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# CATEGORICAL SYLLOGISM

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## CATEGORICAL SYLLOGISM

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### **Introduction**

The syllogism is often regarded as Aristotle’s chief accomplishment in logic. This is why Bertrand Russell says that Aristotle’s most important work in logic is the doctrine of the syllogism (Russell, Aristotle’s Logic 120). In support of this point of view, Peter King and Stewart Shapiro assert that “Aristotle was the first thinker to devise a logical system; the syllogism was his greatest invention in logic” (496). Aristotle defined the syllogism as “a discourse in which certain things being stated, something other than what is stated follows of necessity from their being so. I mean by the last phrase that they produce the consequence, and by this that no further term is required from without in order to make the consequence necessary” (Aristotle, *Prior Analytics* 5). Aristotle gave priority to the categorical proposition as the most fundamental statement (Hurley 6). Hence, a syllogism is a form of reasoning which consists of three categorical propositions having between them exactly three terms each of which occur twice in a manner that the first two propositions jointly imply the third proposition. Since logic deals with arguments and arguments are made up of propositions, it is necessary to begin the discussion on categorical syllogism with an elucidation of the notion of ‘class’ as the defining quality of categorical propositions.

### **The Notion of Class in Categorical Propositions**

The premises and conclusion of arguments are stated in propositions. A proposition is a declarative statement with a definite truth-value. While all propositions can be seen as sentences,

not all sentences can be regarded as propositions. This is because not all sentences are declarative in the sense that a definite truth value can be attributed to them. That is why an exclamation like “that is fantastic!; a command like ‘turn off the television now!’; a prayer like ‘may I die the death of the righteous’; a question like ‘what is your C.G.P.A?’; a suggestions or request like ‘please can you pass me the salt?’ are not propositions because they are not declarative statements. A sentence is a proposition for traditional logic only if it is capable of being either true or false. Truth or falsity can be attributed to statements like: ‘all philosophers are wise persons’; ‘some books are informative documents’; ‘all givers are individuals that never lack’ and so on. The three propositions given here are not just propositions. They have a unique feature which is the quality of being ‘categorical’. What does that mean?

Categorical propositions assert or deny a relationship between classes or terms. For example the statement “all Nigerians are Africans’ is a categorical proposition because it asserts that all members of the class “Nigerians’ are members of another class “Africans’. This feature is lacking in a singular propositions like ‘Socrates is mortal’; ‘Chioma is not hardworking’ and so on which either affirm that the individual mentioned possesses or does not possess a certain quality respectively. In spite of the fact that the statements: ‘Socrates is mortal’ and ‘Chioma is not hardworking’ are declarative, and hence qualify to be seen as propositions, they do not have the categorical quality. That is why they are referred to as singular propositions. They do not make assertions about classes of things. This clarification is fundamental because in dealing with categorical syllogism, such statements are either ruled out since they do not make reference to categories or they are translated into their categorical equivalents. For instance, ‘Socrates is mortal’ can be translated and read as: ‘all individuals identical with Socrates are persons that are mortal’. In this way ‘individuals identical with Socrates’ becomes the subject class while

‘persons that are mortal’ is the predicate class. That way, the singular proposition becomes categorical and can be used in a categorical syllogism.

The notion of ‘class’ in categorical propositions simply indicates that we are either including a class of things into another or excluding a class of things from another either wholly or partially. Since any categorical proposition asserts that either all or part of the class denoted by the subject term is included in or excluded from the class denoted by the predicate term, it implies that there are exactly four types of categorical proposition, namely;

- (1) Those that assert that the whole subject class (s) is included in the predicate class (p): (all s is p).
- (2) Those that assert that the whole subject class (s) is excluded from the predicate class (p): (No s is p).
- (3) Those that assert that part of the subject class (s) is included in the predicate class (p): (some s is p).
- (4) Those that assert that part of the subject class (s) is excluded from the predicate class (p): (some s is not p).

