Peculiarities of Aristotelian Scholastic Logic*

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Abstract—**The article is a retrospective analysis of Aristotle's logic, which had a great influence on the development of logic as a science, and its evolution into scholastic philosophy. With the help of the method of historical reconstruction the author singles out the major elements of logic in general such as the theory of notion, the study of assertion, inferences, the theory of syllogism and the logical operations of definition and division. The article focuses on the link between the logic of The Classical Period and scholasticism and the development of terms used in logic within the scholastic approach of Aristotle and his followers.**

Keywords—Logic; scholasticism; Aristotle's logic; notion; syllogism; definition; division

I. Introduction

It would be absolutely impossible (or at least hard) to adequately estimate the role and the importance of logical theories proposed by representatives of the Russian Scholasticism without at least a small analytical reconstruction of the logical theories that have had a considerable influence over their development. No doubt logic in the frame of slavia scholastic depends on the forms in which logical knowledge has existed before it. In this context it becomes even more important to single out the interesting, unique and new found in the logic of the preceding period of the European philosophy.

One should start with Aristotle. Aristotle himself was proud to say that the new discipline, the name of which he did not have at the moment (it emerged later) – is his creation. It should be mentioned that in this case Aristotle is not sincere. There were already some elements of logic as of a science about properties and rules of argumentation. One should remember Democritus, Sophists and Plato (let alone peculiar, deliberated and argumentative logic within the Hindu theology, in particular negative dialectic of Nagarjuna with his theory of the syllogism of five members, unknown to Aristotle). But it is Aristotle who is credited as the one to systematize and codify the methods of reasoning not formulated in a clear way in his predecessors' s works. More

to it Aristotle turned these methods taken as unites and not as some components of discourse into a subject of scientific inquiry.

II. The Basic Elements of Aristotle's Logic

As it is known, all Aristotle's writings on logic are united under one title "Organon" – "an instrument" or to be more precise "an instrument tof thought" (this title was given not by Aristotle himself but by his followers). "Organon" unites six works: "Categories", "On Interpretation", "Prior Analytics", "Poster Analytics", "Topics", and "Sophistical Refutations". Aristotle is traditionally praised for his theory of the syllogism. All his premises and conclusions are based on terms with broad meaning thus related to sets of things. It is known (the first to draw attention to this fact was a well-known Polish logician J. Łukasiewicz) that both individual and negative terms were not considered by Aristotle. Categories are essential predicates, it is the most general information about the subject of an utterance. One cannot describe a category by the means of the nearest genus and distinguishing characteristic («P is Q(x) »); in other words the system of categories is not predicable in the sense the notions of subject and predicate are used in modern formal logic [1, p.17].

At the same time the theory on the primary and secondary substance, which is an integral part of the treatise "Categories", played a great role in defying a notion, a term as an element of logic theory. Aristotle points out at an ontological difference between a primary and a secondary substance: one can find an opposite to a secondary substance but not to a primary one. We can say that there is something "hot" in opposition to something "cold", but we cannot imagine a nonfire in contrast to a fire. A name (a noun) and notion are said about a subject. The rest (not in the case of primary substances) either tells us about primary substances as about subjects or is situated in them as in subjects [2]. Thus the basic characteristic of a notion or of a name of a thing is its ability to say about a thing as it is: categories are in this case different ways of designating existence [3].

The main theme of Aristotle's logic is the theory of assertion and syllogism. The work "On Interpretation" deals with the problem of an adequate assertion construction. The analysis begins with a remark that there are some elements of

an assertion. According to Aristotle the elements are represented by a name (a noun) and a verb. Neither a name, nor a verb can be valid or invalid in itself, they can be valid or invalid only if they are combined in an assertion, which can correspond to the reality or not.

III.   THE THEORY OF SYLLOGISM

The cornerstone of Aristotle's system is the theory of syllogism – as a theory of a subject of a new science of thought. There are three practically identical definitions of the term "syllogism" in "Organon". According to them syllogism is some unity belonging to a number of logoi and described in the following way: it is a resulting of necessity between given premises and an inference. The translation of V.P. Zubov is easier to follow: "syllogism is a discourse with some assertions in it. As assertions do exist something new arises out of the necessity [4, p. 97]. As Z. N. Mikeladze was right to underline, the definition of a syllogism given by Aristotle is a definition of deduction, of a deductive way of reasoning in the broad sense of this term. At the same time the definition is quite adequate (excluded a comprehensible limitation that an inference must differ from premises) [5]. The aim of syllogistics is to be a base for demonstrative sciences such as mathematics, geometry and optics.

