"Aesthetic in Alhazen's *Kitāb al-manāẓir*"

Hasan Bolkhari Ghehi

Associate Professor of University of Tehran

Abstract   Abū □ Alī al-Hasan ibn al-Haytham, also known in the West as Alhazen[1] is one of the greatest researchers of Optic concept in all the centuries, according to George Sarton (Sarton, 1967:704). His greatest work, *Kitāb al-manāẓir*" (*Treasury of Optics*), had a major influence not only on 13th-century thinkers such as Roger Bacon but also on later scientists such as the astronomer Johannes Kepler (*Britannica encyclopedia*. Ibn al-Haytham). Furthermore, the definition of beauty which had come into spotlight in Greek philosophy by attempts of Plato (Such as *Hippias Major* & *Phaedrus*) was well and deeply reexamined in explorations of Alhazen in optic under his inductive and experimental method. His researches had a great influence on the attitudes of the Westerners toward beauty in late middle ages and renaissance. This paper has taken into consideration the comprehensive definition that Alhazen has given on beauty in his book "*Kitāb al-manāẓir*". His definition promised the foundation of a kind of Islamic aesthetics, but no thinker in Islamic civilization followed his way except Kamal al Din Farsi[2] in "*Kitab Tanqih al-Manazir" (The Revision of Ibn al-Haytham's Optics)*, while the Western thinkers followed his way through translating "*Al-manāẓir*" in 1272. In his studies, Umberto Eco has adequately explained such definition and although he attributes the researches to Witelo[3] (not Alhazen) nowadays it has become clear that the main body of Witelo's "*Perspectivae*" was famous book of Alhazen. The outstanding feature of Alhazen's opinion about beauty is that his theory is a combination of two objective and subjective approaches toward the meaning of beauty.

Keywords   Aesthetic, Islamic studies, Alhazen, *Al-manāẓir*, Kamal al Din Farsi

1. Introduction

Alhazen is among the first ones, who discussed about beauty in a field aside from philosophy as its official field. He also enjoys a high rank in the field of Islamic civilization.

According to Ibn Abī Usaybi□ a[4] (□ *Uyūn ul-Anbā*□ *fī Ṭabaqāt ul-Aṭibbā*□ or *Lives of the Physici),* he was the most active, hardworking and devout scientist in the world of Islam (Ibn Abī Usaybi□ a and Mustafa Nazif Beik[5] consider him a proper pioneer of experimental scientists. He had a unique role in proper explanation of Optic and significant advancement of perspective science in both eastern and western civilizations.

He began to write his important works including *Al-manāẓir* as of the early years of 11th century A.D., which was contemporary with the lifetime of Avicenna[6], who had already spoke on beauty in *Al-shafa* and his other works. Just before him, al-Farabi in "*Al-Madina al-Fadila*"[7] and Brethren of Purity[8] (Ikhwan al-Safa) in "*Rasa'il Ikhwan al-safa*" had spoken of beauty.

But Ikhwan al-Safa and other philosophers in the fields of philosophy and wisdom had analyzed the meaning of beauty almost similar to the views of Greek philosophers. In a metaphor, Avicenna considered beauty as discipline, composition and right degree *(Al- Rasale "Fi al Eshgh"f "The treatise of the love").*

By dividing soul to animal soul and intelligent soul he believed that sense of loving beauty in animal soul was instinctive while it was logical in intelligent soul. In Avicenna's view point a logical beauty meant perception of approaching the beloved. Al-Farabi[9] as well, ranked beauty in the same level with perfection. From his point of view the more a being got closer to perfection the more it would become beautiful. Ikhwan al-Safa as the first authors of encyclopedia in Islamic civilization were under influence of the Greek approach especially the Pythagoras and Aristotle one in defining beauty[10]. They believed that the beauty of natural creatures was resulted from good discipline and composition of their parts.

