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EXPANDED CINEMATOGRAPHY

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Declaration

I declare that I have prepared my Master's Thesis, Dissertation independently on the following topic:

Expanded Cinematography

under the expert guidance of my thesis advisor and with the use of the cited literature and sources.

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ABSTRACT

The cinematography as an art form stands today at a crossroad. There is a lot of controversy surrounding the definition of the term “cinematography” in the context of films in which traditional (lensed) cinematography was subordinated to virtual techniques, such as “The Matrix”, "Life of Pi" and "Gravity”.

The following study will observe the historical development of the camera techniques, as its goal is to verify if the virtual cinematography is a step forward in the evolutionary road of the job of the director of photography. In order to seek for the truest answer, the study will analyze the work of the cinematographers of the above-mentioned feature movies, in terms of their collaboration with the visual effects supervisors and their creative team. The study will try to convey how the DoP's have used the new skills to help support the dramaturgy of the screenplay.

ABSTRACT

Nahlížíme-li na profesi kameramana jakožto na určitou formu umění, pak toto umění dnes stojí na rozcestí. Kolem pojmu kameramanství je dnes určitá kontroverze, zejména v kontextu filmů, u kterých byla klasická kamera podřízena virtuálním technikám (např. Matrix, Life of Pi, Gravitace).

Následující práce se zabývá historickým vývojem kameramanských technik a jejím cílem je ověřit, zda je virtuální kinematografie krokem kupředu v evoluci práce kameramana. Ve snaze dobrat se co nejpravdivější odpovědi, rozhodl jsem se analyzovat práci kameramanů výše zmíněných celovečerních snímků ve smyslu spolupráce se supervizory vizuálních efektů a celým kreativním týmem. V této studii se snažím objasnit, jak tito kameramani použili nové techniky za účelem podpoření dramaturgie příběhu.

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1. INTRODUCTION

At the beginning there was light.

Discovering the light, people became easily fascinated by it and by the means by which they could make a use out of it. Even since Antiquity, they discovered the concept of communicating with light and with the shadows it creates. Aristotle described how beams of sunlight when passing through a small hole project an inverted image on the wall of a darkened room, and doing so he gave us the oldest known reference to the *camera obscura*. The idea of this camera was rediscovered and analyzed during the 16th century but still, we can talk about the roots of modern photography only after the industrial revolution has had its say. It was in 1816, when Nicéphore Niepce, a French lithographer, experimented with recording images on metal plates coated with a sensitized material and years later, in 1827, he designed a homemade camera out of a window and recorded a picture on a pewter plate coated with a light-sensitive chemical emulsion. During the productive 19th century the art of *writing with light* got its tools invented.

“The art challenges the technology, and the technology inspires the art.”¹

- John Lasseter, Director/Writer/Producer for Pixar

It is a fact that the technology is tightly related to the modern use of light to create art. As it progresses, artists gain more ways of expression. The new technologies inspire and motivate, feeding the artists' curiosity and thus – modifying the form of the film art, making the natural change happen. Playing with reality – making the unreal events appear realistically on screen, moving the borderline that divides the fiction from the reality, the possible from the probable became a fuel for the artists' brain.

¹ <http://pixar-animation.weebly.com/journal/school-holiday-work-the-connection-between-art-and-technology>

Further on in this study, we will investigate how the rise of the technology brought magic to the art of drawing with light. It will give an insight into the history of film and animation, showing how they both merged to create more exciting images and stories, even since the beginning of film-mediated storytelling. The study will continue by inclining towards the modernity of this subject, by placing the contemporary technologies in the center of its interest. We will argue how the new technologies evoke the creativity of the new craftsmen of cinematography, how they sculpt again and redefine the task of the *man with the camera* and finally it will question the benefit of these new ways of thinking and creating, wondering and meditating on the possible future of the art of cinematography.

1.1. The first motion picture

It is important to understand the roots of cinematography (or photography, if one insists on being more precise), and to understand how its technology developed in order to become aware of the human need of documenting reality and the excitement of being able to modify it somehow. The thrill of showing the unreal was preceded by the desire for reproducing/documenting reality. This introduction to the human attempts to develop technology for documenting and modifying the reality will help us comprehend the tentative of cinematographers and thus be able to meditate on the possible future of their craft.

The oldest recorded attempt at motion picture photography was made by an Englishman named Edward Muybridge. He was hired by an American in order to help him win a bet by proving that there were times in a horse race when all four of the animal's feet are off the ground. It took five years for Muybridge to come up with the idea to set 24 cameras up in a row along a race track. He attached a string to each camera shutter and stretched the strings across the track. Muybridge chalked lines and numbers on a board behind the track to measure progress. As

Stanford's horse raced on the track, it tripped the wires and recorded 24 photographs that proved that all four of the horse's feet were off the ground at the same time. The American won his bet, and Muybridge continued experimenting. During the early 1880s, he traveled to Paris to demonstrate his multiple-camera system for other photographers and scientists. One of his hosts was Etienne-Jules Marey, who was experimenting with the use of a single camera for recording images in motion.

Meanwhile, across the ocean, Thomas Alva Edison had invented a system that recorded and played back music using wax cylinders. After his invention became popular in consumer households, Edison got an idea for building and selling a device to consumers that displayed moving images to accompany the music. In 1885 he assigned W.K.L. Dickson the task of finding a way to record moving images on the edges of records. Since it was a discouraging task, Dickson connected with George Eastman, a photographer who had to spread a chemical emulsion on a glass plate in a pitch black area and take the picture before the emulsion dried. In 1880, Eastman leased space in a Rochester building and began manufacturing dry plates, which maintained their sensitivity to light. Eastman Dry Plates played a major role in popularizing photography, but the former bank clerk was determined to make it easier to take pictures. Using the patent of Reverend Hannibal Goodwin, Eastman contributed to the creating of the Kodak Brownie snapshot camera 1888. After Dickson saw the Kodak Brownie camera at a meeting of an amateur photographers' club in New Jersey, he traveled to Rochester and met with Eastman, who agreed to provide the film needed for an experimental motion picture camera. That was the grand Eureka who opened a lot of work for Edison. He developed the Kinetograph camera and Kinetoscope projector, which he patented in the United States in 1891. Edison opened the Black Maria Studio in Orange, New Jersey, the following year, and told Dickson to begin producing

motion pictures to showcase at the Chicago exposition. Dickson installed a trolley track at the Black Maria Studio that enabled him to move the camera further away from and closer to his subjects for more intimate shots. That was an early, intuitive step towards making cinematography an interpretive art.

Record of a Sneeze, shot by Dickson, is oldest motion picture on record at the Library of Congress. The title of the 1893 film is literal. It shows Fred Ott, a mechanic who worked for Edison, sneezing.

Edison patented the sprocket drive technology developed by Dickson, who also designed, built and operated the film processor and printer. The Kinetoscope was a sensation at the 1894 Chicago Exposition. It was new and exciting and people got drowned in the new sea of possibilities – to film the world and show it on a screen. But the simple representation of real life by documenting it was soon to be surpassed.

1.2. Modifying the real life pictures

When the Lumière brothers revealed their Cinématographe to the public on 28th of December in 1895 Méliès was in the audience. What he witnessed clearly had a profound effect upon him. Later on, he got himself a Kinetoscope and started projecting other peoples' films. Soon he could not hold on his temper to try and direct his own cinema.

Méliès' principle contribution to cinema was the combination of traditional theatrical elements to motion pictures – being a magician he wanted to present spectacles of a kind not possible in the live theater. In the autumn of 1896, an event occurred which has since passed into film legends and changed the way Méliès looked at filmmaking. Whilst filming a simple street

scene, Méliès camera jammed and it took him a few seconds to correct the problem. Thinking no more about the incident, Méliès processed the film and was struck by the effect such an incident had on the scene - objects suddenly appeared, disappeared or were transformed into other objects. Méliès discovered from this incident that cinema had the capacity for manipulating and distorting time and space. He expanded upon his initial ideas and devised some complex special effects. He pioneered the first double exposure (*La caverne Maudite*), the first split screen with performers acting opposite themselves (*Un Homme de tete*), and the first dissolve (*Cendrillon*).

Being able to modify the real life events and make them look surreal and magical was a new window to the filmmakers. Unreal events could be made to look real on screen and this idea opened a whole new world, proving again how *technology inspires art*.

1.3. Animation

After the popularization of the Cinématographe, and the discovery of the potentials of the movie camera to shoot frame per frame, producers and movie artists started to explore possibilities of animation. They started to draw on black boards and move objects in between their images being recorded so that when images were projected in normal frame rate the objects and drawings started to get a life and move free in space and time. The earliest film trick technique created an illusion of impossible action. Everything that couldn't happen in real life, started to become real through cinema...Magic was created.

