İSMAİL GELENBEVI AT THE ENGINEERING SCHOOL: THE OTTOMAN EXPERIENCE OF EUROPEAN SCIENCE THROUGH LOGARITHMS

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İsmail Gelenbevi Mühendishâne'de:
Osmanlılar'ın Logaritma Aracılığıyla Avrupa Bilimi Tecrübesi

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Title: İsmail Gelenbevi at the Engineering School: The Ottoman Experience of European Science Through Logarithms

The Naval Engineering School (Mühendishane-i Bahr-i Hümayun), established in 1775, created the protype of the engineer as distinct from the existing ranks in the Ottoman state, and it increased Ottoman contact with European science. This thesis examines the career of İsmail Gelenbevi, one of the most distinguised scholars in Ottoman intellectual life and a prominent mathematics teacher at the Engineering School, and his book, Sharhu Cadavil-i Al- Ansab, on the logarithms invented in Europe. While Gelenbevi was experiencing the "old" and "new" types of knowledge together at the "micro" level at this school, the Ottomans as a whole were encountering European science at the "macro" level. This synchronized condition can be seen in his book on logarithms.

This thesis, which also discusses the relationship between traditional Muslim scholarship (ilmiye) and the new engineering education during the first phase of the school, is comprised of three main chapters. First, science in general and mathematics in particular in the Ottoman Empire and the literature on the history of Ottoman science are briefly introduced. Then Gelenbevi's years at the engineering school are discussed in various respects. Finally, inspired by Gelenbevi's book on logarithms, the Ottoman experience of European science and its dimensions are examined.

Sosyal Bilimler Enstitüsü'nde Tarih Yüksek Lisans Derecesi için Hasan Umut

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Başlık: İsmail Gelenbevi Mühendishâne'de:
Osmanlılar'ın Logaritma Aracılığıyla Avrupa Bilimi Tecrübesi

1775 yılında kurulan Mühendishane-i Bahr-i Hümayun, Osmanlı Devleti'ndeki mevcut rütbelerden farklı olarak mühendis profilini ortaya çıkarmış ve Osmanlılar'ın Avrupa bilimi ile temasını artırmıştır. Bu tez, Osmanlı entellektüel yaşamının en seçkin alimlerinden ve Mühendishane'nin önde gelen matematik hocalarından olan İsmail Gelenbevi'nin kariyerini ve Avrupa'da icat edilmiş olan logaritma ile alakalı Şerhu Cedavil-i Ensab adlı kitabını incelemektedir. Gelenbevi "mikro" düzlemde "eski" ve "yeni" tür bilgiyi bu okulda birlikte tecrübe ederken, Osmanlılar da genel olarak "makro" düzlemde Avrupa bilimi ile karşılaşmaktaydılar. Bu eşzamanlı durum onun logaritma eserinde görülebilmektedir.

Bu okulun ilk safhası boyunca ilmiye ile yeni mühendislik eğitimi arasındaki ilişkiyi de tartışan bu tez, üç ana bölümden oluşmaktadır. İlk olarak, Osmanlı İmparatorluğu'nda genelde bilim özelde matematik ile Osmanlı bilim tarihi literatürü kısaca tanıtılmaktadır. Daha sonra Gelenbevi'nin Mühendishane yılları muhtelif açılardan tartışılmaktadır. Son olarak, Gelenbevi'nin logaritma eserinden hareketle, Osmanlı'ların Avrupa bilimi tecrübesi ve bunun boyutları incelenmektedir.

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CHAPTER I

INTRODUCTION

The eighteenth century was a period of remarkable and multi-directional transformations in the Ottoman Empire. However, the problem of identifying these transformations is as important and debatable as those changes. In many fields, including politics, economy, the arts or science, the conceptualization problem is valid regarding this century. On the one hand, while the nineteenth century is associated more easily with European influence on Ottoman studies, the eighteenth century is difficult to conceptualize in the same way. On the other hand, the eighteenth century is also different from what Halil İnalcık[1] calls the "classical age," because the Ottoman accumulation in political, economic and more importantly cultural aspects has been investigated more as a result of the increasingly frequent encounters with European values from this period onwards such that both European incomings and existent values have been questioned in many respects. In short, the eighteenth century Ottoman Empire was an important era in terms of change.

One of the most critical directions of this period was realized in the military system. After a long period of victories, the Ottomans began to suffer defeats, some of which were disastrous. The losses revealed that the Ottoman military structure had problems and that reforms were required. One of the plans involving military reform was associated with education. The necessity for educated military officers was

[1] Halil İnalcık, *The Ottoman Empire: the Classical Age: 1300-1600*, trans. Norman Itzkowitz and Colin Imber (London: Weidenfeld and Nicolson, 1973).

great. Especially the wars against the Russian army had made reform feel like such an urgent necessity.

Eventually, the Ottomans initiated a new approach by establishing a school of engineering (*mühendishâne*). Imperial Naval Engineering School (*Mühendishâne-i Bahr-î Hümayûn*) was established in 1775. In 1795, a new engineering school called the Imperial Land Engineering School (*Mühendishâne-i Berr-i Hümayû*n) was established. The aim of both two schools was to meet the needs of the army in military engineering and thereby to realize reform throughout the army. Although these institutions were not very much effective in their first years, they would have a significant impact on the transformation of Ottoman scientific culture in the following years as many foreign experts taught there and many books were brought from Europe for the school, some of which were translated into Ottoman Turkish. These changes represented a new type of encounter with European science.

Apart from the ʻ*ulema* (Muslim legal scholars) and bureaucracy at different levels of the state, a new profile, that of engineer (*mühendis*), emerged in these schools. What did the formation of this new profile mean in Ottoman history? More specifically, how can we position this prototype when considering the existing structure? These questions are valuable especially for the first period of the Ottoman engineering experience.

No such profession existed in the early eighteenth century and these institutions were to educate them. In this respect, the early years of the Naval Engineering School as a first attempt are worth examining in order to answer the above questions. This examination will show not only the challenges faced at that time, but also give clues about the relationship between the existing and newly emerging education systems. In other words, the question of whether or not the

engineering experience was associated with the *ilmiye*, which was the general name of the Ottoman educational and judicial structure, has also the potential reveal new aspects of an "internal encounter," which means that both "old" and "new" type of knowledge were represented by Ottoman institutions and that they interacted with each other. The main scientific and educational institutions in the Ottoman Empire were the traditional *medrese*s (colleges) in which *müderris*es (professors) received their educations; they represented the existing scientific culture. The engineering schools, however, had increasing contact with European science from the eighteenth century onwards. Therefore, such a picture has the potential to reveal how the existing and new types of knowledge were managed together in eighteenth century Ottoman intellectual life.

At this point, İsmail Gelenbevi presents an interesting case with which to identify such an internal encounter. Gelenbevi, who was both a *professor* and a judge (*kadı*) in his career, belonged to the *ilmiye* system. In addition, he wrote many books in various fields that were part of the Islamic tradition. He then became a mathematics teacher at the Naval Engineering School and wrote books on mathematics. In other words, he experienced both the "old" and the "new" type of knowledge systems simultaneously. That is why, in my opinion, his scientific life is an opportunity for us to find some answers to our questions about eighteenth century intellectual life to some extent. Consequently, this thesis examines two interrelated issues considering his life: First, the effects of the engineering school on an *'âlim* (scholar) and the relation between the *ilmiye* and engineering education in its early years.

Second, the Ottoman experience of European science in the eighteenth century and its dimensions, paying attention to the logarithms invented in Europe in

the seventeenth century and one of Gelenbevi's books on mathematics, *Sharhu Cadâvil al- Ansâb* (Explanations of the tables of logarithms), about logarithms written during his tenure as an instructor at the engineering school. The reason for choosing this book is that the knowledge of logarithms came from a kind of science that was new and as an *'âlim*, Gelenbevi's interest in this topic is intriguing. It presents the opportunity to get a sense of the Ottoman appropriation of the new science.

Although the knowledge of logarithms brought practical ease rather than theoretical transformation to Ottoman mathematics, I suggest in this thesis its entrance into the Ottoman scientific milieu allows us to observe how the Ottomans interacted with European knowledge. In fact, in this thesis, Gelenbevi's book on logarithms will not be the only issue to which focus will be given and I will not go into the details of the mathematical content of the book. Instead, inspired by it, the main issue here will be to find out in what circumstances the Ottomans' relation with European science was realized. Therefore, I will examine his book as a social scientist rather than as a mathematician. What I mean is that the historical, cultural, social or political implications of the book and thereby their logarithms will be the main subjects in this study. In this way, my hope is also to show the potential of scientific books for Ottoman studies in general.

This thesis has three main chapters. In the next chapter, Ottoman scientific culture in general and mathematical sciences in particular will be dealt with. The concept of science will be examined by emphasizing the importance of the word of *'ilm* in Muslim societies. Due to the fact that the main vein of Ottoman science was part of the Islamic tradition, the conceptualization and classification of sciences within this tradition will be explained and the Ottoman framework will be given.

Then, the meaning of the mathematical sciences in Islamic tradition in general and among the Ottomans in particular will be explored to provide a basic understanding of the general scientific environment before turning to European mathematics. Finally, an overview of the debates on the history of Ottoman science will be presented so that the position and potential of the history of science for Ottoman studies can be appreciated. Consequently, by presenting the current historiographical approaches to Ottoman science, I will also imply my approach, which is implemented in this thesis.

The third chapter focuses on the scientific life of İsmail Gelenbevi. His life will be told from the beginning in order to see the milestones in his career, but the main issue will be his time as a mathematics instructor at the engineering school. The question of to what extent the engineering school affected his scientific interests will be discussed. Related to this, why Gelenbevi is described as a mathematician and "engineer" in many works rather than as an Islamic scholar will be investigated historiographically and the meaning of such a tendency will be explained in general. All of them, I hope, will shed light on the early engineering experience in the Empire and its relation to the existing scientific culture, especially with the *ilmiye* structure. More interestingly, this chapter also aims to show that they were not totally separate but in interaction with each other. Finally, I will also remark some other points in his life in order to encourage further studies about him.

The fourth chapter discusses the Ottoman experience of European science. The logarithms will be examined in particular as study and Gelenbevi's book on logarithms. In this chapter, the different dimensions and implications of the encounter with European science will be discussed. First, the general context of the invention of logarithms in Europe will be explained. Then, the entrance of the

logarithms into the Ottoman milieu will be focused on historically. After these, the knowledge of logarithms will be introduced as an instrument of political rivalry and social prestige. This case is interesting because it will reveal how scientific knowledge also could be transformed into active forms. The next issue will be vernacularization of scientific knowledge, including that of logarithms, followed by a discussion of the dissemination of scientific knowledge. Finally, the knowledge of logarithms, which represents multi-directional interactions in the Ottoman case, will be shown. It is sure that the dimensions of the Ottoman experience of the new science were not limited to these, but I hope even they will indicate the general framework.

CHAPTER II

MEANING OF THE MATHEMATICAL SCIENCES IN THE OTTOMAN SCIENTIFIC CULTURE

Before dealing with İsmail Gelenbevi's scientific personality, it would be beneficial to take a look at Ottoman scientific culture in general. This way, it will be easier to make sense of his intellectual stance and scientific work with respect to the relevant background. Certain questions stand out: What do we mean by "Ottoman science"? Is it a coherent analytic category? Does it represent only geography- based idea or also signify an integrated intellectual culture? What can be said regarding the classification of the sciences among Turkish speaking Muslims and the position of mathematical sciences within it? Where and how were the sciences practiced and taught? In order to see the general picture, another question is what the main historiographical approaches to the Ottoman history of science have been.

This chapter intends to find answers to the above questions. In fact, my aim is not only to investigate the cultural background of Ottoman science, particularly the mathematical sciences, but also to understand how and whether or not the history of science can contribute to Ottoman history in general. For this aim, this chapter first deals with the definition of *'ilm,* expressing its different and common aspects with the concept of science within a modern framework. Second, the general framework of the mathematical sciences in the Ottoman Empire will examined. Finally historiographical approaches to the Ottoman history of science, all of which are interrelated to each other, will be presented.

Defining Science in Context

In this part, the question of how science is considered in Islamic societies, including that of the Ottomans in the pre-modern period, will be discussed. This is a significant case because it has a big potential to form the borders and contents of the history of science for the sake of not perpetuating an anachronistic approach. That is why I focus on two sub-branches, one of which includes the explanation of the concept of *'ilm* as the main term for the history of science in Islamic societies, and the other of which deals with the classification of the sciences in terms of systematization and evaluation. Clues about science in Ottoman society will be mainly pursued.

'ilm as a Keyword for Science in Muslim Societies

What does *'ilm* mean? This question is a crucial starting point in our discussion because, as Franz Rosenthal points out, all parts of Muslim intellectual, religious, political and the daily lives of the "average Muslim" rub shoulders with the concept of *'ilm*.[2] The lexical meaning of the Arabic root is "to know"[3] and the best equivalent of this term is "knowledge."[4] During history of Islam, *'ilm* has been used to designate certain specific practices and has also served as a blanket, universal term. In addition, many definitions of knowledge have been offered. Rosenthal writes that more than one hundred of them have been stated by Muslim scholars.

[2] Franz Rosenthal, *Knowledge Triumphant* (Leiden; Boston: Brill, 2007), 2.
[3] Ruhi Baalbeki, *el-Mevridü'l-Vasit: Kamusu Arabi-İngilizi İngilizi-Arabi* (Beyrut: Dârü'l-İlm li'l-Melayin, 1996), 508.
[4] Rosenthal, 1.

This situation reveals that the definition of knowledge has become a significant issue in Islamic thought.

The critical point here is actually from which perspective knowledge is evaluated. For instance, definitions from the perspective of the fact that knowledge is regarded as "… the process of knowing and identical with the knower and the known, or an attribute enabling the knower to know," may become mostly different from ones from the perspective of the fact that it "is cognition (*mâ'rifah*)."[5] Additionally, Muslim philosophers use *'ilm* to identify parallel meaning with science used in the modern era as well.[6] For instance, it can be defined as "a discipline that involves systematic accumulation of knowledge belonging to a definite field during history of science."[7] In fact, systematic accumulation is valid in many fields of *'ilm*, but not totally. It is sure that the process of producing knowledge is one of accumulation, but it does not necessarily refer to a systematic approach. For instance, it is difficult to regard a systematic accumulation in the sciences of the Arabic language as morphology (*sarf*), syntax (*nahiv*) and so on. That is why it seems to me that 'ilm generally implies the sets of knowledge which are interrelated to each other accumulatively or not.

'ilm as used in Islamic civilization and science as a modern term are not identical, but certain measure of functional equivalence exists. To differentiate between the two, it would be useful to look at the classification of *u'lûm* in Islamic culture and of sciences in the modern sense briefly. The issue of the classification of the sciences will be discussed below related to the position of mathematical sciences in it, but it is my hope that one example from it may give clues for understanding the

[5] For instance some definitions are as such: "Knowledge is that through which one knows", "Knowledge is an attribute through which he who is alive becomes knowing", "Knowledge is the cognition of a thing (*ash-shay'*) as it is," etc. Ibid., 52–54.
[6] İlhan Kutluer, "İlim," *TDV İslam Ansiklopedisi* (İstanbul: Türkiye Diyanet Vakfı, 2000), 113.
[7] Ibid., 110.

difference between *'ilm* and the modern concept of science. George Sarton[8] lists which lessons should be included in a history of science curriculum and cites mathematics, astronomy, physics, chemistry, biology (including psychology), geography and geology, anthropology, ethnology, sociology and medicine,[9] which are "deeply united, branches of the same tree."[10] However, is his categorization appropriate for the history of science in Islamic societies? Ibn Khaldun (d. 1406 A.D.), an important scholar in Islamic thought, may help us answer this question. In his book *Maqaddimah,* he classified *'ilm* in two categories: *al- u'lûm al- hikamiyyah al- falsafiyyah* (the philosophical sciences), in which most of sciences listed by Sarton can be also included, and *al- u'lûm al- naqliyyah al wadiyyah* (traditional or conventional sciences) inspired by the Quran and Prophet Muhammad's tradition (*Sunnah*).[11]

These two classifications, in my opinion, propose a differentiation between *'ilm* and the modern concept of science. In spite of the fact that modern science keeps religion-based knowledge out of the scientific way of thinking, Islam-oriented intellectual environment considers revelation-based knowledge and methods as valid scientific values. Seyyed Hossein Nasr, an influential contemporary Muslim intellectual and historian of science, summarizes this situation, expressing the importance of unity (*tawhid*) in Islam as follows: "The arts and sciences in Islam are based on the idea of unity, which is the heart of the Muslim revelation."[12]

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[8] Sarton is a leading figure especially in the institutionalization of the history of science studies. He founded the history of science department at Harvard University as the first academic attempt at the university level.
[9] George Sarton, "The Teaching of the History of Science," *Isis* 13, no. 2 (February 1930): 285– 286.
[10] Ibid., 287.
[11] Ibn Khaldun, *el-Mukaddime*, ed. Abdüsselam Cheddadi, vol. 2 (Dârü'l-Beyza: Beytü'l-Fünun ve'l-Ulum ve'l-Adab, 2005), 358. English meanings of these two Arabic concepts are taken from this translation. Ibn Khaldun, *The Maqaddimah: An Introduction to History*, ed. N. J. Dawood, trans. Franz Rosenthal (London: Routledge and Kegan Paul, 1978), 343.
[12] Seyyed Hossein Nasr, *Science and Civilization in Islam* (New York: New American Library, 1970), 21–22.

This situation draws our attention to the fact that topics and problems that are considered to be scientific in Islamic intellectual life seem to be different from those that are regarded as scientific in the modern framework. In addition to this, it might be better to take into consideration that, as a consequence of the differences in issues between these two, different scientific methods developed. Such a condition eventually compels us to become sensitive to what degree topics and methods evaluated in the history of modern science studies can be appropriated to studies on the history of science in Muslim societies, particularly for the pre-modern era. What is more, when historiographical approaches to the Ottoman history of science are thought of, it will become clearer that the same question is valid in the Ottoman case, too.

Up to this point, I have suggested that ʿilm and science as a modern term are not identical. Especially as a result of historical studies during the last century, it has become apparent that each civilization and even culture has a specific "way of knowing"[13] and naturally intellectual paradigm. Therefore, as Thomas Kuhn, an influential figure of the twentieth century in philosophy and the history of science, remarks, the aim of historians of science is to show the "historical integrity" of science in its own time.[14] In other words, this argument urges us to evaluate studies in the history of the science of any civilization within its own context. Our attempt should be "to understand earlier science in its own terms, avoiding anachronistic formulations and judgments, since our object is also to understand it as it was understood by its creators and contemporaries."[15] This is why all of the things

[13] İhsan Fazlıoğlu, "İki Ucu Müphem Bir Köprü: 'Bilim' ile 'Tarih' ya da 'Bilim Tarihi,'" *TALİD Türk Bilim Tarihi* 2, no. 4 (2004): 12.
[14] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 3rd ed. (Chicago: The University of Chicago Press, 1996), 3.
[15] N. M. Swerdlow, "Montucla"s Legacy: The History of the Exact Sciences," *Journal of the History of Ideas* 54, no. 2 (April 1993): 316.

mentioned above are dedicated to offering a context for a scientific framework in Muslim world culture.

Another issue that should be kept in mind is that the history of Islam based and of modern scientific culture, has also shared interest fields. For instance, Fuat Sezgin, a prominent historian of Islamic science, deals with the following topics in his book: Astronomy, geography, maritime, clocks, geometry, optics, medicine, chemistry, minerals, physics, war techniques, and ancient objects.[16] A book, edited by Roshdi Rashed, another important historian of Islamic science, examines astronomy, mathematics and the physical sciences, technology, alchemy and life sciences.[17] This situation is clarified by the translator of the *Islamic Science an Illustrated Study* by Nasr. The preface of the book consists of just the philosophical or intellectual sciences,[18] not traditional or conventional ones. These examples reveal that the content of the studies of the history of science in Muslim societies actually coincides with the curriculum of Sarton. In other words, the history of Islamic science studies mainly concentrates on intellectual sciences today.

At this point, some questions attract our attention: Are the branches of *'ilm* offered by Ibn Khaldun, the traditional and philosophical sciences, completely separate from each other? For example, did the interpretation of the Quran (*tafsir*) and astronomy always exist independently from each one or is it possible that they were able to feed each other? Robert Gordon Morrison's Ph.D. dissertation explores the intellectual development of Nizam al- Din al- Nisâburi (d. 1329 A.D.), who was an important scholar of the interpretation of the Quran as well as an astronomer.

[16] Fuat Sezgin, *İslam'da Bilim ve Teknik*, ed. Hayri Kaplan and Abdurrahman Aliy, trans. Abdurrahman Aliy, 5 vols. (Ankara: Kültür ve Turizm Bakanlığı, 2007).
[17] Roshdi Rashed and Régis Morelon, eds., *Encyclopedia of the History of Arabic Science*, 3 vols. (London: Routledge and Kegan Paul, 1996).
[18] Seyyed Hossein Nasr, *İslam ve İlim: İslam Medeniyetinde Akli İlimlerin Tarihi ve Esasları*, trans. İlhan Kutluer (İstanbul: İnsan Yayınları, 1989), xii.

Morrison chose this figure because he wrote many works particularly on astronomy and the interpretation of the Quran, arithmetic, grammar and astrology.[19] In the dissertation, Morrison focuses on Nisâburi's scientific and religious work and claims that he shows the "inter-relationship" of Nisâburi's work in both fields.[20]

Morrison's study, in my opinion, offers an important approach and sensitivity. Many scholars in the history of Islam have written on many subjects, as Nisaburi did. The main figure of the present thesis, İsmail Gelenbevi, had a similar intellectual character. He worked in many fields including logic, philosophy, theology and mathematics. Therefore, evaluating this kind of historical figure necessitates a holistic assumption that many scientific branches could be interlinked and could affect each other. To sum up, Morrison's method can be seen as a good example of the history of Islamic science, especially for biographical studies. In fact, although I offer thoughts on how to study a scientific biography and I also deal with Gelenbevi's scientific personality through the same kind of a multi- directional approach, it is not possible within the scope of this MA thesis, which examines his mathematical work as well as his work in other fields.

Regarding the relationship between and interaction of the traditional and philosophical sciences, another issue that should be kept in mind is that the teaching methods of both categories were similar. Hence, there has been a close connection between textual transmission and the teaching tradition in Islamic thought from the very early middle ages until today.[21] In other words, teaching activities have been carried out through textual documents and texts provided have provided the transfer

[19] Robert Gordon Morrison, "The Intellectual Development of Nizam al-Din al-Nisaburi (d. 1329 A.D.)" (Ph.D. Thesis, Columbia University, 1998), iii.
[20] Ibid., 239.
[21] Gerhard Endress, "Reading Avicenna in the Madrasa: Intellectual Genealogies and Chains of Transmisson of Philosophy and the Sciences in the Islamic East," in *Arabic Theology, Arabic Philosophy: From the Many to the One: Essays in Celebration of Richard M. Frank*, ed. James E. Montgomery (Leuven: Uitgeverij Peeters en Departement Oosterse Studies, 2006), 371.

of the intellectual ideas of the writers of those texts to others person or people in another time period.

