see that the pieces fit. They are concerned only with the shape, the *form* of the structure and of each piece as tending thereto. Now, apply this to the edifice of knowledge. *Formal logic* has to do with the principles for the *correct putting together* of the material furnished. The general method of furnishing the material ready prepared is the subject of *material logic.* Hence in *formal logic* we have to work at, to study, only the correct *form* of thought; not minding whether the examples we take to practice upon be true or not: just as one wishing to illustrate the structure of a bridge will take bits of wood, paper, straw, thread, wire or whatever he may find at hand, occupied solely, for the moment, with the *form;* and not at all concerned about the *material.*

3. Natural Logic. Natural logic is the innate disposition all men have to think correctly, to follow certain rules in the pursuit of knowledge, of truth. We are all, by nature, logicians.

4. Artificial Logic. However, as sometimes, even with the best intentions, we are liable to think inaccurately by reason of complications of notions which arise and defects which are easily overlooked in the process of our thought, there has been invented what is called an *artificial logic.* Not that there is anything artificial about it in the sense that it is intended to replace real logic; but, in this sense, that it is made an art whose principles we can learn and apply, to ensure correct thinking. The methods which we follow when we think correctly have been closely observed and have been put together as a connected system of rules. By learning to apply them we can acquire the art of logic.

5. Logic as a Science. But logic is not merely an art. It is primarily a science. For these rules are a systematized body of fixed laws regarding the reason of correctness in thought. Hence logic as a science may be defined: "The science of those laws which must rule the acts of the mind in correct thinking."

6. Logic as an Art. Logic becomes an art when these laws are presented, or made ready instruments, for use, to ensure right thinking, to detect false reasoning, and to mend faulty argument.

ARTICLE II. THREE ACTS OF THE MIND.

Simple Apprehension; Judgment; Reasoning — Idea; Judgment; Argument — Term; Proposition; Syllogism.

7. Three Acts of the Mind. To find out the rules which we must follow in aiming at a knowledge of truth, we must consider three acts which the mind performs in obtaining knowledge. They are: 1. Simple Apprehension; 2. Judgment; 3. Reasoning.

8. Knowledge Representative. All knowledge is representative of something real or possible. It is a mental expression of that something. Hence every act of the mind by which we know may be considered in two ways: either with reference to the degree of activity called forth or with reference to the degree in which it is representative.

9. Simple Apprehension. Simple apprehension is an act by which the mind *simply* perceives or apprehends something without affirming or denying anything about it. If we consider this act as representative, as a mental expression of that something, it is called **an idea** (likeness), **a concept** (the mind conceiving that something in itself, in likeness), **a notion** (the first element of knowledge). Thus by the act of simple apprehension we may have *a notion, an idea, a concept*, of rose, blue, plant, cloth, beauty, justice, etc.

Remark that when we perceive or apprehend we do not perceive the idea, but the object which the idea represents. We do not advert, at least not especially, to the act of the mind. It is only by a second act of the mind, called **reflection,** that we perceive we are perceiving.

10. Judgment. Judgment is that act by which the mind, having formed two ideas, affirms or denies identity between their objects. Thus: *The rose is a plant, This cloth is not blue.* Remark, as for the simple apprehension, that what we affirm or deny is not about the ideas, but about the objects which the ideas represent. This is expressed by saying that we affirm or deny **objective identity.** The judgment, as the simple apprehension, may be regarded as a certain exercise of the activity of the mind, or as representative of the presence or absence of objective identity. As an act it is called **judgment**; as representative it is also called **a judgment** or **a declaration.**

11. Reasoning. Reasoning is an act or a series of acts by which the mind compares (objectively) two cases pronounced upon in two judgments, and in that comparison perceiving *implied* the material for a third judgment, thereupon forms explicitly such third judgment affirming or denying according to what was perceived implicitly through the comparison. This definition will be made sufficiently clear for present purposes by two examples:

First example. The judgment makes two declarations:

A man is a living being;
Hannibal is a man.

The mind compares these two cases and then declares explicitly what it perceives implied, namely:

Hannibal is a living being.

Second example. The judgment makes two declarations:

A horse is a quadruped;
This feathered being is not a quadruped.

The mind compares these two cases and then declares explicitly what it perceives implied, namely:

This feathered being is not a horse.

In the first example the mind worked upon the principle that, in the sense in which two things (*living being*, *Hannibal*) are the same as a third thing (*man*), in the same sense are they the same as one another. In the second example the mind worked upon the principle that, in the sense in which two things (*horse*, *this feathered being*) are, the one (*horse*) the same as a third thing (*quadruped*), the other (*this feathered being*) different from it, in the same sense are they different from one another.

As in the simple apprehension and judgment the action of the mind was also regarded as representative, so the act of reasoning may be regarded as carrying in its third judgment a new representation of something perceived through the two prior judgments. Considered as an act it is called **reasoning, argumentation, deduction.** In the other sense it is called **argument**, and also sometimes **inference, conclusion.**

12. Oral Expression of Thought. Just as our thoughts are, as it were, mental words expressing certain objects, so in written and spoken words do we express our thoughts as well as the objects represented in our thought.

13. Term. The oral (*spoken*) or written word expressing an idea is called **a term**, as, *blue*, *cloth*, *justice*, *beauty*.

14. Proposition. The terms, oral or written words, expressing a judgment are called **a proposition**, as, *Hannibal is a man.*

15. Syllogism. The three propositions expressing an argument are called *a syllogism*, and also **an argument.**

CHAPTER II. IDEAS, TERMS.

16. We shall now proceed, within the limits of the scope of Formal Logic, to make some considerations upon ideas, judgments, arguments; and upon their respective verbal expressions, terms, propositions, syllogisms. We begin with the most elementary, the idea.

ARTICLE I. WAYS OF CLASSIFYING OUR IDEAS.

17. There are many ways of partitioning off into classes all the ideas we have or may have.

1. **Abstract and Concrete.** An *abstract* idea is one which represents its object as independent of, taken asunder from (*abstracted from*), everything else. A *concrete* idea represents its object as coalescing with, in union with, grown together with (*concreted*) something else. Our ideas of *blueness*, *wisdom*, are *abstract*. Our ideas of *blue*, *wise*, are *concrete*, because *blue*, *wise*, are thought of as *concreted* in something else: *blue sky*, *wise judge*.

18. 2. **Clear, Distinct, Complete and Adequate or Comprehensive.** According to the degree of perfection with which ideas express the characteristics (called *notes*) of their object, they are divided into *clear*, *distinct*, *complete* and *adequate* or *comprehensive*.

A *clear* idea expresses characteristics or notes sufficient to discern the object from others. A *distinct* idea distinguishes between these notes themselves. A *complete* idea expresses *all* the notes that distinguish the object *in reality* from others. A *comprehensive* or *adequate* idea expresses all that can be perceived in the object: the human intellect has no such idea of anything.

I see an object moving in the distance. I have an indefinite, obscure idea of something moving. It approaches. I get an idea of my friend X — just enough to know that it is X without distinguishing any marks — a *clear* idea. X comes nearer. Yes, there is the walk and build and countenance of X. My idea is becoming *distinct*. X steps up and shakes hands with me. I know X intimately and thoroughly. I note all the points that distinguish him as X from aught else. My idea is *complete*.

19. 3. **Singular, Particular, Collective, Universal.** Ideas may again be divided according to the number of individuals embraced in the idea and the manner of embracing them; that is, according to the *extension* of the idea. In this way we divide ideas into *singular, particular, collective, universal.*

When one special individual is expressed in a determinate manner, we have a *singular* idea. Thus: *Canada, "The President," to-day, this book.*

When the idea expresses in an indeterminate way some one or other individual or some individuals, it is called *particular.* Thus: *Some man or other, a man, a certain man, some men.*

When several objects are expressed under one idea or concept, but in such a way that the idea cannot be applied to them individually but only as a collection, the idea is called *collective*. Thus: *A crowd, a fleet.* No individual of the collection is a crowd or a fleet.

When several objects are expressed by an idea, but in such a way that the idea not only embraces them all, but is applied to them distributively and individually, we have what is called a *universal* idea. Thus: *Man, horse, gold.* I can say, *Man is a living being*, meaning that *all men are living beings;* meaning also that each individual *man is a living being.* When I say, *The horse is a quadruped*, I mean that *all are quadrupeds*, and *this horse is a quadruped.* When I say, *Gold is a metal*, I mean that *all gold* and that *this piece of gold is metal.*

This partition of ideas being made, we have to deal now, in a special manner, with *universal ideas.*

ARTICLE II. CLASSIFICATION OF UNIVERSAL IDEAS.

Species — Genus — Difference — Property — Accident.
Heads of Predicables.

20. Form. Universal ideas are classified according to the manner in which the one idea can be applied to many individuals; or, what comes to the same, according to the manner in which what the idea represents belongs to many individuals. This will explain itself as we proceed. Let us for the purpose of clearness and brevity introduce a new word, *form* or *formality.* We shall call *form* or *formality* whatever can be the object of an idea. The same thing may have many *forms* (or determinations) existing in it simultaneously. A ball may contain the forms of *wood*, *roundness*, *whiteness*, *elasticity*, etc. In man there are the forms of *spirit, matter, organism, sensation*, etc.

21. Reflex Universal. Any form or formality may become the object of my idea. This idea I may *reflect* upon, and then regard as applicable not only to the individual form from which I first got it, but as applicable to an indefinite number of individual cases, actual or possible, and also as sufficiently representative of the same formality as it exists or may exist in each of those cases. I begin to *regard* the idea as universal, as applicable to many, by reflecting upon it. The idea, as so regarded by reflection, is called a *reflex universal idea.* Even before I reflected upon it, even as I got it *directly* from the individual *form*, it was in itself *capable* of *being applied* to the indefinite number of cases. As such, prior to reflection, it is called a *direct universal.*

22. Species. If a form constitutes, or if combined forms constitute, the whole essence of a *class* of *individuals*, so that no individual of the class can be, or be thought, without said form or combination, then such form or combination is said to be **specific**, and the *reflex* universal idea representing it is called a **specific** idea. Thus the combination of *rational* and *animal* in man constitutes his essence. The complex idea *rational animal* regarded as applicable to all possible men is a *specific idea.*

23. Important Observation. Now here we have something curious to note. The idea *rational animal* is one idea — complex, but *one*. Where, when we apply it to all men actual and possible, has it one object? When we speak of *the rational animal*, of *rational animals*, of *humanity*, we find ourselves figuring to ourselves a certain something outside of us which is neither this man nor that man nor the great collection of all men. Yet is it something which we do put up before us as the object of our universal reflex idea, *rational animal, humanity;* and we talk of it *as if it were* something, *a man in general.* We know that what we say of it is true of each case where there exists *the rational animal,* where there exists *humanity.* What is it? It is a convenience invented by the ingenuity of the mind for the needs of thought. It is consequent upon the innate tendency of the mind to pursue the most profitable and expeditious modes of thought. It is something we create in possessing ourselves of the reflex universal idea. It is a something that does service for all the individual cases. We call it the **species.** I know that the expression *human species* suggests to us the whole collection of men, and that naturalists do use the word *species* to express *collections.* But we do not reason upon collections. We should never get through. Neither do we reason, when speaking, for instance, of *man*, upon this man or that man. When we say *man is mortal*, we speak of man, *in general*, taken as a species, in the sense explained.

24. Genus. If the form be something that is found in all the individuals of two or more classes so as to constitute *part* of the essence of such individuals, or briefly, if the form be found as *part* of the essence in *two or more* species, it is called **generic**, and the reflex universal idea representing it is called a **generic** idea. Thus man and brute agree in this, that they are both *animal;* the formality *animal* is of the essence of the species *man* and of the species *brute*. *Animal*, therefore, is ***generic***, and applies to all the individuals of the two species. If now we put before us that certain something which will stand as one for all the individuals possessing animal nature, we shall have what is called a **genus.**

25. Difference. Now take two species. They agree in something that is common to the essences of both. This, as we have said, is *genus*. But they differ also in other essentials. All the individuals of one species have a formality which is not in any of the individuals of the other, and which distinguishes all the individuals of one from all those of the other. The reflex universal idea of this formality is called a **differential** idea; and as this stands out objectively in the species, it is called a **difference** or **specific difference.** Take the genus *animal.* It embraces the two species, *rational animal* and *irrational animal. Rational* and *irrational* are *specific differences.*

26. Property or *Inseparable Accident.* Sometimes there is found a form in all the individuals of a species, which form, though not of their essence, is still necessarily connected with the essence and flows from it. The reflex universal idea of a form so considered is said to be the idea of a property. Such form, considered in the species, as we have explained species, is named a **property** or an *inseparable accident.* Such may be considered, for instance, the powers of speech and of laughter in man.

27. Accident. If, however, a certain form happen to be common to many individuals, but be in nowise of their essence nor necessarily connected therewith, and be such that it can be added or taken away without affecting the essence, such form is said to be simply **accidental.** The universal reflex idea representing it as so separable is the idea of *an accident.* The form itself, in whatever way considered, as thus separable, is called **an accident.** Thus the forms, *blue*, *green*, *circular*, *square*, *thick*, *soft*, etc., are *separable accidents.* We distinguish the inseparable accidents by the special name of *property.*

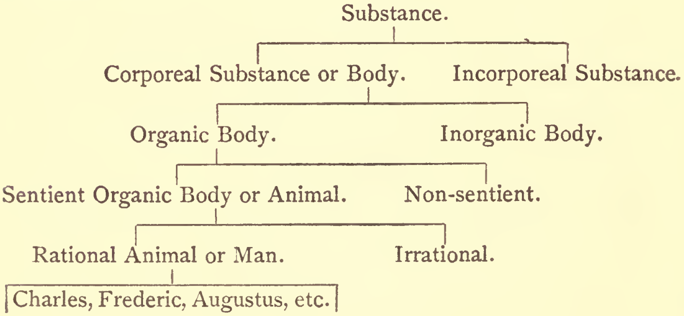
28. Heads of Predicables. The wide reaching nature of the classification which has just been given, will be seen if we consider that whatever we affirm or deny of anything is affirmed or denied as a *genus*, *species*, *difference*, *property* or *accident.* That is to say, whatever we *predicate* (affirmatively or negatively) we *predicate* (affirmatively or negatively) as the *genus*, *species*, etc., of that of which we predicate it. Thus we say *man is a rational animal.* We predicate *rational animal* of *man.* We predicate it as the *species.* If we say *man is rational*, we predicate rational as the *specific difference.* If we say *man is an animal*, we predicate animal as the *genus.* If we say the man is *white*, *yellow*, *strong*, we predicate *white*, *yellow*, *strong* as accidental, as accidents. Hence *genus*, *species*, *difference*, *property*, *accident*, are called **Heads of predicables,** because whatever is *predicable* of anything comes under one of these heads. There is a single exception to this general law. The exception is for the form *being.* *Being* applies to *whatever* can exist or be thought of. The idea of being is said to be *transcendental.* But the predication of *being* (as also of *one*, *true*, *good*) constitutes one of the most subtle discussions of general metaphysics. We need not speak of it here.

