

# The Philosophy of Visual Perception

Vijay Srinath Kanchi

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## Abstract

Since ancient times, the process of exteroception or sense perception of the external world has caught the imagination of philosophers and scientists across the globe. Several theories have been adduced by philosophers, particularly in India, Greece and the Middle East, which speculate on how the external world is experienced. But for obvious reasons, visual perception occupied the center stage of debate. While the understanding of visual perception took a new turn thanks to Kepler's and Isaac Newton's experiments on light and subsequent development of optics as an important branch of physics, the ancient philosophers had a different understanding of the process of visual perception. They seem to have been more concerned with the subjective role in the whole process of perception rather than on the objective aspect. Recent developments in cognitive neuroscience and parapsychology put forward an interesting argument in favor of underscoring the significance of the role of observer in the phenomena called visual perception. This paper examines the ancient theories of the philosophy of visual perception in light of modern scientific understanding, particularly those of the Sāṃkhya and Vaiṣeṣhika Schools as well as those of the ancient Greeks.

## Introduction

According to current scientific understanding, all perception involves external stimuli received by the sense organs, which are carried to the brain as signals by the nervous system and are ultimately processed and experienced in the brain. For example, vision involves light striking the retina of the eye and forming an inverted image there. Odor molecules coming in to contact with the nerve endings in the nostrils mediate smell, and hearing involves pressure waves striking the eardrums. While reception of external stimuli by the senses constitutes only the sensation, percep-

tion on the other hand involves the active participation of the mind and is shaped by learning, memory, expectation, and attention.<sup>1</sup> The contribution of mind to the process of perception is sometimes referred as the "top-down" effect, whereas the "bottom-up" process refers to the processing of sensory input that transforms low-level information to higher-level information, such as extracting shapes and recognizing objects. Since the process of perception takes place outside conscious awareness, even though it involves complex functions of the nervous system, subjectively, it seems mostly effortless.

Visual perception, also known as eyesight, sight, or vision, is the ability to interpret the surrounding environment by processing information that is contained in visible light.<sup>2</sup> Of all our sensory experiences, visual perception based on the sense of sight is the most significant. Antonio Zamora asserts that: "Sight is probably the most developed sense in humans, followed closely by hearing."<sup>3</sup> "Research estimates that 80 to 85% of our perception, learning, cognition and activities are mediated through vision."<sup>4</sup> A study conducted by the U.S. Department of Labor in May 1996 suggests that 83% of human learning occurs visually.<sup>5</sup> Owing to the primacy of the sense of sight over other senses, philosophers across the

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## About the Author

**Dr. Vijay Srinath Kanchi** is a triple Postgraduate in Philosophy, Education and Library and Information Science. He obtained his Ph.D. in Philosophy based on his research on dream consciousness and its ontological and epistemological implications. He is presently pursuing his second Ph.D. on manuscript conservation. Dr. Kanchi has authored numerous books, including a translation and commentary (in English) of *Sri Sita Ramanjaneya Samvadam*, a rare treatise on Yoga. His books, *Sleeping to Dream and Dreaming to Wake Up* and *A Long Pilgrimage* are soon to be published.

world have always taken great interest in the process of visual perception, and many theories were adduced to explain this process. Even today, there is no unanimity among philosophers, neuroscientists and psychologists about the nature of visual perception. Most of these theories can be broadly classified into two groups, depending on whether they believe light enters the eyes and thereby produces image inside the brain, or whether something moves out of the eyes and captures the object outside the brain. This second group underscores the active role of the subject in the process of vision.

Even among those who claimed something moved out of eyes to capture the external world, the Greeks believed that light rays moved out of the eyes and illuminated objects. On the other hand, the Indians, particularly the Sāṃkhyas and Nyāyikas,<sup>6</sup> argued that what goes out of the eyes in the form of sight is the human mind which takes the form of the object—known as *vritti*—and thus the mind is molded into the object perceived. A third group, gaining more and more credence in the last couple of decades, maintains that the process of visual perception involves both moving in and moving out—moving in of light and moving out of mind or the mental field. Scientists studying the sense of being stared at, experienced by many of us even when the person looking at us is outside the field of our vision, surmise that: “an influence seems to pass from the observer to the observed.” According to Rupert Sheldrake, “The sense of being stared at does not seem to fit in with theories that locate all perceptual activity inside the head. It seems more compatible with theories of vision that involve both inward and outward movements of influence.”<sup>7</sup> With this backdrop, it would be interesting to note the theories of vision across the timeline to understand various perspectives and their strong and weak points.

