

**THE IMPLEMENTATION OF CHIAROSCURO IN
PHOTOGRAPHY AND CINEMATOGRAPHY**

A Thesis

by

IGOR KRAGULJAC

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2008

Major Subject: Visualization Sciences

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Committee Members,

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ABSTRACT

The Implementation of Chiaroscuro in Photography and Cinematography.

(December 2008)

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This thesis explores the translation of chiaroscuro lighting and composition in historical paintings to the photographic medium. This translation was achieved by following similar compositional and contrast ratios found in chiaroscuro paintings, resulting in heightened contour and three-dimensionality, thereby creating a dramatic impact on the viewer.

The thesis analyzed ways in which chiaroscuro has been adapted to photography and cinematography. The primary factors of light design and composition were identified and applied to studio subjects to effectively recreate the chiaroscuro effect in a series of photographs. The additional element of a sense of weightlessness was subsequently achieved through the use of an underwater environment.

To my Mother, Father and Wife

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CHAPTER I

INTRODUCTION

When I'm lighting, I like to feel that every light has a dramatic logic and function in the composition. It really is like painting: each piece of light is a brush stroke, giving different emotional values, defining and texturing each part of the shot from foreground to background, highlighting what is important for the audience to see. ~ Laszlo Kovacs (Cinematographer, A.S.C.) [1].

Chiaroscuro is the Italian word for light and shade, and is also used as a term in art for a contrast between light and dark. Chiaroscuro is a method for applying value to a two dimensional artwork to create the illusion of a three-dimensional form. The more technical use of the term relates to painting, drawing or printmaking, where three-dimensional volume is suggested by highlights and shadows and is often called "shading." Chiaroscuro is usually identified by contrasts affecting a whole composition, but is also more technically used by artists and art historians to describe contrasting light effects that were first developed in the Middle Ages. This approach was standard by the early fifteenth-century in painting and manuscript illumination in Italy and Flanders, and then spread to all Western art. The term eventually broadened in meaning to cover all strong contrasts in illumination between light and dark areas in art. This is now the primary meaning of the word [2].

This thesis follows the style of IEEE Transactions on Visualization and Computer Graphics.

In modern times, the presence of chiaroscuro in drawing, printmaking and painting has had a strong influence on other forms of visual art including photography, cinematography, videography and 3D modeling.

I have spent a good part of my life trying to understand why Caravaggio painted the way that he did during different periods of his life. We show the audience what he sees. It is not seen as a source of light that illuminates the subjects, but a pure, transcendental entity that slices through the darkness like a scalpel, dividing the human from the divine. In the painting the subjects are illuminated by a suffused light that is separate from the ray of light. ~ Vittorio Storaro (Cinematographer, A.S.C.) [3].

CHAPTER II

BACKGROUND

II.1. Historical Development of Chiaroscuro

The earliest appearance of painting technique that implies the chiaroscuro effect can be found in the ancient Roman world on wall paintings from Pompeii made in 100 B.C. (Figure 1). The drawn figures revealed surprising subtlety through the use of highlights, reflected light, internal shadows, and cast shadows, which comprise the essential vocabulary of light and shadows that we normally associate with chiaroscuro used in Renaissance, Baroque, and Rococo periods [4].

Another example of Roman art with clear similarities to chiaroscuro is found in Hellenistic art [c.100-c. 25 BC], which can be seen in Egypto-Roman [Faiyum] mummy portraits of the second century A.D. (Figure 2). In this figure, one can notice the contrast between light and shade that creates the volume of the face making it more life-like [4].



Fig. 1. A Mural at *Villa of the Mysteries* [100 B.C.] [4].



Fig. 2. A Mummy *Demetrios* [250-300 A.D.] [4].

II.2. Chiaroscuro in Classic Mayan painting

Another early use of chiaroscuro was employed by classic Mayan artists. Mayan chiaroscuro became increasingly formulaic in the hands of vase painters, but was less sophisticated than the greatest masters of Renaissance art. In this example (Figure 3), a black-background cylinder depicts the Mayan god Maize dancing with a dwarf, drawn in red outline. Here we also have glaze-like applications of darker slips to indicate rounded, solid forms, in the form of a "pink blush." This has become a repeated cultural cue that tells the viewer that this is indeed an object in three-dimensional space [5].



Fig. 3. A Mayan Vase Painting [5].

II.3. Chiaroscuro in Renaissance and Baroque

In ancient Greek and Roman applications of chiaroscuro, as well as in late medieval and early Renaissance paintings in Italy, the artist generally placed the perceptual light source above and slightly in front of the scene or object. This can be seen in the diffused light and shadow used in the frescoes of Giotto [1267-1337] (Figure 4) [2].



Fig. 4. A Painting by G. Bondone [6].



Fig. 5. A Painting by Masaccio [7].

Masaccio[1401-1428], was considered the great innovator in the development of three dimensional illusionism. His great figural scenes in the Brancacci Chapel in Florence (Figure 5) are illuminated from a single light source on one side, as they would have been from the chapel's actual window [2].

By the end of the fifteenth century, Florentine painters like Botticelli [1445-1510], were already experimenting further with chiaroscuro, playing with multiple light sources issuing simultaneously from more than one direction. An excellent example is his justly famous Birth of Venus in the Uffizi (Figure 6), where he has subtly combined the effect of frontal lighting with a delicate backlighting to produce a stunning illusion of solidity in the limbs and body of the foam-born goddess [2].