Aristotle makes use of such terms as «argument», «argumentative syllogism», «scientific syllogism», «scientific argument» as of synonyms drawing a borderline between them and dialectical and sophistical types of syllogism.

Aristotle analyzed only three first figures: (I) P — M — S, (II) M — P — S, (III) P — S — M, where P stands for a major premise, S for a minor premise, and M for a middle term (the forth figure theoretically possible but not analyzed by Aristotle is sometimes said to be registered by a Roman Klavdian Galen). Stagirit demonstrates assertions of his system of syllogisms with the help of letters (as P. Popov and N. Stjaschkin remark [6, p. 71-72] singular utterances which rarely can be found in "Prior Analytics" can be easily transformed into conditional designation of things we are used to designate by letters).

According to a wonderful Polish logician J. Łukasiewicz [7] Aristotle's syllogistics can be described with the help of four basic principles:

A is inherent in all A;

A is inherent in an A;

If A is inherent in all B and B is inherent in all C, then A is inherent in all C;

If A is inherent in all B and C is inherent in a B, then A is inherent in a C.

Formulating the basics of syllogistics, J. Łukasiewicz points out three basic element of the system:

- Primary terms A and I, and E and O determined through the first ones;

- The four aforecited principles;

- Rules – rule of substitution and rule of division.

According to J. Łukasiewicz, Aristotle's syllogistics is based on rules that are formalized nowadays in calculation of utterances: all Aristotle's moods taking into consideration that two of them are included into axiomatics can be deduced from the elements of the system. As to Aristotle himself, he mentions all theoretically possible moods of the first figure, four of which are considered to be valid - Barbara, Celarent, Darii, Ferio (they were called like that later, in the Middle Ages). As to the second and third figures of a syllogism, they are as it was mentioned above, its imperfect types. From the scope of 16 theoretically possible moods Aristotle analyses such as Darapti, Disamis, Datisi, Felapton, Bocardo, Ferison, finding them logistically convincing. All of them can be verified by the means of moods of the first figure.

If according to Aristotle logic is a studies about knowledge in general and syllogism is a way and an instrument of getting trustworthy knowledge, it is easy to assume that spheres and elements of knowledge are isomorphic to each other. In general Aristotle singles out three types of syllogisms: apodictic syllogism as an instrument of arguing орудие доказательства; dialectic syllogism as a means of giving a reasoning ведения правдоподобного рассуждения; and an eristic syllogism used in an argument. In this way Aristotle shows the difference between such spheres of knowledge as apodeictics – theory of an absolutely valid knowledge got by an inference from absolutely valid premises and dialectics – theory of the probable. Stagirit addresses the problems of dialectics in "Topics" (derived from the word topoz – a place). In this treatise the term topoz is treated as a total of universal rules and clauses valid or "working" in any field of knowledge or in some of them (Topoz of a universal/particular character correspondingly). The notion of topoz in dialectics as a system of probabilistic knowledge correlates with a notion of axiom in apodeictics.

It should be mentioned as well that according to Aristotle's point of view (this part of his theory forms an integral part of scholastic logic) there is a whole range of syllogisms which only create the illusion of valid knowledge, in other words of false arguments. False syllogisms can be of two types: if a sophisticated syllogism is classified as a valid one not meant to deceive anyone it is called a paralogism; if invalid arguments/refutations are used on purpose they are sophisms. "On Sophistical Refutations" deals with both types of such fallacies.

Aristotle divides paralogisms into two types: 1) dependent on the language and 2) the ones with do not depend on the language. Stagirit singles out six language paralogisms:

- homonymy – this paralogism arises from the fact that a word can have more than one meaning;

- amphiboly - it is caused by the fact that a noun can play different roles in everyday language (the example provided by Aristotle is the following: someone can see a column. Thus, a column sees. The notion "column" is used both as a

subject and as an object and it is not taken into consideration in the course of an argument.);

- combination – combination of predicative systems that cannot be connected. Aristotle illustrates it with the following examples: "a person who sits can walk" and "a person who does not write can write", but it would be invalid to say that "a person who does not write is writing";

- division – discourse divided into fragments can have another meaning that the same discourse as a whole. – the denotent of terms of a syllogism may differ. An example of such a mistake is the following: "Five is two and three, thus five is an even and an odd number;

- accent or pronunciation – fallacies typical more of written discourse and poetry (it is caused by peculiarities of accent in the Greek language, when the meaning of the word depends on the stress);

- grammatical form –it arises "when two things which differ are described in one and the same way". In this case one violates Aristotle's system of categories.