### A Brief History of Vision Theories

Of the two major theories of vision, the inward or intromission theory, which is also the current scientific understanding of

human sight, emphasizes the entry of light into the eyes. This view underscores the primacy of light in the process of vision and regards vision as a passive activity by the subject. According to this theory, light entering into the eye forms an image on the retina that is carried to the occipital lobes of the cerebral cortex via the optic nerve where the image is processed, thus providing the experience of vision. On the other hand, outward, emission or extramission theories, as held in ancient Greece, maintain that vision is a process where some kind of *light rays* travel through our eyes and come in contact with external objects. Other extramission theorists believe that *vision is a carrier* of the human mind and is an active process initiated by the subject, where a mental field or the mind itself moves out. Some extramissionists even go to the extent of arguing that human emotions are also carried out by the outward moving human mind in the process of visual perception and that the human mind is capable of exerting influence on the external world. As Rupert Sheldrake maintains, “the chief reason for admission of extramission accounts is due to the belief in evil eye and the power of a lover’s gaze.”<sup>8</sup>

The ancient Indian philosophies of Sāṃkhya, Yoga and Nyāya, together with Upanishads, like Chāndogya and Brihadāraṇyaka, speak of the soul using the mind as its instrument and sending it out through the eyes and contacting the objects outside and thus resulting in mental modification or *vritti*, which makes the perception of the object possible. The Upanishads consider the eye to be made up of the same primeval element that is inherent in fire and the sun. The theory that, “like perceives the like” was concurrent in India but also in ancient Greece. This view held that unless the subject and object are intrinsically identical deep within, perception of an object by the subject was impossible. Both extramission and intromission theories have been in vogue for over 2500 years, but extramission theories slowly lost ground as the advances in human anatomy began to explain the visual apparatus of the human body in greater detail. Although the science of human anatomy has helped us understand how light rays create retinal images

which are then carried as electric impulses into the brain, it maintains a studied silence as to how that image is in fact perceived. Sometimes visual perception and processing was depicted as a picture projected onto a mental screen inside the brain, with a little subject inside the brain looking at it.<sup>9</sup> But, as Sheldrake maintains, this view results in an infinite regress, for the little person inside the brain would need a screen inside *his* brain, and a yet tinier person to see the screen, and so on.<sup>10</sup> But, a new theory is emerging which accepts that vision has both active and passive aspects. This paper discusses the key aspects of vision theories that were in vogue at different time periods and argues how a synoptic view of these theories might help in better understanding the process of vision.

### ***The Ancient Western Thought***

In ancient Greece there were two major theories that explained how vision took place. One of the earliest ideas about vision—which was disputed in its own time—was a conjecture that it depended on light that streamed out of the eye to detect the surrounding objects.<sup>11</sup> In the early fifth century BCE, members belonging to the Pythagorean School, who were known as spiritualists and mystics, advocated the extramission theory, maintaining that a visual current was sent outwards from the eye. Alcmaeon, a member of the Pythagorean school, who lived in Croton sometime around 500 – 450 BCE, noted that “The eye obviously has fire within it, for when one is struck this fire flashes out. Vision is due to the gleaming... that is to say the transparent character of that which [in the eye] reflects the object.”<sup>12</sup> This idea that there is a fire in the eye which sends out visual rays enabling vision received a great fillip when Plato also attested to this idea in his *Timaeus*:

And of the organs they first contrived the eyes to give light, and the principle according to which they were inserted was as follows: So much of fire as would not burn, but gave a gentle light, they formed into a substance akin to the light of everyday life; and the pure fire which is within us and related thereto they made to flow

through the eyes in a stream smooth and dense, compressing the whole eye, and especially the center part, so that it kept out everything of a coarser nature, and allowed to pass only this pure element. When the light of day surrounds the stream of vision, then like falls upon like, and they coalesce, and one body is formed by natural affinity in the line of vision, wherever the light that falls from within meets with an external object. And the whole stream of vision, being similarly affected in virtue of similarity, diffuses the motions of what it touches or what touches it over the whole body, until they reach the soul, causing that perception which we call sight.”<sup>13</sup>

Euclid, hailed as the Father of Geometry, taking a cue from the ideas that emphasized the subjective aspect of vision that were in vogue at that time, claimed that some visual rays came out of the eye and traveled in straight lines until they met an object. He wrote in his *Optika* “Rectilinear rays proceeding from the eye diverge infinitely [and] those things are seen upon which the visual rays fall and those things are not seen upon which the visual rays do not fall”<sup>14</sup> Thus Euclid adopted the extramission theory of vision and was devoted to studying primarily the geometrical aspects of rays traveling in straight lines. Giving the example of looking for a pin, and at first not seeing it, but then finding it, Euclid also maintained that vision was an active process. “There is a change in what is seen as a result of this active process of looking and finding, even though the light entering the eye remains the same.”<sup>15</sup>

It is not the case that these ancient sagacious Greeks did not know that external light was significant in the process of vision and that light from the objects entered the eye, facilitating the sense of seeing. Even a very basic observation such as visibility and invisibility of objects in day and night respectively would surely have revealed it to them. Thus, there is no ground to discredit these ancients of this basic observable fact and reduce them to dummies. We need to realize that their focus was on deciphering the subjective aspect of the process of seeing. The technique of the an-

cients—whether of Greece or India, was to meditate deeply and contemplate minutely step by step on the actual phenomenon they were trying to understand in an effort to unravel the actual process phenomenologically. This kind of meditative contemplation naturally focuses more on the subjective share of the process than on the objective aspect. For such meditative contemplators, the objective reality is merely a passive component and it is the subjective aspect that thrives with actual possibilities and which qualifies any phenomenon or event by its partaking in the event.

