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Camera or behind Camera: Ibn al-Haitham vis-à-vis Shaykh Ishraq on Vision

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ABSTRACT

Developing the empirical method based on observation and experiment, Alhazen is considered the greatest Muslim physicist and the most significant figure in the history of optics between antiquity and the seventeenth century. Inventing a camera obscura, Alhazen rebuilt our conception of eyesight. His theory of vision was enormously prominent and much of our understanding of optics and light is based upon his groundbreaking discoveries. He began his criticism of emission by describing what happens when people are exposed to bright lights. No matter what the light source, the effect of bright lights was always the same. What this indicates to Alhazen is that light entering into the eye from an external source had some serious function in eyesight. Respecting observation, experiment and empirical method, Suhrawardi, the father of Illumination School, argues all theories of vision and rejects them just by mere reasoning. Suhrawardi validates his own Illuminationist method by scientists' empirical method. So, I will argue, he is not to deny empirical aspect of Alhazen's theory of vision. In an allegory, I will use the camera, representing the whole process of a human vision, while I use "beyond camera" for the embodiment that allows for the unfolding of a human soul's position in the process of vision. What Alhazen is speaking of, we might call the process within the camera; while what Suhrawardi is speaking of, we could name the process behind the camera.

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1. Issues

During the Islamic Golden Age, a great deal of scientists made the history of humanity heavily indebted. Tracing the development of Muslim civilization, we can observe distinct thinking methods by which improve different facets of society. Being a key scientist of the fifth/eleventh century, Ibn al-Haitham (965 Basrah–1040 Cairo) dramatically developed empirical method based on observation and experiment resulted in which the promotion of sciences and technology. Abu Ali al-Hasan Ibn al-Hasan Ibn al-Haitham, also known by the Latinization Alhazen or Alhacen, was a leading polymath scientist, mathematician, astronomer, who worked in Fatimid Cairo (*al-Fāṭimīyyūn*) during the 11th century under the ruler al-Hakim (Masood, 2009, 121–122). One of his most prominent inventions is deemed his theory of vision on which rests much of our current comprehension of light and optics. It is not obscure that vision was the most important sense for philosophers like Aristotle (322–384 BC). Mentioning in appellation of imagination to a Greek name *phantasia* from *phaos*, he remarks that imagination belongs to the perceiving act the most important of which is vision; and vision is unfeasible wherever light is beyond reach (Aristotle, 1995, 429a1–4). However, the question of what the process of visioning related to light is worth discussing. I will pose the issue against Alhazen as the profound figure of empirical method, also against Suhrawardi (1154 Suhrevard–1191 Aleppo) as the father of intuitive empirical method, each of which posits different theories for vision. That is, Suhrawardi denies all theories of vision including Alhazen's (Suhrawardi, 2002a, 164–179). Giving an account for this divergence, an account of what precisely are their theories is needed. In a chronological order, first follows Alhazen's.

2. Alhazen's Contribution to Vision

Alhazen worked in a range of disciplines and made major contributions to the scientific method as well as optics, mathematics, meteorology, and astronomy. Schramm (1963) in his book *Ibn Al-Haytham's Path to Physics*, increases our knowledge about Alhazen's work as the founder of physics in its modern sense. While Lindberg (1967) develops Alhazen's theory of optics, Rosińska (1986, 38) emphasizes the specific role of Alhazen in mathematics and optics,

> The mere fact that the lecture of optics is preceded by mathematical considerations then use of the data contained in the ledger and to take evidence testifies to Witelo's recognition of the connections existing between mathematics and physics. It is especially visible where it is taken works Alhazen at Wier Optical performance formulated "physically" Witelo gives in mathematical form. Unguru emphasizes another aspect of Witelon's work: in full acknowledgment of between these two teachings, Wite was aware of what It does exist. Hence, mathematics was treated above all as tools in optics.

Alhazen laid many of the foundations for integral calculus, which is used for calculating areas and volumes (Masood, 2009, 145). However mostly, he is known in the West for his works on optics and astronomy, including *The Book of Optics (Kitab al-Manazir), On the Spherical Burning Mirror, On the Light of the Moon,* and *Doubts Concerning Ptolemy.* In *Doubts Concerning Ptolemy* or *Shukūkʿalā Baṭlamyūs*, he raised questions criticizing the elements of Ptolemaic models. In his scientific efforts, Alhazen may well be regarded as an experimentalist who used his abilities to great effect when testing out the theories of the day (Selin, 2008, 1667). Alhazen's main contribution to optics was in suggesting that the mathematics of optics – such as reflection and refraction – need to be consistent with what we know about the biology of the eye.