IV. THE THEORY OF DEFINITION

For Aristotle the sphere of dialectics is a sphere of investigation which is meant to be a kind of methodology of science, as inferences are deduced from assertions and conclusions are made about different problems.

Terminological basis of Aristotle's dialectics comprises four basic terms: a definition, an accident, a genus, and a peculiar property. The central goal of "Topics" is to adequately formulate rules of predicables usage.

Problems treated in "Topics" and a small work titled "On Sophistical Refutations" which is sometimes referred to as the last part of "Topics" were totally adopted by traditional scholastic logic. Six topics dealing with definition could be a sound example to it. Following P. Popov and N. Stashkin [6] one can find there all the necessary provisions to the definition according to the textbooks on traditional logic:

- Definition is to be devoid of any ambiguity (amjibolia);

- Definition cannot be metaphoric, there is to be no words used metaphorically in the definiens (claritas definitiones)

- The definiens should contain a genus and a distinguishing characteristic and should not containe anything else (definitio latior);

- Definition is not to be too narrow, it is not to include characteristics not typical of each and every defying objects (definitio angustior);

- Insufficiency of the definition can be caused by the absence of the genus or of the distinguishing characteristic;

- Incorrectness of a definition is indicated by the absence of the interrelation between the definiendum and the definiens.

It is a small overview of Aristotle's logistic system, which was subject to commentary and interpretations in the Late Classical Period and in the Middle Ages.

V. ARISTOTLE'S LOGIC IN THE PHILOSOPHY OF THE MIDDLE AGES: WORKS OF PORPHYRY AND BOETHIUS

In the Late Classical Period and in the Middle Ages the genre of commentary on Stagirit's works became a logical writing in itself. One of the most important works of the sort is the commentary on Aristotle's "Categories" by a Neoplatonic philosopher Porphyry, as well as his well-known "Introduction to Categories".

This treatise gave rise to a problem of universals, the one significant for the logic of the Middle Ages. The work by Porphyry treats the problem of formation of notions of different level of generality, point at the existence of a very complicated ontologo-gnoseologic problem - the degree of dependence of general notions or universals from real things [8]. This problem was addressed from two points: nominalism (universal is a thing, nomen) and realism (universal is reality, realia, in contrast to a thing, res).

Porphyry's logical approach is original and is of high importance for the following periods, but it cannot be considered to be a major one for the development of a rather unique logic of the Middle Ages. It should be taken into consideration that the works of Aristotle and the works of Porphyry were written in one and the same language – Greek and they are the product of one and the same culture – The Classical one. While the major language of Europe till the XVII century was Latin, and the major culture – Christianity. That is why Boethius acted as a transmitter of Hellenistic culture during the medieval period.

According to G.G. Majorov [9] Boethius starts his logical writings with a commentary on Porphyry's "Introduction". This work carried out in the form of a dialogue was written on the basis of a Latin translation made by Marius Victorinus in the VI century. Boethius was not satisfied by this first logical commentary. Probably it was the cause why he started his own translation of Porphyry's "Introduction" and of "Categories" later. After it he translated other Aristotle's logical writings. As to the Boethius' works on logic, they were written under the influence of Aristotle's "Organon".

Boethius' works "On categorical Syllogism" and "Anti-predicaments" are quite equitable and treat as it seems problems addressed in Aristotle's "Prior Analytics". The latter is an abridged variant of the first part of the first writing. These papers define such basic notions as " a noun", " a verb", "discourse", "a sentence", "a subject", "a predicate", analyze types of relations between different types of sentences, look at the reversibility of predicates in sentences of different types, classify moods of the syllogism giving rules of bringing some moods to others.

The paper "On hypothetical syllogisms" deals with moods of hypothetical syllogisms, modal assertions and introduces a classification of consequences. As to the treatise "On Division" it is to be considered outstanding: Boethius singles out four types of division into classes which is a basis

of any classification according to the logician point of view: a) genre on types, b) whole on parts, c) one and the same word to a set of its meanings; d) accidental characteristics to different objects having these characteristics.

VI. TEXTBOOK ON LOGIC BY PETER OF SPAIN

As it was mentioned above the scholastic logic is based on the theories of the Classical Period. As a part of trivium it was taught alongside grammar and rhetoric in monastic schools founded by Karl The Great, in other words it was an obligatory subject, an obligatory element of the monastic erudition with a special emphasis put on the art of argumentation and classification. At the same time till the taking of Constantinople by crusaders in 1204 logic taught in schools was limited to Boethius' version of it. It was only in the period of the Latin Empire when one could turn to original texts of Aristotle and other logicians of the Classical Period.