In 1914, the American cartoonist Winsor McCay had shown to the world the true potential of animation, by making the cartoon named "Gertie the Dinosaur". The film shows McCay venting to his friends that he had made a movie that stars a Lady dinosaur that will do anything that she is being told. The men bet on that after which the animated film is projected in

the room. The animated sequence shows the dinosaur peeking out of her cave to finally get out of it and raise her right foot, drink water, dance, eat a tree, not harm the passing elephant...actually doing anything that McCay demands her to accomplish. The last scene of the animated film shows a drawing of McCay appearing on screen and demanding Gertie to give him a ride on her back. She accepts and they both ride out of frame. Then the film goes back to the room with the audience where we see how the real McCay wins the bet and gets his share.

Thus, *Gertie the Dinosaur* is the first film to combine live action footage with hand drawn animation. McCay hand-drew almost every one of the 10,000 drawings he used for the film. This idea excited the animator Walt Disney who, later on, in 1923 made the animated series "Alice Comedies", which featured a live action girl interacting with numerous cartoon characters. The first episode of the series is entitled "*Alice's Wonderland*" begins with Alice entering a cartoon studio to witness cartoons being created. She is amazed by what she sees: the cartoon characters come to life and play around. After going to bed that night, she dreams of being in the cartoon world, welcomed by all of the characters. Alice plays with them until a group of lions breaks free from a cage and chases her. This short helped set the stage for what was to come in the later *Alice Comedies*, as it established the world as a playful dream and also introduced the elements which would soon define the series.

The possibility to show on screen objects, creatures and actions which was physically impossible using live action excited the artists and therefore they inclined naturally towards developing the technology of making those images look more and more realistic. The hand drawn images slowly got out of the competition when the computer generated ones got on the market.

1.4. CGI – The computer generated images era

During the midst of the 20th century, the world was facing a new scientific revolution by the invention of the computers. Their usage escalated rapidly and soon they entered the postproduction room of the movie industry. Now they are its inseparable tool. However, they changed completely the task of the cinematographer. Besides working with more technical and creative people to create the perfect image, the cinematographer was faced to work with fictional characters, not portrayed by actors but by a computer code. He was faced with a problem of handling the light of a computer-generated character in a way that it will look good if put in a real live action shot.

The first computer animated character was created in 1968 when a group of soviet physicists and mathematicians with Nikolai Konstantinov as its head created a mathematical model for the motion of a cat. On a BESM-4 computer, they devised a program for solving the ordinary differential equations for this model. The Computer printed hundreds of frames on paper using alphabet symbols that were later filmed in sequence thus creating the first computer animation of a character - a walking cat.

Further on, in the year 1972, Ed Catmull and Fred Parke created the world's first 3D rendered movie, an animated version of Ed's left hand. This clip was eventually discovered by Hollywood producer and incorporated into the 1976 movie "Future world". In one scene of the film where two main characters found out how the robots are made, on small computer monitor we can see the full 3D animated hand and head. The pioneering technique from this scene will be just a basis for 3D rendering that is used today in video games, movies and special effects.

However, the results of this evolution were seen in the 1990's when the world got introduced to the actual visual representation on the screen of a digitally produced character that acts in a live action shot sequence. It is all due to a certain graphic designer Trey Stokes and the computer technicians Brad DeGraf and his partner Michael Wahrman. They developed in 1988 the character of Mike Normal, just with the intention to show off the real-time capabilities of Silicon Graphics' then-new 4D series workstations. Unveiled at the 1988 SIGGRAPH convention, it was the first live performance of a digital character. Mike was a sophisticated talking head driven by a specially built controller that allowed a single puppeteer to control many parameters of the character's face, including mouth, eyes, expression, and head position. The system developed by de Graf/Wahrman to perform Mike Normal was later used to create a representation of the villain Cain in the motion picture RoboCop 2, which is believed to be the first example of digital puppetry being used to create a character in a full-length motion picture.

Still, the grand entrance of the CGI technology in the film industry happened in 1995 with the apparition of "Casper". This was the first feature-length film with a digitally-created, CGI character that took a leading role (almost 40 minutes of film time). The computer-generated, translucent image of the 'friendly spirit' (from the Harvey Comics' character Casper the Friendly Ghost) - was the first fully synthetic speaking character with a natural and distinct personality expressing emotion.

1.5. 21st century: The virtual cinematography

At the turn of the century the cinematography became more and more computer altered, which gave way to new methods of working. The creation of real-time animation by using

camera moves and avatar control techniques made the creation of magnificent virtual worlds possible.

Facing a way of making motion pictures that are more than ever altered by computers, the cinematographers Vilmos Zsigmond (*Close encounters of the third kind, Maverick*) and Yuri Neyman (*Liquid Sky*) felt the need of re-defining it, so they came up with the term of expanded cinema:

“Expanded Cinematography is a state of mind which is recasting the production process around creative choice, rather than developing and working around barriers created by gaps in the ever-evolving technical knowledge. This way of thinking creates a new unity of art and technology, the conversion of existing crafts and the activities of cinematography, design, art direction, visual effects, virtual lighting, pre-visualization, as well as emerging visual practices, into a newly crafted discipline which in turn develops the cinematographer’s profession into a Cinematographer – Artist – Designer – Technologist that is able to comprehend and solve many tasks which modern production can put in front of him or her”²

The following text will give examples on the use of new technologies (*The Matrix trilogy, The Life of Pi, Gravity*) in the modern days. It will examine their look, their positive and negative sides opting to understand what is the art of cinematography developing into: should the cinematographer of today embrace and lean towards the benefits of the new technologies or should he lean backward, searching the nature of the simple artistic expression?

² <http://globalcinematography.com/about/aboutGCI.html>

2. *The Matrix trilogy (1999, 2003)*

In the turn of the century, when as history has shown challenging ideas gain means to be realized, the creators of the most revolutionary movie of the time, *The Matrix*, pushed the limits of the tools with which a cinematographer works and made a huge step forward towards the birth of the virtual cinematography. The last one is a term invented by the visual effects supervisor while he was working on the movie itself. Little did they know, by making a film set in the future, they traced the path of the forthcoming cinematographers. The directors of the movie, the duo then known by the name of Wachowski brothers, imagined a story happening in the future which collided two distinct worlds – a real and a virtual one – and by making the first one look more digital and fake than the later one they expressed out their philosophical point: the way you see the world depends on your will to open your mind, which, if embraced, gives you the strength to change your surroundings for better.



Fig. 1. THE MATRIX (1999) D: The Wachowski Brothers C: Bill Pope

2.1. The story

The story of the film is set in the future, in an environment where there is a machine civil war going on. It is about a complex computer simulation called the Matrix which was created by malicious Artificial Intelligence. The Matrix allows people to live in a world where people are used as energy source for the machines, hiding this terrifying truth from the humanity by creating a convincing mindset for their human minds. The successful computer programmer, living in such a world as an ordinary person lost in the Matrix, Neo, is contacted by a group of underground freedom fighters, led by Morpheus, whose beliefs are that Neo is the chosen one to save humanity. As Neo slowly begins to accept his role as “The One”, him, together with Trinity with whom he falls in love, and Morpheus fight against the machine’s enslavement of humanity. From this point on, the film goes in and out the reality, switching from the world of the Matrix to the real one. Neo is trained to go with the obstacles of the virtual reality, and he slowly becomes persuaded that he really is the chosen one. He accepts the journey fully when Morpheus is endangered. He then, accompanied by Trinity dives into the adventure of a superhuman fight against the Agents of the Matrix.

The audience is led to believe that by the power of love, Neo is able to do anything, but most importantly to believe in himself, in his powers and in the fact that he really is the chosen One in possession of the special powers to save humanity.

Even though the dramaturgy of the story is following the patterns of the well-known and accepted rules of emerging hero stories, what is revolutionary in the Matrix trilogy is the use of technology to tell it, to convey the superpowers of the body movements, to create the reality in which flying, jumping and moving super-fast is considered normal.

“She jumped in the air and the camera swirled around her. At that moment, everything about big budget moviemaking changed. While many late-1990s science fiction films such as 'Dark City' and 'Strange Days' embraced a similar grim, urban aesthetic, 'The Matrix' absorbed it, internalized it, and expanded upon it. The original film would be seminal in stretching the boundaries of computer-generated imagery - literally.”³

– Peter. M. Bracke, filmmaker and a critic



Fig. 2. THE MATRIX (1999) D: The Wachowski Brothers C: Bill Pope



Fig. 3. THE MATRIX - Behind the scenes

³ placetoreview.blogspot.com/2011/08/kindle-3g.html

2.2. The challenging journey before the shoot

Preceding all revolutionary inventions there is a dream, an idea that burns to be exploded out of the creator's mind and be expanded in front of the audience. The Wachowski's brothers were dreaming about the world of The Matrix for years while working on a construction field in Boston. Reading comic books and Japanese anime stories they got infected by the action portrayed by those images. The hero stories, the amazing powers those heroes possess and the aesthetics of the shots were already nourished at those times. Before diving into the story of The Matrix, The Wachowski brothers tested their talents and possibilities with the directing of the movie "*The Bound*", a dark and stylish thriller done in 1997. This movie helped them get financed to make the super – ambitious movie to follow.

