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IBN AL-HAYTHAM'S CLASSIFICATION OF KNOWLEDGE

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Abstract

Ibn al-Haytham (d. 1039) is a well known scholar for his contributions in natural and mathematical sciences. The research focuses on his works in sciences and mathematics and only a few studies carry out on his contribution on philosophy due to the lack of the primary sources. The only known surviving Ibn al-Haytham's work on philosophy is Kitāb Thamarah al-ḥikmah. However, few studies have examined and explored this work. Based on this work, the present study tries to scrutinize Ibn al-Haytham's epistemology and focused mainly on his classification of knowledge. The comparative study of Ibn al-Haytham's classification of knowledge and that of al-Fārābī's, Ibn Ḥazm's, Ṭūsī's, and al-Ghāzālī is also carried out. The result shows that Ibn al-Haytham has two mode of classifications: the ontological and epistemological. It is also obvious that Ibn al-Haytham tries to integrate Greek philosophy and sciences within the worldview of Islām. The results of the present study also suggests that the nexus between the concept of classification of knowledge and the concept of perfect man (al-insān al-tāmm) is obvious.

[Ibn al-Haytham (w. 1039) adalah sarjana yang dikenal sumbangsibnya dalam ilmu-alam dan matematika. Penelitian-penelitian hingga saat ini cenderung difokuskan pada karya-karya sains dan matematikanya saja dan hanya sedikit dilakukan pada karya-karya filsafatnya karena kurangnya rujukan primer. Satu-satunya karya Ibn al-Haytham yang ada dalam bidang filsafat adalah Kitāb Thamarah al-Ḥikmah. Namun, studi yang

dilakukan untuk meneliti dan mengeksplorasi karya ini sejauh ini amat kurang. Berdasarkan karyanya tersebut, kajian ini mencoba untuk meneliti dengan seksama epistemologi Ibn al-Haytham dan utamanya difokuskan pada klasifikasi ilmu pengetahuan. Studi perbandingan antara klasifikasi ilmu Ibn al-Haytham dengan al-Fārābī's, Ibn Ḥazm's, Ṭūsī's, and al-Ghāzālī juga dihadirkan. Hasil penelitian menunjukkan bahwa Ibn al-Haytham memiliki dua cara klasifikasi ilmu pengetahuan. Juga sangat nampak bahwa Ibn al-Haytham mencoba memadukan filsafat dan sains Yunani dalam pandangan alam Islam. Kajian ini juga menunjukkan bahwa terdapat hubungan yang jelas antara konsep klasifikasi ilmu pengetahuan dengan konsep manusia sempurna (al-insān al-tāmm)]

Keywords: Ibn al-Haytham, classification of knowledge, *al-ḥikmah*, *Kitāb Thamarah al-ḥikmah*.

A. Introduction

The full name of Ibn al-Haytham is Abū ‘Alī al-Ḥasan ibn al-Ḥasan Ibn al-Haytham. He was born in Basra, now Iraq, circa 965 A.D.; therefore, he also known as al-Baṣrī. Ibn al-Haytham also known in the Western as Alhacen or Alhazen originated from “al-Ḥasan”. The name of “al-Haytham” itself was taken from his grand father’s name.

His contributions in natural and mathematical sciences made Ibn al-Haytham one of the greatest muslim scientists in islamic civilization or even in the history of science. Honoring Alhazen on his tremendous contribution in modern optics, in 2015 UNESCO celebrated *International Year of Light* (IYL) supported by many reputable scientific institutions such as *International Centre of Theoretical Physics* (ICTP), *American Institute of Physics* (AIP), *American Physical Society* (APS), *IEEE Photonics Society* (IPS), *Institute of Physics* (IOP), *International Society for Optics and Photonics* (SPIE), and *The Optical Society* (OSA).¹ George Sarton regarded him as: “the

¹ Azzedine Boudrioua, “Ibn al-Haytham Optics”, in *Inspired by Light: Reflections from the International Year of Light 2015*, ed. by Jorge Rivero González, Joseph Niemela, and Krisinda Plenkovich (Washington: SPIE, the European Physical Society (EPS), and The Abdus Salam International Centre for Theoretical Physics (ICTP), 2016). http://www.light2015.org/dam/About/Resources/IYL_2015_Inspired_by_Light.pdf, accessed 19 May 2017.

greatest muslim physicist and one of the greatest students of optics of all times“.² Moreover, he is also regarded by many scholars as a pioneer in scientific method.³ However, so far Ibn al-Haytham is never portrayed as a philosopher due to the fact that most of his philosophical works are lost, and only his natural and mathematical works did survive. This article is an attempt to elucidate his philosophical thought.

