S U M M A R Y

O F

L O G I C

S o u r c e

"Handbook of Logic"
by
Houde & Fisher

S U M M A R I Z E D
B Y
M I L O S C H I E L D

Draft

October, 1991

V 2.0

TABLE OF CONTENTS

OVERVIEW

==========

DETAILED VIEW

ACKNOWLEDGEMENTS

I wish to thank all those who have fostered my interest in understanding thinking and logic.

Logic was an unsatisfying experience for me in college. I did well, but I was disappointed and unmotivated. Our text (Suppes: Formal Logic) was an exercise in symbols which seemed too far removed from the nature of human thought. I also had a bad experience in my course on the introduction to philosophy (if you are certain of something, it isn't real; if it is real, then you can't be certain). Based on two bad experiences, I decided to abandon Philosophy and pursue science. In science you were encouraged to strive for both reality and certainty.

After reading Ayn Rand's The Fountainhead, I rediscovered philosophy and logic in some taped lectures given by Nathaniel Branden on the Nature of Objectivism and by Dr. Peikoff on the history of Philosophy and the nature of Logic.

My interest in philosophy grew as I made friendships with others who were similarly interested such as Dr. Douglas Rassmussen (Professor of Philosophy at St. John's University in New York) and Dr. Douglas DenUyl (Professor of Philosphy at Bellarmine in Louisville, Kentucky).

Desiring to retake course in philosophy, I attended classes at St. Thomas. I specifically wanted to study Logic under Dr. Connell using the logic text he had written. I also studied Ethics under Father Stromberg, Metaphysics under Dr. Sullivan, Biomedical Ethics under Dr. Berquist, and Applied Ethics under Dr. Boyle. I subsequently took two graduate courses in Philosophy at the University of Minnesota and attended a week-long seminar on Philosophy at the University of California in San Diego.

As a teacher, I approach my subjects using the mental tools of logic. But my students generally lacked a background in logic. Thus, they could not readily grasp my approach. I then began collecting books on logic, since each author had a distinct approach.

The small Handbook of Logic by Houde and Fisher seemed to be the ultimate in both brevity and in explanation. Unfortunately, it is out of print. Therefore, I decided to summarize this Handbook for my students. This would allow them a way to learn the terms and distinctions that I considered important in using their minds.

I first distributed this material during an interim course at Augsburg in 1989 on the Economic Analysis of Legal Reasoning. I have since distributed portions of this summary to students in MIS 375. Every week, these students write a memo which outlines a problem, summarizes the symptoms, identifies the cause, presents several solutions (with costs and benefits) and then recommends a solution. This material has been useful to some of the students.

Although Critical thinking is distinct from Logic, it is not the opposite of Logic. Therefore, I plan to use some of this material in my forthcoming course on Critical Thinking (with a quantitative emphasis).

Overview of Logic

Logic is the study of reason (reasoning). Logic is the science of thought (the science of Science). Learning logic means learning how to think. To be logical is to be human since man is a rational (reasoning) animal. True knowledge begins with logic.

Kinds of Logic

Some say there are two kinds: the material/substantive vs the formal/mathematical (the traditional or Scholastic vs the modern). Others say Logic must include both.

Nature of Logic

Approach: first identify the aspects of logic and then determine its' overall scope.

Aspects of Logic: Psychological (concerned with man's thinking process) and Ontological (concerned with objects of man's thought. E.g., Is "blindness" real?)

Scope of logic: should be concerned with both the psychological and ontological aspects.

Philosophical Logic

Philosophy: science of all things in their ultimate causes (as known by reason alone).

Philosophical logic: an explanation of thought (the process of thinking)

1. the forms of thoughts (the how of thinking)
2. the contents of thoughts (the what of thinking)
3. the causes or goals of thought (the why of thinking)

Differences between Logic and its aspects

Psychological aspect: internal explanation of the natural progression of man's thoughts

Ontological aspect: external explanation of the natural progression of man's thoughts where the first principles of logic are derived from ontology (the study of being).

However, the laws of being (ontology) must precede the laws of thought.

Ontological laws and principles First laws of ontology (the first indemonstrables)

Negative form Law of contradiction "same attribute cannot … be affirmed and denied of the same subject"

Positive Form: Law of Identity. "a being must always be itself"

Law of the excluded middle: "between being and non-being there is no middle course"

Definitions of logic

Illustrative: the method of science, the science which investigates the principles of thought, the rules that thinking must impose upon itself to be effective; the mind's method for finding truth

Dual aspects of logic as being both an art and science

as art: logic is a faculty to be developed in order to achieve the fullness of its nature.

as science: logic is a study of method as applied to the operations of man's intellect

Essential definition: Logic is the science of correct and true <u>thinking</u>.

Motivation

Man is obligated to think; he cannot do otherwise, if he is to realize his own human-ness.

To be human is to be logical.; to be logical is to be human.

APPROACH TO THE STUDY OF LOGIC

Acts of the Mind (Psychological aspect of logic): There are three unique mental acts involved in thinking.

1. Simple apprehension: "this [subject] is a [predicate]" (a single proposition)
2. Judgement: "If this, then that" (two related propositions)
3. Reasoning: "I want this, therefore I will do this" (three propositions)

Organization of study of logic

The study of logic should parallel the three acts of the mind.

3. Thinking (in its fullest sense) is reasoning
2. Reasoning is based on judgements
1. Judgement grows out of simple apprehension

1. LOGIC OF DEFINITION

SIMPLE APPREHENSION

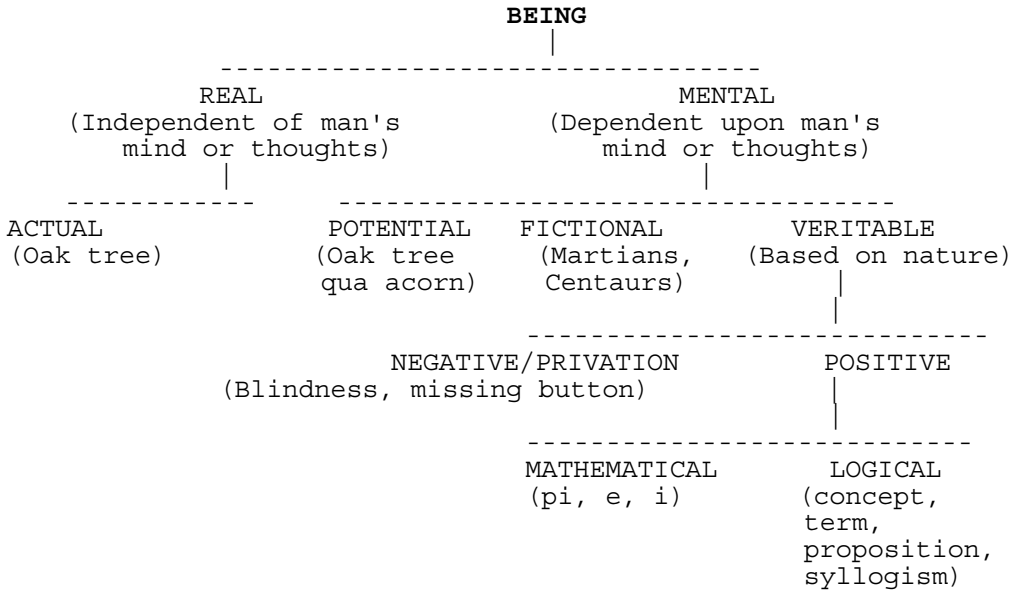
1.1 THE NATURE OF THE ACT

Apprehension:

Illustrations: The point at which mental life begins; the first act of the mind as Mind
Terms: Mind: that by which we know that we know
Derivation (Latin): Apprehendere To take

Definition: The act by which the mind grasps (or lays hold of) an object without affirming or denying anything about it

Objects of apprehension: All things that have "being"



Characteristics of Apprehension

Simple: it is incomplete and does not satisfy the mind
Indifferent: it is neither true nor false
Static: it neither affirms nor denies
Synonyms: attention, concentration, analysis, consideration, isolation, focusing.

