

### 3. Reasoning Theory

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#### 3.1. Syllogistic reasoning

##### 3. 1. 1 Syllogistics

Bibl. st.: Ch. Lahr, *Logique*, 515ss. We begin with paradigm as the basic type:

"All the flowers are beautiful.

Well, this is a flower ,

so this flower is beautiful".

We rewrite this syllogism in full. The wording thus becomes more extensive, its structure all the clearer: what is understood but unsaid is also explicitly expressed. Here the letters 'VZ' stand for preposition, 'NZ' (in Dutch : nazin) for postposition or final sentence.

VZ1 "The collection of all flowers" belongs to "the collection of all that is beautiful."

VZ2 Well, "this flower" belongs to "the collection of all flowers."

NZ so "this flower" belongs to "the collection of all that is beautiful."

This rewriting clarifies, e.g., that the sentence, "Well, this is a flower" situates this singular flower here and now in "the collection of all flowers," of which it is one.

**Basic structure:**

VZ1	me belongs to M .	me < M
VZ2	Well, m belongs to	m < me
NZ	so m belongs to M.	m < M

'Syllogism' means 'closing rhetoric.' The basic form of a syllogism or concluding rhetoric consists - if reduced to its minimally essential core - of three terms incorporated into three judgments, and in such a way that from the two prepositional phrases ('premises') a postpositional phrase ('conclusion') is either unqualified (deductive concluding rhetoric) or qualified (reductive concluding rhetoric) logically 'valid' derivable. (cfr. 4.2)

***The three terms are:***

- ***the 'major' term***, or maior, symbol shortened: capital 'M'. In the rewritten example, the major term 'M' stands for "the collection of all that is beautiful." 'Large' is called because it has the largest size. It occurs in VZ1 and NZ as a proverb.

- ***the 'minor' term*** or minor, symbol shortened: lowercase 'm' stands for "this flower". 'Small' he is called because he is the smallest size. He appears as a subject in VZ2 and NZ. The major and minor term together are called "extremes," to characterize them relative to the middle or common term.

- ***the middle term***, comparison term or medius, symbol shortened: 'me'. In the example : "the collection of all flowers." The medius is subject in the first preposition, and predicate in the second preposition. He is like a catalyst that connects major and minor term and does seem to disappear in the conclusion.

One thus sees that the size of the large term M is larger than the size of the middle term me. And the middle term in turn has a larger size than the small term m. Indeed, there are many other things in the example that are also beautiful than just "the collection of all flowers." The latter collection also includes "this flower."

***The three judgments include consecutively:***

- the first prepositional phrase (VZ1 or propositio maior, symbol shortened: the capital 'M'),

- the second preposition (VZ2 or propositio minor, symbol-shortened lowercase 'm'), both called 'premises'.

- Finally, there is a third sentence, the after sentence, NZ, or "conclusion. The use of the capital 'M' to indicate both the concept and the judgment 'Maior,' can be confusing. Likewise with the lowercase 'm' which can refer equally to the term and the judgment 'minor'. The context indicates whether the term or the judgment is meant. However, we avoid the designations 'M' and 'm' for the premises but use the terms VZ1 and VZ2.

Both prepositional phrases have in common with each other the medius 'me'. The major and minor terms are compared with the medius to see whether and how they agree or not. Each of the two prepositional phrases also has a common term with the nazin: either m or M. It can be seen that a syllogism in the three judgments includes six places: 'M', 'me' and 'm' are each expressed twice.

To magnitude summarized, "The collection of all that is beautiful" contains "the subset of all beautiful flowers." And "the subset of all beautiful flowers" in turn contains "this flower". Schematically: "M > me > m" or still: "m < me < M".

The syllogism can, of course, be phrased both singularly ("this flower"), and privately ("some flowers"):

VZ1 "All flowers (universal) are beautiful.

VZ2 Well, this is a flower (singular); these are single flowers (private);

NZ so this flower is beautiful (singular); these single flowers are beautiful (private)".

Terms terms. Medieval logicians articulate as follows.

- 1. Three and only three terms are substantial (maior, medius, minor). If fewer terms, then it is no longer a syllogism; if more, then the syllogism is no longer valid or resolves itself into multiple syllogisms in succession.