The four types of categorical proposition listed above have the following respective names: Universal Affirmative or A Proposition; Universal Negative or E Proposition; Particular Affirmative or I Proposition and Particular negative or O Proposition respectively. The words all, some and no as used above are called quantifiers because they specify the quantity of the subject class that are either included or excluded from the predicate class. Any standard form categorical proposition must follow the order stated below:

Quantity → subject class → copula → predicate class

In the proposition “All Nigerians are Africans”, ‘All’ is the quantifier; ‘Nigerians’ is the subject class, ‘are’ is the copula while ‘Africans’ is the predicate class. In the light of this a statement like ‘dogs bark’ becomes ‘all dogs are animals that bark’; ‘givers never lack’ becomes ‘all givers are persons that never lack’; ‘few judges are incorruptible’ becomes ‘some judges are incorruptible individuals’; ‘there is at least one umpire that is biased’ becomes ‘some umpires are biased’; ‘two students are intelligent’ becomes ‘some students are intelligent individuals’ and so

on. A careful look at the translated statements reveal that the essential qualities of quantity, subject class, copular and predicate class are made explicit where they were implicit in the given propositions. This is what it means to translate a statement into its standard form categorical proposition equivalent. With the clarification made here, we can proceed to syllogistic arguments.

### **Categorical Syllogism**

A categorical syllogism or a syllogistic argument is a particular kind of argument containing three categorical propositions, two of which are the premises while one is the conclusion. It is a deductive argument in which a conclusion is inferred from two premises. The three categorical propositions of a categorical syllogism together consist of exactly three terms each of which occurs in exactly two of the three propositions. A good example of a categorical syllogism is:

All Nigerians are Africans  
Some Nigerians are women  
Therefore some women are Africans

In combining these three propositions, we have built up a categorical syllogism. We have made three statements in which the third is a conclusion drawn from the first two statements which are its premises. As can be seen in the syllogism stated above, a syllogistic argument is made up of three propositions each with a subject and a predicate. In the propositions “All Nigerians are Africans” for instance, the subject is Nigerians because what is stated in the predicate is stated in reference to the subject. The predicate explains the action of the subject or the attribute it has given to it.

A categorical syllogism is said to be in standard form when its premises and conclusion are all standard form categorical propositions and are arranged in a specified order: the major premise stated first, followed by the minor premise as the second and thirdly the conclusion

which is stated last. In other words, the first two propositions in a standard form categorical syllogism are called premises. The first is the major premise, the second is the minor premise while the third is the conclusion. The idea of standard form categorical syllogism should not be confused with that of standard form categorical proposition discussed earlier. Standard form categorical proposition refers to the translation of a proposition while standard form categorical syllogism has to do with the proper arrangement of an argument.

### **The Major Term, the Minor Term and the Middle Term**

The predicate of the conclusion is said to be the major term of the syllogism; the subject of the conclusion is the minor term; and the middle term occurs once in each of the premises but not in the conclusion. Let us consider the categorical syllogism below.

No heroes are cowards  
Some soldiers are cowards  
Therefore some soldiers are not heroes.

In the example of above, heroes is the major term, soldiers is the minor term, while cowards is the middle term, occurring in both premises but not in the conclusion. The premises of a standard form syllogism are named after the terms that appear in them. The premise containing the major term is the major premise, while the premise containing the minor term is the minor premise. The middle term is not named after any premise. It is common to both premises because it is the link between the two premises. In the example cited above, ‘cowards’ is the middle term. It has become conventional to label the subject and predicate terms as ‘S’ and ‘P’ respectively, while the middle term is simply labeled as ‘M’.

A categorical syllogism is said to be in standard form when its premises and conclusion are all standard form categorical propositions and are arranged in a specified order: the major premise stated first, followed by the minor premise and the conclusion coming last. The conclusion of a standard form categorical syllogism contains two of the syllogism’s three terms.

These are the major term and the minor term. The major term is the term that serves as the predicate of the conclusion while the minor term is the subject of the conclusion. These terms are used to identify the major premise and the minor premise respectively. The major premise contains the major term which is the predicate of the conclusion while the minor premise contains the minor term which is the subject of the conclusion. The middle term is the term that occurs in these two premises but not in the conclusion. These terms are to be ordered in a manner that the first premise is the major premise, followed by the minor premise before the conclusion coming last.