Proper object of apprehension

To know the essence of a thing is to know a thing. To know that we know.

Order of Being:
- What is the relationship between mind and objects of knowing
  - order of nature: order of real things
  - order of knowing: order of things as known
    - subdivided into the sensible and intelligible

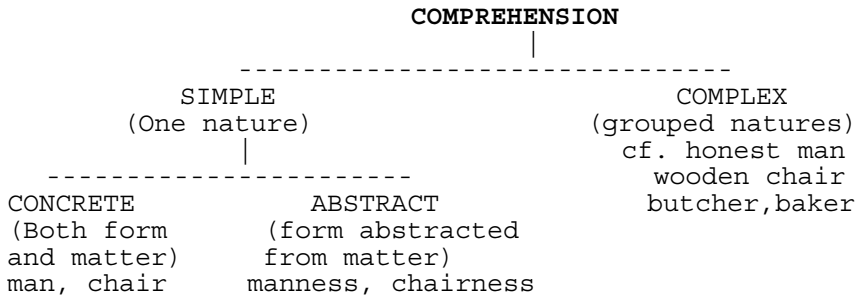
Psychology of apprehension (from Top to Bottom)
- Order of Nature: Thing (singular, material, changing)
- Order of Knowing:
  - Sensible Order
    - Sensation (Sight, hearing, touch, smell, taste)
    - Perception: "thing" or phantasm (singular, material, changing)
  - Intelligible Order (Conception)
    - Active Intellect Implied likeness of "thing" qua abstraction
    - Passive Intellect Expressed likeness (Concept)
      (Universal, Immaterial, Independent of time or space)

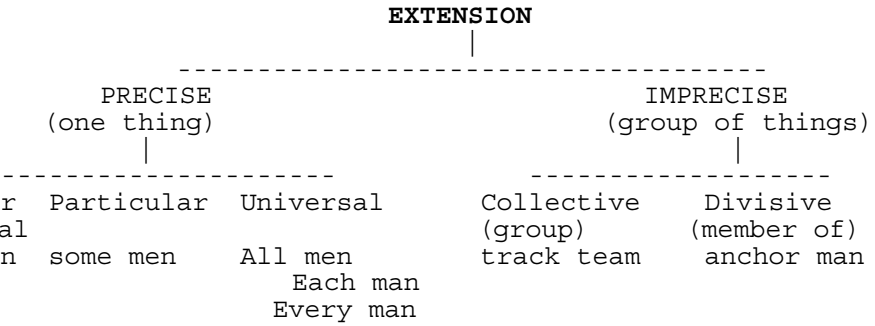
1.2 THE INTERNAL PRODUCT OF THE ACT: THE CONCEPT

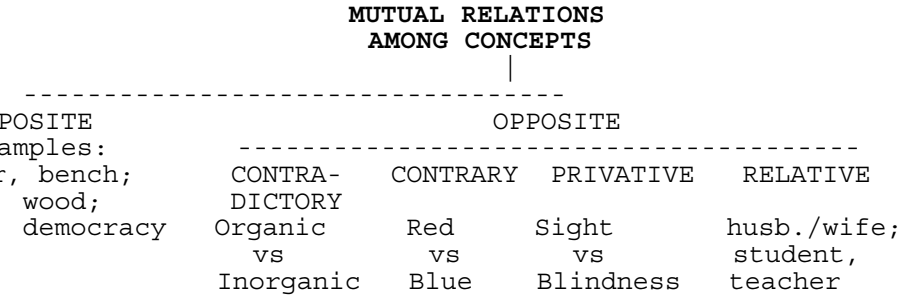
Concept: the product of Apprehension (a genetic explanation)
- Features: produced by mind; resides in mind
- Synonyms: idea and notion.
- Dual nature of concepts as both end and means:
  - concepts are the end (or goal) of our apprehensive knowledge
  - concepts are our means of knowing extra-mental things or objects
- Status of concepts:
  - independent of the object of thought
  - independent of the mind that contains the thought
- Definition: that which comes to mind when the mind knows.

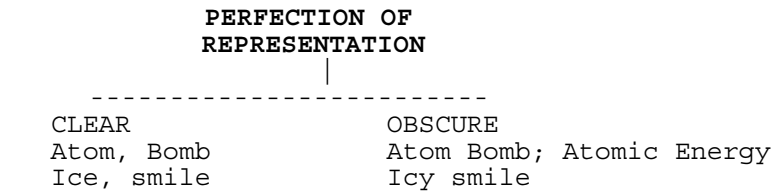
Logical properties of the Concept
- Comprehension: A living being (cf. horse, fish) may have many attributes or aspects, but a being's essence is a comprehensive unity. Essence includes necessary properties (not accidental) (Cf. Man's essence excludes having opposable thumbs)
- Extension: Universality of a concept (cf. man)
- Relationship between comprehension and extension
  - the greater the comprehension, the less the extension and vice versa
  - Example: "Lassie", Collie, Dog, Animal, Organism, and Thing

Properties of Concepts:









1.3 THE SIGN OF THE CONCEPT: THE TERM

Necessity for (or goal of) Signs

As a social being, man needs to communicate. Signs are man's only means to do so.

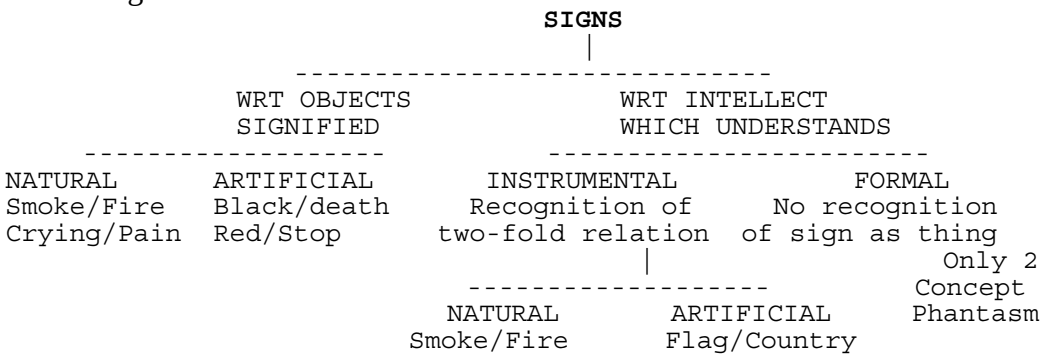
Sign defined

A sign is that which
- signifies (or gives significance to) something
- signifies to (or represents for) the intellect something other than itself

A sign is a two-fold thing:
- something in itself
- a bearer of another (higher) reality

A sign has a two fold-relation:
- first, to the object signified for which it substitutes
- second, to an intellect capable of understanding

Division of Signs



Definition of 'Term'

A sign is that which signifies to (or represent for) the mind an object or a thing.
A term is the sign of a concept (written or spoken)
The common name for 'term' is 'name' or 'word'

Division of Terms

As signs of concepts, terms are divided as are concepts: comprehension, extension, etc.
Terms are also divided by their properties

Properties of Terms

A property is something that emerges or flows from a thing but is not the thing itself.
The number of terms is limited by our vocabulary
The number of concepts is unlimited for two reasons: the number of things in reality is unlimited and the mind can create concepts not found in reality.
(See chart below for equivocal and analogical)
Even if all terms were univocal, the problem of context would still remain.

