

The Trek of Camera: An Outcome of Multidisciplinary Sciences

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Abstract: *There have been myriad versions that bind the invention of camera to some particular people or countries. Notwithstanding, the development of this device is empty of a clear-cut reference that unfolds who was the first to do it. To keep track of the provenance of camera, one can start from the Greek attempts up to the late Nineteenth Century initiatives, which were the cutting edge to transport the camera device into existence. Therefore, this paper traces back the sundry experiments the camera device went through, before coming into view as we perceive it nowadays. In this qualitative study, various artists, philosophers, cineastes, and scientists are tackled as pioneers in the area of camera invention. This paper fosters a historical approach to chronicle the diversified accomplishments that had been being made throughout history to let human beings brag about cinema as an entertaining or edifying art. Therefore, the reader of this article will discover the journey of camera from Aristotle to the Lumière brothers who had finally finished the work that lingered for centuries.*

Keywords: Camera, Experiment, Scientists, Motion Pictures, Cinematography, Audience, Consumption

1. Introduction

Greeks are decidedly the first nation that theorized for the concept of moving pictures when they invented the “zoetrope” (Kupsc, *The History of Cinema for Beginners*, 1998, p. 1). This model is also labeled the pinhole camera. It is a circular hollow device for animation of pictures in movement. It was used with slots on its front so that when it spins, it creates the illusion of moving images. (ibid). The zoetrope encompasses paintings inside, and after rotation, these paintings convey a sequence of actions creating an animated story or event. The derivation of zoetrope dates back to the ancient Greek language: *Zo* means life and *Tropos* denotes the act of turning (ibid).

The camera was an output of multidisciplinary areas of research; it is argued that the etymology of that device stemmed from the camera obscura that was used in the ocular studies of the Arab philosopher *Ibn Al-Haitham* who, in turn, was influenced by the Greek empiricist Aristotle and implemented some of his theories in optics to experiment sunlight effects in dark rooms (Hogendijk, 1985, p. 56)&(Rashed, 1996, p. 663). According to Anderson et al, camera obscura is referred to as “the precursor of a modern camera that uses a dark chamber with a small aperture allowing light in, which brings an image of an object outside into focus on a facing surface”(Anderson, Bateman, Harris, & McAdam, 2006, p. 33). In today’s context, the camera is rudimentarily a gadget capable of recording still and motion pictures. According to the dictionary of media studies, camera “is a device for taking photographs by letting light from an image fall briefly onto sensitized film [...] a device that converts images into electrical signals for television transmission, video recording or digital storage” (ibid).

This being so, the importance of this research is laid in tracking down the journey of the camera invention from the olden history up the 19th century, which witnessed the birth of an art called cinema. As such, this article probes the different experiments and trials that took place within different settings and with different people to come up with the answer of who created the camera as we know it today.

1.1 From Multidisciplinary Experiments to Camera Invention

Arabs have conspicuous insights about the invention of camera. In the Tenth Century, the Arab philosopher *Ibn Al-Haitham* used his ocular sensation to observe the reflections of light coming from a tiny hole and generating moving shadows in an obscure chamber (Helmut & Gernsheim, 1969, p. 13). This hypothesis was a groundbreaking discovery that would open gates for successive scholars to theorize for or invent photography apparatuses. The authors Helmut Gernsheim and Alison Gernsheim (1969) expose that:

The camera obscura was known to the Arabian scholar *Ibn Al-Haitham* (Alhazen) before 1038; spectacle lenses are mentioned by Roger Bacon and seem to have been well known by the end of the thirteenth century; the darkening of nitrate of silver on exposure to sunlight was first recorded by Angelo Sala in 1614. But whereas the camera obscura served at first simply as a convenient means of observing solar eclipses, and, from the Renaissance on, as an aid to drawing, it was not until 1550 that a lens was fixed to the instrument by Girolamo Cardano, and the fact that the darkening of silver salts by light can be applied to the making of images was only discovered by Johann Heinrich Schulze in 1725. (Helmut & Gernsheim, 1969, p. 13)

In the Thirteenth Century, Roger Bacon expanded *Ibn Al-Haitham*’s synthesis when he referred to camera obscura as a tool used to notice eclipses caused out of sunshine, “for he did illustrate the principle of the sun’s rays passing through an aperture and projecting an image of the sun’s disk on a wall, in his treatise *De multiplicatione specierum*” (Helmut & Gernsheim, 1969, p. 18). His empiricist studies to nature and light were fundamental to underline one of the effective theories that were conducive to the making of today’s camera (ibid). He along with others had vicariously served consecutive inventors in the field of ocular industry. That is, Bacon had added a mirror to the camera obscura that had

become a determining factor to make eclipses of better quality (Byrne, 1989, p. 83).