### **Mood and Figure of Categorical Syllogistic Arguments**

After a categorical syllogism has been put into standard form, its validity or invalidity may be determined through mere inspection of the form. The individual form of a syllogism consists of two factors: mood and figure. The mood of a categorical syllogism consists of the letter names of the propositions that make it up. For example, in the categorical syllogism: No heroes are cowards; Some soldiers are cowards; Therefore some soldiers are not heroes, the major premise is an E proposition, the minor premise an I proposition, and the conclusion an O proposition. The mood of that categorical syllogism is EIO.

The mood of a categorical syllogism is determined by the types of standard form categorical propositions it contains. The mood of every syllogism is represented by three letters in a sequential order. The first letter names the type of categorical proposition that the major premise is; the second letter names the type that the minor premises is, while the third letter names the type of categorical proposition that the conclusion is. In other words, the mood of a syllogism will consist of three letters taken from A, E, I and O propositions. Each of the letters identifies the kind of categorical proposition that the major premise, minor premise and the conclusion is.

The figure of a categorical syllogism is determined by the position of its terms, in particular, the position of the middle term in its premises. There are four possible positions of the middle term. This is why there are four possible figures which form the structure of the categorical syllogism. These figures are

1	2	3	4
M    P	P    M	M    P	P    M
<u>S    M</u>	<u>S    M</u>	<u>M    S</u>	<u>M    S</u>
S    P	S    P	S    P	S    P

We will completely describe the forms of a syllogism by stating its mood and figure. While the figure indicates the position of the middle term in the premises, the mood serves to show the sorts of propositions that are used in the whole argument. In all, there are 64 possible moods and 256 distinct forms. The mood of that categorical syllogistic argument below was stated as EIO. But the form of the argument is not determined by its mood alone but also by its figure. In determining its figure, one needs to identify the conclusion of the argument as the predicate of the conclusion is the subject term while the subject of the conclusion is the minor term. In this sense, ‘heroes’ is the major term while ‘soldiers’ is the minor term. ‘Cowards’ is the middle term, occurring in both premises but not in the conclusion. The figure of the standard form categorical syllogism below is figure 2, that is:

“No heroes are cowards.  
Some soldiers are cowards.  
Therefore, some soldiers are not heroes”.

Thus, the form of the argument which comprises of its mood and figure is EIO2.

When asked to rewrite a syllogism into its standard form and name its mood and figure, the procedure is to:

- 1) Identify the conclusion
- 2) Note the predicate term of the conclusion which is the major term of the syllogism.
- 3) Identify the major premise.
- 4) Verify that the other premise is the minor premise



- 5) Rewrite the argument in standard form: major premise stated first, minor premise followed by the conclusion.
- 6) Name the mood and figure.

In summary, in a categorical syllogism, each of the three terms has its own name depending on its position in the argument. The major term is the predicate of the conclusion, and the minor term is the subject of the conclusion. The middle term, which provides the middle ground between the two premises, is the one that occur once in each premise and does not occur in the conclusion. A standard-form categorical syllogism is one that meets the following four conditions:

1. All three statements are standard-form categorical propositions.
2. The two occurrences of each term are identical.
3. Each term is used in the same sense throughout the argument.
4. The major premise is listed first, the minor premise second, and the conclusion last

The first condition requires that each statement has a proper quantifier, subject term, copula, and predicate term. The second and third conditions rule out the possibility of equivocation. For example, if a syllogism containing the word "men" used that term in the sense of human beings in one statement and in the sense of male human beings in another statement, the syllogism would contain more than three terms and would, therefore, not be in standard form. Finally, the fourth condition requires that the three statements be listed in the right order – the major premise stated first, followed by the minor premise and the conclusion. Let us illustrate with an example:

“All watercolors are paintings.  
Some watercolors are masterpieces.  
Therefore, some paintings are masterpieces”.