*"Our main goal with The Matrix was to make an intellectual action movie. We like action movies, guns and kung fu, but we're tired of assembly-line action movies that are devoid of any intellectual content. We were determined to put as many ideas into the movie as we could, and purposefully set out to try to put images up on the screen that people haven't ever seen before."*⁴

Larry Wachowski, co-director and co –writer of The Matrix

When following a never-until-then realized dream, the greatest challenge is to find people who believe in that idea as much as you do. In the year of 1999 to create a world that has never been screened before on the big screen, didn't seem realistic to anybody. To bring their idea and concept more closely to producers and future collaborators and in order to attract them more to their vision, the two brothers decided to create highly graphic storyboard inspired by comic

⁴ American Cinematographer Magazine, "Welcome to the machine", Apr 1999

books. This hand drawn *storyboard bible in color*, contain every single shot of the movie, together with each action, visual moment and style.



Fig. 4. Still from the “storyboard bible” of THE MATRIX



Fig. 5. THE MATRIX (1999) D: The Wachowski Brothers C: Bill Pope

The comic book artists Steve Skroce and Geof Darrow worked for three months with the brothers in a try to search the truest look of the movie. It contained shots which have the esthetics of Japanese animation (anime) and which imposed shooting angles which, as was believed back then, was impossible to be done. Bill Pope, the director of photography of the movie, was approached by the Wachowski brothers as they knew about his grand love of stylized

shots and comic books, hoping he will take the challenge. After analyzing the meticulously done storyboard, the cinematographer realized that showing this unreal world and super powers of the main characters, with the equipment that they had back then, was, however - not possible. The story needed some new technologies and new creations. He found it also very difficult to make a uniformed style of the camera for the two distinct worlds that construct the story of The Matrix.

*"Larry and Andy wanted The Matrix to have two distinct worlds. There is the world in the 2197 future — in which we have the pods made by the computers — and then there's the present-day Matrix world, which was designed to be a slightly unappealing reality."*⁵

- Bill Pope, Director of photography

The challenging world to be created was, more than anything else, the one set in the reality of the future. It is a realm fully populated by biomechanical creatures that control the mankind. The visions the brothers had imposed camera movements and angles which, as they all agreed, could be only done with animation.

2.3 Introducing the visual effects supervisor

When it comes to implementing animation scenes in a feature movie, the Director of photography by himself is incapable of providing all that is needed so that the vision of the director comes to life. The collaborator he needs is someone who generates the DoP's esthetical ideas by using algorithms and machines. John Gaeta was the visual effects supervisor who was hired to collaborate with Bill Pope and make the Wachowski brothers' vision become visible on the screen. He enlisted three visual effects houses — San Francisco-based Manex Visual Effects and Sydney, Australia's Dfilm Services and Animal Logic – where he hired over 100 people to

⁵ American Cinematographer Magazine, "Welcome to the machine", Apr 1999

work for two years on the creation of the virtual camera shots. The software they used then to create the specific reality of the environment as well as the creatures inhabiting it was Alias/Wavefront's Maya software, and later the images were composited via a Cineon.

To illustrate, let's take a look at few scenes from the world of The Matrix, The Matrix Reloaded and Matrix Revolution. One of the most authentic Matrix shot created completely in the studios led by Gaeta is a two minutes long pull back shot which starts from the inside of the head of a baby, passing through a capsule in which the baby is captured, and as the camera goes through this "human battery" while popping out of it, one of the machines intakes it. Then the camera pulls even further to a wide shot of the whole farm containing hundreds of such capsules of human beings being used as energy source.

*"This sequence begins with the camera spiraling out of the eye of a developing fetus, and then corkscrewing up to reveal this infinite field of babies being grown. Then we see these massive Harvesters — giant, floating beasts with long, fleshy arms ending in mechanical claws, picking babies like oranges off a tree. The entire environment is 100 percent CG."*⁶

- John Gaeta, visual effects supervisor

Indeed, the set designers only produced four of them capsules to be shot in the studio. The whole image is then created by using animation techniques, combining camera captured shots with animated ones. This mixture of animation and studio captured shots is a storytelling tool that intertwines through the entire movie, as it feels, in order to portray in the best way the nature of the two distinct worlds that create the story of the trilogy. The director of photography, Bill Pope, also decided to use color as a way to distinct the two worlds. He used the blue tone for

⁶ American Cinematographer Magazine, "Techno Babel", Apr 1999

the portrayal of the reality that happens in 2197, while for the other one, the world of Matrix he used the green color. Further on, during the second part of the trilogy, at the point when Neo accepts his gained super powers, he is involved in a fight with the Agent Smith, or to say it more precisely with hundreds of clones of the very same virus that is permanent in his intention to contaminate the chosen One. The scene is an attractive action of fighting, one man against hundred clones. They attack Neo, cover him completely until he gains force to break out free and flee by flying off. To create the clones and to animate them in their sophisticated, action – like movements, was the groundbreaking job of John Gaeta and his crew of animators. It was not only to set the tone and add details to the image, but the Computer Generated Image (CGI) technique was used for the creation of living characters, with determination, motivation, and action. Finally, as a part of the third movie of the trilogy of The Matrix, there is a scene where the detailed movement of the bodies of the characters, as well as the atmosphere, is done with algorithms. Neo confronts Agent Smith and after a fast cut philosophical conversation in which Neo is asked about his motivation for the fight he responds: “Because I choose to”. His decision is so firm that its sharpness needed to be conveyed to the audience. The creative team here chose to use the slow motion movement of the elements in the shot, while the camera slides around them showing how Neo’s fist breaks the rain drops into smaller pieces, on its way to reach Agent Smith’s face. The beat is heavy and strong, leaving traces of Neo’s fingers on the Agent’s cheek. It all seems very dramatic, stressing out the firmness and determination of the protagonist. Again it will not be possible to be done in that way without the use of the visual effects and what is now to be called “the virtual cinematography”.

2.4 The term virtual cinematography

The world of the Matrix is a place where the people freed out of the machine control are in possession of superpowers which allow them to move fast, jump over huge distances, fly etc. In order to present the supernatural power of a movement that Neo possesses, among the other Agents and freed out people, in the realm of the Matrix, the creative team of the movie – Bill Pope, the Wachowski brothers, and John Gaeta, needed to confront great challenges. Their struggle led them to invent the technique called “bullet time”.

The technique to shoot slow-motion events (fighting, kicking, jumping...) with a dynamic camera movement is a process that allows filmmakers a grand flexibility in controlling speed and movement of on-screen action. The other terms used to describe the effect of the “bullet – time photographing” are: adrenaline time, focus time, frozen time, dead time, flow – motion, dead eye or time slice. Simply put, it is a visual effect that makes as if the time and space of the camera are detached from the time and space of the subject shot. The camera seems to move along a subject that is motionless or moving much slower than the camera itself, which leads to the effect of the subject appearing frozen in time.

“It’s a very simple idea — you’re just capturing images from a lot of points of view in a very narrow time frame”⁷

George Murphy, a visual effects supervisor

This technique of using multiple still cameras to recreate movement is actually older than cinema itself. The pioneer of cinema Edward Muybridge, back in the 19th century, was experimenting with photographing motion of a galloping horse by using a line of cameras to

⁷ variety.com/2001/film/awards/frozen-f-x-still-in-action-1117792382/

capture the animal in its fast running. Further on, this technique continued to attract visual storytellers who needed a way to show slowing down of the time. They have never, however, managed to move through space in a non - linear way. Up until The Matrix, for this effect, the camera was either static either it was moving along in a straight line with the moving subject. But, the team of Matrix invented the circular movement around the subject with which they separated the time and space of the camera with the one in which the subject shot existed. The rotating movement was created with suspending actors on wires, using motion capture, and filming segments with multiple still cameras shooting from multiple angles. There were 120 cameras and 2 motion picture cameras arranged behind a green or blue screen, on a track and aligned with a laser targeting system with which they formed a complex curve in space. This allowed for the camera positions to be read by computers through the laser spots. Later on, the camera path was pre-designed using computer-generated visualizations as a guide. Additionally, the individual frames were scanned for computer processing. Thus, the camera evolved into a new version of itself – the virtual camera or in other words the CG camera.



Fig. 6. THE MATRIX - Comparison between virtual and real

A new question is then imposed – what did the virtual camera see? How could the filmmakers control the background of the image, the space in which the actors moved? The virtual space created for the actors was actually a real, existing set which the director of photography lit according to his artistic vision. The set was then photographed only to be digitally composited to create virtually the 3D space for the actors to move around. This digitally created three-dimensional space was attributed with texture, geometry and reflectance fields. It looked real. From that point on, one can say that the term “virtual cinematography” was born.