Therefore, until early years of the 11th cent. A.D., beauty in Islamic civilization was thought to be under the influence of Greek philosophy and in the author's point of view almost under the influence of verses of holy Quran and the prophet's traditions in the fields of philosophy and wisdom. But Alhazen provided a new vision on beauty, just in an area other than philosophy that had a great effect on the Westerners' aesthetic approach after translation of his book in 1272 A.D.

By centering Alhazen's *Al-manāẓir* book, this paper is intending to deal with meaning of beauty in Islamic thought, the very meaning that Abdelhamid I. Sabra, a professor of

Harvard University, finds as the more comprehensive definition of beauty in Islamic civilization.

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But before doing that, it is essential to have an introduction to the research method of Alhazen and the kind of his approach in analyzing the concepts which was quite a new and so wisely one. This very approach led him to very important and precise concept in perspective and discovery of the dark room.

He, for instance, in his studies discovered that darkness would start when the sun began to descend from the horizon line with an angle of 19 degree. Comparing to the latest computations by modern electronic devices, his computation in ten centuries before shows only one degree of difference!

In his introduction to *Al-manāẓir* he explains his methodology so: "In research and reasoning things should be done gradually and in order. First the premises should be investigated and conclusions should be made cautiously" (Ibn al-Haytham 1983:62). He believed that in expressing the scientific results one should be fair. In advance judgments should be avoided and fact finding should be the main purpose in all judgments and analyses.

His method in dealing with contradictory theories about the same subject was so interesting and modern even by the current latest and prevalent methods. He believed that if we faced two contradictory theories in a research on a subject it would fall in three states. One of them would be right and the other wrong or both wrong or both referring to the same fact. On the third state that he used that in studying impression theory and radius theory, Alhazen believed that there might be some truth in both of them, but some researches might have jumped to conclusion without completing their researches, so the difference between the two theories was just on the surface and more research could indicate that they were both following the same truth. He also emphasized that sometimes disputes on the same subject were resulting from taking different research methods and a deep study of the subject could have solved the disputes (Ibn al-Haytham 1983:61).

Of course his attempts on unifying contradictory theories were under the influence of the most important teaching of School of Baghdad which is the first philosophical school in Islam. That teaching considered the unity of religion and philosophy as a basis or followed a unity approach that, for instance, al-Farabi pursued in "*Kitab al-Jam' bayna ra'yay al-hakimayn*" (*Harmonization of Plato's and Aristotle's Philosophies*) among the viewpoints of Plato and Aristotle. It was the method by which Alhazen studied observing process. He studied two theories of impression and radius in that regard that were famous at that time and by the help of his unique method tried to eliminate the contradictions and use thee common positive points.

On this issue, Ibn al-Haytha said then: "I decided to do my best in observing process and its nature and take a second look at its premises and principles. I begin my research with facts induction and reviewing different states in which subjects are observed and their minor features, furthermore, induction on eyes' features when observing in general and lasting and regular features and malfunctions in particular and separating the features. So I continue my research step by step and in an organized way by analyzing the premises and avoiding incorrect conclusions and on the way I try to be fair and not to follow my personal desires and when we are analyzing the viewpoints of others to distinguish the correct ones from incorrect ones, in fact our main purpose is finding the truth not supporting the viewpoints of others" (Ibn al-Haytham 1983:62).

Then he adds: "I hope my method would gradually lead me to a convincing truth which resolves the disputes and eliminates the ambiguities. Nevertheless, I do believe that I am not protected against the ambiguities and darkness, hidden in human nature but I do my best and seek God assistance in all the stages" (Ibn al-Haytham 1983:62).