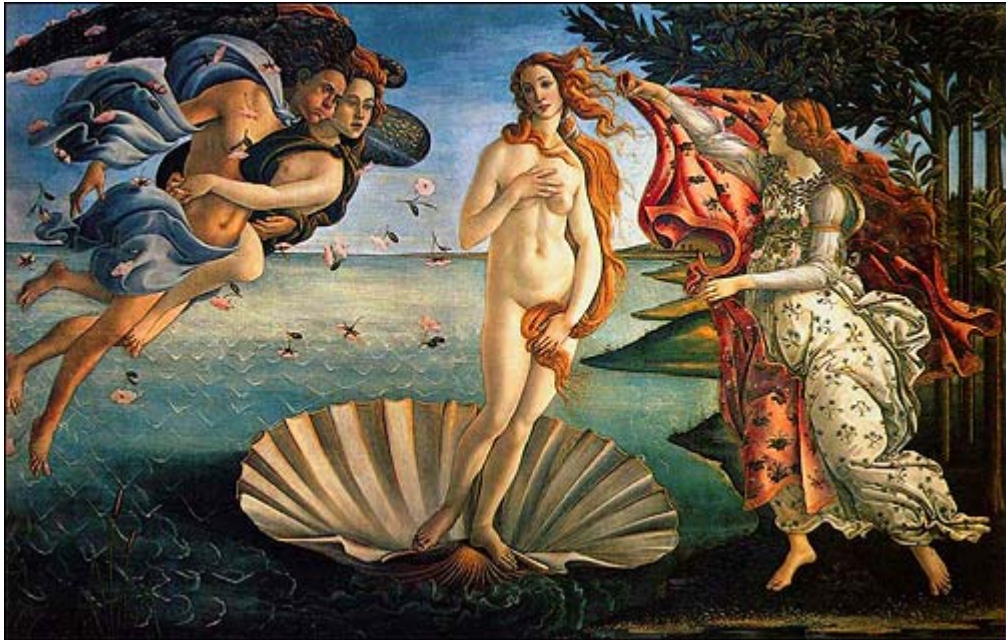


Fig. 6. A Painting by Botticelli [8].

Some of the greatest painters in history employed chiaroscuro to achieve dramatic Effects. Harmenszoon van Rijn Rembrandt [1606-1669] (Figure 7) used light and shadow to convey both internal and external drama. Peter Paul Rubens [1577-1640] often treated light as a mysterious phenomenon (Figure 8), not as the familiar, natural light of the sun or a candle (Figure 9) [2].



Fig. 7. A Painting by H.R. Rembrandt [9].



Fig. 8. A Painting by P. P. Rubens [10].



Fig. 9. A Painting by M. Caravaggio [11].

In the late Baroque period, light and shade were used to reveal, but also to conceal, as well as to insinuate mystery, threat, or outrage. In several paintings by Francisco de Goya [1746-1828], such as *Disasters of War* [1810] (Figure 10) and *Shooting at Montana del Principe Pio* [1814] (Figure 11), the painter uses chiaroscuro to presents a spectacle of human cruelty, stupidity, and madness to rival any sinister, contemporary event in modern social and political history [2].



Fig. 10. A Painting by F. Goya [12].



Fig. 11. A Woodcut by F. Goya [13].

II.4. Caravaggio's Dramatic Chiaroscuro

Caravaggio was an experimental scientist, which led him to make repeated and controlled tests involving the effects of light. He arranged his mise-en-scenes (studio arrangements) with a single light coming down from a high angle, without reflections, as it would fall from a window into a room with the walls painted black. This approach had not been used or imagined in previous centuries by painters, like Raphael, Titian, and Caravaggio [11].

He found a way of setting models against the dark air of a closed room by taking an elevated light source that shone straight down on the subject, leaving the rest in “ombra” (shadow). In this way, he achieved strength through the contrast of light and dark, as seen in his painting *Saint Francis in Meditation* [1604] (Figure 12).

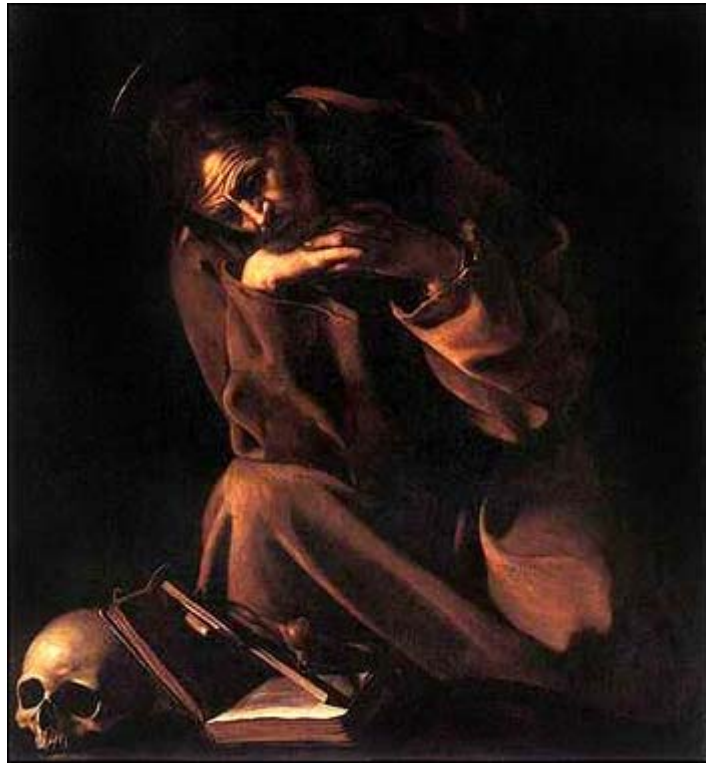


Fig. 12. A Dramatic Chiaroscuro Painting by M. Caravaggio [14].