On the other hand, it is not true that ideas are transferred without change. Writing commentaries (*şerh*) or annotations (*hâşiye*), which explain the canonical texts, provided the dynamic transmission of the texts. More interestingly, sometimes these would gain more importance than the original text itself.[22] As a consequence, links and networks of learning through these documents were formed. The interesting part of this issue is that this educational process was not confined to traditional sciences. The educational method of the rational sciences is also similar. For instance, Gerhard Endress implies an educational correlation between the two science categories by revealing such links in "philosophy and the sciences" in his essay.[23] The pedagogic closeness between the two types of sciences also suggests that the evaluation of the history of science in Islamic societies need not ignore the relationship between them.

Valuing the Sciences through Classification

Classifications of knowledge exist other than the one based on the philosophical and traditional sciences. One of the most significant and famous scholars who maintained different types of classifications was al-Ghazzali (d. 1111/505), one of the most prominent scholars in Islamic thought. The importance of this person is not confined to his contributions to the classification of knowledge. Additionally, due to the fact that al-Ghazzali is considered one of the authorities on

[22] Francis Robinson, "Ottomans- Safavids- Mughals: Shared Knowledge and Connective Systems," *Journal of Islamic Studies* 8, no. 2 (1997): 152.
[23] Endress, 371–422.

Ottoman philosophical thought,[24] his approach to knowledge has the potential to indicate the idea of the classification of the sciences among Ottoman scholars. Throughout explanation of his ideas, Osman Bakar's book on the classification of the sciences mainly benefited from the following.[25]

First, al-Ghazzali set forth four different systems of classification: the theoretical and practical sciences, presential" (*huduri*) and attained (*husuli*) knowledge, religious (*shar'iyah*) and intellectual (*'aqliyah*) sciences, and *fard 'ayn* (obligatory to every individual) and *fard kifayah* (obligatory to all) sciences. Regarding the first classification, it can be said that al-Ghazzali was re- stating the common distinction made by philosophers between theoretical and practical knowledge. That is, this classification was based on whether knowledge was related to man's actions or not. Second, while presential knowledge was "direct, immediate, supra- rational, intuitive, and contemplative," attained knowledge was "indirect, rational, logical, and discursive." That is, this distinction relies on the difference between "immediate and indirect knowledge" regarding the "intelligible or spiritual world."[26]

The issues that will be clarified more here are his last two classification systems. The third one relied on the difference between the religious and intellectual sciences. This conceptualization was very similar to that of Ibn Khaldun, described above. In other words, al-Ghazzali also classified knowledge with respect its source. Whereas he explained that revelation, the source of the religious sciences, and reason, the source of intellectual sciences, were complementary to each other, he

[24] Tevfik Yücedoğru and Veysel Kaya, "Tehâfütler- İçerik ve Yöntem Açısından Bir Karşılaştırma-," in *International Symposium on Khojazada (22-24 October 2010 Bursa) Proceedings*, ed. Tevfik Yücedoğru et al. (Bursa: Bursa Büyükşehir Belediyesi, 2011), 379.
[25] Osman Bakar, *Classification of Knowledge in Islam: A Study in Islamic Philosophies of Science* (Cambridge U.K.: Islamic Texts Society, 1998).
[26] Ibid., 203–204.

expressed the boundaries of reason as a way of knowing and the priority of revelation over it. The last one was the distinction between *fard 'ayn* and *fard kifayah*. The former mainly means "a religious obligation that is binding on every Muslim," and the latter is described as "the obligation which if performed by a sufficient number of Muslims, then the remaining Muslims who did not perform it would not be sinful" by al- Shafi'i, one of the greatest authorities on Islamic jurisprudence. In parallel with these definitions, al-Ghazzali divided knowledge into three groups, the praiseworthy (*mahmud*), the blameworthy (*madhmum*), and the permissible (*mubah*).[27]

From al-Ghazzali's point of view, all of the religious sciences were praiseworthy. Some were *fard 'ayn*, like the sciences of the interpretation of the Qur'an or prophetic traditions, and others were *fard kifayah,* like *kalam* (Islamic theology). While the former was not limited to praiseworthiness, the latter was bound by the "limit of sufficiency." In other words, the limit of the learning of the sciences in this category depended on "individuals, disciplines, and changing needs of society" in general.[28] As Bakar points out, al-Ghazzali, in this classification, took into consideration sciences from the "ethical point of view."[29] In other words, while he set forth a descriptive and source-based approach to the classification of the religious and intellectual sciences, he gave attention to a normative and religiously beneficial approach to the latter.

Al-Ghazzali used such a tripartite division in the intellectual sciences as well. That is, some sciences were praiseworthy, blameworthy or permissible for him. Which sciences were praiseworthy was explained by him in his book *Ihya'* as follows:

[27] Ibid., 206–207.
[28] Ibid., 210–211.
[29] Ibid., 216.

> They are those on whose knowledge the activities of this life depend. Examples are medicine and arithmetic. They are divided into sciences the acquisition of the knowledge of which is meritorious though not obligatory. Sciences whose knowledge is deemed *fard kifayah* comprise every science which is indispensable for the welfare of this world: for example, medicine which is necessary for the life of the body, arithmetic for daily transactions and the division of legacies and inheritances, and other besides. These are the sciences the absence of which could reduce a community to serious straits.[30]

As shown above, the usefulness of the sciences was an important criterion as well. Another interesting point is that none of intellectual sciences was *fard 'ayn* for him. Only some of them were *fard kifayah*. It means that al-Ghazzali held that the intellectual sciences were generally necessary for society but not obligatory for each person to learn. Other sciences like geometry, astronomy, music or physical sciences were considered permissible. They could be practiced but were not as necessary as medicine or arithmetic for the "welfare of this world."

Some sciences were regarded as blameworthy, such as judicial astrology and magic. In addition to the fact that Islamic jurisprudence forbids astrology, al-Ghazzali added other reasons for its blameworthiness. First, due to the fact that astrology assumed that the stars had an effect on the course of events on earth; "most people do not look beyond the immediate and earthly causes and therefore never arrive at the Causes of all causes," which was God. Second, astrology involved the prediction of future events with respect to present causes and it did not have "either …certainty or even…probability." Because of this "ignorance," it was considered blameworthy. Eventually, he regarded astrology to be useless. In respect to magic, it was more problematic in that it generated "the greatest degree of harm" because nobody, not even a prophet or a saint, was "immune from the evil of magic."[31] To sum up, al-Ghazzali specified the legal status of every part of knowledge with

[30] Quoted in ibid., 213.
[31] Ibid., 213–216.

respect to "its usefulness to the individual as well as the society in the light of the ultimate goals of the *Shari"ah*."[32]

In what sense are all arguments mentioned above relevant to the history of Ottoman science? It is easy to claim that Ottoman intellectual and scientific life was directly descended from Islamic civilization. In other words, it is not reasonable to evaluate the Ottomans independently from the Islamic accumulation that habe been constituted before them. For example, Adnan Adıvar, a prominent historian of science in early modern Turkey, claimed that in the Ottoman Empire, *'ilm* included such branches as Islamic theology, *fiqh* (jurisprudence), alchemy, the interpretation of dreams, mathematics, and medicine. In any case, he only paid attention to mathematics, natural sciences and medicine in his book. [33]

What can be said about the classification of the sciences in Ottoman scientific life? For instance, Taşköprüzade (d. 1560), had a sense and classification method similar to the ones in Islamic intellectual history, as discussed above. It is also remarkable to note that Katip Çelebi (d. 1657 A.D.), one of the most prominent Ottoman encyclopaedists, gave details of different types of classification in his book and gave his opinion that Taşköprüzade's system was the best among them.[34] Therefore, Katip Çelebi's opinion about him seems to represent the importance and extent of Taşköprüzade's thought about science in Ottoman intellectual culture. According to him, 'ilm could be classified in two main categories, *u'lûm- u şer'iyye* (the religious sciences), based on the Quran and the Prophet Muhammad's tradition;

[32] Ibid., 207.
[33] Abdülhak Adnan Adıvar, *Osmanlı Türkleri"nde İlim*, ed. Aykut Kazancıgil and Sevim Tekeli, 4th ed. (İstanbul: Remzi, 1982), 6.
[34] Katip Çelebi, *Kes□fu□"z-Zunu□n an Esa□mi"l-Ku□tu□bi ve"l-Fu□nu□n□: Kitapların ve İlimlerin İsimlerinden Şu□phelerin Giderilmesi*, trans. Rüştü Balcı (İstanbul: Türkiye Ekonomik ve Toplumsal Tarih Vakfı, 2007), 23.

and *u'lûm-u acemiyye* (the foreign sciences), which basically had been appropriated from the sciences in Greek philosophy.[35] Katip Çelebi also offered a binary.[36]

The approach of Yahya Nev'i Efendi (d. 1598 A.D.), however, was slightly different from the these. He listed the sciences without offering two main branches. The first three sciences he listed were *ilm-i tarih* (history), *ilm-i hikmet* (philosophy) and *ilm-i hey'et* (astronomy). As he wrote, these sciences were very important because they gave humans the opportunity to know God (*marifet-i zatullah*).[37] Despite the fact that this approach offered a slightly different ordering of the sciences, the basic understanding that regarded both revelation-based and reason-oriented knowledge as scientific was still in case.

Although the general acceptance of the classification of the sciences in the Ottoman period was as above, it does not mean that any challenges to this system did not occur. Because of the fact that some of challenges were associated with the entrance of the new science and engineering education experience that will be discussed within the context of the discussion about İsmail Gelenbevi below, I briefly mention the concept of *fenn*, which implies the complexity of how to position the new types of knowledge that came from Europe in the last period of the Ottoman Empire.

In his treatise, Seyyid Mustafa, one of first Ottoman engineers, used a term called "*mütefennin*" soldier.[38] What does this word of Arabic origin mean? In his context, it seems reasonable to accept it to have been a person who had technical

[35] Taşköprüzade Ahmed Efendi, *Mevzuatü"l-Ulum*, trans. Kemaleddin Mehmed Efendi (Dersaâdet: İkdam Matbaası, 1313).
[36] Katip Çelebi, *Kes□fu□'z-zunu□n an esa□mi'l-ku□tu□bi ve'l-fu□nu□n*, 40–41.
[37] He states as such: "Zübde-i mearif ma"rifet-i zatullah ve umde-i ulum ilm-i sıfatullahtır. Emma bu muammaya kemal-i vukuf asar-i bediadan Müessir-i Kadim'e istidlal hasebiyle ola." Yahya Nev'i, *İlimlerin Özü "Netayic el- Fünun,"* ed. Ömer Tolgay (İstanbul: İnsan Yayınları, 1995), 76.
[38] Kemal Beydilli, "İlk Mühendislerimizden Seyyîd Mustafa ve Nizâmı Cedîd'e Dâir Risâlesi," *İstanbul Üniversitesi Edebiyat Fakültesi Tarih Enstitüsü Dergisi*, no. 13 (1987): 435.

knowledge.[39] On the other hand, with an examination of the word *fenn*, which is the root of *mütefennin*, it becomes complicated. What I mean is that we need to ask whether *fenn* was different from *'ilm* and to what extent. A more crucial problem is presumably whether the usage of these two words in the Ottoman intellectual milieu indicated changes in the definitions and classification of the sciences.

According to Osman Nuri Ergin, the difference between *'ilm* and *fenn* was not understood well enough. Some kinds of knowledge were called *'ilm* and others *fenn*. He remarks that this confusion can be seen in some Ottoman school names like *Darülilim*, *Darülulûm*, or *Darülfünun*.[40] Ergin attracts our attention to an interesting case, but it seems to me that this confusion did not completely mean the ignorance of the Ottoman intellectuals, but their quest to position the new European-origin knowledge with respect to the existing one. As İsmail Kara discusses in an extensive manner, nineteenth century intellectuals struggled to make sense of the terms, *'ilm* and *fenn*.[41] In order to depict this discussion, I will present as examples the ideas of three intellectuals from the nineteenth century and then I will show that the conceptual confusion extended even to the engineering school experience.

Ahmet Mithat, an influential intellectual and journalist, remarked that up until that time, the difference between *'ilm* and *fenn* had not been an issue but that he would deal with it at that time. His criterion was the degree of the correctness of the knowledge they comprised. That is, *fenn* consists of laws and principles (*kanûn* and *kâide*) but *'ilm* does not. Because of this nature, their degree of accuracy is also different. According to Ahmet Mithat, while the knowledge of *'ilm* is deficient

[39] Ferit Devellioğlu, *Osmanlıca - Türkçe Ansiklopedik Lugat: Eski ve Yeni Harflerle*, ed. Aydın Sami Güneyçal, 21st ed. (Ankara: Aydın Kitabevi, 2004), 765.
[40] Osman Nuri Ergin, *Türkiye Maarif Tarihi*, vol. 1-2 (İstanbul: Eser Neşriyat, 1977), 547.
[41] Ismail Kara, *Din ile Modernles□me Arasında: Çag□das□ Tu□rk Du□s□u□ncesinin Meseleleri* (İstanbul: Dergâh Yayınları, 2003), 126–197.

(*nâkıs*), of *fenn* is exact and excellent (*tamâm ve mükemmel*).[42] Indeed it is totally different than the classification of the sciences up to that time. It is not possible to discuss his ideas in detail but to infer that it was an indicator of great debates on the classification of the sciences in the nineteenth century.

Second intellectual of the nineteenth century, Babanzâde Ahmed Naim regards the problem from another perspective. According to him, *'ilm* referred to knowledge (*connaissance* in French), *ilm-i müdevven* to science, and finally *fenn* to the branches of the sciences. For instance, *fıqh* was regarded as a science whereas *feraiz* (the science of Islamic inheritance) was considered *fenn*, a branch of *fıqh*. In other words, he assumed a symantic relationship between them.[43] According to another intellectual, Mehmed İzzet, while *'ilm* was theoretical (*nazarî*) and abstract (*mücerred*), *fenn* was practical (*amelî*) and applied (*tatbikî*).[44]

After these explanations, the meaning of *fenn* in the engineering school milieu may be thought to have been appropriate to Mehmed İzzet's definition. On the other hand, it is intriguing that the usage of it appears complicated here as well. For example, it can be observed that *'ilm* and *fenn* were sometimes used interchangeably. Both "*ilm-i hendese*"[45] and "*fenn-i hendese*"[46] could be stated. Apart from these, a report (*lâhiya*) prepared by D'Ohsson, who was a Swedish ambassador and had good relations with high officials, on the reform of the engineering education is perplexing, too. He used three terms, *'ilm*, *fenn*, and *ma'rifet* as if they were strongly dependent on each other. His approach was that "*ta'lîm-i fünûn*" would make the

[42] Cited in Ibid., 143–144.
[43] Ibid., 140.
[44] Cited in Ibid., 144–145.
[45] Kemal Beydilli, *Türk Bilim ve Matbaacılık Tarihinde Mühendishâne, Mühendishâne Matbaası ve Kütüphânesi (1776-1826)* (İstanbul: Eren Yayıncılık ve Kitapçılık, 1995), 279.
[46] Ibid., 368.

Ottoman Empire superior to other nations (*millets*) in terms of *'ilm* and *ma'rifet*."[47] Another usage of *fenn* mentioned in *Hatt-ı* Hümayun (Imperial Rescript) is given by Kemal Beydilli. In the document, "*fenn-i hesâp*" or "[*fenn-i*] *hendese*" is considered to have two aspects, which were practical (*amelî*) and theoretical (*ilmî*).[48]

What this picture implies is that especially in the nineteenth century, Ottoman intellectuals were faced with the problem of the classification of the sciences depending on the new science being appropriated from Europe. It seems that they did not have a consensus on the definition of *'ilm* and *fenn* or the interrelation between them. Although it appears that this issue became a crucial one in the nineteenth century, some indications of it existed in the eighteenth century to some extent as well. As shown above, the usages of *'ilm* and *fenn* were varied in the engineering education. Along with the emphasis of the practical aspects of *fenn*, it sometimes referred to theoretical knowledge as well. But it seems that in the eighteenth century, the usage of *'ilm* and *fenn* were closer to each other than in the nineteenth century. For instance, even Gelenbevi, in his book on theology, considers *fenn* to have the same meaning as *'ilm* so much that he uses the phrase *al- fünûn al- akliyyah ve al-nakliyyah* (philosophical and traditional sciences).[49] Nevertheless, in my view, the usage of *fenn* in engineering education started to imply a difference than from the kind of education offered in the medreses, both theoretically and practically.

[47] Cited in Ibid., 30.
[48] Ibid., 37.
[49] Gelenbevi İsmail, *Hâşiye-i el-fazıl İsmail el-Gelenbevi ale'l-Celal = Hâşiye ala Şerhi"l-Celal*, vol. 1 (İstanbul: Ahmed İhsan ve Şürekası, 1323), 4.

Mathematical Sciences in the Ottoman Pre-Modern Period

This part examines the position of the mathematical sciences in Ottoman intellectual life. To this end, general answers to two interrelated questions will be pursued: First, what was the position of the mathematical sciences in the classification of sciences, and, where and how were these sciences performed and taught? It is my hope that the answers to these questions will both clarify that the mathematical sciences were not ignored in the Ottoman intellectual milieu and make easy to depict the scientific sensitivity and environment of İsmail Gelenbevi as a scholar, especially as a "mathematician" in the next chapters. In other words, the question of how important mathematics was in the eighteenth century of İsmail Gelenbevi will be kept in mind in order to construct an idea of the general picture that will be dealt with here for regarding his intellectual personality.

As mentioned above, the main tendency in the classification of the sciences in Islamic civilization including that of the Ottomans was as Ibn Khaldun presented in his *Maqaddimah*. He supposed two main branches of the field as the traditional or conventional sciences and the philosophical sciences. The first group was rooted in the Quran and the Prophet Muhammad's tradition and was specific to Islamic intellectual life, and the second one included sciences based on Greek philosophy, especially from the Aristotelian perspective. As shown above, Taşköprüzade, a prominent encyclopaedist in the Ottoman Empire, offered nearly the same classification.

According to Taşköprüzade, the mathematical sciences were part of the philosophical ones. The mathematical sciences included geometry (*hendese*),

astronomy (*hey'et*), arithmetic (*'aded*) and music (*musiki*).[50] Cevad İzgi lists the sub-sciences Taşköprüzade mentioned in his book and we see that geometry was composed of thirteen, astronomy included twenty-seven, arithmetic included eleven and music included three sub-branches. İzgi writes that these sub-branches can be regarded as the topics of those sciences rather than independent scientific fields.[51] It should be emphasized that Taşköprüzâde's classification of the mathematical sciences was compatible with Islamic tradition. For instance, Qutb al-Din al-Shirazi (d. 1311 A.D.), a critical figure in the formation of the scientific culture in Anatolia and Ottoman Empire, regarded the philosophical sciences as two parts: theoretical (*nazari*) and practical (*'amelî*), and included the mathematical sciences in the first part.[52]

The major branches of mathematics were geometry, arithmetic, astronomy and music. In other words, Taşköprüzade and Qutb al- Din al- Shirazi had the same opinion related to topics in mathematics. In fact, Qutb al-Din al-Shirazi regarded those sciences as the core branches of mathematics and stated minor branches which were connected to major ones as well: Optics, algebra, the science of weights, surveying (*ilm-i mesaha*), the science of calculation (*ilm al- jam' ve 'l- tafriq*), mechanical engineering, and the science of balance (*ilm-i awzan ve mawazin*) , the science of astronomical tables and calendars, and the science of irrigation (*ilm-i naql-i miyah*).[53]

This picture implies that the Ottoman positioning of mathematics was a continuation of the classification of sciences in Islamic culture. At this time, some

[50] Taşköprüzade Ahmed Efendi, 402.
[51] Cevad İzgi, *Osmanlı Medreselerinde Ilim*, vol. 1 (İstanbul: İz Yayıncılık, 1997), 187–188.
[52] Cited in Bakar, 249. Taşköprüzade also took this into consideration as a practical part of the philosophical sciences and therefore he wrote about the theoretical aspects of mathematics. Taşköprüzade Ahmed Efendi, 435–442.
[53] Cited in Bakar, 253.

controversial questions might be asked: Until when did Ottoman mathematics continue to be a part of the scientific paradigm of Islamic civilization? More ambitious questions would be how Ottoman scholars handled the new type of mathematics that had been developed in Europe? Was there a period of transition? Did the process involve appropriation? What is the importance of the eighteenth century in this debate? These questions will be discussed in the following chapters.

Another question involves where and how the mathematical sciences were performed and taught. Up to the eighteenth century, mathematics was taught in the medreses, the financial offices of the bureaucracy, the *muvakkithane*s (office of the time observer), observatories, and in homes for interested people.[54]

In the medreses, some books in mathematics were very common in education. Cevad İzgi discusses the mathematics education in medreses in detail and gives various examples. For instance, inspired by the list of books read by grand mufti Feyzullah Efendi (d. 1703 A.D.) during his education, mathematical works like *Şerhu'l- Mulahhas fi'l Hey'et* in astronomy, *Hulasatü'l- Hisab* in arithmetic, *Eşkalu't- Te'sis* in geometry, all of which were very popular in Ottoman scientific life, were used in the medreses.[55]

Additionally, according to *Kevakib-i Seb'a* which was a report about medrese education in the Ottoman Empire prepared for the French embassy, there were lessons on geometry, arithmetic and astronomy in these schools.[56] We understand that mathematical sciences were not ignored in medreses but it should be added that in the medreses and offices in the bureaucracy, the aim of mathematical education

[54] Ekmeleddin İhsanoğlu, ed., *Osmanlı Matematik Literatürü Tarihi (History of Mathematical Literature during the Ottoman Period)* (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 1999), xlix.
[55] İzgi, 175.
[56] Cited in Ömer Özyılmaz, *Osmanlı Medreselerinin Eğitim Programları* (Ankara: Kültür Bakanlığı Yayınları, 2002), 41–42.

was naturally practical for needs in their vocations. On the other hand, this condition was not restricted to those who participated in special groups or studied mathematics themselves in advance.[57]

Advanced mathematics was mainly taught at *muvakkithâne*s and observatories or in special groups.[58] At the palace, there existed a chief court astrologer (*müneccimbaşı*), basic duties of which were to prepare calendars, calendars for Ramadan, and judicial and elective astrology (*eşref saati* or *vakt-i muhtar*). The muvakkithanes were under the control of *müneccimbaşı* and duties of the *muvakkit*s who worked there was mainly to determine praying times via various clocks. Beside this duty, they gave lectures on astronomy, astrology or the calendar, both in their theoretical and practical aspects.[59] Salim Aydüz lists more than sixty muvakkithanes that have been determined to had operated in Ottoman İstanbul.[60] This number suggests that there were more practitioners of the mathematical sciences than we might initially be inclined to think. It is also not hard to guess that in those places, more advanced books than the ones taught in medreses were taught.

Another institution which was dependent on the müneccimbaşı was the İstanbul observatory. This Ottoman observatory experience started in 1575 but full-time work began in 1577 with Takiyyüddin Rasıd as its director. However, this observatory was destroyed in 1580. Therefore, it did not last long enough to form an educational tradition.[61]

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[57] İhsanoğlu, *Osmanlı Matematik*, xlix.
[58] Ibid.
[59] Salim Aydüz, "Osmanlı Devletinde Müneccimbaşılık ve Müneccimbaşılar" (MA Thesis, Istanbul University, 1993), 128.
[60] Salim Aydüz, "Osmanlı Astronomi Müesseseleri," *TALİD Türk Bilim Tarihi* 2, no. 4 (2004): 421–422.
[61] For more information about İstanbul Observatory, see A. Süheyl Ünver, *İstanbul Rasathanesi* (Ankara: Türk Tarih Kurumu, 1985).