It was essential to explain the precise and deep research method of Alhazen in the beginning of the research in order to realize how important his work was. The results of his research and reflecting them in "*Al-manāẓir*" book and then the translation of the book in 1272 A.D. by the Polish Witelo titled "*Perspective*" greatly influenced the scientific and artistic issues in the West. That would be enough just taking a look at the great importance of perspective science in the first art school of the West, which was established by Leon Battista Alberti.[11] Of course, there are some people like Umberto Eco [12] attributing the important comments of Alhazen on beauty to Witelo and finding Whitlow's viewpoints on aesthetics much more interesting but for instance, the examples Eco cites in his book "Art and Beauty in the Middle Ages" all belong to Alhazen and this paper aims to clarify the issue. One thing is clear that the emphasize of Umberto Eco on the great impression of the mentioned viewpoints in his "*Perspective*" that he and the like attribute to Whitlow (while they belong to Alhazen) clearly indicate the great work of Alhazen and his influence on aesthetics science in the West.

Let's make it clear right here that Alhazen never meant to give a plain definition of beauty by his comprehensive research on observing. In analyzing the two prevalent theories on observing, he comes to an analysis combined of both theories and by discovering some details in observing, considers beauty as well but it happens through an experimental approach not a merely philosophical one. In his way, as we mentioned, he began his research by precise analysis of two theories of impression and radius and then came to that conclusion that the reality of observing was not through the exit of something from eyes and combination of that by sunlight and its extension to the visible object as the impression theory demanded nor through the impression of light feature in objects with an image of that in eyes as the radius theory claimed.

He came to such conclusion that observing was not merely perception of color and light of visible object through vision sense but there were other concepts like shape, state (space

orientation), bigness, movement and the like engaged in that act. Of course these factors were not perceived by vision sense but they were perceived by comparison and implications. He did not merely combine the two theories but he created some new concepts in perspective science.

"Ibn al-Haytham's theory of light and vision is neither identical with nor directly descendant from any of the theories known to have previously existed in antiquity or in Islam. It is obvious that it combines elements of earlier theories—owing perhaps more to Ptolemy than to any other writer—but in it these elements are reexamined and rearranged in such a way as to produce something new…. The Optics is not a philosophical dissertation on the nature of light, but an experimental and mathematical investigation of its properties, particularly insofar as these relate to vision." (*Complete Dictionary of Scientific Biography* – 2008).

Alhazen explained and clarified various concepts such as radiation nature, light radiation, the difference between essentially light and accidental light, image formation through re-radiation and refraction of light, the difference between vision perception and vision sense and most importantly analyzing 22 singular factors (such as beauty) enabling vision perception and sense. Among all these concepts, to percept the viewpoint of Alhazen on beauty we will take the 22-singular concepts into consideration.

2. Alhazen's Viewpoints on Stages of Perception

The very interesting point in Alhazen's researches is that by observing objects that have singular concepts such as shape, bigness and movement, soul reaches a perception beyond merely perception of light and color of objects. Likewise, by discussing on this fact that in observing, soul is able to perceive the similarities and dissimilarities of objects, he concludes that perception has stages. He classified them in three groups of mere sensual perception, cognition perception and perception by reasoning.

He believed the first perception would take place by vision senses and cognition perception by recognition of previous knowledge to a certain object (what eyes had already seen and soul recognized that by referring to recollective faculty in re-observing) and the third perception by investigating the visible objects seen by eyes and perception of all the conceptual meanings in them. His words in this regard are so important: "Cognition is not merely a sensation. Vision senses perceive appearance of objects through the images eyes receive from their color and light. So if the recollective faculty feels that it has already seen the object, it begins to remember that. Then it perceives them by cognition.

Next, distinguishing faculty perceives all the meanings in the object already seen (like order, symmetry, asymmetry, difference and a brief of other things that their perception by sensation and cognition is impossible). So some concepts that are perceived by vision senses go through sensation, some through cognition and some through distinguishing

and comparison that are beyond cognition (Ibn al-Haytham 1983:221).

Of course he points to two other levels of perception. In his viewpoint, perception sometimes happens quickly and sometimes in consideration or thoughtfully: "Vision sense perceives objects in two ways: in brief or quickly and in consideration. When the sense focuses on the object, first it perceives the visible appearance and then considers that or does not. If it considers and reaches all the aspects, it perceives it appearance otherwise; it perceives a clear image off that" (Ibn al-Haytham 1983:221).