Leonardo da Vinci is accredited as one of the important contributors in the history of photography (Byrne 66;67). He came to grips with camera obscura as a device that deciphers how the human eye works (ibid). Although da Vinci's studies of camera obscura were not intentionally meaning today's camera, his synthesis was vital to pave the way for other inventors to inspire from it and fabricate the recording device used in cinema and divergent media paradigms. To that extent, the author Edmund F. Byrne evokes the following:

Leonardo saw accurate representation of external images on the internal screen, and this allowed him to compare the camera obscura to the eye, trusting the incoming sensations. By the mid-sixteenth century the camera obscura was known in England, France, Holland, Germany, and Italy.(Byrne, 1989, p. 67)

As for Leonardo da Vinci, the aperture (the hole in camera obscura) is the prototype of the human eye that captures the external world, and the inner side of the eye acts like the dark box in which light comes in and makes an illusion of mirrored pictures (Helmut & Gernsheim, 1969, p. 19). As a corollary, da Vinci evolved a new way of painting through the mimicry of reflections inside the camera obscura. After Leonardo, the physician Girolamo Gardano created a new piece called the biconvex lens. Helmut and Gernsheim singleout:

If you want to see the things which go on in the street, at a time when the sun shines brightly place in the window shutter a bi-convex lens [orbem e vitro]. If you then close the window you will see images projected through the aperture on to the opposite wall, but with rather dull colours; but by placing a piece of very white paper in the place where you see the images, you will attain the eagerly awaited result in a wonderful manner. (Helmut & Gernsheim, 1969, p. 21)

The latter attainment sounds identical with Leonardoda Vinci's; however, quality in Gardano's achievement proves better (ibid). Incrementally, Giovanni Battista made profit of camera obscura to corroborate the field of painting (ibid 22). He took on that device as an instrument that allows for the representation of the physical world. He used it to bounce off light with the object targeted and then used the pencil to imitate the real object, and he dedicated his discovery to beginner painters to draw reality-like pictures (ibid).

Centuries after, an American banker called George Eastman had been capable of inventing a roll film in the mid-1880(Eder, 1978, p. 488). This apparatus is sort of celluloid that enabled to discard heavy glass plates; he, instead, advanced a layer of chemicals along with a particular gelatin coated with papers to generate negatives (ibid). After some respective years, Eastman contrived his camera that contains a roll-film of one-hundred negatives (Romer, 2008, p. 32).

This innovation had indeed changed the nature of photography to meet new methods as Eder avows:

It was at this time that Eastman conceived the idea of roll films, which simplified photography and made it really popular, because it was no longer necessary to carry heavy plates or plate holders. Then came paper films, that is the film consisted of paper coated with an emulsion. In order to make this process possible, it was necessary to coat the emulsion on long continuous widths of the paper, for which Eastman invented a special coating machine, which he patented in 1885. (Eder, 1978, p. 488)

If there were a congruent camera to this millennium in terms of practicality, it would be then the Kodak camera that Eastman invented (Romer, 2008, p. 23). Kodak hitherto has permitted amateur photographers to acquire handheld cameras to document and visualize their stories or memories (ibid). Eastman's contrivance triggered the business market to join the sector of photography (Kupsc, History Of Cinema For Beginners, 2003, p. 2). Ever since, it can be understood that photography has become lucrative and operated under industrial and capitalist underpinnings.