Fig. 7. THE MATRIX (1999) D: The Wachowski Brothers C: Bill Pope

3. *Life of Pi* (2012)

In 2012 director Ang Lee and director of photography Claudio Miranda succeed to create a miraculous achievement of storytelling and a landmark of visual mastery. Groundbreaking family movie “Life of Pi” is an adaptation of the bestseller book with the same title, a story about miracles and a boy who survives a disaster at the sea and is hurtled into an epic journey of adventure and discovery. This Oscar-winning film for best cinematography that year created a big discussion between the filmmakers because of relatively new, fast-evolving field of computer-generated imagery.



Fig. 8. LIFE OF PI (2012) D:Ang Lee C: Claudio Miranda

3.1. The story

The movie “Life of Pi” has a story structure that could be described by the literary term “mise-en-abyme”, or in other words, it is telling a story within a story within a story. It opens with an unnamed Canadian author played by Rafe Spall who accidentally meets an Indian from whom he learns about the existence of a man in Montreal who goes by the name of Pi and who knows a story that will make anyone believe in God. His real name is Piscine Molitor Patel, played by Irrfan Khan, whose profession is a teacher of philosophy. The widely known story he tells is actually about his own astonishing life, starting as the son of a zookeeper in the French enclave in India, Pondicherry, which was ceded as late as in 1954.

From that point on, the two central characters of the movie become the little Indian boy, played by three different actors for different age of his life (Gautam Belur at the age of five, by Ayush Tandon at the age of twelve and by Suraj Sharma at the age of sixteen) and a Bengal tiger from the zoo. They both obtained their names in a comical circumstance. The profoundly thoughtful Piscine got his name by his uncle's favorite swimming pool, the Piscine Molitor in Paris, but then, after enduring the jokes about urinating made by his schoolmates, he changed it to the Greek letter and mystical number. As for the Bengal tiger, which fascinated Pi after meeting him in the zoo, he was caught by the English hunter Richard Parker and got his name by him due to a confusing activity during the transportation to the zoo.

While growing up we see how the boy gradually rejects adopting the rationalism imposed by his father and on the other hand, he becomes attracted to religion and the meaning of life. He creates an individual combination of Hinduism, Christianity, and Islam. A moment comes in their lives when his faith is faced with a trial. It is when his father is forced to give up the family

zoo due to financial reasons, where Pi understands that all his life he has been a captive as the animals themselves. The Patel family takes the animals on an ark in order to sell them in Canada. But it's struck by a very heavy storm. Soon he is alone above the deepest part of the Pacific Ocean. He becomes an orphan who guides a boat with gigantic Bengal tiger, Richard Parker.

What follows is an epic adventure, a story about survival. We see, with a strong feeling of reality, how the boy opposes thirst and starvation, how he finds a way to live in peace with the tiger, how he handles heavy storms, flying fish, dolphins, humpbacked whale etc. The saga concludes with a captivating, but a purposely ordinary ending that raises questions about the reality of what we've just seen and also it intelligently confronts the teleological issues discussed in the movie.

“It was a time filled with wonder that I will always remember.” – Pi, Life of Pi



Fig. 9. LIFE OF PI (2012) D:Ang Lee C: Claudio Miranda

3.2. The un-filmable

Even ten years after the publishing of the book “Life of Pi” by the author Yann Martel in 2001, the producing of its story for the big screen seemed, as put in the words of the director of the movie himself - “unfilmable”. To involve a child, an animal and the use of visual effects in a movie seemed to go against all filmmaking rules. The director Ang Lee was determined to be the brave one and take all the known challenges. In order to do that, he needed the great support of a man who would help him create his vision and bring it to life. The decision fell to the name of Claudio Miranda, director of photography of few attractively shot movies, such as “The curious case of Benjamin Button” (2008) which was the first movie fully shot on digital camera to get the nominations for the Academy Awards for best cinematography and for the American Society of Cinematography’s title for outstanding achievement in cinematography. It was a movie shot digitally but still avoided the electronic look of the image.

After long discussions and reviewing of all the available technologies for shooting the imagery imposed by the story of the movie, the director and his cinematographer decided to make it look believable by using computer generated images. They went on with the production plans and ended up in an abandoned airport in Taiwan where they built a tank of water and shot only the boy and the boat. Everything else was just a blue screen.

When shooting for CGI the lighting demands a lot of thinking about the evenness of the nature of the light that falls on the background and the one that lights the subject being shot. That is why Claudio Miranda explains how long it took for him and the VFX artists to find the right tone for the lighting used for the boat.

“It’s all very naturalistic lighting and it didn’t always have to be beautiful lighting, Sometimes it would be harsh or moonlit, stormy, overcast, light, dark, medium. There were many different looks in that tank. We had 300 feet of material (rags, blacks, etc). The tank was lit with nine ARRIMAXes rigged to MaxMovers clustered to a truss that was used as the sun.”⁸

- Claudio Miranda, Director of photography

In order to make the look of the environment naturalistic while using the blue screen, Miranda decided to use Arri Alexa due to its high contrast range. The sun’s power which dominated the image was easily controlled with this camera’s utilities, making it possible to create subtleties and grades of the shades. In order to get a smoother and more natural look of the image, the DoP also got to the creative decision to use an open shutter for most of the scenes in the movie, which of course allowed more light to enter the camera. The result was in the favor of the audience since it made the scenes set in the deep ocean to look much more as if the scenery was seen by the human eye, which allowed them to follow the images in the fast-edited, action sequences. The creative director of photography used the open shutter in order to prevent the audience of getting sea-sick by watching the movie.

⁸ <https://www.arri.com/de/news/news/claudio-miranda-asc-on-life-of-pi/>



Fig. 10. LIFE OF PI – Behind the scenes

3.3 Blending the real and the virtual

However, the natural look of the film would not be possible to be achieved if it was shot in real surroundings. As stated before, previously to the decision to shoot inside of a tank filled with water the duo Ang and Miranda tried out all the possibilities to shoot on the open waters. They had many reasons to drop that idea. For example, the scene of the message writing, where Pi hopes still he'll get some help from somewhere, which shows using a top shot how the water is calm and steady to the point of resembling a highly reflexive mirror, could not be realized with real, natural setting. It could only be done with CGI. Otherwise, the audience will see the reflection of the camera in the water, or in other words, of the observer from the sky which dramaturgically refers to the addressee of Pi's prayers – God. In order to get the naturalness of the image, Miranda demanded a hole in the studio containing the tank, through which the sunbeams will enter and light up the character in the most authentic way possible. Furthermore, this scene ends with Pi throwing the message in the water, far away from him. The choice of the camera angle for the making of that shot was only allowed by the freedom that the visual effects gave to the crew. They could afterward place the bottle with the message anywhere in the shot,

finding the best composition for it. One can say that the use of computers for shooting this movie facilitated many artistic visions to come to life properly.

Further on, one of the toughest challenges that the filmmakers confronted was to bring to life the character of Richard Parker, the tiger and the companion of the protagonist with whom he spent 227 days trapped on the little lifeboat in the midst of the vast Pacific Ocean. Parker was thus as important as a role as the main character which imposed the need of him to look natural and real. To film a real tiger was, however, thought of, quickly neglected as an idea.



Fig. 11. LIFE OF PI (2012) D:Ang Lee C: Claudio Miranda

“We didn’t want our actor to get eaten! For this reason, and for more creative freedom, the tiger that primarily appears in the film is a digital creation from the effects house Rhythm & Hues⁹”.

- Bill Westenhofer, the visual effects supervisor

As the decision fell to the concept of creating a fully CGI character, the responsibility to bring this creature to life in a completely convincing manner was delivered to the company “Rhythm & Hues”, with visual effect supervision of Bill Westenhofer. This was due to the fact that the company has already had the experience of making furry creatures before, figuring in the following list of movies: “Cats and Dogs”, “The Chronicles of Narnia: The Lion, The Witch and the Wardrobe”, “Golden Compass”. Nonetheless, the company has also had experience in creating masculine creatures such as “Hulk” and also in skin simulation while working on “Knight and Day”.

“We’ve done digital animals before. We try to make them as real as possible, and then they go sing and dance. This was our opportunity to really fool somebody. So I wanted to base every shot on a reference. I told Ang it is too easy to anthropomorphize something even if you don’t want to. I wanted a real tiger in there to cut with. I wanted to force the bar to be pushed¹⁰”

- Bill Westenhofer, the visual effects supervisor

Deciding to keep a real tiger as a reference of how the CGI created Parker should look, Bill Westenhofer, cut out the long lasting dilemma of whether they should have a real tiger on set or not. The final cut of the film contained 170 shots with the tiger out of which only 23 involved

⁹ www.nytimes.com/.../movies/creating-a-tiger-for-life-of-pi.html

¹⁰ www.cgw.com/Publications/CGW/2013/Volume-35...-/Still-Waters-Run-Deep.aspx

the real tiger. So, to illustrate the difference, for the scene in which the tiger swims struggling to go back to the boat and then reaches for Pi's help, the production used a real tiger. On the other hand, for the scene where Richard Parker glances at Pi under the covers, digital effects were used.