Alhazen's discussion on details of vision, particularly 22-singular concepts like light, color, distance, state (space orientation), embodiment (depth), shape, bigness, connection, dispersion, static state, toughness, softness, transparency, opacity, beauty, ugliness, symmetry and asymmetry is so broad and important but our discussion is about beauty as one of the concepts discussed by him.

3. Beauty Analysis in Al-manāẕir

According to Alhazen beauty is a concept perceived by vision sense. But what is interesting here is that he considers all the singular concepts effective in beauty perception. In other words, he believes that beauty perception is subject to presence of all the singular concepts in the visible object (like vision sensation and perception). In this way, he neither considers beauty a merely mental issue that its perception is subject to the quality mind confronting a beautiful object nor a complete visible issue that soul plays no role in perception of that. Therefore, he believes in a collecting approach in defining beauty out of two well-known approaches one considering beauty as a quality in perception and the other one a set of features in an object. According to him, beauty is the result of both activity and special perception of soul and a set of factors in the object.

In part 201 of the third chapter from the second article of Al-manāẕir, Alhazen explains the four states of beauty perception as follows:

1) Sometimes, one perceives beauty through the presence of one of the singular concepts (like color) in the object,

2) Sometimes, perception takes place by perception of some singular concepts (not merely one of them) in the object,

3) Sometimes, it takes place by putting some concepts together in mind (not merely in a singular way),

4) Sometimes, beauty perception is resulting from combination and collecting these concepts by mind ((Ibn al-Haytham 1983:315).

So the singular concepts (22 factors) are the main factors of perceiving beauty that motivate soul to percept them sometimes individually and sometimes in groups. Now the question is that how they motivate human to perceive beauty. Alhazen fortunately takes all such factors into consideration one by one.

Light is the first factor. He believes that light alone is able

to motivate beauty sense in human. Sun, moon and stars are beautiful because they have light.

Color is the second factor. He believes that different colors such as purple and other colors make a visual joy. That is why many products like clothes, carpets, tools, blossoms and gardens motivate sense of beauty in human.

Distance or dimension is the third factor. According to him, distance, not by essentially but accidentally motivates sense of beauty in human. For instance, the beautiful faces that carry a scar, fraction or wrinkles, look perfect when they are seen from distant because distance hides their defects (Ibn al-Haytham 1983: 309).

State or situation is the fourth factor. Alhazen believes that sense of beauty is motivated when things are nicely placed together in order. His example in this regard is so illuminating. He says images and writings would look beautiful when there is an order and harmony in their states. He believes if in a handwriting there is no proportion and discipline among letters in terms of order and state, it would not look eye catching and beautiful (Ibn al-Haytham 1983: 309) even the letters are written in a beautiful way individually.

Embodiment is the fifth factor (that most likely means physical embodiment of body organs, objects and persons)[13]. Alhazen beleives that embodiment of bodies (whether humans, animals or objects) naturally motivates sense of beauty. He has not clarified what exactly it means but based on the definition that Kamal al Din Farsi has provided in interpreting "Al-manāzir" and describing the meaning of embodiment used there, it can be understood that embodiment means athletic and fertility of body that motivates sense of beauty in eyes of observer. Using the word Khasbeh (Memorial) in the original text proves such meaning (An Arabic Dictionary*: Almonjed*).

In viewpoints of some thinkers, such application of embodiment in perspective was an opening to make a relation between this science and world of symbols in the Islamic thought and civilization: "Embodiment perception is an indirect perception that mind begins to reach by perceiving surfaces of objects and quality of their interaction with each other. In other words, it receives objects in two-dimension way and by embodiment; mind perceives their three-dimension state. In this way, perspective science is based on 3-dimension objects and that is the same concept that is prevalent in the world of symbols.