Apart from medreses, institutions, especially astronomical ones, to date have not received much scholarly attention.[62] I am aware the information about the educational aspects of these institutions offered here is limited. In fact, there are many issues regarding Ottoman scientific culture that should be studied in order to go beyond commonsense knowledge.

After all, I infer from this clouded picture that mathematics in Ottoman Empire was taught both theoretically and practically. In other words, the mathematical sciences were not ignored. I also argue that my hypothesis is compatible with the huge Ottoman history of science literature series especially on astronomy, mathematics and music, published by the IRCICA.[63]

[62] Aydüz, "Osmanlı Astronomi," 452.

[63] Research Centre for Islamic History, Art and Culture (IRCICA) began its activites as a subsidiary of the Organisation of the Islamic Conference (OIC) in 1980. Its main activities are research, publishing, documentation and the dissemination of information to introduce well the Islamic culture and civilization and to support reciprocal understanding between Muslim nations and other communities throughout the world. Regarding our topic, it publishes many work on the history of science in the Islamic world especially the Ottoman Empire, under the leadership of Ekmeleddin İhsanoğlu, Secretary General of the Organization of Islamic Cooperation now. Presumably the most important books are the ones on Ottoman science literatures. In these literature series, Ottoman scholars with introductions about their lives and work with detailed information are listed. Owing to these books, now it is easier to acquire more reliable information about Ottoman science. Ekmeleddin İhsanoğlu, ed., *Osmanlı Astronomi Literatürü Tarihi (History of Astronomy Literature during the Ottoman Period)*, 2 vols. (İstanbul: İslam Tarih Sanat ve Kültür Araştırma Merkezi (IRCICA), 1997); İhsanoğlu, *Osmanlı Matematik*; Ekmeleddin İhsanoğlu, ed., *Osmanlı Coğrafya Literatürü Tarihi (History of Geographical Literature during the Ottoman Period*, 2 vols. (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 2000); Ekmeleddin İhsanoğlu, ed., *Osmanlı Musiki Literatürü Tarihi (History of Music Literature during the Ottoman Period)* (İstanbul: İslam Tarih Sanat ve Kültür Araştırma Merkezi (IRCICA), 2002); Ekmeleddin İhsanoğlu, ed., *Osmanlı Askerlik Literatürü Tarihi (History of Military Art and Science Literature during the Ottoman Period)*, 2 vols. (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 2004); Ekmeleddin İhsanoğlu, ed., *Osmanlı Tabii ve Tatbiki Bilimler Literatürü Tarihi (History of the Literature of Natural and Applied Cciences during the Ottoman Period)*, 2 vols. (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 2006); Ekmeleddin İhsanoğlu, ed., *Osmanlı Tıbbi Bilimler Literatürü Tarihi (History of the Literature of Medical Sciences during the Ottoman Period)*, 4 vols. (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 2008).

Debates on the History of Ottoman Science

In this part, the main historiographical approaches to the Ottoman history of science will be discussed. The goal is not to deal with all of the details of challenges in the Ottoman history of science studies, but to make sense of their general context and main issues. To this end, first, the concept of "Ottoman science" will be examined and then the debates on the history of science writing shall be briefly stated. As a result of all issues in this part, it is my expectation that would be provided a more comprehensive sense towards the Ottoman history of science and call attention to the position and potential of the Ottoman history of science studies.

Conceptualization of Ottoman Science

What does "Ottoman science" stand for? A more striking question, which may represent the doubts that form the background for the lack of interest in this issue, is another: "Was there really such a thing as Ottoman science?"[64] The general definition of the concept, its borders of research and framework of its relations with other cultures and sciences were determined first by Ekmeleddin İhsanoğlu, one of leading figures in the history of Ottoman science.[65] İhsanoğlu states that Ottoman science covered all scientific activities performed in Ottoman geography throughout six centuries.[66] He emphasizes that this was not an "exclusive definition." What he

[64] Berna Kılınç, "Ottoman Science Studies- A Review," in *Turkish Studies in the History and Philosophy of Science*, ed. Gürol Irzık and Güven Güzeldere, vol. 244, Boston Studies in the Philosophy of Science (Dordrecht: Springer, 2005), 251.
[65] Mustafa Kaçar, "'Osmanlı Bilimi' Kavramının Oluşumu ve Günümüz Bilim Tarihçiliği," in *Essays in Honour of Ekmeleddin İhsanoğlu: Societies, Cultures, Sciences: A Collection of Articles*, ed. Mustafa Kaçar and Zeynep Durukal, vol. 1 (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 2006), 396.
[66] Ekmeleddin İhsanoğlu, "Osmanlı Bilimine Toplu Bakış," in *Osmanlı: Bilim*, ed. Güler Eren, vol. 8 (Ankara: Yeni Türkiye Yayınları, 1999), 17.

implies is is that in the Ottoman geography, many languages were used as scientific languages and in addition to Muslims, there were also non-Muslims who contributed to those scientific activities and Ottoman science includes all these activities. Additionally, the adjective "Ottoman" is a reference like "Umayyad," "Abbasid," or "Safawid," all of which represent a "determined and limited period of Islamic history and geography." All of the reasons mentioned led İhsanoğlu to specify that the period of science, which was performed during the period and within the Ottoman Empire geography as "Ottoman science."[67] As a consequence, Ottoman science is not used in order to refer to a different way of scientific methodology than that of the scientific culture in Muslim societies. According to Nacer Miloudi, this concept can be differentiated "sociologically" from ones with respect to that it is shaped by the socio-cultural needs of the Ottoman Empire.[68]

Apart from this, it should be emphasized thanks to Fazlıoğlu's significance and the importance of the holistic approach for Ottoman studies. The scientific relations between the Ottoman Empire and, for instance, the Timurids or Safavid and other cultures in Islamic world were not independent from each other. On the contrary, contacts between them were active and all of them were fed by the Islamic scientific paradigm. For instance, Musa Kadızade, who was from Bursa, was the teacher of Ulugh Beg, who was a Timurid ruler as well as astronomer. Additionally, a book on mathematics by one of the important scholars of the Safavids, Bahaeddin al- Amili, *Hulâsatu al- Hisâb,* was used for education in the Ottoman medreses.[69]

[67] Ekmeleddin İhsanoğlu, "Ottoman Science in the Classical Period and Early Contacts with European Science and Technology," in *Transfer of Modern Science and Technology to the Muslim World,* ed. Ekmeleddin İhsanoğlu (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 1992), 2.
[68] Nacer Miloudi, "Osmanlı Tarihinde Bilim ve Teknoloji," in *Osmanlı: Bilim*, ed. Güler Eren, vol. 8 (Ankara: Yeni Türkiye Yayınları, 1999), 35.
[69] Fazlıoğlu, "İki Ucu Müphem," 23.

To go a little bit further in this case, Françis Robinson offers an insightful perspective. He discusses the intellectual relationship between three empires, the Ottomans, Safavids and Mughals, and he argues that interaction between them was multi-directional. On the contrary, he claims that their relationship can be defined as "shared knowledge and connective systems" by explaining travels as one kind of interactions for various aims.[70] In addition to this, relations between the Ottomans and Europeans, and the scientific activities performed by non-Muslim Ottomans especially after the encounter with new science should not be ignored. After all, it should be kept in mind that the concept of "Ottoman science" should not be evoked from within a framework such as that suggested by İhsanoğlu.

Some Debates on the Historiography of Ottoman Science

This section presents a brief framework of the Ottoman historiography of science inspired by an article by Cemil Aydın[71] in which he successfully analyzes the history of debates on Islam vs. science that was a controversial issue not only in the Ottoman Empire, but throughout the Islamic world.

According to Aydın, during the modernization process in the twentieth century in the Muslim world, the history of science gained a very important position in "historical consciousness" beyond "scholarly interest" to understand the history of science. It is easy to infer that this was related to developments in Europe because the scientific superiority of Europe over other cultures was emphasized as the basic agent of these developments. We see that this condition brought "a very essentialized

[70] Robinson, 171.
[71] Cemil Aydın, "Beyond Culturalism? An Overview of the Historiography on Ottoman Science in Turkey," in *Multicultural Science in the Ottoman Empire*, ed. Ekmeleddin İhsanoğlu, Kostas Chatzis, and Efthymios Nicolaidis (Turnhout: Brepols, 2003), 201–215.

and polarized debate" about the correlation between the Islamic religious tradition and modern science.[72] The indicative question was actually very simple, but challenging: Does Islam preclude scientific progress? Answers can be grouped mainly in two parts: Either Islam was "the most backward and anti- scientific religion" or "an intellectually progressive religion that was a true friend of science."[73]

Cemil Aydın takes two prominent historians of science in early modern Turkey, Adnan Adıvar and Aydın Sayılı, as Islam- negative culturalists regarding the Ottoman history of science. Adıvar's book, *Osmanlı Türkleri'nde İlim*, was one of first systematic Ottoman histories of science writings in modern Turkey. What's more, he argues that Ottoman Muslim society had become "inhospitable" to the reception of science and technology due to the "Islamic dogmatism of their culture." In fact, from his point of view, there were many people who had had free souls, like Mehmed II or Katip Çelebi, among the Ottomans. On the other hand, "fanaticism and indifference of society" occurred as an obstacle to scientific development. To sum up, the history offered by Adıvar was indeed the "History of the (Absence) of Ottoman Science."[74]

Aydın Sayılı was another important historian of science in early modern Turkey. The supervisor of his thesis at Harvard University was George Sarton and it was the first Ph.D. dissertation in the academic field of the history of science.[75] Sayılı paid special attention to the concept of scientific revolution and asked why this

[72] Ibid., 201.
[73] B. Harun Küçük, "Islam, Christianity, and the Conflict Thesis," in *Science and Religion: New Historical Perspectives,* ed. Thomas Dixon, Geoffrey Cantor, and Stephen Pumfrey (Cambridge: Cambridge University Press, 2010), 111.
[74] Cited in Aydın, 204.
[75] Selami Çalışkan, "Türkiye'de Bilim Tarihi Sahasında İlk Doktora Tezi: Aydın Sayılı 'Observatory in Islam,'" *TALİD Türk Bilim Tarihi* 2, no. 4 (2004): 701. Title of this thesis is "The Institutions of Science and Learning in the Muslim World" and one of its chapters was also extended into the book. Aydın Sayılı, *The Observatory in Islam*, 2nd ed. (Ankara: Türk Tarih Kurumu, 1988).

revolution had not been led by Muslim scholars despite the fact that they had come very close to the Copernican revolution, which was regarded as one of the most significant parts of the scientific revolution process. Additionally, he wrote that although this revolution was the most important event in world history,[76] the Ottomans had taken no notice of this process.[77] Finally, he applies a culturalist explanation of the Ottoman decline in science and takes "faith" as an explanatory unit. In fact, he considers the social, political and economic factors in his explanations as well, but cultural and intellectual causes were more "tractable" than others for him.[78]

This case was valid in the late period of the Ottoman Empire as well and two people had a significant effect on the perception reagarding to Islam vs. science. The first one was John William Draper and his book, *History of the Conflict between Religion and Science*. This book was translated by Ahmed Mithat with a critical preface in Ottoman-Turkish.[79]

The second and most probably the greatest effect came from Ernest Renan and his famous speech at the Sorbonne in 1883, during which he declared that Islam and science were not compatible. Moreover, he argued that Islam itself was hostile to science and progress. In fact, Renan's idea was not specific to Islam because he actually claimed that religion in general conflicted with science and progress.[80] Islam was at the center of conflict narratives in that century and more interestingly, the target of scholars like Draper, whose aim was not to confront Islam itself, but to

[76] Cited in Aydın, 206.
[77] Aydın Sayılı, "The Place of Science in the Turkish Movement of Westernization and Atatürk," *Erdem* 1, no. 1 (1985): 26.
[78] Aydın, 207.
[79] J. M. Draper, *Niza-ı Ilm-u Din = İslam-u Ulum*, trans. Ahmed Midhat Efendi (Dersaâdet: Tercüman-ı Hakikat, 1313). For further information about how Ahmed Mithat transformed Napier"s text into the declaration that Islam and science were allies, see M. Alper Yalcinkaya, "Science as an Ally of Religion: a Muslim Appropriation of "the Conflict Thesis"," *The British Journal for the History of Science* 44, no. 2 (2011): 161-181.
[80] Cited in Aydın, 202.

attack Christianity through Islam.[81] Aydın called this kind of approach "Islam-negative culturalism."[82]

Many scholars, in Islamic world in general, Ottoman Empire in particular, responded to this approach rapidly.[83] Most of intellectuals claim that Islam itself is the main factor for the rise of Islamic science and only problem regarding its decline is deviations from "true Islam." Aydın called this kind of approach "Islam- positive culturalism."[84]

From the perspective of those in this group, most of the thinkers in Europe were misinformed about Islam. For instance, Namık Kemal, in his refutation to the speech of Renan, strongly expressed that those people were actually ignorant (*câhil*) of Islam.[85] In addition to this, unlike the European scholars argued, Islam supported education (*ma'ârif*) and eventually science.[86] The basic problem of Europeans was that they thought all bad things were caused by religion.[87] As a consequence, this general misconception led them to make incorrect inferences regarding the issue of Islam and science.

Additionally, some scholars in the Ottoman Empire believed that modern scientific activities and their results were compatible with Islam. Aydın cited Said Nursi, an influential scholar in the late Ottoman period and modern Turkey, as an example of this kind of attitude. Nursi gave special importance to science and, more

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[81] Küçük, 112–113.
[82] Aydın, 204.
[83] For instance, Namık Kemal's response is one of the most famous ones. Namık Kemal, *Renan Müdafanamesi: İslamiyet ve Maarif*, ed. Mehmed Fuad Köprülü (Ankara: Milli Kültür Yayınları, 1962). Jamaladdin Afghani, Rashid Rida, or Muhammad Hamidullah are other important figures who wrote refutations to Renan"s claims. This article is a useful survey on the refutations. Dücane Cündioğlu, "Ernest Renan ve 'Reddiyeler' Bağlamında İslâm-Bilim Tartışmalarına Bibliyografik Bir Katkı," *Divan: İlmi Araştırmalar* 2 (1996): 1-94.
[84] Aydın, 203.
[85] "*Yalnız Ernest Renan değil, Avrupa'da Ulum-ı Şarkıyye'ye intisab ile maruf olanların Diyanet-i İslamiyye mebhasinde zihinlere hayret verecek kadar cahil olduklarını pek kolay isbat edebilirim*." Namık Kemal, 13.
[86] "*İslamiyet'in maarife mani' değil, bil'akis mürebbi olduğunu isbat için…"* Ibid., 11.
[87] Ibid., 13.

significantly, he appropriated some modern scientific findings to affirm the Islamic faith.[88] In fact, according to many intellectuals in that period, the roots of modern science were in Islamic civilization.[89] The knowledge coming from new scientific developments could be received as Muslim without doubt. To summarize, it is clear that Islam-positive culturalists generally regarded a compromise between Islam and science, and the history of Islamic science was considered as evidence of that.

Aydın directs our attention to some contradictions of both culturalist groups. For instance, Islam-negative culturalists, in most of the cases, did not consider the fact that Ibn Rushd was a pious jurist or that Takiyüddin and Katip Çelebi were religious persons as much as other Ottoman Muslims were.[90] In other words, there were many other figures that were both believers and successful in scientific activities. On the other hand, Islam-positive culturalism had struggled to explain the position of the Muslim world compared to Europe. In fact, Islam-positive culturalists focused on the "golden age of Islamic science until the thirteenth century" and disregarded Ottoman scientific activities in a general sense. They were proud of Ottoman achievements in political and military aspects, but they criticized Ottoman educational institutions for not producing scientific progress.[91]

Both the Islam-positive and Islam-negative culturalists agreed with the position of the Ottomans in scientific culture to some degree. Both claimed that the Ottoman institutions did not achieve remarkable scientific studies. It seems to me that this situation may have been related to the many defeats in politics and wars the

[88] Aydın, 209.
[89] One interesting example is as such: "*Avrupa'nın ilmini, fennini sanayi'ini başka bir şey zannediyoruz. O ulum ve fünun, o sanayi"ki Asya-yı vusta medreselerinden, Irak sahralarından, Endülüs viranelerinden Avrupa saha-i terakkilerine isar-ı füyüzat eylemiştir*." Qouted in Kara, Din ile, 136.
[90] Aydın, 209.
[91] Ibid., 210.

Ottoman Empire had experienced, especially in the last its last period; and second, orientalist studies from the nineteenth century onwards.

Due to the fact that European achievements were mainly referred to as scientific accomplishments, many officials and intellectuals in the Ottoman Empire thought that Ottoman defeat against Europe had been caused by its scientific deficiency. In other words, as the Ottoman Empire lost wars and political prestige to Europe, Ottoman officials and intellectuals were faced more with the difference between the Ottoman Empire and West, which led to more defeats. As Şükrü Hanioğlu explains in detail, their answer in general to make sense of the backwardness of the Ottoman Empire and superiority of the West was implicit in science (*u'lûm ve fünûn*).[92] In other words, their political deficiency was transformed into scientific ones in their eyes. Many Ottoman thinkers were indeed torn between the European scientific splendor and the absence of it in their country. Hereupon, the relationship between the Ottoman political defeats and formation of the Ottoman historiography of science especially in modern Turkey, as discussed above, seemed interconnected and was worthy of more focused studies.

Second, studies on Islamic philosophy done after the nineteenth century in Europe seem to have been influential on the formation of the Ottoman historiography of science as well. Dimitri Gutas, in his comprehensive article, shows the main historiographical approaches to Islamic philosophy in the twentieth century.[93] According to him, one of the approaches to Islamic philosophy was Orientalist. As he remarks, one of the assumptions of this approach is that Arabic [Islamic]

[92] Şükrü Hanioğlu, *Bir Siyasal Örgüt Olarak Osmanlı İttihad ve Terakki Cemiyeti ve Jön Türklük: (1889-1902)*, vol. 1 (İstanbul: İletişim Yayınları, 1985), 16–17.
[93] He uses Arabic philosophy instead of Islamic philosophy but it can be said that both two concepts stand for same conceptual framework.

philosophy ends with Ibn Rushd.[94] It means that intellectual life in Islamic world became weak after the thirteenth century. This view is very similar to the concept of "golden age" of Islamic civilization mainly advocated by Islam-positive culturalists. In fact, both were formed dependant on each other. That is, as Avner Ben Zaken remarks, historians of Islamic science generally accepted the assumption that emerging notion of "early-modern science," which represented a historical break from the East, too. Such a claim led to the conceptualization of science with civilization so that "modern science was a European science and medieval science was Muslim science."[95] In other words, presumably, Orientalist assumptions that referred to the scientific superiority of Europe and to the Muslim world's scientific weakness after the thirteenth century fed the idea of the "golden age" with which many of the intellectuals at the end of Ottoman Empire agreed. Nevertheless, at this point the position of the Ottoman Empire was dramatic. Due to the fact that the Ottoman Empire had risen after the thirteenth century, it was regarded as weak in philosophy *de facto* and thus in science. This issue needs further clarification.

After the two culturalist approaches were stated, Aydın dealt with the effect and contributions of Ekmeleddin İhsanoğlu to the debates on Islam vs. science. In general, Aydın held that İhsanoğlu had had a leading role in evaluating the Ottoman history of science differently from both of the two culturalist approaches. Two of his most prominent contributions were becoming a leading figure to enrich the sources of the Ottoman history of science and to make it a subject of study at the

[94] Dimitri Gutas, "The Study of Arabic Philosophy in the Twentieth Century: An Essay on the Historiography of Arabic Philosophy," *British Journal of Middle Eastern Studies* 29, no. 1 (May 2002): 15–16.
[95] Avner Ben Zaken, "The Angelus Novus of Early Modern Science: The Past, the East and the Circulation of Post-Copernican Astronomy in the Eastern Mediterranean, 1560-1660" (Ph.D. Thesis, University of California, Los Angeles, 2004), 15.

international level.[96] Especially books on the history of literature edited by him and published by the IRCICA brought a great dynamism to the history of Ottoman science studies, as mentioned before.

As a result of work that showed a rich collection of scientific works duing the Empire, some remarkable comments became more visible and acceptable. First, it was emphasized that Ottoman scientific and intellectual life were not static. Second, it was not a true approach to compare the Ottomans with the Europeans regardless of the historical context of the encounter. Third, unlike Adıvar argues, the Ottomans were aware of the developments that were occurring in Europe and received science and technology to meet their needs and interest. Fourth, unlike people who had a negative attitude toward the Islam vs. science issue, İhsanoğlu claimed that the attitude of Ottoman scholars (*ulema)* and the scientific community toward the European science had been positive.[97] Aydın called İhsanoğlu's perspective of the culturalist approaches as the "sociological approach to the history of Ottoman science."[98]

In addition to İhsanoğlu's sociological approach, the methodological contributions of two historians of science who were inspired by Fazlıoğlu are worth mention. He emphasized two crucial names and their importance in the Ottoman history of science: Salih Zeki and Aydın Sayılı.

Salih Zeki (d. 1921) as a prominent historian of science in the late period of the Ottoman Empire made two significant contributions to history of science studies in Turkey. First of all, before him, most of the Ottomans had benefited from the secondary sources of Islamic science studies mainly done by European orientalists. He paid attention to and studied these manuscripts himself. In other words, he had

[96] Fazlıoğlu, "İki Ucu Müphem," 22.
[97] Aydın, 212.
[98] Ibid., 213.

direct access to the primary sources of the history of Islamic sciences. Second, he approached those manuscripts from a "historical perspective."[99] In other words, he does not evaluate manuscripts separately, but in their historical contexts. The second person Fazlıoğlu expresses is Aydın Sayılı. Unlike the evaluations of Cemil Aydın on Aydın Sayılı, Sayılı"s contributions to these studies can be mainly classified into two: Firstly, he focused on to publish critical texts of the manuscripts in Arabic, Persian and Ottoman Turkish so that primary sources of Ottoman history of science could enrich. He, secondly, offered a methodological perspective to evaluate manuscripts that could be called as "civilizational perspective."[100] That is, he took the civilizational aspects of historical entities as explanatory units in science studies and reminded us that comprehensive paradigms and scientific activities belonged to and were influenced by these.

Up to now, the starting and main dynamics of the history Ottoman of science studies have been depicted as if they were "external." In other words, this field was formed as a result of the confrontation with Islam and Ottomans with respect to modern science. In fact, this is not the case. The Ottomans themselves were also curious about the history of their sciences, but it should be kept in mind that their curiosity about and methodology of the history of sciences were not same as the history of sciences institutionalized in modern times. For instance, many commentaries (*şerh*) and annotations (*hâşiye*) written in Ottoman scientific culture can give clues about the Ottoman consciousness of their scientific past. This kind of work has big potential to see the historical background and evolution of ideas through them. It is important to note that the commentary tradition was common in

[99] Fazlıoğlu, "İki Ucu Müphem," 19.
[100] Ibid., 21.

many fields, like mathematics, catechism (*ilmihal*), music, and language.[101] Additionally, works on the classification of science are also good examples of the scientific sensitivity of the Ottomans historically because they represent an attempt to research the historical background of the sciences for the sake of learning about the past of a topic.[102] Those kinds of examples also remind us that there are many special sources for the Ottoman history of science and that the main problem is to evaluate them within their context.

[101] İsmail Kara, "'Unuttuklarını Hatırla!' Şerh ve Haşiye Meselesine Dair Birkaç Not," *Divan : Disiplinlerarası Çalışmalar Dergisi* 15, no. 28 (January 2010): 5.
[102] Fazlıoğlu, "İki Ucu Müphem," 14.