This cutting-edge fulfillment was distinctly decisive for the advent of motion pictures cameras and thus the art of cinematography (Tagliaferro, 2003, p. 76). Étienne-Jules Marey had evolved in 1882 a machine called the chronophotographic¹ gun, which some experts call the raffle (Kupsc, The History of Cinema for Beginners, 1998, p. 2). Inspiring from Muybridge's experiment, which was based on the setup of many cameras, Marey developed a single camera capable of catching numerous pictures in few seconds by using a role paper of celluloid (ibid). Raimondo-Souto describes Marey's contribution as it follows:

In 1887-88 Marey built an apparatus named the chronophotograph with a design very similar to the latter classic motion picture camera [his phonographic raffle], with a lens, a special shutter, a gate, an intermittent mechanism, and sensitized Kodak paper film, including loops, two and hand crank.(Raimondo-Souto, 2007, p. 4)

His primary purpose of using this paradigm was to study objects in movement, for he was an expert interested in assorted sciences. The documentary filmmaker Virgilio Tosi evokes that "Mary was only interested in studying by photographic means the mechanism of flight in various species of animals" (Tosi, 2005, p. 96). In the late 1880s, Marey met Edison, and it was an opportunity to exhibit the chronophotograph apparatus in front of him, and this permitted Edison to make benefit from Marey's experiment to develop the optical phonograph² (ibid 111).

Tomas Edison is notably the overt beneficiary of Marey's fabrications. Edison's unprecedented device was the kinetograph that enabled viewers to see moving pictures

¹A device capable of capturing successive images and hence creating movement.

²Rudimentary movie projector

projected inside a large box, after paying their tickets (Tagliaferro, 2003, p. 79). At that period, there were no movie theaters. Instead, there were parlors where customers gather, and Edison's kinoscope was a large manufactured container that operated somehow like cinema theaters only allowing one person to watch moving picture inside it (Kupsc, History Of Cinema For Beginners, 2003, p. 3). In 1891, Dickson succeeded under the auspices of Edison's company to improve a kinoscope capable of producing animated sequences of pictures, and this machine relied on Eastman's celluloid which was used in Kodak to create moving pictures (Raimondo-Souto, 2007, p. 5). Holly Cerfrey (2003) furtherly states that "Edison invented the Kinoscope, a motion picture camera. The Kinoscope took pictures quickly. The pictures were recorded on a strip of film that was wrapped on a wheel or a spool" (Cerfrey, 2003, p. 16). Edison's peculiarity is embodied in the electrical processing he employed for the process of shooting (Raimondo-Souto, 2007, p. 5). As electricity scientist, Edison used bulbs lightening to project his target bodies. This method permitted photographers to take numerous pictures at a bit at a time with fine fineness (William Kennedy-Laurie Dickson, 1970, p. 55).

1.2 Lumière Brothers' Groundbreaking Achievement

Needless to say, Edison is a lighthouse figure in the sector of cinema. Nonetheless, the Lumière brothers, Lumière Auguste and Lumière Louis, are worth mentioning for their exclusive screen projectors (Romer, 2008, p. 25). Their interventions are considered the clue to what is called nowadays movies theaters. The scholar Grant B. Romer perfectly recapitulates the brothers' accomplishments:

In 1904 they invented the first widely used color process, the autochrome. In 1895 they publicly demonstrated their cinematographe motion picture camera and projector, which used perforated, celluloid 35 mm film; the design continues to be used in nearly all modern filmmaking apparatus. They were acknowledged in that same year for making the first movie to be publicly exhibited. (ibid 129)

The Lumière brothers had succeeded to overshadow Edison when they improved an apparatus that could project moving pictures on screens face to face with audiences. In virtue of this invention, people interested in cinematography, namely bourgeois society, could henceforth watch locomotion films collectively in movie theaters as an alternative of throwing the eye on Edison and others' peepholes to observe what takes place inside the primitive kinoscope (ibid)³. The influential basics that framed the work of Lumière brothers were noticeably Marey's findings and experiments. Going in tandem with this stance, Joseph Maria Eder exposes that:

Marey's work shows clearly the thread leading to cinematography, an invention which since 1892 is perfected and final in its basic elements. Lumiere have evidently done

nothing more than add a technical improvement to this basic invention. In place of the name given to it by Marey, which was adopted by Lumiere, "chronophotography," the term "cinematography," introduced by Leon Bouly, has been accepted and brought into general use. (Eder, 1978, p. 511)

The Lumière brothers' appropriation of Marey's discovery is symmetrically described by Virgilio Tosi when he referred in his *Cinema before Cinema* (2005) to the Lumière brothers' frequent paid visits to Marey's laboratory during the early 1890s with the aim of grasping the chronophotographic components (Tosi, 2005, pp. 126-127). Their regular inspections in that workshop along with other professional and official meetings with Marey and other practitioners gave rise to a new machine proficient to project animated pictures on a wet wide screen. This device was applauded by dint of its ability to project large frames on large screens (ibid). From that time, the Lumière brothers' device has been called the *Cinématographe*.