In addition, as an empirical physicist, Alhazen overhauled our understanding of eyesight, inventing an early imaging device (a pinhole camera or camera obscura meaning "darkened room").[1] His theory of vision was enormously prominent and much of our understanding of optics and light is based upon his groundbreaking discoveries (Masood, 2009, 5, 84, 89–90). Figuring out the mechanisms for sight and the nature of vision are amongst the oldest questions in the history of physics and philosophy. These were of interest to scientists from the Islamic world too, and by the time of the Translation Movement from Greek to Arabic, Ibn al-Haitham was conscious of the leading theories of the day. Perhaps the most popular of these theories of vision was what is now called the emission or extromission theory, whose proponents included Plato. Although our current understanding of vision did not come directly from Alhazen, he was among the first to demonstrate critical flaws in the emission theory (Masood, 2009, 173–175). For this theory, the human eye is able to see objects because the eye releases a special kind of optical energy. This energy can be regarded as being a bit like electromagnetic radiation; it streams ahead out of the eye in pulses, shining a sort of light, which allows humans to see.

The emission theory wasn't without its critics, including Aristotle. The critics of emission theory hold that, instead of a light pulsing out of the eye, our vision is more likely to come from a light that is released from physical objects themselves, which then interacts with the eye. This theory is known as intromission, and is not outlying from our latest knowledge of vision.

[1] "Camera obscura is a very old device. Oldest mention of its effect is by Mozi, Chinese philosopher and the founder of Mohism, during the 5th century BC. He noticed that an image from camera obscura is flipped upside down and from left to right as a result of light's moving in straight line. The Greek philosopher Aristotle noticed in the 4th century that light from a sun eclipse that passes through holes between the leaves, projects an image of an eclipsed sun on the ground. Passing of light in the straight line also noticed Euclid the 4th century BC and Theon of Alexandria in the 4th century AD. Anthemius of Tralles, which designed the Hagia Sophia, used a type of camera obscura in his experiments in the 6th century. Al-Kindi, Arab philosopher, mathematician, physician, and musician, performed experiments with light and a pinhole in the 9th century and proved again behavior of light. All these scientists experimented with a small hole and light but none of them suggested that a screen is used so an image from one side of a hole in the surface could be projected at the screen on the other. First one to do so was Alhazen (also known as Ibn al-Haytham) in the 11th century" (*Photography History Facts*, 2023).

Galen (129– c. 216) had yet another view; he shared the emission idea that the eye emits optical energy, but he also held that our ability to see happens when this energy combines with the surrounding air and with sunlight. Avicenna's critiques of emission were powerful and to a certain extent convincing. However, he was unable to significantly advance our understanding of vision. (Avicenna, 1983, 102) Instead, the job of taking the study of optics to new heights fell to Alhazen. He began his criticism of emission by describing what happens when people are exposed to bright lights. For example, anyone who tries to look directly at the sun feels pain as do those who try to look at the sun's reflection in a mirror. No matter what the light source, the effect of bright lights was always the same. This suggested to Alhazen that light entering into the eye from an external source had some role in eyesight.

Furthermore, he argued, even provided we accepted Galen's view, holding that the eye released a visual energy which interacts with the air, the result of this interaction would need to flow back into the eye so that vision could be registered by the observer's brain. This confirmed that even if we accept emission some form of intromission would be needed for the eye to be able to see.

To try his ideas further, he began to experiment with refraction, which is the bending of light as it passes from one medium to another. For Alhazen, provided vision is what happens when light passes from an object and into the eye, it is likely to bend once it enters the eye. This refracted light could lead to a distorted image, so Alhazen implemented many tests to see if it was possible for light to transfer from one medium to another without being bent.

The crucial insight is that the idea that light travels through transparent bodies in straight lines was confirmed by Alhazen just after years of experiment. His demonstration of the theory was to place a straight stick or taut thread next to the light beam to prove that light goes in a straight line (Guimaraes, 2011, 105; Sambursky, 1974, 136). He explained his method presenting the problem:

> How does light travel through transparent bodies? Light travels through transparent bodies in straight lines… We have explained this exhaustively in our *Book of optics*. But let us now mention something to prove this convincingly.

He stated the fact that light goes in straight lines is clearly observable in the lights entering into dark rooms through holes. And the entering light in the dust which fills the air is visible in a clear and lucid manner (Guimaraes, 2011, 102, 105).