Scholastic (belonging to a school in word for word translation) logic was in need of its own textbooks. The most well-known textbook was the one written in the beginning of the XIII century and relevant till the middle of the XVI century by Peter of Spain titled Summulae Logicales - Summaries of Logic. There were a number of theories on the origin of this writing. According to the view of K. Prantl [10] a well-known historian on the logic of the previous century, the textbook by Peter of Spain was a translation of a well-known Greek textbook "Sinopis" by a Byzantine scientist of the XI century Michael Psellos. But in the previous century it became evident that this dependence is wrong, as the analysis of the text showed that "Summaries of Logic" cannot be reduced only to "Sinopsis" [11, 12].

It should be mentioned that the work of Peter of Spain cannot be called original from the point of view of its contents, it is an adaptation of complex Aristotle's logic to the needs of scholars. The main contribution of Peter of Spain is the form this logic was given – the form of mnemonic verses describing figures and moods of syllogisms and giving names to the moods (Barbara, Celarent etc.).

VII. THE DEVELOPMENT OF ARISTOTLE'S IDEAS IN SCHOLASTICISM

Despite the fact that the treatise of Peter of Spain was as we would put it nowadays "a basic textbook for universities" a true development of logic took place in a bit different sphere – in a sphere of theologico - ontological theories elaborated by the representatives of later Scholasticism. The main part in this sphere was given to thomism although it is impossible to imagine logic of the Middle Ages without theories of the school of Chartres' representatives (especially Gilbert of Poitiers, who was the first of philosophers to use such notions as essence and substance as a ground used to argue on the possibility of unique things to exist) and the school of St Victor's representatives, as well as of Johannes Duns Scotus.

This article focuses only on St. Thomas Aquinas and Johannes Duns Scotus doctrines. St. Thomas Aquinas (1225 – 1274) is a well-known theologist of the Middle Ages, creator of Thomism. His main works are "Summa Theologica" (1267-1273 not finished) and "Summa contra gentiles" known as well under the title "Summa Philosophica" (1259-1264). St. Thomas's theory of substance, formulated in the first and second volumes of "Summa Philosophica" and the first volume of "Summa Theologica" is based in general on the antithesis of potential – incompleteness open to change – and actual – principle of order and («potentiality» (matter) and «actuality» (God) are two poles of existence), and Aristotle's approach to the differentiation of primary and secondary substance treated as accident and substance. This approach not only becomes the dominant one within the Catholic Church but plays a role of a common ground in the philosophy of the New Times (Descartes, Spinoza).

At the same time one cannot say that Thomas shared all Aristotle's views. It is known that he criticized Stagirit for his disapproval of Plato's theory of an inner form of a word. Problems of modal logic were of paramount importance to him. He focused on six types of modal operators – validity, invalidity, necessity, possibility, fortuity, impossibility and gave logic squares of relations between modalities. If one is to estimate the modal scholastic logic in general it is hard to disagree with a Finish logician S.Knuutila [13], who said that scholastic modality system was based on defying "necessity" and "possibility" as "validity in all the cases" and "validity in some cases" correspondingly.

Everything said above can be mentioned not only in connection to Thomas Aquinas but in connection to Johannes Duns Scotus, his contemporary and an opponent in some sense. As most researches note the interest for Johannes Duns Scotus's approach lies in a great number of distinctions, the major of which is the distinction of real (distinctio realis) and formal (distinctio formalis), and distinctions like distinctio rationis, in other words of something rational, speculative and purely logical. An example for the first one is the distinction between matter and form (in the way they are treated by Aristotle and Aquinas). The second one can be illustrated by the distinction between a general character of a thing and its individual characteristics as of something unique. The third distinction between things arises if one mentally compares and matches them [14, 15].

It is said that Scotus founded terminological base drawing a borderline between abstract and concrete notions as well as such terms as formalitas (referring to form), materialitas (materiality), incompossibilitas (incompatible with possibility), esse reale (real existance), intentionale (intentional existance), realitas (reality), causa sine qua non (an indispensable condition). But the most unique part of Scotus's theory is his treatment of universals, a problem which was a complicated one and highly actual in the Middle Ages. Duns Scotus attaches more importance to individual in a dichotomy universal/individual. But it does not mean that universal is something unexisting: universal is existing (uversale est ens), as non-existing cannot be cognized as

mind is directed by something that can be cognized… there is nothing corresponding to fiction in the world, while there is something outside mind that corresponds to general, due to it it can analyze causes with the help of intention".