PROPERTIES OF TERMS

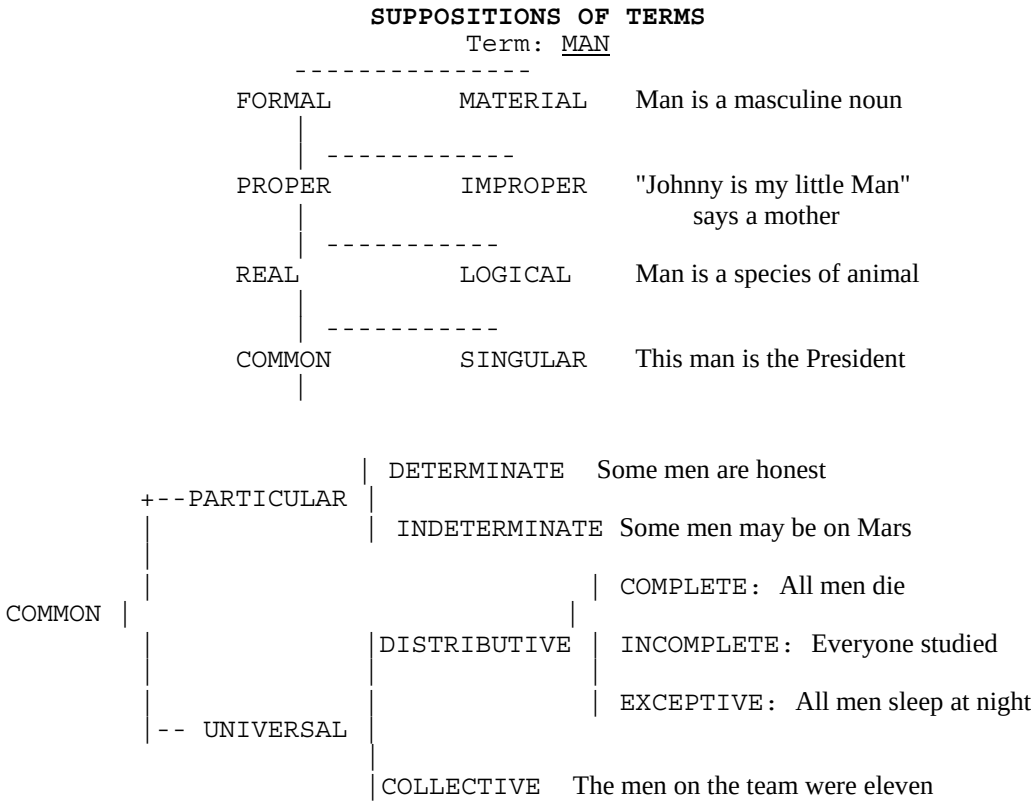
SIGNIFICATION (Its original object or meaning	**SUPPOSITION** (Its contextual object or meaning	**RHETORIC**
		AMPLIFICATION
		RESTRICTION
		TRANSFER
A Lamb is an animal	Lamb is a word	DIMINUATION
	Lamb is a meat	REIMPOSITION
	the Lamb of God	
	go like a lamb	

SIGNIFICATION OF TERMS

UNIVOCAL	EQUIVOCAL		ANALOGICAL
Only 1 thing	More than 1 thing		2 or more
gold, moon, oxygen			things with
	SPEECH	WRITING	a likeness
	dear vs deer	bark vs bark	foot of body
		of dog	of tree	foot of mtn.
			head of body
			head of state

Examples: Marginal student,

Divisions of Supposition



Ambiguities:

A common/particular/determinate form can be used to designate a singular.

Cf. Laws for the common good can be written to benefit a specific few

Example: Those men with Social Security Number 478-45-2863 shall pay no taxes.

Summary

Rhetorician: Choose the right word: be concrete, use economy of diction, avoid redundancy and circumlocution.

Logician: Always be careful in the use of terms. Always distinguish between the logical and the emotional meanings of a term

1.4 MODES OF KNOWING PROPER TO THE FIRST ACT

'Modes of knowing' versus 'objects as known'?

We are concerned with knowing what something is rather than just knowing the names of things
We are concerned with knowing what a pencil is rather than just knowing that "That is a pencil".

Modes of Knowing (qua apprehension)

In understanding a term or idea (including its two-fold aspect of comprehension and extension), the mind must define and divide.

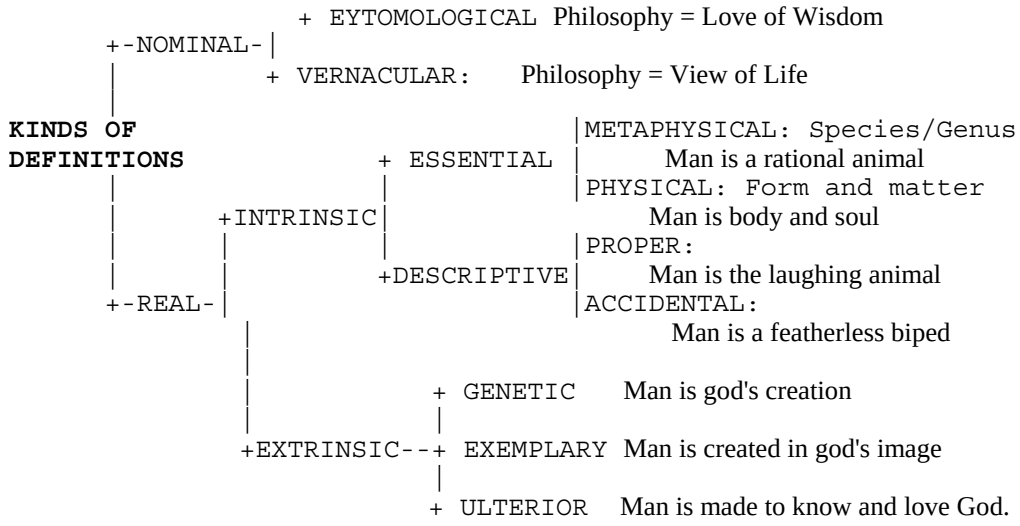
Definition and Division:

These are modes of knowing proper to the first act. They answer the needs of the mind
Through them, the intellect not only knows a diamond when it encounters one, but it also knows what the diamond is.