As it was already mentioned images have a 2-dimension quality in the world of symbols due to their non-material and abstract quality. Next to the 2- dimension quality of eyes in visual and embodiment perceptions, such 2- dimension images have made scientists and researchers consider imagination faculty and world of symbols as the basis for realization of perspective.

Henry Corbin for instance, calls such science "Mirror Manifestation", a manifestation in which mirror is not merely an essence in which image is an accidental command but "essence of mirror is just a place to manifest images" (Corbin, 1983:18). In his viewpoint, "active imagination" is the full symbol of mirror and plays the same role in manifestation of images that mirror does[14]:

"For this reason, theory of world of symbols is connected to theory of imagination cognition". (Corbin, 1983:18).

By overlooking the perspective that was following realization of outside world and manifesting it in its three dimension[15], Iranian painting placed its base on the discrete classification of image 2-dimension space (based on the 2-dimension quality of world of symbols): "As for the Persian miniature, it is also based on the heterogeneous division of the two-dimensional space involved, for only in this way can each horizon of the two-dimensional surface come to symbolize a state of being as well as a degree of consciousness. And even in those miniatures where there is an integration of space and the creation of a homogeneous space, this whole space is clearly distinguished by its "non-three-dimensional" character from the natural space around it. It is therefore itself a recapitulation of the space of another world and concerns another mode of consciousness.

The law of perspective followed in the Persian miniature, before influence of Renaissance art along with internal factors brought about its decay, is one based on natural perspective, the perspectiva naturalist, whose geometric principles were developed by Euclid and later Muslim geometers and opticians such as Ibn al-Heytham and Kamal al-Din al-Farsi. The miniature remained faithful to the law of this science, and in conformity with the "realism" of the Islamic view did not betray the two-dimensional nature of the surface by making it appear as three-dimensional, as was to happen through the application of rules of "artificial perspective", the *perspectiva artificialis*, during the European Renaissance" (Nasr.1987: pp178-179)

Therefore, Iranian- Islamic painting owned such resources and references in its historical background in science and mysticism. Shape or form is another factor of creating sense of art. In viewpoint of Alhazen, moon crescent looks so beautiful for its so unique shape. The beauty of people, animals, trees and blossoms are for their shapes and appearances.

Umberto Eco attributes all such examples to Witelo without noticing that Witelo had expressed the very viewpoints of Alhazen.[16]

Bigness is another factor for creating sense of beauty. Moon looks beautiful more than stars because it looks bigger and bigger stars look more beautiful than the small ones. Being placed in singular form is another reason for creating beauty. Alhazen claims that stars, lamps and candles look more beautiful when they are placed separately and individually comparing to when they are connected to each other. Individual blossoms look more beautiful than when they are alone rather than when they are in groups. Connection is a reason for creating beauty as well.

Of course it is right on opposition of the previous factor because in some occasions, gardens full of blossoms in groups look more beautiful than gardens with blossoms here

and there. Number is a factor for making beauty as well. For instance, the areas in the sky with more number of stars look more beautiful than the areas with less number of stars.

Movement is another factor. What Alhazen cites as an example here is so interesting. According to him, the essence of movement of a dancer and many movements and signs of human in his words and acts creates beauty. Static state is another factor and dignity is the example Alhazen cites for this factor. A dignified behavior of human makes beauty. The other factor is violence or toughness. This strange viewpoint of Alhazen indicates that some clothes and carpets that are tough look beautiful and that is probably in the opposition of the next coming factor which is softness and fineness and that is why fine clothes and polished things motivate human sense of beauty.

Transparency is another factor that makes, for instance gems and jewelries look more beautiful. Opacity is another factor. Alhazen believes that if the colors, lights and shapes that are in visible objects are not placed in a dim and murky background their beauty cannot be perceived (an emphasis on the contradiction of background and color that is an important factor in effect of paintings' aesthetics).