Fig. 13. A Religious Painting of Jesus by M. Caravaggio [15].

In his studio Caravaggio constructed a kind of painter's "laboratory", a "camera ombrosa" (shadow box) with adjustable light effects. Even in his "revolutionary" innovations and "scientific" experiments with dramatic chiaroscuro, Caravaggio was, however, following tradition. He carefully pondered the use of a metaphorical "twilight" in his religious paintings, in which chiaroscuro may itself function as a metaphor for a sort of "spiritual darkness" lacking full "enlightenment" [16].

Caravaggio went so far in this manner of working that he never brought his figures into the daylight, but placed them in the dark brown atmosphere of a closed room (Caravaggio camera ombrosa). In his famous painting *The Incredulity of Saint Thomas* (Figure 13) we again see his use of a single light source from above, illuminating the principal parts of the bodies while leaving the remainder in shadow for the purpose of creating "vehemenza di chiaro, e di oscuro" (force through a strong contrast of light and dark) [16].

Early in Caravaggio's career, the chiaroscuro effect was much softer and used more sparingly (Figure 14). In his later works, one can see a more dramatic use of light reinforced throughout with bold shadows and a great deal of black to give relief to the form (Figure 15). His contemporaries in Rome were greatly impressed by his novelty, praising him as the only true imitator of nature [17].



Fig. 14. A Scene Painting by M. Caravaggio [18].



Fig. 15. A Religious Painting by M. Caravaggio [19].

II.5. The Use of Chiaroscuro by Modern and Contemporary Painters

Besides Francisco Goya [1746-1828], the visual elaboration of war employing the chiaroscuro technique is also seen in the work of Eugene Delacroix [1798-1863] in his famous painting *Liberty Leading the People* (Figure 16). This painting was defined as the first political work in modern painting [20].

The chiaroscuro effect is presented diagonally with an emphasis on the transition from dark shadow towards light areas. In this painting the presence of dark and light refer to the struggle for change from a low, gloomy and stingy condition to a high, bright and satisfied state. The light in the upper right corner of the painting advocates the shift or swing of the collective as well as the individual psyche of the people, as if to fuel their desire and courage to take up arms.



Fig. 16. A Painting by E. D. Croix [21].

Pablo Picasso [1881-1973], was one of the most recognized figures in twentieth-century art. During his *Blue Period* (1901–1904), he created a somber effect in his paintings by using the chiaroscuro effect, rendered in blue and blue-green colors (Figure 17) [20].

The *Blue Period* dramatizes the artist’s experience as an outcast from society. Indeed, in Paris at that time, far from family and home, Picasso is unrecognized, unappreciated and in extreme poverty. Picasso’s “Blue Period” is further triggered by the fate of his closest friend, Carles Casagemas, whose infatuation with a girl and subsequent rejection led to his attempt to kill her and to commit suicide. Picasso explained later, “*It was thinking about Casagemas that got me started painting in blue.*” The blue color in conjunction with gradation of light and shadows were main elements for Picasso’s dramatic visual expression that is so recognizable and unique in modern art [20].

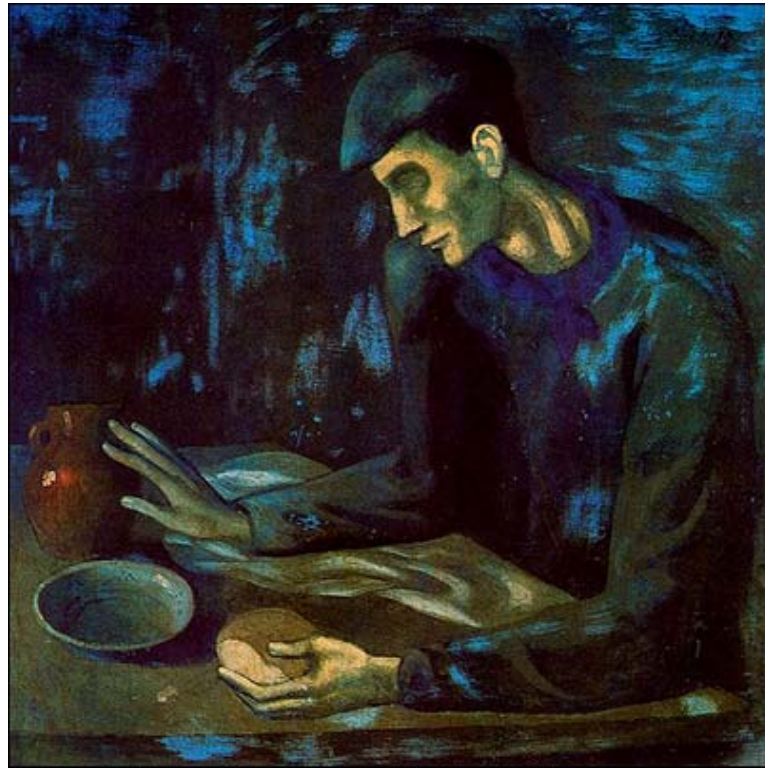


Fig. 17. A Painting by P. Picasso [22].

As most artists and art lovers know, creating something “new and unique” is both a challenge and an imperative. One artist who has succeeded in this is acclaimed Swiss surrealist H. R. Giger [1940-]. He created alien life forms in their otherworldly environments in the film classic *Alien* (1979), for which he received an Oscar in 1980 [23].