CHAPTER III

FORMATION OF AN "ENGINEER": İSMAİL GELENBEVI (1730-91)

This chapter examines İsmail Gelenbevi's scientific life by focusing on his career, which was shaped during his teachership at the engineering school. Who was he, just an ordinary Ottoman scholar? What differentiated him from other scholars in eighteenth century Ottoman society? In what environment did he grow up and how did he decide to enter *ilmiye*? What did they do during the long and challenging path of *'ilm*? What kind of changes did he experience in his life scientifically and socially? What is the meaning of the fact that such an Ottoman scholar became an instructor at the engineering school established by the state for an education different from that of the medrese system and who wrote mathematics books there? This chapter aims not only to follow the milestones of Gelenbevi's life, but also to indicate the relationship between the *ilmiye* system and engineering education by emphasizing the fact that in the first engineering experience, these two allegedly different institutions had a positive relation to each other. For this aim, this chapter will follow Gelenbevi's life chronologically, highlighting important aspects of it.

Orphan in the Difficult Life of *'İlm*

İsmail b. Mustafa el-Gelenbevi el-Rumi el-Hanefi[103] came to be known as Gelenbevi. As his name suggests, he was born in Gelenbe in the province of Aydın,

[103] Babanzade Bağdatlı İsmail Paşa, *Hediyyetü'l-Arifin Esmai'l-Müellifin ve Asarü'l-Musannafin*, ed. İbnülemin Mahmûd Kemal İnal and Avni Aktuç, trans. Kilisli Rifat Bilge, vol. 1 (Ankara: Milli

now in Kırkağaç in Manisa, in 1731 (1143).[104] His grandfather and father were from the *ilmiye* and his family was well-respected in the town. His father died in 1738 (1150) when he was nearly seven years old, and that is why he began his education a bit later than usual.[105]

The beginning of his education presents an interesting vignette. When he was playing a *ceviz oyunu* (walnut game) with his friend, one of his father's friends saw him and chided him because playing out on the street did not become a child from a scholarly family like his. This episode touched him so deeply that he embarked upon his studies at once.[106]

Gelenbevi started his education in his village, but it was not sufficient for a boy who was such a genius and ambitious to learn. He could have tajen the easiest way and stayed with his mother in the town, but instead he went to the center of scientific life in the Ottoman Empire, İstanbul. By taking this difficult but fruitful way he became one of the most important figures of eighteenth century Ottoman intellectual life. Although it is written that he attended the medrese in Fatih,[107] İbnü'l- Emin Mahmut Kemal İnal wrote in his book *Gelenbevi* that he entered the medrese in Soğuk Kuyu.[108] It is possible to infer that he first entered the latter medrese, and then moved on to study at the *Fatih Medresesi*. There he learned

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Eğitim Bakanlığı, 1951), 222. In some sources, Mahmud is considered to have been his father's name. Fındıklılı İsmet Efendi, *Eş-Şekaiku'n-Nu'maniyye ve Zeyilleri: Tekmiletü'ş-Şakaik fi Hakki Ehli'l-Hakaik*, ed. Abdülkadir Özcan, vol. 5 (İstanbul: Çağrı Yayınları, 1989), 136.; Ahmed Cevdet Paşa, *Tarih-i Cevdet*, 2nd ed. (Istanbul: Matbaa-i Osmaniye, 1309), 233. On the other hand, Mustafa is true one as stated in one of his books. In fact, Mahmud is his grandfather"s name. Gelenbevi Ismail, *Dekaikü'l-Beyân fî Kıbleti'l-Büldan* (Istanbul: Dârü't-tıbâati'l-âmire, 1337), 2.

[104] Bursalı Mehmed Tahir, *Aydın Vilayeti"ne Mensub Meşayih Ulema Şuara Müerrihin ve Etibbanın Teracim-i Ahvali.* (İzmir: Keşişyan Matbaası, 1324), 87.

[105] Fındıklılı İsmet Efendi, 136.

[106] Ahmed Cevdet Paşa, 233.

[107] Şerafettin Gölcük and Metin Yurdagür, "Gelenbevi," *TDV İslam Ansiklopedisi* (İstanbul: Türkiye Diyanet Vakfı, 1996), 552.

[108] İbnü'l- Emin Mahmut Kemal, *Gelenbevi*, Istanbul Universitesi Nadir Eserler Kutuphanesi, İbnü'l-Emin, Nr. 3561, Yeni Kayıt 10966, 1332, 11. I benefited from the transliteration of this manuscript by Selman Aybar. Selman Aybar, "İbnü'l- Emin Mahmut Kemal İnal'ın Gelenbevi İsmail Efendi Hakkındaki Osmanlıca El Yazması Eserinin Çevrimyazısı" (Undergraduate Thesis, Istanbul University, 2006).

Arabic and the traditional sciences under the tutelage of the famous scholar Yasincizade Osman Efendi, and the philosophical sciences from another famous scholar, Müftizade Mehmed Emin Efendi, better known as "The Walking Library" (*Ayaklı Kütüphane*) because of his well known polymath scientific personality.[109]

These men were important to Gelenbevi because both were precious scholars in İstanbul at the time.[110] From this general picture, one thing may be realized from the very beginning: This orphan from the hinterland was not an ordinary student and received a very good education after coming to İstanbul.

An Emerging Personality among the *Ulema*

Gelenbevi completed his medrese education, passed the *ru'ûs* examinations and became a legal scholar in 1763 (1177).[111] In the Ottoman *ilmiye* structure, those who wanted to be a legal scholar or judge (*kadı*) should be a candidate (*mülâzım*) first after graduation from medrese. This procedure was called the candidacy (*mülâzemet*) system in general. In fact the candidacy system had two meanings in the Ottoman state. The first one was training medrese graduates to become legal scholars or judges and the second indicated a waiting period for a legal scholar or judge in İstanbul for appointment to a new position after an old one had finished. Gelenbevi's case was surely of the first kind.[112] This system became necessary when the number of medrese students became greater than that of positions for professors (*müderrislik*) in the Empire. Owing to this system, only those who became *mülâzım* (lieutenant)

[109] Abdülkuddüs Bingöl, *Gelenbevî İsmail*, Kültür ve Turizm Bakanlığı Yayınları 914 (Ankara: Kültür ve Turizm Bakanlığı, 1988), 3.
[110] Ebü'l-Ula Mardin, *Huzur Dersleri*, ed. İsmet Sungurbey, vol. 2-3 (İstanbul: İstanbul Üniversitesi Hukuk Fakültesi, 1966), 262.
[111] Ahmed Cevdet Paşa, 233.
[112] For more information, see İsmail Hakkı Uzunçarşılı, *Osmanlı Devleti'nin İlmiye Teşkilatı*, 3rd ed. (Ankara: Türk Tarih Kurumu, 1988), 45–53.

and then passed the *Ru'ûs* examination could become legal scholars. But who decided which medrese gradutes could be lieutenants? The short answer is the high-level officials of the *ilmiye*. For instance, the grand mufti, the Sultan's teachers, *kazasker*s (chief judge), *nakîbüleşrâf* (chief of the descendants of the Prophet), judges and *müfti*s in the big cities, and some of the legal scholars of the important medreses had such a right.[113]

At this point, the question of how and thanks to whom Gelenbevi became a lieutenant seems important because it was not easy especially from the sixteenth century onwards.[114] The relations with those who had the right to select lieutenants were crucial. Although I was unable to reach satisfying answer as to how Gelenbevi achieved this process, I will offer my comments on this issue based on the sources I was able to access. No doubt this lack of documentation does not mean the absence of such a relation. His teachers, Yasincizade Osman Efendi and Müftizade Mehmet Emin Efendi, appear to have been influential figures among the ulema. Therefore, it is possible that they might have had the right to select lieutenants or had good relations with those who had such a right. Considering that Gelenbevi continued his relationships with his two teachers to such a degree that he continued to take private lessons with Müftizade even after becoming a legal scholar and the teacher of the son of Yasincizade Osman Efendi, Abdülvehhâb b. Osman, who later became grand mufti, a sense of emerging career may be obtained through of statuses of these scholars. In other words, it is possible that Gelenbevi's rise in the *ilmiye* might have been the result of his intelligence and success.

[113] Mehmet İpşirli, "The Learned Institution (İlmiye)," in *History of the Ottoman State, Society & Civilization*, vol. 1 (İstanbul: İslam Tarih, Sanat ve Kültür Araştırma Merkezi (IRCICA), 2001), 262.
[114] Cornell H. Fleischer tells of Mustafa Âli's career in his book and it is seen that becoming a mülâzım was a challenge in his life. See, Cornell H. Fleischer, *Bureaucrat and Intellectual in the Ottoman Empire: the Historian Mustafa Âli (1541-1600)* (Princeton: Princeton University Press, 1986).

As Denise Klein shows in her study, between 1630- 1703, 715 out of 994 scholars were not from İstanbul. Furthermore, 691 out of them did not come from an ulema family.[115] What these results imply is that it might have been possible that Gelenbevi rose among the ulema with the support of his success and teachers. Nevertheless, this issue remains to be solved.

As an indication of his emerging position among the ulema, his presence at audiences with the Sultan called *Huzur Dersleri* or *Huzur-ı Hümayun Dersleri* (audience with the sovereign),[116] which was a lecture series given at the palace by the leading scholars under the patronage and with the participantion of the Sultan during the sacred month of Ramadan, seems to offer a good case because he participated in it. In a month, eight lectures were given and one of the most commonly read Quran commentaries in the Empire, Kadı Beyzavi's *Tefsiri* was read and explained. One instructor (*mukarrir*) gave the lectures and his respondents (*muhâtap*) listened to him and asked questions.[117]

Although Ata Bey says that this practice could have been rooted in the time of Osman I,[118] Sultan Mustafa III regularized these lectures in 1758 (1172) and they continued regularly until the end of the Empire.[119] According to Madeline C. Zilfi, this practice primarily evoked certain kinds of relations between the political group and the ulema. In other words, this practice put the ulema "as a group closer to the Sultan and thus closer to the center of official political life." In addition to this, as the medreses were occurred the "dominant" religious institutions, this ceremony

[115] Denise Klein, *Die osmanischen Ulema des 17. Jahrhunderts: Eine Geschlossene Gesellschaft?* (Berlin: Klaus Schwarz Verlag, 2007), 92–95.
[116] Mardin, 2-3:262.
[117] For very comprehensive information, Mardin's work is the best. See Mardin.
[118] Tayyar-zade Ata, *Osmanlı Saray Tarihi: Tarih-i Enderun*, ed. Mehmet Arslan, vol. 1 (Istanbul: Kitabevi, 2010), 313–314. On the other hand, İsmail Hakkı Uzunçarşılı expresses that Ata Bey's claim does not have any root; Uzunçarşılı, *İlmiye Teşkilatı*, 215.
[119] Mehmet Zeki Pakalın, *Osmanlı Tarih Deyimleri ve Terimleri Sözlüğü*, vol. 1, 3rd ed. (Ankara: Milli Eğitim Bakanlığı, 1983), 865.

provided that the Sultan was the student of the *ilmiye*.[120] That is, the executive group showed how scholars were significant for them religiously, politically and socially through this practice. These lectures show that the *ilmiye* were expected to "unify society."[121]

One of Gelenbevi's teachers, Yasincizade Osman Efendi, was among those who attended this important lecture in 1758 (1172) and 1759 (1173) as a respondant.[122] Another teacher of Gelenbevi, Müftizade Mehmed Emin Efendi, attended the lecture as a respondant in 1758 (1172) and 1759 (1173) and as a lecturer many times as well.[123] More interestingly and importantly, because unpleasant debates could occur between a lecturer and a respondent in front of Abdulhamid I, it was decided to make Müftizade a referee so as to prevent this kind of problem.[124] This issue shows how Müftizade was considered a prominent scholar whose scientific authority was accepted by all of the ulema.

Like his teachers, Gelenbevi also attended lectures as a respondent in 1776 (1190)[125] and 1783 (1197).[126] At this point, it is possible to infer that Gelenbevi also was appreciated as a scholar in many aspects and was respected among the ulema. In other words, he was significant to the state scientifically, politically and socially.

To sum up, Gelenbevi appears to have been a considerably respected scholar among the *ilmiye*. The more important issue regarding his time as a teacher at the engineering school is that, inspired by his participation in the *Huzur Dersleri*, it seems, he was in good standing with the high officials as well. To what degree did

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[120] Madeline C. Zilfi, *The Politics of Piety: The Ottoman Ulema in the Postclassical Age (1600-1800)* (Minneapolis: Bibliotheca Islamica, 1988), 229.
[121] Ibid., 231.
[122] Mardin, 2-3:1–2.
[123] Ibid., 2-3:204.
[124] Muhammed Zahid Kevseri, "Gelenbevi İsmail Efendi," trans. Musa Alak, *İstanbul Üniversitesi İlahiyat Fakültesi Dergisi*, no. 11 (2005): 145.
[125] Mardin, 2-3:796.
[126] Ibid., 2-3:262.

this relationship affect his appointment to the engineering school in a positive manner? For an answer to this question it is necessary to examine his time as an instructor in that establishment.

Gelenbevi as "Engineer": The Mühendishâne Years

Education Reforms in the Military

In this part, a historical background of the education in engineering school (*Mühendishane*) in the eighteenth century will be given. The intention is not to give all of the technical details about the engineering education, but just to reveal that although the experience was not historically an instant development; events had instant effects on it. In this context, it may be useful to start from the beginning of the eighteenth century. Bernard Lewis claims that the Treaty of Karlowitz of 1699, which was the result of the second unsuccessful siege of Vienna by the Ottomans, was a turning point in Ottoman history because

> this was the first time that the Ottoman Empire signed a peace treaty as the defeated power in a clearly decided war, and was compelled to cede extensive territories, long under Ottoman rule and regarded as part of the House of Islam, to the infidel enemy. It was a fateful opening into eighteenth century.[127]

It was true that the Ottomans lost the lands for which they had fought since 1526. In addition to the fact that it affected Ottoman foreign policy and started to change the Ottoman perception of Europeans, its relations with some internal events

[127] Bernard Lewis, *The Emergence of Modern Turkey* (London: Oxford University Press, 1961), 36.

like the Celali uprisings, long-term rebellions mainly in Anatolia, should not be ignored.[128]

The relationship between the "decline paradigm," which is criticized by many Ottoman historians now,[129] and the above statement by Lewis will not be discussed here, but suffice it to say that the military problems after this treaty have become an accentuated issue in eighteenth century Ottoman studies. A tendency has emerged to assume a positive correlation between the defeats and the military reforms in the eighteenth century.[130] However, this century was not confined to losses, but included remarkable victories at war, especially before 1750. For instance, the Russo-Turkish (1710–1711) and the Russo-Austrian-Turkish (1735–1739) wars concluded with positive results for the Ottoman Empire. Mustafa Kaçar writes that the defeats of the Ottoman army stemmed from bad strategy, not from the weakness of the Empire.[131]

As a result of the Treaty of Passarowitz in 1718, close attention began to be paid to military developments in Europe. Finding solutions especially for technically educating the army and then transferring European military technology and methods became important issues. For example, İbrahim Müteferrika, who founded the first printing press in the Ottoman empire, drew the attention of Sultan Mahmud I to this issue in his book *Usulü'l Hikem fi Nizami'l Ümem* (Rational bases for the polities of nation), printed in 1731.[132] In this book, he evaluated the reasons for the problems in the organization of the Ottoman state and for the power of European states. He first

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[128] Feridun Emecen, "From the Founding to Küçük Kaynarca," in *History of the Ottoman State, Society & Civilization*, ed. Ekmeleddin İhsanoğlu, vol. 1 (İstanbul: Research Center for Islamic History Art and Culture (IRCICA), 2001), 54.
[129] For the critical evaluation of the paradigm, Cemal Kafadar, "The Question of Ottoman Decline," *Harvard Middle East and Islamic Review* 4, no. 1-2 (1998/1997): 30-75.
[130] Niyazi Berkes, *The Development of Secularism in Turkey* (London: Hurst & Company, 1998), 30; Hüseyin G. Yurdaydın, "Düşünce ve Bilim Tarihi (1600- 1839)," in *Türkiye Tarihi*, ed. Sina Akşin, vol. 3 (İstanbul: Cem Yayınevi, 1988), 275.
[131] Mustafa Kaçar, "Osmanlı Devleti'nde Bilim ve Eğitim Anlayışındaki Değişmeler ve Mühendishanelerin Kuruluşu" (PhD Thesis, İstanbul University, 1996), 152.
[132] Berrak Burçak, "Science a Remedy for All Ills Healing 'the Sick Man of Europe' a Case for Ottoman Scientism" (PhD Thesis, Princeton University, 2005), 31.

explained the changes Europe had undergone and its current state. For example, he compared the three forms of government, monarchy, aristocracy and democracy. He discussed the position of the military in all of these forms of government and concluded that dependence upon the old methods was dangerous for the Ottoman armies. He commented on new methods and techniques in military service and the warfare developed in "Christian countries," and so implied what the Ottomans should do in this respect.[133]

The employment of foreign experts was considered a solution for military innovations. One of first attempts, made in 1717, occurred when a French military officer, De Rochefort, prepared a project on education in the army.[134] A more significant attempt was to revive the Corps of Salaried Bombardiers (*Ulufeli Humbaracı Ocağı*) in 1735.[135] The reorganization of the Corp was done by a French military expert, Claude-Alexandre Comte de Bonneval, known as Humbaracı (bombardier) Ahmed Paşa after he converted to Islam. According to Berrak Burçak, de Bonneval opened a military engineering school (*Hendesehâne*) for teaching geometry and other mathematical sciences that was the basis for the modern artillery service of the Empire.[136]

Niyazi Berkes accepts the presence of such an institution, but claims that there is no evidence of de Bonneval's personal association with this institution.[137] Aykut Kazancıgil argues that although no documents or information in the Ottoman archives regarding the foundation of such an institution in the Corp has been found yet, the mathematical sciences and practical engineering lectures were part of the corp's training because it is known that there were individuals called *Hocâ-yı*

[133] Berkes, 42–44.
[134] Ibid., 31.
[135] Kaçar, "Osmanlı Devleti"nde," 18.
[136] Burçak, "Science," 33.
[137] Berkes, 48.

mühendis (engineering instructor), *Muallim-i resim* (drawing instructor), and *Hoca-yı oda* (room instructor).[138] For example, a man called Mühendis Selim was one of scholars at this early incarnation of Ottoman engineering schools.[139] Consequently, there is a great deal of circumstantial evidence to the effect that engineering education became institutionalized in the Ottoman Empire after the 1730s.

The military transformation of the Ottoman and Russian Empires and their relations with the Russian state make for an intersting study. These two states influenced each other over a long period. Interactions between them were not usually peaceful, especially in the eighteenth century when the Russians' military capabilities became more powerful than those of the Ottomans.[140] For instance, in 1770 they set fire to the Ottoman fleet at Çeşme after the Russian Baltic fleet came to the Aegean Sea with the support of England. After just a few weeks, the Ottoman army was defeated by the Russian army on the Danube as well.

Above all, presumably, the event that triggered new efforts to reorganize the Ottoman army was the peace treaty of Küçük Kaynarca in 1774 after the six-year war. The war was had begun when Russian hegemony over the Polish-Lithuanian Commonwealth increased to such a degree that it disturbed the Ottomans. A Russian army detachment passed into Ottoman territory. When they tried to pull back the Polish forces, the Ottoman Empire declared war.[141] The Russo-Turkish war of 1768-1774 was a disaster for the Ottomans. Finally, the Treaty of Küçük Kaynarca was signed in 1774.

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[138] Aykut Kazancıgil, *Osmanlılarda Bilim ve Teknoloji* (İstanbul: Gazeteciler ve Yazarlar Vakfı, 1999), 219.
[139] Kaçar, "Osmanlı Devleti'nde," 26.
[140] Gábor Ágoston, "Military Transformation in the Ottoman Empire and Russia, 1500-1800," *Kritika: Explorations in Russian and Eurasian History* 12, no. 2 (2011): 282.
[141] Kahraman Şakul, "Russo- Ottoman War of 1768- 1774," ed. Gábor Ágoston and Bruce Masters, *Encyclopedia of the Ottoman Empire* (New York: Facts on File, 2008), 492.

According to Carl Brown, this treaty was a turning point in Ottoman history.[142] His argument is meaningful to some extent. The treaty made the Ottomans politically and economically unstable, adding to the loss of their international prestige.[143] The effects of this war were not limited to this indeed. The Ottomans had had trouble with technical problems in the war as well and even opened a school for artillery in 1772 to overcome them, but the results were not effective.[144] Eventually, these challenges accelerated the establishment of a new institution called the Naval Engineering School to meet the necessities in military education.[145]

In this picture, it may be thought that the Ottoman military reforms in education, which evolved to the point of establishing an engineering school, were a historical but passive process shaped by defeats and thereby the inability of the Ottomans. It is sure that wars that resulted in dramatic defeats motivated Ottoman officials to become active in military reforms, which were implemented to some extent. For instance, Zorlu writes that the defeat in Çeşme in 1770 became "a motivating force behind reform movements," which later resulted in the "systematic construction of new types of sailing warships" in this period.[146]

Additionally, it does not mean that they were oblivious to the external and internal dynamics of the era. As state above, İbrahim Müteferrika was aware of what was happened outside the Ottoman Empire and was able to analyze the main political organizations and try to reveal the significance for the military in them. More intriguingly, there also were dome remarkable officials who were able to identify the internal problems with which the Ottoman military was faced. For instance, in 1772

[142] Carl Brown, *International Politics and the Middle East. Old Rules, Dangerous Game* (Princeton: Princeton University Press, 1984), 23.
[143] Şakul, 493.
[144] Kemal Beydilli, "Mühendishane-i Bahri-i Hümayun," *TDV İslam Ansiklopedisi* (İstanbul: Türkiye Diyanet Vakfı, 2006), 514.
[145] Kaçar, "Osmanlı Devleti"nde," 97.
[146] Tuncay Zorlu, *Innovation and Empire in Turkey: Sultan Selim III and the Modernisation of the Ottoman Navy* (London: Tauris Academic Studies, 2008), 159.

during the Russo-Turkish war, the minister of foreign affairs (*Reisü'l- Küttab*) İsmail Bey observed that the main problem was not a material or spiritual deficiency, but the inadequacy of technical service.[147]

What's more, the Ottoman Empire was not the only state faced with technical problems in its military. The Seven Years' War, which lasted between 1756-1763 and involved most of the great powers of the time, dramatically affected each of them militarily. France, Austria, Russia and Prussia observed the inadequacies of their military officers. The establishment of military schools in Europe intensified in the eighteenth century. In France, the Civil Engineering School (*Ecole des Ponts et Chaussees*), which was to construct roads and bridges, was established in 1747, followed by the Engineering School (*Ecole du Genié*) in 1748. Although the first military engineering school was established in 1718 in Vienna, it took time to mature.[148] To sum up, developments in the military education of the Ottomans were formed based on a combination of internal and external dynamics which were interwined.