Nor does one respect this rule when the same term has more than one meaning or scope. For example, in the following reasoning, the term "coat" is thought of first as not folded, then as folded so that it is used twice in a different meaning and the syllogism is immediately perceived as invalid: "I can get into my coat. Well, my coat can go in the suitcase, so I can go in the suitcase".

- **2.** The extent of the nazin should never exceed that of the premises. Indeed, one cannot infer from what is less what is more.

- **3.** The middle term is expressed either once or twice in its full extent if not it creates more than three terms. Thus:

"All lions (universal) are (a species; private) animals.

well, all wolves (universal) are (another kind; private) animals;

so all lions (universal) are wolves (universal)."

We put the fallacy in parentheses. Was said:

"All lions are animals. Well, all animals are wolves , so all lions are wolves".

then the derivation would be logically valid because the middle term "animals" is then universal ("genus" and not "species"). The logical validity is evident e.g. in the hypothetical wording: If all lions are animals, and if all animals are wolves, then all lions are wolves. As applied logic, the reasoning is obviously false because VZ2 "all animals are wolves" is false.

**4.** The middle term should never appear in the after sentence. Indeed, it has its role in both prepositional phrases.

The terms on the sentences. These are as follows.

**5.** From two negating prepositional phrases, no after sentence is derivable.

Indeed; what sensible conclusion could be conceivable, e.g., from the prepositional phrases:

"Roses are not animals, well, pears are not roses, so ... ".

**6.** From two affirmative prepositional phrases, no negating postpositional phrase is derivable.

From "All flowers are beautiful, well this is a flower, so this is not a...", there is no conclusion to be drawn either.

- **7.** The after sentence exhibits the same information (cognitive content) as the least informative preposition. Indeed, the conclusion of the syllogism with the beautiful flowers only

says that "this flower" is beautiful. A negating preposition is less informative than an affirmative one. The judgment "these flowers are not yellow" tells us a lot less than the judgment, "these flowers are yellow."

- If one prepositional phrase is negative and the second is affirmative, the postpositional phrase is negative.

From the premises, "Pears are not flowers, well this is a pear..." can only be concluded to the negative conclusion "so, this pear is not a flower." A private preposition contains less information than a universal one. If one prepositional phrase is private and the second universal, then the postpositional phrase is private. This was abundantly clear in the syllogism regarding the beautiful flowers.

- **8.** From two private prepositional phrases, no after sentence is inferable. No information is available. The basic insight according to La Logique de Port-Royal is as follows: "The most comprehensive preposition (VZ1) must include the nazin and the least comprehensive preposition (VZ2) must show that it is so."

Behold a sampling of the sophisticated syllogism bequeathed to us by scholasticism (800/1450).

### ***3. 1. 2 If, then - connections***

Bibl. st.: G. Jacoby, *Die Ansprüche der Logistiker auf die Logik und ihre*

*Geschichtschreibung*, Stuttgart, 1962, 59ff. In logistics, "if, then" is the decisive connection concerning reasoning. It is logical only insofar as representation of (total, partial or incongruous) identity.

1. "If the weather is warm, metals expand." In itself, the connection is causal. It only becomes logical if that causal connection is also a form of identity.

2. "If the present is Saturday, the day after tomorrow will be Monday." Note: As a present stands to a day after tomorrow, so a Saturday stands to a Monday. This makes sense because the day order of the week involves such derivation: the general rule ("As a present ...") is part-identical to the application ("so states ... ") because an application is one instance of a general collection.

***Hypothetical sentences.*** Logistic talks about categorical reasoning of Aristotle leading to predicate-logistics, and hypothetical reasoning of the Stoa leading to utterance-logistics.

Logistically, there is a - logistic distinction between these two calculi. But logistically that distinction is without reason. For both are merely different subject-bound language forms representing the same logical token.

- Categorical. All human beings are mortal. Athenians are human beings. So they are mortal.

Mixed hypothetical. If human, then mortal. Well, the Athenians are human beings.

So they are mortal. Note: "Well, Athenians are human beings" is a non-logical observation.

- Pure hypothetical. If humans, then mortal. If Athenians, then human. So if Athenians, then mortal. Note: The observation of a moment ago is now hypothetical.