One of the earliest historical account on Ibn al-Haytham was written by Ibn Abī Uṣaybi‘ah in his *‘Uyūn al-Anbā’ Fī Ṭabaqāt al-Atibbā’* circa 1250 A.D. containing Ibn al-Haytham work lists and his short excerpted-autobiography. Ibn Abī Uṣaybi‘ah lists about 182 Ibn al-Haytham’s works in his *‘Uyūn al-Anbā’*. Around 41% of his works are in mathematical sciences and its applications, 21% in metaphysics, 18% in *Kalām*, and in logic, natural sciences, accounting, medical sciences, political sciences are 16% approximately. However, there are only around 61 of his works available, all of which are in natural and mathematical sciences.⁴

As stated before, most of his works are unavailable today, especially his works on philosophy and *Kalām*. However, a close survey has been done on his works and legacy; as a result, a work entitled *Kitāb Thamarah al-Hikmah* was found containing many philosophical aspects which has not been studied intensively. Even though *Kitāb Thamarah al-Hikmah* basically classified as mathematical text, Ibn al-Haytham discusses many important philosophical aspects, including discussion on classification of knowledge.

One of the well known topics on epistemology in the history of

² George Sarton, *Introduction to the History of Science*, vol. 1 (Baltimore: Carnegie Institution of Washington, 1931), p. 721; David C. Lindberg, *Theories of Vision from Al-kindī to Kepler* (Chicago: The Univ. of Chicago Press, 1976), p. 58; Jan P. Hogendijk and Abdelhamid I. Sabra (eds.), *The Enterprise of Science in Islam: New Perspectives* (Cambridge (Massachusetts): MIT Press, 2003), pp. 89–90; Peter Adamson, “Vision, Light and Color in Al-Kindī, Ptolemy and The Ancient Commentators”, *Arabic Sciences and Philosophy*, vol. 16, no. 2 (2006), p. 207.

³ Jim Al-Khalili, *Pathfinders: The Golden Age of Arabic Science* (London: Allen Lane, 2010), p. 170; Rosanna Gorini, “Al-Haytham the Man of Experience: First Steps in the Science of Vision”, *Journal of the International Society for History of Islamic Medicine*, vol. 2, no. 4 (2003), p. 55.

⁴ Aḥmad b. al-Qāsim Ibn Abī Uṣaybi‘ah, *Uyūn al-Anbā’ Fī Ṭabaqāt al-Atibbā’* (Beirut: Dar al-Kutūb al-‘Ilmiyyah, 1998), pp. 508–15; Carl Brockelmann, *Geschichte der Arabischen Litteratur*, vol. 1 (Leiden: Brill, 1943), pp. 617–9.

islamic philosophical corpuses is the classification of knowledge.⁵ Some of the prominent muslim scholars in the past have elucidated this topic in their works. For examples, al-Fārābī (d. 339/950) in his renowned *Ihṣā' al-'Ulūm*, Ibn Ḥazm al-Andalūsī (d. 456/1064) in his *Marātib al-'Ulūm*, Abū Ḥāmid al-Ghazālī (d. 505/1111) in his celebrated work *Ihyā' 'Ulūmuddīn*, Naṣīr al-Dīn Ṭūsī (d. 1274 M) in his *Akblaq-i-Nasiri*, Quṭb al-Dīn al-Shīrāzī (d. 710/1311) in his *Durrat al-Tāj*, and Ibn Khaldūn (d. 784/1382) in his magnum opus *Muqaddimah*. These works have been examined and explored by many scholars. For instance, research on the classification of knowledge of Ṭūsī has been done by Shephenson,⁶ that of Ibn Ḥazm by A.J. Chejne.⁷ Al-Ghazālī's classification has also been scrutinized by many scholars such as Mustafa Abu-Sway, and Osman Bakar.⁸ In addition, study on the classification of knowledge of Ibn Khaldūn has carried out by Zaid Ahmad,⁹ and al-Fārābī, *al-Quṭb al-Dīn al-Shīrāzī*, and al-Ghazālī has investigated by Osman Bakar; unfortunately, there is no hitherto study has been done that of Ibn al-Haytham.

B. Kitāb Thamarah al-Ḥikmah

Ibn Abī Uṣaybi'ah did not mention “*Kitāb Thamarah al-Ḥikmah*” under Ibn al-Haytham works lists; however, a number of studies have found that this work is attributed to Ibn al-Haytham. For instance, Abū Rīdah, who edited *Kitāb Thamarah al-Ḥikmah* for the first time, stated that this work indeed is one of the Ibn al-Haytham works.¹⁰ This opinion is

⁵ Osman Bakar, *Classification of Knowledge in Islam: a Study in Islamic Philosophies of Science* (Kuala Lumpur: International Institute of Islamic Thought and Civilization, 2006), p. 1.

⁶ J. Shephenson, “The Classification of the Sciences according to Nasiruddin Tusi”, *Isis*, vol. 5, no. 2 (1923), pp. 329–38.

⁷ Anwar G. Chejne, *Ibn Ḥazm al-Andalusī wa manqifubu min al-'Ulūm*. (Chicago: Kazi Publ, 1982).

⁸ Mustafa Abu-Sway, *Al-Ghazālīyy: A Study in Islamic Epistemology* (Kuala Lumpur: Dewan Bahasa dan Pustaka, 1996); Bakar, *Classification of knowledge in Islam*.

⁹ Zaid Ahmad, *The Epistemology of Ibn Khaldūn* (London: Routledge/Curzon, 2003).

