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The Logic and Grammatical Metaphysics of Plato and Aristotle*

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Grammaticas es formale; … indica proprietates *de forma*,
non *de ideas*. Grammaticas espone usu, et non logica.
In scholas nos tribus importantia excessive ad grammatica.

(Peano, *De derivatione*, II, p. 481)

Ullo grammatico dice: <verbo exprime statu aut actione>,
sed *statu* et *actione* es nomine, ergo verbo exprime nomine. …
In Anglo vocabulo *sun* es adjectivo,
verbo, nomine et significa <albo, redde albo, res albo>,
run vale <curre, cursu, fac curre>.
Ab contextu resulta si in versione
ab Anglo ad Latino, nos debe adopta nomine, adjectivo aut verbo.

(G. Peano, ibidem, *Algebra de grammatica*, p. 514)

We discuss how in the history of philosophical-scientific thought the confusion between the properties *de re* and *de forma* have led to confuse grammatical properties, of mere language, with logical and real properties, to call *the science of being as being or ontology* as they were just mere grammatical classifications, in short, only what we call a grammatical logic and metaphysics, far from a scientific and realistic logic. In all this, we make use of the relevant indications of the great mathematician, logician, linguist, but unfortunately and wrongly considered non-philosopher, Peano.[1]

Keywords: de re and *de forma* properties, logic-metaphysics-science and traditions of thought, Peano

Introduction: Aristotle, the Father of Formal Logic? The Problem of Sources

In so much Western historical-philosophical-scientific tradition, the foundation of formal logic is generally traced back to Aristotle (IV BC). Indeed, it is widely believed that Aristotle would have drawn his logical rules and classification from the mathematics of his time and from its demonstrative procedures. An authoritative historian of mathematics writes that:

> Aristotle's main achievement was the foundation of the science of logic. By providing correct laws to mathematical reasoning the Greeks had laid the foundation for logic, but it fell to Aristotle to codify and systematize these laws in a separate discipline. Aristotle's writings make it clear beyond any doubt that he derived logic from mathematics. (Kline, 1972, p. 66)

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[1] What is discussed, see *Opere scelte* di G. Peano, Vol. I, II, III, Cremonese, Firenze and my papers: Boscarino (2018; 2020); *Peano, a logical, mathematician and linguist, a master of science and philosophy*, forthcoming in Italian.

In the absence of written documents, alternative or prior to Aristotelian ones, it is believed that Aristotle was the father of logic. Yet from various testimonies we know that Democritus (5th century BC), expert in mathematics, would have already written on logic and questions of logic[2] and that Eudoxus, a contemporary of Aristotle, already handled in his definitions and mathematical demonstrations, with great wealth and refinement, logical and linguistic tools, not attributable to the so-called Aristotelian logic.

Peano's Criticisms of This Historiographical Tradition: Mathematical Logic

Of these in Aristotle either no mention is made or there is no full awareness. Peano, a great logician and mathematician, writes about this:

> It is known that scholastic logic (i.e. Aristotelian logic, our addition) is not of significant use in mathematical proofs, since in these the classifications and rules of syllogism are never mentioned, and on the other hand they make use of reasoning, all convincing, but not reducible to the forms considered in Logic. For these reasons, some mathematicians including Descartes proclaim evidence to be the only criterion for recognizing the accuracy of a reasoning. But this principle in its turn left much to be desired […]. (Peano, 1957, p. 81)

In several places, Peano demonstrates how mathematical definitions do not always meet the requirements of the Aristotelian conception of definition, by proximate gender and specific difference. Once again, Peano writes:

> Aristotle, Topici, I, 8, puts the rule: o orismòs ek genous kai diaphoròn estin, which Boethius translated for genus proximum et differentiamspecificam and is reproduced as an absolute rule in all the treatises of logic. The classic example of this property is the definition: homo = rational animal. Here animal and rational indicate two classes. Between those two classes the operation called conjunction by grammarians is implied, logical multiplication after Boole, generally indicated by "et" in common language, in mathematical logic by the sign ∩, therefore Aristotle's rule would say that every definition has the form: x = A∩ B where A and B are known classes, called genus and species, and x is the class that is defined. Some mathematical definition satisfies Aristotle's rule. This is Euclid's definition 22, which can translate: square = quadrilateral ∩ equilateral ∩ equiangle. But this definition can be applied at most to the definition of a class. It is not true for the definition 2 = 1 + 1, for that of the number e (e = lim (1 + 1/m) for infinite m) and for the definitions of entities that are not classes. Class definitions also do not necessarily have the preceding form. For example in the definition: composite number = (number greater than 1) × (number greater than 1) between the two classes, which in this case are identical, the sign of conjunction is not placed, but of multiplication. The followers of classical logic answer that in the definitions "2 = sum of 1 with 1", "composite number = product of two numbers", and = limit of […]. The genus is represented by the words sum, product, limit. But these words do not indicate classes, but functions; every number is sum and product and limit. The class corresponds to the first category ousìa of Aristotle, while the function belongs to the fourth pros ti. (Peano, 1957, pp. 426-427)

The same definition of proportion between any four quantities, even incommensurable, given by Euclid in Book V of the *Elements*, but which from the historiographic tradition traces back to Eudoxus, does not meet the requirement of definition, given by Aristotle. It is a definition by abstraction, which in symbolic terms, Peano writes as follows:

$$P\,(x) = P\,(y).\,=.\,x\,R\,y$$

where x and y are individuals, P is a property, R is a relation, which enjoys the reflexive, symmetric and transitive property.

[2] See the testimony of Diogenes Laertius (2014).

Of the syllogistic rules, used by mathematicians in their demonstrative reasoning, Peano acknowledges that Aristotle has only identified the two syllogistic rules in the two forms:

1. $(A \subset B \text{ and } B \subset C) \Rightarrow A \subset C$;

2. $(A \subset B \text{ and } x \in A) \Rightarrow x \in B$.

Two Traditions of Thinking on the Meaning of Logic

If this is the case, then we must conjecture that already in ancient Greece *two different ways of understanding logic faced each other*, *two traditions of thought*, the Platonic-Aristotelian one and the Pythagorean-Parmenidean or Democritean one, as you prefer, one founded on common language (or at most on rhetorical reasoning, as observed by Vailati) (Giovanni, 1987), which then acted as a link to the construction of grammatical logic and of an absurd grammatical metaphysics, where linguistic or formal or morphological distinctions were assumed as logical or even real distinctions, the other on scientific theory, in which the logical element is neither confused with *the linguistic element* nor with *the empirical fact*, since it serves instead to understand it, to reduce it to *a scientific fact* (Boscarino, 2016).

The common language for the need and the urgency of communication gives names to things, but these are not reality. To understand reality, *to make science* of it, *to construct the theory*, it is necessary to abstract from names, and start from the meanings, from the physical properties, indeed from *the ideas of properties*, which the names express or represent, or rather from *the concept.*

Parmenides says:

> Fr. 8 But remove the thought from this way of research nor let the habit born from the multiple experiences force you along this way to use the eye that does not see and the hearing that echoes with illusory sounds and the language, but judge with reason the pugnacious examination that I am presenting to you. […] It is the same thing to think and to think that it is because without being, in what is said you will not find thinking: […] […] Therefore they all will be only words as many mortals have established, convinced that it was true: to be born and to perish, to be and not to be, change of place and mutation of the brilliant color.[3]

Democritus then says that "*ideas*" are the *principles* of things: He calls *the elements* "*ideas*".[4]

For Democritus, atoms are *logoi theoretà*.[5] Unfortunately, a bad and superficial interpretation is perpetuated on the concept of atom in Democritus (Boscarino, 2011).