İsmail Gelenbevi at the *Mühendishâne*

The School of Theory, School of Mathematics, or as it was called in French, *Ecole de Théorie, Ecole de Mathématiques*, and in Turkish *Mühendishane-i Bahri Hümayun*, was established in Tersâne in İstanbul by the Baron de Tott on the orders of Grand Admiral Gazi Hasan Paşa on April 29, 1775.[149] It mainly aimed to educate students in naval engineering. Mustafa Raşit Efendi was appointed director (*nâzır*) of

[147] Kemal Beydilli, "Savaş Eğitiminde Okullaşma (1775- 1807)," in *XVIII. Yüzyıl Başından XX. Yüzyıla Kadar Türk Denizcilik Tarihi*, ed. Zeki Arıkan and Lütfü Sancar, vol. 2 (Ankara: Deniz Kuvvetleri Komutanlığı, 2009), 274.
[148] Ibid., 269–272.
[149] Kaçar, "Osmanlı Devleti"nde," 97.

the school, and[150] Cezayirli Seyyid Hasan Hoca was its first instructor.[151] The Baron de Tott selected students by means of an examination.

The first students were experienced captains who had basic mathematical knowledge, some high- ranking officials, and the sons of both. In the beginning, the French teacher of the school, Gilles Jean-Marie Brazzer de Kermovan, gave mathematics-oriented lectures, but then because of the need for educated navigators, he taught lessons like geometry (*hendese*), geography and naval engineering were added to the curriculum at the request of the Grand Admiral.[152] According to Toderini, an Italian priest who was in İstanbul between 1781- 1786 and later wrote about his observations there, the number of students in the school was more than fifty, only ten of whom were full-time students.[153] From this point on, education in this school was opened to those who were interested.

The second period of the Engineering School can be said to have started with the involvement of Halil Hamid Paşa, who was called the "reformist vezir" by the Europeans. He became grand vezir on December 31, 1782.[154] The school was restructured during his tenure. First, he first solved the location problem of the school, transferring it to a larger, two-story building. Next, the curriculum was reorganized and two new French engineers were invited to teach there. André-Joseph de Lafitte-Clavé and Joseph Gabriel Monnier had come to the Ottoman Empire for some technical jobs like fortificiation. They started to teach at the engineering school on October 28, 1784.[155]

[150] Fevzi Kurtoğlu, "Hendesehanei Bahrî, Mühendishanei Bahrî," in *Deniz Mektepleri Tarihçesi (1928-1939)*, vol. 2 (Ankara: Genelkurmay Başkanlığı IX. Deniz Şubesi, 1941), 5.
[151] Ibid.
[152] Beydilli, "Mühendishane," 514.
[153] Kaçar, "Osmanlı Devleti"nde," 101.
[154] Ibid., 68.
[155] Ibid., 79.

Their employment at the Naval Engineering School can be regarded as the first step of the foundation of the Land Engineering School, which was established in 1795. They were land engineers and introduced subjects such as fortification, tactics and geometry.[156]

The French engineers started to teach practical lessons first, and then theoretical lessons in December 1784.[157] Soon after, two Ottoman instructors, Gelenbevi İsmail Efendi and Kassâbbaşızâde İbrahim Efendi, were appointed for theoretical lessons.[158] In a report by Lafitte-Clavé, Gelenbevi's name is first mentioned on January 18, 1785.[159] So we can conclude that Gelenbevi started to give classes at the school between these two dates.

The arrival of the two French teachers triggered inspired changes such as a new curriculum including theoretical and practical lessons, and the employment of two teachers for theoretical lessons apart from the ones taught by the French engineers. All of this, most probably, was the project of grand vezir Halil Hamid Paşa for the sake of the re-organization of the school. In my view, the appointment of Gelenbevi was also a part of that project. This argument is crucial in two respects. First, Halil Hamid Paşa paid attention to the school and instituted a "project" for higher quality education there because the state needed good and technically equipped engineers. Such an interest was not personal; the engineering school enjoyed the attention of the state itself because of its significance for military and thereby the state. For instance, Grand Admiral Cezayirli Gazi Hasan Paşa visited the

[156] Beydilli, "Mühendishane," 514.
[157] Kaçar, "Osmanlı Devleti'nde," 107.
[158] Beydilli, *Türk Bilim*, 24.
[159] Lafitte- Clavé, *Journal D'un Officier Français à Constantinople en 1784- 1788*, Archives du Ministére de la Guerre, Paris, Dépôt du Génie, Art. 14, nr. 118, 34. In this thesis, typed and numberized version of the report by D. Anoyatis- Pelé.

school frequently and encouraged the people there. More importantly, Abdulhamid I came to this school and encouraged everyone to do their jobs.[160]

The second point involves the position of Gelenbevi. He was involved in this state-sponsored project as an instructor. Here one question becomes meaningful: Why was he selected as a mathematics teacher over other candidates? It is easily inferred that he was well-known as a good mathematician, but he was not the only one. For instance, Muğlalı Palabıyık Mehmed Efendi was uncomfortable when Gelenbevi was appointed to the engineering school instead of him because he regarded himself as superior to Gelenbevi. He asked an official about this issue and received a response that is interesting and a little bit tragic. This official said that they could not test which of them was better because both were great mathematicians, but Gelenbevi needed the money more due to the fact that he had many children.[161] This statement shows that Gelenbevi was appointed not only for his mathematical competency. It seems he had good relations with some high-level officials to the degree that those people knew and were sensitive to his private life, including his family conditions.

As discussed above, Gelenbevi attended *Huzur Dersleri*, which showed an interaction between ulema and the Sultan and high officials. From this, it can be argued that Gelenbevi had a good relationship with the bureaucracy. Regarding his tenure at the engineering school, Stanford Shaw states that Gelenbevi was close to Grand Vezir Halil Hamid Pasha and Grand Admiral Cezayirli Gazi Hasan Pasha, who appointed him to teach there.[162] Although we do not know how he gained such good relations, Gelenbevi's network along with his competence were strong enough

[160] Kurtoğlu, 5; Lafitte- Clavé, 56.
[161] İbnü'l- Emin, 36.
[162] Stanford J. Shaw, *Between Old and New: The Ottoman Empire under Sultan Selim III 1789-1807* (Cambridge, Mass.: Harvard University Press, 1971), 442.

for him to be appointed to a new school that was regarded as very important to the state.

Gelenbevi was an active figure at the engineering school. He was chief instructor in mathematics. In addition to this, we learn that he was also able to find good students for the school such that Seyyid Burhan declared that he directed the best students to the school.[163] Thereupon, according to the Lafitte-Clave's report, as an example, we learn that two students directed by İsmail Gelenbevi attended the lesson.[164]

His effectiveness was not confined to finding good students. He also was interested in the existence and importance of the school. He and the other teachers of the school even wrote a report (*lâhiya*) expressing why the school was significant and the need for it. As a result of such activities, stipends were assigned to six senior (*kıdemli*) students of the school so that they could become full-time students.[165] From this, it can be concluded that Gelenbevi was an active teacher who, along with his duties as instructor, worked to improve the school.

Scientific Transformation: From *'alim* to Engineer

During the early years of the reign of Selim III, when the Ottomans were involved in the Russo-Turkish War of 1787-1792, military manoeuvres were conducted in Kağıthane. The Sultan was displeased because the targets of the bombardiers were missed. Hereupon, Gelenbevi was invited to correction their aim. As a result of his calculations, the Sultan so pleased that he awarded Gelenbevi four oka (*okka*) of rice a day. More significantly, in 1790 he was appointed to the position

[163] Lafitte- Clavé, 157.
[164] Ibid., 187.
[165] Beydilli, *Türk Bilim*, 278; Lafitte- Clavé, 249.

of molla, or judge of canon law (*mevleviyet*), in Yenişehir, the importance of which will be explained below. In this way, he acquired a remarkable position in the Ottoman *ilmiye* system.[166]

This narrative, at the first glance, is surprising because a scholar who wrote sophisticated books on philosophical topics appears to have been very knowledgeable on technical issues. This may not seem interesting due to the fact that he had been a teacher at an engineering school for approximately four years by then. It is known that he was there for theoretical mathematics lectures not for technical ones, but thanks to the details Lafitte Clavé wrote in his report, we learn that even Gelenbevi sometimes attended practical lectures as well, such that in sixtieth fortification lesson, he joined others in the of the top of a bridge.[167] What is more, Akifzâde points out that Gelenbevi was a master in engineering.[168] Nonetheless, this case, which occurred during the late period of Gelenbevi's life, is sufficiently interesting to go further: Gelenbevi was presented as an "engineer" prototype rather than as a member of the Ottoman ulema in *Tarih-i Cevdet*.

Here one question should be asked: Was an Ottoman scholar competent in technical matters extraordinary compared to other scholars in Ottoman history? In fact, no. Especially in the the eighteenth century, many scholars were included in technical projects. For example, the mufti of Yenişehir, Hacı Mehmet Efendizade Mehmet Said Efendi, who was the first teacher at the *Hendesehâne* when it was established in 1735, was one of the ulema. Supposedly, he was so successful that he invented some technical tools (*hendese âletleri*). The more intriguing point here is

[166] Ahmed Cevdet Paşa, 235.
[167] Lafitte- Clavé, 49.
[168] Abdürrahim b. İsmail Amasyalı Akifzade, *el-Mecmu' fi'l-Meşhud ve'l-Mesmu"*, trans. Hikmet Özdemir (İstanbul: Türkiye İlmi, İçtimai Hizmetler Vakfı, 1998), 106.

that he was awarded with the rank of professor at the *Kadızade Ahmed Çelebi Medresesi* owing to his success.[169]

Another skillful scholar was Ebû Sehl Nu'mân Efendi, who was a member of the Ottoman committee to re-determine the Ottoman-Austrian border after the treaty of Belgrad in 1739. He held the position of border judge (*sınır mollası*) and was active in determining the border. More interestingly, he is said to have made an instrument, in fifteen days, similar to one that the Austrian committee had bought from France for the determination of the border and but hid from the Ottomans. This also caused concern among Austrians how he could have learned about it.[170]

Similarly, in addition to Gelenbevi, Kasabbaşızade İbrahim Efendi, Palabıyık Mehmet Efendi and Bahar Efendi, teachers at the Naval Engineering School, were also from among the ulema. Abdurrahman Efendi and Hüseyin Rıfkı Tamani, employed at the Land Engineering School, also had roots in the *ilmiye*.[171]

Here it is appropriate to mention the arguments of Ahmet Cihan. According to Cihan, the relative power of the Ottoman ulema increased after the 1770s and their impact on the reform process was considerable. He claims that such scholars were active in technical education and shows some supporting examples.[172] One important aspect of the relationship between the ulema and the engineering education, he states, is that when the prototype called engineer did not yet exist, the ulema made remarkable contributions to formation and maturation of it through new education institutions. As emphasized above, that those among them were competent in technical issues made this process easy. According to Kemal Beydilli, it is not

[169] Tayyar-zade Ata, 257.
[170] Ebû Sehl Nu'mân Efendi, *Tedbîrât-ı Pesendîde (Beğenilmiş Tedbirler)*, ed. Ali İbrahim Savaş (Ankara: Türk Tarih Kurumu, 1999), 13–14.
[171] Ahmet Cihan, "Modernleşme Döneminde Osmanlı Uleması: 1770-1876" (Ph.D. dissertation, İstanbul University, 1994), 119–121.
[172] Ibid., 5.

coincidence that members of the ulema were appointed to positions as instructors in the engineering school because they were acquainted with technical issues thanks to some judicial jobs that necessitated knowing arithmetic, geometry, and astrological calendars.[173] All of this implies that Gelenbevi's techinal competency was no coincidence.

Beydilli also sheds light on the relationship between the *ilmiye* and the engineering school by giving an intriguing detail about the scholars who worked there. Many of them, including Gelenbevi, were given appointments as judges during or after their postings at the engineering school.[174] As stated above Gelenbevi was appointed to the Yenişehir- Fener Mevleviyeti in 1790 (1204). Other instructors receiving such appointments were Abdurrahman Efendi, to Yenişehir-Fener in 1807,[175] and Ali Bahar to the Üsküdar Mevleviyeti.[176]

More interestingly, there were many scholars from the *ilmiye* who attended lectures at the engineering school. Lafitte-Clavé states that many of them were eager to attend lessons there.[177] The traces of a salient connection become clear: a bi-directional relation between Mühendishâne and *ilmiye* existed at the institutional level. That is, the ulema, playing an active role in the first engineering experience, trained the first Ottoman engineers. Consequently, this school became a means for them to raise their status in the ulema system.

One case belongs to Hüseyin Rıfkı Tamâni, a teacher at the Land Engineering School. He published a book called *Lağım Endâhtı* (Explosion underground) and presented it to Selim III, but the Sultan suspected that he had done so with the hope of being rewarded with passing the *ru'ûs* (proficiency exam in the *ilmiye*) so that

[173] Beydilli, *Türk Bilim,* 25.
[174] Ibid., 25–26.
[175] Ibid., 34.
[176] Ibid., 312.
[177] Lafitte- Clavé, 29.

would elevate him to the status of professor or judge, he said that people who were involved in engineering should not seek to receive such appointments.[178] To sum up, technical education and degrees in the *ilmiye* do not seem to have been in opposition. On the contrary, they strongly fed each other. More interestingly, both of two could be continued at the same time. İbnü'l- Emin states that onn August 13, 1785 (7 Şevval 1199), when Gelenbevi was a mathematics teacher at the engineering school, he became a professor at the *Haseki Sultan Medresesi* and his rank among the *ilmiye* rose from senior medrese teacher (*hareket-i altmışlı*) to teacher of the highest degree who taught in the medrese at Sülemaniye mosque (*Musıle-ı Sülaymaniyei*).[179] According to Kethüdazade Arif Efendi, Gelenbevi, one of the students of Palabıyık Mehmed Efendi, was both the molla Eyüp and a mathematics teacher when he corrected the aim of the canons in the period of Selim III.[180]

Above, a story that was included in *Tarih-i Cevdet* regarding the "engineering" aspect of Gelenbevi was given, to what degree this label was suitable to him should be questioned. If it was not unusual for a member of the ulema to acquire technical skills, why do we need to use the new term "engineer"? More importantly, did Gelenbevi's success at engineering transform his scientific personality? In other words, did his years at the engineering school change his scientific career?

In order to find answers to these questions, it may be useful to compare him with Küçük Seyyid Mustafa, one of his students and one of the first teachers at the Land Engineering School. For, inspired by Berrak Burçak's article, it can be inferred that it is appropriate to call Küçük Seyyid Mustafa an engineer in terms of the

[178] "*Bizim Mühendishâne tarîkına Müderrislik ve Mollâlık uymaz… Zira, bu fenler ve ma'rifetler ancak askerî tâ'ifesine ve sefere yarar 'ademlere olmalıdır*." Quoted in Beydilli, *Türk Bilim*, 368.
[179] İbnü'l- Emin, 14.
[180] Emin Efendi, *Osmanlı hayatından kesitler = Menakıb-ı Kethüdazade el-Hac Mehmed Arif Efendi*, ed. Hasan Gürkan and Hür Mahmut Yücer (İstanbul: İnsan Yayınları, 2007), 346.

importance he ascribed to science and engineering.[181] Let us ascertain how much of an "engineer" Gelenbevi was by taking into consideration of Burçak's evaluation of "Diatribe de L'ingénieur Seid Mustapha sur l'état actuel de l'art militarie, du génie, et des sciences à Constantinople," written by Küçük Seyyid Mustafa, in order to introduce the *Nizam-ı Cedid* (New Order), which was the general name of the reforms introducerd during the reign of Selim III.[182] Before this, however, it will be beneficial to evaluate Gelenbevi as an '*alim* and his importance in this respect, generally.

In order to make sense of eighteenth century Ottoman intellectual life, understanding İsmail Gelenbevi as an '*alim* is vitally important. According to Khaled El-Rouayheb, he was "unquestionably" the most important philosopher and logician in the eighteenth century.[183] Bursalı Mehmed Tahir listed thirty-four books attributed to him.[184] It is surely remarkable that scholars who produced this many works were rare in Ottoman intellectual life. What's more, compared to those in the eighteenth century, the question of what triggered him to write so many works is difficult to answer. Ahmed Cevdet noted the same thing and he praised Gelenbevi for his books, which would represent the intellectual life of his period. For Ahmed Cevdet, if Gelenbevi had not written those books, we would not have the chance to learn about the intellectual accumulation of his period because most of the best scholars, including even his famous teacher Müftizade, did not write anything.[185]

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[181] Berrak Burçak, "Modernization, Science and Engineering in the Early Nineteenth Century Ottoman Empire," *Middle Eastern Studies* 44, no. 1 (January 2008): 69-83.
[182] Kemal Beydilli, who published the Turkish translation of the treatise, remarks that at that time there were two people called Seyyid Mustafa. The first was one of the first students of *Mühendishane-i Bahr-i Hümayun* and then a teacher there. The person who wrote this treatise was the second one. In order to distunguish them from each other, Beydilli uses *Büyük* (Big) for the first and *Küçük* (Small) for the second one. Beydilli, "İlk Mühendislerimizden," 393–429.
[183] Khaled El-Rouayheb, *Relational Syllogisms and the History of Arabic Logic 900-1900* (Leiden;; Boston: Brill, 2010), 199.
[184] Bursalı Mehmed Tahir, 97–99.
[185] Ahmed Cevdet Paşa, 233.

In fact, although such comments which include severe criticism of eighteenth century Ottoman intellectual life mainly reflect the significance of Gelenbevi and his works, it will be useful to remain distant from them. Many recent studies report that these years were very dynamic in terms of intellectual activity, including writing. El-Rouayheb gives an example of logic and dialectic and he states that the number of extant writings in these fields by intellectuals of the seventeenth and eighteenth centuries is much greater than those by of the fifteenth and sixteenth.[186] Therefore, as studies on eighteenth century Ottoman scientific life increases, we should be ready to encounter results different from those reported by Ahmed Cevdet and others.[187]

It is clear that Gelenbevi's interest was wide.[188] He dealt with many significant issues that had been discussed in Muslim intellectual world for centuries. The fields of logic, philosophy, mathematics, theology, astronomy, Sufism and many others like even chess[189] or the production of gunpowder[190] are some in which he interested. In addition, he continued some approaches in his work in various intellectual schools that had existed for centuries; he was able to contribute new ones to them as well. In other words, while he provided the continuity of these schools, at the same time, he transformed parts of them.[191] Here it is important to note to what extent there was a relationship between his intellectual attributes and eighteenth century Ottoman intellectual life. It is no doubt that Gelenbevi's works indicate a

[186] El-Rouayheb, 157–158.
[187] One surprising result is about Palabıyık Mehmed Emin Efendi. It is generally accepted that this famous mathematician of his period did not write any books. For instance, İhsanoğlu, *Osmanlı Matematik*, 262. On the other hand, İhsan Fazlıoğlu verbally stated that he has found a book attributed to him.
[188] For the list of his books, see Bursalı Mehmed Tahir, 97–99.
[189] Gelenbevi İsmail, *Satranç Risalesi*, Sülaymaniye Kütüphanesi, Yazma Bağışlar, 3900, 25 vr..
[190] Bursalı Mehmed Tahir mentions that he has a book called "Risale fi Keyfiyyeti İ'mal-i Barut." Bursalı Mehmed Tahir, 99.
[191] No doubt is that one of the fields that he offers insightful approaches to existing accumulation is logic. For a detailed work on it, see El-Rouayheb, 196– 227.

quest within the Ottoman intellectual milieu. Although this issue warrants further examination, unfortunately it remains beyond the scope of this thesis.

After many intellectual successes, İsmail Gelenbevi became a teacher, as discussed above. He was appointed to the engineering school to give theoretical mathematics lectures there. As shown above, he gave not only lectures, but also attended technical lessons himself. It is no doubt that he was very skillful both in theoretical and "applied" mathematics. Nevertheless, during his successful engineering education, I wonder about whether he continued his studies on logic, philosophy, theology and so forth along with his teaching of mathematics at the Engineering school. In other words, did he still behave as an *'alim* and write books or did become an "engineer"?

This question is surely meaningful, but it is difficult to answer because the problem here is to determine what the criteria of leaving the *'alim* and becoming an engineer were. To overcome this problem, I suggest three measures: to compare him with Küçük Seyyid Mustafa, as explained above; to examine his writings during his time as an engineering instructor; and to look at whether he had students in the medrese education system in the same period.

Küçük Seyyid Mustafa was born in 1774 in İstanbul. When he was around 20, he decided to go to France for education, but he gave up this idea when he learned that a new school, a Land Engineering School, would be opened. He submitted a petition to the Sultan in order to become a student at the new school. Eventually he was accepted and entered the institution in 1794.[192] In this story, it is apparent that Seyyid Mustafa was eager to become an engineer. His aim to go to France first shows his passion to learn this new science. He did not start his career in

[192] Beydilli, "İlk Mühendislerimizden," 415–422.

the same way that İsmail Gelenbevi did. Gelenbevi was educated in the mainstream Ottoman education system, medreses, and entered technical education in the late period of his life.

According to Burçak, Seyyid Mustafa was reliant on and an admirer of the new science he learned and taught at the engineering school. More intriguingly, this new type of science represented "a new and different type of knowledge" that became "a criterion of learning." For him, ignorance of this science marked an important deficiency in a person. In other words, his classification of people with respect to the new science was "educated," for those who had received this education, and "ignorant" for those that had not. Burçak claims that he regarded "educated" people as superior and the "ignorant" as second rate.[193]

This view is worth paying attention to understand the view of one of the first Ottoman engineers of this European science that had started to become important in the Empire. In my view, it is difficult to think of the same attitude in Gelenbevi. As mentioned above, Seyyid Mustafa's scientific personality had been shaped by his engineering education and his advocation of the new science was actually existential to him. In other words, for Seyyid Mustafa, praising the new science and institution meant affirming his scientific personality, which had been formed there. His belief that his inclination to study science was "an innate characteristic" also shows how he internalized the new mode of thinking.[194]

On the other hand, the engineering experience was not the center of Gelenbevi's scientific personality, but one part of it that was intensified in the late period of his life. In this respect, one point can be expressed. Gelenbevi as a member of the first generation to be involved with engineering education, and Seyyid

[193] Burçak, "Modernization," 74.
[194] Ibid., 72.

Mustafa, as a member of the second, differed from each other in terms of valuing the new type of learning.

Up to know, these may be thought to have been two completely different engineer personalities but actually they were not. Most probably, their most common aspects was that both worked for the state and, consequently, for the Sultan. The engineering school experience was a state project to meet the demand for professional engineers in the military. According to Burçak, this case realized in the life of Seyyid Mustafa shows "a new relationship between modern science and loyalty to the Ottoman Sultan."[195] What she implies is that this relationship was two-sided. First, the state opened military schools to train "scientific officers" and then, these officers served the Sultan.

Although Gelenbevi was not educated in military schools as Seyyid Mustafa was, he became the part of this system based on serving the state. In fact, the case is more interesting for Gelenbevi because he was not as directly dependent on the state when he was an *'alim* as much as when was an "engineer." In other words, Gelenbevi gave up his "autonomous" position to the state as a member of ulema when he added his career in engineering. No matter what the background of these engineers, they both practiced mathematics and engineering in the service of state.

What about İsmail Gelenbevi as an author? What topics did he write on before engineering school and after it? In my opinion, the writing career of Gelenbevi is very significant to understanding how he balanced the 'alim protytpe with engineering. In order to arrive at a more precise answer, in fact, it is necessary to examine the writing date and contents of each of his books. Unfortunately, a full inventory of all of his works was beyond the scope of this study. However, I think

[195] Ibid., 76.

that information accessed can give an idea of his tendencies on this issue. Gelenbevi appears to have had a two-period writing adventure parallel to his time as an instructor at the engineering school. The school had a slight effect on what he wrote. While before he had mainly dealt with different issues of Islamic thought, he wrote on mathematics for educational purposes during engineering experience.