¹⁰ Muḥammad 'Abd al-Hādī Abū Rīdah, “Preface”, in *Maqālah 'an thamarat al-ḥikmah* (al-Qāhirah: al-Maktabāt al-Miṣriyyah bi al-Qāhirah, 1991), p. nn.

supported by other scholars, such as ‘Ammār Jam’ī al-Ṭālibī,¹¹ Jum’ah Sayyid Yūsuf,¹² and also Henry Corbin:

“He was an important influence in the fields of celestial physics, astronomy, optics, and the science of perspective. His philosophical presuppositions are still to be systematically examined; he was deeply learned in philosophical culture, for he had read Galen and Aristotle carefully, but his own philosophical work is unfortunately lost, or else remains unedited, like the *Kitāb Thamarah al-Hikmah*, ‘the fruits of philosophy’.”¹³

The manuscript of *Kitāb Thamarah al-Hikmah* is catalogued as MS 1604 in Köprülü library Turkey together with another works by various author such as *Iḥṣā al-‘Ulūm*, *Risālah ‘Uyūn al-Masā’il*, *Risālah Mabādī’ al-Ashya’ wa Marātibihā* by al-Farābī, etc. *Kitāb Thamarah al-Hikmah* is located between page 41 and 59 and written in naskhī style.¹⁴ It has been edited and introduced by Muḥammad ‘Abd al-Hādī Abū Rīdah for the first time in 1991 under the title *Maqālah ‘an Thamarah al-Hikmah* as for Abū Rīdah the word “Kitāb” was not originally from Ibn al-Haytham but it was added later on by the copywriter.¹⁵ In 1998 the manuscript was edited for the second time by ‘Ammār Jam’ī al-Ṭālibī based on the same manuscript.¹⁶

In *Kitāb Thamarah al-Hikmah*, Ibn al-Haytham discusses many topics which can be classified as: the definition of al-Hikmah, i.e islamic philosophy or knowledge in general, the classification of knowledge, psychology of the human soul, the concept of happiness, **the concept of The Perfect Man (*al-insān al-tāmm*)**, introduction to geometry, the

¹¹ ‘Ammār Jam’ī al-Ṭālibī, “Kitāb Thamarah al-Hikmah li Ibn al-Haytham Dirāsah wa Taḥqīq”, *Majallat Majma’ al-Lughah al-‘Arabīyah bi-Dimashq*, vol. 73, no. 2 (1998), p. 264.

¹² Jum’ah Sayyid Yusuf, “Ibn al-Haytham”, in *‘Ilm al-Nafs Fī Turath al-Islāmiy*, vol. 2 (Cairo: Al-Ma’had al-‘Alamiy lil Fikr al-Islāmiy, 1996), pp. 9–14.

¹³ Henry Corbin, *History Of Islamic Philosophy*, trans. by Liadain Sherrard and Philip Sherrard (London: Kegan Paul International, 1993), p. 149.

¹⁴ Ramazan. Şeşen, Cemil. Akpınar, and Cevat. İzgi, *Catalogue of Manuscripts in the Köprülü Library*, vol. 2 (Istanbul: Research Centre for Islamic History, Art, and Culture, 1986), pp. 330–1.

¹⁵ Rīdah, “Preface”.

¹⁶ al-Ṭālibī, “Kitāb Thamarah al-Hikmah li Ibn al-Haytham Dirāsah wa Taḥqīq”, p. 281.

methods of proof in mathematics, and the purposes of studying nature and philosophy in general. However, as for present study the concern is focused on the classification of knowledge aspect.

C. Ibn al-Haytham's Classification of Knowledge

Ibn al-Haytham gives the definition of *al-hikmah* that “every true knowledge and all beneficial actions”¹⁷:

الحكمة علم كل حق وعمل كل نافع

“*al-hikmah* is every true knowledge and all beneficial actions”

Therefore, according to the definition, *al-hikmah* consists of two parts: the theoretical and the practical one. The theoretical part of *al-hikmah* that reflected from its definition, which is “every true knowledge” (*al-'ilm bi kulli haqqin*), can be divided into three branches of knowledge: mathematical sciences (*riyādiyyāt*), that is science of shape and number; natural sciences (*ṭabī'īyyāt*), such as science of all existents (*manjūdāt*), their properties, causes and foundations; and metaphysics (*ilāhiyyāt*), that is science concerning the reality of everything beyond the heaven (*khārij al-samā'*), the first actor (*al-fā'il al-awwal*), the initial origin (*mabda' al-mabādī'*), the first beginning (*awwal al-awā'il*).

The mathematics-physics-metaphysics classification obviously is ontological based classification, which is a recognition of the hierarchy of beings. Ibn al-Haytham elucidates that mathematical sciences such as geometry is a science that the objects of the knowledge are exist only in the mind (*mutakhayyalan ma'qūlan*) which is free from natural matter (*al-mādah al-ṭabī'īyyāt*).¹⁸ This is what Ibn al-Haytham calls as mathematical body (*jism ta'līmī*).¹⁹ As for physics, the object of the knowledge are all material body and sensible matter, whereas the subject matter of metaphysics is everything beyond senses and reason.

The practical part, which is every beneficial actions (*al-'amal li*

¹⁷ *Ibid.*, p. 282.

¹⁸ Barbara Hooper Sude, “Ibn al-Haytham's Commentary on the Premises of Euclid's Elements: Books I-VI”, Ph.D. Dissertation (New Jersey: Princeton University, 1974), p. 22.