Definition Defined:

Derivation: Latin: de-finire "to state the limit of"
Summary: to say what something is (and what it is not)

Kinds of Definitions



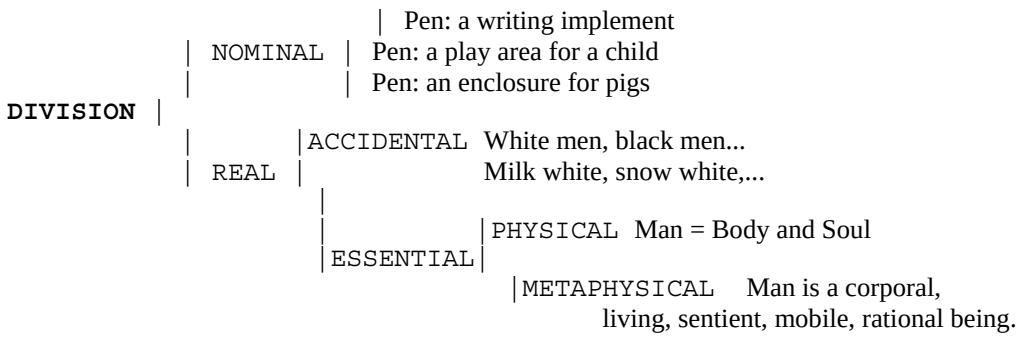
Division

Defined as 'breaking down a thing into its parts'

Division is breaking the

genus into its' logical species. (the parts of a Metaphysical definition)

thing into its material components (the parts of a Physical definition)



Rules of good Division

1. There must be a whole thing to be divided.
2. There must be a principle (purpose or basis) of division
3. There must be a correspondence between the principle and the divided parts.

   Mankind cannot be properly divided into white men, Germans, females, etc.

   Literature cannot be properly divided into poetry, fiction, short works, etc.

The Second Act of the Mind

JUDGMENT

2.1 THE NATURE OF THE ACT

What is the relation of judgement (2nd act) to apprehension (1st act)?

Simple apprehension involves knowing a 'thing'. It asserts only its existence (Tree is; John is).

By itself, apprehension is incomplete and unsatisfactory. It is simple, indifferent to truth or falsity; it is static because it neither affirms nor denies.

The life of the mind (like all other life) is generative (it attains it fullness gradually by degrees).

In the progression of knowledge, the first step is apprehension; the second is judgement.

What are the psychological steps involved in judging?

Judging can be analyzed in 3 steps.

First, the mind knows the existence of a thing

Second, the mind establishes the identity of a thing by relating it to other things.

Third, the mind gives its assent (agreement) to the 'identity' of 'things'.

What is the definition of a judgement?

Judgement is a mental act

* by which the mind assorts, separates, divides or unites the things which it apprehends
* in order to establish their identity
* for the purpose of affirming or denying their ultimate truth or falsity.

What are the differences between apprehension and judgment?

	Apprehension	Judgment
Motion	Static	Dynamic
Action	Passive	Active
Object of:	essence (quiddity)	existence
	essential	existential

Synonyms: synthesis, attribution assent, predication, interpretation.

What are the components of judgement?

Logical components: Any of the mind's concepts (things as known by the mind)

Rhetorical components: the rhetorician's concepts of 'sentence', 'subject' and 'predicate'

The sentence is the counterpart of the judgement or proposition.

In logic, the judgement consists of

* the subject (that of which something is affirmed)
* the copula (the verb to be) [may be negative]
* the predicate (that which is affirmed or denied of the subject)

How are predicates (predicaments) classified?

* Substantitive (that which exists in and of itself)
  The essence (quiddity) of a thing. [Eg. Man is a rational animal]
* Accidental (that which exists in, of and by another but is not necessary to another)
  [Eg. Man is a featherless biped] [Eg. Man has an opposable thumb]
  # Quantitative (the interval/ratio attributes) [Eg. Man averages 5'6" in height]
  # Qualitative (non-quantitative attributes) [Eg. Man exists in two sexes]
  # Relational (between two things) [Eg. Male & female can produce a child]
  # Active (action of one thing on another; production of one thing by another)
  # Passive (effect induced on one by another; the reception of one thing by another)
  * Temporal (existence in time or in a sequence)
  * Spatial (existence in space/spatial relation)
  * Positional (physical attitude of a thing)
  * Clothe-al (expressive of the covering)

This substantitive predicate and the 9 accidental predicates make up the 10 categories.
According to Aristotle, Aquinas and other philosophers, these 10 categories exhaust the possibilities of predication by the human mind.

What are the kinds of judgements?

Simple: single subject, copula and single predicate.
Complex: multiple subjects, copulas or predicates

What are the properties of judgements?

Completeness and Unity: If it contains all its components and they are logically related.
Truth or falsehood: If it reflects conformity between the mind and its objective evidence
Note: Truth (falsehood) is one thing; Knowledge of truth (falsehood) is another
Eg. "More people smoke ___ than any other cigarette"

Motivation to understand judgements.

Sellers seek to reduce public thinking to a minimum.
Buyers need to understand the process of judging to make better judgements.

2.2 The Internal Product of the Act: The Mental Statement.

The mental statement

Definition: The representation formed in and by the mind when making a judgement

Components of the mental statement:

* material (the concepts or terms involved)
* formal (the union/separation, composition/division, or the inclusion/exclusion)

Role of the mental statement:

Mental life begins with apprehension (concepts), but thinking begins with judgement (the ordering of concepts)

2.3 The Sign of the Mental Statement: The Proposition

The sign of the mental statement is the proposition

Definition: A proposition is a written or spoken expression of the mental statement.

Function: A proposition is the basic unit of intelligible logical communication.

Components:

Review: classification of terms as constant or variable

Variable terms: All subjects (nouns, pronouns) and all predicate adjectives

Constant terms: the copula, all adverbs, simple adjectives, conjunctions and prepositions

Propositions consist of

variable terms whose comprehension and extension are affected by modifying constants.

The terms of the proposition involving the subject and predicate are referred to as the extremes (term = terminus).

The relation between subject and predicate

In uniting extremes in a true affirmative proposition (eg. the whale is a mammal), the subject and predicate signify the same thing in reality but different things in idea. This is even true when the subject and predicate are the same word (eg. the moon is the moon). Yet these two terms are different in idea:

* subjects are taken materially (the individual substance, object or being) and
* predicates are taken formally (the form).

How are propositions divided?

Propositions are divided by the five principles of division:

1. unity (simple vs complex)
2. quality of copula (categorical and modal)
3. quantity of the subject (indefinite vs def)
4. temporal (past, present or future)
5. matter (impossible, contingent or necessary)

What are the details of these five divisions?

1. unity (simple vs complex)
2. quality of copula (categorical and modal)
    * categorical (affirmative vs negative)
    * modal
        * possible [Even a fool can be right]
        * impossible [A blind man cannot see]
        * contingent [A blind man can be cured]
        * necessity [All men must die]
3. quantity of the subject term (indefinite vs def)
        * indefinite [Boys will be boys]
        * definite
            * Singular: This house is a barn
            * Particular: Some houses are barns
            * Universal: No house is a barn or All houses are man-made
4. temporal (past, present or future)
5. matter (impossible, contingent or necessary)

    based on the relation between the predicate and the comprehension of the subject.
        * impossible: the predicate <u>can not</u> be found in the subject
        * contingent: the predicate <u>may</u> be found in the subject
        * necessary: the predicate <u>must</u> be found in the subject

Two-way Classification of Propositions (A,E,I and O)

By integrating quantity (extension of the subject) with quality (of the copula) we can obtain 4 inclusive groups. These classifications are identified, arbitrarily, by the first 4 vowels of the English alphabet: A, E, I and O. These classifications are shown below:

	AFFIRMATIVE	NEGATIVE
UNIVERSAL	A: All whales are mammals	E: No whales are mammals
PARTICULAR:	I: Some whales are mammals	O: Some whales are not mammals

Quantity in AEIO
* includes only definite non-singulars
* excludes definite singulars and indefinites

Quality in AEIO
* includes only the categorical aspects
* excludes the modal aspects

How do the exclusions behave?