Aristides Gazetas similarly attributes this apparatus as being more advantageous than Edison or Marey's cameras, since the *Cinématographe* was incorporated with a projector (Gazetas, 2008, p. 22). Another idiosyncrasy of perfection could be the mobility of that camera. It allowed cameramen to move autonomously and shoot any part they like to capture (ibid). Gazetas adds that "the camera offered its operators few indoor lighting problems, and like the TV camera today, used natural daylight to their advantage to photograph important events" (ibid). This genius procurement enticed irrevocably markets worldwide for its promising outcomes on the economic thriving of businessmen (Gazetas, 2008, pp. 22-25).

2. Movie Theaters and the Market System

The success of Lumière brothers put forward the possibility to make films more comfortably and feasibly (Gazetas, 2008, p. 22). Besides, the likelihood to establish movie theaters had become practical; thus, cinematography fanciers started to get used to a new phenomenon, which is attending cinema halls to watch a movie, and as a corollary, the sale of either thickets or films was a truth that seduced producers to join the art of cinema, and they came to grips with it from a profitable perspective (ibid 22, 23).

Since 1887, the Lumière brothers endeavored to proliferate their contributions to the field of cinema. The Lumière Company, inter alia, mastered and excelled in the production of many serving appliances that were mandatory for the seamless start of cinematography. This being so, the entire world sought after the brothers' inventions, which, *de facto*, were able to invade Europe, the united states, and other corners in the planet dramatically. This datum is seemingly uttered by Joseph Maria Eder:

Lumiere's cinema apparatus was presented at London on December 28, 1895. In the German countries it was first introduced at Vienna on March 20, 1896. Then it appeared at Berlin, and soon it had spread all over the

³It is described as primitive since Edison will gradually improve a developed kinoscope.

world. At the World Exposition at Paris, r 900, the brothers Lumiere projected their motion pictures on large wall surfaces and proved their capability for mass production.(Eder, 1978, p. 521)

Such a triumph allowed the brothers to shortly place their devices in the market to be exploited by professionals and amateurs (ibid). Thereafter, a plethora of film attempts took place as a repercussion of the success of the *Cinématographe* and the new kinetoscope, which became sophisticated in virtue of Thomas Armat's vitascope that had been synchronized with the kinetoscope by Edison (Gazetas, 2008, p. 22). What is more, these films inevitably needed exhibition, and hence opening movie theaters to see virtual locomotion was compulsory and an upshot of audience demands.

Before the rise of modern movie theaters as they are known here and now, films used to be projected in parlors, vaudeville theaters, or other public operas and museums, which are rudimentary sites in comparison to nickelodeons and modern cinema theaters (Musser, 1991, p. 66;142). *Leonard-Cushing Fight* (1894) *Sandow* (1894) *The Kiss* (1896), *The Record of a Sneeze* (1894) and *Corbett-Fitzsimmons Fight* (1897), to name but a few, are early shorts underlining the idea of entertaining audiences (Streible, 2008, p. 72;83). In France, cinema advent was quite similar to U.S.A. Richard Abe (1994) evokes that films of the French movement were exhibited at the premises of places he calls 'locations':

By the time of Pathé's drive films were exhibited in a variety of locations, nearly all of them established sites of spectacle attractions. In Paris, besides Méliès's Robert-Houdin Théâtre, there was another magic theater near the Grand Café, the Sale des Capucines (owned by the Isola Brthers), which included films on its programs. Similarly, there were wax museums like the one directed by Léonard Béguiné on the Boulevard de bonne Nouvelle and, especially, the Musée [...] There beginning in 1892, for three hours every afternoon and evening, Emile Reynauld had projected "Pantomimes lumineuses" such as *Pauvre Pierrot* and *Autour d'une cabine* [...] Then in 1899, Gaumont actualités were added to the variety of performances in Grévin's theater. [...] Another site in the capital was the Dufayel department store [...] which had a small theater that presented the Lumière actualités as early as 1896 and then continued to exhibit publicity films.(Abel, 1994, p. 15)

While films in the United State were keen on entertainment, French early films were stretching on actualities. They were kind of reality reproduction shown to people (Rollyson, 2006, p. 8). Andre Gaudreault (2009) puts is differently and asserts that "the Lumière brothers, therefore, did not invent animated views. What they invented, rather, was a device for recording moving pictures that was designed in such a way as to project them onto a screen"(Gaudreault & Gunning, 2009, p. 8). The brothers' films in France were hegemonic

as they attracted audiences largely. *Workers Leaving The Lumière Factory in Lyon*(1895) is decidedly taken as the first exhibited film in Europe along with *The Arrival of a Train at La Ciotat Station* (1895), which were both exposed at the Grand Café⁴ in 1895 (ibid). This phase could be better described as the beginning of film commercialization. Not surprisingly though, filmmakers started to choose showrooms where they can invite small numbers of people to see their shorts (ibid 15-17).