The syllogism above is not in standard form. To put this syllogism into standard form the order of the premises must be reversed. The major premise, the one containing "masterpieces," which is the predicate term in the conclusion, must be listed first, and the minor premise (the one containing "paintings;" which is the subject term in the conclusion) must be listed second.

Techniques that have been developed for translating non-standard-form syllogisms into equivalent arguments that are in standard form are in line with the four conditions listed above.

From the foregoing, it has been illustrated how given a syllogism, we can obtain the mood and figure. Sometimes we can be given the mood and figure of categorical syllogisms and asked to state them fully in natural language. Suppose we are given the form EIO4 to reconstruct in syllogistic form, we first use the mood to determine the structure of the form:

- E     No \_\_\_\_\_ are \_\_\_\_\_
- I     Some \_\_\_\_\_ are \_\_\_\_\_
- O     Some \_\_\_\_\_ are not \_\_\_\_\_

Then we use the figure to determine the arrangement of the middle terms

- E     No \_\_\_\_\_ are medical practitioners
- I     Some medical practitioners are \_\_\_\_\_
- O     Some \_\_\_\_\_ are not \_\_\_\_\_

Thirdly, supply the major and minor terms bearing in mind that the predicate of the conclusion is always repeated in the major (first) premise while the subject of the conclusion is always repeated in the minor (second) premise. In that way, we have the following as the correct translation for EIO4.

- E     No pugilists are medical practitioners.
- I     Some medical practitioners are song writers.
- O     Therefore, Some song writers are not pugilists.

What the above points imply is that one should be able to translate a syllogistic argument into its mood and figure. Also, if given the mood and figure, one should be able to translate them into their ordinary language equivalents.

### **Rules and Fallacies of Categorical Syllogism**

The idea that valid syllogisms should conform to certain rules was first discussed by Aristotle. If any of the rules is violated then the syllogism is invalid on account of a specific fallacy committed. Conversely, if none of the rules is violated, then the syllogism is valid. In order to eliminate invalid arguments from the two hundred and fifty six possible syllogisms,

there are some rules which explain the necessary conditions for the validity of any syllogism. A syllogism is valid if its form makes it impossible for the syllogism to have both premises true and its conclusion false.

**Rule 1:** A valid standard form categorical syllogism must contain exactly three terms each of which is used in the same sense all through the argument. In other words a valid categorical syllogism must not contain more than three terms. Any categorical syllogism that contains more than three terms is said to be invalid and commits the fallacy of four terms. A good example is:

All bats are nocturnal creatures  
Some bats are objects used for the game of lawn tennis  
Therefore, some objects used for the game of lawn tennis are nocturnal creatures.

The above argument is invalid because in a valid categorical syllogism, the three terms must be used in the same sense. In the argument above, the first premise is talking about bats as nocturnal flying animals while the second premise is talking about bats as objects used in the game of lawn tennis. Thus instead of three terms which is the standard for categorical syllogism there are four terms in the argument namely ‘nocturnal creatures’ which is the major term, ‘objects used in the game of lawn tennis’ which is the minor term, ‘bats’ as nocturnal creatures and ‘bats’ as objects used in the game of table tennis. Since ‘bats’ is used in different senses in the argument, it renders inference impossible.

**Rule 2:** In a valid syllogism the middle term must be distributed in at least one of the premises. In order to understand this rule, it is important to have an idea of the concept of distribution. A term is said to be distributed if the assertion of which it is a part concerns the whole of its membership. In other words, if a proposition asserts something about every member of a class, then the class is distributed if not, then such a class is not distributed. We, therefore, have the following result:

A proposition: All S is P                      Subject term is distributed, predicate is undistributed.

E proposition: No S is P	Subject term is distributed, predicate is distributed.
I proposition: Some S is P	Subject term is undistributed, predicate is undistributed.
O proposition: Some S is not P	Subject is undistributed, predicate is distributed.