ARTICLE III. SUBORDINATION OF GENERA.

Highest Genus — Subaltern Genera — Lowest Species — Individuals.

29. The Same Form Generic and Specific. It is to be remarked that there are cases where the same form considered as a *universal* is capable of being regarded as both *genus* and *species.* Take, for instance, the form *substance.* Since the individuals to which it extends can be divided into the two classes, *corporeal substance* (body) and *incorporeal substance* (spirit), it is *genus* with reference to them, and they are species embraced by it. But the form *corporeal substance* (body) is again *a genus* when regarded as *universal,* for it extends to individuals that can again be divided into classes, — *organic body* and *inorganic body.* These become species under it. *Organic body,* next taken as a universal, becomes a *genus* with reference to the classes *sentient organic body* (animal) and *non-sentient organic body* (plant). These are species under it. But *animal* is also *genus* with reference to *rational* animal and *irrational* animal.

30. Diagram. The following plan will exhibit this to the eye:


Substance.
Corporeal Substance or Body.
Incorporeal Substance.
Organic Body.
Inorganic Body.
Sentient Organic Body or Animal.
Non-sentient.
Rational Animal or Man.
Irrational.
Charles, Frederic, Augustus, etc.

31. Highest Genus, Lowest Species, Subaltern Genera. In this table it is seen that *substance* is used as *genus* only. *Body, organic body* and *animal* are used both as *species* and as *genus*. *Man* is used as species only.

When a *genus* cannot be considered as a species under a higher genus, it is called **highest genus.**

When a *species* under one genus cannot be made a genus with reference to individuals under it, that is, when the individuals cannot be classified as *species*, it is called **lowest species.**

The forms that are *predicable* both as *genus* and as *species* are called **subaltern genera.**

In the table, **Substance** (supposing it to be incapable of being ranged as species under a higher genus) is **highest genus. Man** is *lowest species. Body, Organic Body, Animal,* are *subaltern genera. Charles, Frederick, Augustus,* etc., are merely individuals of the species *man.*

ARTICLE IV. CLASSIFICATION AND USE OF TERMS.

Real, Logical — Univocal, Equivocal, Analogous — Supposition.

32. Real and Logical Terms. We may now say a word about *terms.* Terms are the written or spoken words that stand for ideas or for the objects of ideas. A term is called **real** when it expresses an object as that object may exist independently of the mind. Thus *London, this man,* are real terms. A term is called **logical** when it expresses an object in that kind of existence which depends entirely on the mind, as *man, animal,* used in the universal sense to stand for *genus* or *species*, v. gr., for animal and man in general. *Genus* and *species* as we have explained them are mental creations, doing service as representatives for a class, or what is the same, their existence is *logical*, dependent on the mind. Hence the terms expressing them as such are called logical terms.

33. Univocal, Equivocal, Analogous Terms. Leaving the *real* terms and concerning ourselves solely with the logical, we find that, on account of the defects of language, some terms, doing service as universals, do not always represent the same ideas nor apply in the same manner to all the individuals for which we make them stand. We find terms to be not only *univocal*, but also *equivocal* and *analogous*.

34. Univocal. That term is called **univocal** (one word) which is really but *one* term in meaning as well as in sound. That is to say, the *univocal* term is always applied with the same signification to each and all of the *inferiors* (*i.e.* species or individuals) to which it can be applied. Such are the terms, *animal, man*.

35. Equivocal. But if the same written or spoken word, the same term, comes, in the complexity of language-growth, to stand for two or more different ideas and objects of ideas, it is called an **equivocal** term. Thus the term *pen* is equivocal. It is a *word* that serves *equally* to express different ideas and objects of ideas. It stands equally for a *writing instrument* and a *cattle enclosure*. The equivocation is sometimes in the sound only, as *bow* (a reverence) and *bough*. Sometimes it is in the writing only, as *bow* (*a reverence*) and *bow* (in archery).

36. Analogous. Again, there are terms that are applied to different things neither *univocally* (*i.e.* in quite the same meaning), nor *equivocally* (*i.e.* in quite different meanings), strictly speaking. The same term is used on account of some connection between the objects. The connection is called, in philosophy, **analogy.** The terms are called **analogous** terms.

When the *analogy* or *connection* is merely a likeness between the objects, it is called *analogy* of *proportion.* We make this the ground for the use of the metaphor. We will call a man *a lion* on account of his courage. We merely abbreviate a comparison.

There is another analogy where the connection is closer. We say *a healthy man* and also (however justly) *a healthy climate, a healthy complexion.* We affirm of the climate (which is the cause) and of the complexion (which is a natural sign) the *attribute* which, in its full, original and proper meaning, belongs only to the man. We have here again, strictly speaking, figures of speech. This analogy is closer than the mere similitude. It is called *analogy* of *attribution.* However, it is specified as *analogy of extrinsic attribution*, because the form that is attributed, *health*, is intrinsic to man only, belongs to man only, and is extrinsic to *climate* and to *complexion*, they being but the cause and the sign of man's health. But we have introduced this question only to come to what is called the *analogy of intrinsic attribution.* And we speak of the *analogy of intrinsic attribution* only as an aid to the understanding of a later question, the subtle question of the attribution of *being*, referred to in **28.** Therefore —

What is attributed may really exist in all the individuals to which it is attributed, and still not in such a way that it can be attributed *univocally*, *i.e.* in the very same sense and manner. It exists in one independently of all the others, but in the others only dependently upon this one. Thus *being* is predicated of *God* and of *created things:* of God, independently; of created things, only with dependence upon the Creator. *Being* is not used *univocally.* It does not apply in the same sense to Creator and Creation. It cannot be called *genus.* Under genus the species are independent one of another. But this question will be treated in the General Metaphysics.

37. Supposition. *The supposition* of a term is what is *sub-posed* by (*put under*) the term, what is implied by it or intended to be understood by it. This depends upon the wish of the one who uses the term. We might extend this subject and go back over all the various classifications of ideas and their corresponding objects. We shall give but three wide divisions of the supposition and thus close this chapter.

The supposition is said to be **material** when we imply no more than is evident from the *mere sound* of the term or its *appearance* as written. Thus, when we say or write, MAN *is a word of one syllable,* our use or supposition of the term *man* is material.

If we imply that the term is used in the universal sense to stand for *genus* or *species,* the supposition is called **logical.** In the sentence, MAN *is a rational animal,* the supposition of the term *man* is logical.

When we wish the term to stand for a *reality,* the supposition is called **real.** In the sentence, THIS MAN *is temperate,* the supposition of the term *man* is real.

CHAPTER III. JUDGMENTS, PROPOSITIONS.

ARTICLE I. DEFINITION AND STRUCTURE OF PROPOSITIONS.

38. Judgment. The *judgment*, as we have said, is that act of the mind by which we compare two objects of thought and pronounce upon their identity or agreement, affirming or denying. It is an affirmation or a denial.

It is not always necessary that any appreciable time should be taken to compare the terms before passing sentence. There may be and there are cases where the verdict is evident at once upon the presentation of the terms. We see at once the identity or the disagreement. Our daily thoughts are full of instances in point.

39. Proposition. We have already stated that the judgment as expressed in spoken or written words is called a *proposition.*

40. Subject, Copula, Predicate. A proposition consists of three parts, *subject, copula, predicate.* The *subject* is that of which something is affirmed or denied. The *predicate* is that which is affirmed or denied of the subject. The *copula* is a word or words expressive of the affirmation or denial, the words, namely, *is, are, is not, are not.*

SUBJECT.	COPULA.	PREDICATE.
Man	is	rational.
Knowledge	is not	virtue.
Vices	are	detestable.
Sinners	are not	saints.

The *copula* is a convenience of language. It merely stands for the agreement or disagreement that exists in the objects; this agreement or disagreement is perceived by the mind comparing the ideas, and is finally pronounced upon in the judgment.

41. Logical and Grammatical Predicate. We must be careful to distinguish between the predicate of the *logician* and the predicate of the *grammarian.* In the sentence, *Birds fly*, the grammarian may tell us that *fly* is the predicate. The logician will resolve the sentence in such a way as to employ the *copula.* He will say, *Birds are beings-that-fly;* and with him the predicate is *beings-that-fly.* Thus the logician will transform any sentence to put it into logical shape.

* * *

ARTICLE II. SIMPLE AND COMPOUND PROPOSITIONS.

Simple — Compound — Copulative — Disjunctive — Conditional — Causal.

42. A Simple Proposition contains but one principal subject and one principal predicate. *The ship is sailing,* is a simple proposition. We may add circumstances of time and place, adjectives, adverbial and relative clauses, without making it a compound proposition. It will become *complex*, but not compound. *The ship that was* *made last year at New York is sailing amid icebergs that have floated from Greenland to the coast of Newfoundland,* is still for the logician a *simple* sentence though *complex.* All that belongs to *ship* goes in as subject. All that belongs to *sailing* goes in as predicate.

43. A Compound Proposition contains two or more principal subjects and predicates expressed or implied. *Paris and Berlin are beautiful* is a compound proposition and stands for the two simple propositions *Paris is beautiful, Berlin is beautiful.* Add another predicate: *Paris and Berlin are large and beautiful.* Here we have four simple propositions in the compound.

44. Various Constructions. There are various kinds of simple and compound propositions — various as the grammatical constructions invented to secure brevity in language, the sometimes cumbersome vehicle of thought. The propositions receive their names from the constructions. We call attention to a few propositions.

45. Categorical. A categorical proposition is one that affirms or denies absolutely and directly. It may be simple or compound. Thus: *Man is rational, The soul is not material, Prudence and Justice are virtues, Camels and giraffes are not insects.*

46. Conditional. A conditional proposition affirms or denies not absolutely, but *on condition. The rain is coming* is categorical. But, *If the wind is west, the rain is coming* is a conditional proposition. Remark that this is really a simple proposition. We do not say, *The wind is west, the rain is coming.* We merely affirm conditional connection between the two. The conditional proposition is also called *hypothetical.*

47. Conjunctive. A conjunctive proposition affirms the simultaneous incompatibility between two cases. *No man can spend all his money on drink and still support his family.* Here we do not affirm or deny the categorical propositions that *he spends his money on drink*, that *he supports his family.* We affirm only the incompatibility between the two. The proposition is simple, however complicated in language. The *conjunctive* proposition is reducible to the *conditional* thus: *If a man spends all his money on drink, he cannot support his family.* The conjunctive proposition is therefore a species of the hypothetical. It is always negative. It is called conjunctive for the sake of a name, on account of the conjunctive particle *and* which connects the incompatible cases.

48. Disjunctive. A disjunctive proposition is made up of two or more categorical propositions connected in such way by a disjunctive particle that no one is declared absolutely, but the acceptance of one implies the rejection of the others. Thus, speaking of a person's age, I may say, *He is either just fifty or under fifty or past fifty.* Suppose I declare *categorically* that *he is just fifty;* then the two other parts become *he is not under fifty, he is not past fifty.* However, the denial of one case does not imply the affirmation of the other two. If I say, *He is not just fifty*, I may not therefore affirm both that *he is under fifty* and *that he is past fifty.* The remaining parts are simply left in the diminished disjunctive proposition, *He is either under fifty or past fifty.* The disjunctive proposition is a species of the hypothetical, with one part positive and the other part negative. Thus: *If he is just fifty, he is* *neither under fifty nor past fifty.* As the example given implies two such conditions, we might class it with the compound propositions; but this matters nothing to our purpose.

49. Remark. Here we shall leave the complex and compound propositions. We have mentioned the *conditional*, *conjunctive* and *disjunctive*, because we shall have occasion to refer to them when treating of the varieties of the syllogism.

Henceforth in the present chapter we shall confine our study to the elementary proposition, the *simple categorical* proposition.

ARTICLE III. IMMEDIATE AND MEDIATE JUDGMENTS.

50. All Judgments. The judgments we form are all necessarily either **immediate** or **mediate.**

51. Immediate. An immediate judgment is one that is formed without a process of reasoning. If some one says to me, *A whole orange is greater than half an orange*, I do not ask him to prove it. I see the truth *immediately*, and pronounce upon it without having to be led to see it through the medium of other truths better known. Again, if I take a piece of heated iron in my hand, I can and do know and say at once, *This iron is hot.* I do not have to go through any other judgment to arrive at the knowledge that *this iron is hot.* The judgment is immediate.

52. Mediate. On the other hand, if some one tells me that *the three angles of a triangle are equal to two right angles*, I do not see at once that it is so; I ask him to show me that it is so. And he proceeds to put before me other propositions through which I see, until it dawns upon me that what he said at first is true. These other propositions or truths are the *medium* through which I see that the *three angles are equal to two right angles.* This judgment is therefore called a *mediate* judgment. To take another example. I hand a banknote to some one, as payment. He tells me, *This banknote is a counterfeit.* I do not perceive that the note is a counferfeit. He imparts to me some new knowledge, and through the *medium* of that knowledge, I too can see and say, *This note is a counterfeit.* My judgment is mediate.

53. The Process. The process by which one judgment, proposition, is made evident through the medium of others is called *reasoning.* This will form the subject of the next chapter. We have still to consider, in this chapter, two other divisions of judgments or propositions. This we shall do in the two following articles.

Article IV. Connection between Subject and Predicate.

A Priori, A Posteriori — Necessary, Contingent — Absolute, Hypothetical — Metaphysical, Physical — Analytical, Synthetical.

54. All Judgments. If we consider the connection that exists between the predicate and the subject, we can classify all judgments as **a priori** or **a posteriori.**

55. A Priori. If the predicate is such that it is always implied in the subject, and in such way that a full understanding of what is meant by the subject and predicate is sufficient, without any experiment upon a particular case, to make us see that the proposition holds in all cases, absolutely, necessarily and without possible exception, the proposition or judgment is called *a priori*. It is seen to hold *prior* to any application to a particular case. *A whole is greater than any of its parts; no thing can simultaneously exist and not exist*, — these are *a priori* propositions.