To achieve the desired effect, he used dramatic chiaroscuro in his painting reference for the futuristic alien model (Figure 18). As a painter, sculptor, designer and interior architect, Giger extends his artistic vision into all domains. Fundamental to the nature of his work is the biomechanical aesthetic, dialectic between life and machine, representing a universe at once disturbing and sublime. As seen in many of Caravaggio’s paintings, the background is entirely dark and illumination is achieved using a single light

source from above.



Fig. 18. A Painting by H.R. Giger [24].

Odd Nerdrum [1944-] is a figurative painter whose painterly, pre modern, Renaissance style is highly reminiscent of Rembrandt. In 1968 Nerdrum was introduced for the first time to the works of Caravaggio. Nerdrum is especially interested in creating psychological intensity in the faces of common men through the use of cross lighting to create chiaroscuro three dimensionality. The works of Caravaggio is a major influence on Nerdrum's work [25].

His painting *Water Protector* (Figure 19) presents an allegorical scene depicting a time after our own civilization has passed. In this painting, the background landscape is created from studies made on repeated trips to Iceland [25].



Fig. 19. A Chiaroscuro Painting by O. Nerdrum [26].

II.6. The Use of Chiaroscuro by Early Photographers

There are many schools of painting. Why should there not be many schools of photographic art? There is hardly a right and a wrong in these matters, but there is truth, and that should form the basis of all works of art. ~ Alfred Stieglitz (Camera Club of New York, Photographer).

Pictorialism was a photographic movement in vogue beginning around 1885 and reaching its height in the early years of the 20th century. This movement largely subscribed to the idea that art photography needed to emulate painting and etching of the time. Most of the pictures characteristic of pictorialism were black and white or sepia-toned (Figure 20) using the methods of soft focus, special filters and lens coatings, heavy manipulation in the darkroom, and exotic printing processes [27].

In direct contrast to this approach was the Pure Photography movement, which refers to photography that attempts to depict a scene as realistically and objectively as permitted by the medium, renouncing the use of manipulation (Figure 21).



Fig. 20. An Outdoor Photo by A. Stieglitz [28].



Fig. 21. An Outdoor Photo by A. Adams [29].

Alfred Stieglitz [1864-1946], is arguably the most important figure in the world of art photography. He established the Camera Club of New York (1884) and announced that every published image would be a picture, not a photograph. He wanted to force the art world to recognize photography "as a distinctive medium of individual expression" [27].

By observing his portrait of Marie Rapp (Figure 22), we can recognize the influence from Renaissance paintings in the typical chiaroscuro effect. Although this model is almost entirely blended into the dark background, the light that is coming from the top clearly divides the main subject from the background and helps to define the inner character of the model.



Fig. 22. A Portrait Photo by A. Stieglitz [30].

Gertrude Käsebier [1852 – 1934], a famous American portrait photographer was part of the *Photo Secession* movement along with Alfred Stieglitz, Edward Steichen, Alvin Langdon Coburn and Clarence Hudson White. She founded the group Pictorial Photographers of America.

After studying painting in her late thirties, she shifted her interests to photography. Using relaxed poses in natural light, and emphasizing the play of light and dark (*chiaroscuro*), Käsebier let her subjects fill most of the frame. She was also noted for her printing process and for her ability to produce images with a painterly quality (Figure 23) [27].



Fig. 23. A Portrait Photo by G. Kasebier [31].

Another well known pictorial photographer was **Frank Eugene Smith** [1865-1936]. He was born in New York and moved to Munich in his 20s where he studied art and soon became well-established as a portrait painter before he took up photography around 1885 [27]. Employing his knowledge about portrait painting, he created photographs that exhibited the qualities of a painting.

Other than the use of chiaroscuro in photographic works, Smith was known for substantial manipulation of the negative to the extent that the output was often a cross between a graphic work and a photographic print. His most well known works were heavily influenced by pictorialism. He merged the skills of a painter and a photographer, and etched his negatives to produce startling and beautiful prints (Figure 24).



Fig. 24. A Photo by F. EUGENE [32].

Ansel Adams [1902-1984], described himself as a photographer, lecturer and writer. He endlessly traveled the country in pursuit of both the natural beauty he revered and photographed as well as the audience he craved. Adams felt an intense commitment to promoting photography as a fine art and played a key role in the establishment of the first museum department of photography, at the Museum of Modern Art in New York [33].

Although he was primarily a photographer of nature, he created some portraits in the studio. In *Gottardo Piazzoni in his Studio* (Figure 25) he uses the chiaroscuro technique not only to describe the main subject, but also to highlight the shape of his surroundings. Adams's technical mastery was almost legendary. More than any creative photographer before or since, he reveled in the theory and practice of the medium.

Adams served as the principal photographic consultant to companies such as Polaroid and Hasselblad and, informally, to many other photographic professionals and organizations [33]. Adams developed the famous and highly complex zone system, used in controlling and relating exposure and development, enabling photographers to creatively visualize an image to produce a photograph that expressed that visualization.

He produced ten volumes of technical manuals on photography, which are considered the most influential books ever written on the subject [33].



Fig. 25. A Portrait Photo by ANSEL ADAMS [34].

II.7. The Use of Chiaroscuro in Cinematography

Many cinematographers studied chiaroscuro in Renaissance paintings to become aware of the subtlest effects produced by light, in order to integrate these qualities into their films.

If I want a soulful lesson in beautiful light, yes, I'll walk around metropolitan Museum of art and look at the Vermeer paintings. ~ Gordon Willis (Cinematographer, A.S.C.) [1].

Cinematographer **Gordon Willis**, was interested in film from an early age, likely due to his father's career as a make-up artist for Warner Bros. After being cast in several child roles, he turned to other aspects of stagecraft and to still photography. Following the Korean War (where he made documentaries for the U.S. Air Force), he worked in the U.S. military camera department for 12 years before photographing his first feature, *End Of The Road* (1969) [1].