Definite singular propositions behave like universals

Indefinite propositions with
* a concrete subject may be universal or particular
* an abstract subject are universal (A or E)

Modal propositions of
* necessity are universal affirmatives (A)
* impossibility are universal negatives (E)
* contingency and possibility are particulars: I or O

Three-way Classification of Propositions

By integrating quality (of copula) and quantity (of subject) with matter (logical relation of predicate and subject), and disregarding impossibilities, a three-way classification emerges:

Necessary	AN:	All men must die eventually
Contingent	AC:	All chairs are made of wood
Impossible	AI:	All dogs are hats (No point in discussing impossibles)

LOGICAL RELATIONS OF PROPOSITIONS:

What is a logical relation?

A logical relationship is the relation between two propositions (when the terms are the same ones or similar)

What are the logical relations among similar propositions?

Between relevant or interrelated propositions, there are 3 kinds of logical relations:

* opposition,
* conversion and
* obversion

Opposition: Successive affirmation and denial of identical predicates of identical subjects
Eg. All men are mortal; All men are not mortal; No men are mortal
Eg. Some men are mortal; Some men are not mortal
Eg. All men are not mortal; No men are mortal; Some men are not mortal

Conversion: Inverting or interchanging the extremes of the proposition in such a way as to restate the same truth
Eg. Some barns are red-colored things. Some red-colored things are barns

Obversion: Bringing two opposed propositions into agreement by adding a negative particle to one.
Eg. Some men are kind; Some men are unkind; Some men are <u>not</u> unkind

Opposition

Necessary conditions:
1. Both propositions must have the same extremes (same subject; same predicate)
2. The terms of the proposition (variables and constants) where the same, must have the same meaning
3. The copulas of the two propositions must be opposite in quality (is vs is not; can vs cannot, may vs may not, must vs must not)

There are 4 varieties of opposition:

1. contradiction
2. contrariety
3. sub-contraiety
4. sub-alternation

Opposition of Contradiction

Definition: One proposition purely and simply denies what the other affirms.

Examples: A vs O; E vs I

N: A: All dogs are mammals (True); O: Some dogs are not mammals (False)

N: A: All mammals are dogs (False); O: Some mammals are not dogs (True)

C: E: No books are read (False); I: Some books are read (True)

C: E: No books are natural (True); I: Some books are natural (False)

Rule of Contradiction: Two contradictory propositions (whether in necessary or contingent matter) cannot (at the same time) have the same truth value. If one is true, the other is false (and vice versa).

Opposition of Contrariety

Definition: Two universal propositions opposed in quality (but not in quantity).

Example: A vs E

T vs F: All dogs are mammals vs No dogs are mammals
F vs T: All dogs are plants vs No dogs are plants

T vs F: All books are real vs No books are real
F vs T: All books are plants vs No books are plants
--> F vs F: All books are read vs No books are read.

Rule of Contrariety: Two contrary propositions cannot be true together. If one is true the other is false. In necessary matter, if one is false the other is true. But in contingent matter, if one is false, the other can be false.

Opposition of sub-contrariety

Definition: Two particular propositions opposed in quality (but not in quantity).

Examples: I vs O

	T vs F:	Some dogs are mammals;	Some dogs are not mammals
	F vs T:	Some dogs are plants;	Some dogs are not plants
	T vs F:	Some books are man-made;	Some books are not man-made
	F vs T:	Some books are plants;	Some books are not plants
-->	T vs T:	Some books are read;	Some books are not read

Rule of sub-contrariety: Two sub-contrary propositions cannot be false together but can be true together. If one is false, the other is true. In necessary matter if one is true, the other must be false; in contingent matter if one is true, then the other may also be true.

Proof:

1. Contradictories must have opposite truth values.
2. Contraries cannot both be false but may both be true.

Opposition of sub-alternation

Definition: 2 propositions differing in quantity (universal vs particular) but not in quality.

Example: A vs I; E vs O.

		----Universal----- vs	---- Particular-----
	T vs T:	All dogs are mammals;	Some dogs are mammals
	F vs F:	All dogs are plants;	Some dogs are plants
	T vs T:	No dogs are plants;	Some dogs are not plants
	F vs F:	No dogs are mammals;	Some dogs are not mammals
	T vs T:	All books are man-made;	Some books are man-made
	F vs F:	All books are plants;	Some books are plants
-->	F vs T:	All books are read;	Some books are read
	T vs T:	No books are mammals;	Some books are not mammals
	F vs T:	No books are read;	Some books are not read
	F vs F:	No books are read;	Some books are not books

Rule of sub-alternation: For two sub-alternation propositions, in any matter

* if universal = True, then particular = True.
* if particular = False, then universal = False

A true 'superior' includes a true 'inferior'

A false 'inferior' precludes a true 'superior'

In necessary matter,

* if universal is False, then particular must be False.

In contingent matter,

* if universal is False, then particular may still be True.

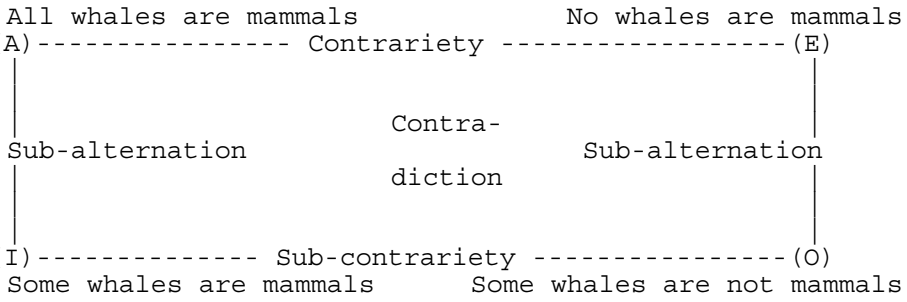
Q. Why necessary/contingent MATTER vs N/C PROPOSTION???