Being human involves being mortal, being Athenian involves being human, so being Athenian involves being mortal. Note: Just as a subset stands to a universal set, so Athenian being stands to being human and being human stands to being mortal. The partial identity is the reason why the "if, then" formula is strictly logical.

**Reasoning Theory.** Decisive for logical validity are 1. (distributive or collective) quantity (distributive quantity: singular, private or universal, and collective quantity: part, parts, whole) and 2. (affirmative or negative) quality of judgments. For they decide identity (in its total, partial or absurd form).

**Hypothetical wording.** The hypothetical formulation is logically the best in that it brings the prepositional phrases into suppositional form and, precisely because of this, limits itself to the strictly logical of the reasoning. Herbart (1776/1841) said that in logic totally categorical reasoning is nevertheless hypothetical in its true sense.

Logic pays attention to identity (total, partial, absurd) and not to establishing facts and thus not to truth or falsehood. Whereby logic distinguishes more sharply between mixed hypothetical and pure hypothetical. For pure hypothetical reasoning belongs to pure logic while mixed hypothetical reasoning belongs to applied logic (methodology) since the second preposition articulates an observation (see above).

**Two types of reasoning theories.** The history of reasoning theories shows two types, the Aristotelian which, as strictly logical, pays attention to identity, and the philonic which pays attention to truth and falsity. The predicate logic "logistifies" the Aristotelian; the statement

logic the philonical. One acts wrong - according to Jacoby - if one calls logistics 'logic' because one thereby confuses two strictly distinguishable systems.

**Note:** Hypotheses are imagined judgments. This implies that the acts intended in them are "being in itself," not by virtue of itself but by virtue of 'positing,' arbitrarily positing as being in itself. "A be B" means that A and B should be treated as if they were identically existing in themselves independently of their 'position,' even if in fact they are not. Also: that statement lacks the copula "is," i.e., the claim to truth. The fiction that something is real is not the affirmative judgment that something is real.

### 3. 1. 3 *Combinatorics within the syllogism*

Bibl. st.: Ch. Lahr, *Cours*, 520ss . - O. Willmann, *Abriss*, 88ff. To combine - from the Latin 'cum' + 'bini' (two each) - is to place (at least in our case here) a multitude of (to be placed) data in a 'configuration' (a set of places).

Syllogisms are divided into a number of figures on the one hand and a number of modes on the other.

The syllogism has four figures.

Observing the place that the middle term or medius can occupy in a syllogism, one distinguishes four possible "schemata" (Lat.: figurae), "figures.

- the medius can be Subject (subject) in VZ1, and Predicate (saying) in VZ2.
- the medius can be either Predicate in VZ1 or VZ2.
- the medius can be Subject in VZ1 and also in VZ2.
- the medius can be Predicate in VZ1 and Subject in VZ2.

It is common practice in these schemata to represent the medius by ... the capital 'M'.

We get:

	Fig. 1	fig. 2.1	fig. 2.2	fig. 3
VZ 1	M-	- M	M-	-M
VZ 2	-M	- M	M-	M-
NZ	SP	SP	S P	SP

The letters "S" and "P" in the NZ stand for Subject and Predicate. In the conclusion, 'something' of 'something' is expressed: 'S is P'. The open places '-' in VZ1 and VZ2 of the various figures are now filled by the letter 'S' or 'P'. 'S' if the expression contains the same term as 'S' in the NZ. 'P' if the expression contains the same term as 'P' in the NZ.

The configuration above defines four possible "schemata" (Lat.: figurae), "figures. We now fill this in with some examples.

***1. Barbara:***

- MP All flowers (M) are beautiful (P) ,
- SM Well, begonias (S) are flowers (M),
- SP So begonias (S) are beautiful (P).

***Celarent:***

- MP Mammals (M) are not fish (P),
- SM Well, whales (S) are mammals (M),
- SP so whales (S) are not fish (P).

***Darii:***

- MP All people (M) are mentally gifted (P).
- SM Well, Jan (S) is a human being (M).
- SP So Jan (S) is mentally retarded (P).

***Ferio:***

- MP All humans (M) are not incorporeal (P).
- SM Well, Jan (S) is a human being (M).
- SP So Jan (S) is not incorporeal (P).

