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ARISTOTELIAN STRUCTURE OF SYLLOGISM

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Abstract. Mind has concepts and ideas which everyone wants to express or communicate. For this purpose we use words, signs and symbols. By using these ones we formulate sentences and such sentences form a language which each human being use in talking, writing or in conversation. Due to the combination of words we make sentences and by combining the latter we make hypothesis and syllogism. In Aristotle's scheme of logic, "Syllogism" occupies important place. Here focus is "Syllogism", its formulation, kinds and importance.

Key Words: Distribution, Figure, Mood, Proposition, Rules, Sentence**,** Terms.

Aristotle has been considered the father of logic. If it is not true yet the critics have to accept that he is the first one who clearly presented the laws of logic and made it a science. He laid the foundations of this science and started it from the concepts to words. And from words to sentences and from there to propositions and premises and to the conclusion. In his system of logic, "Syllogism" occupied the central place.

The process of deducing result is called Inference which is divided into two branches e.g. "Direct Inference" (a process in which conclusions are derived from one premise e.g. The Traditional Square of Opposition) while the other branch is called the "Indirect Inference" (and in this process results can be deduced from two premises and result as third premise). This later form is called Syllogism. In discussing syllogism, its forms, process, results, methods, moods etc. it is convenient to start from making distinction between a "Sentence" and a "Proposition".

Definition of Sentence

According to Antisthenes a sentence is "that which indicates what a thing was or is" and he stated also, that "someone who says what is, speaks truly".[1]

Regarding types of sentences the sophists classified them. So question, command, wish, answer were included by Protaghorasa and (phasis) assertion, (apophsis) denial, appellation and question were distinguished by Alcidamas.[2]

The earliest piece of logic is perhaps is seen in the *Dissoin Logoi* (Double Argument). It is a discussion on falsehood or truthfulness. There are at least, two groups regarding the status of truth in sentences.

The first group has the opinion that *"Truth is a Temporal property"*. And a sentence is recognized true in a condition if and only if the situation is as depicted by the sentence when it is expressed and it is false if it is not describe the present situation.

The other group says that *"Truth is a A-Temporal property"* of sentences, a sentence is true if and only if in a condition when whatever is said is the case otherwise false.[3]

Aristotle in his magnum opus "The Organon," (The Instrument, concerning logical presentation of thoughts in the form of arguments) laid the foundations and builds the structure of what we called "Syllogism".

In Fact, this title expresses the controversial debates regarding the status of Logic as being a part of Philosophy (according to some Stoics) or as a tool or instrument used by philosophy (According to some latter Peripatetics) and naming this work (The instrument) is favouring the later view. Keep in mind that Aristotle himself never used this term.[4]

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[1] Borchert, Donald M., ed. *Encycloppedia of Philosophy*. New York: Thomson Gale, Macmillan Reference, 2006.

[2] İbid.

[3] Borchert, Donald M., ed. *Encycloppedia of Philosophy*. New York: Thomson Gale, Macmillan Reference, 2006.

[4] www.stenfordencyclopedia.com

Aristotle devised logical rules for the recognition of concepts, as they are, to keep oneself away from vagueness and meaninglessness. And it was the basis for making a tool to measure validity of thought. Logical rules are not about the 'process of thought' which psychology deals, but they are about the 'product of thought' i.e. how our thought 'ought to be'. In other words we apply logical rules to determine the validity of thought, and validity or truth is the freedom from self-contradiction, and in agreement with actual facts.

Classification of Sentences

In common routine life we, to express our meanings, wishes, assertions, denials, prayers, happiness exclamations, joys, grieves etc. use every kind of sentence depending on situation (as we already have seen that sophists tried to classified sentences) so Aristotle also categorized the sentence in detail e.g.

1= Propositions of Affirmation and Negation Type
2= Propositions of Particular and Universal Type
3= Propositions of Simple and Compound Type
4= Propositions of Hypothetical, Categorical and Disjunctive Type
5= Propositions of Synthetic or analytical Type

Aristotle, taking only the first and the second type of propositions builds his system of Syllogism.

Formation of Propositions

The logical form of a proposition is determined by its quantity (universal and particular) and by its quality (affirmative and negative). So both terms in a proposition are classes which can be so related in at least three ways:

1- All of one class may be included in all of another class. Thus the class of all cats is wholly included (or wholly contained) in the class of all mammals.