SQUARE OF OPPOSITION

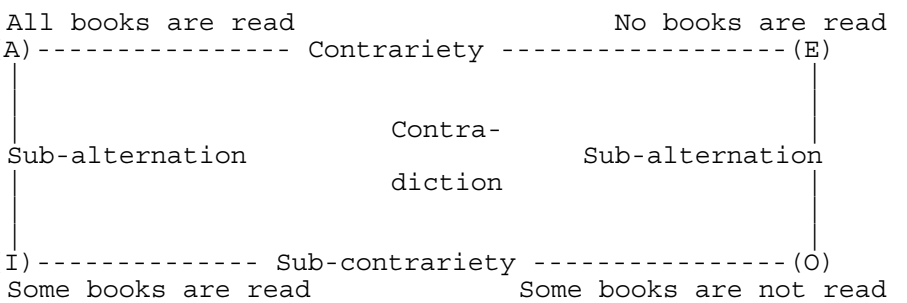
To better hold the AEIO relationships, consider the following graphical representations. Universals are located above particulars. Negatives are to the right of affirmatives. The quality of the copula (is vs is not) is horizontal; the quantity of the subject is vertical

==========

CATEGORICAL PROPOSITIONS
(Necessary Matter)

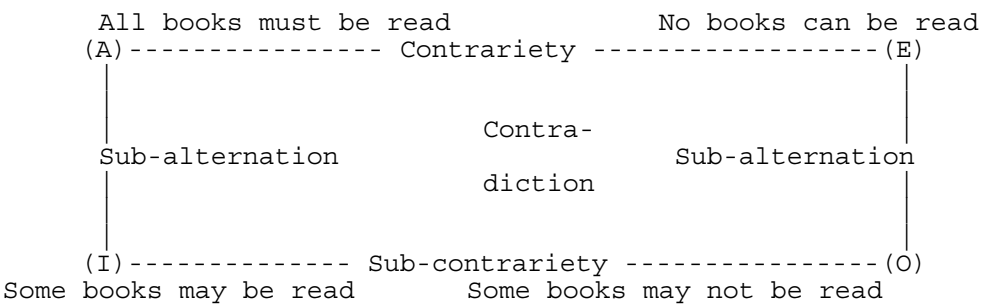


CATEGORICAL PROPOSITIONS
(Contingent Matter)



==========

SQUARE OF OPPOSITION
MODAL PROPOSITIONS



2.4 MODE OF KNOWING PROPER TO THE SECOND ACT

Immediate Inference

Definition and division are the modes of knowing proper to the first act: apprehension.
Immediate inference is the mode of knowing proper to the second act: judgement.
Inference is the act of the mind in moving from one judgement to another.
Inference is synonymous with consequence, implication, inclusion or suggestion

Process: Beginning with a judgement (or several judgements), the mind arrives at another judgement (or conclusion). The truth (or falsity) of this conclusion is implied by/ included in/suggested by that of the others.

Two Types of Inference

* mediate inference: based on the relationship between 3 or more judgements (see Part 3)
* immediate inference: an inference drawn directly from a single proposition.

Types of Immediate inference.

The kinds of immediate inference correspond to the kinds of logical relations between propositions:

* Opposition: 4 varieties: Contradiction, contrariety, sub-contrariety and sub-alternation
* Conversion: 3 varieties: Simple, accidental and contrapositional.
* Obversion:

Utility of Immediate Inference

Through logical inference, we know an expressed judgement as a unit of intelligible communication: its import and its contextual intention and extension.

The Third Act of the Mind
REASONING

3.1 THE NATURE OF THE ACT

The Psychology of Reasoning.

Thought begins with apprehension of existents
and results in the formation of concepts
Thought proceeds thence to judgements of their identity
and results in the formation of propositions.
in order to affirm/deny their truth/falsehood
Thought proceeds by immediate judgements

But in moving from the known to the unknown (from one
set of judgements to another judgement, the mind
is performing the third act: reasoning.

What is reasoning?

Definition: the act by which the mind, proceeding from judgement, moves to a second judgement and thence (because of their inter-relationship) to a third judgement.

By moving from known to unknown the mind is doing what, in its nature, it is designed to do. Here is the mind in its wholeness; here is mental life at its fullest.

Kinds of reasoning.

There are two ways in which the mind discovers truth: deduction and induction

Deductive reasoning is reasoning that literally (de+decu) leads <u>out of</u> something: from cause to effect, from universal judgement to particular.

Eg. 1. All men are mortal
2. Aristotle is a man
therefore,
3. Aristotle is mortal

Inductive reasoning is reasoning that literally (in-duco) leads <u>into</u> something: from effects to cause, from particulars to universal.

Eg. 1. Aristotle and Aquinas were mortal
2. Aristotle and Aquinas are men
therefore, .
3. All men are mortal

Deductive and inductive reasoning both lead to truth.
As such they are not opposites but rather complimentary.

3.2 THE INTERNAL PRODUCT OF THE ACT: THEN MENTAL ARGUMENT

What is the mental argument?

A concept is the representation of a thing's existence
A proposition is the representation of a thing's identity
An argument is the representation of .....

What are the components of mental arguments?

Mental arguments involve combinations of logical forms.
Logical forms are determined by constants and variables.
Constants are terms like IF, AND, THEN.
Variables are propositions like A is B, B is C, etc.
Example of a logical form:

1. IF B is A
2. AND C is B
3. THEN C is A

Alternatively, mental arguments involve three parts:
1. antecedents (called premises) from which the
2. consequent (conclusion) is supposed to flow. The
3. consequence of the relationship between antecedent and consequent is the argument itself.

Division of Mental Argumentation

Matter vs Form.
Matter:
* Proximate matter: the propositions contains always (only) the 3 variable terms: A is B; B is C, etc.
* Remote matter: the three terms themselves: A, B, C.

Form (of the argument)
* valid: if the antecedent really infers the consequent
* invalid: if " " " " " " " does not infer " " " " " "

Universal Law of Argumentation.

In every valid argument,
* from a true antecedent, a true consequence always follows
* from a false antecedent, a true consequence may follow (by accident)

Eg. My purse is on the moon; The moon is in my pocket
Therefore, my purse is in my pocket.

The form of the argument identifies its validity.
The matter of the argument assures us of its truth.

3.3 THE SIGN OF THE MENTAL ARGUMENT: THE SYLLOGISM

Definition of the Syllogism

A syllogism is any two propositions arranged to lead the mind to a third.

Deductive Syllogism

Inference: act of mind in moving from one judgement to a 2nd

Immediate inference: moving from a single judgement

Eg. If 'John is at home' is true,
then 'John is not at home' must be false.

Mediate inference: moving from at least 2 judgements.

Eg. 'John is a soldier'; 'a soldier is not a sailor'
therefore 'John is not a sailor'.

Deductive syllogism: A mental conclusion which necessarily follows from the premises.

Rules: It consists of 2 premises and 1 conclusion.
The two premises contain a total of exactly 3 terms.
One of these terms (middle) appears in both premises.
The other terms (extrema) appear in only one premise each.

Universal Principles

From the nature of the deductive syllogism, we can derive three universal principles for its right use.

1. Principle of right identity and separating third:

Two terms, both identical with a 3rd common term, are identical with each other.

Two terms, one of which is identical with a common 3rd term and the other not identical with the common 3rd term, are not identical with each other.

Eg. If B is A and C is B, then C is A ???
If B is A and C is not B, then C is not A

2. Principle of ALL (de Omni) and NONE (de Nullo),

That which is affirmed universally of a term is affirmed of everything contained within that term.

Categorical

A: All Humans are mammals	A: All humans are mammals
I: Aristotle is human	A: All Iowans are human
I: Aristotle is a mammal	A: All Iowans are mammals

That which is universally denied of a term is denied of everything contained within that term.

Categorical

E: No humans are plants	E:No humans are plants
I: Aristotle is a human	A:All Iowans are human
O: Aristotle is not a plant	E:No Iowans are plants

3. Principle of universality of the middle term.
The middle term must be understood (at least once in the antecedent) as a universal concept or as an objective note of a universal essence.
Greeks are human; Milo is a Greek; Milo is human.

Categorical (or Assertoric) Syllogism

Definition: A categorical syllogism is one where .the premises (and conclusion) are categorical propositions.