As Rupert Sheldrake points out: “Euclid recognized that light played a part in vision, but he said very little about the way it was related to the visual rays projecting outwards from the eyes.”<sup>16</sup> Euclid, with his mathematical temperament, was more focused on the geometrical aspects of the process of vision. As noted previously, his main concern was with the idea that light rays traveled in straight lines. Hence, he laid down the geometrical rules to explain how eyes projected the images we see outside ourselves and overlooked everything else that did not fall within the ambit of geometry. He also clearly stated the principles of mirror reflection, recognizing the equality of what we now call “the angles of incidence and reflection,” and he explained virtual images in terms of the movement of visual rays outwards from the eyes.<sup>17</sup> Ptolemy, another Mathematician and Astronomer of Greece, also supported the Euclidian view of visual rays emitting from the eyes with the only difference being that he believed visual rays formed a continuous bundle or cone.

Plato’s emphasis on internal fire and Euclid’s approach to visual rays are subtly different. Plato, being a philosopher to the core believed in the unity of subject and object and argued in *Timaeus* that the same fire that constitutes and illuminates the external objects is also present in the subject in a gentle form, since the subject is composed of the same elements from which the universe is produced. This idea can also be traced in the works of Empedocles, another prominent figure in Greek philosophical history. A fragment of the poem attributed to Empedocles in the fifth century

BCE, maintains that the pupil of the human eye is created from the primeval fire [by Aphrodite] and because of this, it lets through the fire (light), or finer part. This is an extension of the principle that like perceives like. Vision occurs only when there is right correspondence between the internal fire and the external fire. It is important to keep in mind here that for Empedocles as well as for Plato, although an intraocular fire is required for the visual perception, it is not a *fire that issues forth from the eyes*, just as the science historian, David Lindberg rightly pointed out. Lindberg’s comment on Plato’s theory of vision is worth serious consideration:

Visual fire emanates from the eye and coalesces with the daylight, to form a single homogeneous body stretching from the eye to the visible object: this body is the instrument of the visual power for reaching into the space before the eye. The stress in this passage is not on the emission of an effluence from both the eye and the object of vision, but on the formation of a body through the coalescence of visual rays and daylight which serves as a material intermediary between the visible object and the eye.... and passes on this to the soul.<sup>18</sup>

### ***The Intromission Theories***

Another view on how the human eye perceived the external world was also in vogue. This theory focused exclusively on the entering of light into the eyes from the outside and is known as intromission theory. The Atomists and Natural Philosophers of Greece, such as Democritus and Epicurus, were chief proponents of this view. Democritus (ca. 460.–370 BCE) suggested that the air between the eye and the object seen is “contracted and stamped” by the object itself and the observing eye. The pressed air, still holding various colours of the object wanders and “appears in the eye.”<sup>19</sup> But interestingly, if we can trust Theophrastus, Democritus also held the view, just like Plato, that “an image is produced when the effluence from the object of sight meets an opposing effluence from the observer.”<sup>20</sup> When Democritus talks of air being contracted and stamped by both the sub-

ject and the object, it probably is more apt to understand it as a model that emphasizes both subjective and objective aspects of sight—the meeting of mind and visual sense data from the object, rather than indulge in hairsplitting whether some intermediary image is really formed in the mid air between the subject and object. The idea that sensory experience takes place somewhere between the subject and object and not truly at the subject or object as ancient Indian philosophers as the Vignānavādins, Sāmkhyas and Nyāyikas thought, will be discussed elsewhere.

Epicurus also favoured the intromission view when he pointed out “...particles are continually streaming off from the surface of bodies though no diminution of the bodies is observed. . . And those given off maintain their position and arrangement. . . it is by the entrance of something coming from external objects that we see shapes and think of them.”<sup>21</sup>

It is important to keep in mind that both schools of thought—intromission and extromission—relied upon the principle of “like is only known by the like.” This notion supposes that the eye was composed of some *internal fire*, which interacted with the *external fire* of visible light and made vision possible. Plato makes this assertion in his dialogue *Ti-maeus*, as does Aristotle, in his *De Sensu*.<sup>22</sup>

However, this understanding of subject and object being produced out of the same fiery substance, and this commonality being the fulcrum of perceptual experience took a back seat with the advent of science in the beginning of the seventeenth century. In 1604 CE, Johannes Kepler, who revolutionized the field of astronomy with his discoveries, also radically transformed how we understand visual perception with his intromission theory, according to which light came into the eyes, but nothing went out from them.<sup>23</sup> This period marks the beginning of the materialistic scientific age, a complete shift of humankind’s approach toward perceptible reality, where the wisdom of ancient intellectuals in appreciating the subjective and objective roles was sealed and put into docks for the next several centu-

ries. With this new theory of Kepler, vision of the external world no longer belonged to the outer world where it seemed to be, but is suddenly relegated to the inside of the brain.

