THE FORM OF THE SIMPLE SYLLOGISM

The simple (or categorical) syllogism is composed of two simple statements. These are the premises of the syllogism. The conclusion is also, of course, a simple statement.

When do two simple statements have the form of a syllogism? Before we can begin to answer this question, we must take apart these simple statements into their subjects and predicates. These subjects and predicates are called the limits or terms of our formal analysis. As will be seen, the (simple) syllogism requires one term common to both premises. This common term is called the *middle* term. Hence, although there are two simple statements as premises, there are only three different terms since one is used twice or is found in both premises. This middle term, by its relation to the two private terms in the two premises, enables reason to affirm or deny one of the private terms of the other in the conclusion. Consider this syllogism:

Every animal is alive
Every man is an animal
Every man is alive

The premises *Every animal is alive* and *Every man is an animal* have in common the term *animal*. *Animal* is the middle term common to both premises and by its relation to the private terms of the premises (*alive* and *man*), it enables reason to say one of them of the other in the conclusion. Sometimes, however, the middle or common term, by its relation to the private terms, enables reason to deny one of the private terms of the other in the conclusion. Consider this syllogism:

No odd number is even
Every three is an odd number
No three is even

Here the middle or common term, *odd number*, enables reason to deny *even* of *three* in the conclusion.

The term which is the predicate of the conclusion is called the *major* term and the premise in which it is found the *major* premise. The term which is the subject of the conclusion is called the *minor* term and the premise in which it is found is called the *minor* premise. These terms are so named because the predicate is usually said of more than the subject. For the purpose of consistent analysis, it is customary to put the major premise first and the minor premise below it and the conclusion below them with a line between as done above.

The father of logic, Aristotle, distinguished three *figures* of the syllogism by the position of the middle term in comparison to the major and minor terms. If the middle term is between the major and the minor terms (that is, if it is the subject in the major premise and the predicate in the minor premise), there is the *first* figure. The above two examples are in the first figure. If the middle term is the predicate in both premises, there is the *second* figure. An example of a syllogism in the second figure:

No man is a woman
<u>Every mother is a woman</u>
No mother is a man

If the middle term is the subject in both premises, there is the *third* figure. An example of a syllogism in the third figure:

Every dog has four legs
<u>Every dog is an animal</u>
Some animal has four legs

There is a reason why these figures are called the first, second, and third. The first is the most powerful and is more clear than the second and third. And the second is more powerful than the third. In the first figure, as will be seen, it is possible to conclude both universal affirmative and universal negative conclusions. In the second figure, one can conclude universal negative conclusions, but *not* universal affirmative conclusions. In the third figure, *no* universal conclusions can be drawn. It will also be seen that the syllogisms of the second and third figure must be made clear through those of the first figure.

Since the form of the syllogism is independent of its matter, we can represent the form of the three figures by letters. If the major term is represented by A and the minor term by C and the middle term by B, we can present the form in the following way:

First figure B - A
C - B

Second Figure	A - B
	C - B
Third Figure	B - A
	B - C

The place of the subject is to the left of the dash and the predicate to the right.

Since either premise can be universal or particular, affirmative or negative, there are four possibilities for each premise. And, hence, there are sixteen combinations, or *cases* or *moods* as they are called, to be considered in each figure. Most of these combinations do not result in a syllogism; that is, no other statement follows necessarily when they are laid down.

How can we determine whether a case or mood is a syllogism or not?

Syllogisms are based on two beginnings. These are called the *said of all* and the *said of none*.

The *said of all* may be stated thus: If a first term is said of all a second term, the first term must also be said of whatever the second term is said of. For example: if *animal* is said of all *dogs*, then *animal* must be said of whatever *dog* is said. The *said of all* is a statement known through itself by understanding its parts. If A (whatever A may be) is said of all B, then A must be said of whatever B is said of - otherwise there would be a B that A is not said of.

The *said of none* may be stated thus: If a first term is said of none of a second term, the first term must also be denied of whatever the second term is said of. For example: if *stone* is said of none of the *animals*, then *stone* must be denied of whatever *animal* is said of. The *said of none* is also a statement known through itself by understanding its parts. If A (whatever A may be) is said of none of B, then A must be denied of whatever B is said of - otherwise there would be a B that A is said of.