Fig. 12. LIFE OF PI (2012) D:Ang Lee C: Claudio Miranda

For creating the digitally generated character, they got inspiration by analyzing every detail of a real tiger, using photographs to get every shade and detail right. They also analyzed the change in the tiger's fur – the growth of the hair by the time of the shooting for example – and they implemented what they saw in the animated character. The dirtier his fur becomes, the more it loses its reflective value. Using this detailed analyze of real world elements, they were doing something that was never done before - something photo-real as anyone has ever done with the animal in the modern cinema. A group of artists worked only on the look of the fur, creating as small details as the reflection of the sunbeams on the hair. This was possible because

of their decision to add subsurface light transporting also known as light scattering for the creation of the fur. This allowed to the fur of the tiger to gain reflective values and rich glow in the shadows. Moreover, one other technique was implemented. The whole environment was ray-traced to the tiger, which is to say that a path of light was tracked in computer graphic through pixels in an image plane (which is relatable to the technique used in the creation of *The Matrix*) allowing the CGI created tiger to interact with the world created in the studio as well as with the virtual world. To be exact, they were using a real boat to bounce light up into Richard Parker, whenever the shot was fully computer generated or not. Since the chest of the tiger is white, in order to make the CGI created tiger look more convincing, they needed to add nice bounce light from the orange boat on his chest. The global illumination was as true as possible. By expanding this technique of ray-tracing and subsurface scattering the visual effect team of “*Life of Pi*” succeeded to make a very high degree of visual realism in this movie.

Another challenge the creative crew encountered was to make the impressions of the CGI-created tiger look convincing, or in other words, to add emotions to the body movements and acting of Richard Parker. Westenhofer claims against the tendency of some animators to anthropomorphize animals, that is to acquire them with more human characteristics, and discusses how while working on the “*The Life of Pi*” the crew kept their attention on maintaining the animalistic instincts visible in the movements of Parker. For example, for creating the scene where the tiger feels sick and is therefore taken care of by the boy, the crew consulted a trainer for animals demanding from him to share an experience of human – animal interaction while the later one is in a bad health condition. The story he shared inspired the crew to make the scene where Pi pets Parker as he looks up into his eyes. For the creation of these dramatic performances of the animal, there were 50 animators working all over the world - in Los

Angeles, India, and Kuala Lumpur. In order to realize that scene, they made the main actor portraying the character of Pi, have a blue sock laying on his lap. The crew, later on, replaced this sock with the digital tiger and simulated the interaction of Pi's hands in the tiger's fur.

The combination of techniques in the creation of the vivacity and authenticity of Richard Parker discussed above are of high importance for one of the most pondering scenes in the movie. Lying on the boat in the middle of the night, Pi notices the tiger looking down towards the surface of the water. He asks him then "Tell me what you see?" Light is reflected on Parker's face and as Pi leans down out of curiosity, the same light colors his skin too. The camera then shows the reflection of Parker's face in the water, pulling in, diving in the depth of the sea as if it dives in the depth of Parker's thoughts. In the deep seas, we flow and see part of the realm of underwater animals, starting from a squid attacking his prey which as a connection explodes to pieces into a whole world of animals (which we saw in the beginning of the film as a part of the boat before the big storm). A dreamy sequence starts from there on, showing the dance of those animals, their flow in the deep water and a surrealistic mixture of the microcosms and the macrocosms. What follows is an image of plankton which resembles Pi's mother with the detail of her religious dot on the forehead followed by an image of the sunken boat. The shot ends with a pull-out from Pi's face leaning down the water. The way the beginning and the ending image of the 30 seconds long shot are inviting for meditating over the connection between the tiger and the boy. This shot makes a relation between the thoughts of the two characters, entering one head and exiting another. The viewer might ask, who's thought were they? Are the two characters actually a part of one entity, are they the same? Raising these questions, the shot is already giving hints for the resolution of the movie, where Pi is asked to describe his days at the sea, and

instead of giving one clear answer he gives out two – one of them contains the tiger and the other doesn't – claiming that his audience has the freedom to choose in whichever to believe in.

“I'm dramatically trained, not visually trained. So to me, all the visuals, whatever you see, came from dramatic needs: the mood of the situation or the emotion of the character.”¹¹

- Ang Lee

In this movie, the CGI technology helped the creative crew achieve higher abilities to make their visions, philosophy and metaphorical art come perceptible on screen. It wouldn't be at all possible without the help of the virtual cinematography. With all the camera techniques that the director of photography used to create that image, such as the 3D, the creative use of shutter speed and the change of aspect ratio, the movie gains a look that seems more natural to the viewer (a trait that was not applicable to the look of *The Matrix*). On the other hand, the crew purposely created the unreal scenery of some of the wonders that happen in the deep seas during the movie, in order to stress out their miraculous nature. The characters in the movie, by viewing the un-natural events in the sea, are amazed, which amplifies the sensation of wonder and awe among the audience. In such a manner, this way of filming contributes to the fusion of the both genres – animation and fiction. They both collide in one harmonious “*Life of Pi*.”



Fig. 13. LIFE OF PI - Comparison between virtual and real

¹¹ www.nytimes.com/2012/11/.../creating-a-tiger-for-life-of-pi.htm.



Fig. 14. LIFE OF PI (2012) D:Ang Lee C: Claudio Miranda



Fig. 15. LIFE OF PI (2012) D:Ang Lee C: Claudio Miranda

4. Gravity (2013)

In the vastly appreciated movie “Gravity”, its director Alfonso Cuarón and its director of photography Emanuel Lubezki, succeeded to portray the psychical universe beyond the Earth’s atmosphere in a fascinatingly realistic manner. Placing the story in a location where “life is impossible” they made a movie which emphasizes the psychology of the characters and their unstable emotional state. The film succeeds to represent outer space as one great metaphor for human subconscious; therefore it is one of the most challenging and experimental films of modern cinema.



Fig. 16. GRAVITY (2013) D: Alfonso Cuarón C: Emanuel Lubezki

4.1. The camera as storyteller

The story follows the adventures of the two main characters which they encounter in the space. Rayan Stone played by Sandra Bullock is a biomedical engineer that was sent in space on her first mission to upgrade NASA’s space telescope. She is there to get things done and leave, not to admire the beauty that surrounds her. She doesn’t care about anything else

except her goal - to solve the technical glitch with her equipment. Opposite to her character is the space astronaut Matt Kowalski (George Clooney) who is commanding his last mission. He also has his own goal, and that is to enjoy his final mission in space and ideally to break the record in spacewalking. He is a type of person that lives every day to the fullest; a character with a lot of memories and without a single worry in his mind. The contrast of the characters is shown symbolically through the visuals present even in the very first scene of the movie. Namely, the first time we see Sandra Bullock's character she is attached to a piece of machinery and her movements are limited, which symbolically claims her attachment to fixed ideas and more explicitly – to machines and technology. In contrast, the character of George Clooney is floating around the satellite not attached to anything and just admiring the beauty of the space. Through the visual information, we understand that one of the characters is an obsessive worker while the other one has a mind freed of any burden.

From the beginning of the movie, the main characters constantly find themselves in situations of life and death. In a matter of seconds, debris from a Russian satellite which moves with an enormous speed - strikes the shuttle where Stone and Kowalski use as a base for their mission. The shuttle is destroyed, leaving Stone helplessly floating into the vast darkness. The image here tells us how she really feels – lonely, abandoned and not in control of her life. Her only hope is Kowalski, who, luckily, has the complete control over the situation. At the end of the scene, he finally succeeds to get in contact with her and rescue her from the void. The rest of their crew, unfortunately, doesn't survive the debris fields that float around the Earth's orbit. The both of them stay alone in the deathly space, tethered to nothing but each other. Their metaphorical journey proceeds as they decide to reach another space station, hoping that they will find the way to reach home. At this point, we find out that Stone actually doesn't have a

place that she calls home, that she lost everything and that she is just “driving” through life. She lost her daughter in a schoolyard accident couple of years ago, and afterward, she finds it hard to go through the grief. The wide dark void of the space is used to symbolically represent the sadness that obsesses her after she lost her child. Her astronaut fellow Kowalski; the guy who is enjoying radio music and admiring the “breathtaking sunset” after hearing her tragic story, tries to encourage her to move forward and persist. Even in the crucial moment when he needs to detach from her and drift into the endless space, he is teaching her that she needs to learn to “let it go” and that life sometimes is “not up to you” but it depends on a number of different coincidences.