It is thanks to this fashion that Alhazen constitutes one of the key figures in the development of the scientific method (Guimaraes, 2011, 102). The central theme in scientific method is that all evidence must be empirical. In scientific method the word empirical points to the use of working hypotheses that can be tested using observation and experiment (Pickett, 2011, 585).

Alhazen used experimentation to support most of the statements in his *Book of Optics* and grounded his theories of vision, light and color, as well as his research in catoptrics and dioptrics. In effect, he combined observation, experiment and rational reasoning to support his intromission theory of vision, in which rays of light are emitted from objects rather than from the eyes. He used

similar demonstrations to show that the ancient emission theory of eyesight supported by Ptolemy and Euclid, and the ancient intromission theory supported by Aristotle, were both wrong.

Ibn al-Haitham also explained the role of induction in syllogism, and criticized Aristotle for his lack of contribution to the method of induction, which Alhazen regarded as superior to syllogism. Alhazen, in fact, posited that induction is the fundamental prerequisite for accurate scientific research (Plott, 2000, 462).

Alhazen may have been the first scientist to adopt a form of positivism in his approach. He wrote that, we do not go beyond experience, and we cannot be content to use pure concepts in investigating natural phenomena. (Alhacen, 1983, 59-60; See also: Rashed, 2007, 19)

And asserted that the understanding of these cannot be acquired without mathematics. After assuming that light is a material substance, he does not further discuss its nature but confines his investigations to the diffusion and propagation of light. The only properties of light he takes into account are those treatable by geometry and verifiable by experiment (Rashed, 2007, 19; 2016, 25–39; see also: Tbakhi, Amr 2007, 464–467). Alhazen has explained his method himself:

> Whosoever seeks the truth will not proceed by studying the writings of his predecessors and by simply accepting his own good opinion of them. Whosoever studies the works of science must, if he wants to find the truth, transform himself into a critic of everything he reads. He must examine tests and explanations with the greatest precision and question them from all angles and aspects (Alhacen, 1983, 61-62; See also: Masood, 2009, 169).

George Sarton considered Alhazen the greatest Muslim physicist and one of the greatest figures of optics in history (Sarton, 1927, 721). In *Theories of Vision from Al-Kindi to Kepler* another science historian David C. Lindberg said:

> Alhazen was undoubtedly the most significant figure in the history of optics between antiquity and the seventeenth century (Lindberg, 1976, 58).

Of the many other sources describing Ibn al-Haitham as the father of modern optics, M. Ali Kettani said:

> One name stands out as that of a rare genius in physical research: Abu Ali Al-Hasan Ibn Al-Haitham of Basrah, without question the father of modern optics (Kettani, 1976, 140).

3. Suhrawardi's Stand on Vision

Suhrawardi's theory of vision is trackable in his writings and notions around perception which I will discuss in two sections of Avicennian vs. Illuminationist views. As the first section following Avicenna (980–1037), Suhrawardi (1154–1191) considers four human perceptions: sensory perception, imagination, illusion and rational perception (Avicenna, 1983, 51–53; 1986, 344–346;

1995, 277–278; 1985, 102–103; 1984, 23; 1953, 30–33). He explains vision as a sensory perception that is capable of perceiving just the external form of an object and its accidents like position, place, quantity, color, and figure. If the object is not placed in front of the eyes, eyes cannot perceive it, however, imagination is able to perceive the absent beings. Suhrawardi has compared vision and imagination in three aspects of power, separation and permanence, considering imagination atop vision[1] (Suhrawardi, 2002d, 407–410). Vision and imagination are among ten senses of human beings consisting of five inner senses vs. five outer senses. About five inward senses in his different books, Suhrawardi refers to Avicenna and repeats some of his examples (Suhrawardi, 2002b, 179–182; 2002e, 201–203, 111–112; 2002d, 352–355, 130–132, 29–31, 87–88, 227, 249, 278–279, 331). Just in *Hayakel al-Noor*, *motekhayelah* faculty is neglected to mention that I think it might be explained as pen blunder or scribes' fault. Suhrawardi has focused on ten inner senses in his treatise, *A Day with a Group of Sufis*; also in the treatises of *The Red Intellect*, *On the Reality of Love* and *The Shrill Cry of Simurgh* ten senses have been expressed in allegories.