***Note:*** This infill is the basic infill.



### **2.1. Cesare:**

- PM All pure spirits (P) are not human (M).  
SM Well, Flemings (S) are people (M).  
SP So Flemings (S) are not clean minds (P).

### ***Camestres:***

- PM All mortals (P) are an animated body (M).  
SM Well, all angels (S) are nonanimated bodies (M).  
SP So all angels (S) are not mortal (P).

### **2.2. Darapti:**

- MP The Seven Wise Men of Hellas (M) are conscientious (P).  
MS Well, the Seven Wise Men of Hellas (M) are pagans (S).  
SP So some pagans (S) are conscientious (P).

3. The fourth figure is rejected by e.g. Lahr but is explained by Willmann as follows. It is called "galenic" because Galenus of Pergamon (129/199; aristotelian and physician) introduced it. She is an inversion - see infills 1 and 4 above - of the first, the basic figure. Willmann admits that she has virtually no new insight ("information") into final sentence to offer (and thus agrees with logicians like Lahr).

We now give how Willmann fills in the first and fourth figures.

- MP All animals with cloven hooves (M) are mammals (P).  
SM Well, cattle (S) are animals with cloven hooves (M).  
SP So cattle (S) are some mammals (P).

- PM All cattle (P) have cloven hooves (M).  
MP Well, animals with cloven hooves (M) are mammals (P).  
SP So some mammals (S) are cattle (P).

**Conclusion.** The first figure - highly regarded by Aristotle (it is reasoned) - is the figure to which figures 2.1. and 2.2. are reducible. The galenic is negligible.

***The syllogism has 64 modes.***

In the diagram under 1.1.5., the quantities (all, some, none) and qualities (yes or no) of judgments were expressed in four ways. We already mentioned there that the scholastics derived A (all) and I (some (do)) from the vowels of the word 'affirmare' ('confirm'), and O (some not) and E (none) from the vowels of the word 'nego' ('I deny'):

- A: All flowers are beautiful. all (universally affirmative).
- I: Some flowers are beautiful. some are (private affirmative).
- O: Some flowers are not beautiful. some are not (privately negative).
- E: No flowers are beautiful. no (universal negative).

Thus one can distinguish four modes in VZ 1. But this is equally true of VZ2. Thus VZ 1, mode A, can be combined with VZ2, also in mode A. Both prepositional phrases together then give "AA. One can similarly combine A in VZ1 with I in VZ2, (AI) or O in VZ2 (AO) , or E in VZ2 (AE). Then with VZ 1, mode I, one can combine with all modes in VZ2: IA, II, IO, IE... Both prepositional phrases can thus be completed in 16 ways. But there is more. Even the after sentence can know one of these four modes. Thus one arrives - theoretically - at 16 x 4 or 64 possible fillings and thus there are 64 modes.

***The syllogism has 256 types.***

Thoroughly combining the 4 figures with the 64 modes gives 256 types of syllogism. Valid of these are 19. Applied ones are about 5 or 6.

We illustrate with following valid syllogism, belonging to Figure 1, in which both VZ1, VZ2, and NZ are universally affirmative (affirmare). Hence the lowercase 'a' each time between the schematic sentences of the syllogism.

VZ 1	MaP	All flowers (M) are beautiful (P) ,
VZ 2	SaM	Well, begonias (S) are flowers (M),
NZ	SaP	so begonias (S) are beautiful (P).

General: All M is P (MaP), well all S is M (SaM), so all S is P (SaP). Three times 'a'. As a mnemonic device, scholastics gave this form of syllogism the name "Barbara. One looked at the vowels in the word: three times an 'a'; meaning that each of the three sentences in the reasoning is universally affirmative.

The section on Peirce's pragmatic maxim (1.2.15) already gave us an example of such a 'Barbara' - syllogism:

VZ 1	MaP	All people die.
VZ 2	SaM	Henok and Elias were people.
NZ	SaP	Henok and Elias die.

The same chapter also gave us according to example of syllogism according to figure 1.

VZ 1	MoP	Henok and Elias were not mortal.
VZ 2	MaS	Henok and Elias were people.
NZ	SoP	Some people are not mortal.

The letter 'o' in VZ 1 and NZ indicates negation (nego). Schematic: Some M are not a P (Mop), well every M is an S (Mas), so some S are not a P (Sop).