Shadow expresses beauty as well. The point is that up to here Alhazen was using the word of creating beauty but for this factor he uses the word expression: "the faces with scars, wrinkles and ugly fractions and look ugly, may look beautiful if they stay under poor light and shadows because they hide the ugliness and manifest beauty while strong lights or sunlight hide beauty. Likewise, the range of colors seen in feathers of birds like peacocks is due to manifestation of shadow and fractioned lights" (Ibn al-Haytham 1983:310).

Darkness is another factor expressing beauty. For this reason, stars in darkness and dark nights look more beautiful rather than under moonlight and that is why lights, candles and fires are beautiful at nights. Similarity is another factor as well. For instance, similar animal organs or human eyes make beauty. Alhazen believes that the two eyes each in a different shape or different color would look ugly. After similarity, dissimilarity is the other factor to make beauty. Dissimilarity of organs in humans and animals makes beauty and the same is true about images and letters. They would motivate no sense of beauty in human if all the organs are used in an equal way. Here, beauty perception comes out of their dissimilarity.

4. Conclusions

Before discussing about the most important factor for making beauty, that is somehow, the common point among Alhazen the philosophers before him and has a fundamental role in his aesthetical theory, it is essential to notice two points:

Firstly, induction is the ground for Alhazen to prove the presence of such factors in creating sense of beauty. In his viewpoint based on induction, it has become clear that such factors have motivated sense of beauty in human in different states. This concept is remarkable in the beginning of paying attention to the experimental approach in the Western philosophy.

Secondly, in his viewpoint, the presence of such factors is proportional. That is to say such concepts are not making beauty under any state or form but some images are able to do so and some others are not. Consider, for instance bigness which does not create beauty everywhere and sometimes it even makes ugliness or not every color creates beauty by itself.

Therefore, all the above mentioned factors play a role in creating beauty but sometimes in their right states and sometimes individually or in groups. In other words, sometimes such factors motivate sense of beauty individually and sometimes collectively. The important example of Alhazen in this regard is handwriting. If in handwriting all the forms are in order and letters are written appropriately beauty is created, otherwise not. Writing and proportion of colors are the other examples in this regard.

After citing these two points and giving a general description of them, in part 226 of the third chapter of the second part of Al-Manazir, he mentions two more factors of proportion and coalition in addition to the previous 22 factors. These two factors create beauty when visible things consist of various parts and organs. Therefore, to create beauty there should be a proportion between parts and organs of a compound object, otherwise no beauty would come out.

The other point in this area is the emphasis of Alhazen on the proportion of singular concepts to some other ones and their contrast. For instance, if singular concepts such as shape, color and size in objects are equal, their effect in human soul would be ugliness not beauty. Therefore, it is essential that everything look beautiful in proportion of itself and in comparison to other parts.

Meanwhile, Alhazen warns that proportion creates beauty when the parts of a compound object, are not individually ugly, because in that case they cannot create beauty in proportion. Therefore, although the factor of proportion is so important in the effect of beauty, sense of beauty is not merely limited to that.

The end of this part indicates that Alhazen's final definition and interpretation of beauty concept is that beauty as one of the singular concepts is created in perfection out of the very proportion and coalition that take place among the singular concepts.

Therefore, the final Alhazen's final conclusion on beauty is the very well-known and prevalent theory of the Islamic world in those centuries: presence of proportion in visible objects. Of course his unique definition of the truth about vision which made the realization subject to perception of the singular concepts in the form of the visible object could surely motivate no other theory on beauty but the difference between his theory and other Islamic philosophers' on beauty is that this great scientist made his research on beauty in an experimental and scientific ground (not merely a philosophical and wisdom ground) and furthermore he made a thorough investigation about the type of function of soul in

sensation and perceiving beauty. It meant giving a status to soul in perceiving beauty not merely symmetry and proportion of visible things or objects.