Categorical propositions are propositions where the copula expresses an absolute relationship (is, is not) between the subject and predicate.

Rules of the Categorical Syllogism

1. There must be only 3 terms
2. The middle term must never be found in the conclusion
3. The terms must never be more inclusive in the conclusion than in the premise
4. The middle term must be understood in at least one of the premises as universal (or distributive?)
5. From two negative premises, no conclusion is possible
6. From two particular premises, no conclusion is possible
7. From two affirmative premises, a negative conclusion is not possible (Eg. AAE is impossible)
8. The conclusion always follows the inferior premise
Particular is inferior to universal
Negative is inferior to affirmative
Eg. AEA is invalid; AIA is invalid
AEI is invalid; AIE is invalid

Figures of Categorical Syllogisms

The term 'Figure' means the arrangement of terms within the premises.

There are 4 figures. (2 terms/premise * 2 premises)

Let P & C be extrema. Let M be the middle (common) term.
In proposition 3, the conclusion (C) is always in proposition 1 (The major premise).

Note: Figure 4 is the opposite of figure 1.

Proposition	1	2	3	4
1 Conclusion	**M**-C	C-**M**	**M**-C	C-**M**
2 Premise	P-**M**	P-**M**	**M**-P	**M**-P
3	P-C	P-C	P-C	P-C

Moods of Categorical Syllogisms

Mood: the dispositions and kinds of propositions used in the premises
Using A,E,I and O, there are 4 kinds of propositions.
There are two premises (propositions) per syllogism
There are 16 moods per figure (4 x 4)
There are 4 figures for all the syllogisms.
There are 64 moods for all the syllogisms (4 x (4x4))
With 4 possible kinds of conclusions (A,E,I,O), there are 256 unique syllogisms.

*** Of these 256, only 24 (15+9) will be found to be valid.
Learning how to identify the valid 24 and how to
identify the invalid 232 is a major task.

Invalid Moods

There 7 invalid moods per form. These are identified by
applying the following rules.

No conclusion is possible from
* two negative premises.
This eliminates all EE, EO, OE, and OO combinations.
This eliminates 4 moods per form.

* two particular premises.
This eliminates all II, IO, OI, and OO combinations.
This eliminates 4 moods per form.

This leaves AA, AE, AI, AO, EA, EI, IA, IE and OA.
This leaves 9 moods per form (the OO was common to both
of the foregoing rules)

This result is displayed in the following table.

	First Premise		
2nd Premise	A	E	I	O
A	.....	.....	.....	.....
E	.....	negatives	.....	negatives
I	.....	.....	particulars	particular
O	.....	negatives	particulars	negatives & particulars

Summary: All moods with A may be valid (7 moods)
The EI and IE moods may be valid (2 moods)

Invalid moods of various figures

Assertions:

for Figure	cannot be	must be
	--------- A valid conclusion ----------	
2	affirmative (A or I)	negative (E or O)
3	universal (A or E)	particular (I or O)
4	universal affirmative (A)	non-'A' (E, I or O)

Summary of valid Moods (all figures)

The author asserts (w/o proof) there are 19 valid moods.
Note: the order of premises is important!
1: AAA, AII, EAE, EIO plus AAI and EAO
2: AEE, AOO, EAE, EIO plus AEO and EAO
3: AAI, AII, EAO, EIO, IAI, OAO
4: AAI, EAE, EAO, EIO, IAI plus EAO (already included)

Summary of valid moods by kind of premises:
Valid moods are identified by their form (1-4) and
the mood of their conclusion (A,E,I,O)

2nd Prms.	First Premise A	E	I	O
A	1A,3I,4I	1E,2E,3O,4E,4O	4I	3O
E	2E	negatives	...	negatives
I	1I,3I,3I	1O,2O,3O,4O	particulars	particulars
O	2O	negatives	particulars	negatives & particulars

Note: Underscored conclusions are universals (A & E)
which could be replaced by particulars (I & O).
This adds 5 to 19 for a total of 24 valid syllogisms.
Summary of valid mood by type of figure:

Figure	#	Description
1	4	AAA, AII, EAE, EIO plus AAI and EAO
2	4	AEE, AOO, EAE, EIO plus AEO and EAO
3	6	AAI, AII, EAO, EIO, IAI, OAO
4	5	AAI, EAE, EAO, EIO, IAI
	==	
	19 plus 4 (23 valid moods)	

Note: The underscored items can be converted to 1st form.

Know which are valid/invalid; know why (be able to prove) **** A Non-trivial task (identify which = hard; prove=very hard)

Perfect Figure, Perfect Mood and Perfect Syllogism

Figure 1 is the most perfect of the 4 figures.
It is the only one in which all conclusions are possible
The conclusions follow directly from the premises
(see de Omni and de Nullo)
The AAA and EAE are the most perfect moods of the 1st figure
Their conclusions are universal.
The other moods can be reduced to these two (De Nullo)
AAA->AII; EAE->EIO
The First figure in either of the two perfect moods
constitutes the Perfect (deductive) Syllogism.

Method of Identifying Valid forms
All (valid) modes can be either
converted to a first form equivalent, or
their opposite reduced to the impossible.

Rules of Conversion (See previous section 2.??)
E and I can be converted simply (by swapping extrema)
A can be converted only accidentally (to I)
O cannot be converted.

Examples using conversion
2nd form: Convert 1st or convert 2nd and rearrange P1-P2.
If E is 1st, convert simply (EAE; EIO)
If E is 2nd, convert simply & rearrange P1-P2
(AEE->EAE)
Note: AOO cannot be converted (must be reduced)

3rd form. Convert 2nd or convert 1st&3rd & rearrange
If E or I is 2nd, convert simply (EIO,AII)
If E or I is 1st and 3rd, convert both simply and
rearrange P1-P2 (IAI->AII)
If A is 2nd, convert to I (EAO->EIO,AAI->AII)
Note: OAO cannot be converted (must be reduced)

4th form. Convert conclusion and rearrange premises
If E or I is 3rd, convert simply and rearrange P1-P2
(IAI->AII; AAI->AAI)

Examples using reductio ad absurdum
(Assume opposite is True, demonstrate impossibility)
2nd form AOO. Take the conclusion (O), obtain its contradictory (A) and affirm it (A).
Substitute this contradictory conclusion (A) for 1 of the premises(O).
We arrive at a perfect syllogism (AA/A). Thus the original syllogism is valid.

Modal Syllogisms

Defined: a syllogism with a premise which is a modal.

Rule: the modality in the premise must be maintained in in the conclusion.

Rule: the same forms are valid for modal syllogism as are valid for categorical syllogism.

Example in 1st form AII:

All mammals are warm-blooded
Some dinosaurs may be mammals
Some dinosaurs may be warm-blooded

The Enthymeme:

Defined: an incomplete syllogism (one missing premise)

Rule: The remaining premise provides the middle term and the conclusion gives the two extrema.

Example: All peredactyls are dinosaurs
Therefore, all peredactyls may be mammals
(See example above)

Sorites:

Defined: an extended syllogism with several middle terms.

Example: All B is A
All A is C
All C is D
All D is E
then All B is E

Compound Syllogisms

Defined: A syllogism with at least one compound proposition.