The scholastics called this form of syllogism, with successive vowels: o, a, o, Bocardo.

Finally, let us also give Peirce's third example, belonging to the second figure.

VZ 1	PaM	All human beings are mortal.
VZ 2	SoM	Henok and Elias are not mortal.
NZ	So P	Henok and Elias were not people.

Schematic: All P is M, well some S are not M, so some S are not P. The scholastics called this form of syllogism Baroco, the consecutive vowels: a, o, o. Schematic: All P is M, well some S are not M, so some S are not P.

One can also check this naming in such syllogisms as Darii, Ferio, Cesare, Camestres and Darapti, all given above. Many more types exist. The consonants also have a function in this naming, but that is beyond the scope of this text.

*Note:* M. Hunyadi, *On peut enfin lire le grand Peirce en français*, in: *Le Temps* (Geneva) 14.12.2002, 43, says that Peirce (1839/1914) passes as the greatest logician of his time and that he was always a great admirer of the extreme akribeia (accuracy) of the medieval logicians whose legacy he wished to continue. Hunyadi refers to Cl. Tiercelin / P. Thibaud, dir., *Charles Sanders Peirce, Pragmatisme et pragmatisme*, Paris, 2002.

*As an aside*, "pragmatism" is a pragmatism (thinking that judges concepts by their results) that assigns an objective value to concepts (as with the medieval concept realists). Pierce was a concept realist in the wake of the medieval concept realists.

### **3. 1. 4 Enthymeen (unsaid reason or inference)**

Villainy humor teems with enthymemes. What exactly is concealed (supposedly known) in: "Mommy, when did you first meet Daddy?" - "Two years after our marriage, baby."

Natural logic tolerates such enthymemes; logistics utterly not, but, to avoid needless repetition, it tolerates a her own set of enthymes. (1) Humor (2) irony (3) sarcasm) in utterances says with the unsaid including the person's knowing.

'Enthymèma' (ancient Greek: "what is in the mind") in logic has a plurality of definitions. We dwell on one of them. "A syllogism, if of it either the reason (one of the prepositional phrases) or the inference (the postpositional phrase) remains unsaid, is an enthymeme."

*Example.* P. Foulquié / R. Saint-Jean, *Dict. de la langue philosophique*, Paris, 1969-.

2.215 (Enthymème), says it like this. VZ 1 (maior) is omitted: "Thou hast lied. So thou deserves no more trust". VZ 2 (minor) is omitted: "All who have lied no longer deserve trust."

So thou deserves no more trust". NZ is omitted: "All who have lied no longer deserve trust. Well then, ye have lied".

***Explanation.***

(1) What is GG (given or phenomenon) with the situation being reasoned about need not be said needlessly.

(2) Well, within a syllogism there is a consistency between the reason (the prepositional phrases, VZ1, VZ2) and the inference (the postpositional phrase, NZ) such that, within a given situation, one of the phrases can be omitted (synecdochic structure).

(3) So o.g. an application of the economy principle (thrift principle), preferably one of the sentences is not said.

**Note:** Petrus Aureolus (+ 1322) is often mentioned in reference to the economy principle which reads, "Entia non sunt multiplicanda praeter necessitatem" (Being need not be multiplied without necessity"). But this nominalist means by this the abstract presuppositions which he believes are redundant.

Here: "What can be said with sufficiently plain words need not be added with superfluous words." This is the axiom of natural logic of the common sense.

G. Jacoby, *Die Ansprüche der Logistiker auf die Logik und ihre Geschichtschreibung*, Stuttgart, 1962, 53/55 (Relationslogik), draws attention to the fact that logisticians, when they criticize the natural logic concerning relations, forget precisely the enthymemes. "If today is Sunday, the day after tomorrow will be Tuesday." Logisticians claim that natural logic cannot account for that within its language. To which Jacoby: "Given a general for all weeks order of days "Sunday / Monday / Tuesday / Wednesday / Thursday / Friday / Saturday." Well, today Sunday. So (given the well-known, situation-given order) the day after tomorrow Tuesday". The given (GG) order of weekdays is unspoken, (= enthymeme).