And again about Democritus we are told:

> Diotima reports that according to Democritus there are three criteria for judgment:
> (1) phenomenal data for the understanding of invisible things […];
> (2) the concept, for scientific research […];
> (3) the passions, for what one must desire or flee:because towards which we feel attracted is to be followed, from which we feel rejected is to be run away.[6]

Aristotle, classifying the Greek names or words into ten classes, believed, starting from the names, that he could classify *10 ways of thinking and being of reality, 10 categories.*

Peano notes in this regard:

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[3] See Diels Kranz, B, 28, *Presocratics.*

[4] Ib. A, 68, p. 57.

[5] Democritus believed that indivisible bodies were principles of the things, but as theoretical elements. See Democrito (1970, p. 297), our translation from the Greek.

[6] Ib. A. 68, p. 111.

> Max Muller notes that Aristotle drew the ten categories, not from grammarsGreek still to be written, but from the Greek language, and that if he, instead of Greek, had been Semitic or Chinese, he would have made a different classification into categories.[7]

We point out how Aristotle doing so *confused formal or morphological or linguistic distinctions with logical or real distinctions*. It is not of the "thing", *de re*. for example of "man", being first or second substance, according to the Aristotelian classification, or if you want *individual or class*, according to today's logical classification.

In the two propositions:

1. <<man>> is rational;

2. <man> is class.

The "1. <<man>>" is class, it indicates a second substance, according to the Aristotelian classification, "2. <man>" is an individual, therefore, according to the Aristotelian classification, it indicates a first substance.

According to the Aristotelian definitions it would follow that

second substance = first substance or individual = class

Absurd! Following Aristotle's grammatical logic one falls into absurdities, since the formal or linguistic meaning of the name is confused with its logical, or even real, meaning, which is what grammatical classifications do. Grammatical classifications, writes Peano, are only formal, *de forma*, not logical or real, *de re*.[8]

It is not of the thing to be individual or class, first or second substance, but of the linguistic form of the thing. Moreover, Peano writes: *Every common name, or name of a class, is the proper name of the class* (Peano, 1957, p. 380).

It is still:

> Nous n'avons jamais defini the individual, ni introduit un signe peur le rappresenter. Tout objet x est considered as an individ, lorsqu'il figure as subjet dans la proposition x ε_u; la u est alors une K (class). Une class u figure comme individu lorsqu'elle figure in a proposition u ε V; alors the class V a pour individus des classes; elle est done KK, une classe de classes. On peut aussi considerer des KKK, ou classes de classes de classes, etc. (Peano, 1957, p. 161)

A few more examples serve to clarify what is being argued here. In the proposition "man is mortal", "man", according to the Aristotelian definition, is a second substance, but in the proposition "Socrates is man", "man" is a quality of Socrates, therefore we have:

quality = second substance

The Aristotelian distinction then is not logical, of the idea, of the thing, but formal or linguistic. It is not the property of man, of the idea of man being a second substance, but of its linguistic form. Hence my definition of Aristotelian logic as grammatical logic, meaning by it precisely that logic or way of thinking, in which real or logical meanings of words are confused with their formal or linguistic meanings, as happens in grammatical distinctions. Grammar was built on Aristotelian logic, with the confusion already highlighted.

Peano writes:

> According to Max Müller, The science of thought, London, 1887, grammatical categories derive from Aristotle, who classifies Greek words into ten classes. According to the scholastic philosophers, the Latin translation of the names of the

[7] See in my book in Italian *Traditions of Thought*; and Peano (n.d.).
[8] Ibidem.

> categories is: “1 substantia, 2 quantum, 3 which, 4 ad aliquid, 5 ubi, 6 when, 7 situmesse, 8 se habere, 9 agere, 10 pati”. M. Müller says that they meet the current nomenclature: 1 noun, 2 adjective quantity, 3 qualifying adjective, 4 relative adjective, 5 local adverb, 6 temporal adverb, 7 and 8 intransitive verb, 9 active transitive verb, 10 passive verb. Examples of Aristotle: 1 man, horse, 2 two meters, 3 white, 4 double, major, 5 in the house, 6 yesterday, 7 lies, is, 8 is hot, 9 is cut, 10 is cut. Muller notes that this classification is relative to Greek; the classification of the words of the Semitic or Chinese language is different. And in the neo-Latin language the translation of the examples 2 5 8 10 is made for sentences not for a word. Aristotle’s categories, modified, merged and subdivided, generate the ten subsequent grammatical categories; only the number remains constant. [9]

