RECENT LOGICAL STUDIES' EFFECT ON MODERNIZATION OF TURKISH THOUGHT

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Abstract

Developments of Turkish thought can not be understood sufficiently without considering logical studies in this field. Ottoman logicians dismissed logical developments in western philosophy. Interest in mathematical or symbolic logic can be traced back to the end of the eighteenth century. Turkish logical researches have characteristic features. For example, while westernization was gaining strength in education system at that time, traditional Islamic thought was widening its popularity. Also as a distinctive trait, it was mathematicians who studied modern logic in Turkish thought. The science of logic had a very significant place in Philosophical education in Madrasah curriculum. Traditional and modern logic were taught together in the secondary and high schools.

Preliminary Remarks

In this study modern developments in Turkish thought will be analyzed within the context of logical investigations. This essay will also try to show the traces of the transmission of recent logical investigations from Western philosophy to Turkish thought. We will give a brief perspective on how Turkish thought got a dual structure in this transformation process with modernization efforts. Description of new developments of Turkish thought will be provided by illustrating its main features with some due works.

Undoubtedly everything is not known in detail about the logical investigations in Turkish thought. So much more systematic and historical researches are needed. There have somewhat been various researches in recent years, but there hasn't been a detailed treatment of history of logic in Turkish thought yet.

Modern logical improvements in Western philosophy were transmitted to Turkish thought after the Tanzīmāt i.e. administrative reforms in late Ottoman period (the years 1839-1876). On the other hand, this familiarity with modern logic spurred researches on traditional logic. For this reason these classical studies had to be accepted a kind of new logical development. As a result traditional logic made progress and was generalized in Turkish thought. In this context logical studies in modern Turkish thought can be divided into two main groups: a) Traditional-classical-logic depending on Aristotelian logic; b) Modern logical studies. The first one is dominated by al-Farabi`s logical researches and that of Avicenna's (Ibn Sīnā d. 1037 A.D.)

Turkish scholars who studied history of Turkish thought pointed out that logical works in Turkish thought were written down in three styles: first, the works corresponding to traditional logic, and these works are not but repetition of what went before. Secondly, the works reconciling antique and modern studies, which hold traditional and modern logical matters together. Thirdly, the works considering modern logical matters only. These final works were written in western style.[1]

HOW DID THE LOGICAL TRADITION CONTINUE FROM THE OTTOMAN TO TURKISH?

What is traditional logic? Al-Kindī, al-Farabī and Avicenna established the tradition (the line) of Arabic logic by depending on Aristotelian logic. There is no doubt that Al-Kindī, al-Farabī and Avicenna (Ibn Sīnā), Ibn Rushd (Averroes: c. 1126-1198), Fahreddīn al-Rāzī (c. 1149-1209) al-Sayyid al-Sharīf al-Jurcānī (c. 1340-1413) and other eminent Islamic philosophers also treated the science of logic as the beginning of scientific reasoning and the basis of their philosophical systems. So, it must be confessed that rational understanding in Islamic Philosophy was developed by the effect of Greek philosophy.

Muslim logicians attempted to examine all matters of logic and their contributions changed Aristotelian logic into Islamic one. It is obvious that traditional Muslim logic came up from these contributions. Muslim logicians

showed great ability in discussing some logical problems such as defining concepts, five universals (five predicables), definition and description, explanation in modal notions, verifying modal propositions, and finally in the form and material of syllogism. The different line of history of logic in classical Islamic culture arose from all these contributions.

N.Rescher states that "it would seem that the theory of temporal modalities represent the most significant addition made by the medieval Arabic logicians to the body of logical material that they received from the Greeks".[2] Some logical matters were great concern to the Muslim logicians such as the relationship between logic and grammar, conditional syllogism, the problem of universals, the analysis of the concepts of existence and predication, theory of categorical propositions. These topics were cause of some logical or logico-philosophical questions which the Muslim philosophers treated in.[3]

K.Gyekye suggested that "Muslim scholars soon found that logic, as a study of the general principles of reasoning, was valuable in technical controversy. Moreover, knowledge of the principles and methods of reasoning would help the theologian in detecting the falsehood and inconsistencies in the arguments of their opponents".[4]