Such propositions are also called *necessary*, because an exception is impossible. They are called *absolute*, because they hold, absolved from, free from, all condition. They are called *metaphysical*, because their truth does not depend upon the physical, actual order of things existing. They are called *analytical*, because by analyzing the subject, by taking it asunder into all that it implies, we will finally arrive at the predicate and see that the predicate belongs to the subject.

56. A Posteriori. An *a posteriori* proposition is one in which the idea of the predicate is not implied in the idea of the subject. Some one says to me, *This iron is hot*. I may know all that books can teach about the nature of iron and the nature of heat. But all of it will not teach me that *this iron is hot*. I must have experience of this particular case of iron and heat. After the test, *posterior* to the experience, I may affirm, *This iron is hot*. Hence the name *a posteriori*.

Such propositions are also called *contingent*, as opposed to *necessary*, because they may happen to be true or not true. They are called *hypothetical*, as opposed to *absolute*, because their truth depends upon a supposition, a hypothesis, which may be wanting. They are called *physical*, because they represent facts of the actual, physical order. Finally, they are called *synthetic*, as opposed to analytic, because they are made up by the *synthesis*, the putting together, of two ideas, terms, neither of which is found in the analysis of the other.

57. Synthetic a Priori. We have here to make a remark upon an assertion of Emmanuel Kant which has caused a great deal of confusion in philosophy. He asserted that there could be a proposition which would be at once synthetic and *a priori*, and he called it the *synthetic a priori*. Kant illustrates his discovery with examples. For instance, he draws upon arithmetical addition. The proposition *three and two are five*, $3 + 2 = 5$, is with him *synthetic a priori: a priori*, because it is absolute; *synthetic*, because, he says, the predicate *five*, 5, adds on a new notion over and above *three and two*, $3 + 2$. Let us see if the predicate adds a new idea. We repeat what we said before, that we do not reason with the mere sound of the voice or the mere appearance of marks on paper. What does the subject mean? 3 means $1 + 1 + 1$. 2 means $1 + 1$. $3 + 2$ means $1 + 1 + 1 + 1 + 1$. 5 means $1 + 1 + 1 + 1 + 1$. Now put down the meaning of $3 + 2 = 5$, and you have $1 + 1 + 1 + 1 + 1 = 1 + 1 + 1 + 1 + 1$. What is there in the predicate that is not in the subject?

* * *

ARTICLE V. EXTENSION AND COMPREHENSION.

58. An Axiom. We have delayed to this point a very important consideration on the subject of ideas and terms. We have delayed it on account of its immediate use in the next article. In fact, we do not hesitate to say that the thorough understanding of the subject of the present article is the key to philosophy. There is an old axiom in philosophy which runs thus: *The greater the extension, the smaller the comprehension;* or *The smaller the comprehension, the greater the extension;* or *Widen the extension, and you diminish the comprehension;* or *Expand the comprehension, and you narrow the extension.* All mean the same thing. But what do they mean?

59. Extension. The extension of an idea or a term refers to the number of individuals to which it can apply.

60. Comprehension. The comprehension of an idea or of a term refers to the number of ideas or terms implied in said idea or term.

61. Illustration. Take the idea, *animal.* It can apply to — that is, it extends to all individuals in which there is animal nature. But combine it with the idea *rational*, so as to have *rational animal*, or *man.* At once you shut out from its application all irrational animals. You cut them off from its extension. You narrow its extension. Why? Because you have expanded the comprehension. The idea man comprehends not merely *animal* but animal + rational. If you expand the comprehension by adding the term *white*, so as to have *white man*, you will diminish the extension by cutting off all men who are not white. And so on. Every new idea added represents a new requisite in the object that is to correspond. The more you require in the objects, the fewer will they be found.

Once more take the term *animal.* What is its comprehension? What ideas does it imply? It implies *sensitive organic material substance.* Diminish the comprehension. Take away the term *sensitive.* You have left *organic material substance.* At once you have widened the extension so as to take in the whole vegetable kingdom. Diminish comprehension again. Strike out *organic.* There remains *material substance.* The extension is widened so as to take in all that is *matter* whether *organic* or *not.* Diminish the comprehension again. Strike out *material. Substance* remains. The extension has been increased so as to reach into the spiritual world.

ARTICLE VI. EXTENSION OF PROPOSITIONS — QUALITY.

Universal — Collective — Particular — Singular.

62. Extension. We have just spoken of *extension* in the abstract as contrasted with *comprehension.* In No. 19 we saw that the same idea could be used with varied compass within the entire range of its extension. It may be *singular, particular, collective, universal.*

63. The Subject. The **extension** of a **proposition** depends upon the **extension** or compass of the **subject** as used in the proposition. The proposition is named accordingly *singular, particular, collective, universal.* The following are examples. Singular: *This man is virtuous.* Particular: *Some man is virtuous. Some men are virtuous.* Collective: *The crowd is orderly.* Universal: *Angels are spirits.*

64. N.B. In speaking of terms and propositions we shall often not make a distinction between singular, collective and particular, but shall call them indifferently by the name *particular* as representing any term or proposition that is *not universal.*

65. The Predicate. To state clearly what we wish to say about the predicate, let us take four propositions, — two universal and two particular, — and let one of each kind be an affirmative proposition; the other, a negative. This will give us, for instance, the following:

1. ***Cats are quadrupeds.*** (UNIVERSAL AFFIRMATIVE.)
2. ***Birds are not quadrupeds.*** (UNIVERSAL NEGATIVE.)
3. ***This field is triangular.*** (PARTICULAR AFFIRMATIVE.)
4. ***Some roses are not red.*** (PARTICULAR NEGATIVE.)

66. Universal Affirmative. The first proposition is universal, because its subject is universal, *i.e.* taken in its entire extension. As to the *predicate*, *quadruped*, we do not directly allude to its extension. We merely assert that the idea *quadruped* enters into the comprehension of the idea *cat*. And as *cat* here is universal, taking in each and every cat, we do state that *quadruped* is at least coextensive with *cat*. But we do for a fact know that *quadruped* has a wider extension than *cat*, that *cat* covers only a part of the extension of *quadruped*. Only some quadrupeds are cats. Hence, when we speak according to our knowledge and say that *all cats are quadrupeds*, we wish to say that *some quadrupeds are cats*, or the idea, *cat*, extends *to some* individuals, *not to all* individuals in the extension of *quadruped*. *Quadruped*, therefore, in the discussion of the proposition is to be regarded as a *particular term*. As these remarks hold good for all universal affirmative propositions (one class excepted), we formulate the law: *The Predicate in a universal affirmative proposition is a particular term.*

67. One Exception. The one exception is, when the predicate is the exact essential definition of the subject. Thus in the proposition, *Man is a rational animal*, the

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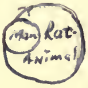

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predicate, *rational animal*, is the essential definition of the subject, *man*. It is synonymous with *man*. Hence it is precisely coextensive with the subject. We can say, *Man is a rational animal*, or *Rational animal is man*. But though we say, *Cat is quadruped*, we cannot say, *Quadruped is cat*. *Quadruped* may be *tiger* or *elephant*. *Rational animal*, however, cannot be anything but man.

68. Universal Negative. In the second proposition, *Birds are not quadrupeds*, the subject is universal, and hence, too, the proposition. By denial we separate the idea *quadruped* from the comprehension of the idea *bird*. So that wherever the idea *bird* is applicable, in its entire extension, there the idea *quadruped* is excluded. Now, knowing that quadruped can have its own extension, the proposition implies that *bird* and quadruped extend to two distinct classes of individuals. To say that birds are not quadrupeds is the same as saying that no individual bird is a quadruped. Not one bird can be found in the class quadruped. Not one quadruped can be found in the class bird. If it could, some bird would be a quadruped. What is this but to exclude quadrupeds in its entire extension, that is, as a *universal*, from the entire extension of the subject? As the same remarks hold good for all universal negative propositions, we formulate the law: *The Predicate in a universal negative proposition is a universal term.*

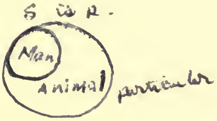
69. Particular Affirmative. In the third proposition, *This field is triangular*, the subject is particular. Hence the proposition is particular. Referring to our knowledge of things, we shall find that the predicate, *triangular*, is used in a particular sense. We do not predicate of this field all that is or may be *triangular*, the entire extension of *triangular;* but only this particular case of *triangular.* This field is one of the things embraced in the extension of *triangular. Triangular*, hence, is used in the particular sense. These remarks hold good for every particular affirmative proposition. Hence the law: (*The Predicate in a particular affirmative proposition is a particular term.*)

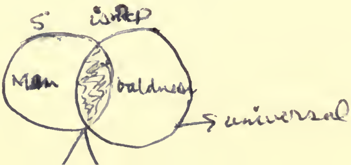
70. Particular Negative. In the fourth proposition, *Some roses are not red*, the extension of the subject, *only some roses*, is particular. Hence the proposition is particular. The predicate *red*, however, is used in the universal sense. We affirm that *redness* is not found in the comprehension of some certain roses. No one of these some certain roses is to be found in the entire extension of things that are red. We separate the entire extension of things that are red from these some certain roses. Hence, in our denial of *red* as applicable to some roses, we use it in its entire extension, or as a universal. These remarks hold good for every particular negative proposition. Hence the law: *The Predicate in a particular negative proposition is a universal term.*

71. Two Laws. Now let us put the four laws together and make two of them. The first and third will give us this: *The predicate in an affirmative proposition is used as a particular term*, i.e. *according to part of its extension.*

The second and fourth law will give us this: *The predicate in a negative proposition is used as a universal term*, i.e. *according to its entire extension.*

72. Affirmative and Negative. We have not thought it necessary to state explicitly heretofore that every proposition must be either affirmative or negative. For





all needs, up to the present, this was sufficiently implied in the definitions of *judgment* and *proposition.*

73. Negative Particle. We call attention now to the fact that, in the negative proposition, the negative particle need not necessarily stand between the subject and the predicate. To say, *Birds are not quadrupeds,* is the same as saying, *No bird is a quadruped.* Both are negative and are understood as such. We have not to question the arbitrary constructions of language. Still be it understood that, in order to have a negative proposition, the language must be capable of such construction that the negative particle *not* may be construed with the copula, *is, are,* so as to form with it one piece that shall be, not as a link between subject and predicate, but as a wall of separation. This is the case in the example given above. But the following proposition is affirmative: *Not to complain in adversity is a mark of a great soul.* We may indeed say, *To complain in adversity is not a mark of a great soul;* but the two propositions are not identical in meaning, for we turn the predicate from a *particular* into a *universal.* However, we may say, *A mark of a great soul is not-to-complain-in-adversity.* Here the negative particle, though next to the copula, *is,* does not form one piece with it: it forms a piece of the predicate. The proposition is affirmative.

74. Quantity and Quality. The extension of a proposition, universal, particular, etc., is referred to as its *quantity.* The form, affirmative or negative, is referred to as its *quality.*

ARTICLE VII. RELATED PROPOSITIONS.

Conversion — Equivalence — Opposition.

75. Three Relationships. We now pass on to consider the relations that may exist between certain propositions. The relation between two propositions — when there is any relation at all — will be one of *convertibility*, of *equivalence* or of *opposition*.

76. Conversion. A proposition is said to be convertible into another when the subject can be made predicate and the predicate subject without loss of truth in the new proposition. Thus the proposition, *No man is an angel*, is convertible into *No angel is a man*. There are three ways of converting propositions. We may keep the quantity and quality unchanged; or we may change quantity only; or we may change quality only. The first is called *simple* conversion; the second, conversion *per accidens;* the third, conversion by *contraposition.* Without minding these traditional names, we shall exemplify the three conversions.

Quantity and quality unchanged. This conversion may take place in propositions where subject and predicate are both universal or both particular — that is, in universal negative and particular affirmative; as also, in propositions where the predicate is the essential definition of the subject, since the two are coextensive. Thus, *No man is an angel* is convertible into *No angel is a man. This field is square* is convertible into *This square thing is a field. Man is a rational animal* is convertible into *The rational animal is man.*

Quantity changed. This kind of conversion may be applied to universal affirmative and universal negative propositions. In the universal affirmative, *All plants are substances,* the predicate is particular. If we make it subject, we have *Some substances are plants.* The universal negative, *No man is an angel,* we saw above may be converted into *No angel is a man.* This being universal, applies to each individual in the extension of the subject; hence we have, *This angel is not a man.*

Quality changed. This kind of conversion may be used upon the universal affirmative and the particular negative. The universal affirmative, *Cats are quadrupeds,* tells us that cats are altogether within the extension of quadruped. Outside of the extension of quadruped, cats are not to be looked for. Hence the proposition is convertible into *What is not quadruped is not a cat.* In the particular negative, *Some roses are not red, red* is universal in its extension. Hence outside of the extension of red there are some roses; or, *Some things not red are roses.*

77. Equivalence or Equipollence. A proposition is said to be *equivalent* to (equal in value) or *equipollent* with (equal in weight) another when it means the same thing as the other, there being no conversion of subject and predicate. A proposition is turned into its equipollent in various ways by the use of the negative particle. Thus, *Every man is mortal* is equivalent to *No man is not mortal,* etc.

78. Opposition. To explain what is meant by opposition, let us take the universal affirmative proposition, *Every man is just.* In order merely to contradict this it would be sufficient to say, *Some man is not just.* Now take the universal negative proposition, *No man is just.* To contradict this it is enough to say, *Some* *man is just.* We have in both cases an opposition between a universal and a particular, an affirmative and a negative. There is opposition in both quantity and quality. The opposition is one of *contradiction.* Propositions so related are called *contradictories.* Both cannot be true, simultaneously; nor can both be false, simultaneously. If it be true that all men are just, then it is false that some man is not just.

Opposition in quality only. When two universal propositions are opposed in quality, *i.e.* one being affirmative, the other negative, as, *All men are just* and *No men are just*, there is not merely a contradiction of a sweeping statement. There is a sweeping statement to the contrary. The contradiction covers each individual in the extension of the opposite proposition. The opposition is one of *contrariety.* The propositions are called *contraries.* Both cannot be true at the same time, because each one contradicts every individual case of the other. However, both *may be* false. They may both claim too much in opposite directions.

The particular propositions implied in these two universals, that is, the particulars, *Some man is just* and *Some man is not just*, as opposed to one another in quality, are called *subcontraries.* Both may be true, since their contradictories, the universals, may both be false, may both assert too much. Both particulars, however, cannot be false; for if both were false, then their contradictories, the universals, would both be true.