The *said of all* can also be stated in a grammatically different way with letters thus: if every B is an A, then whatever is a B is also an A. For example: if every dog is an animal, then whatever is a dog must also be an animal. And the *said of none* can be stated thus: if no B is an A, then whatever is a B is not an A. For example: if no animal is a stone, then whatever is an animal is not a stone. Both statements can be seen through themselves to be necessarily true once they have been understood. If we understand what it means to say that Every B is an A, it is, of course, obvious that whatever is a B is also an A.

Likewise, if we understand what it means to say that No B is an A, it is equally obvious that whatever is a B is also not an A.

From the above, it can be seen that the *said of all* and the *said of none* require two statements, one of which is universal and the other affirmative, placing something under the subject of the universal statement. In letters, we need a statement either in the form *Every B is an A* or in the form *No B is an A* and a second affirmative statement placing every C or some C under B, or saying that every C, or some C, is a B. Hence, it is clear that the *said of all* and the *said of none* cannot be found in any two particular statements or in any two negative statements. Even the *said of none* requires one affirmative statement placing something under the subject of a universal negative statement. And as will be seen, there can be no syllogism from two negative or from two particular (simple) statements.

Where the *said of all* or the *said of none* apply, there is found necessity in a form. But where they do not extend, there the simple statements lack the form of the syllogism. However, it is only in the first figure that the *said of all* or the *said of none* can be found in the statements as they are arranged. (For the said of all and the said of none require that the subject of the universal statement be a predicate in the other statement and this is found only in the first figure.) In the second and third figure, we can see the said of all or the said of none apply only after some statements or statements have been converted. Conversion of a (simple) statement means putting the subject in the place of the predicate and the predicate in the place of the subject. We must see when the truth of a simple statement does or does necessarily involves the truth of its convert before we can see which cases of the second or third figure are valid; that is, are syllogisms. Hence, we shall consider the conversion of statements before we consider the cases of the second or third figures.

When the said of all or the said of none cannot be found in the premises as they are or by conversion, it is possible to prove by examples that nothing is necessarily so with C as a subject and A as a predicate. We must take examples for A, B, and C such that the premises are true when these examples are substituted in place of the letters, and one set of examples where *Every C is A* is true and one set of examples where *No C is A* is true. By the square of opposition, it can be seen that if the universal affirmative is true once, the negative statements are false once. And if the universal negative statement is true once, the two affirmative statements are false once. Hence, nothing is true always. Hence nothing is necessarily so when the premises are true. Hence, there is no syllogism since something must be necessarily so for there to be a syllogism.

THE UNIVERSAL FORMS OF THE FIRST FIGURE

Among the universal forms or cases of speech in the first figure (by *universal*, we mean with two universal statements), two have the form of a syllogism and two do not. One form clearly involves the said of all and another, the said of none:

Every B is A	based on	No B is A	based on
Every C is B	said of all	Every C is B	said of none
Every C is A		No C is A	

But the remaining two universal forms of the first figure lack both the said of all and the said of none. This is immediately clear in the form with two universal negative statements. For even the said of none requires an affirmative statement placing something under the subject of the universal negative statement. We can easily find examples satisfying the three conditions necessary.

No B is A	Examples for	A: animal
No C is B		B: stone
		C: cat, tree

The premises are true when these examples are substituted for A, B and C; and we have one example where Every C is A; and there is one example where No C is A. Hence nothing is always so when the premises are true. And if nothing is always so, then nothing is necessarily so. And if nothing is necessarily so, there is no syllogism.

The remaining universal form in the first figure often deceives:

Every B is A
No C is B

Many think that it follows that No C is A. They are mistaken. For neither the said of all, nor the said of none, applies; and examples can be found for A, B and C to satisfy the three conditions. Nothing is placed under the subject of either universal statement, so neither the said of all, nor the said of none applies. Examples satisfying the three conditions are for A, *animal;* for B, *dog;* and for C, *cat* and *stone*.

It is impossible to find examples satisfying these three conditions for the valid forms above where the said of all and the said of none apply.