The middle class, or say a massive audience, would contribute noticeably to the growth of movie theaters in USA and Europe on account of the privileges they gained in the end of the Nineteenth Century (Gaudreault & Gunning, 2009, p. 11). The advantages proletariat had received along with the social mobility of some lower classes in the 19th century made it possible for large segments in society to satisfy their leisure needs; cinema, meanwhile, was a lure to most of society members regarding its spell and uniqueness. In 1905, nickelodeons started to occur as sites for public screening. Gaudreault and Gunning throw light on this fact revealing that:

The nickelodeon triggered a severe crisis, both within the film industry and in American society. The proliferation of nickel film theaters and their popularity among the working class meant that a whole class of people now possessed a form of entertainment and representation that had seemed to appear without either the blessing or the control of the better classes.(Gaudreault & Gunning, 2009, p. 16)

This phenomenon has become known as 'paying public projection'. Herein, the market system began to take audiences into consideration to correspond to their artistic tastes and affiliations (ibid). Simultaneously, censorship would intervene in the American cinema because of its potential to shape and reshapes people's cognitive qualities (ibid). The National Board of Censorship was the first institution to revise films in the United States before display (ibid).

The trajectory of the camera denotes that this super technology is the outcome of the interplay between various scientists and experiments. These brief insights on camera evolution put limelight under many disciplines and sciences that respectively, proportionally, and collaboratively led to such a giant device and therefore paved the way for cineastes to pepper humanity with novel forms of art. The inventors above approve that cinematography in not patented under the name of one person or nation, yet the warrant should be bestowed to all scientists who took part in the birth of filming gadgets and hence the art of cinema.

3. Conclusion

The antecedent discoveries render cinema a chain of appropriation. In art, appropriation, can refer to the methods of transformation from one form of art to another similar

⁴ It is further known as Le Salon Indien du Grand Café in Paris. It is the place where Lumière brothers projected their first films ever.

shape, but with new themes or meanings (Young, 2008, p. 1). This morphing needs a previous paradigm with which new forms of arts model and then develop into a new art. Hence, art is a process of evolution that interchangeably adopts and adapts multiple pre-existing arts. James O. Young (2008) sheds light on the concept of appropriation and describes it in the following cases:

Artists from many cultures are constantly engaging in cultural appropriation. Picasso famously appropriated motifs which originated in the work of African carvers. Painters who are members of mainstream Australian culture have employed styles developed by the aboriginal cultures of Australasia. The jazz and blues styles developed in the context of African American culture have been appropriated by non-members of the culture from Bix Beiderbecke to Eric Clapton. Paul Simon has incorporated into his music elements of music from South Africa's townships. (ibid)

Young's idea herein overlaps with the notion of assimilation that emanates from intercultural encounters; hereafter, appropriation denotes that art is influenced in virtue of its interchangeability. This is a prominent fact that leads to cultural mingling and therefore the conversion of art. Thus, appropriation unfolds the acts of adoption and adaption of artistic works through interconnectedness, heredity, or borrowing (ibid 31). This mechanism *de facto* could be the prime reason that leads to artistic versatility. According to Young, the appropriation of art can concern the performance of the 'artistic content' (iterating the same work) or the fostering of the 'artistic elements' that include the methods and undelaying theories of other works (ibid 4). Appropriation, in so doing, is a smooth process that confers new aesthetic values to new works of art.

In the instance of cinematography, appropriation is manifested in abundant aspects. This is apparent in the multiplied mannerisms that exist in cinema genres and approaches. Besides, one can argue that the different modes of filmmaking in cinema are mere appropriations from the early shootings of leader cineastes like Thomas Edison and the Lumière Brothers who conducted the first initiatives of motion pictures during the late 19th century, and from whom it can be speculated that film theories sprouted and constituted divergent cinematographic movements.

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