In his work Aristotle gives his definitions of noun and verb:

> Name, writes Aristotle, is a signifying voice by convention, regardless of time and no part of it is significant if taken separately. The case definition of name is the same as the name; the difference lies in the fact that the case of the name combined with “is” or “was” or “will be” does not mean anything true or false, while the name is always true or false, combined with “is”, “was” or “will be”, so for example, “of Philo is” or “of Philo is not”, in fact none of these expressions is true or false. (Aristotle, 1962, p. 2)

> Verb is what a temporal determination also means, none of its parts has meaning if taken separately, and it is always a sign of what is said about something else. “He will run” or “he ran” are not verbs, but inflections of the verb. They differ from the verb in that the verb unites the present tense with the meaning, while the inflections unite the tenses outside the present with their meaning. (p. 3)

It is said that grammars did not yet exist at the time of Aristotle, yet already in these definitions it is clear the confusion between what the sign means in itself and its meaning, between the linguistic form of the sign and the properties of the thing. The name, as a signifying linguistic form, is the meaning, the same idea or thing.

For Aristotle the name is (=) the thing. Hence his nebulous and absurd philosophy, of the verbalistic type, of deducing meanings from names, not distinguishing the morphological meaning from the logical or real meaning of the names.

Grammatical Platonic Metaphysics at the Basis of Aristotelian Metaphysics

Grammatical Platonic metaphysics is the basis of Aristotelian grammatical logic and metaphysics. For Plato, the noun is the idea.

“It is not true,we are used to putting a single idea for each group of many objects to which we give the same noun” (Plato, 1903a, I, Section 596a).

Plato’s criticism of the definition of *Being as one* arises from this confusion between the property of noun and the property of idea of the thing. In his speeches on *The One*, both in the *Sophis*t and in *Parmenides*, Plato confuses the property or noun <<one>>, which is preached of many with the idea of <one> which is preached by an individual. In the analysis of the propositions, Aristotle once again confuses their formal or linguistic meaning with their real or logical meaning. For Aristotle, the meaning of the declarative form of the proposition is different from that of the other expressive forms, which express exclamation, command, prayer, etc. The meaning of the former is to be true or false, while of the latter we cannot preach their value of truth, true or false.

“Not every discourse is declarative, but that to which the true or the false belongs; and this does not belong to all discourses: prayer, for example, is a discourse, but it is neither true nor false” (Aristotle, 1962, p. 4)

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[9] See Peano (pp. 458-459). Our translation from interlingua.

Now this, in my opinion, is false. For example, the exclamation sentence: <how beautiful you are!> can be reduced to two declarative propositions <How beautiful you are!> = <You are beautiful and I am admired by your beauty> as well as the proposition, which expresses prayer: <Help me>can be reduced to two declaratives <Help me> = <I am in a state of danger and I am asking for help from you>. Once again Aristotle's grammatical logic confuses the formal or linguistic with the logical. But then what does "true" mean? Denoting a state of things? But then also <How beautiful you are!> can denote a state of things.

Aristotle borrowed from Plato the meaning of "noun", "verb", "true", "false", his conception of the proposition, his grammatical philosophy in general, even if apparently the two philosophies seem to diverge.

About the meaning of "noun" and "verb" Plato writes:

> The stranger (or Plato): I would say in fact that there is a double gender of our phonic signs that indicate the being of something.
>
> Theaetetus: How?
>
> The stranger: One is called "gender of nouns" the other of verbs.
>
> T.: Tell us what each of them consists of.
>
> The stranger: We say "verb", it seems to me, that which indicates actions.
>
> T.: Yes.
>
> The stranger: And "noun" is that phonic sign that is referred to those /that perform those actions.
>
> T.: Perfectly.
>
> The stranger: And so from just two nouns said one after the other, the speech never results, nor does it result from verbs, said without accompanying nouns. (Plato, 1903b, Section 262a)

Thus for Plato the following proposition "we like eating" to eat likes would not be a proposition, since in his grammar neither of the two words would be defined as a noun!