The science of logic had a strong influence on methodology of religious sciences and gained very important place among other sciences owing to the Ghazālī's treatment of logic. Ghazālī wrote in defense of logical studies and his studies contributed very much to powerfully for the acceptance of the science of logic. Ghazālī was willing not only tolerate logic and its use as a basis for Islamic theology, but to support and recommend its study as an essential instrument of the clear reasoning needed as guide in the good life.[5] The effects of logic on Islamic Jurisprudence and Islamic theology (Kalām) is evidence by using materials of logic especially using analysis of concept, systems of signs (dalālāt), definition (had). These subjects were examined deeply in religious sciences particularly in theological discussion and methodology of Islamic scholars depending upon principles and rules of logic.

Gyekye commented on how Muslim philosopher "...made some contributions to the history of logic. When the Greek logical works were handed to the Muslim scholars in translations in and after the century A.D., they studied them thoroughly and critically and wrote commentaries upon them."[6]

Furthermore, we can say, during the three centuries (from tenth to twelfth century) there were developments in Muslim philosophy especially in logic. After the thirteenth century Muslim scholars made no original contribution to the development of logic and philosophy. There was no development in Turkish philosophy from the thirteenth to eighteenth century, approximately 500 years. In Turkish thought, what authors of the eighteenth century knew in logic were the same as authors of the thirteenth century did. All of the published work was a mere paraphrasing of the ancient and classical texts. After the thirteenth century there were a number of logicians who wrote commentaries on chief logical texts, which were only paraphrasing.

It can be said that in the last period of classical Islamic culture before Ottoman period, al- Abharī (d. 1264), Shams al-Dīn al-Samarkandī (d. 1302) were eminent logicians whose works had clear and definite effects on logical treatment of Turkish logicians. Al-Abharī's book entitled *Isaghuji* and al-Samarkandī's book *Kistās al-Afkār*⁺ were original from the standpoint of explanation and division. These authors quote directly from the works of Aristotle and Avicenna; they are speaking strictly and not commenting upon them; on the contrary they restate and paraphrase their logical matters in their own way with their own views. For example Shams al-Dīn al-Samarkandī quotes directly from Aristotle and Avicenna in his *Sharh al- Kistās al-Afkār*.[7]

In classical Islamic culture, Aristotelian logic arrived at the following standard arrangement of logical works: Isagoge (Porphyry), Categoriae, De Interpretatione, Analytica Priora, Analytica Posteriora, Topica, Sophistici Elenchi, Rhetorica and Poetica. These nine works were thought of as dealing with nine respective distinct branches of logic. This construction of Aristotelian logic was taken over by the Islamic Logicians resulting in the following organization of the subject matter of logic: al- Isaghujī, al-Maqūlāt, al-'Ibārah, al-Qiyās, al-Burhān, al-Jadal, al-Mughālitah (al-Safsatah), al-Khitābah, al-Shi'r. The totality of this *Organon* was referred to as "The eight books" with the Poetica or sometimes Isagoge excluded.

It is evident that following the tradition of Hellenistic Aristotelianism, the classical Islamic culture arranged the Aristotle's Organon as nine books. Unlike this approach, the last period of Islamic philosophy changed this treatment and Ottoman-Turkish logicians divided Aristotelian Organon into two separate sections: the "*tasawwurāt* (apprehensions) and the "*tasdīkāt*"(assents).

Any more subjects of logic are not treated within the nine books as in the first period of Islamic philosophy. The Muslim logicians who lived in Ottoman period (from the thirteenth century to the nineteenth century) examined subjects of logic by gathering in two main titles "*tasawwurāt*" and "*tasdīkāt*". Moreover, they made some changes in examining the subjects of logic: they omitted matter of "definition" from Analytica Posteriora (*Kitāb al-Burhān*) and added it to "five universals"; also they omitted wholly categories from the subject of logic. Furthermore Turkish logicians passed the five books (*al-Burhān, al-Jadal, al-Mughālitah, al-Khitābah, al-Shi'r*), which were entitled "five arts" by them without examining them deeply. The Turkish logicians customarily referred to the first three books (*al-Maqūlāt, al-Ibārah, and al-Qiyās*) and generally confined themselves to the logic of "the three books".