I spent a lot of time in movie theatres while I was growing up in New York during the '40s and '50s, so I was greatly influenced by the body of work that was coming out of the Hollywood studios at that time. Each studio had its own genre, its own set of emotions it would tap into, its own photographic style even its own musical sound. The cumulative effect of watching all these movies was that I was enchanted by the medium and I became smitten by the idea of making movies. People often say to me about my work, "it is so real" but it's not, it is entirely interpretative. ~ Gordon Willis [1].

The method by which Willis arrived at the look of *The Godfather* (1972), was achieved by choosing the proper lighting setup that would visually define the dramatic aspects of the story and characters.

The answer was overhead lighting, which had of course been around for years, but not really as a means of key lighting. That's the system I used to light Brando's office at the beginning of the movie, and it worked so I extended it into the rest of the picture (Figure

26) . ~ Gordon Willis [1].



Fig. 26. Scene 1: The Godfather [35].



Fig. 27. Scene 2: The Godfather [36].

Willis also manipulated the light so that at times Brando's eyes were in darkness, making it difficult to tell what he was thinking. The sinister atmosphere of the office interior, (Figures 26, 27) was juxtaposed with parallel action shots scenes of a wedding (which were intentionally overexposed), in order to give the film a bright/dark (chiaroscuro) visual relativity (Figure 28).



Fig. 28. Scene 10: The Godfather [37].



Fig. 29. Scene 9: The Godfather [38].

After the Godfather, I became jokingly known as the "Prince of darkness" because of a handful of scenes in which you couldn't see Brando's eyes (Figure 29). It got blown out of proportion but it is true to say that because I constantly think in terms of the visual relativity between light and dark, I don't feel compelled always to light an actor so you can see every single hair on his head. I prefer to have characters moving between dark and light. To me its very powerful when you have people talking in a darkened corner, or a character dying in long shot, what you don't see sometimes can be just as effective as what you do see. The important thing is that the light you have in a scene, bright or dark, functions emotionally ~ Gordon Willis [1].

I am often asked, "how did you get such and such an effect?" I wish I could say "well, it's number 23", but its never that simple. After the Godfather I got a lot phone calls from people wanting to know what I did to get the brassy, slightly yellow feeling to the photography.

Theythought that they could emulate the look of the film simply by reproducing that one element. There was a rash of bad movies printed with yellow, but the truth is, that color effect wouldn't have worked without the lighting structure of that film, and the lighting wouldn't have worked without Dean Tavoularis' wonderful set design and Anne Hill Jonestone's costumes. All these visual elements are interconnected with how the director sees the film, how individual scenes are played, how an actor speaks his lines. Film making is an organic process; its never one thing that makes a movie work. Assuming you know your craft, why you do something is more important than how. ~ Gordon Willis [1].

CHAPTER III

TECHNICAL COMPONENTS

III.1. The Visual Qualities of Chiaroscuro

One of the main qualities of chiaroscuro is in lending a pleasing effect to the whole picture by dividing the space into masses of light and shade, and preventing visual confusion by leading the eye around the composition. In that way, the observer's eye may first see the primary subject and be gradually led to examine the whole picture in a way that keeps parts in obscurity, and reveals others, according to their pictorial value. Defining the most important parts of the scene through the use of light and shade, chiaroscuro creates emphasis and expression in the picture (Figure 30).



Fig. 30. A Painting by A. Cabanel [39].

III.2. About Light in General

Due to the fact that light and dark are primary components of chiaroscuro, the scientific aspects of light and its perception have bearing on this artistic effect. Visible light is electromagnetic radiation of a wavelength that is detectable to the human eye (about 400–700 nm). In a scientific context, the word “light” is sometimes used to refer to the entire electromagnetic spectrum. Light is composed of elementary particles called photons. Any light that we see is made up of a collection of one or more photons propagating through space as electromagnetic waves [40].

A light wave consists of energy in the form of electric and magnetic fields. The fields vibrate at right angles to the direction of movement of the wave, and at right angles to each other. Because light has both electric and magnetic fields, it is also referred to as electromagnetic radiation. When a light wave hits an object, what happens to it depends on the energy of the light wave, the natural frequency at which electrons vibrate in the material and the strength with which the atoms in the material hold on to their electrons [40].

Based on these three factors, the following things can happen when light hits an object. The waves can be reflected, absorbed or refracted through the object. Light waves can also pass through the object with no visible effect.

III.3. Human Perception of Light

The human eye has a very high dynamic contrast ratio, around 1,000,000:1. Adaptation is achieved in part through adjustments of the iris and slow chemical changes, which take some time (i.e., the delay in being able to see when switching from bright lighting to pitch darkness.) [41]. The eyes' ability to detect contrast depends on scene brightness, with contrast sensitivity of the eye decreasing to about 8% of its maximum at low light levels; eye sensitivity also decreases with lower contrast subjects. The human eye is able to perceive bright sunlight and faint starlight.

Some of the latest flat panel displays have a quoted contrast ratio between 10,000 and 15,000:1. Film is able to hold a contrast range of around 1000:1. The range of the human eye is greater than any film or digital camera. The camera can function over a smaller range than that of the human eye by adjusting ISO speed, aperture and exposure time.

The eye is a contrast detector, not an absolute detector like the sensor in a digital camera. In any illuminated scene, the eye can see over a 10,000-step range in contrast detection, but this depends on the brightness of the scene. The eye has an amazing ability to see detail and perceive contrast in both very bright and very dim objects.