There are as many kinds of compound syllogisms as there are kinds of compound propositions.

a. conjunctive or disjunctive syllogism:

Example of disjunctive affirmative:

A cannot be both B and C
A is B
thus, A cannot be C

b. Conditional syllogism

Defined: a syllogism with a conditional premise

Example: If Dr Jones is right then dinosaurs are mammals
All mammals are warm-blooded
then if Dr Jones is right, dinosaurs are warm-blooded

Rules for more complex conclusions

Affirming the

1. condition accepts the conditioned
2. conditioned is not accepting the condition

Rejecting the

3. condition does not reject the conditioned
4. conditioned rejects the condition

Example: If Dr Jones is right then dinosaurs are mammals
Dinosaurs are not mammals thus: Dr Jones is not right

c. Causal syllogisms

Definition: a premise is a causal proposition (because)

Rule: A causal syllogism can be converted to a conditional syllogism (because is the logical equivalent of if)

Examples:

* A lunar eclipse occurs because moon enters the earth's shadow (time conditioned = can)
The earth does cast a shadow to the moon. thus a lunar eclipse can occur.

* Dinosaurs must die when rodents eat all their food
Rodents ate all the dinosaur's food thus the dinosaurs must die

d. The dilemma. A disjunctive syllogism so constructed that the same conclusion follows (no matter which part of the disjunctive premise is affirmed)

Example: Logicians are either right or wrong
If they are right, they do not need logic
If they are wrong, logic is of no help
-->logic is useless to logicians

Polysollgism

Defined: a series of syllogisms where the conclusion for one set are a premise for a subsequent set.

Classification of Deductive Syllogisms

Apart from the preceding distinctions, deductive syllogisms may be classified by their premises into 4 classes: demonstrative, probable, erroneous and fallacious

* Demonstrative (conclusion is a certainty)
  Both premises involve necessary matter: all men are mortal
  The premises must be necessary:
    predicate is an element in essence of subject
    subject is an element in essence of predicate
  The predicate must be universal:
    It must apply equally to all of whom it is affirmed
  The predicate must be primary:
    All men are mortal vs all men are hairless bipeds

* Probable (conclusion is an object of opinion)
  A premise involves probable matter (based on opinion)

* Erroneous (conclusion is false)
  Example: Heroes are looked up to. Tall people are looked up to Therefore Tall people are heroes

* Fallacious (conclusion is intentionally false)
  an erroneous syllogism intended to deceive)

Fallacies in Deductive Reasoning

1. Equivocation (see the preceding example)
2. Accident:
   Wine is an inebriating beverage
   John is drinking wine
   -->John is inebriated
3. Confusion between Absolute and Qualified, Universals and Particulars:
   Book Example: 2nd form [AAA & IAI are both invalid]
   Chairman Mao is a yellow skinned person
   Koreans are yellow-skinned people
   -->Chairman Mao is a Korean
   Example: 1st form (AAA vs IAA)
   Chairman Mao is yellow skinned
   The head of the party is Chairman Mao
   The head of the party is yellow-skinned

4. Ignoring the issue
Avoiding, skirting or evading the conclusion

5. Begging the question
Example: Mary gets sick when she drinks milk
thus Mary is not a milk-drinker.

The Inductive Syllogism:

Defined: A group of 3 propositions in the reverse order
as in a deductive syllogism

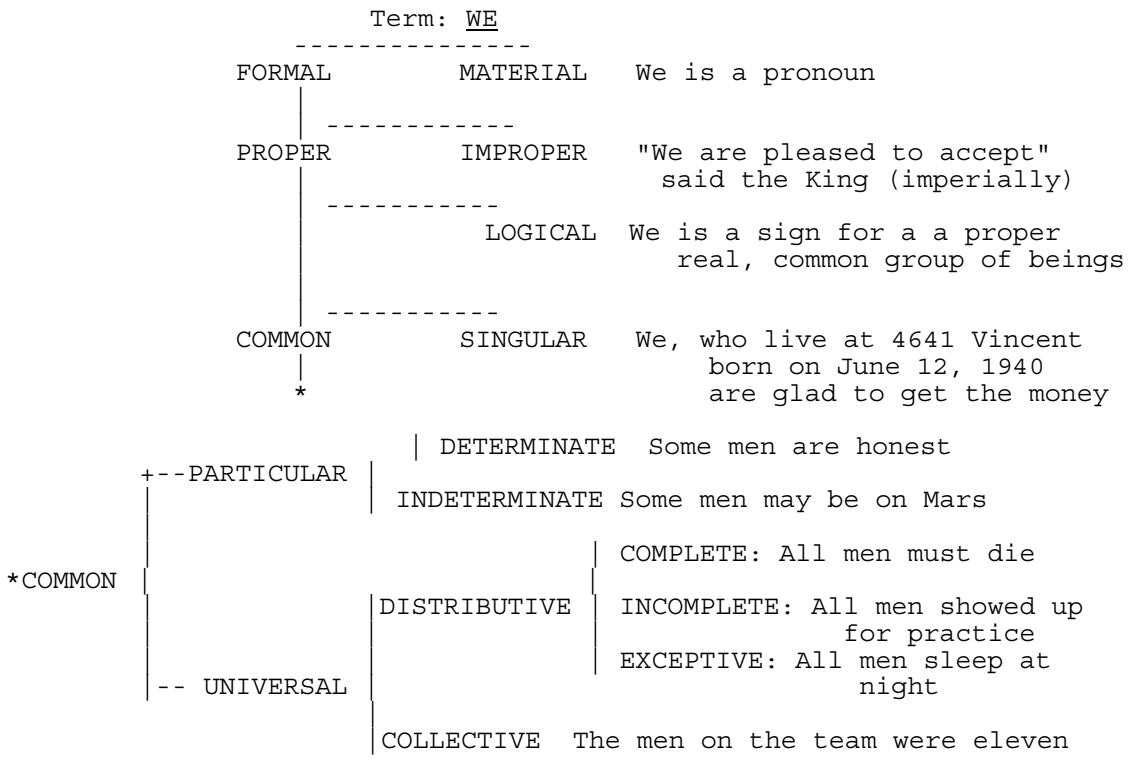
Example: All animals that I know drink water
The Eland is an animal; therefore all Elands drink water

Note: The Eland is an African Antelope;
The Eland does not need to drink water.

Discussion:
Man senses particulars (not universals)
Man senses properties (not things or stuffs)
Man inductively infers existence, identity, essence, genus and species
All premises for deductive propositions are inductions

Universal Principle:
Whatever is affirmed (denied) of ALL the particulars
is affirmed (denied) of the universal.

Sufficient and Insufficient Induction:
When enough (so few) particulars are known that a
universal is (not) warranted.


Term: WE
FORMAL
MATERIAL
We is a pronoun
PROPER
IMPROPER
"We are pleased to accept"
said the King (imperially)
LOGICAL
We is a sign for a a proper
real, common group of beings
COMMON
SINGULAR
We, who live at 4641 Vincent
born on June 12, 1940
are glad to get the money
*
*COMMON
PARTICULAR
UNIVERSAL
DETERMINATE
Some men are honest
INDETERMINATE
Some men may be on Mars
DISTRIBUTIVE
COMPLETE: All men must die
INCOMPLETE: All men showed up
for practice
EXCEPTIVE: All men sleep at
night
COLLECTIVE
The men on the team were eleven