Opposition in quantity only. This is the opposition between a universal and particular affirmative or a universal and particular negative, as, *All men are just* and *Some man is just;* or *No man is just* and *Some man is not just.* There is in reality no opposition here.

The particular is implied in the universal. It is a subaltern of the universal. Hence, for the sake of a name, propositions so related, the universal and its implied particular, are called subalterns. If the universal is true, the particular is true. If the universal is false, the particular may still be true. From the truth or falsity of the particular we can form no judgment about the truth or falsity of its universal.

79. Diagram. Now look at the following diagram:

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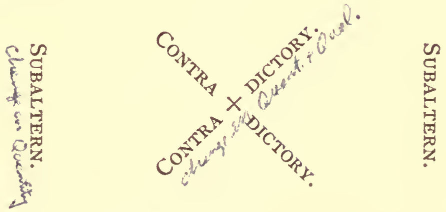
1. All men are just (*Univ. Aff.*). 2. No man is just (*Univ. Neg.*).



3. Some man is just (*Part. Aff.*). 4. Some man is not just (*Part. Neg.*).

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1 and 2 are contraries; 3 and 4 are subcontraries; 1 and 4, also 2 and 3, are contradictories; 1 and 3, also 2 and 4, are subalterns (1 and 2 being called subalternant, 3 and 4 their subalternates).

It is clear that if 1 is true, 3 is true; and that if 2 is true, 4 is true. But we cannot conclude from 3 to 1 nor from 4 to 2.

1 and 4 cannot be both false. One must be true, and the other false. The same is to be said of 2 and 3.

3 and 4 may be both true, or one true and the other false. Both cannot be false.

CHAPTER IV. REASONING, ARGUMENT.

ARTICLE I. THE SYLLOGISM.

Argument — The Syllogism — Analysis of Argument — Middle and Extremes.

80. Reasoning and Argument. We have seen how the idea is the element of the judgment, and thus the term, the element of the proposition. We have now to see how an argument is constructed out of propositions. We defined Reasoning (11) to be an act, or a series of acts, by which the mind compares the truths expressed by two judgments, and in that comparison perceives implied a third truth, which it accordingly expresses mentally in a third judgment. This process, we said, regarded as mere mental working, is called *reasoning*. Regarded as knowledge contained in the third judgment, pronounced as having been implied in the two others, we called it *inference* or *argument*. The propositions which, taken together, represent in language the knowledge and its process, we also called *argument*. We shall use the word *argument* in this latter sense.

81. Styles of Argument. There are indeed many combinations of propositions which are used as language-representations of the process of reasoning, many styles of argument. Different names are given to them, according to the variety of structure. We have *the Syllogism*, *the Enthymeme, the Sorites, the Polysyllogism, the Epichirem, the Dilemma.* All, however, are reducible to the syllogism, which is the nearest approach language can make towards exhibiting the working of the mind in reasoning. Not that we always, or usually, argue, in speaking or writing, with completed syllogisms. We abbreviate. However, we must study the syllogism in its completeness. We begin with it. A few words at the end of this chapter will then suffice to explain the other styles of argument.

82. The Syllogism. The syllogism is an argument made up of three propositions so connected that if the first two be admitted, the third must, likewise, be admitted. Thus,

Every plant is a substance;] antecedent
But the verbena is a plant.
Therefore, *The verbena is a substance.* consequent.

83. Antecedent; Consequent; Premisses. The first two propositions taken together are called the **antecedent.** The third proposition is called the **consequent.** In the antecedent the evidence is stated. In the consequent the verdict is given. The two propositions of the antecedent are commonly called **premisses** (put before). The first is called the **major premiss**; the second, the **minor premiss.** For brevity's sake they are styled the **major** and the **minor.** The original meaning of *major* and *minor*, and the reason for the use of the terms, will be explained in the next article.

84. Consequence. If the consequent does really follow from the premisses, we have what is called a **consequence**, by which we mean that the assertion contained in the consequent is a consequence of what was laid down in the premisses. If an argument is proposed to us in which the consequent does not follow as a consequence, the argument must be regarded as faulty. Hence,

(*a*) If both the premisses be true, and the argument be rightly constructed, the consequent, called also the conclusion, must be true: the consequent must be admitted.

(*b*) The conclusion, or consequent, may indeed be a true proposition, as stated, and taken by itself; and, still, on account of a flaw in the structure of the argument, it may not really follow from the premisses. In this case we may admit it as an independent proposition. We admit the *consequent*, but we deny the *consequence*.

85. Axioms. We repeat here two axioms stated in No. 11. They are the bases upon which every argument must rest. If the conclusion is an affirmative proposition the argument rests upon this axiom: *In the sense in which two things are the same as a third thing, in the same sense are they the same as one another.* If the conclusion is a negative proposition, the argument rests upon this axiom: *In the sense in which two things are, the one the same as a third thing, the other different from it, in the same sense are they different from one another.*

86. Analysis of Argument. Now look at the argument given above, namely:

ANTECEDENT	Every plant is a substance *(Major Premiss)*. But the verbena is a plant *(Minor Premiss)*.
CONSEQUENT OR CONCLUSION	Therefore, the verbena is a substance *(Consequence)*.

You will find

1. That it contains but three terms,—*plant, substance, verbena.*

2. That one of the terms, *plant,* occurs twice in the premisses,— once in the major, and once in the minor.

3. That the two other terms, *substance, verbena,* occur each once in the premisses, one in the major, and one in the minor; and that they both occur in the conclusion.

4. That the term *plant* is not found in the conclusion.

5. That thus each term occurs twice in the argument.

6. That the term *plant,* which occurs twice in the premisses, is there compared with the two others; with one in the major, with the second in the minor.

7. That a certain relationship having been discovered, in the premisses, between *verbena* and substance, by means of the aforesaid comparison, this relationship is declared in the conclusion.

87. Middle and Extremes. The term that is used as a standard of comparison between the two others is called the *middle term;* or for brevity, the *middle:* the two others are called the *extreme terms* or the *extremes,* one the *major* and the other the *minor* extreme. We shall have to speak of this subject presently.

ARTICLE II. FIGURES AND MOODS OF THE SYLLOGISM.

Major and Minor Premiss — Major and Minor Extreme — Middle Term.

88. Major; Minor; Middle. We spoke, in the last article, of *major* and *minor premiss, major* and *minor extreme,* and of the *middle.* We called the first premiss the major, and the second premiss the minor, and we shall continue to call them so. But the first premiss is not always really the major, in the original meaning attached to the word; nor, in the same original meaning, is the second always the minor. According to the original use of the words, the major premiss is the premiss in which the *middle* is compared with the *major extreme;* and the *minor premiss* is the one in which the *middle* is compared with the *minor extreme.* The major extreme is the one whose extension is greater than that of the middle. The minor extreme is the one whose extension is less than that of the middle. This is how the middle came to be called middle; because, its extension is between the extensions of the two other terms.

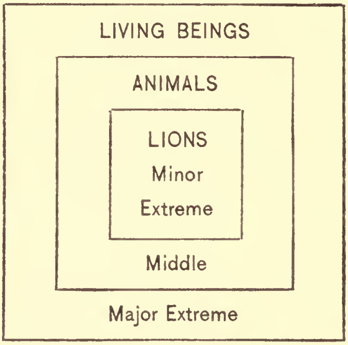
There is only one style of syllogism in which the middle is a real middle, as just explained. This is in the most obvious style of construction of the syllogism (No. 89); and it is from this that the names have grown into common use, and are applied to all syllogisms, in the same way, regardless of construction. We call the premiss put first, the major; that put second, the minor: and we never speak of the extremes as *major* and *minor.* This leads us to the question of figures of the syllogism.

By Figures are meant merely the various combinations of the extremes with the middle, in the premisses.

89. First Figure. The First Figure is the one that we have just spoken of. In this, the middle is made the subject of the premiss containing the major extreme, and this premiss is placed first: it (the middle) is made the predicate of the premiss containing the minor extreme, and this premiss is placed second. Thus:

Animals are living beings; (MAJOR PREMISS.)
But lions are animals. (MINOR PREMISS.)
Therefore, ***Lions are living beings.***

Here the middle, *animals*, has less extension than *living beings* (major extreme), and greater extension than *lions* (minor extreme). The following squares will show how one is included in the extension of the other, and how easily the argument proceeds on that account.



As our argument was stated, we proceeded within the extension of *living beings* to find *animals*, and then within the extension of *animals* to find *lions;* thence to conclude that *lions* were within the extension of *living beings*, and that *living being* could be predicated of *lion*. The minor premiss might be placed first, and the major premiss second. Thus:

Lions are animals;
But animals are living beings.
Therefore, ***Lions are living beings.***

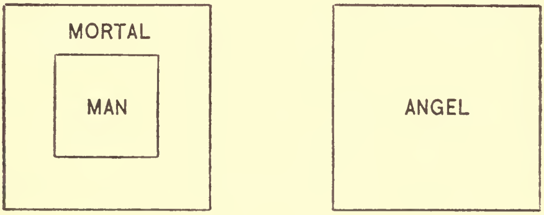
In this, we proceed from the *minor extreme* up through the middle to the *major extreme*.

90. Second Figure. We remark, again, that outside of the First Figure, what we call *middle* is really not a middle, in the true sense, but only in the sense that it is taken as a *term of comparison* between two other terms. Still we keep the name, *middle;* and the other terms are called simply the *extremes.*

In what we call the Second Figure, the middle term is used as predicate in both premisses. Thus:

Every man is mortal;
No angel is mortal.
Therefore, ***No angel is a man.***

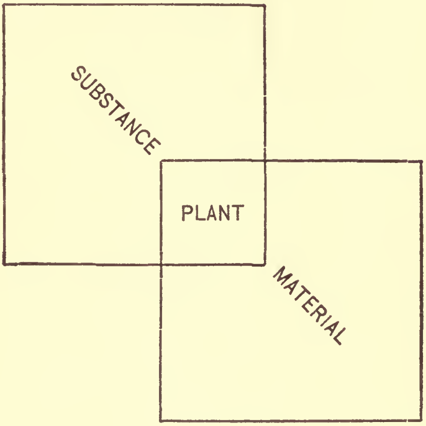
Here *mortal* is the *middle. Man* is truly *minor* with reference to mortal. But we cannot say that *Angel* is *major* with reference to mortal. *Angel* is simply excluded by, and excludes, mortal, and hence, excludes the *minor* contained in mortal.



91. Third Figure. In what we call the Third Figure the term of comparison is the subject of both the first and second premiss. Thus:

Every plant is substance;
Every plant is material.
Therefore, ***Some substance is material.***

Here the term *plant* has less extension than either of the other two. The meaning of *middle* is lost. The *extremes* are both major.



Both *substance* and *material* cover the extension of plant, and hence partly coincide, *i.e.* at least to the extent of plant. This will suffice on the subject of Figures.

What we have to remember is this, that in practice the premiss which stands first we shall call *major;* the premiss that stands second, *minor;* the term that is used as the standard of comparison, *middle;* the two other terms, *extremes.*

92. Moods of the Syllogism. By moods of the Syllogism are meant the various combinations that may be made in the premisses, of universal, particular, affirmative and negative propositions. We should derive no practical utility from a discussion of the sixty-four possible combinations, few of which give a correct argument. For the sake of a completeness, which is not necessary, we subjoin the following remarks on figures and moods.

1. There is a Fourth Figure, which is little used, and which it is well to avoid in argumentation. In it the middle is made predicate of the major proposition and subject of the minor.

Every tree is organic;
Everything organic is substance.
Therefore, ***Some substance is a tree.***

This, it will be noticed, is the same as the First Figure with the position of subject and predicate inverted in the conclusion, and the proposition accordingly changed from the universal, *Every tree is a substance*, to the implied particular.

2. If now we take the four kinds of propositions, Universal Affirmative, Universal Negative, Particular Affirmative and Particular Negative, and make all the possible combinations of them that can be made in each of the Four Figures, we shall find that there are sixteen possible combinations in each figure, or sixty-four in all, — simply regarding the position of the middle and taking no account of the validity of the conclusion. These sixty-four combinations are called the *Moods* of the Syllogism. If we take into account the validity of the conclusion as proceeding from the premisses, we shall find that only nineteen of the sixty-four combinations make correct arguments. These nineteen Moods are thus distributed: 4 in the First Figure; 4 in the Second; 6 in the Third; and 5 in the Fourth.

We shall be able to decide upon the correctness of any combination from the laws of the syllogism which follow.

ARTICLE III. LAWS OF THE SYLLOGISM.

93. Scope of the Laws. We are now prepared to formulate the laws which must govern the construction of the correct syllogism. These laws have reference to the number of terms, the extension of terms, the place of the middle term, the quantity and quality of premisses and conclusion.

94. First Law. Three Terms. *There must be three, and only three, terms, and they must be only three in meaning.* This is evident from what has been said: that the conclusion of a syllogism is simply a declaration of identity or difference between two terms (objectively), which identity or difference was implied by the comparison of these terms (objectively) with a third term in the premisses. It is not enough, therefore, to have the terms *three* in mere sound or written appearance. They must be three in meaning (objectively). Our reasoning is not upon sounds of the voice or upon printed letters; it is upon that which is represented both by the idea and by the spoken and written word. If we say:

Stores are warehouses,
Stores can be eaten,
Therefore, ***Warehouses can be eaten,***

we have three terms in sound and writing; but we have four in meaning; and thus there is no syllogism. If we say:

Eye is the organ of sight,
I is a personal pronoun,
Therefore, ***The organ of sight is a personal pronoun,***

the terms are *three* in sound, but four in meaning, as in writing. There is no syllogism. If we say:

Andrew Jackson is one of the Presidents,
Franklin Pierce is one of the Presidents,
Therefore, **Andrew Jackson is Franklin Pierce,**

we have four terms, in meaning; because, *One-of-the-Presidents* is taken in two different *particular* senses.

95. Second Law. Extension of Extremes. *Neither extreme may have a greater extension in the conclusion than it had in the premisses.* This is a consequence, or an application, of the first law. For if a term in the conclusion embraces more individuals than it did in the premisses, it is really a fourth term, because it stands for something not meant in its first use. In the following,

Tobacco is a plant,
Tobacco is narcotic,
Therefore, **Plants are narcotic,**

the term *plant*, as predicate of an affirmative proposition in the major, is a particular term; whilst, in the conclusion, as subject of the universal proposition, it is taken according to its entire extension. There are four terms: hence no syllogism.