In university curriculum (madrasahs) logic occupied a special place as one of the oldest intellectual studies. After the classical Islamic culture, the logical tradition of Muslims entered a period of decline. The principal achievement of Ottoman –Turkish logicians in the field of logic was to keep alive current tradition.

This content of logic, without changing until the last quarter of nineteenth century, dominated Turkish logical tradition. Unlike this treatment, in Western Philosophy after the 16th century there had been a resurgence of interest in logical and mathematical inquiry. However, Turkish thought was unaware of the philosophical movements that took place in Western Philosophy until the end of the eighteenth century. The constructive influence of developments of logic in Western philosophy led a number of Turkish logicians to study traditional logic. The new development in Western philosophy made much affect on the teaching of formal logic (classical logic). For this reason there were two educational programs in logic at the end of the eighteenth century: formal logic and modern logic.

DEVELOPMENT OF LOGIC IN TURKISH THOUGHT

Some of the important Turkish logicians who defended Aristotle's logic were Muhammad Abu Bakr al-Mara'shī (d. 1737) (*Tartîb al-'Ulûm*), Ismail Gelenbevī (*Mîzan al-Burhān*), Ahmet Cevdet (Mi'yar al-Sedat). Mehmet Hilmi (*Hulasa al-Mantiq*), Ahmed Hamdi (*Mantiq*), Hocazadah Mehmed Tāhir (Zubdah al-Muhtelitāt min al-Tasdikāt), Abdurrahmān Nāim (Mantiq Hulāsasi), Mehmed Tevfīk (Gāyeh al-Beyān), Mehmed Nūrī (Iqmal al-Burhān fī al-Tercumān-ı Mīzān), Ahmet Hifzi (Qism al-Tasawwurāt min Hulasāh al-Mīzān), Omer Fevzī (Mi'yar al-Ulūm), Ali Irfan (*Methal-ı Mantiq*). Their works were

written within the tradition of classical Islamic culture. Their content was determined by Aristotelian logic and Islamic traditional logic. These works had the characteristics of being mere textbooks that were written to be taught in secondary school (*maktab*) and *madrasahs*. In these textbooks educational objectives were aimed rather than scientific concern. For this reason the science of logic was considered as the technical study omitting the metaphysical matters from the field of logic. The syllogism, propositions and conceptions were the core subjects in these textbooks.

Before the *Tanzīmāt* period intellectual world of Turkish thought was ignoring the new developments in the fields of philosophy, logic and science in Western thought, because Turkish scholars mostly tended to confine their treatment to traditional Islamic culture whereas the great advance had been made in the mathematical thinking in the West. The principal achievement of Western Philosophy was modern mathematical constructions. For example Turkish scientists didn't know Giordano Bruno's philosophical and mathematical works; also Galileo Galileo's and Descartes' philosophy depending on mathematical reasoning was not known by them.

Turkish thought acquainted with the improvements of the scientific, philosophical and logical fields that made progress in the new age in the West after the *Tanzīmāt* period. Unfortunately as the basics of Western Civilization - its scientific methods, mentality and philosophy- were not comprehended by Turkish scholars of the time, the ideas transmitted from the West manifested themselves rather superficial and feeble. But on the other hand these new developments in logic and philosophy led Turkish scholars to take traditional Islamic sciences and new developments into account all in all.

When the old scientific and logical understanding paled with the resurgence of modern scientific understanding, the reconciliation studies began as we called it 'the reconciling works/second group' at the outset. The contents of this second logical works were determined by need which strikes a balance between two distinct developments in logic: namely traditional Islamic logic and modern logic. The authors believe that those two developments were complementary.

The followings are some works that take new developments and traditional topics of logic into account together: Italian logician Gallupi (*Key to the Sciences*) whose book was translated to Turkish by Ohannes Pasha as "*Miftāh al-Funūn*", Ali Sedat (*Mīzān al-'Ukūl fī al-Mantiq ve al-'Usūl; Lisān al- Mīzān*), Ismail Hakki Izmirli (*Mi'yar al-'Ulūm*).