2- Some, but not all, of the members of one class may be included in another class. Thus the class of all students is partially included (or partially contained) in the class of all females.

3- Two classes may have no members in common. Thus the class of all triangles and the class of all circles may be said to exclude one another.[5]

Difference between a "Sentence" and a "Proposition".

A sentence may occur in every tense (Past, Present and Future) and can express any type of emotion or thought but Aristotle limited the term of proposition only to those sentences which are only in present tense having the quality of *Affirmation* or *Negation* and being only *Universal* or *Particular*. According to him, a proposition involves two terms, a subject and a predicate, each of which is grammatically represented with a noun. These nouns are the concepts (of classes or the categories) and their combination and separation determine the truth value of a proposition i.e. when their combination and separation corresponds to the combination and the separation of the thing they represent. Every such sentence must have the same structure: it must contain a subject and a predicate and must either affirm or deny the predicate of the subject. Thus every assertion is either the affirmation or the denial of a single predicate of a single subject.

The Structure of Proposition

Aristotle formulated the structure of proposition as subject, predicate and copula. Here copula is only the joining sign among both terms. Many sentences contain assertion by virtue of time i.e. past, present and future. But Aristotelian logic is confined only to present tense of logical form. The verb 'to be' i.e. 'is' is not just a link between two terms but is itself a part of the predicate as asserted. Aristotle supposed that every proposition was analyzable to subject and predicate by the help of the verb 'to be'.

Types of Propositions

In 'Categories' Aristotle gives account for the formulation of the theory of 'Terms' and in 'De Interpretation' he turns to proposition which are sentences that contain either truth or falsity and propositions assert judgments about concepts so from the categorization of sentences

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[5] Copi, Irving M. *Introduction to Logic.* 11. New York: Macmillan Publishing Company, 1990.

he takes the Quality expressing Propositions (Affirmation or Negation) and Quantity describing propositions (Particular or Universal) and forms the following four types of Propositions

1= Proposition of Universally Affirmative Type
2= Proposition of Universally Negative Type
3= Proposition of Particular Affirmative Type
4= Proposition of Particular Negative Type

Due to certain objectives e.g. he gives them special signifying symbols (A.E.I.O)

"A" signifies Universal Affirmative Proposition
"E" signifies Universal Negative Proposition
"I" signifies Particular Affirmative Proposition
"O" signifies Particular Negative Proposition

These four propositions are the building blocks or the bricks of the building of Syllogism.

Components of a Proposition in Syllogism

When we want to express a concept of mind in the form of a word e.g. "CAT" or "DOG" or "TABLE" or "MAN", we use words and the proper arrangement of the words form a sentence or a proposition. Aristotle calls these words "Terms" instead of words. He explains that a proposition is a combination of the following "Terms" e.g.

1. The Subject (loosely, It is the doer of an action)
2. The Predicate (on it the action is to be done)
3. The Copula (It is the linking term)

Components:	Subject	Copula	Predicate
Proposition	Man	is	mortal
Proposition	Plato	is	man

Location of these terms

To locate the proper place of the above said terms (The Subject, The Predicate, The Middle Term) we have to recognize the Middle Term.

A= The common Term which is called "The middle term" is the one that takes place in the Major Proposition as well as in the Minor Proposition.

B= The Major Term is the predicate of the conclusion and is located in the Major

C=The Subject of the Conclusion is the Minor Term and is placed in the Minor Premise.

So the formulation is as follows:

Proposition	**Man**	**is**	**Mortal**
	(Middle term)	*(Copula)*	*(Predicate)*
Proposition	**Plato**	**is**	**Man**
	(Subject)	*(Copula)*	*(Middle term)*
Conclusion	**Plato**	**is**	**Mortal**
	(Subject)	*(Copula)*	*(Predicate)*

Definition of Syllogism

According to Aristotle,

"A syllogism *[sil-uh-jiz-uh m (noun)]*[6] is discourse in which certain things being stated, something other than what is stated follows of necessity from their being so. It means they produce the consequence and by this that no further term is required from without in order to make the consequence necessary."[7]

A set of three premises which form an argument of which the last one (of the three propositions) is regarded as conclusion of such argument and proved as a result of the Major Proposition (having Major Term) and the Minor Proposition (having Minor Term) with a

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[6] http://dictionary.reference.com/browse/syllogism www.stenfordencyclopedia.com

[7] Aristotle. *The Complete Works (Prior Analytics).* Translated by A. J. Jenkinson. digital edition, 2011

connecting common term between the former and later propositions is called Syllogism.[8]

Kinds of Syllogism

There are two Kinds of Syllogism.