96. Third Law. Extension of the Middle Term. *The middle term must be used once, at least, according to its entire extension*, i.e. *as universal.* The reason: for if it be twice a particular, each use may embrace totally different sets of individuals, totally distinct sections of the entire extension. This would give two different meanings for the middle, and hence, four terms. If we say:

Tigers are animals,
Lions are animals,

we may not conclude

Therefore, ***Lions are tigers.***

The middle term, *animals*, is twice particular, covering distinct sections of the entire extension, *animals*. It is really *two terms*.

An objection. How, then, can the middle term be used once universally, and once particularly? Will not this give us four terms? No; because what is said of the term taken universally, *i.e.* standing for all individuals, and for each and every individual in the extension, can also be said of this or that individual taken separately. An example:

Spirit is indivisible;
The soul is spirit.
Therefore, ***The soul is indivisible.***

In the major, *spirit* is universal. We say that *all spirits* are indivisible; hence, that each particular spirit is indivisible. In the minor, we simply call one particular spirit by its name. In the major we said *any spirit.* In the minor we make the choice that has been offered us directly in the major. There are only three terms.

Of course the middle may be used twice universally. In this case, both premisses will have to be affirmative, and the conclusion will be particular. Thus:

All fishes are sensitive;
All fishes are shy.
Therefore, ***Some things sensitive are shy.***

In these premisses the extremes are predicates of affirmative propositions, and hence are particular. Therefore, by the second law, they must have a particular extension in the conclusion. This last example belongs to the Third Figure.

97. Fourth Law. Place of the Middle Term. *The middle term must not be found in the conclusion.* This is evident from the nature of the syllogism. Two terms are compared, separately in the premisses, with a third term, in order that their identity, or disparity, may be expressed in the conclusion; the middle term being rejected, after its use as a standard of comparison.

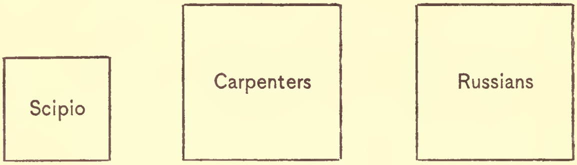
98. Fifth Law. Affirmative Conclusion. *Two affirmative premisses demand an affirmative conclusion.* For if, in the premisses, we implicitly affirm the identity of the extremes, we cannot deny that identity, explicitly, in the conclusion.

99. Sixth Law. Negative Conclusion. *One premiss affirmative and one premiss negative demand a negative conclusion.* For, in the premisses, we implicitly deny identity between the extremes, by declaring that one is identical with the middle, and that the other is not. Hence we have but to deny their identity, explicitly, in the conclusion.

100. Seventh Law. No Conclusion. *From two negative premisses we can draw no conclusion.* If we say,

Scipio is not a carpenter,
Scipio is not a Russian,

there is no conclusion to be drawn. We have done nothing but to place Scipio outside the extension of the two extremes; but there is nothing from which to infer whether there be, or be not, Russians among the carpenters, or carpenters among the Russians. All we can say is what has been affirmed explicitly, that Scipio is neither a Russian nor a carpenter.



The same holds if the premisses are two negative universal propositions. All the terms will be universal. The middle term, in its entire extension, will be outside the entire extension of each extreme.

No star is an elephant;
No elephant is a wheelbarrow.
No conclusion.

101. Eighth Law. No Conclusion. *From two particular premisses we can draw no conclusion.* For they will be either, 1, both negative; or 2, both affirmative; or 3, one affirmative and one negative.

First case: both negative. This is settled by the seventh law.

Second case: both affirmative. In this case the subjects are particular, as we have particular propositions; and the predicates are particular because the propositions are affirmative (No. 71). Hence the middle term is not taken once universally, and the third law is broken.

Third case: one affirmative and one negative. Then, according to the sixth law, the conclusion will have to be negative. The predicate of the conclusion will thus be universal (No. 71). As this predicate is one of the extremes, it must, by the second law, be universal in the premisses. But in the premisses there is only one place for a universal term; that is, as predicate of the negative premiss. The particular affirmative premiss cannot have a universal term, and the subject of the particular negative premiss must be particular. Now if this one place in the premisses where a universal term can be, be taken by one of the extremes, the middle term will not be, cannot be, used universally at all. Hence this third case is an impossibility, and the eighth law holds.

We must here make an exception for the case where both premisses are **singular.** In this case there may be a conclusion. Thus:

Mars is a planet;
Mars is uninhabited.
Therefore, ***One planet is uninhabited.***

The reason is that the term, *Mars*, being applicable to one individual only must be used in its entire extension, and hence, as subject in both premisses, has the value of a universal: so that the two premisses may be treated as universals.

102. Ninth Law. Particular Conclusion. *If one premiss be particular, the conclusion must be particular.* Of course, by the eighth law, one premiss must be universal. The possible cases with one premiss universal, and one particular, are:

1. With both premisses affirmative;
2. With one premiss affirmative, the other negative;

and in the second case we have an alternative. We may take a universal affirmative and a particular negative; or we may take a universal negative and a particular affirmative.

1. Making both premisses affirmative, we shall have,

UNIVERSAL AFFIRMATIVE (with subject *universal* and predicate particular);
PARTICULAR AFFIRMATIVE (with subject particular and predicate particular).

There is but one place for a universal term. This must be for the middle (*Third Law*). The extremes are both particulars in the premisses. Hence the subject of the conclusion must be particular (*Second Law*); and the conclusion, a particular proposition.

2. Making one premiss negative and one affirmative, we shall have either

UNIVERSAL AFFIRMATIVE (with subject *universal* and predicate particular);
PARTICULAR NEGATIVE (with subject particular and predicate *universal*).

Or,

UNIVERSAL NEGATIVE (with subject *universal* and predicate *universal*);
PARTICULAR AFFIRMATIVE (with subject particular and predicate particular).

In either case there are two places for a universal. One place must be for the middle (*Third Law*). The other place will be for the extreme which is predicate of the conclusion; the conclusion being negative, since one premiss is negative. The subject of the conclusion must therefore be an extreme, used particularly in the premisses. It must be particular in the conclusion (*Second Law*), and will make the conclusion a particular proposition.

103. Caution. Here we leave the laws of the syllogism. Certain correct syllogisms may be adduced which may seem to contravene the laws. But if the propositions of the syllogisms thus presented be examined, it will be seen that certain propositions, apparently particular, are really universal; and certain propositions, apparently negative, are really affirmative, or *vice versa.* But let it be kept in mind that we reason not with mere words as they sound or appear on paper, but with what they stand for; and words, by tricks of grammar, may be made to obscure a thought in the presentation. In the same way, syllogisms with ill-drawn conclusions may be made to appear in keeping with the laws. But study the sense of the propositions.

ARTICLE IV. SOME SPECIES OF THE SYLLOGISM.

Conditional — Conjunctive — Disjunctive.

104. Simple and Compound Syllogisms. We have hitherto, for the sake of clearness, given examples of syllogisms composed of simple categorical propositions only. Such syllogisms are, as their component propositions, called simple. One compound premiss is sufficient to make the syllogism compound and equal to as many simple syllogisms as there are simple categorical propositions compounded into that premiss. We do not propose to treat of compound syllogisms. We should never end. Attention is called here to three complexities in the syllogism, to which we alluded in No. 49.

105. Conditional Syllogisms. In these the major is a conditional proposition (46); for instance, this, *If they* *are studying logic, they are training their minds.* The first member of the conditional proposition is called the condition; the second, the consequent. The minor may affirm the condition categorically:

They are studying logic.

Then the conclusion must affirm the consequent categorically:

They are training their minds.

Or the minor may deny the consequent:

They are not training their minds.

Then the conclusion denies the condition:

They are not studying logic.

NOTE. 1. The denial of the condition will not necessitate the denial of the consequent. This (the consequent) may be true for other reasons. In the present instance they might be studying grammar or geometry without logic; and they would still be training their minds.

2. Hence affirmation of the consequent does not always necessitate affirmation of the condition. There may, as we said, be other conditions from which it (the consequent) would follow. They may in the present instance be training their minds by studying other matters than logic.

106. Conjunctive Syllogisms. In these, two incompatible propositions are proposed in the major by means of a conjunctive proposition (47). The minor affirms one, and the conclusion denies the other. Example:

No man can spend all his money on drink and still support his family;
But he spends all his money on drink.

Therefore,

He does not support his family.

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What we said about looking into the meaning of the proposition and not being deceived by tricks of construction is of service here. The conjunctive proposition is really equivalent to a conditional, thus, *If a man spends all his money on drink, he is unable to support his family;* and with regard to affirmation and denial of condition and consequent must be treated as such.

107. Disjunctive Syllogisms. In these the major puts all the alternatives of a case in the disjunctive proposition (48). If the minor makes choice of one, the conclusion will be the denial of all the others. If the minor denies all but one, that one will be affirmed in the conclusion, etc.

Example: ***He is either just fifty or under fifty or past fifty;***
But he is just fifty;
Therefore, ***He is neither under fifty nor past fifty:***
Or ***But he is neither under fifty nor past fifty;***
Therefore, ***He is just fifty:***
Or ***But he is not just fifty;***
Therefore, ***He is either under fifty or past fifty.***

In the last case, as we have three possibilities, and the minor denies one only, the two others remain as a disjunctive proposition in the conclusion. This form of syllogism may also be reduced to the conditional with one member positive and the other negative. *If he is under fifty, he is neither just fifty nor past fifty.*

The conjunctive syllogism is useful in controversy and investigation. But it is, at the same time, capable of treacherous application for the spread of error in history and physical science, by the use of disjunctive majors which are not complete. The disjunction should state all the possibilities of the case. The members should have marked lines of division, and not run into one another. All the members may not be true; neither may all be false.

ARTICLE V. OTHER STYLES OF ARGUMENT.

Enthymeme — Sorites — Polysyllogism — Epichirem — Dilemma.

108. Argument Abbreviated. We said (No. 81) that when we write and speak we do not always, nor even usually, carry on an argumentation with completed syllogisms. We abbreviate. The various methods of abbreviation give us various styles of argument, which have, respectively, their proper names.

109. Enthymeme. If we drop one premiss in the syllogism, the argument is called an *enthymeme.* Example:

All liquids will flow;
Therefore, *This tar will flow.*

We have dropped one evident premiss, *this tar is liquid,* to avoid being tiresome.

Enthymeme originally meant a probable argument; but, by a mistake as to its derivation, it came to be applied to the argument where one premiss is kept in the mind. In this sense alone is the word now used.

110. Sorites. (*Piled-up argument.*) When we put down three or more premisses and, then, *one* conclusion following from them, the argument is called a *Sorites.* It abbreviates by dropping intermediate conclusions. It presumes the evidence of the conclusion after the first two premisses, and adds a third premiss as a minor to the second premiss considered as a major; then a fourth premiss as a minor to the third premiss considered as a major, etc. Thus:

He who desponds ceases to labor;
He who ceases to labor makes no progress;
He who makes no progress does not reach the end.

Therefore,

He who desponds does not reach the end.

It is easy to see that this is an abbreviation of two syllogisms. Thus:

He who desponds ceases to labor;
He who ceases to labor makes no progress.

Therefore,

He who desponds makes no progress.

The next syllogism begins with this conclusion as a major:

He who desponds makes no progress;
He who makes no progress does not reach the end.

Therefore,

He who desponds does not reach the end.

As the Sorites involves so much argument, and proceeds so rapidly, we must be cautious with an adversary who uses it. The Sorites may be drawn out to any length. Each implied syllogism must observe the laws of the syllogism.

111. Polysyllogism. If we argue with a chain argument, as in the Sorites, but in such a way that we bring out the intermediate conclusions, not explicitly *twice* as above, but *once*, to be used, simultaneously, as conclusion to the two preceding premisses, and as major to a following minor, our argument is called a *Polysyllogism.* The preceding example, as a polysyllogism, will be:

He who desponds ceases to labor;
He who ceases to labor makes no progress.

Therefore,

He who desponds makes no progress;
He who makes no progress does not reach the end.

Therefore,

He who desponds does not reach the end.

112. Epichirem. If a premiss, or even each premiss, requires proof, and the proof is attached to it immediately, whether in substance or in full, the argument is called an *Epichirem* (*taking in hand the doubted premiss at once*). Example:

One who denies the existence of God and a future life cannot be trusted in society; because he admits no motive to restrain him from evil when he can do the evil without temporal inconvenience.
But the atheist denies the existence of God and a future life.

Therefore,

He cannot be trusted in society.

113. Dilemma. The Dilemma is a double argument in the compass of a single syllogism. It may be even triple, quadruple, etc. The major is a disjunctive proposition. The minor takes up each member of the disjunction, separately, and an equally satisfactory conclusion is drawn from whichever member is chosen. Thus a schoolboy might argue, to escape his evening study:

> ***To-morrow morning it will be either raining or not raining.***
>
> ***If it be raining, I will have an excuse to stay at home. If it be not raining, I can use my permission to take a day at the fair.***

Therefore,

> ***Whatever the weather may be, I shall not have to go to school; and hence I need not study my lessons to-night.***

The Dilemma is sometimes a very useful form of argument for a summary refutation of false theories.

CHAPTER V. TRUTH OF THE PREMISSES.

ARTICLE I. FORMAL AND MATERIAL LOGIC.

114. The Form. We have seen what is required in the quality and quantity of the premisses, and in the extension of middle and extremes, in order that a given conclusion may be taken as lawfully drawn from given premisses. If I say,

Every steamboat is a sunflower,
Every sunflower is a violin,
Therefore, *Every steamboat is a violin,*

and suppose the premisses to be true, I have to accept the conclusion, inevitably, from the premisses. The conclusion is in perfect accord with all the laws of the syllogism. All that formal logic has shown us to be necessary in quality, quantity and extension has been — supposing the premisses true — strictly attended to. Yet every proposition in the strange argument is false. This leads us to speak of the matter of the premisses, as affecting the acceptance of the conclusion. We shall say something, therefore, on the truth of the premisses. It may be urged that the subject does not belong strictly to the *formal* logic. The formal logic has to deal, strictly speaking, only with the *form*, or structure, of argument necessary to have a conclusion rightly drawn from premisses; — the matter, or truth, of the premisses being left out of consideration. And for this reason is it called *formal logic*. By this is it distinguished from *material logic*.