In respect of his Illuminationist opinion about perception in *Hikmat al-Ishraq*, Suhrawardi propounds a different idea from Avicenna's theory on the faculties of imagination, *motekhayelah*, illusion and memory. He refers some of these faculties to others and defines activities for some that result in a new conception (Suhrawardi, 2002a, 500–501). Illuminated imagination theory requires us to discuss about its bases, the most important of which is Suhrawardi's theory of vision. Suhrawardi has expressed his theory of vision in several sections of *Hikmat al-Ishraq*. Afterward he uses the theory to explain Light of all lights' (Nur al-anwar) knowledge (Suhrawardi, 2002a, 376–377), all intelligible (immaterial) lights' knowledge, as well as human beings' external and internal senses (Suhrawardi, 2002a, 502–503). He rejects different views about vision in *al-Mashare and al-Motarehat* and then refers the secret of vision to *Hikmat al-Ishraq* (Suhrawardi, 2002a, 164–179). Discussing all existing theories of vision in the first part of *Hikmat al-Ishraq*, Suhrawardi invalidates all of them including the exit of radius from eyes, reflection, impression, as well as reasoning. Then he considers visible forms and infers that these forms do not exist within the mirror, within the air or within the eyes. Reflection is neither the same object form based on reflection of the mirror radius nor exactly the same object form that is seen except reflection and impression. Forms that the sages assume in eye lenses are in fact the same as the visible forms, that

[1] Suhrawardi considers illusion perception, including meanings regarding the sensible, more powerful than vision and imagination. Yet illusion cannot separate meanings from the sensible and all three kinds of sensory, imaginary and illusion perceptions are physical and cannot be separated from matter. But intellectual perception will find essences as they are. Suhrawardi interprets that intellectual perception can be possessed in the spiritual realm in the blink of an eye. Distinction between human and animal is in this perception that is abstract and its principle is from the spiritual world. Therefore, it can find spiritual substances. Its place is not in the human body but he looks at the body and the invisible world. Intellect is called human rational soul, heart, spirit and psyche too. Because perceptions of vision, imagination and illusion are physical, they can only capture the material world and cannot attain anything in the intellect infinite universe and if they want to find some forms in the world intellect, they can only find it in a physical matter. Vision and even imagination and illusion are all worthless comparing intellectual faculties.

is, those forms are not within the air or lens or …. This is a method to express the reality of vision, visible forms and imagination (Suhrawardi, 2002a, 269–270). However, in the second part of his book *Hikmat al-Ishraq*, Suhrawardi's theory of vision will be more developed. Suhrawardi holds since vision is neither based on visible object form impression in the eyes nor based upon the exit of something from the eyes, it is related just on confrontation between the healthy eyes and the luminous objects. Put another way, three items of healthy eyes, light and confrontation are well sufficient for vision. confrontation means the lack of obstacle between the eyes and objects. Of course, way too distant as well as way too close constitutes an obstacle too. Herein, Suhrawardi puts off spelling out the issue of imagination and the world of images (Suhrawardi, 2002a, 348).[1] Suhrawardi has talked about the reality of vision distinctively as well as negatively but not positively. It is as if he wants to say that vision is just vision and no more. However, in his commentaries, Shahrezoori has added an affirmative description about the reality of vision under the topic of outer senses. He says when there is a confrontation between a vision member and a luminous object, there will be an illuminated intuitive knowledge for soul on the visualized object and then soul will conceive the object intuitively without any intermediary issue or object. This is the whole reality of vision (Shahrezoori, 2002, 489; 2006, 391).

Suhrawardi's theory of vision is the backbone of his theory of imagination. So, his method in developing the theory of imagination is similar to his theory of vision. Shaky Ishraq explains negatively and distinctively what imagination is not. But unlike the debate of vision, Suhrawardi himself will add here a positive notion and affirmative expression in respect of what imagination *is*. Suhrawardi, unlike Avicenna, does not consider imagination as a source of common sense. He concludes that there are no forgotten subjects in human faculties, by studying on reminiscence process, but they are true in the universe of Memoirs, and this universe is under design of Spherical *Esfahbod* lights or Spherical souls that forget nothing and there is no oblivescence in that universe. Shurawardi's argument is that sometimes it is so drudgery to remember a lost issue and there is no success although you tackle a lot. Then you will spontaneously remember the forgotten subject or issue. If the forgotten subject was there in a human's soul or in his physical faculties, it wouldn't be hidden from the rational soul or from the Ruler light, because obstacles cannot keep covering the Ruler light. Imaginary forms that the human will forget are similar and despite Avicenna, Suhrawardi says that the imagination faculty of humans is not the source of imaginary forms. Also, memory faculty is not the source of particular concepts and meanings. Suhrawardi's reasonings are