These books got started to treat new logical developments in Turkish thought. This Turkish translation (*Miftāh al-Funūn*) of Gallupi's book and other two books prepared the ground for the first treatment of modern logical matters. Although Ohannes Pasha, Ali Sedat and Izmirli were in favor of old–traditional

logic, they, unlike other Turkish logicians who went before, treated modern logical matters in their books. *Miftāh al-Funūn* changed traditional classification of the subject matter and the mode of the treatment of the logic. It, unlike classical works, was analytical rather than synthetical, which means that the matter of syllogism was considered as an initial subject. Gallupi arranges the subject matter of logic in the following order: the syllogism, the proposition and the term. The last two are respectively components of syllogism.

According to Turkish logician Necati Oner (d.1927-....) *Miftāh al-Funūn* is not merely a translation, but it has important modifications made by its translator, Ohannes Pasha. He imported some chapters into the book titled '*lahikha*' dealing with methods of the sciences. The treatment of methods in this book stimulated wide interest in the subject-matter of methods for other logical studies.[8] Afterwards methods of the sciences were considered as main topics for the logical studies.

Ali Sedat is the most important logician whose works are the turning point for Turkish logical movements. He pioneered to introduce the philosophical and logical developments taking place after the Renaissance in Western thought. His two books mentioned above are original and involve traditional-formal logic and new logical studies. He elaborated widely matter of methods of the sciences and discussed the modifications that English logicians made in Aristotelian logic. In this connection, he discusses the matter of quantity of predicate*, which is suggested by English Logician George Hamilton, the problem of induction, which was put forward by Francis Bacon against the theory of syllogism of Aristotle. The most important point of his book entitled *Mīzān al-'Ukūl fī al-Mantiq ve al-'Usūl* is the "*lahikha*" that Ali Sedat added to it. The rest of the work is devoted to the discussion of the logical improvements occurred in Europe. It for the first time handled George Bool's and Stanley Jevon's logical studies extensively, which is uttered as the mathematizing the logic*.

Ali Sedat is the principal logician among other Turkish logicians. Ali Sedat's logical studies are the first original attempt to make critical examination of these modifications occurred in logic. Ali Sedat pointed out the deficiency of mathematical logic based on mathematics. He bases his examination upon the very new ideas of Bool's. He is speaking directly of the logical matters in his own way with his own views. He defined logic as the study of the types or forms of arguments.

Whereas Ali Sedat is in favour of traditional logic, Izmirli is in favour of new logical treatments. Ali Sedat paid attention to the deficiency of mathematical logic. Because, he believed that logic must not depend upon mathematical field. Since range of logic is more general than mathematics.

Ali Sedat had already remarked that to subject logic to mathematical reasoning was a useless attempt. He made references to the views of English logicians in his book. He remained closely faithful to Aristotelian logic during his logical studies. However he can be accepted as a starting point in Turkish logical movements.[9]

The same pattern was followed in Izmirli's works unifying the old logical studies with recent ones. While he investigates only traditional logic in his book *M'iyar al-'Ulūm*, he treats modern

logical matters in his book entitled *Felsefe Dersleri (Philosophical Lectures)*. Izmirli wrote this work in different form from *M'iyar al-'Ulūm* by adapting the contents of Paul Janet's, Rabier's and Boirac's book. For this reason *Felsefe Dersleri* is not systematical work. It was divided into two chapters; the first chapter deals with the theory of knowledge, philosophical and scientific knowledge; and the second chapter was wholly devoted to the science of logic. Izmirli is considering formal logic at first by comparing and contrasting traditional handling with western style, and then he is introducing Boole's algebraic logic at the end of the second chapter.

Felsefe Dersleri contains algebraic logic and matter of quantity of predicate, which was suggested by English Logician George Hamilton and it also includes criticism of formal logic suggested by Descartes, Bacon and John Stuart Mill. For Turkish thought it is quite important to have such a thinker like Izmirli who explained the modifications occured in Aristotelian logic after The Renaissance in Western philosophy.