¹⁹ Sude, “Ibn al-Haytham's Commentary on the Premises of Euclid's Elements: Books I-VI”.

kuḥlli nāfi'in), also can be divided into two main branches: firstly, practical sciences pertaining to individual, such as medical science to maintain health, cultivation of morals; and secondly, practical sciences pertaining to a community, such as, management of household (*tadbīr al-manẓilah*), administration of government (*tadbīr al-mudun*), and prophetic politics (*al-siyāsah al-nabawīyah*) by upholding the laws (*al-sunan* and *al-aḥkām*) and providing legal retaliation and punishment (*al-qisās* and *mujaẓāt*).²⁰

Ibn al-Haytham system of classification is laid on the metaphysical foundation which is derived from the worldview of Islām such as the concept of God, the nature of man and nature, the concept of knowledge, the orientation of the science inquiry, etc. The diagram below shows the classification system clearly:

Furthermore, he includes following disciplines into mathematical science:²¹

- Geometry, that is study of properties of mathematical shapes.
- Arithmetics, that is study of properties of numbers.
- Musical composition, that is study of how to compose sounds and harmonics.
- Astronomy (*ʿilm al-hay'ah*).

From four branches of mathematics above, fifteen demonstrative sciences are produced, they are:

- Geodesy (*al-masālah*), utilized to measure length, area and volume of things.
- Accounting (*ʿilm hisāb al-mu'āmalāt*), this is the science that is used for commercial transactions, their business deals, and is also used in the *nine Indian numeral* system.
- Algebra (*al-jabr wa al-muqābalah*).
- The science of calculating inheritance share (*farā'id*) and wills (*waṣāyā*).
- Optics (*ʿilm al-manāẓir*).
- The science of weights (*ʿilm al-atḥqāl*).
- The science of problem solving in mathematics to find the unknown

²⁰ al-Ṭālibī, "Kitāb Thamarah al-Ḥikmah li Ibn al-Haytham Dirāsah wa Taḥqīq", p. 289.

²¹ *Ibid.*, p. 291; Ibn al-Haytham, "Maqālah li al-Ḥasan ibn al-Ḥasan ibn al-Haytham Fī al-Ṭahlīl wa al-Tarkīb", in *Ibn al-Haytham: ʿālim al-bandasah al-riyāḍīyah*, ed. by 'Alī Ishāq 'Abd al-Laṭīf (Ammān: Manshūrāt al-Jāmi'ah al-Urduniyyah 'Imādah al-Baḥth al-'Ilmiyy, 1993), pp. 333–47.

(*al-maṭlūb*) in geometrical problems.

- The science of mechanical devices (*‘ilm al-ḥiyal*). *ḥiyal* is mechanical devices which is moved by their own mostly using water power.
- The science of configuration of heavenly and earthly bodies, and number of celestial bodies, its size and distance from earth. This kind of science is called *‘ilm al-hay’ab*.
- The science of observation of the moon, the sun, and planets, the science of making observation devices, measuring distance and period of revolution of planets, and the science of making astronomical tables (*ẓij*).
- The science of time determination by shadow using tool called sundial (*rakḥāmāt*), so the specific times during both day and night can be determined.
- The science of measuring spherical surface area and making astrolabe and other astronomical devices.

The science of determining day and night times using water-powered devices and other marvel devices.

- The science of composing melodies (*al-alḥān*).
- The science of construction, including how to construct building, bridge, dam, water gate, how to excavate, and how to construct irrigation system.

Ibn al-Haytham states that the ultimate purpose of *al-ḥikmah* is to understand the wisdom of God, to remember Him in all his creation, and to cultivate faith in Allāh as a God, Lord, Creator, the All-knowing, and the Exalted one:

“...because this treatise is sufficient to enter this science (geometry) by studying its roots and continuing into the branches. And from logic one will reach the natural sciences (*ṭabī‘ī*) that is *al-ḥikmah*, its foundations, its reasons, and its causes, until he reaches metaphysics (*ilāhiyah*) from which he will understand the wisdom of God The Exalted (*al-ḥikmah Allāh Ta‘āla*), remembering Him in the organization of the heaven and the earth as well as all that is between. Therefore, one should cultivate his faith in (God) The Creator, The Worshiped God, The Most High, The Most Wise, The Almighty, The All-knowing.”²²

²² al-Ṭālibī, “Kitāb Thamarah al-Ḥikmah li Ibn al-Haytham Dirāsah wa Taḥqīq”, p. 309.