What this rule says is that for a categorical syllogism to be valid, the middle term must be distributed in either the major premise or the minor premise. For example:

All Russians are revolutionists  
 All Anarchists are revolutionists  
 Therefore, All Anarchists are Russians

In the example above, both premises are universal affirmative propositions that do not distribute their predicate classes, which in this case is the term, 'revolutionists' It shows that there is no connection between Russians and Anarchists in the premises; therefore the conclusion that all Anarchists are Russians does not follow. This argument is invalid and commits the fallacy of undistributed middle term.

**Rule 3:** In a valid categorical syllogism, if a term is distributed in the conclusion, it must be distributed in the premise where it occurs. When the conclusion of a syllogism distributes a term that was not distributed in the premise, then the syllogism is invalid because the conclusion says more than what is warranted in the premises. In other words when a term is distributed in the conclusion and not distributed in the premises, then the argument is said to commit the fallacy of illicit major if it is the major term that is involved or illicit minor, if it involves the minor term.

Examples of this fallacy are:

- (1) All dogs are mammals  
 No cats are dogs  
 Therefore, No cats are mammals.

This commits the fallacy of illicit major because the major term is distributed in the conclusion, but not in the premise where it occurs.

- (2) All enzymes are organic compounds  
 All enzymes are proteins  
 Therefore, all proteins are organic compounds

This argument commits fallacy of illicit minor term because the conclusion is a universal affirmative proposition which distributes its subject term, so the term ‘proteins’ is distributed, but this term appeared in the minor term undistributed even though it is still an A proposition. Hence, the categorical syllogistic argument is invalid and commits the fallacy of illicit minor.

**Rule 4:** No standard form categorical syllogism having two negative premises is valid. In other words any syllogism with two negative premises is considered to be invalid and commits the fallacy of exclusive premise.

Example:     No astrologers are scientists.  
               Some scientists are not magicians  
               Therefore, some magicians are not astrologers

In this example, no valid inference can be drawn between the major term. So, it is said to commit the fallacy of exclusive premise. You cannot draw a valid conclusion from two negative premises.

**Rule 5:** If any of the premises of a valid standard form categorical syllogism is negative, the conclusion must be negative. In other words, you cannot draw an affirmative conclusion from a negative premise or premises. Example:

              No poets are managers  
               Some artists are poets  
               Therefore, some artists are managers.

The exclusion of ‘poets’ and ‘managers’ from each other asserted by the major premise does not justify any valid inference regarding the inclusion of ‘artists’ and ‘managers’. Any syllogism that breaks rule 5 can be said to be committing the fallacy of drawing an affirmative conclusion from a negative premise.

**Rule 6:** No valid standard form categorical syllogism with a particular conclusion can have two universal premises. To break this rule is to move from premises having no existential import to a conclusion that does. A particular proposition asserts the existence of its terms.

Example:

All household pets are domestic animals.  
 No unicorns are domestic animals  
 Therefore some unicorns are not household pets.

This syllogism is invalid because the major and minor premises have no existential import since they are universals. The conclusion is a particular proposition which has existential import. Any syllogism that violates rule 6 maybe said to commit the existential fallacy. The reason the syllogism is invalid is that the conclusion asserts that unicorns exist whereas its premises do not make any such assertion. These six rules determine the validity of syllogistic arguments. Any categorical syllogism that violates any of these rules can be said to be invalid. However, the six rules stated here is not the only method for proving the validity of syllogistic arguments. Another effective method that comes in for mentioning is the use of Venn diagrams, an approach that was introduced by the English logician John Venn (1834-1923). It is a system of overlapping circles, each representing the major, minor and middle terms respectively. Using the Venn diagram proof, when one diagrams the two premises of a valid syllogism, the conclusion does not need to be diagrammed as it would have already been diagrammed when the premises were diagrammed. This shows the relationship of entailment between the premises and conclusion of a valid categorical syllogism. We shall not deal with Venn diagrams here because the text is intended for beginners. What we will do at this point is to summarize what has been dealt with so far.