115. The Matter. *Material logic* will teach us what care must be taken in the use of the various means we have of arriving at the truth, that is in the use of our various faculties; and when we may cease examining, and rest reasonably secure in mind as to the truth or falsity of what is expressed in a proposition. So that, if we should meet with a syllogism such as the following,

Every timepiece is made of brass,
All brass is organic matter,
Therefore, *Every timepiece is made of organic matter,*

material logic would have to tell us how to use our faculties, — that is, how far to trust the various faculties — in our search for truth in the propositions. It is only when we have decided as to how far we are to admit the propositions that the work of *formal* logic begins. Nevertheless, we begin the study of philosophy with *formal logic*, because we have had so much practical experience in the use of our faculties, that we already hold securely that many propositions are true, many others false, and many, again, doubtful; and we want, at once, a safe and systematic rule for arguing from the known to the unknown. Therefore we study formal logic first.

However, we shall here make a short consideration upon the truth and falsity of the premisses, and upon the corresponding adhesion of mind which we can give to the conclusion. Yet we shall do this in such a way as not to touch the question of the means we have for arriving at the truth.

116. Value of the Conclusion. We cannot hold to the conclusion any more firmly than we hold to the premisses. Supposing the form of the syllogism to be correct, if we are certain of the truth of the major and minor, we shall be equally certain of the truth of the conclusion. If we have a lingering doubt as to the truth of either major or minor, that doubt will cling to the conclusion, *as a conclusion.*

An argument that is defective in the *form* is called a *paralogism.* An argument containing hidden error in the *matter* is called a *sophism* or *fallacy.* When there is no defect in the form and no error in the premisses, the argument is a *demonstration.* Defect of *form* has been abundantly treated (Nos. 80–102). Something must now be said concerning the *demonstration* and the *fallacy.*

NOTE. It may be well to call attention to the fact that the truth of a conclusion is no indication of the truth of the premisses. With a correct form we may draw a true conclusion from very absurd premisses. Ex.: *Fire is ice; Ice is hot;* th. *Fire is hot.*

ARTICLE II. THE DEMONSTRATION.

Direct — Indirect — Simple — Compound — A Priori — A Posteriori.

117. Two Kinds. A demonstration is an argument in which the conclusion is drawn from premisses of whose truth we are certain. It may be *direct* or *indirect;* and either kind may be *a priori* or *a posteriori.*

118. Direct. In the direct demonstration we draw the conclusion we desire, directly from the premisses where we have compared its subject and its predicate with a middle term. Thus:

The soul can think;
Matter cannot think.
Therefore, ***The soul is not matter.***

119. Indirect. In the indirect demonstration, instead of drawing our conclusion as coming directly from premisses in a syllogism, we show that the contradictory cannot be true, by exhibiting the absurd consequences that would follow from such contradictory. The indirect demonstration is of frequent use in geometry, where we show absurd consequences that would follow from not admitting the theorem laid down.

120. Simple; Compound. A demonstration is called *simple* when the whole argumentation is finished clearly and satisfactorily with a single syllogism. If, however, it be necessary to bring forward new syllogisms to prove the major or minor or both — which may not be clear, or may be called in question — and, perhaps, again, new sollogisms to prove the new majors or minors, the demonstration is called *compound*. All the longer theorems in geometry are illustrations in point.

121. A Priori. An argument is called *a priori* when it advances from premisses which state truths that are *prior* in the nature of things to the truth stated in the conclusion. Thus we may advance from what we know about the nature of a cause or agent, to establish some conclusion regarding the nature of the effect it may produce. The name *a priori* is used, also, for an argument where we advance from principles in their wider extension to an application of the same principles in a less wide extension; as, for instance, from principles regarding the whole animal kingdom to conclusions respecting elephants and kangaroos. Likewise, whenever we advance from principles to facts, as from the general truths about triangles to the exhibition of the truths applied in a particular given triangle.

122. A Posteriori. The *a posteriori* demonstration proceeds in the opposite direction. It advances from what is *posterior* in the nature of things to what is *prior* in the nature of things. From the existence of an effect it concludes to the existence of a cause; from the nature of an effect to the nature of the cause. It rises from a given fact to the principle that must explain the fact. We have an illustrious example of the *a posteriori* argument in the discovery of the planet Neptune. After a quarter of a century of observations made upon the planet Uranus, discovered by Sir W. Herschel, it was found that its movement did not correspond with the known forces of gravity acting upon it, especially from Jupiter and Saturn. There was a fact: movement. The movement must have a cause. The cause must be a heavenly body. The movement was of such a character, said Leverrier, that if it came from a single heavenly body, that body, at a given time would be found in a given point of the heavens. The telescope is directed, at the given time, to the given point; and there is found the planet Neptune!

* * *

ARTICLE III. INDUCTION.

Complete and Incomplete Induction — Example — Analogy.

123. Deduction and Induction. We add here a special article about a peculiar kind of **a posteriori** argument, which, by custom, has been allowed to appropriate, as it were, the name *Induction.* Every *a posteriori* argument is, indeed, an *induction*, as opposed to the *a priori* argument, which is a *deduction. Deduction* means the drawing out of a particular proposition or conclusion from the universal premiss. *Induction*, on the contrary, is a leading back to the universal from the particular. Every process of thought from the particular to the universal is inductive. We wish to speak of induction, in the usual and limited acceptation of the word, as signifying an argument which passes from a uniform experience of *several* individual cases to a universal conclusion covering them all. The induction may be, as it is termed, *complete* or *incomplete*.

124. Complete Induction. The induction is called *complete* when after having really made an examination of all the cases of which there is question, and having found that the same proposition, varying only the subject, is applicable to each case individually, we draw a conclusion in which we include them all in a single universal proposition. If, for instance, I, an American, step into a railway car and finding there five men, A, B, C, D, E, I discover gradually that A is an American, that B is an American, that each of the five is an American, and conclude that all the men in the car are Americans, I go through the process of a complete induction. The complete induction is the exact reverse of a detailed deduction, in which, from the universal, that all the men in the car are Americans, I would conclude : A is an American, B is, C is, D is, E is, I am an American.

We may sometimes think we have a complete induction when, in reality, we have not. We are liable to overlook particular cases. Moreover, sometimes even when the greatest care is taken in the observation of facts in certain branches of the natural sciences, when *all* the known facts have been classified under a general proposition, some new discovery will show that the general proposition is untrue, and that the induction was not as complete as it was believed to be.

125. Incomplete Induction. It is to the *incomplete induction*, which bears the name in the strictest sense, that we wish to call particular attention. It is a process by which, from experience of a limited number of cases, we pass on to formulate a universal law. Thus we formulate the laws of gravitation, of equilibrium, of reflection, of refraction, from a very limited number of cases; and we hold these laws to be applicable, as universal propositions, to cases tried and untried. Is the process lawful?

We inquire more particularly into the matter because some modern logicians, of the school of experimentalists, make the study of induction the chief business of logic. The process of thought may be accepted as lawful, — the experiments having been rightly conducted, — but, upon one condition. The condition is, that we admit the reality of such a thing as *cause*. This very condition, which is absolutely necessary to the validity of the process of induction, is not accepted by the great champion of induction among the experimentalists, Mr. J. Stuart Mill. The process, then, *is* lawful if we admit true causality; namely, that whatever begins to be, depends for its existence upon some real influence exercised by something else in bringing it about. In other words, Every effect demands a cause.

Recognizing this, we may set to work with experiment and observation at the process of induction. If we find, by repeated test, that the same consequent follows the same antecedent constantly and uniformly in whatsoever circumstances or adjuncts of time, place, quality or relation the antecedent may be tried, and in all the variations of circumstances by composition, opposition, etc.; if we find, on the other hand, that, suppressing the one antecedent in question, whilst leaving all the circumstances and adjuncts the same, the said consequent does not make its appearance in any of the cases when the antecedent is so suppressed; if, again, varying the antecedent, in the various cases, in quantity, intensity, direction, etc., we find that the consequent varies proportionally in quantity, intensity, direction, etc.; in other words, if we find that said consequent follows said antecedent only, but always, and in regular proportion, — we are bound to recognize as really existing in said antecedent a certain power whereby it brings into existence the said consequent; and, also, in said consequent, a certain real dependence for its existence upon the antecedent. We perceive the two to be related as cause and effect. But yet more. We perceive that the antecedent is cause by reason of something inherent to its very nature; for we have made our observations, tests, experiments, abstracting from it everything but its essential, inherent nature. But the essential, inherent nature of that thing must be present always where that thing is; the same yesterday, to-day, to-morrow. Hence we conclude that the same thing will produce the same effect to-morrow as to-day. We formulate a universal law which reaches to the future. Mr. J. Stuart Mill has, of all writers, written best upon the manner of making the tests for an induction. But as he does not recognize the reality of cause, as he puts no real connection between *foregoing* and *following*, his conclusion is universal only to the extent of the tests actually made. What he builds up with one hand he tears down with the other.

126. Example. Allied to induction is what is sometimes called the argument from example. It concludes to the universal from a few cases; and, even, it may be, from a single case, without the tests and observations prescribed for induction. Its value is rather in discovery than in proof. A superior, well trained and vigilant mind will often suspect, and even detect, the universal law in a single case; but it will be necessary to go through the various tests, to make the law acceptable to the ordinary intelligence. In general use it is an argument weak in point of logic. Logically, it *suggests* at most the possibility of a case. It is resorted to in oratorical discussion. The orator has the advantage of forcing his listeners on without giving them time to examine, and urges them to act under the impression of a possibility.

127. Analogy. The argument from analogy is still less reliable, logically, than the argument from example. It is a pure figure of rhetoric, a parallel between two cases of quite different orders. It is useful to persuade an audience that cannot listen to dry argument, but can listen very well to a story, and then follow out the application of the story, in all its details, to the question under treatment.

128. Caution. In philosophical argument be wary in the use of example and analogy. It is so easy to give illustrations and to make comparisons. Therefore have we so many self-styled "scientists," to-day, setting themselves up as professional discoverers, and flying to conclusions which the slow, careful processes of induction do not warrant.

ARTICLE IV. FALLACIES.

Begging the Question — Evading the Question — Accident — A Dicto Simpliciter, etc. — Consequent — Cause — Question — Reference — Objections.

129. Fallacy. We have distinguished the Fallacy or Sophism from the Paralogism. The paralogism is an argument with a flaw in the form. A conclusion, true in itself, may be found in a syllogism which is faulty in the form. The conclusion may be true, indeed, but it has not been proved. We have previously considered arguments, with regard to the correctness of the form (Laws of the Syllogism). This article has reference to the *matter* of the conclusion. Any argument with a false conclusion is a *fallacy*. The word, however, is applied, in its special sense, to falsely concluding arguments which have so much the appearance of correctness as easily to deceive the unwary or to silence those whose limited knowledge or intelligence does not enable them to detect the deceit. We shall not consider any fallacy which is an evident violation of the laws of the syllogism. Every equivocation is such, since it uses a word in two senses, and thus gives us four terms in the syllogism. We subjoin some fallacies arising from the matter.

130. Petitio Principii or Begging the Question. This is to insert cleverly and covertly into the premisses the very thing that has to be proved. This is a favorite fallacy of demagogues haranguing listeners whose hearts are already in the conclusion. Communistic gatherings echo with arguments like this :

"All men are born into the world, equal, with equal rights to live, equally, upon the earth and to enjoy an equal share of the spontaneous productions of the earth. So that by Nature herself are they justified in asserting their equality against all comers.

"But all the existing laws of society are in open conflict with the equal rights of men and are framed only to increase the inequality.

"Therefore, as we cannot get the rights of our equality from society, we are by Nature herself justified in overturning governments and helping ourselves."

Here, you see, the right to plunder is assumed covertly in order to justify plunder.

The **circulus vitiosus** (*vicious circle*) is of the same order as the *petitio principii*. We prove, for instance, the fall of the apple from the tree by gravitation; and, later on, we establish gravitation by the fall of the apple.

131. Evading the Question (*ignorantia elenchi*). Under this head may be ranged all those tricks of argument by which one tries to make the best of his case without offering proof; or to shirk an objection without showing it to be invalid. This may be done by assuming for proof or disproof something similar or analogous to the point in question; or by attacking an opponent on the ground that he is not to be regarded as an authority on the subject (*argumentum ad hominem*), thus arousing prejudice against his argument; or by appealing to the passions of the reader or listener; or by trying to shame an opponent out of the debate by citing against him authorities that have the respect of the listeners.

This is an utterly illogical way of proceeding, but it may be followed with great effect.

132. Fallacy of the Accident. This consists in assuming as essential what is purely accidental. Thus a man might argue against Christianity because some who profess it are not exemplary in their conduct. However, evil-doers are never such by reason of Christianity; they may be, in spite of it.

133. A Dicto Simpliciter ad Dictum Secundum Quid, and *vice versa.* This is the fallacy of arguing *from an unqualified statement to the same statement qualified,* or *vice versa.* This fallacy pervades daily conversation. From the unqualified statement that a man is learned the popular mind jumps to the conclusion that he is learned in particular matters to which, perhaps, he has never given any attention. How many a man truly "learned" has had to pay for his name as "learned" by being consulted as though he were an encyclopædia? This fallacy works with equal success in the opposite direction. An exhibition of some knowledge in a few particular matters is soon made the basis for the conclusion that the exhibitor is "learned."

unqualified induction.

134. Fallacy of the Consequent. This consists in a misuse of the conditional syllogism. Thus some one says: *If the gale is strong to-night, the tower will fall.* In the morning the tower is found to have fallen. The fallacy infers that the gale was strong. The truth is that the tower may have fallen under other agencies.

[illegible]

135. Fallacy of the Cause. This lies in assuming as the cause of something that which is merely an accompanying or preceding circumstance, or at most an occasion. Thus we sometimes read in the newspapers that the political principles of a party in power are the cause of all the fluctuations in trade. Therefore, to secure steady

[illegible]

business, the administration must be changed. And when the administration is changed, and the same difficulties occur, the responsibility is shifted to the opposite principles of the new party in power. Or we read that the *cause* of a bank robbery was the insecure system of bolts put on by a certain safe company, thus shifting the responsibility from the want of vigilance on the part of the authorities, and from that education of the head without the education of the heart, so prolific in evil-doers.

136. Fallacy of the Question. This consists in asking a number of questions all of which are evidently to be answered in the same way, by yes or no; and then very deftly inserting one question whose answer should be the opposite, but which is made to pass along with the others, as answerable in the same way. Thus the communistic orator: "Are we poltroons? Shall we reject the equality nature has bestowed upon us? Shall we see the products of the earth, which nature intended for all, piled up for the use of a few? Can we, as nature's freemen, refuse to vindicate our equality? Is there anything to prevent us from destroying? They refuse us a share in their millions. Shall we refuse them a share in our poverty? etc. Therefore, etc."