Rupert Sheldrake points out:

Kepler’s theory of the retinal image seemed to resolve a debate about the nature of vision that had been going on for two thousand years, and it was one of the first great triumphs of modern science. But his theory raised a problem that Kepler admitted he could not solve, and which is still unsolved today. The theory explained how images form on retinas, but it did not explain how we actually see. We do not see two tiny inverted images of the external world on our retinas. We see the world outside us, right way up, and single, not double. The only way Kepler could deal with this problem was by excluding it from optics. Once an object’s images had formed on the retinas, it was someone else’s business to explain how we actually see. Ironically, the intromission theory left vision unexplained.<sup>24</sup>

Kepler’s theory does not explain how a stare is different from a glance, how emotions are carried by the looks and stares of people and, importantly, how the eyes often see and sense more than what is visible. It also turns a blind eye on the question of the sense of being stared at, even when the person looking at us is outside the field of our vision. His theory also overlooks the belief in evil eye and power packed glances that are often attested to by cultures across the globe. Nor does it explain what happens once the image is set in the brain after it entered the eye. This image is as good as the external world; in his model, in place of the world, one is stated to encounter its representational image. But how does Kepler account for seeing? How a thing that is external to the subject is assimilated and comprehended is never addressed. As a model, intromission makes vision a passive process ignoring the active role of subjective attention.

### ***The Enigma: A Reread at Extromission Theories***

Humankind has been studying optical phenomena for a very long time. The oldest surviving mirrors and burning lenses were dated before 1500 BCE. Accounts of various eye diseases and eye surgeries were documented on papyrus by the Egyptians around that time. And around 400 BCE, people in China were said to have been examining the nature of radiation, shadows and reflections. At the same time, in India, intricate surgeries were performed by ancient doctors like Suśruta and Caraka. *Pancāngs* (conventional almanacs and ephemerides) that detailed the minute motion of stellar objects and predicted occultations, eclipses and the like with great accuracy, were very much in vogue. Kañāda, a proponent of Vaiśeṣhika darśana—one of the six systems of Indian philosophy—developed his atomic theory through an extensive study of the sun rays coming in through small apertures. With such a reasonable degree of understanding of the natural world around them, what made the ancient intellectuals mistake the eye as the source of light instead of the reflecting surface of objects? Or when they spoke of emissions from the eye, were they talking about something else? Insects attraction to the radiance of fire had been a favorite metaphor for ancient Indian philosophers to adduce the dangers of sensual attractions. That simple observation itself should have made them understand that light rays are external to the observer. But yet why did they argue that the subject was “reaching out” to the object and not the light rays entering the eyes?

To solve this conundrum one needs to understand that the ancient world was looking at the phenomenon from an entirely different perspective. While the present scientific age is object oriented, the ancient world, particularly of Greece and India, was more interested in explaining the observable phenomena from the subjective perspective. They were greatly enticed by the subject-object interaction and wondered how an object that seems to be unconnected and alien to the subject in all respects and located at a distance could still be perceived. The most appalling fact that enticed their imagination was that perception is the proprietary feature of subjective beings alone.

Though light travels and falls on everything, the ancients believed that only sentient beings, or that class of entities that had a “subjective eye,” could perceive and respond to external stimuli. All else was inanimate and had no awareness. Those entities called sentient beings have a special faculty to “receive” the external world inside them through a special mechanism called sensation. The processes of sensation and perception are not merely a passive activity; they involve the active effort on the part of the subject. As the physicist and the author, Arthur Zajonc rightly points out, “there is a change in what is seen as a result of this active process of looking and finding, even though the light entering the eye remains the same.”<sup>25</sup>