And again speaking of propositions, of true and false he writes:

> The stranger: It is necessary that the proposition, when it exists, is a proposition of something; it is impossible that it is not a proposition of something.
>
> Theaetetus: Exactly.
>
> The stranger: And then is it not necessary that it is also qualitatively determined?
>
> T.: How not?
>
> The stranger: Theaetetus sits. It isnot a long speech, is it?
>
> The stranger: Theaetetus, to whom I speak, flies.
>
> The stranger: Do we affirm that each of these two discourses must be necessarily qualitatively determined?
>
> T.: Yes.
>
> The stranger: So what shall we say is the quality of these two?
>
> T.: The one is false, I would say, the other is true.
>
> The stranger: Is it true the discourse of them that says things as they are towards you?
>
> T.: Certainly.
>
> The stranger: And then the false one says different things from what they are. (Plato, 1903b, Sections 262e, 263a & b)
>
> …
>
> The stranger: The thought therefore and the proposition are the same thing, with the only difference that the proposition that occurs inside the soul, made by the soul with itself, without a voice, precisely this was called "thought" by us. (Plato, 1903b, Section 263e)

With his grammatical logic and common sense, Plato believes, equivocating on the meaning of not being, to refute Parmenides for whom the true is *being = the non-contradictory*, while the false is *not being = the contradictory*.

That contradictory propositions, writes Simplicius, phys. 117, 2, are not true at the same time it is said by Parmenides in those verses in which he blames those who identify opposites.

Of what is contradictory or absurd, of not-being for Parmenides it cannot be said that it is, (it) exists. The simultaneous affirmation of the absurd property and the existence of individuals who satisfy it is the falsehood for Parmenides, the unspeakable. "*You will never force to be what it is not*", Parmenides says in one of his most famous verses. *Not-being* is not *the different*, according to the meaning of Plato, but *the contradictory*, according to the meaning of Parmenides.

This is of mathematical logic and science, that, *the different* is of grammatical logic or common language.

Plato believes he is refuting Parmenides in *the Sophist*, arguing that *not being* as different is, contrary to what Parmenides affirms, once again confusing the formal meaning of name, *nothing*, with the idea of its (Boscarino, 2018).

You can have *the idea of nothing, as of not-contradictory*, without a real thing corresponding to its name and affirm its existence as *an idea of the name*.

Aristotle then believes he is overcoming the logic of Parmenides, opposing to him the many meanings of the term "being", *the categories*, but he does not realize that it is precisely the vagueness and ambiguity of the words of the common language that Parmenides intends to overcome, for a discourse, which want to call it *philosophical-scientific*. Euclid, a mathematician, who uses the logic of Parmenides, affirms the *not-existence of the maximum prime number*, when he demonstrates its contradiction, for which nothing = not to be = = not-existent is precisely *the contradictory*, not *the different*, which can have its own existence, and which is used in common language, perhaps to declare false what one wants to affirm as different

For Aristotle, the object of logic are declarative or categorical propositions. Peano, who studied and highlighted the logic of mathematics instead highlighted how the propositions of mathematical or scientific logic are conditional propositions of the type $x \in A$, where x is an individual and A is a class, that is where x is a real variable and A is a property and the term *existence* is what is predicted of *properties*, not of *individuals*, a *simple linguistic, formal operator*, without physical or real meaning, an Aristotelian ambiguity that is still perpetuated in so much contemporary logic to the Russel (Boscarino, Notarrigo, & Pagano, 1989).

Conclusion

We are faced once again with two logics, if you will, metaphysics,two radically opposite philosophies of proposition, one of mathematical logic, the other of grammatical logic or common language, and their confusion remains unfortunately still today with the aggravating that it is called mathematical or formal logic what is still mere grammatical logic, which are Platonic-Aristotelian remains or disguises (Boscarino et al., 1989).

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