Salih Zeki (1864-1921), a Turkish mathematician who lived in the second half of the nineteenth and in the early twentieth century, is the author of many works in the field of mathematics, modern physics, philosophy and logic. He can be considered the very defender Boolean algebra of logic. His fundamental work in logic, the most illuminating work on mathematical logic so far, in Turkish thought, is entitled *Mizan al-Tefekkur*. Here we will sum up the standpoint taken by Salih Zeki rather than going into detail.

Salih Zeki set himself the task of introducing mathematical logic to Turkish thought. He is the first and last logician to accept algebra of logic. As a consequence no scholars after him have been interested in mathematical logic. In his work entitled *Mîzan al-Tafakkur*, Salih Zeki says the science of logic can be divided into three different parts: formal logic, quantified logic and symbolic logic. According to him symbolic logic is the most important one among others. Symbolic logic can be applied to wide ranges, while others were limited in their range of application.[10] Salih Zeki calls the mathematical logic as symbolic logic.

Salih Zeki came to believe that all sciences were to be progressed and developed by nature. In any way there is no need to take into account Euclid's Geometry, al-Khwarizmi's *Kitab al- Jabr* and Aristotle's Organon. Their times are out of date now. Their methods are the things of the past. It is necessary to trace Western scientific methods to learn scientific, philosophical and logical developments.[11] According to Salih Zeki, the key of modernization in Turkish civilization is mathematical reasoning. The aim of Salih Zeki's research was to

make mathematics more general acceptance in Turkish scholars.[12] For this reason he investigated and elaborated the algebra of logic set forth by Boole.

It is remarkable fact that Salih Zeki was the very defender of modern logic While, Ismail Gelenbevi, Ali Sedat and Ismail Hakki defend traditional logic. But no school arose with its distinctive representatives. Those are only a few of the great number of logicians. Among all these logicians Ismail Gelenbevi and Salih Zeki holds a very important place in the history of Turkish thought.

Ottoman logicians dismissed the new philosophical and logical investigations that were peculiar to modern logic. Modern interest in mathematical logic or symbolic logic in Turkish thought can be traced to the end of the eighteenth century. In opposition to this situation, the new logical developments in Western Philosophy can be traced to Raymond Lull's work. His importance rests on his invention of a system for combining concepts in a mechanical fashion. In his system signs for the most important concepts in certain groups were to be set out round circles and various combinations were to be produced by the rotation of the circles about a common centre. Despite his selection of fundamental concepts, he did not show great philosophical ability and his method of combining them has not produced any results, nevertheless his system which his followers called "The Arts Magna" did not have some influence on development of logic.[13]

Aristotle's logic, which is also called traditional logic, continued for over two thousand years to constitute almost the whole body of logical theory. Traditionally logic has been considered as a part of philosophy which also includes theory of knowledge, metaphysics and ethics. A few additions and improvements were made here and there during The Middle Ages, but no actual challenge was directed to it until the middle of the nineteenth century.[14]

For a long time it was thought that traditional logic was the only method of the sciences. Then it is claimed that traditional logic was considered insufficient and limited for the other sciences as a method. Other logical attitudes were searched owing to the fact that Aristotelian logic was limited in its range of application. It should be noted that all new developments are due to the work done by mathematicians. Throughout the ages the success of abstract reasoning in mathematics led many philosophers and scientist to extend its application to other fields. Descartes' achievement in applying algebraic

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methods to the study of formal logic might perhaps be treated likewise. Thomas Hobbes and a few others considered abstract reasoning as a kind of reckoning.[15]

According to William Kneale, the rise of new philosophical interest connected with natural science led gradually to neglect of formal logic.[16] At the beginning methodological ideas seem to underlie all developments in Western Philosophy. Advance of methodology in logical area does not follow from logical problems, but from the scientific involutions. It isn't the aim of methodological studies to improve logical system but to give appropriate method of modern natural science. Their aim has rather been to construct a guide new method corresponding new scientific involutions. There was no essential distinction between logic and methodology in medieval philosophy.

Descartes and Bacon's attempts are to be viewed not as the logic, but method of the science. The influence of methodological ideas seems to be much stronger than modern mathematical logic. The new logical constructions are result of mathematics.