[1] Given that the impression or the exit of rays is not the necessity of vision and the lack of cover is sufficient to reach to vision, Suhrawardi argues, the knowledge of the Light of lights returns to his vision. Because he is self-manifesting in himself and other beings are constantly apparent even clear for him, since there is no cover against him (Suhrawardi, 2002a, 376–377); and all knowledge of intelligible (immaterial) lights and Lordly lights (Esfahbodie lights) return to their vision (Suhrawardi, 2002a, 503). Suhrawardi's commentators know Esfahbod light and the Ruler light as rational soul. Bahai Lahiji holds Esfahbod means army leader in Pahlavi language and is called Sepahbod (general) in Persian and it is named Esfahbod due to the presidency of rational soul in body and body forces (Bahai Lahiji, 1973, 146).

the same associated with objects as well as concepts. According to him, forgotten imaginary forms are true in the celestial universe and the Ruler light returns those forms from there when you remember the forgotten forms. Of course, Suhrawardi posits that there is a faculty in humans to have reminding and reminiscence capacity (Suhrawardi, 2002a, 502). So, two faculties of memory and imagination are considered just faculties that are capable of accepting the forgotten affairs and lost issues from the celestial universe.

According to Shaykh Ishraq, the imaginary forms and visible forms both are similarly situated. As impression in the eye or brain is impossible, neither the visible forms nor the imaginary forms are impressed. So, the imaginary forms are suspended bodies without any place that mirror and human imagination is a position or a place for their manifestation and because vision is soul intuitive illuminated observing, other appearance and inner senses refer to nature of the Ruler light, who is all-emanating by virtue of its essence and the Ruler light illuminates on imaginary forms and such that namely other appearance and inner senses. *Esfahbod* light illuminates on vision that there is no need to attain the form and its illumination on imagination is the same (Suhrawardi, 2002a, 502–504). Suhrawardi regards imagination as the direct view of Ideal Beings by *Esfahbod* (Lordly) light. Suhrawardi's theory of vision is collatable with his theory of imagination on six sides. First: Sight faculty is a physical faculty and also the soul can see Ideal Beings of the mirrors by that. Imagination faculties are the same in Suhrawardi point of view and are physical, and the soul can see Ideal Beings through it. Second: Vision is qualified to confrontation; imaginary perception is also qualified to confrontation. Third: Vision is done without the intermediate of object form; also, imaginary perception is without intermediate. It means nothing is coming from outside to mind and imaginary forms are suspended ideas that are per se perceiver as objects are per se object perceived. Fourth: In both cases, illuminated intuitive knowledge is resulted for soul. Fifth: In both cases, cognation of perceiver and object perceived is impossible and the Ruler light that is intelligible (immaterial) can see both of the physical objects and suspended ideas (that have incomplete abstract), as in objects perception by Light of lights and Mighty (Qaherah) lights, cognation is impossible. Sixth: Light is conditional in both cases: in vision, the object should be luminous, and in Ideas of mirrors also the light is auxiliary cause. In inner senses, both illumination of intelligible (immaterial) lights and the Ruler light are necessary.

4. Discussion and Conclusion

Alhazen based upon empirical method develops his theory of vision. Suhrawardi admits to validity of observation and empirical method of scientist, utilizing it as a foundation for his own intuitive method (Suhrawardi, 2002b, 13):

> Shahadna al'mahsusat WA ta'yaqqanna min baed ahwaleha, thuma banayna ealayha euluman sahihat kalhayat WA ghayriha. fakadha, nushadhed min

> alruwhaniaat ‘ashya’ thumma nabni ealayha. Wa man laysa hadha sabiluhu falaysa min alhikmat fi shay’ wa sayaleab bih alshukuk (Suhrawardi, 2002b, 13).
>
> We observed the perceptible and became certain of some of their states, then we constructed upon them valid sciences like geometry and others. Similarly, we witness things from spiritualities and build upon them. And whoever does not follow this path is not wise in anything and will be played with by doubts.

Just like we observe the sensory and then based upon it we establish the correct sciences like astronomy, we observe the spiritual based on which we establish the true knowledge. So, the reason why Suhrawardi disputes Alhazen’s theory of vision could be explained by distinction between the vision by the camera and vision by one behind the camera. That is, if we regard our vision as a camera and our soul as who works behind a camera, what Suhrawardi denies in respect of the theories of vision, is not about the process happening inside the camera but is about the soul working behind a camera. Whatever the process inside the camera would be, the real one who sees is our soul whose knowledge on the visualized objects is an intuition without any intermediary issue or object.

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