137. Fallacy of Reference. This is untruth — the inventing of false references for the support of a proposition. People do not usually verify references, and hence may be easily deceived by a long array of authorities [?] cited at the foot of the page.

138. Fallacy of Objections. This consists in pouring forth a volume of objections, one immediately after another before giving opportunity for reply. The adversary's time may be more than taken up in trying to answer one of them. Even then his long, careful answer may not be as effective with the audience (or reader) as the terse, captious objection; and besides, the other objections will be carried away unanswered.

CHAPTER VI. METHOD.

ARTICLE I. SCIENTIFIC METHOD.

139. Scientific Method. Supposing the premisses to be true and the form of correct argumentation to be fully understood and rigorously applied, there are still different methods which may be followed in the search for conclusions, in the pursuit of truth. Moreover, methods which may have proved most satisfactory to our own minds in the search for, and discovery of truth, we may find less satisfactory for communicating the same truth fully, briefly, and clearly to others.

We do not refer here to the mere variations of order in which a number of truths, such as dates of events in history, may be learned or communicated, one after another. But we refer to methods of arriving at the knowledge of even *one* truth as a *conclusion*, *i.e.* in such a way as to possess, together with the truth, also the reasons for it. We speak of scientific methods which give us scientific knowledge, Science.

140. Analysis and Synthesis. There are two kinds of scientific method, the *analytic* and the *synthetic*. The analytic proceeds by way of *analysis* or *taking apart;* the synthetic, by way of *synthesis* or *putting together.* To take a broad example: the chemist analyzes, when he proceeds to find out the nature and proportions of the various elements in a lump of crude matter brought him from the mines; he synthetizes, when he puts together various chemical elements for the purpose of discovering some new law of combinations. Thus analysis proceeds from the whole to the parts; synthesis, from the parts to the whole.

Before considering the methods of synthesis and analysis we shall touch upon two other points, — *definition* and *division*, — the understanding of which will enable us to speak more briefly and more clearly about the methods.

ARTICLE II. DEFINITION.

Nominal — Real — Descriptive — Genetic — Essential — Physical — Metaphysical — Rules.

141. Definition. Correct definition is a thing always to be prized in writing and discourse, even for its effectiveness in concentrating vague thought and shortening discussion. A universal habit of correct definition would be fatal to false argument and would put an end to much debate that is carried on to tiresome lengths. But the habit of correct definition belongs to the trained master mind. And as most minds are not such, and as most men shirk the search and labor demanded by correct definition, therefore have we so much, in philosophy as in other things, that is written *all around* a subject instead of *about* it. But here we are called upon to give a definition of a definition. Therefore: A definition is *the expression in words of the meaning attached to a term*; or, a definition is *the expression in words of the nature of an object.* That is to say, there are two kinds of definition. If we fix our attention on the *word*, to make it known in its character as a *sign*, we have the *nominal* definition. If we fix our attention on the *thing*, to define what *it is*, we have the *real* definition.

142. Nominal Definition. We give a nominal definition, (1) When we make known the sense in which we are using a term for the case in question; (2) When we make known the meaning usually and generally given to a term; (3) When we declare the true literal meaning of a term according to its derivation. Thus, *infinite*, from the Latin *in* (a negative particle) and *finis* (a limit), means *without limit*.

143. Real Definition. This may also be threefold,—*descriptive*, *genetic*, *essential*.

The *descriptive* definition is nothing more than a description. It does not enter into the essence of the object. It gives such a combination of accidental features, circumstances, etc., as may suffice to make the object recognizable. Its treatment belongs to works on composition and style.

The *genetic* definition (from *genesis*, origin) gives the process by which a thing is produced. A genetic definition of a circle would be: *A plane surface generated by revolving a straight line about one of its extremities fixed.*

The *essential* definition names the essential parts of an object; that is, those without which the object can neither be nor be thought of. According to the way in which we look at an object, we may find it made up of *separable* essential parts which, taken together, will give us the whole essence; or of *inseparable* essential parts which, considered as taken together, will also give us the whole essence. Such *separable* parts are called *physical* parts, and the enumeration of them is the *real essential physical* definition. Such *non-separable* parts are called *metaphysical* parts, and the enumeration of them is the *real essential metaphysical* definition. Thus, in man, spiritual soul and organic body are essential parts; they embrace all that is essential; they are actually separable; taken together, they give us the essence. Hence to say that man is *a being composed of a spiritual soul and an organic body*, is to give an essential physical definition of man. Again, in man, animal nature and rational nature are essential parts; they embrace all that is essential; taken together, they give us the entire essence. But they are not physically, that is actually, separable. Take away rational nature, and you have not animal nature left, but only a dead body; for the principle of life is gone. Such parts are separable only in the consideration of the mind; that is, in an order of things outside the real physical order, — or, in the metaphysical order. They are called metaphysical parts. Hence to say that *man is a rational animal*, is to give the essential metaphysical definition of man. This is the true definition in logic. It classifies according to those logical considerations spoken of in Chapter II., Article II. It gives the species by combining the two essentials of proximate genus and final difference; and there is no mistaking a thing thus defined. — It is the perfect definition.

144. Rules for Definition. We may summarize the requisites of a good definition:

1. The terms of the definition should convey a more definite idea than the single term expressing the thing

defined. This does not mean that every term in the definition should always be at once better known by everybody than the single term. When we define a circle to be *a plane surface with a single curved line for a boundary every point of which is equally distant from one fixed point in the surface*, our definition is less intelligible to an ignorant person than is the term *circle*. But one who learns the meaning of the terms in the definition will get from it a more definite idea than he had before possessing the definition of a circle.

2. Make the definition such that it may be convertible by simple conversion (No. 76) with the term expressing the object defined. Thus: if *a circle is a plane surface . . . etc.*, then *a plane surface . . . etc.* (as above) *is a circle*.

3. Do not define by a negation, by saying what a thing is not. However, sometimes a negative term comes up for definition. In this case separate it into its negative and positive parts, and define the positive part. For instance, *injustice* is the *absence of justice*. Now define *justice*, and you shall have defined *injustice*.

4. Use words in their exact literal meaning; and when there is a choice of words, use such as are most commonly understood.

5. In philosophical matters insist upon the essential metaphysical definition. It may sometimes be useful to begin with or to work upon the physical definition; but never lose sight of the metaphysical.

ARTICLE III. DIVISION.

145. Scientific Division. Definition, the perfect logical definition, regards the comprehension of a term (Chapter III., Article V.). Division, the perfect logical division, regards the extension. This difference we must examine into as being of serious importance in all scientific study. A few words, however, first, upon division in general and on certain divisions which are precisely the inverse of the *essential* definition whether physical or metaphysical.

146. Parts, Physical and Metaphysical. We saw that essential definition (No. 143) is the enumeration of the essential *parts*, as taken together to form the *whole*. Division, in general, is a separation of *whatever* may be regarded as *a whole*, a unit, into its parts. If we regard an essence as a whole, a unit, made up of the parts enumerated in the essential physical definition, we have what is called a *physical* whole, which is divisible by *physical*, *actual* division into physical parts. Thus *man*, considered as a physical whole, is divisible actually into the physical parts, spiritual soul and organic body. If, however, we regard an essence as a whole, a unit, made up of the parts enumerated in the essential metaphysical definition, we have what is called a *metaphysical* whole, which is divisible by *metaphysical*, *mental* division into metaphysical parts. Thus *man*, considered as a metaphysical whole, is divisible into the metaphysical parts, *animal nature* and *rational nature*.

147. Actual Union. The union of parts in both cases is an *actual* union. The physical parts, however, are *really* separable; the metaphysical parts, only *mentally*.

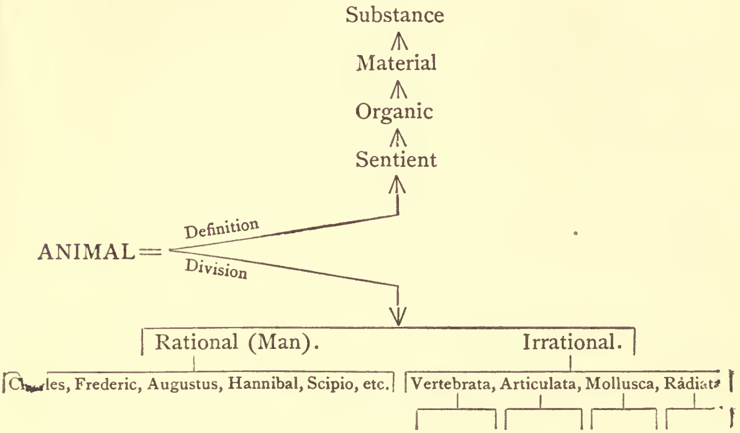
148. Integral Parts. Parts which are really separable but which are not essential, *i.e.* not absolutely necessary for the existence of the whole, though belonging to its integrity or entirety, are called *integral* parts. A hand or a foot is an integral part of man.

To summarize, therefore: A whole, regarded in its essence as made up of real parts actually existing, may be considered as made up of physical parts, really separable; or of metaphysical parts not really separable.

Physical parts which, though belonging to the normal state of the whole, to its integrity, yet can be separated without destroying the essence, are called integral. Thus: a hand or a foot in man.

149. Logical Division. To return now to logical division: the parts we are especially concerned with, in this article, and which we are to get at by logical division, are not such as are bound together in actual union by an actual bond of unity, so as to make a real, actual something. We are concerned with *another kind* of parts, those, namely, which are embraced by, and go to make up the extension of an idea or term, not those which are found in comprehension. We said that the perfect definition was the enumeration of notions contained in the comprehension. The perfect division is the enumeration of, the partitioning off of what can be reached by the extension of a term. This logical division is therefore the enumeration, the dividing up, of species under genus, or of individuals under species. A genus is a logical whole; the species under it and their subdivisions are logical parts. A species is a logical whole; the individuals it extends to are logical parts.

The following diagram will explain better than words the precise distinction between logical definition and logical division. To define *animal*, we go upwards,


Substance
Material
Organic
Sentient
Definition
ANIMAL =
Division
Rational (Man).
Irrational.
Charles, Frederic, Augustus, Hannibal, Scipio, etc.
Vertebrata, Articulata, Mollusca, Radiata

taking in the various notions in the comprehension: *sentient*, *organic*, *material*, *substance*. To divide animal, we go downwards, classifying all that can be reached by the extension of the term.

150. Potential Parts. Every term taken in the reflex universal sense (Nos. 21, 23) expresses a whole which is divisible by this kind of division into the parts of its extension. As thus divisible it is called a *potential* whole, because it extends not only to what really exists, but also to what exists only in *potentia;* that is, to whatever of the same kind may exist. All the birds in the universe might be destroyed, still *bird* would express a *potential* whole embracing all birds past and all birds possible in the present and the future though they shall not all exist, — embracing them all as *potential* parts into which it (*bird*) is *capable* of being divided by logical division.

151. Logical Whole. This kind of whole, then, is the *logical* whole; because, being the object of a reflex universal idea, it does not exist as a unit in reality, but only by consideration of the mind. Thus *man*, considered as the object (Nos. 21, 23) of the reflex universal idea, is not a one something that can actually be torn asunder into separate men; nor can *substance*, taken as the object of a reflex universal idea, be really split up into material and immaterial substance. Yet in the mysterious process of thought, *man*, *substance*, do logically embrace all men, all substances, actual and possible.

152. Importance of Division. It is the logical division which we must be careful to have special regard for, in philosophizing. Philosophy deals with the universal. It is from beginning to end a combination and correlation of the comprehension and extension of ideas. The advantage of correct logical division in the study of a subject is evident. It maps out the whole question before us, at the start; and saves us from time-losing, wandering discussions, as well as from incomplete treatment of the matter in hand.

153. How to Divide. To divide correctly:

1. Let the sum of the parts be exactly equal to the whole.

2. Therefore see that no single member of the division is equal to the whole. A bad division of plants would be into those that grow and those that bear fruit. The first member is equal to the whole.

3. Do not make one member to include another or part of another. This would happen if *substance* were divided into *immaterial*, *material*, *living* and *organic*. *Living* enters into *material* and *immaterial*. *Organic* enters into *living* and *material*.

4. Divide first into *proximate* and *immediate* members, and then, if possible, subdivide. The meaning of this is that we should first seek the widest general grand divisions and then see if we cannot regard these as new wholes to be subdivided, etc.

5. In scientific matters prefer the logical division. See if the whole may not be regarded as a genus. Mark off the species. See, again, if any species, thus found, may be regarded, in its turn, as a genus (Chapter II., Article III.); and do not go on to divide into individuals until a species cannot be regarded as a new genus. (See Diagram No. 30).

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Article IV. Analysis and Synthesis.

154. The Question Put. We may now go on to the explanation of the methods referred to above (Nos. 139, 140). A proposition is presented to us in study, reflection, reading, conversation, debate. Is it true or false? We make an assertion. We do not doubt the truth of our proposition, but how shall we proceed to place it in evidence, by means of demonstration? An adversary advances a false statement. How shall we prove it to be false? A single object of thought is offered us for investigation. What propositions shall we formulate regarding it? What shall we predicate of it? Of what may it be predicated?

155. The Answer: Analysis and Synthesis. Our investigation of any single object of thought must begin by analysis or synthesis, and must advance by one or the other, either purely by analysis or purely by synthesis, or by changing about, as circumstances may prompt, from one to the other. Let the object of thought presented for investigation be *animal.* We must begin by trying to make *animal* the subject or the predicate of a proposition. If we begin by making it a *subject,* we are using analysis; we are beginning by the analytic method. If we begin by trying to use it as a predicate, we are using synthesis; we are beginning by the synthetic method. Again, an entire proposition is presented to us: *Animal is substance,* or *Animal is not mineral.* We have to test the truth of the proposition. We must begin by studying the subject or the predicate. If we begin with the subject, we are using analysis; if with the predicate, we are using synthesis. The meaning of all this and the reasons for the terminology will best be seen in the case of a complete proposition.