This is the turning point of the protagonist. Stone makes her way to the space station; she removes rapidly her astronaut suit and starts floating - in the position of an embryo. This image shows us how vulnerable and lost she feels in the never-ending space. At the same time it suggests the idea that she finally feels ready for a new beginning and new fight.

Later on, she manages to run away from the menacing fire in the station and to get into the Russian spacecraft that will help her finally arrive home. But, because the spacecraft is without gas and thus it won't start up - she gives up again. She starts crying, her tears start to float in the cabin and the camera sets its focus on them. Through that tiny drop of tear, we definitely understand Stone's despair and agony, but also that it is insignificant compared to the universe itself. In that moment reality and fantasy are becoming the same. She sees her astronaut fellow Kowalski next to her, how he is telling her to “Enjoy the ride. You got to plant both your feet on the ground and start living life.”

Eventually Stock learns how to let it go and decides to “Enjoy the ride”. She digs deep in her memory and remembers that in the boot camp she learned how to start a shuttle. She finally

succeeds to reach the Earth. Her shuttle crashes into the ocean and starts to fill up with water, but that is not an obstacle for her – since nothing can stop her now. She easily floats back to the surface, resembling the frog that goes along her. Again through the beauty of this symbolic image we understand that the main purpose of every living creature is to move forward and never stop hoping and believing. That is exactly what our character is doing at the ending scene of the movie - after having felt the ground under her feet for the first time after a long period in space, she stands up and starts walking towards her future. We see her from a low camera angle - she looks strong and secure and that gives us a totally opposite picture of what we had of her in the beginning of the movie when she was portrayed as a small and insignificant creature. She changed.



Fig. 17. GRAVITY (2013) D: Alfonso Cuaron C: Emanuel Lubezki

“Gravity was one of the most challenging movies I’ve ever done, and one of the most exciting because everything was new. Every minute we were testing and trying new things.”¹²

- Emanuel Chivo Lubezki

¹² <https://codex.online/casestudies/lubezki-and-cuaron-test-the-limits-of-filmmaking-technology-on-gravity>

4.2. The collaboration between the Director of Photography and the Visual Effects Supervisor

It is hard to think of another mass-audience film in recent years that has so thoroughly departed from the current technological and stylistic conventions of mainstream filmmaking. The story scripted for “Gravity” required innovative style and technique. The only way to represent the environment of outer space was through Computer Generated Images (CGI). And that raised a question about the line between cinematography and visual effects. The director of photography needed to work together with visual effects supervisor, in order to get the best possible results. But even if they collaborate to create together the film image, their roles and approach to the problematic of the lighting and framing stay the same. Lubezki as the cinematographer of the movie still was needed to light and frame the shot. He was still the author of the image; even if not all parts of the shot were done as perceived by his camera. Maybe even 80 percent of the movie was made by algorithms, but he was still required in order to supervise it. This kind of approach requires another skills and talents from the cinematographer. Just because the movie has extensive CGI effects, that doesn’t necessarily mean that the responsibilities of the director of photography lessen. To create mathematically the image of the movie is still a task for someone with an eye and in command of the technology. He, as a cinematographer, didn’t have practical lights on the movie set, neither had he had real locations; instead, he worked with a digital space made by animation program and thousands of virtual lights that gave him hundred different options - virtual ones. We are discussing a process that is an extension to the cinematography.

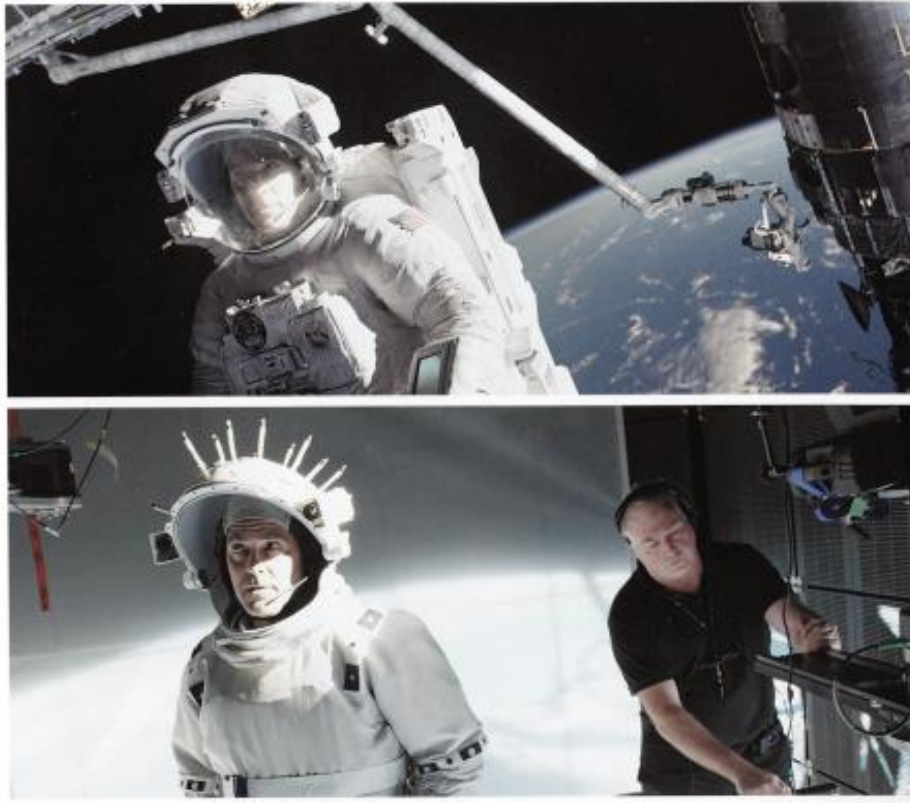


Fig. 18. GRAVITY - Comparison between virtual and real

The team first started with the creation of the backgrounds. The cinematographer was involved in every aspect of this digital image making. With his crew of digital gaffers, he was deciding which part of the shot will be completely dark and which one will be overexposed. He could also make decisions over the placement of the action in relation to the Earth's surface. Therefore, he made some creative decisions connected to the dramaturgy of the story like for example when the characters talk about their home he decided the lighting to be warm and calm, and he placed them above the Southern hemisphere, illuminating them by the reflections of the Sahara desert. Or, when the main character feels disconnected and lost, it was decided that she is placed right above the unlit by the Sun part of the Earth so that the darkness of the image will embrace the reflection of her deep emotions. Many of those decisions were made early in the process, which is a quite new approach for the cinematographer. In one of the interviews, the CG

lighting supervisor notes that Lubezki needed to use rough interoperations of real objects because he was used to very quick feedback in terms of what the light's going to look like.



Fig. 19. GRAVITY (2013) D: Alfonso Cuaron C: Emanuel Lubezki

4.3. The uncanny valley

From the beginning of the cinema, one of the most complex challenges for the cinematographers was to incorporate actors into the background, whether he was creating a photograph, a painting or a computer generated image. For Lubezki, while creating this movie, the greatest challenge was to find the right way to match these background images to the real actors. The biggest conundrum there is the lighting. If the lighting of the actors doesn't match the generated picture it is possible to reach the phenomena know in the animation world as "the uncanny valley." That is a moment in the film where everything is very close to real, but the subconscious of the viewer knows that something is wrong. The only way to avoid the uncanny valley is to use natural light on the faces and to match the lighting between the faces and the surroundings as closely as possible. This challenge led Lubezki, one of greatest

cinematographers of our time, to invent one of the film's extraordinary innovations – the LED box. This light box was a constructed cube with dimensions ranging around 20m tall and 3m wide made of 196 panels, each containing 4096 LED lights. Inside the LED box, the CG environment played across the walls and ceiling, simulating the bounce light from the Earth on the faces of the actors. This solution also helped the actors to imagine the visual experience of outer space while they pretended to float in the endless void. Furthermore, it allowed the cinematographer to stay in charge of the lighting while collaborating with the visual effects supervisor on the framing and design of the shots. Every part of the box was with different lighting, it was possible to have darkness on one side, light on another, a hot spot in the middle and different colors. The complexity of the LED Box allowed the creation of the nuanced realism of the light falling on the faces of the actors. If the DoP had chosen to light the scenes with a different kind of lighting he would not have succeeded to provide the perfect match of the color, the tone and the rhythm of the scene. With this innovation, Lubezki had the full control of the image and he also succeeded to match the real and virtual elements in the frame.