In digital imaging, in order to achieve the brightness range the eye can utilize, it is necessary to approach the range of brightness that the eye may normally encounter [41]. To effectively create photographic or cinematic scenes it is essential to establish a unit of measure for light. Traditionally, light was measured in terms of a standard candle, which lead to the development of the measurement of light intensity known as the “foot-candle”

[41]. By using a light meter to measure light intensity, the artist can reproduce the scene in a way that most accurately reflects natural perception.

III.4. Light Metering

A light meter is a device used to measure the amount of light falling on a subject or environment. In photography, a light meter is often used to determine the proper exposure for a photograph.

Our eyes and brains are not very good judges of contrast because we can see a much greater contrast range (about 13 stops or Zones) than film or video. We are also more aware of color differences, but for exposure control we must first think in terms of the brightness of objects in the scene and the density on our negatives and prints. Typically a light meter, either digital or analog, allows the photographer to determine which shutter speed and iris setting should be selected for an optimum exposure, given a certain lighting situation and film speed.

Light meters are also used in the fields of cinematography and scenic design, in order to determine the optimum light level for a scene [42].



Fig. 31. A Painting by J. Vermeer.



Fig. 32. A Photo by E. Serra.

Measuring light for chiaroscuro is crucial, because of the high contrast between light and shadow (Figure 31). The primary key to obtaining a valid exposure is to define visible detail in the darkest and the lightest areas in the scene. The only way to balance these two opposing elements is by using the correct exposure established with a light meter (Figure 32). If we fail to use the light meter or we just trust our visual judgment, we are in danger of overexposing or underexposing areas, leading to a loss of detail [42].

III.5. Achieving Contrast Ranges in Traditional Photography

Achieving the desired contrast range in traditional photography involves image management (placement of the camera, choice of lens, and possibly the use of camera movements) and most importantly, control of image values. In photography that uses film and chemical processing, the Zone System is concerned with control of these image values, ensuring that light and dark values are rendered with discernible detail (Figure 33).

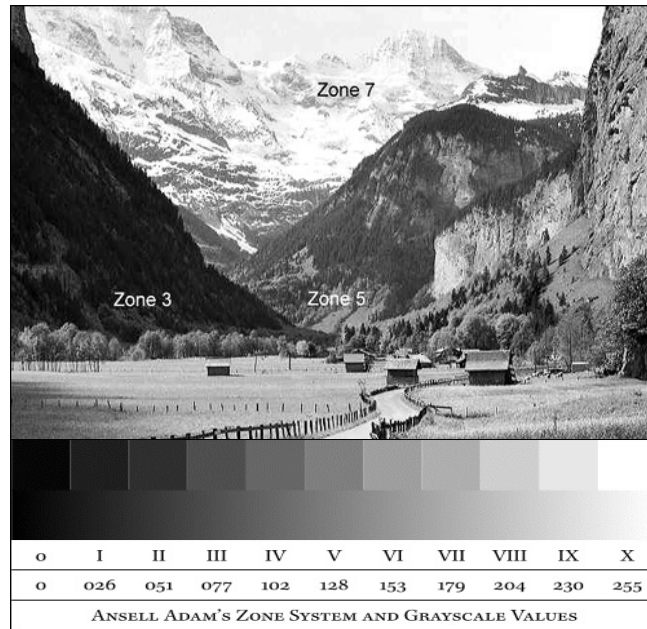


Fig. 33. A Photo by A. ADAMS with the *Zone System* [42].

Table 1. The Zone System

Zone	Reflectance	Comments	Stops Over/Under
Zone IX = Snow	95%	No Detail	+4
Zone VIII = Off White	80%	Some Detail	+3
Zone VII = Light Grays	70%		+2
Zone VI =Caucasian Skin	35%		+1
Zone V =Middle Gray	18%	Average	0
Zone IV =Brown Skin	16%		-1
Zone III =Black Skin	13%		-2
Zone II =Very Black Skin	9%	Some Detail	-3
Zone I =Black Velvet	2%	No Detail	-4

The Zone System, formulated by Ansel Adams and Fred Archer in 1941, is a photographic technique for determining optimal film exposure and development [42].

The Zone System provides photographers with a systematic method of precisely defining relationship between the way they visualize the photographic subject and the final results.

Almost any scene of photographic interest contains elements of different luminance; consequently, the “exposure” actually is many different exposures. The exposure time is the same for all elements, but image luminance varies with the luminance of each subject element [42]. Keeping in mind all these dynamics, a photographer must know how light and shadow can reveal form through stark contrasts or by gradations of value across surfaces.

III.6. Achieving Contrast Ranges in Digital Photography

Successful transfer of chiaroscuro to digital photography requires precise management of the tonal range. Since the chiaroscuro style usually results in a large portion of dark shadows in the scene, very often we can entirely lose visible details in shadows, causing the scene to end up with empty black areas. To prevent this, the artist uses a set of techniques that allow a greater dynamic range of exposures (the scale of values between light and dark areas).

High dynamic range imaging (HDRI) can enable photographers to record wider tonal detail than a given camera could capture in a single photograph [43]. The intention of HDRI is to accurately represent intensity levels found in real scenes ranging from direct sunlight to deep shadow (Figure 34).



Fig. 34. An Original Photo and the Same Photo Processed by HDR – Photo by Shyam Kannapurakkaran.