This paper comes to an end with another emphasis that Alhazen places ugliness right before beauty and defines that so: "Ugliness is a form empty of beautiful concepts. So the forms lacking the singular concepts whether individually or by symmetry or proportion are deemed ugly. Now if both beautiful and ugly concepts are gathered in the same form, soul perceives the beautiful ones as beautiful and the ugly ones as ugly and that is due to distinguishing faculty that soul enjoys in perceiving concepts" (Ibn al-Haytham 1983: 316).

REFERENCES

[1]   Nazif, Mostafa (1943). Al-Hasan ibn al-Haytham, his optical researches and discoveries (2 Vols.), Cairo, Egypt.

[2]   Ibn al Haytham, (1989). Kitāb al-manāẓir (The optics of ibn al-Haytham) On Direct Vision. English Translation with a Commentary by Abdelhamid I Sabra 2 vols. The Warburg Institute, University of London, U.K.

[3]   Ibn al-Haytham (1983). Kitab al-Manazir Books I-III. Edited with introduction, concordance tables, by A. Sabra. Kuwait: The National Council for Culture, Arts, and Letters.

[4]   Umberto Eco (2002). Art and beauty in the Middle Ages, YALE University Press.

[5]   Nasr. Seyyed Hossein (1987). Islamic Art and Spirituality, Golgonooza Press.

[6]   Sabra, A. I. (2008) [1970–80]. "Ibn Al-Haytham, Abū ☐ Alī Al-Ḥasan Ibn Al-Ḥasan". Complete Dictionary of Scientific Biography. Encyclopedia.com.

[7]   Maluf .Luwis (2002). Arabic Dictionary: Almonjed, Zawel Gorba press, Qom, Iran.

[8]   Farsi, Kamal al Din (1348-1930). Kitab Tanqih al-Manazir (The Revision of the Optics) le-d̲awī al-abṣār wa'l-baṣā☐ er, 2 vols, Hyderabad (Deccan).

[9]   Britannica, Ibn al-Haytham, www.britannika.com.

[10] Corbin. Henry (1983). Face de Dieu, Face de l'homme: Hermeneutique et soufisme. Flammarion. France.

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1 Abū ☐ Alī al-Ḥasan ibn al-Ḥasan ibn al-Haytham, frequently referred to as Ibn al-Haytham (Latinized as Alhazen or Alhacen; c. 965 – c. 1040) was an Arab scientist, polymath, mathematician, astronomer and philosopher who made significant contributions to the principles of optics, astronomy, mathematics, meteorology, visual perception and the scientific method. He has been described as the father of modern optics, ophthalmology, experimental physics and scientific methodology and the first theoretical physicist In medieval Europe, he was nicknamed *Ptolemaeus Secundus* ("Ptolemy the Second") or simply called "The Physicist". He is also sometimes called al-Basri after Basra, his birthplace.

2 Kamal al-Din Hasan ibn Ali ibn Hasan al-Farisi or Abu Hasan Muhammad ibn Hasan (1267– 12 January 131 long assumed to be 1320) was a prominent Persian born in Tabriz, Iran. He made two major contributions to science, one on optics, the other on number theory. Farisi was a pupil of the great astronomer and mathematician Qutb al-Din al-Shirazi, who in turn was a pupil of Nasir al-Din Tusi.

3 Witelo (also Erazmus   Ciolek Witelo; Witelon; Vitellio; Vitello; Vitello Thuringopolonis; Vitulon; Erazm Ciołek; born ca. 1230, probably in Legnica in Lower Silesia; died after 1280, before 1314).

4 Ibn Abi Usaibia (1203-1270), Ibn Abī Uṣ aybi☐ a Mu☐ affaq al-Dīn Abū al-☐ Abbās Aḥ mad Ibn Al-Qāsim Ibn Khalīfa al-Khazrajī), an Arab physician and historian, was born at Damascus, a descendant of the Banu Khazraj tribe and the son of an oculist, and studied medicine at Damascus and Cairo. In 1236 he was appointed physician to a new hospital in Cairo, but he surrendered the appointment the following year to take up a post given him by the amir of Damascus in Salkhad near that city. There he lived and died.