“The lighting on the movie is very complex—it’s changing all the time from day to night, all the color temperatures are changing and the contrast is changing. There were a lot of subtleties that you can capture with the box, subtleties that make the integration of the virtual cinematography and the live-action much better than ever before¹³.”- says Lubezki about LED Box

¹³ <https://www.wheretowatch.com/2013/10/one-of-the-greatest-cinematographers-ever-gravity-cinematographer-emmanuel-lubezki>

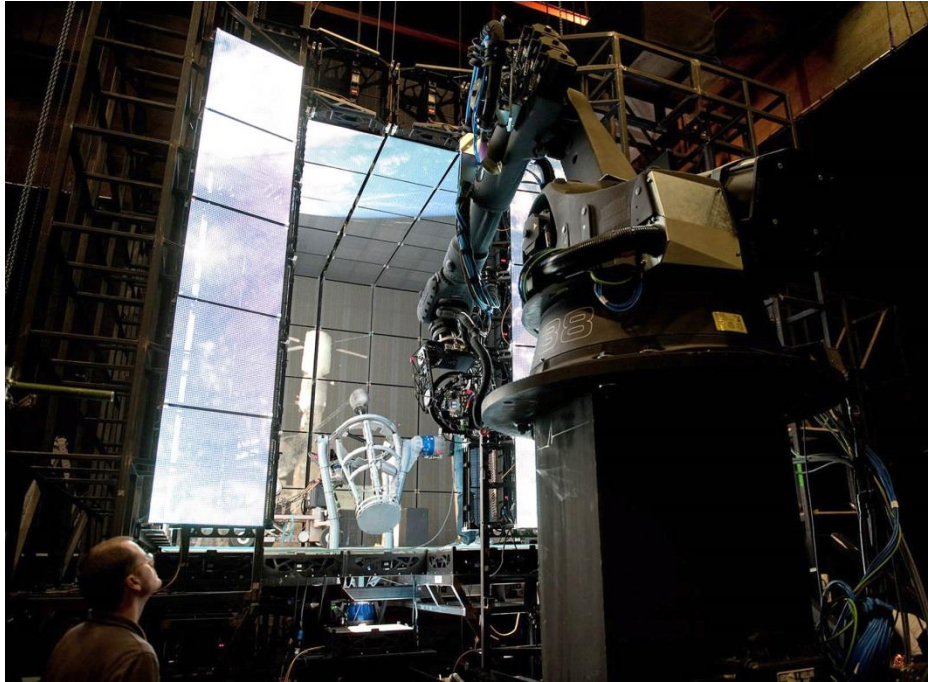


Fig. 20. GRAVITY - Behind the scenes

4.4 Floating camera

Since the story of the movie is set outside of the Earth's atmosphere, where there is zero gravity which means a space deprived of the ability to move "up" or "down", close or faraway, space where everything is weightless - the cinematographer was on the hard task to define the camera movements which will perfectly present the conditions. The camera couldn't be static in this kind of environment. The viewers, Lubetzki thought, needed to feel the absence of gravity in space. This was completed by using extremely long takes, and breaking the "line of action". The film duo, Cuaron and Lubezki is famous by their long takes, or how they call it "elastic shots". Elastic shots represent one shot without cutting to shoot an action where it is possible and preferable to have different shot sizes, from close-up to wide shot. In this particular movie, Lubezki and Cuaron made one of the longest "elastic" shots in movie history. The beginning shot of the movie is 17 minutes long and starts with the wide shot of the Earth, goes through close-

ups of the characters and finishes with a wide shot of Stone floating in the dark space. In the beginning of the shot, where we see a small shuttle with astronauts approaching the camera, the audience is so wrapped in the space that it is difficult to say if the camera is moving forward or the objects are coming closer. Everything has the feeling of floating in the space. Through this moment placed at the very beginning, we can easily understand and feel the zero gravity in the space. One of the others ingenuities of this opening shot is the use of the camera movement to explain the rules of the world where “up” and “down” do not exist. The cinematographer and the director decided that the camera will constantly break the line of action while performing its movements. Therefore, in one part of this shot, the camera pans from the right profile of Kowalsky to his left profile. With this method, orientation inside of the scene becomes impossible since everything is constantly rotating.

Technically, to achieve this kind of mood only using the then known camera equipment was impossible. The camera was supposed to be in constant movement, rotating around the actors and “floating” in the space. To accomplish this, Lubezki needed to invent something new. The dimensions that are used as parameters in Earth’s reality do not apply to the reality in the space, and as a consequence, the team needed to create an environment where approaching one object looks like the both objects move, controlling the distance between them. Considering that it was almost impossible to make actors look like they are floating in space, the filmmakers decided to make the camera perform most of the motion. Inspired by a robot that was originally designed to make cars, they created motion – controlled camera rig that could be moved in any direction around actors. This construction was built together with special kind of dolly that increased the flexibility of the camera movement. Also, it allowed adjusting the speed of the preprogrammed moves so that they could adapt to the actors’ performances. The problem of the

big mass that could block all the lights in the LED box was solved by adding a special remote head. Essentially the camera had all the preferences as any virtual camera from animation programs; it could rotate, twist and move in any axis.

Having obtained the possibility to move the camera anywhere they wanted, Cuaron and Lubezki could shoot anything that they had imagined. Through one of the most memorable camera movements, a shot is created which starts with a close up of Stone from outside of her astronaut suit, after which the camera passes the helmet and stays together with her inside of the suit. Then it turns to become the point of view of the main character. With this movement, the camera is no longer strictly subjective or objective but it becomes an immersive experience like the viewer is omnipresent and omnipotent. Through this shot, we can understand the danger in which the main character is and her state of mind she. The empathy is successfully achieved. If there was no technology as CGI this kind of shot would never be possible.



Fig. 21. GRAVITY (2013) D: Alfonso Cuaron C: Emanuel Lubezki

5. CONCLUSION

The most valued camerawork is the one which supports the story of the movie, its tone, its rhythm and its emotion; a cinematography which does not impose itself on the character in order to show how powerful and attractive it can be. All the above-discussed movies have stories with similar themes which demand an innovative cinematography. Namely, the characters that lead the action in the stories are with strong willpower and they are in a situation to fight for their survival. What they need in order to succeed is to discover their hidden powers and push their own limits of what is known as possible. As they pursue the challenge to widen their limits, they all receive the power to conquer their obstacles. Their environment is helping them in their journey to become heroes by implementing strong obstacles on their way in order to test their abilities, and as such, one can say it is some kind of an antagonist. The surrounding, then, gains personified values, since it has its own remarkable superpowers, while at the same time it is used as an esthetical tool since the audience is led to be fascinated by its beauty.

During their effort to bring these characters and their environments to the big screen, the directors of photography of the before discussed movies - Bill Pope, Claudio Miranda and Emanuel Lubezki - needed to use special techniques of cinematography, in other words, they needed to expand it.

First of all, all of the above-mentioned movies needed a camera work that will be free to move in the space, in order to depict the strength of the characters related to their environment in their stories. Bill Pope in “The Matrix” uses a camera that can move against time, rotating around the main characters in the moments where it is dramaturgically needed to emphasize how fast they can move or how freed is their mind from the control of the machines, the realm of the Matrix.

On the other hand, Pi in “Life of Pi” feels trapped in the middle of the ocean which he can never ever escape before he succeeds to overcome his fears. Therefore the camera department needed to make sure the shots are static, in order to portray the sense of being trapped and without hope of exit. However, having the story set in the middle of the ocean it presented a huge challenge. They used cranes and spider-cams to move freely around the boat and the characters in order to tell the story in the best way possible. On the contrary, Lubezki’s camera in “Gravity” needed to spin and rotate all the time together with Stone in the deep Space, to move freely in the environment which is deprived of gravity. The camera needed to obtain the properties of a virtual camera in animation, to rotate and move without any obstacles of its surrounding, to be in the right position and to move to the right place in order to capture and furthermore deliver the emotion of the protagonists. All of these cinematographers took the advantage of this new technology which enabled them to emphasize even more the characters’ feelings and powers. These cinematographers use fully the ability of the camera to reach its purpose, which is to expose the dramaturgy of the story.