This method was developed to produce a single image from a set of photographs taken with a range of exposures. Information stored in high dynamic range images usually corresponds to the physical values of luminance or radiance that can be observed in the real world. This is different from traditional digital images, which represent colors that should appear on a monitor or a paper print. Therefore, HDR image formats are often called "scene-referred" in contrast to traditional digital images, which are "device-referred" or "output-referred." Furthermore, traditional images are usually encoded for the human visual system (maximizing the visual information stored in the fixed number of bits), which is usually called "gamma encoding" or "gamma correction." The values stored for HDR images are often linear, which means that they can represent relative or absolute values of radiance or luminance [43].

At the 1997 Special Interest Group on Computer Graphics Convention (SIGGRAPH), Paul Debevec presented his paper "Recovering High Dynamic Range Radiance Maps from photographs". It described photographing the same scene many times with a wide range of exposure settings and combining those separate exposures into one

HDR image. This HDR image captured a higher dynamic range of the viewed scene, from dark shadows to bright lights or reflected highlights [43]. HDRI lighting plays an important role in movie making when computer 3D objects are to be integrated into captured scenes.

III.7. The Implementation of Chiaroscuro in Photography

Since chiaroscuro became a highly developed technique of painting during the Renaissance, it is interesting to note the various interpretations of it.

The word chiaroscuro, derived from the Italian, and literally meaning light-dark, clearly conveys the idea it is intended to express. Some refer to it as a way of creating the illusion of rounded three dimensional form created through gradations of light and shade rather than through line. Another is the creation of dramatic effects by placing in opposition very light and very dark areas of an image. All of this is as relevant to photography as it is to painting, and serves as a system with which we can look at ways of establishing higher contrast (Figure 35).



Fig. 35. A Photo by C. H. White [44].

Contrast is the difference between light and shade in an image, which affects the quality of lighting and thus the aesthetics of the photograph. The natural and simple effect of light, with its attendant shadow on objects, is provided with greater fidelity by good photography than by any other method of delineation [45].

The knowledge of how to manage light and shade, with its intermediate gradations, connecting one with another, is the skill most necessary for creating the chiaroscuro effect in photography. Light and shade stands forth as a reality, it gives depth and roundness and contributes to expression and sentiment likeness and atmosphere of the scene.

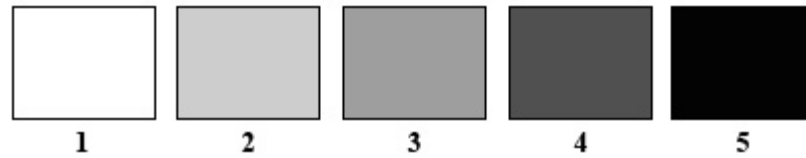


Fig. 36. A *Gray Scale* by H. P. ROBINSON [46].

Although there are between white and black, an infinite number of gradations, it will be convenient to divide them into light (1), half-light (2), middle tone (3), half-dark (4) and dark (5) (Figure 36). If a picture were composed of light and half-light only, the effect would be weak and flat (Figure 37).



Fig. 37. A Photo by E. LUCILE [47].

The secret of success in lighting a figure depends not so much on any given formula for the adjustment of blinds and backgrounds as it does upon a proper appreciation of what type of light treatment is required to lend character and individuality. To achieve this, one must have an understanding of light values and utilize them appropriately. Every picture should contain its brightest light and its darkest shadow. In this way all lights and

shadows may be depicted in their due relationship [48]. The severe logic of light and shade will produce strength and reality in a picture (Figure 38).



Fig. 38. A Photo by D. RUDOLPH [49].

CHAPTER IV

VISUAL REFERENCES AND COMPARISONS

IV.1. Visual Comparison in Paintings

Portraits from the early Renaissance period (14th to 15th century) were mostly made without chiaroscuro technique, and subsequently exhibited an absence of depth in space, figure volume and background shadows (Figures 39, 40).

Portraits from the Baroque period, with light coming from frame left, demonstrates both delicate modeling chiaroscuro to give volume to the body of the model, and also strong chiaroscuro in the more common sense as seen in the contrast between the well-lit model and the very dark background (Figures 41, 42) [50].



Fig. 39. A Painting by A. Baldovinetti [51].



Fig. 40. A Painting by H. Holbein [52].



Fig. 41. A Chiaroscuro Painting by M. Caravaggio [53].



Fig. 42. A Painting by G. D. Tour [54].

It is believed Jan Vermeer [1632-1675] used the camera obscura and other advanced observational and mathematical means to create paintings of interiors wherein every nuance of value is rendered. Whether he did or did not make use of viewing devices, he was one of several individuals passionately interested in the phenomenon of light [50].

IV.2. Visual Comparison in Films

As in Baroque paintings, chiaroscuro is achieved in cinematography and photography through the use of extreme low-key lighting to create distinct areas of light and shadow. In the following examples, it is my objective to compare basic visual similarities between these two mediums.

In the painting *Portrait of Maffeo Barberini* [1598] (Figure 43), Caravaggio uses body position and lighting from above to create the image of power, exemplified by

Maffeo Barberini, a powerful Florentine and church prelate. The scene from *The Godfather* [1972] (Figure 44) is staged very similarly to the painting with the obvious intent of creating the same effect capturing the power of Michael Corleone.



Fig. 43. A Portrait Painting by M. Caravaggio [55]. Fig. Fig 44. A Scene from the Film: The Godfather [56].

In his painting *Saint Francis of Assisi in His Tomb* [1673], Zurbaran shows the uncorrupted body of St. Francis of Assisi hovering above his tomb illuminated by a single ray of light (Figure 45). This effect hides his face in darkness, reinforcing the fact that this is not St. Francis, but a deathly representation of him. Similarly, the scene from the film *Star Wars Episode III: Revenge of the Sith* [2005] portrays Anakin Skywalker (Figure 46), newly recruited to the dark side of the force, through the use of a single ray of light shining down on a hooded figure, evoking the same sentiment from the Zuraban painting that Anakin is dead because Darth Vader lives in his place.