### ***The Ancient Indian Thought on Perception***

The *Upanishads*, the fountainhead of Indian thought, describe an internal fire that burns as the devouring fire in the belly called *vaisvānara*, which is immanent and permeating throughout the universe. Many passages in *Bṛihadāraṇyaka* and *Chāndogya Upanishad* and *Maitrāyana Brāhmaṇa* speak of the eye as the abode of fire, the mind (*Mānas*) as the light, and the Immortal Antaryāmin or Vishnu’s manifestation as inner controller in the heart, as the source. The *Bṛihadāraṇyaka Upanishad* informs us that we project our minds out predominantly from the right eye (*Indho ha vai nāmaiṣa yo’yam dakṣiṇe’kṣan puruṣaḥ*) and that this projected mind is called *Indha*. *Indha* is the real name of Indra the King of Gods but the *devas*, being *parokshapriaya* (gods prefer only indirect referencing to keep things under wraps), camouflaged the name to hide the true meaning from ordinary humans. The principles in the right eye and the left eye join together in the activity of perception, which the *Bṛihadāraṇyaka Upanishad* says are like symbols of *Virāt* (the brilliant or shining one) and His Śakti. The *Virāt* and His Power are manifest in the right eye and the left eye, respectively, as the following explains: (*Athaitad vāme’kṣaṇi puruṣarūpam, eṣāsya patnī virāt, tayor eṣa samstāvoya eso’ntar-hṛdaya ākāśaḥ*). When the activity

of perception is withdrawn, the mental sensation goes back to its abode, its own source. The mind returns to its source in the ether of the heart, the *hrdaya ākāśah*.

Elaborate metaphysical speculation on how the universe came into being and how the sense organs evolved was also presented in the Sāṃkhya and Vaiśeṣhika systems of Indian darśana. The process of sensory perception is elaborately discussed in these systems together with how the knowledge of the external world arises in the mind. In these systems, both the objective world and the sense organs have the same source of origination, hence they are causally related to each other. The world's objects are made of five elements that are experienced by the corresponding sense organs via a medium called *tanmātras*.

### **“Tanmātra” and the Sense Organs**

The traditional Indian account of sensory perception is based on the theory of *tanmātras* or primordial elements, which are the basis for the sense qualia. This view holds that what we perceive is not the object per se but only the subtle aspects, the *tanmātras*, which are created as independent entities along with their corresponding gross elements at the very beginning of creation. According to the traditional approach, the five sense organs, the five gross elements and their corresponding five *tanmātras* are all causally related. Though both Sāṃkhya and Vaiśeṣhika agree that objects made up of five elements are causally related

to the sense organs that perceive them, there is subtle variance in how both schools address this subject. Sāṃkhya maintains that the gross world originated from the subtle mind, the central sense organ, which in turn originated from the subtler aspects of *prakṛti* called *Ahankāra* (ego) and *mahat* (intellect). Thus, the subtle world, consisting of awareness, conation, cognition and affection, predates the world of gross objects.

Sāṃkhya maintains that *Ahankāra* has a lower aspect called *tāmasa Ahankāra* and a higher aspect called *Sāttvika Ahankāra* which undergo the process of evolution under the influence of the *Rajo Guṇa*. The *Sāttvika Ahankāra* produces the five sensory and the five motor organs. According to Sāṃkhya, the five subtle essences, which are called *tanmātras* or things-in-themselves, arise from the *Tāmasa Ahankāra*. These are the essences of sight, smell, taste, touch and sound. They are neither the qualities nor the differentia of the gross elements nor the functions, (that is to say they are not the sensory organs either), but are the subtle essences which produce the gross elements as well as their qualities. From these *tanmātras* are produced the five gross elements. For example, from the subtle essence of color or sight combined with those of sound and touch, arises the element of fire or light together with the qualities of sound, touch and color. This is better comprehended with the help of the following chart.

<b>Tanmātra</b>	<b>Gross Element</b>	<b>Corresponding Sense Organ</b>
Ṣabda (sound)	Ākāśa (space)	Sense of hearing (through the auditory organ)
Ṣabda (sound) + Sparṣa (touch)	Vāyu (air)	Sense of touch (through the tactile organ).
Ṣabda (sound), Sparṣa (touch) + Roopa (form)	Téjas (fire)	Sense of sight (through eyes).
Ṣabda (sound), Sparṣa (touch), Roopa (form) + Rasa (taste)	Āpah (water)	sense of taste (through the tongue).
Ṣabda (sound), Sparṣa (touch), Roopa (form), Rasa (taste) + Gandha (smell)	Prithvi (earth)	sense of smell (through the olfactory organ).

Whereas Nyāya, being a predominantly realistic school maintains that the five senses, together with the *tanmātras*, are produced out of the gross elements.