Perfect and Imperfect.

The former is one that which demands nothing other than what has been said to make clear what whatever necessarily follows and the latter is the one that demands one or many more propositions.[9]

Distribution of Terms

"Distribution is an attribute of the terms (subject and predicate) of propositions".

"A term is said to be distributed if the proposition makes an assertion about every member of the class denoted by the term; otherwise, it is undistributed."[10]

So the "Distribution" of terms in all the four propositions is as follows:

►In the Universal Affirmative proposition:

		Subject	Copula	Predicate
A =	All	Dogs	are	Chairs

The subject is taken as a whole so here Subject term is the distributed term.

►In the Universal Negative proposition:

		Subject	Copula	Predicate
E =	No	Dogs	are	Chairs

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[8] http://dictionary.reference.com/browse/syllogism

[9] Aristotle. *The Complete Works (Prior Analytics).* Translated by A. J. Jenkinson. digital edition, 2011.

[10] Hurley, P.J. *A Concise Introduction to Logic.* 11. Boston: Wadsworth Cengage Learning, 2012.

Here both classes e.g. the subject class and the predicate (the attribute of subject) have no participation and excluded from one another so in E Proposition both terms are distributed terms.

►In the Particular Affirmative proposition:

	Subject	Copula	Predicate
I=	Some Dogs	are	Chairs

In this "I" (particular affirmative) proposition both classes e.g. the subject and the predicate have not been taken as a whole but as a part so both terms are undistributed.

►In the Particular Negative proposition:

	Subject	Copula	Predicate
O=	Some Dogs	are-not	Chairs

In this "O" (particular negative) proposition the subject class has been taken as a part but the object class signifies the whole class so the predicate class is distributed one.

Figures of Syllogism

In constructing the syllogistic argument, according to Aristotelian Rules only three propositions are allowed in which only three terms each being used twice can from the syllogistic argument. The common term which is called middle term which can be found in the major and minor premises plays a vital roll in forming the structure of syllogistic argument. Analysis shows that the middle term can take the following possible places in the syllogistic argument. This formation is called the Figures of Syllogism.[11]

Figure 1	Figure 2	Figure 3	Figure 4
M P	P M	M P	P M
S M	S M	M S	M S
S P	S P	S P	S P

[11] Hurley, P.J. *A Concise Introduction to Logic.* 11. Boston: Wadsworth Cengage Learning, 2012.

It must not be ignored that Aristotle presented only three Figures.[12]

The remaining fourth figure is latter addition by Galen[13]. But now all the four figures are mentioned in the books regarding the subject.[14]

Rules of Constructing Valid Syllogistic Argument.[15]

1= In a standard and valid form of syllogistic argument it must have only three terms:

(The Subject, The Predicate and the Middle term).

2= In a standard and valid form of syllogistic argument each of the term must be used in exactly the same sense throughout the argument in which it is used at first.

3= A standard and valid form of syllogism must have only three Premises:

(The Major premise, The Minor Premise and The Conclusion).

Not more or less than three propositions.

4= In a standard and valid form of syllogistic argument The Middle Term must be distributed at least in any one of the premises between the The Major Premise or The Minor Premise.

5= In a standard and valid form of syllogistic argument no term, subject or predicate of the conclusion can be taken as distributed if it is not distributed in the premise.

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[12] Aristotle. *The Complete Works (Prior Analytics).* Translated by A. J. Jenkinson. digital edition, 2011.

[13] Stebbing, Susan. *A Modern Elementary Logic.* London: Methuen & Co Ltd, 1961.

[14] Copi, Irving M. *Introduction to Logic.* 11. New York: Macmillan Publishing Company, 1990.

[15] Aristotle. *The Complete Works (Prior Analytics).* Translated by A. J. Jenkinson. digital edition, 2011

6= In a standard and valid form of syllogistic argument, if both the Major and the Minor premises are Universal then Particular conclusion cannot be derived.

7= In a standard and valid form of syllogistic argument if any one of the Major or the Minor premises is Particular the Conclusion must be Particular.

8= In a standard and valid form of syllogistic argument no conclusion can be drawn from two Particular premises.