156. Analysis. Take the propositions, *Animal is substance, Animal is not mineral.* Are they true? We know that in an affirmative proposition the form (No. 20) of the predicate is included in the comprehension of the subject (No. 66); and that in the negative proposition the form of the predicate is excluded from the comprehension of the subject (No. 68). Suppose we begin by a study of the subject. To see whether the forms, *substance, mineral,* are comprehended in *animal,* we must take *animal* apart into all the forms implied in its comprehension. We must *analyze* it. We do this by taking it as a *metaphysical whole,* proceeding upward

(No. 149) from the metaphysical whole, *animal*, through all the forms, parts, of its comprehension. There we find *substance* embraced in the comprehension, but not *mineral*. Hence *animal is substance, animal is not mineral*. The process is nothing more than logical definition.

157. Synthesis. On the contrary, if we begin by the study of the predicate, since we know that in an affirmative proposition the predicate expresses some form that is contained in the comprehension of the subject, we shall — if the predicate be not merely the essential definition of the subject (No. 66) — we shall have to keep adding on to it what is compatible with it until we shall have gathered together all the forms embraced in the comprehension of the subject. Thus (No. 149) we keep on adding *material*, *organic*, *sentient*, one after another, to *substance*, until we get a combination that gives us *animal*. This is synthesis. The process is that of logical division. In the case of a negative proposition, — if it be true, — we may keep on adding to the predicate forever, and we shall never find a combination giving us the subject. This proves that the negative proposition is true. If in an affirmative proposition we fail to find the subject, this shows the proposition to be false.

158. The Explanation Complete. These few words cover all the essentials of synthesis and analysis as scientific methods. The words *analysis* and *synthesis* are sometimes used in ways that are apt to confuse the mind. Reduce every mode of expression back to that of comprehension, remembering that it varies inversely with extension, and the confusion will disappear.

159. Singular to Universal, and Vice Versa. It is said that analysis proceeds from the singular, or particular, or less universal, to the more universal; and that synthesis proceeds from the more universal to the less universal. This would seem to contradict all that we have been saying. But remember that reference is here made to the *extension*, which varies inversely with the comprehension. When we proceed from *animal* up to *substance*, we go from the less universal to the more universal *in extension*, though from the wider to the less wide comprehension. Hence there is analysis in both cases.

160. Complex to Simple, and Vice Versa. It is said that analysis goes from the complex to the simple; synthesis, from the simple to the complex. Understand this of comprehension. This manner of expression is applied to the process from particular concrete facts to the universal law, for analysis; and to the process from the law to particular applications, for synthesis. But how is the single fact complex and the universal law simple? You will see it in an illustration. You argue from the particular concrete facts regarding matter, to a universal law regarding matter. The single fact is complex. The matter you have is this or that kind of matter, organic, inorganic, vegetable, animal, mineral, gaseous, liquid, etc. You have a complex comprehension. You have to analyze the separate cases, and cut away from the comprehension, until you arrive at the simpler form, *matter*, simpler in comprehension, more universal in extension, to make your general law about *all matter*, without specifying this or that *particular* kind of matter.

Induction is analytic. Deduction is synthetic.

161. Discovery and Instruction. The modern growing natural sciences *grow* by analysis. The sciences that have been explored to satisfaction and present a complete whole, as also growing sciences, — botany, chemistry, etc., — *so far as they have been explored and classified*, are *best taught* by the synthetic method. Analysis is best for discovery. Synthesis is, in general, more satisfactory for instruction. The two methods may be used alternately, in the same treatment of the same subject. A change is sometimes useful in the treatment to rouse attention.

162. Analytic and Synthetic Sciences. A science is called analytic or synthetic from the method chiefly used in its development. If, however, both methods enter very largely on account of the nature of the subject-matter, we have the *mixed* method, properly so called. Logic and geometry are synthetic. The various branches that make up the modern physics are analytic. Civil engineering, taken as a whole, is *mixed;* it implies the synthetic mathematics and also the result of analytic observation on material to be used, as well as climatic conditions, etc. — In this little book we have mingled analysis whenever it seemed useful for clearness or interest.

163. Advice. With what has been said, the student will be enabled to follow up the complete working of synthesis and analysis by attention to the processes pursued in standard treatises on the various sciences.

If you find yourself confronted with the burden of proof or investigation, observe the following:

1. Work cautiously.
2. Consult your actual knowledge. The general out-

line of your actual knowledge may determine your method. Particulars may be so scanty that you will see your way to lie only through general principles, by synthesis. Or facts may be in such abundance that you may set to work at once by analysis.

3. Beware of being unconsciously betrayed into a fallacy.

4. Be on the alert for the moment when you can formulate a definition of terms.

5. In distributing and classifying, keep in view the logical division.

6. When you have found something by analysis, go over it again by synthesis. This will map it out in your memory.

Article V. Science.

164. Science. With a clear understanding of what is required for correct thought, and with some insight into methods of procedure, we may go in pursuit of knowledge. Every perception of any truth is knowledge. If this perception be through a demonstration, it is called scientific knowledge. The perception, through demonstration, of a complete body of related truths regarding a given object, is called science.

165. Object of a Science. The same object may be the *object* of more than one science. For we may consider the same object under different aspects; and obtain, regarding it, different sets-of-connected-truths — each set complete without the other. In other words, we may consider different forms, or formalities, found in the totality of the comprehension of the object.

166. Material and Formal Object. The object, taken in the totality of its comprehension, is called the *material object* of a science. The particular formality considered, or this formality as affecting the material object — abstraction made from all the other formalities comprehended — is called the *formal object* of the science. The whole corporeal universe is the material object *v.gr.* of both astronomy and chemistry. But the formal object of the science of astronomy is the mass, magnitude, distance, co-ordinated motions, etc., of the various masses of matter, called heavenly bodies, which make up the corporeal universe; whilst the formal object of chemistry is the substantial distinction between elements of matter and their respective capacities for substantial union with one another. Again, various things, even of different orders, may be united into one science by reason of a formality running through them all. Thus, spirit, matter, substance, accident, all contain in their comprehension, the formality of *being;* and can be taken all together as the material object of the science of being. They can all be considered in the same science, under the aspect of being, and this will give us the science of *Ontology.*

167. A Delusion. Knowledge acquired by scientific processes is scientific knowledge. The possession of such knowledge is the possession of science. No other knowledge has a right to the name. Children in primary schools who are obliged to memorize a few facts about rocks or animals or flowers, are often instructed to a false acceptation of the word by being told that they are "studying science"!! Thus they come to regard geology, zoölogy, botany, any and every science, as merely a list of facts, and the acquisition of a science to be an affair of memory and not of reason.

168. OUTLINE OF SCIENCES.

- BEING. **Ontology.**
  - FINITE.
    - SUBSTANTIAL (*substance*).
      - MATERIAL (*in the wide sense, including the whole visible Sensible Universe*). **Cosmology.**
        - ANIMATE (*organic*). **Biology,** as general Science of Life.
          - RATIONAL (*in general*). (MAN). **Anthropology.**
            - ANIMAL BODY. (*refer to* SENSITIVE).
            - SOUL. **Psychology.**
              - Nature of Soul.
              - Powers of Soul.
                - Power of actuating sense perception and vegetation, in conjunction with organism.
                - Intellect.
                  - Nature of Intellect.
                  - Method of work. **Formal Logic** or **Laws of Thought.**
                  - Material for work. **Material Logic** or **Truth of Thought.**
                - Free Will.
                  - Existence and Nature of Free Will.
                  - Norma of Free Act. (**Ethics.**)
                  - Practical Morality. (**Ethics.**)
          - IRRATIONAL.
            - SENSITIVE. (BRUTE). **Sensation. Physiology, etc.**
            - NON-SENSITIVE. (PLANT). **Vegetation. Botany.**
        - INANIMATE. All the Sciences that treat of inanimate inorganic matter. **Astronomy, Geology, Physics, Chemistry, etc.**
      - SPIRITUAL.
    - ACCIDENTAL (*accident*).
  - INFINITE. **Natural Theology.**

In the preceding table or "Outline of the Sciences" we have advanced from the term of *least comprehension* and *greatest extension*, namely, the term, BEING. That which is represented by the term or concept BEING supplies the subject-matter for **Ontology,** the Science of BEING.

We go on trying to increase the comprehension and diminish the extension by adding the terms, FINITE and INFINITE, to BEING. The division is not one of genus into species, as we have seen when speaking of analogy (Nos. 28, 36), yet it serves us for this very broad outline. INFINITE BEING is the subject-matter of the science called, in philosophy, **Natural Theology.**

Continuing with FINITE BEING, increasing comprehension and diminishing extension, we have, in a perfect division, SUBSTANTIAL FINITE BEING and ACCIDENTAL FINITE BEING. **Ontology** extends thus far, defining the *notions* of INFINITE and FINITE, and treating of Substance and of all that is not Substance, that is of Accident; quantity, quality, action, time, space, etc. It is general philosophy.

Again dividing, and increasing comprehension, we have MATERIAL SUBSTANTIAL FINITE BEING and SPIRITUAL SUBSTANTIAL FINITE BEING. We do not treat of bodiless spirit under the Finite, in philosophy. But taking the MATERIAL, in the wide sense of the term, we have the subject-matter of the science, **Cosmology.**

Increasing the comprehension, again, by adding ANIMATE and INANIMATE, we get in the ANIMATE MATERIAL, etc., the subject-matter of the science, **Biology,** as general science of life. If we take the other subdivision, INANIMATE MATERIAL, etc., we find that range of sciences which treat of inanimate, inorganic matter: **Physics,** etc.

We leave the INANIMATE; and we divide the ANIMATE, by adding to the comprehension, into the RATIONAL and the IRRATIONAL. The IRRATIONAL divided by adding to comprehension, gives us SENSITIVE and NON-SENSITIVE (the brute and the plant), with the sciences, **Sensation,** etc., **Vegetation,** etc.

Returning to RATIONAL ANIMATE, etc., we find here the science of MAN in general, or **Anthropology.** From this point forward we are engaged solely with MAN. We can no longer divide into *species.* We use such divisions as will give us a complete and clear view of the subject, MAN.

By *actual physical essential* division (No. 146) we can divide MAN into SOUL and ANIMAL BODY. The ANIMAL BODY, for general principles, we refer over to Sensation. SOUL is the subject-matter of the Science, **Psychology.** Psychology will treat of the *Nature of the Soul* and the *Powers of the Soul. The Powers of the Soul,* we group under three headings: *Power of actuating sense-perception,* etc.; *Intellect; Free-Will.*

Intellect, we consider in its *Nature;* its *Method of Work;* its *Supply of Material.* The *Method of Work* constitutes the object (or subject-matter) of the Science, **Formal Logic.** The *Supply of Material* for true thought gives us the object of the Science, **Material Logic.**

Under the heading of *Free Will* we treat of the *Existence and Nature* of Free Will; of the *Norma or Rule of the Free Act;* and of *Practical Morality. The Existence and Nature of Free Will,* we may readily refer to the treatise on the *Powers of the Soul.* In this way, accepting Free Will from Psychology, we have, left, the *Norma of Free Act* and *Practical Morality.* These last two, Norma and Practice, taken together, form the subject-matter of the Science, **Ethics.**

This is one presentation of the philosophical and subsidiary sciences. In studying, we begin upon the lowest line with **Formal Logic.** Next, we take up **Material Logic.** Thus equipped, we go back to **Ontology,** and follow down through the FINITE until we reach the border line of **Ethics.** Here, we turn back to take up the study of **Natural Theology,** which we had omitted and for which we are now prepared. At length, with what philosophy can teach us of God and man and of the wide universe about us, we study, **in Ethics,** the practical conclusions to be drawn from the whole, to guide the actions of the free, intelligent being, MAN.

POINTS FOR PRACTICE. — The practical utility of Formal Logic, and the mental training to be derived from it, depend altogether upon the skill acquired in readily discerning the comprehension and extension of terms. The Laws of the Syllogism — Definition, Division, Synthesis, and Analysis — are all to be learned by the careful study of Extension and Comprehension. Special attention should be given to these two correlated points. Original illustrations should be sought for as a proof that those in the book have been understood.

(9) Name objects of the simple apprehension or of the idea. (10) Give examples of judgments. (11) Upon what two principles does the mind work in reasoning? (13–15) What is a term, a proposition, a syllogism? (17–19) Give three classifications of ideas. (19) Examples of singular, particular, collective, universal ideas. (20) How are universal ideas classified? What is meant by form, formality, or determination, in reference to ideas? (21–27) Examples of species, genus, difference, property, accident. (29) Name some forms that may be used both as generic and specific. (30) Give illustrations of highest genus, lowest species, subaltern genera. Tables of contents in scientific works will furnish examples. (32) Examples of real and logical terms. (33–35) Univocal and equivocal terms. (36) What is an analogous term? and why is the question of analogy introduced here? (37) Examples of the material, logical, real supposition of terms. (40) Examples of propositions, pointing out the subject, copula, and predicate. (41) Examples showing the difference between the logical and the grammatical predicate. (42) Examples of simple. (43) Compound. (45, 46) Categorical, conditional. (47, 48) Conjunctive and disjunctive propositions. Show how they are reducible to the conditional. (54, 55) Examples of *a priori* and *a posteriori* judgments. Show why the *a priori* are called necessary, absolute, metaphysical, analytical; and the *a posteriori*, contingent, hypothetical, physical, synthetical. (59–61) What is meant by the extension and comprehension of terms or ideas? (62–63) What does the extension of a proposition depend upon? Examples of the four extensions of propositions. (65–70) Explain the laws which declare the extension of the predicate in universal and particular propositions, both affirmative and negative. Name and illustrate the one exception for the universal affirmative. (73) State what is absolutely necessary that a proposition may have the force of a negation. (76) Examples of the conversion of propositions, retaining and changing quantity and quality. (78) Of opposition in quantity and quality. (84) Explain the difference between consequent and consequence. (86) Give the analysis of an (original) argument. (88) Explain the true, primary meaning of Middle Term. (92) What is meant by the Moods of the Syllogism? (94–102) Nine Laws of the Syllogism. Compose faulty arguments or syllogisms, and show how each law may be violated. (104–107) Examples of syllogisms. Show how the conjunctive and disjunctive are reduced to the conditional. (108–113) Examples of enthymeme, sorites, polysyllogism, epichirem, dilemma. (114–122) Difference between formal and material logic; between direct and indirect demonstration; between simple and compound; between the *a priori* and the *a posteriori*. (124) Example of complete induction. (125) What is required for the validity of the incomplete induction? (129–138) Examples of various fallacies. (145) What is the essential distinction between logical definition and logical division? (146) What is meant by physical and metaphysical parts? (149–153) What is a logical whole? logical division? What are logical parts?

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