The five senses are the functions of the mind and are derived from Ahankāra, the individual ego (Here ego does not refer to the “pride” but to the individual identity). The senses, the mind and the ego function for *buddhi* or intellect, which functions directly for the *Puruṣa*, the indwelling spirit. The Soul employs the intellect, ego and mind, the *antahkaranas* or the internal organs that are part of the subtle creation and reach out through the sense organs to the external objects that are made up of five gross elements. It is important to note here that in the *Bhagavad Gita*, which relies on the Sāṃkhya system, *prakṛti* is described as consisting of eight components: earth, water, fire, air, space, mind, intellect and ego.<sup>26</sup> On a graded scale, each component is subtler than its predecessor. The earth is grossest. It has definite form and fixed shape; water being on the higher side of the scale is subtler and hence more malleable than earth and takes the shape of the container it enters. Similarly, fire is subtler than water and space is subtler than air, enabling it to take any shape and allowing any object of any shape in it. Mind, being a substance that is even subtler than space, has the ability to assume the shape of any substance it comes into contact with. This modification of the mind in accordance with the object it came into contact with is called *vṛitti*. It is this *vṛitti* that is experienced by the mind as the object. This model offers a better explanation of how an object is experienced than the intromission model, which merely states that an image of the object is projected inside the brain, since the *Vṛitti* is non-different from the perceiving mind, whereas the image is alien to the mind and there is no tertiary quid to join them together.

The Nyāya School, founded by the sage Gotama or Gautama is predominantly an intellectual, analytical and logical school. Nyāya and Vaiśeṣika are both regarded to be “*samānāntara*” or similar philosophies. Nyāya develops logic and epistemology, whereas Vaiśeṣika develops metaphysics and ontology. Ac-

ording to Vaiśeṣika, we can only experience or conceive of anything when it is knowable and nameable (*Gñeya* and *Abhideya*). According to the Nyāya-Vaiśeṣika the five sensory organs are derived from the five gross physical elements. Thus, they view both the constituent elements of subjective organs/instruments and the objects as one and the same. Interestingly, Nyāya also looks upon knowledge as the “one that illuminates the objects” (*arthaprakāśobuddhi*). Knowledge, in this system, is compared to light. Just as light illumines all the objects set before it, similarly, knowledge also manifests all the objects around it.

The five kinds of external perception, visual, auditory, tactual, gustatory and olfactory, are brought about by the sense organs of sight, sound, touch, taste and smell respectively. The external sense organs are constituted of the material elements of earth, water, fire, air and space, and therefore each can sense the particular quality of its element. For example, the sense organ of taste is composed of the atoms of water and perceives “taste” which is the specific quality of water.

The Nyāya-Vaiśeṣika systems also provide a functional model similar to that of Sāṃkhya to demonstrate the process of perception. Nyāya Sūtra 1.1.16 points out that the absence of simultaneous cognition from all of the senses indicates the presence of a faculty which governs selective attention. This faculty is called the *mānas*, which is an insentient psychological apparatus that processes the information of the senses. A formulation of perception by the Vaiśeṣika school (Vaiśeṣika-Sūtra 3.1.18), accepted by Nyāya, is that it normally consists in a chain of connection between four things: a self and its *mānas*, *mānas* and a sense organ, and the sense organ and an object. *Mānas* relies on the five senses to experience the external world. It is also the faculty that governs mnemonic retrieval and apperceptive awareness of mental states and emotions. Selves, in the Nyāya Vaiśeṣika parlance, are lower ego substances, which are fundamentally loci of awareness, cognition, and mnemonic dispositions (*samskāras*). The self here should not be mistaken for the Self with the capital letter S,



which signifies the quality-less all pervasive Supreme Soul that lies at the core.

The ancient Indian understanding of any phenomenon including perception was not an intellectual exercise where arbitrary and haphazard thinking produced a theoretical model. Rather, it was based primarily on meditative

contemplation on the processes underlying the phenomenon for prolonged periods of time, where such meditation enabled the yogis to magnify and peruse the minutest aspects of phenomena that normally went unnoticed. This naturally led them to study in great detail the subjective experiences. For example, the insight of Nyāya darśana when it

comes to defining how we perceive objects through our senses and carry out successful activity is remarkable when we gain the insight of the neurological processes that take place during our viewing and identification of an object. Sage Gotama defines direct knowledge or *Pratyaksha Pramāna* as “*indriyārthasannikarshotpannam gnānam, ayvapadēṣam, avyabhicārim, vyavasāyātmakam pratyaksham.*” According to this definition direct knowledge is the perception of an object as the result of the union of sense organs with the object perceived which passes through three distinct stages. The first stage is the vague idea of the object without qualification. Immediately, in an iota of time, perception moves to the second stage and we begin to have a more distinct identity of the perceived object which finally translates into completion of the identification process. The whole sequence of perception described in the *Nyāya Sūtra* is reaffirmed by neural images obtained through PET scanners. Using PET scanners in conjunction with the reaction time test and other tests it has become

***The traditional Indian account of sensory perception is based on the theory of “tanmātras” or primordial elements, which are the basis for the sense qualia. This view holds that what we perceive is not the object per se but only the subtle aspects . . . which are created as independent entities along with their corresponding gross elements at the very beginning of creation.***

clear that each aspect of attention involves a specific area of cortex. When a dot is flashed in front of the eye, the posterior region of the cortex where vision is processed lights up first, followed by the central region of the cortex where special analyses are formed. The anterior region of the cortex where identification occurs, lights up third. Once the posterior system has answered the question “where is it?,” the anterior system addresses the question “what is it?” Hobson points out that these two questions have long been recognized as key stages in the processing of perceptual data.<sup>27</sup>