While *Şerh-i Îsâğocî* (Commentary of Isagoci), a logic book, was written before 1763, El-Burhân (*fî ilmi'l-mantık ve fenni'l-mîzân*), one of his most famous books on logic in the Islamic realm, was written between 1763 and 1776.[196] Another book, *Ta'lîkât 'alâ Mîri'l- Âdâb* was written in 1775 (1189).[197] Another book, *Haşiye 'alâ Haşiyeti'1-Lârî 'alâ Şerhi Hidâyetü'l-Hikme*" was written in 1774 (1188).[198] On the other hand, *Hisâbü"l-Küsûr (Küsûr-ı hisâb),* which was used as a mathematics textbook in the engineering school,[199] was written between 1786 (1200) and 1789 (1203)[200] and *Sharhu Cadâvil al- Ansâb* in 1787.[201] These books were written during the years that Gelenbevi was working at the school.

A book on Islamic thought written in the period of the engineering school was not found during the research phase of this study. That is why it may be inferred that Gelenbevi focused his writing on mathematical and technical issues. On the other hand, it does not mean that he had abandoned Islamic thought. In order to clarify this, looking at whether he had students for classical education during the years at engineering school indicates to what extent he was interested in such issues during that period.

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[196] El-Rouayheb, 197.
[197] Rifat Okudan, *Gelenbevi ve Vahdet-i Vûcud* (Isparta: Fakülte Kitabevi, 2006), 72.
[198] Gelenbevi İsmail, *Haşiye 'alâ Haşiyeti'1-Lârî 'alâ Şerhi Hidâyeti'l-hikme*', Sülaymaniye Kütüphanesi, Mehmed Asım Bey, 181/2.
[199] Apart from this, his work on geometry called *Müselles Risalesi* was used as textbook as well. Beydilli, *Türk Bilim*, 228.
[200] Salih Zeki, *Asar-ı Bakiye*, vol. 2 (Istanbul: Matbaa-i Âmire, 1329), 298.
[201] Gelenbevi İsmail, *Risâle fî Şerh-î Cedâvili'l-Ensâb ve Nisbeti'l-Ceybiyye ve'l-Zılliye ve Ceybi'l-A'şârî ve Zılli'l-A'şârî*, Bâyezîd Umûmî Kütüphanesi, Nr. 4516, 233.

During his scientific life, Gelenbevi had students who later rose to very good positions in their careers. For instance, Yasincizade Abdülvehhab b. Osman (d. 1833/1249), for example, become grand mufti.[202] This is not a surprising because Gelenbevi was so selective in choosing his students such that according to Akifzâde, he only accepted the most intelligent ones.[203] When we take into consideration that he found good students for the engineering school along with this information, it can be concluded that he had close relations with students and teaching activities. As stated above, he continued to give lectures at medrese when he was teacher at the engineering school.[204] Apart from this, according to Laffite-Clavé, clergies on November 11, 1785 Gelenbevi attended the examination of the ulema, which lasted eight days to determine the clergy.[205] This implies that Gelenbevi continued his educational and judicial activities as part of the ulema even after he was appointed to the engineering school.

To sum up, Gelenbevi does not appear to have been an engineer in the same sense as Küçük Seyyid Mustafa. In addition to this, he continued his position and responsibilities associated with his career as a scholar. On the other hand, he was slightly affected by his role as teacher at the engineering school in that he focused on mathematics and technical issues more. This is why I prefer to use the category "transition figure" for Gelenbevi, referring to a mediator personality between the medrese-based and engineering-based systems.

[202] Kevseri, 153.
[203] Amasyalı Akifzade, 106.
[204] İbnü'l- Emin, 14.
[205] Lafitte-Clavé, 115.

Historiographical Formation of an "Engineer": *Tarih-i Cevdet*

What do I mean by historiographical contribution? Up to now, I mainly have dealt with Gelenbevi's scientific life, focusing on his post as an instructor at the engineering school. I hope that I have been able to show that many of the narratives about Gelenbevi pay particular attention to his skills and success in mathematics and other technical matters rather than on his quality in Islamic thought. It is no doubt that there are some studies which reveal his significance in Islamic thought.[206] On the other hand, from a historical perspective, Gelenbevi is mainly introduced as a great mathematician. In addition to this, his time as an instructor at the engineering school is stressed along with his technical accomplishments there. In such a case, the question of what all of this means becomes important.

Regarding the issue at hand, two stories about his life are widespread in both academic and popular sources, like the Internet. The first one is about his book on logarithms, which will be discussed below in detail. Here, in brief, let me explain: A French engineer came to İstanbul with some tables of logarithms and asked whether any of the Ottomans knew it. He was directed to Gelenbevi and who gave him his book on logarithms. The engineer was very surprised because he had not expected an Ottoman to have this knowledge, and praised him.[207] The second story is the one about his mathematical calculations for the guns of the bombardiers in front of Selim III. Many books mention these two stories, which surely highlight his mathematical

[206] El-Rouayheb; Rıfat Okudan, "18. Yüzyıl Osmanlı Kelamcı ve Mantıkçısı İsmail Gelenbevi'nin Varlık Nazariyesi (Vahdet-i Vücud Savunması)," *Tasavvuf İlmî ve Akademik Araştırma Dergisi (İbnü"l-Arabî Özel Sayısı-2)*, no. 23 (2009): 241-255.; Abdülkuddüs Bingöl, *Gelenbevi"nin Mantık Anlayışı* (İstanbul: Milli Eğitim Bakanlığı, 1993).

[207] Political and social implications of this story will be given in the next chapter in detail.

and technical skills[208] to such a degree that we may forget his long life in which he wrote many books on Islamic thought.

What is the main source of these narratives? As can be guessed from my references above, it is *Tarih-i Cevdet,* written by the famous chronicler Ahmed Cevdet in the second half of the nineteenth century. In the part where he describes the period of Abdulhamid I, he gives information about some important figures of the period in a section titled "*Meşahir, Ulema ve Şuara vesaire*" (Celebrities, scholars and poets and such). The first person he described was Müftizâde, the teacher of Gelenbevi. After him, the life of Gelenbevi was explained in considerable detail. Much information including his birth date, his place of origin, his teachers, books, and so forth was included. He presented the details of the two aforementioned stories as well.[209]

It can be inferred from his narrative that he was proud of Gelenbevi for his success. Doubtlessly, as an ulema-oriented person, Ahmed Cevdet knew Gelenbevi's important books on Islamic thought. Moreover, in *Tarih-i Cevdet,* he also stated that his books in the Arabic language were well-known and well thought of.[210] If this were so, however, why did he prefer to introduce Gelenbevi's two mathematics books, *Sharhu Cadâvil al- Ansâb* and *Hisabü'l- Küsur* specifically and cite his successes in engineering instead of his prominent works on logic, philosophy and so

[208] Salih Zeki, "İsmail Gelenbevi," *Kamus-ı Riyaziyat* (İstanbul: Karabet Matbaası, 1315), 319–321; Kevseri, 146–148.; Abdurrahman Aygün, "Türk İrfan Semasının Şanlı Dâhîsi ve Direği Gelenbeli İsmâil Efendi Merhum," *Diyanet İşleri Başkanlığı Dergisi* (1961): 188–190; Osman Keskioğlu, "İsmail Gelenbevi (1143-1205 H. /1730-1791 M.) ve Subût-ı Hilâl Meselesi," *Ankara Üniversitesi İlahiyat Fakültesi Dergisi* 13 (1965): 22–24; Ebü'l-Ula Mardin, *Huzur Dersleri*, vol. 1 (Istanbul: İsmail Akgün Matbaası, 1956), 262–263.; Kemal Zülfü Taneri, *Türk Matematikcileri* (Matbaacılık Okulu, 1958), 64–65; İsmail Hakkı Uzunçarşılı, *Osmanlı Tarihi: XVIII. Yüzyıl*, vol. 4, part 2 (Ankara: Türk Tarih Kurumu, 1977); Bursalı Mehmed Tahir, 89–92; Uzunçarşılı, *Osmanlı Tarihi,* 622; Faik Reşat, "Gelenbevi İsmail Efendi," in *Eslaf: Bilginler, Düşünürler, Şairler*, ed. Şemseddin Kutlu (İstanbul: Tercüman Gazetesi, 1975), 302–304.
[209] Ahmed Cevdet Paşa, 233–235.
[210] Ibid.

on except to relate the story of *El- Burhan*, his book on logic?[211] At first glance, it seems that Cevdet deliberately introduced him as a mathematician and engineer. But there was more to it than that.

Inspired by Christoph Neumann's work on *Tarih-i Cevdet* and its political implications,[212] I suggest that Cevdet put emphasis on Gelenbevi thanks to his two privileged aspects: he was a distinguished scholar among contemporary ulema thanks to his interaction with the new science and presumably, more importantly, his role "during the crisis state the experienced."[213] Before pursuing that topic, it is one similarity between Gelenbevi and Cevdet must be noted. Both men were part of the *ilmiye* and were students of the new science as well. While Gelenbevi's encounter with the new science eventually intensified during his time as an instructor at the engineering school, Cevdet was taught it by Albay Nuri, one of teachers at the Engineering School (*Topçu Hârbiye*).[214] The engineering institutions affected their process of learning the European sciences.

Cevdet as a scholar with a medrese background also described the situation of the ulema in the book. In fact, he severely criticized them. According to him, this class had deteriorated to such a degree such that nepotism was widespread among them. Competency was no longer important. Many so-called *'alim* emerged. As a result of these, education in medreses also became worse.[215] Gelenbevi was represented a precious exception with his scientific qualities and skills.

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[211] Ahmet Cevdet read this book when he was a student. Taking into account the fact that he also wrote a logic book called *Miyâr-ı Sedad*, it is possible to comment that he gave attention to Gelenbevi in terms of logic as well. Hilmi Ziya Ülken, *Türkiye'de Çağdaş Düşünce Tarihi*, 2nd ed. (İstanbul: Ülken Yayınları, 1979), 69–70.
[212] Christoph K. Neumann, *Araç Tarih Amaç Tanzimat: Tarih-i Cevdet'in Siyasi Anlamı*, trans. Meltem Arun (İstanbul: Türkiye Ekonomik ve Toplumsal Tarih Vakfı, 2000).
[213] Ibid., 90.
[214] Ülken, 69.
[215] Neumann, 88.

According to Neumann, Cevdet sometimes used a scholar's virtues and sophistication as a trump against the majority of the ulema[216] and, in my view; his presentation of Gelenbevi's life was exactly like that. This issue overlaps with another of his criticisms of the ulema, that they were closed to technical (*teknik)* and scientific (*fen*) developments.[217] In other words, he regarded many scholars as "ignorant" of the new emerging science, but he praised the ulema any time mathematics and medicine were.[218] Unlike those, Gelenbevi was described as a symbol of the "open-minded" *'alim* with his skill at learning the new mathematical and engineering developments coming from Europe. Again, his description of Gelenbevi includes criticism of the ulema due to their weak interaction with new science.

The second part of Cevdet's historiographical approach regarding Gelenbevi was his role during the crisis with which the state was faced. As mentioned above, in the period of Abdulhamid I, serious problems in the military occurred. The Ottoman Empire lost the Russo-Turko War between 1768 and 1774 and following it, the decision was made to found an engineering school for to train professional Ottoman military engineers. Cevdet also attached importance to the foundation of Naval Engineering School (*Bahriye Mektebi*, as he called it).[219] Neumann explains that it was an opportunity for him to introduce high-level scholars (*molla*) if they had been appointed to or they had had roles in political matters or in the crisis with which the state was faced.[220] As a consequence, in *Tarih-i Cevdet*, Gelenbevi was a good case as a result of his successful activities at the engineering school. In this respect,

[216] Ibid., 91.
[217] Ibid.
[218] Ibid., 88.
[219] Ahmed Cevdet Paşa, 230–231.
[220] Neumann, 90.

another reason Cevdet portrayed Gelenbevi as a mathematician seems to have been related to his service to the state during one period of crisis.

A Bizarre Story

The orphan grew, reached a well-respected position and he was at Yenişehir-Fener in the last period of his life. While he was legal scholar at *Haseki Paşa Medresesi* in 1785, he later became a judge as the molla of Eyüp and then as mevlevi of Yenişehir in 1790 (1204). He eventually rose to a considerably good position. Apparently, he decided to continue his career as a judge rather than a professor. Why would such a productive scholar prefer a position as a judge? In fact, it is difficult to say, but taking into consideration his career path, that he could write distinctive works on important issues, that he taught high capacity students and that he had participated in the engineering education experience which was strongly implies support form the state, in my opinion, such a path implies an emerging personality. But a more interesting question than this is whether his appointment to Yenişehir indicates a continuation of or a stop to his rise within the structure of the *ilmiye*? Although these questions would allow for valuable commentary about the relationship among the ulema, my aim here is not to delve into a comprehensive analysis of his appointment and what happened after it, but just to attract the attention to this issue by narrating two different stories about his death.

We know that Gelenbevi died at Yenişehir in 1791 (1205). However, the stories about his death vary. In one version, he died from sadness as a result of a letter sent by grand mufti Hamidizade Mustafa Efendi. At this point, some questions should be raised: Did the grand mufti really send such a letter to Gelenbevi and, if so,

why? What were its contents? In fact, Ahmet Cevdet and Bursalı Mehmed Tahir make no mention of a letter sent by the grand mufti; they just inform us of his death date and place.[221] Yet most scholars mention the existence of such a letter. While some give no indication of the contents of the letter, others write that in the letter the grand mufti insulted Gelenbevi for his different approach to the case of *ru'yet-i hilâl*.[222]

If that was the case, what was this issue? According to some Islamic scholars, the method of determining the start of the holy month and religious festival of Ramadan is based on witness (*şehâdet*) and this view is basically attributed to the words of the Prophet Muhammad. If certain formations of the moon are witnessed, it signals the beginning of the month of Ramadan and then the religious festival will start. In view of many other scholars, the calculation of astronomical data and mathematical methods is valid and truer than witness for such a case.[223] People writing on Gelenbevi state that the grand mufti advocated the first approach whereas Gelenbevi did the second one. This version of the story is mainly attributed to Mehmed Fatın (Gökmen), one of the leading figures of astronomy studies in the late Ottoman and early Republican periods.[224]

Apart from above narratives, İbnü'l- Emin Mahmud Kemal offers a different version. His work, *Gelenbevi,* was written on the basis of information taken from *Tarih-i Cevdet* and from Gelenbevi's grandson, Hayrullah Efendi.[225] It is possible to

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[221] Ahmed Cevdet Paşa, 235.; Bursalı Mehmed Tahir, 92.
[222] Keskioğlu, 24–25.; Bingöl, *Gelenbevî*, 14–15; Remzi Demir, "İsmail Gelenbevî'nin Üçgenlerin Kenarları Adlı Risâlesi," *Erdem* 9, no. 25 (1996): 177.; Gölcük and Yurdagür, 553.
[223] For more information See Keskioğlu.
[224] "*Pederim merhum bu tezkere Gelenbevi'nin Şevval gurresini isbat ile şahitlerin şehadetini, ru'yetin mümkün olamayacağı hakkındaki kendi hesabatına istinaden red eylemesi üzerine yazılmış şedid tevhibat ve tenkidatı muhtevi olduğunu ve bundan müteessiren vefat eylediğini ve bilahare Yenişehir müsellemi tarafından şahitler tazyik edilerek, filhakika yalan yere şehadet etmiş olduklarının itiraf neticesi anlaşıldığını nakl eylemişti."* M. Fatın, "Ru'yet-i Hilal Mes'elesi," *Sebilürreşad* 22, no. 555-556 (1339): 72.
[225] İbnü'l- Emin, 6.

consider that he offers a more particular source and approach to Gelenbevi's life. According to him, the grand mufti sent an insulting letter to Gelenbevi, but the content did not involve *ru'yet-i hilâl.* Hamidizade envied Gelenbevi because he might have been directed to the position of grand mufti in the future.[226] That is why the grand muftihe wanted to exile him from the capital city.

A more challenging argument is that the grand mufti dictated a pseudo-petition to the Sultan in the name of Gelenbevi in which he demanded to be appointed to the position of molla at Yenişehir; otherwise he would go to France with a French engineer who proposed that Gelenbevi work as a mathematics teacher there.[227] In addition to this, İbnü'l-Emin also states that when Gelenbevi was in Yenişehir, the grand mufti played his last hand and sent him a letter which declared that he would stay there until the end of his life.[228] It is seen that İbnü'l-Emin offers complicated.

At this point, we have two extremely different versions considering the letter that supposedly caused Gelenbevi's death. Regardless of which one is true, whether both indicate Gelenbevi's emerging personality, which is what interests us here. I would like to deal briefly with how important the position of molla at Yenişehir to which Gelenbevi was appointed in the bureaucratic progression toward becoming a grand mufti, by showing the career path of his teacher, Müftizade.

The mevleviyet was a kind of *kadılık* (judgeship). It was granted to the highest level scholars (*kibâr-ı müderrisin*), those who had top bureaucratic positions among the ulema, of the rank *musile-i Süleymaniye* or higher.[229] This judgeship

[226] Ibid., 46.
[227] Ibid., 49. Kethüdazade also argues that franks proposed him to come to "Frengistan" but Gelenbevi did not accept. Emin Efendi, 325.
[228] İbnü'l- Emin, 51.
[229] Mehmet Zeki Pakalın, *Osmanlı Tarih Deyimleri ve Terimleri Sözlüğü*, vol. 2, 3rd ed. (Ankara: Milli Eğitim Bakanlığı, 1983), 519.

consisted of four stages: *Haremeyn Mevleviyeti*, *Bilad-ı Hamse Mevleviyetleri*, *Mahreç Mevleviyetleri,* and *Devriye Mevleviyetleri.* Haremeyn *Mevleviyeti,* which included the judges of Mecca and Medina in equal position, was the highest degree after the İstanbul judgeship (*Kadılığı*). Some of the people who were appointed to this position went there and fulfilled their duty, but others just took this rank (*pâye*). Those who went and did their duty there would then be eligible to be appointed to the İstanbul *Kadılığı* according to a law passed in 1775 (1189).

The second highest position among the mevleviyet was *Bilâd-ı Hamse Mevleviyetleri*, which included Edirne, Bursa, Damascus, Egypt and Filibe. People were first granted to its rank than were appointed. The Mahreç Mevleviyetleri were located in Jeruselam, Aleppo, Tırhala Yenişehri (Yenişehr-i Fenar), Galata, İzmir, Salonica, Eyüp, Üsküdar, Sofia, Crete and Trabzon. The *Süleymaniye Darü'l-Hadisi* judge, four judges in Süleymaniye, and the *Hamise-i Süleymaniye* and *Musıle-i Süleymaniye* judges were appointed. If the scholar at the highest position among them did not accept the position, it was offered to a lower one. In fact, Gelenbevi's degree was increased from *Hareket-i Altmışlı* to *Musıle-ı Süleymaniye,*which was the lowest position among the highest level scholars in 1785 (1199).[230] The *Devriye Mevleviyetleri* were the lowest group, located in different regions of the Empire. The duration of the duties was one year and those who finished their term became candidates and began the wait to be appointed to a higher rank.[231]

When the career of Gelenbevi's teacher, Müftizade, is examined, it is seen that after he became legal scholar in 1750 (1163), he became the Yenişehir Mollası in 1780 (1193) and was appointed to the position of *Mekke-i Mükerreme* in 1786 (1200) and to the *Sadr-ı Anadolu* in 1791 (1205). Finally, he became the *Anadolu*

[230] İbnü'l- Emin, 14.
[231] Uzunçarşılı, *İlmiye Teşkilatı*, 99–103.

Kazaskeri in 1797 (1211).[232] In my opinion, Gelenbevi, in the beginning, had a career path similar to that of his teacher. Therefore, it seems to me that Gelenbevi may have been such an emerging scholar within the bureaucracy, but more research is needed to substantiate this theory.

[232] Mardin, 2-3:204.

CHAPTER IV

THE OTTOMAN ENCOUNTER WITH THE NEW SCIENCE: THE CASE OF LOGARITHMS

In this chapter, the Ottoman experience with European science will be dealt with generally taking logarithms as a case. Although Gelenbevi's book on logarithms, *Sharhu Cadâvil al- Ansâb*, is not only issue that will be examined here, it will be my source of inspiration because of its importance during this experience. For this aim, first a historical context of the invention of logarithms in Europe will be presented. Then, the introduction of logarithms to Ottoman scientific culture will be explained. After that, the political and social implications of the knowledge of logarithms will be emphasized and then the Ottoman vernacularization of scientific knowledge in the context of logarithms will be detailed. Finally, the dissemination of the knowledge of logarithms and then its aspects that indicate multi-directional interaction will be discussed in general.

The Invention of Logarithms in Europe

The logarithm was invented by a Scottish scholar John Napier (1550- 1617). The term he suggested was the combination two Greek words, logos (ratio) and arithmos (number),[233] meaning "reckoning number."[234] Logarithms are based mainly on the relationship between arithmetic progression (0, 1, 2, 3, 4…) and geometric progression (1, 2, 4, 8, 16…). Through the tables of logarithms of numbers prepared

[233] Rafael Villarreal- Calderon, "Chopping Logs: A Look at the History and Uses of Logarithms," *The Montana Mathematics Enthusiast* 5, no. 2&3 (July 2008): 337.
[234] Burton, *Mathematics The History of Mathematics An Introduction*, 6th ed. (McGraw-Hill, 2006), 354.

based on this relation, the operations of multiplication and division can be transformed into operations of addition and substraction, respectively, which are then much more easier to calculate than the previous methods. In other words, if we multiply two numbers, it is enough to add the logarithmic values of those numbers because its sum gives the logarithmic value of the product. Operations of division can be done in the same manner.[235]

Napier explained the reason behind his search for a new system in his *Mirifici Logarithmorum Canonis Descriptio* (Description of the wonderful canon of logarithms) (1614):

> Seeing there is nothing… that is so troublesome to Mathematicall practice, nor that doth more modest and hinder Calculators, than the Multiplications, Divisions, square and cubical Extractions of great numbers, which besides the tedious expense of time, are for the most part subject to many errors, I began therefore to consider in my minde by what certaine and ready Art I might remove those hindrances.[236]

Napier identified two critical problems in performing mathematical calculations in his time. The first one was the difficulty in using large numbers in different types of calculations and having to expend great time and effort at performing these calculations. Second, and maybe more important, depending upon the first problem, were calculation errors. Napier statement gives not only a sense about his motivation to study logarithms, but also remarkable clues regarding what kinds of challenges the scientific community in Europe faced at the early modern period.

During the Renaissance, German mathematicians had constructed trigonometrical tables of great accuracy and this precision had caused an increase in

[235] For learning mathematical conceptualization of logarithms and its theory briefly, see R. C. Pierce, "A Brief History of Logarithms," *The Two-Year College Mathematics Journal* 8, no. 1 (Ocak 1977): 22-26.
[236] This English translation is quoted in Villarreal-Calderon, 337.

the work of the calculator.[237] As is known, from the sixteenth century onwards, many developments in astronomy were observed as well. For instance, in 1543, Nicolas Copernicus (1473-1543) published his epochal book, *De Revolutionibus Orbium Coelestium*[238] which included the heliocentric model of solar system that has been the commonly accepted alternative model to Ptolemy's geocentric system. During the same period in which Napier studied logarithms, Tycho Brahe made astronomical and planetary observations in an observatory built by himself. Kepler also was studying planetary orbits. There is no doubt that the above developments significantly affected the emerging scientific consciousness, but these were just a few of the many developments that occurred in the period under discussion.