5 Mostafa Nazif Beik ; A contemporary Egyptian author.

6. Pūr Sina☐ (Ṗur-e Sina; [☐ puːr ☐ siːnɑ ː] "son of Sina"; August c. 980 – June 1037), commonly known as Ibn Sīnā, or in Arabic writing Abū ☐ Alī al-Ḥusayn ibn ☐ Abd Allāh ibn Al-Hasan ibn Ali ibn Sīnā or by his Latinized name Avicenna, was a Persian polymath, who wrote almost 450 works on a wide range of subjects, of which around 240 have survived. In particular, 150 of his surviving works concentrate on philosophy and 40 of them concentrate on medicine.

7 Al-Farabi's important book: ārā ahl al-madīna al-fāḍ ila ("*The Virtuous City*").

8 The Brethren of Purity (*ekhw ān alsf ā*, also The Brethren of Sincerity) were a secret society of Muslim philosophers in Basra, Iraq, in the 10th century CE. The structure of this mysterious organization and the identities of its members have never been clear. Their esoteric teachings and philosophy are expounded in an epistolary style in the *Encyclopedia of the Brethren of Purity* (*Rasa'il Ikhwan al-safa'*), a giant compendium of 52 epistles that would greatly influence later encyclopedias. A good deal of Muslim and Western scholarship has been spent on just pinning down the identities of the Brethren and the century in which they were active.

9 Al-Farabi (The Second Teache,r Abū Naṣ r Muḥ ammad ibn Muḥ ammad Fārābī) for other recorded variants of his name known in the West as Alpharabius (c. 872 in Fārāb – between 14 December, 950 and 12 January, 951 in Damascus),   was a renowned scientist and philosopher of the Islamic Golden Age. He was also a cosmologist, logician, and musician.

10 It should be noted that Ikhwan Al-Safa who are among the greatest Muslim scientists are called "Muslim Pythagoreans".

11 Leon Battista Alberti (February 14, 1404 – April 20, 1472) was an Italian humanist author, artist, architect, poet, priest, linguist, philosopher and cryptographer; he epitomized the Renaissance Man. Although he is often characterized as an "architect" exclusively, as James Beck has observed, "to single out one of Leon Battista's 'fields' over others as somehow functionally independent and self-sufficient is of no help at all to any effort to characterize Alberti's extensive explorations in the fine arts." Alberti's life was described in Giorgio Vasari's *Vite de' pi ù eccellenti pittori, scultori, e architettori* or 'Lives of the most excellent painters, sculptors and architects'

12 Umberto Eco, OMRI (Italian: [um☐ ɛ rto ☐ɛ ko]; born 5 January 1932) is an Italian semiotician, essayist, philosopher, literary critic, and novelist. He is best known for his groundbreaking 1980 historical mystery novel Il nome della rosa (The Name of the Rose), an intellectual mystery combining semiotics in fiction, biblical analysis, medieval studies and literary theory. He has since written further novels, including Il pendolo di Foucault (Foucault's Pendulum) and L'isola del giorno prima (The Island of the Day Before). His most recent novel Il cimitero di Praga (The Prague Cemetery), released in 2010, was a best-seller.

13 In interpreting "Al-manāzir", Kamal al Din Farsi defines embodiment as extension of object in triple dimensions that is perceived by some eyes in some objects not all of them (Tanghih Al-manāzir, page 195).

[14] With this difference that mirror manifests the images of the visible world and active imagination does the same for the world of symbols.

[15] The same science that had done so by applying perspectiva artificialis science during the renaissance in the words of Dr. Seyed Hosian Nasr. Dr. Seyed Hosain Nasr, translated by Ghasemian, page 173, Art Religious Studies Publication, Tehran, 1996.

[16] See "*Art and beauty in the Middle Ages*" by Umberto Eco. 1986, Yale university.