Furthermore, the above discussed directors of photography use yet another important dramaturgical tool for telling the story in the most effective way, which is the special attention to the space that surrounds the characters, the environment in which they move, or in other words - the image itself. The common trait of the tree distinct movies is that most of the image is generated by computers. The world surrounding the characters is digitally created with strong devotion, since by observing it the characters learn more about their own personality traits, and by doing that they help us, the audience, get more important information about them and the story. Sometimes we can even see the world through their eyes, their point of view. It’s not accidentally that often it rains in “The Matrix” since the drops of rain subconsciously remind us

of the matrices of the digitally created world of the Matrix. And that is also how Neo sees the world after he becomes the One - he grows into a being which is more than human in its powers, because of the freeing of his mind. Later on, when he reinforces his power through his journey and arrives in Mega city, we see him surrounded by the buildings made of machines – an imagery that is shocking and powerful by its vastness. Viewers see something that was never seen before – blue toned picture of a terrifying futuristic world, full of thunders and flying machines. We are scared of this environment, but the One is not since he has more power than an ordinary human being. He sees this world he finds himself in in a different manner which instead of viewing with his eyes he feels with his enlarged senses the power and the presence of the machines. The image we are shown as his point of view has yellow tones and is overexposed as if the character is in front of The God itself. Another example of an image with an atmosphere filled with the presence of God is the scene of “Life of Pi”, where Pi and Richard Parker stay alone in the open sea. Their environment is bright and filled with sunlight from the dusk while the sea stays still without any waves. We see Pi who loses his last glimmers of hope and in his background we see the moving clouds reflected in the water. In one top shot of the scene, Pi’s despair and the viewers’ hope is merged through the image. Furthermore, in the scene of “Gravity” where character Stone succeeds to get detached from the human invention and starts to fly away into space, the Space around her becomes increasingly larger. In this way, the shot is showing us how small she is in comparison to the huge universe. All of these scenes are helping the viewer to get attached to the characters, and then follow them with engagement through their journey. In such a manner, the effect brought by the CGI becomes a pillar of the dramaturgy.

The discussed creation of the computer-generated images and the camera movements that demand innovative technology involves, of course, a wider crew of creative people besides the

director of photography, among which the visual effects supervisor and the animators. Should we question the responsibilities and the creative input of the director of photography in such a production, we are invited to analyze the process of creation of the fully animated movies which involve a completely digital process of creation. There are not life actors, no stage lighting which is limited by the space in use. The creators of the image are free to imagine every light source and the composition of the objects it throws its beams at. Lately, the process of the creation of the animated movies started to involve a director of photography as one of the leading figures in all of the phases of the production. His job there is to imagine the atmosphere, the tones, and compositions of the shots - all in favor of the dramaturgy of the story told. We can name more than few examples, such as Rango (2011), Inside Out (2015), Wall – e (2008), How to train your dragon (2010) etc. Patrick Lin, the director of photography of the animated movie Inside Out built the concept of the camera for the world inside the head of the protagonist and the one outside of it. When we are outside the movements of the camera are organic, done with the use of handheld or steady-cam (animated movement inspired by live camera techniques), which makes them harsher and eager in portraying the confusion that the girl has. On the other hand, for the scenes happening inside of the girl’s head they used dollies and cranes (again, animated movements in the image inspired by live camera techniques) in order to get more elegant images, portraying the stillness of the realm of the emotions and thoughts. Moreover, they wanted to distinguish the two worlds by using the effect of different optics when depicting them. Patrick Lin tested the lenses on traditional cameras and then implemented what he saw in the creating of the virtual cinematography. This was the first time that an animation studio used real lenses to construct virtual ones. Also, while creating the hand – held inspired movement, they wanted to copy not only the way the images look while shot with the traditional camera, but they also wanted to replicate and animate the human mistakes while operating with the camera. They did

this by motion capture applied to a camera operator and then analyzed his movements. This “human mistake animated shot” was used cleverly in the scene where the girl escapes home and is driven by a strong sense of confusion, fear, and anger. The dramaturgy of the scene is supported by the image, in other words, the camera work. So, we can really discuss traditional camera techniques applied in the making of a completely animated movie. By mixing the traditional and the virtual camera techniques, the image obtained is highly supportive of the dramaturgy of the story. Those results will not be possible without the creative input of the director of photography and his knowledge.

These new ways of creating movies, which make the DoP more of a painter, and maybe less of a technician, are growing him into a situation where he is invited to learn new skills. As seen through the lenses of the history of art, one can claim how the techniques of painting have evolved through the centuries. The use of different materials, different approaches, and esthetical values did not lessen the value of the painter. The painter developed new skills but remained the same in his art, in his effort to reach for the emotions of his viewers. In the same manner, the director of photography faced in front of the challenge of the virtual cinematography is invited to learn new skills but get even more in touch with the sole purpose of his role – to reach for the audience’s emotions by supporting the dramaturgy of the story that the film is depicting. Because of this one can consider the virtual cinematography as a part of the evolutionary process of the development of the camera techniques.

6. FILMOGRAPHY

- The Matrix, directed by Wachowski brothers (Lana Wachowski and Lilly Wachowski) (1999; USA, Australia; CO: Warner Bros Pictures, 2h 16min) DVD
- The Matrix Reloaded, directed by Wachowski brothers (Lana Wachowski and Lilly Wachowski)(2013; USA, Australia; CO: Warner Bros Pictures, 2h 18min) DVD
- The Matrix Revolutions, directed by Wachowski brothers (Lana Wachowski and Lilly Wachowski)(2013; USA, Australia; CO: Warner Bros Pictures, 2h 9min) DVD
- Life of Pi, directed by Ang Lee (2012; USA, France, Taiwan, India, Canada, UK; CO: Fox 2000 Pictures, 2h 7min) DVD
- Gravity, directed by Alfonso Cuaron (2013; USA, UK; CO: Warner Bros. Pictures, 1h 31min) DVD

7. BIBLIOGRAPHY

- ABEL, R. 2005, Encyclopedia of early cinema, Taylor & Francis, ISBN 10: 0415778565
- BENJAMIN, B. “Facing the void.” American Cinematographer 94, no 11 (November 2013) https://www.theasc.com/ac_magazine/November2013/Gravity/page1.php
- “Behind the scenes – The Matrix (1999).” YouTube, uploaded by Gaming Nexus, 19 Sep. 2016, https://www.youtube.com/watch?v=FmbLewdQ_Qo
- “Behind the scenes – The Matrix Reloaded.” YouTube, uploaded by Gaming Nexus, 19 Sep. 2016, <https://www.youtube.com/watch?v=VsBfvG7QDUc>
- BOWSER , E. 1994, The transformation of cinema 1907-1915, Berkley: University of California Press, ISBN: 9780520085343
- CASTELLI, (JEAN) C. 2012, The Making of Life of Pi: A film, a Journey, HarperCollins, ISBN: 9780062114143
- CLEMENTS, J. 2013, Anime: a History, Library of Congress, ISBN 978-1-84457-390-5
- DK Publishing Inc. 2015, The movie book, New York, New York: DK Publishing, ISBN: 1465452168
- “Emanuel Lubezki ponders virtual cinematography” TheACS, 2 Feb. 2013, <http://www.theasc.com/site/blog/parallax-view/emmanuel-lubezki-ponders-virtual-cinematography/>
- GILLS, S. 2005, The Matrix typology: Cyber punk reloaded, London New York: Wallflower, ISBN: 9781904764328

- “Gravity - Behind the scenes Featurette takes audiences from script to screen.” YouTube, uploaded by TheWrap, 23 Dec. 2013, <https://www.youtube.com/watch?v=QxHc8Ns5g1c>
- GRESS, J. 2015, [Digital] visual effects & compositing, San Francisco California : New Riders, ISBN 9780321984388
- HANNAVY, J. 2013, Encyclopedia of Nineteenth-Century Photography, Taylor & Francis, ISBN 9780203941782
- LISA, “Behind the camera of Disney Pixar’s inside out: riley cam vs. mind cam.” (May 2015) <http://momontheside.com/behind-the-camera-of-disney-pixars-inside-out>
- MIRANDA, CLAUDIO. “Life of Pi/ Claudio Miranda, ASC.” Interview with Jim Hemphill, Accessed 18 Apr. 2016, <https://www.theasc.com/site/podcasts/life-of-pi-claudio-miranda-asc/>
- MURRAY L. R, HEUMANN K. J, 2011, That’s all folks?: ecocritical readings of American animated features, Lincoln: University of Nebraska press, ISBN: 9780803235120
- POBST, C. “Welcome to the machine.” American Cinematographer 80, no 4 (April 1999) <http://www.theasc.com/magazine/apr99/matrix/index.htm>
- ROBERTSON, B. “Still waters run deep” CGW 35, no 7 (December 2012) <http://www.cgw.com/Publications/CGW/2013/Volume-35-Issue-7-Dec-2012-/Still-Waters-Run-Deep.aspx>
- SITO T, 2016, Moving innovations: a history of computer animation, The MIT press, ISBN: 9780262314312
- TOSI, V. 2005, Cinema before cinema: the origins of scientific cinematography, British Universities Film & Video Council ISBN 9780901299758
- “The Matrix revolutions BTS: Behind the Matrix.” YouTube, uploaded by Stanislav Zaleski, 9 Jan. 2017, https://www.youtube.com/watch?v=i_t_LAI8eLo
- “The making of Matrix (199).” YouTube, uploaded by Andrew Rayner, 21 Mar. 2014, <https://www.youtube.com/watch?v=8ufqaDx4iuQ>
- “Visual effects : Going behind the magic – Life of Pi”, YouTube, uploaded by The Aloomax, 29 Mar. 2015 <https://www.youtube.com/watch?v=TgSPys9PatU>