What all of this mean is that new scientific developments particularly in astronomy started to push the limits of the existent mathematics, for it was an indispensable tool for astronomical observations and modeling. Especially trigonometry was commonly used and in practice, frequent use of trigonometric methods meant that astronomers had to work their way through a large amount of numerical data.

Napier was not the only mathematician who was trying to devise methods that would make calculations more accurate and easier to perform. The Swiss instrument maker Jobst Bürgi (1552-1632), devised a similar logarithmic scale in the 1580s. His tables, *Arithmetische and Geometrische Progress-Tabulen*, were published in Prague in 1620, six years after Napier's book.[239] In Napier's case, it took at least twenty years to find a working calculation system that was completely

[237] Cajori Florian, *A History of Mathematics* (New York: The Macmillan Company, 1909), 187–188.
[238] English translation is "On the Revolutions of the Heavenly Spheres."
[239] Burton, 357.

reliable.[240] As French mathematician Pierre de Laplace asserted, the invention of logarithms "shorten[ed] the labors [and] doubled the life of the astronomer."[241]

This statement became all the more meaningful after logarithmic tables were prepared for natural numbers as well, as Napier himself was inclined to focus on the multiplication and division of sines and bounded his study to the logarithms of the sines of angles.[242] His work was quickly translated into English in 1616 with the title *A Description of the Admirable Table of Logarithms*.[243] After him, some other scholars developed the theory of logarithms and logarithmic tables.

Presumably the most important one of them was Henry Briggs. As a friend of Napier, he had been in contact with him about logarithms and he proposed logarithms using ten as a base. His suggestion was more useful and his method became widespread after he published a book called *Arithmetica Logarithmica* in 1624, which included fourteen-place logarithms of the first 20,000 numbers and those from 90,000 to 100,000.[244] As a result of many contributions to the theory, astronomical calculations could be done more quickly through logarithmic tables, and it is not hard to infer that this evoked new developments in many fields of science in the years that followed.

[240] Following the laudatory words of Henry Briggs, the second most important figure in the theory of logarithm, to his friend Napier also shows that the main motivation for inventing logarithm was astronomical calculations. "...to know by what engine of wit or ingenuity you came first to think of this most eİhsanoğluellent help in astronomy, viz. the logarithms…" Florian, 190.
[241] Burton, 340.
[242] Evangelos N. Panagiotou, "Using History to Teach Mathematics: The Case of Logarithms," *Science & Education* 20, no. 1 (July 2010): 7.
[243] Burton, 354.
[244] Ibid., 356.

A Brief History of Logarithms in the Ottoman Empire

The question of when and how the story of logarithms in Ottoman Empire started is an interesting case in many aspects. As is known, the reign of Ahmed III, especially last part of it called "Tulip Era" (*Lâle Devri*) between 1718- 1730, is so fruitful to be studied by Ottoman historians with respect to various perspectives and issues. In this period, many changes in the organization of state, scientific activities, life style, artistic norms or cultural interactions with different regions particularly Europe occurred. In other words, desire for the new increased the interest in and interaction with Europe. Here, the visit of Yirmisekiz Mehmed Çelebi to France is a special in terms of relations between the Ottomans and Europe.

Yirmisekiz Mehmed Çelebi with a delegation to France as an embassador sent by Ahmed III to the court of the French king Louis XV in 1720. They stayed there approximately ten months. This trip is important for our topic because Mehmed Efendi was a good observer and kept a travelogue.[245] Adding to the fact that he gave remarkable information about France, he successfully displayed the responses of both the Ottoman and French people to the encounter of the two different cultures. Another significant aspect of his trip is that its time coincided with the period of Ottoman desire for the new. In other words, Mehmed Çelebi and his group were not only political mediators but also, and mostly, observers of the novelty. His travelogue offers valuable information about the effects of the interaction on the Ottoman consciousness.

Yirmisekiz Mehmet Çelebi tells kept notes on many of the things that he saw. One of them was his visit to the Paris Observatory. This visit had a special place for

[245] Yirmisekiz Çelebi Mehmed Efendi, *Yirmisekiz Çelebi Mehmed Efendi'nin Fransa Sefaretnamesi*, ed. Beynun Akyavaş (Ankara: Türk Kültürünü Araştırma Enstitüsü, 1993).

him because he had been sent particularly to observe science and technology. He spent a lot of time there and he surveyed the planets of Venus, Saturn, Jupiter and the moon via telescope. It was exciting because this was first time he had had the opportunity to do such a thing.[246] The head of the observatory was the famous astronomer, Jacques Cassini. The Ottoman ambassador, who admired what he saw there, also chatted with him about Ottoman astronomy and the astronomical tables that were used in Ottoman Empire. At that time, Ottoman scientific circles were using the tables of Ulugh Beg. After this most probably enjoyable chat, Salih Zeki reports that Cassini presented astronomical tables to Mehmet Çelebi that had been prepared by his father, Giovanni Domenico Cassini, and had not been published yet.[247]

According to Salih Zeki, Mustafa III wanted these tables to be translated and assigned this duty to İsmail Çınari, whom he had known since the period of his *şehzadelik* (princeship). Beside his competency in astronomy and mathematics, Çinari knew French. These tables were translated into Turkish with the name *Tuhfe-i Behic-i Rasinî Tercüme-i Zîc-i Cassini*.[248]

Cassini noted some problems that his father considered opposed Ulugh Beg's tables and gave them to the ambassador. The book translated by İsmail Çınari in 1772 was actually *Tables Astronomiques*, which had been published in 1740 by Jacques Cassini when he completed his father"s tables.[249] Regarding this issue, İhsanoğlu argues another version of events based on a book by Montucla called *Histoire des Mathematiques*. According to this book, Mustafa III ordered "the most recent and the most perfect" books on European astronomy from the Academy of

[246] Fatma Müge Göçek, *East Encounters West: France and the Ottoman Empire in the Eighteenth Century* (New York: Oxford University, 1987), 57–58.
[247] Salih Zeki, "Ismail Halifezade," *Kamus-ı Riyaziyat* (İstanbul: Karabet Matbaası, 1315), 316.
[248] Ibid.
[249] İhsanoğlu, *Osmanlı Astronomi,* 534.

Sciences in Paris and, according to İhsanoglu, most probably *Tables Astronomiques* was one of the volumes sent to İstanbul.[250] Consequently, it can be inferred that the time period of introduction and translation of Cassini's tables were nearly the same.

It is worthwhile to note that actually this experience was not the first one for İsmail Çınari. He also had translated *Théorie de la Lune* and*Tables de la Lune* by the French astronomer Alexis-Claude Clairaut, in the name of *Tercüme-i Zic-i Kılaro* in 1767.[251] It reveals that Çınari had a close relationship with new developments in astronomy. Salih Zeki wondered why such a scholar was not well known and concluded that it was because he was not from the *ilmiye* or state offices (*devlet ricâli*).[252]

In his translation of the Cassini tables, Çınari knew the fact that Cassini used logarithms for calculations in his tables and that is why he explained the logarithms and its functions in the preface of the translations as such:

> It should be known that the Franks have arranged a table under the title of logarithms which contains the logarithms of the numbers from 1 to 10,000. If it is desired to multiply two numbers, we have simply to add the logarithms of them and the sum gives the logarithm of the product.[253]

After that, he continued with which can be considered significant in terms of the Ottoman history of logarithms:

> Cassini made astronomical calculations by means of tables of ratios (logarithmic tables) but did not give any idea of its principle and application in the text. The translator undertook this duty and added a résumé of its principle.[254]

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[250] Ekmeleddin İhsanoğlu, "Introduction of Western Science to the Ottoman World: A Case Study of. Modern Astronomy (1660–1860)," in *Transfer of Modern Science and Technology to the Muslim World*, ed. Ekmeleddin İhsanoğlu (Istanbul: IRCICA, 1992), 96–97.
[251] Ibid., 96.
[252] İhsanoğlu, *Osmanlı Astronomi*, 531.
[253] Quoted in Salih Mourad, "Introduction of Logarithms into Turkey," in *Napier Tercentenary Memorial Volume*, ed. Cargill Gilston Knott (London: Published for The Royal Society of Edinburgh, 1915), 140–141.
[254] Qouted in Ibid., 141.

Based on these statements, many historians consider this to have been the beginning of the story of logarithms in Ottoman Empire as this. While this historical case is accepted, it seems to me that it needs more research. First, although the application of logarithms was introduced to the Ottomans in the second part of the eighteenth century, Ottoman mathematicians had already had a basic idea of this method.[255] Ali b. Vali b. Hamzat el- Mağribi in this issue, respected as one of the most important Ottoman mathematicians, published a book called *Tuhfat al-A'dâd li Zavi'l-Ruşd va'l-Sadad* and in this book, in which he demonstrated the relation between arithmetic progression and geometric progression, which is the basic assumption of the theory of logarithms. The difference of al-Mağribi than Napier is that he started the arithmetic progression from 1 (1, 2, 3, 4 …) instead of 0 (0, 1, 2, 3 …), as Napier did.[256]

As a consequence, it is possible to infer that the method of logarithms was not wholly unknown to Ottoman mathematical culture. On the contrary, they had a theoretical background of it and presumably the appropriation of logarithm from Europe might not have been strange to Ottoman scholars. However, this inference further complicates the issue. If the Ottoman mathematicians had a sense of the idea of logarithms, why did they prefer to write about logarithms and prepare the tables of them instead of translating and appropriating this knowledge? In order to answer this question in a thorough manner, it is necessary to delve into the prevailing theories of numbers in the Ottoman Empire until the eighteenth century, and the theoretical and other contexts that could have triggered the transformation of those works like the ones in Europe.

[255] İhsan Fazlıoğlu, "İsmail Efendi (Gelenbevi)," ed. Ekrem Çakıroğlu, *Yaşamları ve Yapıtlarıyla Osmanlılar Ansiklopedisi* (İstanbul: Yapı Kredi Kültür Sanat Yayıncılık, 1999), 667.
[256] Melek Dosay Gökdoğan, "Osmanlılarda Matematik," in *Osmanlılarda Bilim ve Teknoloji: Makaleler*, ed. Yavuz Unat (Ankara: Nobel Yayın Dağıtım, 2010), 290.

Even so, I shall propose my comments on this issue in a brief manner so as to bring attention to the necessity of deeper studies on this issue. As shown above, after Napier invented the methods of logarithms, this theory developed both theoretically and practically within a short period in Europe. Before the Ottomans encountered this knowledge, a considerably large literature on this issue had been already matured. Especially, the preparation of the tables of logarithms was a challenging process and in Europe, tables of logarithms developed in time after Napier. Due to the fact that the introduction of the logarithms of the Ottomans was a practical and result-oriented activity, attempting to prepare new tables of logartihms instead of translating and appropriating them would have been akin to the reinvention of the wheel and thereby futile. That is why the Ottoman literature on logarithms focused on introducing it and how to use the tables. Secondly, studies on different cultures in Ottoman society should be expanded so that scientific interactions within Ottoman society can be understood. It may not be surprising that, for instance, that non-Muslim Ottomans might have learned about logarithms even before Çınari's translation.

In Çınari"s book, logarithms was not a central issue but simply supplemented the astronomical tables. The first extensive work on logarithms was written by Feyzullah Sermed (d. 1787). He wrongly says that logarithm was invented by a Hungarian mathematician. The name of his book is *Maksadayn fi Hall al- Nisbatayn* written in 1780.[257] He explains how to use logarithms in astronomical calculations in the book. Besides this, he also mentions some mathematical information and *rub'-i mukantarat*, an astronomical instrument.[258] The point that attracts our attention is that

[257] İhsanoğlu, *Osmanlı Matematik,* 249–250.
[258] İhsanoğlu, *Osmanlı Astronomi*, 525.

this book is also related to the usage of logarithms in astronomy as Çınari"s translation is.

The next book on logarithms was published by İsmail Gelenbevi. He wrote *Sarhu Cadavil al-Ansab* in 1787 as a second specific book on logarithms.[259] It was also known as *Logaritma Şerhi* (Explanation of logarithms).[260] In this book, Gelenbevi first explained the function of the logarithms. According to him, mathematical operations like multiplication, division, square, square root and so on especially in the operations including sinus and tanjant were hard to solve and in order to make them easy, three tables, *cedvel-i ensab* (logarithmic tables) for absolute numbers (*mutlak a'dad*), *nisbet-i ceybiyye* for trigonometric values of sinus and *nisbet-i zılliye* for trigonometric values of tangent were invented. He dealt with two main parts, the first of which was about how to construct (*keyfiyyet-i inşaa ve îcâd*) these tables and their principles (*esâs ve mebnâsı*), and the second of which was about how to use (*turûk-u i'mâl*) them.[261] While there were three tables at the end of the original work,[262] they were not available in the copies I examined.

Gelenbevi's book was considerably long, with 233 pages in the copy with which I worked. What attracts the attention at first glance is that it is very readable and understandable. The language and phrasing are simple and easy. Along with the fact that he explained the rules in detail, he also gave as many examples as needed to make the topic easy understand. Another attractive aspect of this work is that he presented examples from astronomical events belonging to Muslim societies, like the

[259] For information of the copies of the manuscript, see İhsanoğlu, *Osmanlı Matematik*, 256–258.
[260] Ibid., 257.
[261] "…*i□ mâl-i hisâbiyyede darb ve taksîm ve terbî□ teczîr ve tekâîb ve dıl□-ı kü□ b vesâi□ r mudall□ ât ve adlâ□ istihracları ba□ızmevâdda husûsen zât-ı küsûr-u cüyûb ve zılāl ihtilâtıyla olan hisablarda umur-u asîreden ve usreti sebebiyle ekseriyâ hisâblarda galat vâki□ olmağin li-ecl el-teshîl ve el-tahlîs müte□ ahhirîn üç cedvel ihtirâ□ eylemişlerdir ki biri mutlak a□ dâda müte□ allikdir, aña cedvel-i ensâb tesmiye olunur. Ve biri her kavsin ceybine müte□ llikdir, aña nisbet-i ceybiyye cedveli tesmiye olunur. Ve biri her kavsin zıllına müte□ allikdir, aña nisbet-i zıllıyye cedveli tesmiye olunur*…" Gelenbevi İsmail, "Risâle fi," 4.
[262] İhsanoğlu, *Osmanlı Matematik,* 257.

timing of fasting (*mevâkıt-ı savm*) in order to show how to use tables of logarithms.[263]

Why did Gelenbevi write this work? Before Gelenbevi, the knowledge of logarithms had been known and there were books on it even in Turkish, as mentioned above. At the engineering school, logarithms were known and used. For instance, Lafitte-Clavé wrote in his notes on December 28, 1784 that the French scientist Callet's book on logarithms was used at the school.[264] More interesting information is that Abdurrahman Efendi (Atur-Aman in the report), one of students at the school then teacher at the Land Engineering School, started to begin to translate the explanation of the Tables of Logarithms in February 12, 1787 in the lecture.[265]

This information implies that Gelenbevi's work was not a novelty. If so, what triggered him to write this work? A more crucial question is whether he wrote the book alone or whether it was the common product of a "commission" at the school. That this may have been the case is suggested by Lafitte-Clavé. According to a note belonging to December 13, 1785, Abdurrahman Efendi taught algebra at the engineering school. Additionally, we learn that he also studied to translate some parts of the book of Bézout, a French mathematician. More strikingly, he gave these studies to İsmail Gelenbevi.[266]

Here we face with an interesting personality. Although Abdurrahman Efendi was a student there, he may even have taught and been an active figure in the engineering education system. Even though there were teachers for theoretical mathematics including Gelenbevi, Abdurrahman Efendi gave lectures on the subject. This is not extraordinary because he also translated Callet's books of logarithms in a

[263] Gelenbevi İsmail, "Risâle fî," 209.
[264] Lafitte- Clavé, 26.
[265] Ibid., 285.
[266] Ibid., 130.

lecture to teach before Gelenbevi wrote his book on logarithms.[267] It also shows that he knew French.

In my view, these few but satisfactory indications reveal that Abdurrahman Efendi was very active in teaching activities. Moreover, he became an important figure in the new mathematics thanks to his skill in mathematics and competency in the French language. Let me combine these results to comment about the story of the writing of the book on logarithms attributed to İsmail Gelenbevi. Abdurrahman Efendi, who shared the studies that he translated from French books and taught logarithms instead of Gelenbevi or other scholars at the school, might have been included in the writing process of the book attributed to İsmail Gelenbevi. Even if not, his importance in the education on logarithms cannot be ignored.

Between Rivalry and Prestige: The Knowledge of Logarithms

Tarih-i Cevdet related a story regarding İsmail Gelenbevi and his books on logarithms. A French engineer came to İstanbul and brought tables of logarithms. He asked Raşid Efendi, the minister of foreign affairs at the Sublime Porte (*Bab-ı Âli*) in which science (*fen*) logarithms were included but it seems that he was unable to acquire an answer. For this reason he concluded that this science was not known in İstanbul. This engineer was directed to İsmail Gelenbevi. He saw Gelenbevi's poor house, and in a condescending tone asked Gelenbevi to answer his question on logarithms. Gelenbevi gave him his book on logarithms written within a short period. This unusual event affected the engineer deeply who then said: "If this man was in Europe, he would be worth his weight in gold." He requested a portrait of Gelenbevi,

[267] Ibid., 285.

who then was portrayed in the room of Raşid Efendi. Supposedly due to the fact that Gelenbevi's own fur coat (*kürk*) was old, he wore the kind of sable coat (*samur kürk*) that was worn only by state officials (*rical-i devlet*) at that time. Hereupon, what Gelenbevi portrayed his social standing and his sense of humor when he commented, "Praise God that I saw myself in a sable coat."[268]

Before criticizing the correctness of this story, it is of use to mention that it has been recounted in many works,[269] which actually indicates the general opinion about Gelenbevi in literature. It is sure that because of the fact the story has a "legendary" aspect, it is more compelling. For this reason, his book on logarithms is positioned around such a legend and it is actually has been obstacle to evaluating it in its historical context.

To what degree is Cevdet's narrative true? Who was that French engineer? First of all, during the time the aforementioned event is mentioned, Cevdet did not describe Gelenbevi as a teacher at the engineering school. Even he told the story before he mentioned his being a teacher in mathematics there. For this reason, it seems most probable that he accepted that this story occurred before his engineering experience. Shortly, that Gelenbevi had written his book on logarithms before he started at the engineering school was implicitly assumed. However, reality was different. İsmail Gelenbevi completed his *Sarhu Cadavil al-Ansab* on 30 September 1787 (17 Zilhicce 1201).[270] That is, he was a teacher at the Engineering school when this work finished. Second, in the story, Raşid Efendi was presented as being the minister of foreign affairs during Gelenbevi's book wrote. He was at this post

[268] Ahmed Cevdet Paşa, 234.
[269] For detailed information, see Chapter 3 which includes the historiographical circumstances of the stories about Gelenbevi.
[270] Gelenbevi İsmail, "Risâle fî," 233.

between December 1787 and October 18, 1788, which is certainly later than when the book was written.[271]

Another point is that he said that Gelenbevi had invented "such a new science by using old mathematics"[272] and he had not known of the development of logarithms in Europe. As mentioned in previous part, which is reinforced by the statement of Salih Zeki in *Resimli Gazete* in detail,[273] logaritms were introduced to Ottoman scientific culture before Gelenbevi İsmail. Gelenbevi also mentions that this science had been invented recently.[274] If so, how should Cevdet's narrative be evaluated?

Although our story does not completely overlap with historical realities, it should not be ignored because the details of the story offers some clues about the periods in which Gelenbevi İsmail Efendi lived and that *Tarih-i Cevdet* was written with respect to the encounter with new science. In other words, it indicates some points about Ottoman-Europeans relation and rivalry based on scientific activity. Rivalry took shape not only around science in itself, but also its political and social implications. Let us try to make sense of this rivalry by examining the positions of the unknown French engineer and Gelenbevi İsmail Efendi in Ahmed Cevdet's narrative.

The unnamed engineer came from Europe, where logarithms had been invented as and had started to be used in a short time. The engineer was aware of such a privileged condition. He set forth the fact that the Eurpeans had acquired a superior position with respect to scientific progress over the Ottomans with which

[271] Yılmaz Öztuna, *Devletler ve Hanedanlar: Türkiye (1074-1990)*, vol. 3 (Ankara: Kültür ve Turizm Bakanlığı, 2005), 1030.
[272] "*riyaziyat-i kadimeye tatbiken böyle bir fenn-i nevzuhurun*…" Ahmed Cevdet Paşa, 234.
[273] Salih Zeki, "Gelenbevi İsmail Efendinin (rahmetullah) Terceme-i Hali Hakkında Bir Mütalaa," *Resimli Gazete* 4, no. 192 (Teşrin-i Sani 1310): 426-429.; Salih Zeki, "Gelenbevi İsmail Efendinin (rahmetullah) Terceme-i Hali Hakkında Bir Mütalaa," *Resimli Gazete* 4, no. 193 (Kanun-u Evvel 1310): 441-442.
[274] Gelenbevi İsmail, "Risâle fî," 4.

Europe had been in rivalry over the years and he behaved as such when he came to İstanbul. By thinking that Ottoman scientists were unaware of logarithms, he attributed superiority to the culture to which he belonged. That the Sublime Porte officials directed the French engineer to Gelenbevi shows that not only the engineer, but also the Ottomans participated in this rivalry. At this point, logarithms became a symbol for "rivalry between cultures." Logarithms as new knowledge were transformed into an active "power" in the multi-directional rivalry between cultures.

Within this framework, the mission of İsmail Gelenbevi shows the vividness and scientific productivity of the Ottoman intellectual environment in spite of all the problems with which the Ottoman Empire was faced. Gelenbevi responded to the engineer in scientific form. When taking into consideration the fact that Ahmed Cevdet mentioned that mathematics had developed very much in Europe along with the fact that Gelenbevi had invented logarithms on the basis of his own scientific tradition, Gelenbevi defended Ottoman "honor". In short, Gelenbevi represented an Ottoman intellectual life which was not "backward" relative to Europe, but even more "advanced" than it in the eyes of Cevdet.

Another crucial detail is seen in reply to the French engineer's "insolent" behaviours: Gelebevi's "forebearing" manner to him. That is, Ahmed Cevdet, referring to the relation between knowledge and ethics, represented Gelenbevi as both a scholarly and modest Ottoman figure. In short, the knowledge of logarithms seems to have been a part of the rivalry between cultures and an effective tool in the inter-relationship of rivalry, power and ethics.

After this examination of the political reflections of logarithms as new knowledge, now it is time to point out another implication of the knowledge of logarithms: Prestige in Ottoman culture. The general question that should be focused

on here is what the impact of the new knowledge on Ottoman intellectual milieu was. In particular, how the knowledge of logarithms was perceived by Ottoman scholars and, more interestingly, how much prestige the scholars who knew this knowledge acquired. Specifically, what was the meaning of writing a book on logarithms in such a period?

It was mentioned before that Cevdet regarded the knowledge of logarithms in a significant manner such that although Gelenbevi had many works on various topics, he mainly focused on two mathematics books, *Sharhu Cadâvil al- Ansâb* and *Hisabü'l- Küsur*.[275] More strikingly, the book on logarithms was given more attention. It seems to me that this was an indicator of mathematical knowledge in the eyes of Cevdet. As an Ottoman intellectual, Cevdet also placed emphasis on logarithms and this may imply the general perspective of Ottoman intellectuals toward it. Moreover, the fact that the French engineer was directed to İsmail Gelenbevi and that he put on the sable of a state official for his portrait, in my opinion, reflect his social and intellectual prestige, which seemed to have increased more with the knowledge of logarithms.