From his explanation, it is clear that he classifies firstly based on theoretical ('*aqliyyah*) - practical ('*amaliyyah*) divisions; secondly, he classifies based on the hierarchy or degree of existence (*marātib al-mujūd*) in which he places metaphysics i.e. God as ultimate reality and ultimate goal for the seekers of knowledge. From this point of view, it is obvious that Ibn al-Haytham classifies knowledge ontologically and axiologically rather than religious-worldly categorical or epistemological classification. Consequently, he includes some religious sciences into one of the branches of *al-hikmah*, such as the islamic inheritance law (*farā'id*) as mathematical science. He also uses mathematics as a tool to solves religious matters such as how to determinate right direction of *qibla* from which reflected by his works: *Maqālah fī Istikbrāj Samt al-Qiblah fī Jamī' al-Maskūnah* (Treatise on Deriving the Direction of the Qiblah from the Whole Place), *Maqālah fīmā Tad'ū Ilayhi Hājab al-Umūr al-Shar'iyyah min al-Umūr al-Handasiyyah* (Treatise on Which is Required by Shari 'ah Matters from Geometrical Matters and Cannot be Avoid With),²³ *Maqālah Samt al-Qiblah bi al-ḥisāb* (Treatise on the Direction of the Qiblah by Calculation).²⁴

However, he also classifies knowledge epistemologically. It can be said that this is the second mode of his classification. He asserts that religious science is different from mathematical science due to the sources and the method of acquiring knowledge:

“From the statements made by the noble Shaykh, it is clear that he believes in Ptolemy's words in everything he says, without relying on a demonstration or calling on a proof, but by pure imitation (*taqlīd*); that is how experts in the prophetic tradition have faith in Prophets, may the blessing of God be upon them. But it is not the way that mathematicians have faith in specialists in the demonstrative sciences (*al-'ulūm al-burhānī*)”²⁵

Moreover, he also recognizes human senses as a tool for acquiring empirical sciences, and observation as well as experiment as method of proof.²⁶ From these facts, it is obvious that Ibn al-Haytham recognizes

²³ Ibn Abī Uṣaybi'ah, *Uyūn al-Anbā' Fī Ṭabaqāt al-Atibbā'*, p. 509.

²⁴ *Ibid.*, p. 514.

²⁵ Quoted by Roshdi Rashed, “The Celestial Kinematics Of Ibn Al-Haytham”, *Arabic Sciences and Philosophy*, vol. 17, no. 1 (2007), p. 11.

²⁶ Muhammad Saud, *The Scientific Method of Ibn Al-Haytham* (Islamabad: Islamic Research Institute, International Islamic University, 1990), p. 18.

three sources and methods of acquiring knowledge: true report based on authority, reason, and sound senses.

In general, Ibn al-Haytham's classification of knowledge is well-known in history of Islamic philosophy and among Muslim philosophers. For example, al-Fārābī classifies knowledge ontologically based on the degree of existents or beings (*mawjūd* pl. *mawjūdāt*). The degree of beings are: 1). God; 2) The angels; 3) The celestial bodies; 4) The terrestrial bodies.²⁷ Based on those hierarchy, al-Fārābī classifies knowledge as follows:²⁸

- Science of language (*'ilm al-lisān*);
- Logic (*'ilm al-manṭiq*);
- Mathematical sciences (*'ulūm al-ta'ālīm*). The including arithmetics, geometry, optics, astronomy, music, The science of mechanical devices (*'ilm al-ḥiyāl*), the science of weight (*'ilm al-athqāl*);²⁹
- Physics or natural science (*al-'ilm al-ṭabī'ī*);
- Metaphysics (*al-'ilm al-ilāhī*);
- Political science (*al-'ilm al-madani*);
- Jurisprudence (*'ilm al-fiqh*);
- Dialectical theology (*'ilm al-kalām*)

Al-Fārābī states that the purposes of the system of classification is “to enumerate the generally known sciences one by one and to give a general survey of each one of them”.³⁰ By this he means that the hierarchy moves from the most intelligible and sensible knowledge, i.e. mathematics and physics, to the knowledge that are not able to understand only by the intellect and senses i.e. metaphysics. It implies by this classification that the hierarchy is intended for students as a guide for seeking knowledge step by step. Like Ibn al-Haytham, al-Fārābī also emphasizes the importance of logic as a tool for all intellectual sciences. He compares the importance of logic to intellect as the importance of

²⁷ Bakar, *Classification of knowledge in Islam*, p. 96.

²⁸ *Ibid.*, pp. 121–4; Chejne, *Ibn Ḥazm al-Andalusī wa mawqifuhu min al-'Ulūm.*, pp. 85–6.

²⁹ Abū-Naṣr Muḥammad Ibn-Muḥammad al-Fārābī, *Iḥṣā' al-'ulūm* (Beirut: Dār wa al-Maktabah al-Hilāl, 1996), pp. 49–65.

³⁰ Chejne, *Ibn Ḥazm al-Andalusī wa mawqifuhu min al-'Ulūm.*, p. 86.

grammar to language, as prosody to poetry.³¹

Even though there are similarities in terms of intention of the classification as a guide for the seekers of knowledge, there is slight difference between al-Fārābī's classification and that of Ibn al-Haytham. Al-Fārābī mentions religious sciences by name such as *'ilm al-fiqh* whereas that of Ibn al-Haytham tends to merge some of religious sciences, e.g., *farā'id* into mathematics. Generally, the main feature of Ibn al-Haytham's system of classification is the same as that of al-Fārābī's. However, there are some differences such as Ibn al-Haytham does not mention explicitly the science of jurisprudence (*'ilm al-fiqh*) probably because he includes this particular science into politics, economics, and administration of government. Ibn al-Haytham, for some reason, also does not single out the science of language in his system of classification. In the case of optics, even though both al-Fārābī and Ibn al-Haytham place this particular science under mathematical sciences, unlike al-Fārābī, Ibn al-Haytham states that without physics, mathematics alone will not be able to solve many problems in optics:

“Our subject is obscure and the way leading to knowledge of its nature difficult; moreover, our inquiry requires a combination of the natural and the mathematical sciences. It is dependent on the natural sciences because vision is one of the senses and these belong to natural things. It is dependent on the mathematical sciences because sight perceives shape, position, magnitude, movement and rest, in addition to its being characterized by straight lines; and since it is the mathematical sciences that investigate these things, the inquiry into our subject truly combines the natural and the mathematical sciences.”³²

As far as we are concerned such approach and treatment on optics are a novel method in scientific inquiry. Ibn al-Haytham for the first time uses and combines both mathematical method and observational verification to prove a scientific hypothesis, which signifies the birth of so-called the modern scientific method.

Ibn al-Hazm classification of knowledge is more based on

³¹ Farābī, *Iḥṣā' al-'ulūm*, p. 28.

³² Ibn al-Haytham, *The Optics of Ibn al-Haytham. Books I-III, On direct vision*, ed. by A.I. Sabra (London: Warburg Institute, University of London, 1989), p. 4.

epistemology point of view. His classification is given as follows:³³

- Religious law (*shari'ah*), including *kalām*, *fiqh*, and *hadith*;
- Science of language;
- History (*akhhbar*);
- Astronomy (*'ilm al-nujūm*);
- Arithmetics and mathematics in general (*'ilm al-'adad*);
- Logic (*'ilm al-mantiq*);
- Medical science (*'ilm al-ṭibb*);

According to Ibn al-Ḥazm, each discipline is related to one another. Religious sciences, although are different with so-called worldly sciences but still they are interrelated. For instance, religious sciences such as *farā'id* and determination of *qibla* for prayer require mathematical sciences. Therefore, one should not underestimate any particular sciences as long as it is beneficial.³⁴ In the other hand, philosophical sciences (*'ulūm al-awā'il*) are not superior to religious sciences due to the fact that every particular science has own limitations.³⁵ From what Ibn al-Ḥazm explains, even though there are some sort of differences between his classification of knowledge and that of Ibn al-Haytham in term of epistemological point of view, but both are in agreement in term of the integrality of knowledge and the interrelation between each discipline. They also not regard religious or revealed sciences as opposition to so-called worldly or rational sciences, i.e. dualism. In fact, this two sort of knowledge are complement one another. The main feature that distinguishes Ibn Ḥazm's classification of knowledge from that of Ibn al-Haytham is in Ibn Ḥazm's classification the religious-intellectual classification is obvious whereas in that of Ibn al-Haytham's is not except in his second mode of classification.

As for Ṭūsī, following Aristotle,³⁶ he divides philosophy into two categories: the theoretical and the practical. The theoretical part consists of metaphysics, mathematics, and natural sciences whereas

³³ Anwar G. Chejne, "Ibn Hazm's Maratib Al-'Ulum", in *Ibn Ḥazm al-Andalusī wa maṣqifuhu min al-'Ulūm*. (Chicago: Kazi Publ, 1982), p. 204.

³⁴ *Ibid.*, pp. 206–8.

³⁵ *Ibid.*, pp. 212–3.

³⁶ Shephenson, "The Classification of the Sciences according to Nasiruddin Tusi", p. 335.

the practical part including ethics, economics, and politics.³⁷ Aristotle classifies philosophy into three parts: the theoretical, the practical, and the productive. The theoretical part comprises mathematics, physics, and theology. He states:

“Thus there are three theoretical sciences, mathematics, physics, theology (for if the divine is present anywhere, it is in such objects), and the highest science must deal with the highest objects. The theoretical sciences are the highest of the sciences, and this is the highest of the theoretical sciences.”³⁸ Where the productive includes discipline such as poetics, and the practical consists of three branches: ethics, economics, and politics.³⁹

As we see above, Ṭūsī's classification of knowledge is comparable to that of Ibn al-Haytham's.

The main reference of the al-Ghazālī's classification of knowledge is his work *Ihyā' 'Ulūmiddīn*, in particular *Kitāb al-'Ilm* section.⁴⁰ Unlike Ibn al-Haytham, al-Fārābī, and al-Ṭūsī, as well as Ibn Ḥazm, the classification of knowledge of al-Ghazālī is more various. He gives more than one bases for the classification system. For example, he classifies sciences based on *farḍ 'ayn-farḍ kifāyah*, based on which are of those sciences are required by every individual the most, based on how the knowledge are acquired (*mu'āmalah-mukāshafah*), and based on the nobility of each science, as well as based on the sources and channels of knowledge.⁴¹ The main feature of al-Ghazālī's method of classification is based on a philosophy that due to the fact that every human age is short and limited, one should prioritize the most important sort of knowledge required for his salvation in this world and the hereafter. Therefore, he divides knowledge into two main categories based on its sources: *'ulūm al-shar'īyyah* and *'ulūm ghayr al-shar'īyyah*.⁴² The former is a type of knowledge mainly based on and originated from revelation (The Holy *Qur'ān*) and prophetic

³⁷ *Ibid.*, pp. 334–5.