**Note:** S. Gerritsen, *"Het verband ontgaan me" (Problems of comprehension with suppressed arguments)*, Amsterdam, 1999, talks at length about enthymematic reasoning and, among other things, about rewriting texts to bring out the unsaid. Author brings up such problems from ancient times.

### 3. 1. 5 *The role of the middle term*

Bibl. st.: G. Bolland, Hrsg., *Hegel's kleine Logik*, Leiden, 1899,257. Hegel summarizes the configuration (set of places) of one type of syllogism: "If two things are equal to a third, then they are equal among themselves." Symbol shortening: A and b; the third is C.

**Example.** Do we set the major term 'viviparous' equal to P, the middle term 'all mammals' equal to M, the minor term 'all whales' equal to S. The major term is Predicate in VZ1 and in the NZ. The minor term is Subject in VZ2 and in the NZ. The middle term is Subject in VZ2 and in the NZ.

VZ 1	MaP	All mammals (M) are viviparous (P)
VZ 2	SaM	Well, all whales (S) are mammals (M).
NZ	SaP	So all whales (S) are viviparous (P)

The middle term (M) is necessary as a "catalyst. The role of the catalyst in chemistry is well known: it activates the chemical reaction but is weakened when it is finished. - The middle term (M) is necessary as a catalyst of the reasoning process in VZ 1 (subject) and in VZ 2 (saying) but is attenuated in the NZ! Which may become even more visible if, instead of the above configuration, one introduces a linear configuration and makes it hypothetical: "If M = P and S = M, then S = P." - As mentioned, M has disappeared in the final formulation.

**Quantitative or mathematical reasoning.** This is how Hegel formulates the basic configuration, and Bolland explains. Such reasoning - "If S and P are equal to M, then S is equal to P" - occurs in mathematics as an axiom. Well, of this and other axioms it is common to claim that they are unprovable, yes, that they do not even need a proof. Yet they are valid in the sense of "applicable again and again." Reason: they are - normally (if sufficiently developed reason is present) - virtually immediately evident or directly given ("phenomenon"). Any normal form of syllogism e.g. puts the "mathematical axiom" first.

Of course Bolland situates the above configuration (either in rectangular scheme or linear) in Hegel's metaphysics. However, this one does not interest us here now. Well this: our human mind works with configurations and its fillings. He possesses such a thing somewhere in his 'depths' as a kind of 'depth structures' (as structuralists say) to a mostly unconscious degree. They become conscious as soon as one explicitly engages in logic.

**Note:** Of course a configuration is present in a reasoning like:

VZ 1	MaP	"All that thinks (M), is (P).
VZ 2	SaM	Well, I (S) think (M).
NZ	SaP	So I (S) am (P).

This is similar to R. Descartes' famous statement "I think; therefore I am." But beware: in Descartes' view, his statement is not reasoning but the expression of a direct inner perception or "intuition" that is admittedly expressed in the form of (enthymematic, since the first preposition is not there) reasoning and gives rise to misunderstanding of what he is actually describing.

### **3.1.6. This section summarized.**

*A syllogism consists of three terms, the major, the medius and the minor, incorporated into three judgments and in such a way that from the two prepositional phrases a postpositional phrase is logically "valid" derivable. Terms and sentences must satisfy well-defined conditions.*

*Reasoning can be phrased categorically or hypothetically. The hypothetical formulation is logically most appropriate. Logic pays attention to identity and not to establishing facts and therefore not to truth or falsehood.*

*Aristotelian logic pays attention to identity, philonical ones to truth and falsity.*

*Syllogisms become in a four figures, depending on the place occupied by the middle term in the syllogism. Furthermore, each figure has 64 modes : wordings in which quality and quantity differ. Each sentence of the syllogism can be said combinatorially in four different modes. This means that one figure can be combined in  $4^3$  ways. The four figures together thus give  $64 \times 4$  or 256 possible combinations or types. Of these, however, most are logically incorrect. Only 19 are logically valid and 5 or 6 types are actually used, which strongly relativizes the importance of this whole combinatorics.*

*The names of the various types are chosen to reflect their characteristics.*

*Sometimes a sentence is under understood in logical reasoning and can be concealed.*

*In a syllogism, the middle term has a connecting role between major and minor and is in the conclusion disappeared.*