MIXED FORMS OF THE FIRST FIGURE

Among the mixed forms of speech in the first figure (in which one statement is universal and the other particular), only two have the form of a syllogism and the remaining six do not. The two which have the form of a syllogism are based on the said of all and the said of none:

Every B is A	based on	No B is A	based on
Some C is B	said of all	Some C is B	said of none
Some C is A		Some C is not A	

But if the second or minor premise is a particular negative, no syllogism is possible for nothing has been put under the subject of the universal premise. Examples satisfying the three conditions show that there is nothing that is always or necessarily so:

Every B is A	A: animal	No B is A	A: animal
Some C is not B	B: dog	Some C is not B	B: stone
	C: cat, stone		C: cat, tree

If the minor premise is universal and the major particular, no syllogism is possible for nothing is placed under the subject of the universal premise. We can show this for the forms in which the minor is universal affirmative by one set of examples, fulfilling the three conditions for both:

Some B is A	A: four-footed	Some B is not A
Every C is B	B: animal	Every C is B
	C: dog, man	

Likewise, the two forms where the second or minor premise is a universal negative can be shown not to have the form of a syllogism by one set of examples fulfilling the three conditions for both:

Some B is A No C is B	A: sweet B: black C: sugar, salt	Some B is not A No C is B

The particular forms of speech in any figure (those composed of two particular statements) can never have the said of all or the said of none in them since both of these require a universal statement. One set of examples can be used to satisfy the three conditions for all:

Some B is A Some C is B	A: animal B: white thing C: dog, stone	Some B is not A Some C is B
Some B is A Some C is not B		Some B is not A Some C is not B

If we examine the four forms of speech in the first figure which have the form of a syllogism, we can induce that only those are syllogisms whose major premise is universal and whose minor premise is affirmative. There can be, of course, only four forms that have a major premise that is universal and a minor premise which is affirmative (for there are only two possibilities for each premise).

We can also see that there is one form in which to conclude a universal affirmative, one form in which to conclude a universal negative, one form in which to conclude a particular affirmative and one in which to conclude a particular negative. (In the second figure, there are only negative conclusions; and in the third figure, there are only particular conclusions.)

CONVERSION OF STATEMENTS

Before we can consider which forms in the second and third figure are syllogisms and which are not, we must first consider the conversion of statements. For the said of all and the said of none do not fit the order of terms in the second and third figure, but sometimes by conversion we can see the said of all or the said of none. But such conversion (as will be seen) returns to the order of the first figure.

Conversion is most useful in the universal negative statement. If a universal negative statement is true, its converse is also necessarily true. In form with letters, if *No B is a A* is true, then necessarily the converse *No A is B* is also true. Although we can consider this by induction (no dog is a cat and no cat is a dog; no square is a circle and no circle is a square; and so on), we cannot look at every universal negative statement to see that this is true - for there is no limit to them. But we can show that this must be true in every universal negative statement in the following way:

> If *No A is B* is not necessarily true, then by the square of opposition, it is possible that *Some A is B*.
>
> If it is possible that *Some A is B*, let it happen. And let us call that A which is a B *X*. Hence, X is both an A and a B. Hence, there is some B (namely X) that is an A.
>
> But again by the square of opposition, it is impossible that *Some B is A* when it is true that *No B is A*. But this impossibility follows necessarily from admitting that it is possible that *Some A is B* could be true. Hence, *Some A is B* cannot be true.
>
> But if *Some A is B* is false, then, by the square of opposition, its contradictory *No A is B* must be true.
>
> Thus if *No A is B* is true, necessarily *No B is A* must be true.

It is interesting to see that, in the above way, the father of logic, Aristotle, was able to show that the converse of *every* universal negative statement which is true, is also true.

It can also be seen from this that if a universal negative statement is false, its converse is also necessarily false. For if the converse were true, then by the above demonstration the original would also necessarily have been true. But it is false. Hence, its converse must also be false.