³⁸ Aristotle., *Aristotle's Metaphysics*, ed. by W.D. Ross (Oxford: Clarendon Press, 1924), p. 351.

³⁹ *Ibid.*, p. 353.

⁴⁰ Abū Ḥamīd al-Ghazālī, *Ihyā' 'Ulūmiddīn li'l- Imām al-Ghazālī*, vol. 1 (Semarang: Karya Toha Putera), pp. 17–29.

⁴¹ Bakar, *Classification of knowledge in Islam*, p. 203.

⁴² al-Ghazālī, *Ihyā' 'Ulūmiddīn li'l- Imām al-Ghazālī*, 1: 17.

tradition (*al-ḥadīth al-nabawīy*) whereas the latter is sort of knowledge acquired by reason called intellectual sciences. Moreover, he divides the *'ulūm al-shar'īyyah* into four categories: the fundamental principles (*usūl*), the branches (*furū'*), the introductory sciences (*muqaddimāt*), and the complementary sciences (*mutammimāt*), as for the *'ulūm ghayr al-shar'īyyah* he also divides into four parts: mathematical sciences (*bandasah wa ḥisāb*), logic (*mantiq*), metaphysics (*ilāhiyāt*), and natural sciences (*ṭabī'īyyāt*).⁴³ This classification may be listed as follows:

1. *The religious sciences ('ulūm al-shar'īyyah)*

- The fundamental principles (*usūl*): the Holy Qur'ān, the prophetic traditions, the consensus, and the tradition of the companions of the prophet,
- The branches (*furū'*);
 - Concerning to worldly affairs, such as fiqh including: The science of religious rites;⁴⁴ The political sciences, the science of business transaction,⁴⁵
 - Concerning to the hereafter, such as the science of the purification of the heart and refinement of the moral qualities (*'ilm al-akhlāq*).
- The introductory sciences (*muqaddimāt*), such as the linguistic sciences, the science of writing, etc.
- The complementary sciences (*mutammimāt*) such as the principles of jurisprudence *uṣūl al-fiqh*, the science related prophetic traditions, *qirā'ah*, and so on.

2. *The intellectual sciences ('ulūm ghayr al-shar'īyyah)*

- Mathematical sciences (*bandasah wa ḥisāb*);
- Logic (*mantiq*),
- Metaphysics (*ilāhiyāt*);
- Natural sciences (*ṭabī'īyyāt*).

Al-Ghazālī elucidates more on the natural sciences (*ṭabī'īyyāt*) in his another renowned work *The Incoherence of the Philosophers* (*Tahāfut al-Falāsifah*). He includes physics, meteorology, mineralogy, medicine,

⁴³ *Ibid.*, 1: 23.

⁴⁴ *Ibid.*, 1: 18.

⁴⁵ *Ibid.*

physiognomy, the science of the interpretation of dreams, alchemy, and so on.⁴⁶

There are some differences between al-Ghazālī's system of classification and that of Ibn al-Haytham's, especially in the first mode of Ibn al-Haytham's classifications. However, the most distinguished feature between the two is the basis of the classification. It is obvious that the basis of the al-Ghazālī's system of classification is the classification of *'ulūm al-shar'īyyah* - *'ulūm ghayr al-shar'īyyah* or religious-intellectual distinction. Although Ibn al-Haytham recognize this distinction as well in his second mode of classification, it is vague in the first mode. In addition, al-Ghazālī includes logic as a branch of philosophy, whereas for Ibn al-Haytham logic is a philosophical tool for distinguishing truth (*sidq*) from falsehood (*kidhb*) in statements, true (*al-ḥaqq*) from false (*al-bāṭil*) in doctrines, and good (*al-khayr*) from evil (*al-sharr*) in deeds.⁴⁷ For Ibn al-Haytham one should master logic and geometry in order to understand the whole branches of philosophy. The reason is that by mastering logic and geometry one will be able to present demonstrative proof (*burhān*) which is essential in most of the philosophical sciences.⁴⁸ Therefore, according to Ibn al-Haytham, logic and geometry are preliminary skill for all philosophical sciences.

It is worth noting that like al-Ghazālī, who includes political science into religious sciences,⁴⁹ Ibn al-Haytham calls political science as *al-siyāsah al-nabawīyah*. Although he does not clarify the concept any further, it is possible that the meaning of the term is every political practice that follows prophetic traditions i.e. *al-siyāsah al-shar'īyyah*.

As we have seen above, Ibn al-Haytham's method of classification is more ontological rather than epistemological. This method was also used by many muslim philosophers, such as al-Ṭūsī and al-Fārābī, as we have noticed above. This is obvious, due to the fact that most of the

⁴⁶ Abū Ḥamīd al-Ghazālī, *The Incoherence of The Philosophers: Tabāfut al-falāsifah*, trans. by Michael E. Marmura. (Provo, Utah: Brigham Young University Press, 2000), pp. 161–3.

⁴⁷ al-Ṭālibī, "Kitāb Thamarah al-Ḥikmah li Ibn al-Haytham Dirāsah wa Taḥqīq", pp. 290–1.

⁴⁸ *Ibid.*, p. 291.