In Buddhist philosophy, *Āyatana* or “sense-sphere” or “sense-base” includes the mind as an internal sense organ (*klista manovigñāna*) in addition to the five traditional senses. The Buddhist Vigñānavāda School maintains that the true object can never be perceived and only qualities are sensed. In fact according to some schools of Vigñānavāda Buddhism there is no external reality, each object is only a collection of perceptions accrued by the sense organs and exists only in the mind. According to them, the external world, even if it were to exist, is never knowable because the only thing accessible to us is not the direct object but the model created inside our minds. Hence, they say the right description would be to admit that the only world that really exists is the world of perceptions: a world existing in the mind and created by the mind, for the mind and of the mind. It is the only world we can be sure of. This line of thought leads us to some interesting corollaries: if whatever is perceived is only what is within the mind then whatever the reality we experience out there is indeed within our mind. Therefore, it is an incorrect assumption to think there is an external world in which our

bodies exist and wherein our minds dwell; on the contrary, reality can be more aptly described as the world, including our bodies, residing within the perceiving mind. Thus, if concepts, percepts, thoughts etc., are nothing more than modifications of the mind, akin to the shifting waves in the ocean, then the world we experience through the medium of our mind is also none other than the mind. This means it is the same mind that experiences itself as an external world, whereas in reality it is the mental modifications or *vrittis* that are aroused in the mind due to its own inner propensities which the mind mistakes as external reality.

### ***Extramission revisited in Modern day***

Of late, several researchers in the fields of cognitive neuroscience, psychology, parapsychology and philosophy, have begun to relook at how visual perception actually takes place. This has been prompted by new discoveries in the aforementioned fields as well the inadequacy of current understanding in explaining the intricate phenomena of perception. One of the often-overlooked issues is the belief in the power of the so-called “evil eye.” Denounced as mere superstition, the veracity of this belief has hardly been studied seriously despite the widespread belief in the existence of the evil eye across space and time. Similarly, the ability of the eyes to rapidly reflect myriad emotions has been reduced to body language and facial expressions, which have never been studied from the extramissionist point of view. Added to this is the “sense of being stared at” that a great number of people claim to have experienced at some time or other in their lives, which also requires a new model of visual perception.

Sheldrake, who carried out his research on the sense of being stared at in Britain, Sweden and the United States, found out that more women (81%) than men (74%) felt they were being stared at. He also recorded that many police officers, surveillance personnel and soldiers attest to the fact of experiencing the sense of being stared at. He says:

Most were convinced of the reality of this sense, and told stories about times when

people they were watching seemed to know they were being observed, however well the observers were hidden. When detectives are trained to follow people, they are told not to stare at their backs any more than necessary, because otherwise the person might turn around, catch their eye and blow their cover. Some pet owners claim that they can wake their sleeping dogs or cats by staring at them. Some hunters and wildlife photographers are convinced that animals can detect their gaze even when they are hidden and looking at animals through telescopic lenses or sights.<sup>28</sup>

This led researchers like Sheldrake to revisit the idea of extramission. His research concluded that looking at a person or animal can affect that person or animal at a distance, and that “an influence seems to pass from the observer to the observed.”<sup>29</sup> He argues, “if all mental activity and all visual experience are confined to the insides of heads, then the sense of being stared at ought not to occur. And if it does, it is almost impossible to explain.”<sup>30</sup> He contends that this was probably the reason why the phenomenon had been ignored for so long and that vision is rooted in the activity of the brain, but is not confined to the inside of the head.<sup>31</sup> Sheldrake argues strongly in favor of those theories of vision that involve both inward and outward movements of influence, and he proposes what he terms “perceptual fields” that link the perceiver to that which is perceived, which according to him, are rooted in the brain, but extend far beyond it.

### ***The Synoptic View of Vision***

Since the beginning of the last century, though intermittently, the two-way theory of vision, duly recognizing the subjective and objective aspects of the process of vision, has been presented by various philosophers and scientists. Prominent western philosophers such as Henri Bergson (1859–1941), William James (1842–1904), Alfred North Whitehead (1861–1925) and Bertrand Russell (1872–1948) also propounded the two-way theories of vision. As Sheldrake points out, the main feature of the two-way theories of vision is the admission of a view that images are projected out beyond

the brain to the places where they appear to be. Thus, if one looks at a tree, light from the tree enters the eyes, inverted images form on the retinas, and changes occur in the eyes and in various regions of the brain. These give rise to a perceptual image of the tree, which is situated where the tree actually is.<sup>32</sup> The tree that one is seeing is in his/her mind, but not inside his/her brain. This theory of vision resembles the combined intromission-extramission theory widespread in ancient Greece, the Arab world and medieval Europe.<sup>33</sup> Sheldrake also emphasizes the role of vision and its connection with bodily activity, and argues that vision is not confined to the inside of the head, but extends outwards into the world, closely linked to the organism's movements and actions.<sup>34</sup>