If the universal affirmative statement *Every B is A* is true, its converse *Every A is B* is *not* necessarily true. Every dog, for example, is an animal, but not every animal is a dog. But if *Every B is A* is true, necessarily the partial converse *Some A is B* is true. This can be shown by the square of opposition and what we have seen in the universal negative:

> If *Some A is B* is not true, then by the square of opposition, its contradictory *No A is B* is true.
>
> But we have seen that, if a universal negative is true, its converse is true. Hence, if *No A is B* is true, then *No B is A* is true.
>
> But *No B is A* cannot be true when *Every B is A*. Hence, an impossibility follows from saying that *Some A is B* is not true.

One could also reason from the convertibility of the universal negative in falsehood thus:

> If *Every B is A* is true, then *No B is A* must be false.
>
> And if *No B is A* is false, then *No A is B* must also be false.
>
> And if *No A is B* is false, then its contradictory *Some A is B* must be true.
>
> Hence, If *Every B is A* is true, then *Some A is B* must be true.

One can also show that the particular affirmative converts. If *Some B is A* is true, necessarily *Some A is B* is also true:

> For if *Some A is B* were not true, then, by the square of opposition, its contradictory *No A is B* would be true.
>
> And if *No A is B* were true, *No B is A* would also be true.
>
> But it is impossible that *No B is A* is true when *Some B is A*. Hence, something impossible follows if we do not admit that *Some A is B* is true when *Some B is A* is true.

We can also show this through the convertibility of the universal negative in falsehood:

> If *Some B is A* is true, then by the square of opposition, its contradictory *No B is A* must be false.

But if *No B is A* is false, then *No A is B* is false.

And if *No A is B* is false, then by the square of opposition, its contradictory *Some A is B* must be true.

But the particular negative does not convert. If *Some B is not A* is true, it does not follow necessarily that *Some A is not B*. For example: *Some animal is not a dog* is true, but the converse *Some dog is not an animal* is false.

Thus, the universal negative is most useful in conversion and the particular negative is useless for conversion. The fact that the universal negative converts fully and the universal affirmative converts only partially is the reason why in the second figure there can be only negative conclusions and why in the third figure there can be only particular conclusions.

UNIVERSAL FORMS IN THE SECOND FIGURE

We shall consider here only the universal forms in the second figure (that is, those which are composed of two universal statements). Two of these forms of speech in the second figure have the form of a syllogism and two do not. Those that have one universal negative and one universal affirmative (regardless of which is the major and which is the minor premise) have the form of a syllogism. But one must convert before one can see that something follows necessarily or that the *said of none* is involved.

No A is B	The major converts to	No B is A	by said
<u>Every C is B</u>	The minor stays the same	<u>Every C is B</u>	of none
		No C is A	

By conversion of the major premise, we return to the first figure where the application of the *said of none* is clear as it stands.

But when the major premise is universal affirmative and the minor, universal negative, two conversions are necessary to get a conclusion with C as a subject and A as a predicate.

Every A is B			
<u>No C is B</u>	the minor converts to	No B is C	by said
	and the major is put under	<u>Every A is B</u>	of none

No A is C

And *No A is C* converts to *No C is A*

Thus, two conversions are necessary to see that *No C is A* necessarily follows from *Every A is B* and *No C is B* being laid down. And it also involves a return to the arrangement of the first figure (although C is where A is and vice-versa).

But there is no syllogism in the second figure with two universal affirmatives or two universal negatives. Examples satisfying the three conditions are below:

Every A is B	A: even number	No A is B	A: animal
Every C is B	B: number	No C is B	B: stone
	C: four, five		C: dog, tree

UNIVERSAL FORMS OF THE THIRD FIGURE

Among the universal forms in the third figure (those with two universal statements), there is a syllogism when the minor premise is universal affirmative, but none when the minor premise is universal negative. The two forms that are syllogisms require a conversion of their minor premise before we can see what follows necessarily. And such conversion returns us to the order of the first figure. The two valid forms:

Every B is A	remains	Every B is A	
Every B is C	converts to	Some C is B	by the said of all
		Some C is A	

No B is A	remains	No B is A	by said of none
Every B is C	converts to	Some C is B	
		Some C is not A	

But when the minor premise is universal negative, no syllogism is possible as is shown by examples satisfying the three conditions

Every B is A	A: animal	No B is A	A: animal
<u>No B is C</u>	B: dog	<u>No B is C</u>	B: stone
	C: cat, stone		C: cat, tree