A categorical syllogism is a deductive argument consisting of three categorical propositions and containing a total of three different terms, each of which appears twice in

distinct propositions. In a standard form categorical syllogism, the propositions are all in standard form, the two occurrences of each term are identical, each term is used in the same sense throughout the argument, and the major premise is listed first, the minor premise second, and the conclusion last. The major premise is the one that contains the major term which by definition is the predicate of the conclusion, and the minor premise is the one that contains the minor term which by definition is the subject of the conclusion. The middle term is the one that appears twice in the premises, but never in the conclusion.

The validity of a standard form syllogism is determined by its form, and the form is identified in terms of mood and figure. The mood consists of the letter names of the propositions that compose the syllogism, and the figure is determined by the location of the two occurrences of the middle term in the premises. The validity of categorical syllogisms can also be tested by the application of six rules. A syllogism is valid if and only if (1) it does not have more than three terms, (2) its middle term is distributed in at least one premise, (3) a term distributed in the conclusion is also distributed in the premise, (4) at least one premise is affirmative, (5) a negative conclusion occurs with a negative premise and vice versa and (6) a particular conclusion, should there be any one, occurs with a particular premise.

### **Evaluation and Conclusion**

The theory of the categorical syllogism has been criticized on many grounds. Susan Stebbing for instance, holds that “it is to be regretted that Aristotle, in working out his theory of the syllogism, interpreted his definition much more narrowly, so that he excluded all propositions that are not of the subject-predicate form” (81). A proposition stating that two things have a certain relation for instance has a different form from subject-predicate propositions and the failure to perceive this difference or to allow for it has been the source of many errors (Russell, *The Essence* 81).

John Stuart Mill has noted that the maxim that “whatever can be affirmed (or denied) of a class may be affirmed (or denied) of everything included in the class is the axiom which is the basis of the syllogistic theory” (96). Criticizing this maxim, Francis H. Bradley holds the opinion that since the conclusion of a syllogism does not tell us something other than the truths it depends upon, then the syllogism is no inference at all. For him, “an inference must be more than a vain repetition, and its result is no echo of reiteration” (112). Based on this, Bradley further writes of the syllogism, that it is “begotten by an old metaphysical blunder, nourished by a senseless choice of examples, fostered by the conservatism of logicians and protected by the impotence of younger rivals” (113). Also, Bertrand Russell has raised a three-point criticism against the syllogism (Aristotle’s Logic, 124). The criticisms are based on:

- (1) Formal defects within the system itself. Aristotle does not draw any distinction between the two statements: “Socrates is a man” and “all Greeks are men”.
- (2) Over-estimation of the syllogism as compared to other forms of deductive argument. Within logic, there are non-syllogistic inferences such as “A horse is an animal; therefore, a horse’s head is an animal’s head”. Valid syllogisms in fact are only some among valid deductions and have no logical priority over others.
- (3) Over-estimation of deduction as a form of argument.

F. H. Bradley and Bertrand Russell must have had non-syllogistic expectations of the syllogism. Against their positions Brendan Larvor has stated that “syllogistic logic still retains its usefulness based on the fact that it successfully identifies those valid arguments that fall within its scope” (130). Though Aristotle’s syllogism has been criticized on many points, its importance in the history of logic as the first system of logic to be developed cannot be disputed. John Corcoran and Michael Scanlan have noted that “modern writers tended to look upon Aristotle’s logic with jaundiced eyes, finding fault wherever possible and emphasizing differences between



what they took to be Aristotle's logic and what they took to be modern mathematical logic" (78). In the opinion of Susan Stebbing, "a new impetus has been given to the study of logic by the work of the symbolic or mathematical logicians. It might be supposed that the science of logic thus conceived, has nothing in common with Aristotle's conception of logic. But that would be a mistake. There are considerable grounds for supposing that, in recognizing that the ideal of logic is the exhibition of form, the mathematical logicians are carrying on the work which Aristotle himself initiated" (xi). On this note, we conclude that the study of the categorical syllogism is a necessary propaedeutic for every discipline. Just like consistent drill and exercise contributes to the fitness of the body, a devotee to the study of the syllogism and logic generally trains the mind in the direction of gaining clarity, precision and consistency in reasoning.

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