The greatest advantage of this model of vision is that it is compatible with common sense. It gives due credit to both the subjective and objective contribution to the process of vision. If we freed ourselves from the scientific learning that we accrued in school, it would naturally occur to us that we perceive the external world *out there* and not inside our brains. However, due to the overemphasis of the objective study of light progression and human anatomy, we are now made to believe a more outlandish model that compels us to believe that the experience of the world is taking place inside our brain and not outside as it appears to be. Noting that this rather bizarre practice that came into vogue in this scientific age, the psychologist Max Velmans, points out that if S is gazing at a cat, her only visual experience of the cat is the cat she sees out in the world. If she is asked to point to this phenomenal cat (her "cat experience"), she should point not to her brain but to the cat as perceived, out in space beyond the body surface.<sup>35</sup>

On the other hand, by admitting that the mind also reaches out to the objective image that is received, a more meaningful blended theory of vision emerges. Further incorporating the concept of *vritti*, which maintains that the mind itself gets molded into the perceived object, and that it is the *vritti*, not the imagery that is experienced enables us to cross over the otherwise un-bridgeable gap between subject and object.

It is worth noting the fact that quantum theory also strongly suggests the observer-observed interconnectedness. The observer's effect documented by quantum physics amply demonstrates that the sub-atomic particles behave differently depending on whether or not an observer is looking at them. Quantum entanglement, telepathy, clairvoyance and the wisdom of ancient Indian seers all point to the unity of subject and object.

## Conclusion

After this brief survey of various theories of visual perception, it would naturally be pertinent to wonder as to which among the various models adduced at different periods of time best represents the true reality. At this juncture we must draw our attention to the views of the world-renowned astrophysicist Stephen Hawking about the nature of reality and how it is best described by different models. *Model-dependent-realism*, advocated by Stephen Hawking and Leonard Mlodinow claims "that it is meaningless to talk about the 'true reality' of a model as we can never be absolutely certain of anything. The only meaningful thing is the usefulness of the model."<sup>36</sup>

A world picture consists of the combination of a set of observations accompanied by a conceptual model and by rules connecting the model concepts to the observations. Different world pictures that describe particular data equally well all have equal claims to be valid. There is no requirement that a world picture be unique, or even that the data selected include all available observations. A network of overlapping world pictures covers the universe of all observations at present and, where overlap occurs; multiple, equally valid, world pictures exist. At present, science requires multiple models to encompass existing observations.

Like the overlapping maps in a Mercator projection, where the ranges of different versions overlap, they predict the same phenomena. But just as there is no flat map that is a good representation of the earth's entire surface, there is no single theory that is a good representation of observations in all situations.<sup>37</sup>

It may be summarized, however, that the biggest shortcoming of the inward or intromission theories is that they look upon vision as a passive activity reducing or even altogether overlooking the role of the subject (observer) and weaving the whole story around the entry of light into the eye. Outward or extramission theories, on the other hand, describe the same phenomena from the subjective perspective and explain how perception is made possible with the active involvement of the subject in the process of vision. A more balanced approach would be to construct a combined theory of vision that covers both active subjective and passive objective aspects of the process of visual perception. The recognition of the fact that if the objective external world is completely unrelated and alien to the subject then it cannot be experienced by the subject because, to connect both of them together and bridging the gap, a common link would be required. Unless such a connecting common thread between the observer and the observed has the sameness with subject and object perception would not be possible. The central teaching of ancient Indian wisdom repeatedly underscores and points out that the subject and the object are non-dual.

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fluent on other schools of Indian philosophy. Sāmkhya is an enumerationist philosophy whose epistemology accepts three of six pramanas (proofs) as the only reliable means of gaining knowledge. These include *pratyaksa* (perception), *anumāna* (inference) and *śabda āptavacana* (word/testimony of reliable sources). Sometimes described as one of the rationalist schools of Indian philosophy," <https://en.wikipedia.org/wiki/Samkhya> (Last accessed May 7, 2017). "The Nyāya School is founded by the sage Gotama or Gautama, not to be confused with Gautama Buddha. Nyāya means correct thinking with proper arguments and valid reasoning. Thus, Nyāya philosophy is known as tarkashāstra (the science of reasoning); pramānashāstra (the science of logic and epistemology); hetuvidyā (the science of causes); vāda vidyā (the science of debate); and anviksiki (the science of critical study). The Nyāya philosophy as a practitioner and believer of realism seeks for acquiring knowledge of reality," <http://egyankosh.ac.in/bitstream/123456789/38168/1/Unit-1.pdf0> (Last accessed June 2, 2017).

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