Additionally, people who wrote books on logarithms like Hüseyin Rıfkı Tamani and Başhoca İshak Efendi were also influential figures at the Land Engneering School. A more striking detail is found in a note Gelenbevi wrote down in Callet's book. Gelenbevi wrote, in Arabic, on the back cover of Callet's books, which he studied, he studied that only those "who are equipped by the elegancy of mathematics" can appreciate this book and thereby this knowledge.[276] That is, he implicitly claimed that not everyone who knew mathematics could penetrate the

[275] Ahmed Cevdet Paşa, 234–235.
[276] Callet, *Tables Portatives de Logarithmes*, Bâyezîd Umûmî Kütüphanesi, Nr. 4473, 1783.

knowledge of logarithms, and makes us understand that those who knew logarithms made a special group.

The Vernacularization of Scientific Knowledge, Including Logarithms

The language used most frequently in Ottoman scientific life was surely Arabic. It continued to be used until the end of the Empire. In fact, books written in Turkish were also available from the very beginning of the state. Some works in Persian were also written. Compared to the amount of literature in Arabic, their number was all but insignificant. This applied to mathematics works as well. According to data offered in *History of Mathematical Literature during the Ottoman Period*, while the number of mathematics works written in Arabic was sixty-five in the seventeenth century, the number of works in Turkish was just five in the same period. This case was valid for eighteenth century as well so that there were 107 in Arabic and just thirteen in Turkish. Still, it is not accurate to conclude that Arabic was dominant throughout all Ottoman history. For instance, the winds changed starting from the end of the eighteenth century and in the nineteenth century, while the number of works in Arabic was 99, those in Turkish reached 73, which is nearly five times more than the number of works written in the previous century. The situation in the twentieth century was more dramatic: 109 in Arabic and 339 in Turkish.[277]

What does this mean? From this picture, it may be easily inferred that Ottoman literature in mathematics underwent a linguistic transformation especially from the eighteenth century onwards. Nevertheless, how should we make sense of it?

[277] İhsanoğlu, *Osmanlı Matematik,* xciv.

Where and how could İsmail Gelenbevi, who wrote five of six mathematics books in Turkish be positioned within this general framework?[278] As a scholar who wrote in Arabic in various fields like logic, theology or philosophy, even astronomy, why did he "perform" mathematics in Turkish? What kinds of factors affected the scientific attitudes of Gelenbevi and other contemporary scholars scientific?

To conceptualize this transformation, it seems that "vernacularization" is a fitting term. William Crossgrove, who wrote an article on late medieval Europe, defines vernacularization regarding on which the period he works as such: "Vernacularization refers to the transposition of texts from a high- status language, usually Latin, into a vernacular language that typically has lower prestige as a written language."[279] Additionally, he states that a high-status language is learned or used in books while a vernacular language is generally a spoken one. In spite of this categorization, he accepts the dynamic nature of languages, and high-status and vernacular languages may change their positions with respect to different times and spaces.[280] In the Ottoman case, thanks to the transformation in works on mathematics and other fields, Turkish acquired a high-status position and consolidated its aspect of being a book language. The increase in the number of such works positively affected this multidirectional process.

In the Ottoman case, vernacularization became reality in two types. The first one was compilation activities and the other wass translations. In fact, both two existed throughout Ottoman history. On the other hand, from the eighteenth century onwards, the number of these activities sharply increased, as shown above. Adding to the fact that many books, some of which were in Arabic, were had been in Ottoman

[278] For more information, see ibid., 251–259; and Fazlıoğlu, "İsmail Efendi," 667–668.
[279] William Crossgrove, "The Vernacularization of Science, Medicine, and Technology in Late Medieval Europe: Broadening Our Perspectives," *Early Science and Medicine* 5, no. 1 (2000): 47.
[280] Ibid., 50.

culture before and some of which were European-oriented contemporary books that were translated into Turkish, Ottoman scholars also wrote in Turkish. It is time to ask a question: Given the fact that Gelenbevi wrote his logarithms book when he was a teacher at the engineering school, to what degree was this institution influential in the vernacularization process of the Ottoman intellectual world?

In order to understand the effects of the engineering school in this process, it is relevant to ask which factors triggered science writing in general, mathematics specifically. It is sure that this process was complicated and analyzing the causes and effects of vernacularization here needs to be done very broadly. On the other hand, it is possible to infer some main agents of this process within the scope of this study. First of all, one of the causes of the vernacularization was surely education and educational institutions. At this point, the position of the engineering school is worth consideration. Teachers at the engineering school predominantly wrote in Turkish. Instructors like İsmail Gelenbevi, Hüseyin Rıfkı Tamani, Başhoca İshak Efendi who were teachers at Naval and Land Engineering Schools wrote educational books in Turkish and these books introduced the new sciences.

In fact, the position of education and education materials in appropriating the new sciences outside Europe is an attractive topic. According to some distinguished scholars who deal with historiographical issues on science and technology, textbooks were closely related with the emergence and strengthening of the scientific disciplines.[281] Those including İsmail Gelenbevi confirm this argument so that it was no coincidence that his book on logarithms as new knowledge introducing it to Ottomans was written when he was at the engineering school.

[281] Kostas Gavroglu and et al, "Science and Technology in the European Periphery: Some Historiographical Reflections," *History of Science* 46 (2008): 164.

Another main agent that determined the language of education at the engineering school was surely the students. As is known, Arabic was the language of medreses and the students there received high-level Arabic courses. However, the situation was different in the engineering schools. Not all of the students had Arabic-based educations. For instance, the first students of the Naval Engineering School were old captains and the children of some high-level officials[282] along with some from the ulema. In such a condition, Turkish became the language of education automatically.

Lafitte-Clavé also points out as a problem that the Ottomans mathematics books were mainly in Arabic.[283] Additionally, due to the fact that the aim of writing these books was mainly to teach practical and vocational knowledge, Turkish books provided fast and easy transfer and implementiataion of the knowledge into practice. In fact, such a tendency was not specific to engineering education. Before it, some works had been written in Turkish for vocational aims in medicine, accounting or practical astronomy. For instance, Hacı Atmacaoğlu wrote his *Mecma' el- Kavaid* ,which was about accounting mathematics, in 1494 and presented it to Bayezid II.[284] This implies that the aim of transferring practical knowledge in a vocational circumstance had been case in Ottomans for centuries and activities the engineering school may be regarded as an accelerated continuation of such a target.

In addition to the effects of the educational purpose on literature in Turkish, the position of the state on this process should not be ignored. As is known, especially from Tulip Period onwards, the state organized many translation activities. Many translations had been done until this period. On the other hand, it was the first

[282] Kaçar, "Osmanlı Devleti"nde," 101.
[283] Lafitte-Clavé, 29.
[284] İhsan Fazlıoğlu, "Osmanlı Döneminde "Bilim" Alanında Türkçe Telif ve Tercüme Eserlerin Türkçe Oluş Nedenleri ve Bu Eserlerin Dil Bilincinin Oluşmasındaki Yeri ve Önemi," *Kutadgubilig Felsefe- Bilim Araştırmaları Dergisi*, no. 3 (March 2003): 165.

time that translation activities were systematic and organized by state. In fact, the state organized works to be written in Turkish by supporting authors who wrote in the Turkish language. In this period, most of the translated books are about history.[285]

After that, the consciousness of state official regarding the Turkish language continued to increase. In my opinion, as a state institution, the engineering school also served such a policy. Many of the books written by engineering school teachers indicate this to some degree.

The Dissemination and Popularization of Logarithms

Hüseyin Rıfkı Tamani, one of the famous teachers at the Land Engineering School, also wrote a book on logarithm in 1792.[286] His book became the fourth book on logarithms written in Turkish. It is not surprising that he wrote in Turkish because scholars before him had written in Turkish as well. He explained why he chose to write in this language:

> *… taife-i Efrencin ihtira' eyledikleri 'logaritma' ismiyle musemma olan cedavil-i selasenin bilad-i İslamiye'de şuyu'u hasebiyle tarik-i a'mali ehemm ve elzem olmağın, … bir risale telif ve tanzim ve nef'i 'am olsun içün lisan-i Türki üzere terkim eyledim*.[287]

He said that the book had been written in Turkish so that it would become widespread and its benefit would become more common. In other words, he wanted to disseminate the knowledge of logarithms. Actually this process did not start with Hüseyin Tamani. Before him, İsmail Gelenbevi's book on logarithm had served such

[285] Salim Aydüz, "Lale Devri'nde Yapılan İlmî Faaliyetler," *Divan: İlmi Araştırmalar* 2, no. 3 (January 1997): 144.
[286] Ali Rıza Tosun evaluates this book on his MA thesis. Ali Rıza Tosun, "Osmanlılar"da Logaritma" (MA thesis, Ankara University, 2002).
[287] Quoted in Fazlıoğlu, "Osmanlı Döneminde," 172.

an aim by having been written Turkish and understandable. Apart from the students at the engineering education, some visitors also attended lectures there so that the total number of students and visitors could have been exceeded fifty.[288] It shows that logarithms as new knowledge were known not only by the members of the school, but also by many visitors and state officials. From the journal of Lafitte-Clave, we learn that Capitan Bey was also interested in logarithms and he also studied Callet's logarithms book.[289] All these may signify that logarithms were disseminated and popularized in scientific and bureaucratic circles.

In addition to these, one point attracts my attention regarding the dissemination of the logarithms. The question of how effective the İstanbul milieu was to transfer new knowledge to the other parts of the Islamic world was is very important to understanding the scientific network between different parts of the Islamic world. Two copies of the manuscripts of Gelenbevi's logarithms book were listed in Egyptian catalogues.[290] Beside this, *Mecmua-i Ulum-i Riyaziye*, which mentions various topics of the new science including logarithms and was written for educational purposes by Başhoca İshak Efendi, a teacher at Land Engineering School and one of the most famous Ottoman engineers, was printed in Bulak, one of the most popular print houses in Egypt, in 1835 (1251) and 1845 (1261).[291] This suggests that dissemination of the new knowledge was not limited to the İstanbul environment. On the contrary, this case displays a multi-directional networks and it should be studied.

[288] Kaçar, "Osmanlı Devleti"nde," 101.
[289] Lafitte- Clavé, 26.
[290] İhsanoğlu, *Osmanlı Matematik*, 258.
[291] Ibid., 283.

Logarithms as a Tool of Multi-Directional Interaction

Were only Muslim scholars in İstanbul interested in science in the Ottoman Empire? What about non-Muslim Ottomans? More importantly, did Muslim and non-Muslim "scientists" work independently from each other or did they interact? Despite the diversified Ottoman society, a sufficient number of studies showing the multi-cultural aspects of Ottoman science do not exist.[292] However, a good example of such an interaction is İsmail Gelenbevi and how he learned about logarithms. The relevant case was described by Seyyid Mustafa, who was one of the first students of the Land Engineering School and then a teacher. As mentioned above, he wrote a treatise in French titled "Diatribe de L'ingénieur Seid Mustapha sur l'état actuel de l'art militarie, du génie, et des sciences à Constantinople." In this document he stated that he learned logarithms from İsmail Gelenbevi. Regarding our issue, he also adds that Gelenbevi had learned logarithms from a Greek.[293]

In fact, Gelenbevi's case is surely not an exception in Ottoman history. The different religious and ethnic groups of Ottoman society contributed to Ottoman scientific culture by interacting with each other. Moreover, many non-Muslim Ottomans made great contributions to Ottoman science by introducing the new scientific developments developed in Europe. For instance, as mentioned before, Taqi al-Din (Takiyüddin) built an observatory in the sixteenth century and in this observatory, Daud al-Riyyadi, an Italian Jew from Salonika worked with and helped him. According to Avner Ben Zaken, his name was David Shushan. He could read

[292] Ekmeleddin İhsanoğlu, Kostas Chatzis, and Efthymios Nicolaidis, eds., *Multicultural Science in the Ottoman Empire* (Turnhout: Brepols, 2003).This study can be exceptional but it mainly depicts "in- group" activites of each one rather than interactions between groups.
[293] Beydilli, "İlk Mühendislerimizden," 413.

and translate Latin works and was "the one highly appreciated by 'the great Muslim scholar' Taqi al- Din."[294]

Other non-Muslims played decisive roles translating new scientific literature as well. Panayotis Nikusios and Alexandros Mavrokordatos had good relations with the Köprülü family of viziers and they were effective in some part of the translation attempts. One of them was the *Atlas Maior* by which Katip Çelebi was inspired during his preparation of *Cihannüma*.[295]

Such a case was valid in the eighteenth century as well. In this period, non-Muslim scholars had contributed to the introduction of the new sciences. For example, three out of fourteen translated books at the Engineering library were translated by Konstantin İpsilanti from French into Turkish between 1792 and 1794.[296] Additionally, at the Naval Engineering School, lectures prepared by French teachers were translated into Turkish by Miran, an Armenian Ottoman.[297]

In my sense, even these few examples are enough to make sense of the nature of Ottoman science. Above all, if the case is the appropriation of European science, the interaction between different groups should not be ignored in order to understand the Ottoman history of science from the holistic perspective. Here I can suggest that Ottoman society experienced two kinds of interactions related to the scientific activities at the time Gelenbevi lived inspired by his engineering experience.

The first is the one occurred between the Ottomans and other societies, mainly Europeans. Many scholars and books that came from Europe can be shown as examples of such an interaction. I suggest calling this "macro-level interaction." The

[294] Ben Zaken, 58–60.
[295] Gottfried Hagen, "Ottoman Understandings of the World in the Seventeeth Century," in *An Ottoman Mentality: The World of Evliya Çelebi*, by Robert Dankoff (Leiden; Boston: Brill, 2004), 250.
[296] Kaçar, "Osmanlı Devleti'nde ," 166.
[297] Beydilli, "Mühendishane," 515.

second is the one that occurred between various groups in Ottoman society. As shown above, different parts of society shared the new knowledge. I suggest calling this this “micro- level interaction.” To bring new horizons to Ottoman studies, it should be kept in mind that studies on micro-level interactions are as important as the macro-level ones or maybe more.

CHAPTER V

CONCLUSION

This thesis discussed Gelenbevi İsmail's scientific life and, inspired by his book on logarithms, the Ottoman experience of the European science. In this respect, in the second chapter, the general framework of the history of Ottoman science and mathematics in particular were dealt with. First the concept of 'ilm was examined for its similarities with and differences from the modern concept of science and the classification of the sciences in both systems were shown as examples of that. In this way, the methodological sentiment when examining the history of science in Muslim societies was stressed referring to the Ottoman history of science in order not to fall into an anachronistic or noncontextual position in those kinds of studies.

Then, the position of mathematical sciences in Ottoman scientific culture mainly in the pre-modern period and how and where those sciences were taught were explained. Those explanations show that mathematical science could be taught in different places in addition to medreses. Last, the conceptualization of Ottoman science was taken briefly into consideration. It was revealed that this concept included all of the scientific activities within the Ottoman geography. Although this definition aimed at a comprehensive historiographical approach to Ottoman science, as discussed, current studies are far from giving the scientific inter-relations between the different groups of Ottoman society.

After those, the main historiographical debates on Ottoman science were presented. It was seen that Islam-negative and positive culturalists had a great effect

on the history of Ottoman science studies and both two were shaped by an essentialist discussion whether Islam was compatible with science or not. Differently from those, the "sociological approach to science" was introduced and its potential to bridge the history of science studies and Ottoman studies in general was generally implied.

In the third chapter, the life of İsmail Gelenbevi was examined in many respects. His emergence among the ulema and becoming an important scholar were discussed. As a very successful student of famous scholars like Yasincizâde Osman Efendi and Müftizâde Mehmet Emin Efendi, in my view, he enjoyed good relations with high level scholars and officials. However, the main issue of this chapter was Gelenbevi's time as a teacher of mathematics at the engineering school. Inspired by his experience, information was given about both the *ilmiye* and the engineering education. In the first years of the engineering school, many scholars from the medrese system were employed as teachers there. It was seen that success could provide a better position in the *ilmiye* structure. The *ilmiye* and engineering systems had a mutual relationship such that a scholar taught first as an engineer and then gained a better position through it.

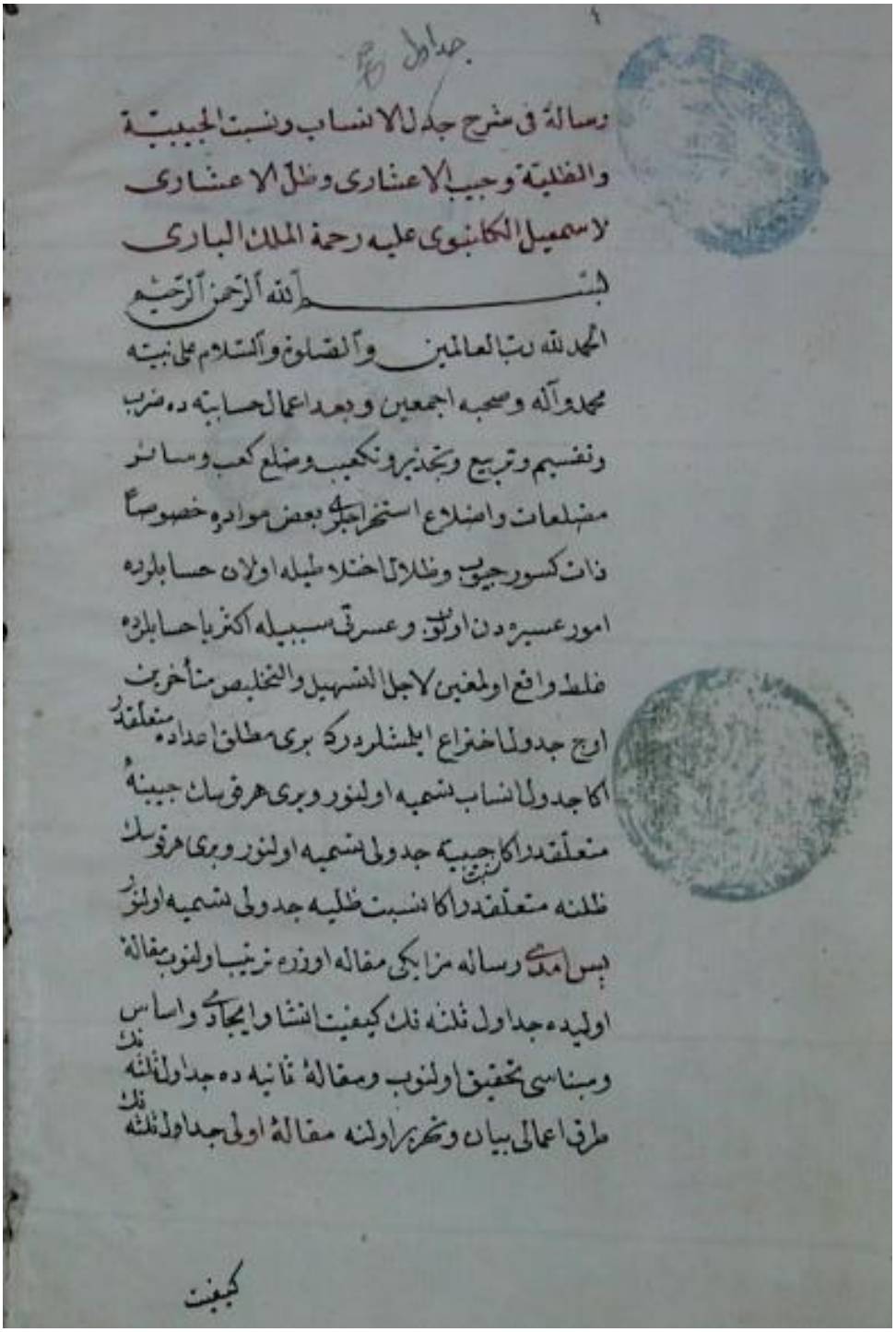
Apart from those, the question of whether Gelenbevi experienced an intellectual transformation during his time at the engineering school was discussed. He wrote books on mathematics for students of engineering and was active in the school. In addition to this, he continued his position in the *ilmiye*. Therefore, in my view, he represents a "transition figure" between the college-oriented and the engineering-oriented scientific systems. It also was questioned why Gelenbevi has been presented as an engineer and mathematician rather than as an Islamic scholar

historically and it was shown that the reason for this was the description of him in *Tarih-i Cevdet*. Finally, the historical discussions about his death were summarized.

In the fourth chapter, inspired by Gelebevi's book on logarithms, the Ottoman contact with European science was investigated. After discussing the invention of logarithms in Europe and introduction to Ottoman scientific culture, it was revealed how the knowledge of logarithms became a symbol of rivalry with Europe and prestige among the Ottomans by analyzing Gelenbevi's story about logarithms in *Tarih-i Cevdet*. The dimensions of the Ottoman experience of the new science were discussed within the framework of some concepts like vernacularization, dissemination, popularization and multi-directional interaction. Although the knowledge of logarithms did not represent a major theoretical transformation in Ottoman mathematics, the process of it helped clarify the changes involved and the extent of it in Ottoman scientific culture from the eighteenth century onwards. In addition to this, Gelenbevi's book on logarithms was introduced briefly as one of the first works on logarithms. It was seen that Gelenbevi wrote this book for educational purposes in the engineering school. Despite this, it was not learned to what extent his book was used by the students at this school.

To sum up, this thesis emphasized two concurrent transformations, the first was in Gelenbevi's own scientific life and the second was in eighteenth century Ottoman science in general. While Gelenbevi was faced with the "new" at the micro-level, Ottoman science encountered it at the macro- level. Such a similarity is impressive. Presumably, Gelenbevi and his work are so interesting is their association with the general experience of Ottoman scientific culture. However, one question remains to be answered in order to understand the extent of such an

association: To what degree did this transformation have an effect on the Ottoman mentality and society?


جداول

رسالة فى شرح جدل الانساب ونسبت الجيبية
والظلية وجيب الاعشارى وظل الاعشارى
لاسمعيل الكلنبوى عليه رحمة الملك البارى

بسم الله الرحمن الرحيم

الحمد لله رب العالمين والصلوة والسلام على نبيه
محمد وآله وصحبه اجمعين وبعد اعمال حسابيه ده ضرب
وتقسيم وتربيع وتجذير وتكعيب وضلع كعب وسائر
مضلعات واضلاع استخراجيه بعض موادده خصوصا
ذات كسور جيوب وظلال اختلاطيله اولان حسابلرده
امور عسيره دن اولوب وعسرتى سببيله اكثريا حسابلرده
غلط واقع اولمغين لاجل التسهيل والتخليص متأخرين
اوج جدول اختراع ايلمشلردركه برى مطلق اعداده متعلقدر
اكا جدول انساب تسميه اولنور وبرى هر قوسك جيبينه
متعلقدر اكا جيبيه جدولى تسميه اولنور وبرى هر قوسك
ظلنه متعلقدر اكا نسبت ظليه جدولى تسميه اولنور
پس امدكى رساله مزبكى مقاله اوزره ترتيب اولنوب مقالة
اوليده جداول ثلثه نك كيفيت انشا وايجاد واساس
وبناسى تحقيق اولنوب ومقالة ثانيه ده جداول ثلثه نك
طرق اعمالى بيان وتحرير اولنه مقالة اولى جداول ثلثه نك

كيفيت

First pages of Gelenbevi's book, *Sharhu Cadâvil al- Ansâb*

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