Russell says that "mathematics and logic, historically speaking, have been entirely distinct studies. Mathematics has been connected with the science, logic with Greek. But both have developed in modern times: logic has become more mathematical and mathematics has become more logical. The consequence is that it has now become wholly impossible to draw a line between the two; in fact the two are one."[17]

The notion of mathematical logic arose in the period from Leibniz to 1847. In this period many points of detail were formulated especially by Leibniz, however there was no school at this time. There were some periods such as The Boolean Period from Boole's Analysis to Schroder's Vorlesungen, during this period there was a continuous development of the first form of mathematical logic and the period of Frege from his Begriffsschrift (1879) to the Principia Mathematica of Whitehead and Russell (1910-1913). Frege, Pierce and Peano set a new goal to find foundations for mathematics. A series of important logical ideas and methods were developed.[18]

There are two lines of new developments of modern logic: In the tradition of Boole and Schroder logic was subjected to mathematical analysis; in 'Principia Mathematica' mathematics was subjected to logical analysis. Russell and Whitehead found in the new logic the instrument of analyzing the

concepts and principles of mathematics while the earlier symbolists (Leibniz, De Morgan, George Boole Schroder) tried to mathematize logic by devising and using a system of mathematical notation.[19]

Boole employed fairly difficult mathematical theorems in order to present and prove some of the results he obtained in his logical research. Problems were formulated in a mathematical way.[20] Although logic has many common principles, it can not only be reduced to algebra. There is a clear difference between Frege's logical symbolism and Boole's symbolism modeled on mathematics. According Frege the use of arithmetical symbolism in logic would lead to an ambiguity of symbols. Frege was not tempted to set logic tasks, which were analogous to mathematical problems. The fact that Frege did not use mathematical methods in logic influenced Whitehead and Russell. They wrote *Principia Mathematica* containing the study of mathematical logic.[21]

According to Lukasiewicz, "the ancients created certain logical systems, still very imperfect but which certainly can be considered the first stages in the development of contemporary systems of mathematical logic... In fact, there are not two logics, mathematical and philosophical (formal ancient logic); there is only one logic, founded by Aristotle, completed by the ancient school of the Stoics, and pursued, often with great subtlety, by medieval logicians, and it is that logic which is developed by mathematical logic."[22]

Final Evaluation

Logical researches in modern Turkish thought have characteristic features. They have their own peculiar perspective towards science of logic. In accordance with this characteristic, studies in traditional logic have been considered parts of new developments in logical studies. Some works, even if they are referred to as parts of traditional logic, have been accepted as new developments. As the Arabic texts of logic could be easily published in Turkish, the spread of formal logic outside the "*Madrasahs*" was easier and faster than recent developments in modern logic.

In the beginning of *Tanzimat*, nationalistic attitude in thought appeared and knowledge of Islamic logic (traditional-formal logic) was translated from Arabic texts and commentaries to Turkish and was publicized. Therefore classical Islamic thought which was confined to *Madrasahs* went beyond them

due to the fact that traditional thought was strong and systematic to gain superiority over occidental movements, which were unsystematic and weak. Reaction to Occidentalism was very strong motive in holding and grasping formal-traditional logic.[23]

While tendencies in westernization were gaining strength, a strict devotional attitude to traditional Islamic thought was becoming popular. To prevent harmful effects of new philosophical ideas on Islamic thought, formal logic was taught in new schools and Arabic texts were translated into Turkish. It may be said that formal logic is considered as an appropriate instrument for formalization of Islamic thought. Furthermore formal logic affected linguistic studies and Principles of Jurisprudence and Islamic theology.

The science of logic was taught in Arabic in Ottoman *Madrasahs* until the second half of nineteenth century. When the new secondary schools were opened to make a stand against the Madrasahs after the Tanzimat – administrative reforms period, lessons of logic were taught in Turkish.[24]

Contemporary Turkish logicians have a comprehensive and unified understanding on logic and as a result traditional and modern logic are educated together in the secondary and high school. There are departments of philosophy in which both formal logic and mathematical logic have been studied. It was mathematicians who studied modern logic in Turkish thought some of whom were Ali Sedat and Salih Zeki. It could easily be argued than when modern mathematical elaboration was developed in Turkish thought, the interest of modern philosophical and logical studies made progress.