The principle of individuation according to Scotus is inseparable from form, form refers to matter as type refers to specie. The last form is haesseitas «thisness» as an extreme reality of existance, not "whatness" («quidditas»), but «thisness» as a marker of something individual, as a positive characteristic of existence.

The object of logic according to Scotus is notions created by the work of mind. But the theory of notion and assertion in itself is something preliminary, a real object of logic is a theory of argument and inference which helps us to go from something known to something unknown (this is the reason why the theory of notion and assertion is called "old logic" while the theory of argument and inference - "new logic'). Existence taken as it is transcendent, but when it is divided into ten categories, it becomes subject to logical analysis.

VIII. CONCLUSION

Scholastic logic is based on logical theories of the Classical Period, to be more precise on those formulated and described in the writings of Aristotle. Aristotle not only gave system to the earlier pronounced logical ideas, but developed the theory of syllogism and inference and elaborated the theory of syllogism. An undeniable merit of Aristotle in the development of logic as a science is his theory of notion and of definition of a thing [16].

Aristotle's logic became a basis of Medieval scholastic logic, which assimilated the ideas of Aristotle through the works of Boethius, who translated Aristotle's writings into Latin and wrote commentaries on them. The textbook "Summaries of Logic" by Peter of Spain gave an account of principles of Aristotle logic, while the development of the logical thought took place in the sphere of ontological thinking by the representatives of the Later Scholasticism. The most prominent logicians of this period are St. Thomas Aquinas who made a considerable contribution to modal logic and Johannes Duns Scotus who elaborated the theory of inference and argument.

REFERENCES

[1] Voishvillo E. K. Notion. M., 1967.

[2] Aristotle "Categories ", 2a, 30; 2b, 5. Works in 4 volumes. M., 1978.

[3] Aristotle "Metaphysics", V 8, 1017a, 23. Works in 4 volumes. M., 1978.

[4] Zubov B. Aristotle. M., 1963.

[5] Mikeladze Z.N. Aristotle's intentional // Modal and intentional logic and their application to the problems of scientific methodology. M., 1984.

[6] Popov P., Stjaschkin N. Development of logic from the Classical Period till renascence. M., 1970.

[7] Łukasiewicz J. Aristotle's syllogistics from the point of view of modern formal logic. M., 1959.

[8] Oseledchik M.B., Inozemtsev V.A., Ivlev V.Y., Ivleva M.L. Logical-Philosophical Approach to the Interpretation of the Concept of Knowledge //Proceedings of the 2016 3rd International Conference on Education, Language, Art and Inter-cultural Communication (ICELAIC 2016). Advances in Social Science, Education and Humanities Research. Paris: Atlantis Press, 2017. Volume 40. P.297-301.

[9] Mayorov G.G. Life and case of Boethius. M., 1990.

[10] Prantl K. Geschihte der Logic im Abendlande. Leipzig, Bd.II, 1861, Bd.III, 1867.

[11] Chistyakova O.V. Byzantium − Russ − Russia. Philosophical and Anthropological Traditions. Textbook. Kuban State University Press. Krasnodar-Moscow. 2005. – 223 p. ISBN: 5-8209-0380-3.

[12] Chistyakova O.V. Philosophy of Byzantium and Ancient Russ. Textbook. Moscow State Institute for the Tourism Industry named after Y. A. Senkevich. Moscow, 2014. – 224 p. ISBN: 978-5-96300-042-7.

[13] Knuutila S. Changes of modal paradigm in later medieval philosophy // Modal and intentional logic and their application to the problems of scientific methodology. M., 1984.

[14] Chistyakova O.V. The Problem of a Human in Eastern Orthodox Patristic. Monograph. North Caucasian Scientific Center of the Higher School Press. Rostov-on-Don, 1999. – 255 p. ISBN 5-877872-115-5

[15] Chistyakova O.V. The Problem of a Human in the Eastern Patristic. Cultural and Methodological Analysis. Thesis for Doctor of Science Degree in Philosophy. Rostov-on-Don State University, 1999.

[16] Inozemtsev V.A., Ivlev V.Y., Ivleva M.L., Oseledchik M.B. Representology in the System of Modern Epistemology //Proceedings of the 2016 3rd International Conference on Education, Language, Art and Inter-cultural Communication (ICELAIC 2016). Advances in Social Science, Education and Humanities Research. Paris: Atlantis Press, 2017. Volume 40. P. 697-701.