9= In a standard and valid form of syllogism, conclusion cannot be derived from two Negative propositions.

10= In a standard and valid form of syllogistic argument if any one of the Major or the Minor premises is negative the conclusion of the argument must be negative.

11= In a standard and valid form of syllogistic argument no conclusion can be drawn from the Particular Major Premise and The Minor Negative Premise.

Moodes of Syllogism

In logic we have four propositions A, E, I, O, but in deducing result in syllogism we can use only three proposition being the major proposition, the minor proposition and the conclusion. So the mood of standard form of a syllogistic argument is presented by the short names of propositions A, E, I, O. The mood is presented only through the three letters because the standard form of categorical syllogistic argument comprises on three propositions e.g. AA A. AI I, EA E, etc. The first letter signifies the Major premise, the second signifies the Minor premise and the last one signifies the conclusion.

So a standard form of a syllogistic argument depends on the Four standard forms of categorical propositions (A, E, I, O) as well as on the placement of middle term in the propositions. Consequently, we by multiplying the four propositions get the following possible forms of syllogistic arguments.

A x (A, E, I, O)				**E x (A, E, I, O)**			
AA-A,	AA-E,	AA-I,	AA-O,	EA-A,	EA-E,	EA-I,	EA-O,
AE-A,	AE-E,	AE-I,	AE-O,	EE-A,	EE-E,	EE-I,	EE-O,
A I-A,	A I-E,	A I-I,	A I-O,	EI-A,	E I-E,	E I-I,	EI-O,
AO-A,	AO-E,	AO-I,	AO-O,	EO-A,	EO-E,	EO-I,	EO-O,

I x (A, E, I, O)				**O x (A, E, I, O)**			
IA-A,	IA-E,	IA-I,	IA-O,	OA-A,	OA-E,	OA-I,	OA-O,
IE-A,	IE-E,	IE-I,	IE-O,	OE-A,	OE-E,	OE-I,	OE-O,
I I-A,	I I-E,	I I-I,	I I-O,	OI-A,	OI-E,	OI-I,	OI-O,
IO-A,	IO-E,	IO-I,	IO-O,	OO-A,	OO-E,	OO-I,	OO-O,

These are 64 moods of syllogistic arguments and each multiplied by the 4 figures of syllogism results 256 mood of a standard form of a categorical syllogistic argument. Among these 256[16] moods, only a few moods are valid and all the remaining are false due to the violation of any rule mentioned above or it commit any fallacy which leads to incorrect conclusion.

Conclusion

It is clear evidence and bright fact that Aristotle's logic ruled over two thousand years but due to modern research some criticisms have also been made by logicians.

Aristotle's logic is basically a *Term Logic* i.e. Terms are the building blocks of proposition and propositions are the building blocks of syllogism. But modern logic is not term logic, in modern logic; whole proposition may be taken just as a variable. But Aristotle's logic is the evaluation of terms and terms designate classes, so that is why, traditional square of opposition is opposed chiefly in modern logic. George Boole points out the imperfection in the square of opposition. If we take 'I' proposition 'some unicorns have horns', which could be inferred by its correspondent 'A' proposition 'all unicorns have horns'. Here problem arises that in 'I' proposition, we have to take at least one

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[16] Copi, Irving M. *Introduction to Logic.* 11. New York: Macmillan Publishing Company, 1990.

instance, whose existence we have to assert. So 'I' proposition has existential import. If 'I' proposition has existential import than its correspondent 'A' must have too. This problem led the square of opposition in doubtful condition. But to secure its previous position Boole suggested the concept of 'pre-supposition' that we must assume or presuppose that the corresponding universal proposition never refers to any empty class. But the resolution of the 'blanket existential presupposition' imposed many intellectual errors and Boolean interpretation doesn't have to assume that there are any members in any class. Modern theory abandoned Aristotelian concept of empty class. Modern logic takes universal proposition as having no existential import. 'All unicorns have horns 'and 'no unicorns have wings' may both be true in modern logic even if there are no unicorns. But if there are unicorns then 'I' proposition 'some unicorns have horns' is false and also the 'O' proposition 'some unicorns don't have wings'.

In modern logic, variables are used instead of terms and propositions, and modern logicians mathematically deduct the conclusion from given variables. So the structure of proposition and syllogism in modern logic is not restricted to subject, predicate and copula, as it was in the Aristotelian logic and it is different from traditional logic.

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