⁴⁹ Bakar, *Classification of knowledge in Islam*, p. 222.

philosophers in some extents adopt Aristotelian system of classification. Another prominent philosopher who also adopts Aristotelian classification is Ibn Sīnā. He also divides *al-ḥikmah* into theoretical-practical categorization,⁵⁰ and he also branches the theoretical philosophy into mathematics, physics, and metaphysics.⁵¹ As for the practical, like Ibn al-Haytham, he classifies it into three aspects: pertaining to an individual that is the science of *akhlāq*, to a group of individuals such as economics (*tadbīr al-manẓilah*), and the political sciences.⁵²

Aristotle divides philosophy into three categories, they are: the theoretical, the practical, and the productive. The theoretical consists of mathematics, physics, theology:

“Thus there are three theoretical sciences, mathematics, physics, theology (for if the divine is present anywhere, it is in such objects), and the highest science must deal with the highest objects. The theoretical sciences are the highest of the sciences, and this is the highest of the theoretical sciences.”⁵³

However, like many other muslim philosophers, Ibn al-Haytham is not blindly follows Aristotelian philosophy. In fact, he differs with Aristotle in many key concepts, but the most important is on the concept of God as we have seen in his statement above. Ibn al-Haytham’s concept of God is projected from the worldview of Islam, whereas the concept of “God” in Aristotelian lore is depicted as a passive God and careless. He only care about and ponder upon himself. Moreover, Aristotelian God is not the God who creates the universe,⁵⁴ which is opposed to the concept of God in islamic view and in all major religions belief in general.

D. Concluding Remarks

Ibn al-Haytham’s classification of knowledge is more ontological

⁵⁰ al-Ḥusayn b. ‘Abd Allāh Ibn Sīnā, *Tis‘ Rasā’il fī al- al-Ḥikmah wa al-Ṭabī’yyāt* (Cairo: Dār al-‘Arab li’l-Bustānī, 1989), p. 105.

⁵¹ Ibn Sīnā, *Tis‘ Rasā’il fī al- al-Ḥikmah wa al-Ṭabī’yyāt*.

⁵² *Ibid.*, p. 107.

⁵³ Aristotle., *Aristotle’s Metaphysics*, p. 351.

⁵⁴ Étienne Gilson, *God and Philosophy* (New Haven: Yale University Press, 1944), p. 33; Janet Martin Soskice, “Love and Reason”, in *Philosophers and God: At the Frontiers of Faith and Reason*, ed. by John Cornwell and Michael McGhee (New York: Continuum, 2009), p. 84.

than epistemological. However, besides this particular mode of classification, Ibn al-Haytham is also known in another point of view of classification which is more epistemological based on the sources and channel of knowledge. This two mode of classification signifies that Ibn al-Haytham does not discount any kind of branch of knowledge as long as it has benefit to man in order to achieve the ultimate purpose of studying *al-ḥikmah* that is being a “perfect man” (*al-insān al-tāmm*).⁵⁵

It is noticed that Ibn al-Haytham tries to integrate all kinds of disciplines including revealed knowledge as well as Greek philosophy and sciences. It is also apparent that Ibn al-Haytham attempts to integrate and to shape greek philosophy and sciences within the worldview of Islām. He acknowledges three sources and methods for acquiring knowledge that are reason, senses, and revelation. Furthermore, he also emphasizes the right method and source for each kind of knowledge. In addition, for Ibn al-Haytham the ultimate purpose of the study of natural phenomena is to understand the wisdom of God and not limited into some narrow-pragmatical purposes.

It is worth noting that Ibn al-Haytham not only classifies knowledge but also produces copious works in accordance with his classification. As we have noticed, according to Ibn Uṣaybi‘ah lists,⁵⁶ Ibn al-Haytham has written more than 182 works encompassing logic, mathematical sciences, natural sciences, accounting, medical sciences, political sciences, Kalām, and metaphysics. It is evident that his variety of works reflects his philosophical understanding of the knowledge as for Ibn al-Haytham one should strive to seek every true knowledge and to perform every beneficial action (*al-ḥikmah*) in order to achieve the highest rank as a perfect man (*al-insān al-tāmm*) as stated before; consequently, one is urged to explore all branches of true and beneficial knowledge as wide as possible. Because for Ibn al-Haytham the perfection of man can only be accomplished if one can provide what is needed by his rational soul (*al-naḥs al-nāṭiqah*) that is the knowledge about all the realities of existents (*ḥaqā’iq al-manjūdāt*).⁵⁷

⁵⁵ al-Ṭālibī, “Kitāb Thamarah al-Ḥikmah li Ibn al-Haytham Dirāsah wa Taḥqīq”, p. 288.

⁵⁶ Ibn Abī Uṣaybi‘a, ‘*Uyūn al-Anbā’ fi ṭabaqāt al-Aṭibbā’*’, pp. 508–15.

⁵⁷ al-Ṭālibī, “Kitāb Thamarah al-Ḥikmah li Ibn al-Haytham Dirāsah wa Taḥqīq”, p. 289.

Therefore, the nexus between the concept of classification of knowledge and the concept of human perfection becomes apparent.

From what we have discussed above, it is obvious that Ibn al-Haytham is not only a great scientist but also a philosopher even though we could not scrutinize his works due to the fact that most of his philosophical opuses were lost.

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