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[1] Hilmi Ziya Ülken, (Istanbul: 1934), "Tanzimattan Sonra Mantık Hareketleri", *Edebiyat Fakültesi Tarih Mecmuası*, Issue: 1pp. 37–51; Necati Öner, *Tanzimattan Sonra Türkiye'de İlim ve Mantık Anlayışı*, (Ankara: 1967), p. 12, 50, 61

[2] Nicholas Rescher and Arnold Vander Nat, (Foundation of Language Supplementary Series, No: 2, Dordrecht 1967), "The Arabic Theory of Temporal Modal Syllogistic", G. Hourani (ed.) *Essays in Islamic Philosophy and Science*, p. 189; Rescher, (Albany 1973) "Temporal Modalities in Arabic Logic", *Studies in Modality*, p.17

[3] Kwame Gyekye, (Albany 1979), *Arabic Logic*, p. 12

[4] Gyekye, (1979), p. 2

[5] Nicholas Rescher, (Pittsburgh: 1963), *Studies in the History of Arabic Logic*, p.55

[6] Gyekye, (1979), p.1

* Shams al-Dīn al-Samarkandī, wrote a commentary entitled *Sharh al-Kistās al-Afkār* on his book *Kistās al-Afkār*, in the MS of *Suleymāniye*, Ayasofya No: 2556

[7] Shams al-Dīn al-Samarkandī, *Sharh al- Kistās al-Afkār*, Ayasofya 2556

[8] For detail see P. Gallupi, (Istanbul: 1928), *Miftāh al-Funūn*, pp.160-189

* Every standart-form categorical proposition is said to have both a "quality" and a "quantity". The quality of a proposition is affirmative or negative; the quantity of a proposition is universal or particular. (Irving M. Copy, *Introduction to Logic*, p. 138)

* Some mathematicians such as De Morgan and George Bole took up the task of extending the realm of formal logic. They tried to mathematize logic by introducing a system of notation. Boole gave an account of the formal logic in terms of algebra, consequently Boole presented a logic based on algebra. (Cemal Yıldırım, (METU Pres, Ankara: 1981), *Logic The Study of Deductive Reasoning*, p. 142–43

[9] Far more knowledge see Ali Sedat, (Karabat Publication, Istanbul: 1303), *Mīzān al-'Ukūl fī al-Mantiq ve al-'Usūl*. pp. 204.

[10] Salih Zeki, (İstanbul 1912) *Mizan al-Tefekkur*, p. 65

[11] Salih Zeki, (March, 1326), "Skolâstik", *Darussafaka Dergisi*, Number:1, Vol. 10. p. 443–44

[12] Bursalı Mehmet Tahir, (Istanbul: 1975), *Osmanli Muellifleri*, (Ed.) Ismail Ozen, p. 289

[13] Bochenski, *A history of Formal Logic*, (USA: 1970), (Translated and Edited By I. Thomas), p. 272; Kneale, (1989), *The Development of Logic*, p. 242

[14] Cemal Yildirim, *Logic The Study of Deductive Reasoning*, (Metu Press, Ankara: 1981), p.5

[15] Yildirim, *ibid*, p.141

[16] Kneale, *ibid*, p. 246

[17] Bertrand Russell, *An Introduction to Mathematical Philosophy*, (London: 1919), p. 194

[18] Bochenski, (1970), p. 249

[19] Yildirim, ibid, p. 143–44

[20] Jan Lukasiewicz, (Copyright 1963), *Element of Mathematical Logic*, (Translated from Polish by Olgierd Wostasiewicz), p. 4

[21] Lukasiewicz, *ibid*, p. 5–6

[22] *Ibid*, p. 8

[23] Hilmi Ziya Ulken, (Istanbul: 1979), *Turkiye'de Cagdas Dusunce Tarihi*, second ed., p. 68

[24] Necati Oner, (December 1992), "Turkiye'de Mantik Calismalari", *Felsefe Dunyasi*, Issue: 6, p. 3