Fig. 45. A Painting by F. D. Zurbaran [57]



Fig. 46. A Scene from the Film: *Star Wars 3* [58].

In *Andrea Doria as Neptune* [1550-55], Bronzino uses chiaroscuro to enhance the musculature of the subject (Figure 47), the naval commander Andrea Doria, represented in the painting as Neptune. In the film *300* [2006], a similar effect is used to enhance the musculature of Leonidas, the powerful warrior-king of the Spartans (Figure 48).



Fig. 47. A Painting by A. Bronzino [59].



Fig. 48. A Scene from the Film: *300* [60].

In Giger's painting *Pilot in Cockpit of Alien Wrack* (Figure 49), the use of chiaroscuro is so completely effective in creating the illusion of a three-dimensional piece that when compared to the scene from *Alien* (Figure 50), the effect (this time on a three-dimensional landscape) is strikingly similar. Both scenes use shading to give the image depth and texture. When one considers that the former is a two-dimensional work and the latter a three-dimensional scene from a film, the effect is eerie.

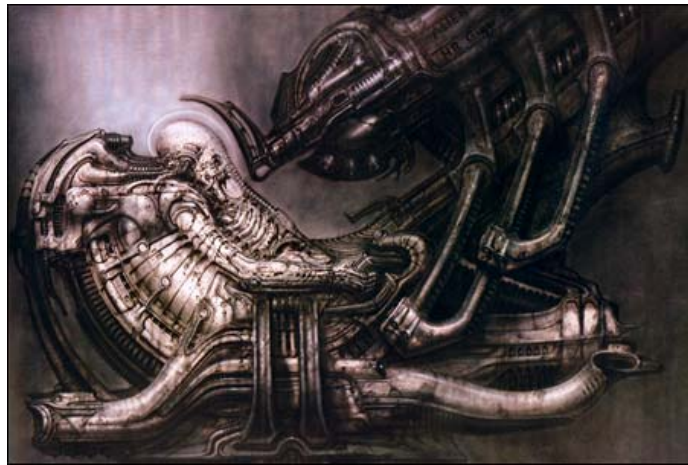


Fig. 49. A Previsualization Painting by H. R. GIGER [61].



Fig. 50. A Scene from the Film: *Alien* [62].

Rarely is the transition from artistic conception to three-dimensional reality so seamlessly achieved. It is important to mention that Giger's painting *Pilot in Cockpit of Alien Wrack* (Figure 46) was a result of the previsualisation process for the movie *Alien*.

Odd Nerdrum's painting, *Dawn* (Figure 51), is an extremely interesting work because it is a blend of the old and the new. Nerdrum uses a painting style that harkens back to old masters of chiaroscuro like Caravaggio while exploring modern themes in a surrealistic format.

The subject of *Dawn* seems to be despair. Four men sitting in a field are crying out in anguish at the coming sun, as if to protest the coming of a new day. The four seated figures are clearly the focus of the scene. Their pale skin stands in stark contrast to the darkness that pervades the rest of the painting. The darkness surrounding them enhances a sense of despair. The yellow sky indicates that the sun is soon coming over the mountains.

The scene from *The Cell*, while obviously inspired by Nerdrum's painting is also the inverse of it (Figure 52),. Instead of being surrounded by darkness, three seated figures are bathed in light with darkness in the distance, and light in the foreground. While in Nerdrum's painting, the seated figures are crying out in despair against the coming sun, in the scene from *The Cell*, the seated figures are heralding its arrival.



Fig. 51. A Chiaroscuro Painting by O. NERDRUM [63].



Fig. 52. A Scene from the Film: *The Cell* [64].

IV.3. Visual Comparison in Photography

Caravaggio's painting *St. Francis of Assisi in Ecstasy* (Figure 53), captures St. Francis's experience of receiving the stigmata. St. Francis is held lovingly by an angel and the lighting focuses only on St. Francis and the angel. Everything else in the painting is almost completely shrouded in darkness. The chiaroscuro effect is used to indicate a holy occurrence, the experience of the stigmata, the wounds Christ received while on the cross.

Here the background is insignificant; the focus is on St. Francis and what he is experiencing. Likewise, the photograph by W. Eugene Smith (Figure 54) uses a similar lighting approach and composition. One of Smith's subjects, Tomoko, is deformed by Minamata disease, a type of mercury poisoning. She is posed similarly to St. Francis in the Caravaggio painting, held by her mother as St. Francis was held by the angel.

In the Caravaggio painting, St. Francis appears to both succumb to and transcend his affliction. This is similar to the case with Tomoko. Though she is obviously suffering due to this disease, there is also a suggestion of transcendence. Like the painting, the photograph employs a chiaroscuro effect that completely shrouds everything except the subjects in darkness, and focuses on Tomoko making the only focus on Tomoko and her mother in this ecstatic pose.



Fig. 53. A Religious Chiaroscuro Painting by M. Caravaggio [65].



Fig. 54. A Photo by W. E. Smith [66].

CHAPTER V

METHODOLOGY

V.1. Steps in Translations of the Chiaroscuro Effect

In translating the chiaroscuro effect from painting to photography the first step is to understand the principles of achieving chiaroscuro lighting in paintings (Figure 55). Most often, the subject is dramatically lit by a shaft of light from a single constricted and often unseen source.

Chiaroscuro defines objects not by a contour line, but by the contrast between the object and the background. The overall color palette usually contains warm colors in contrast with dark tones (hard shadows).

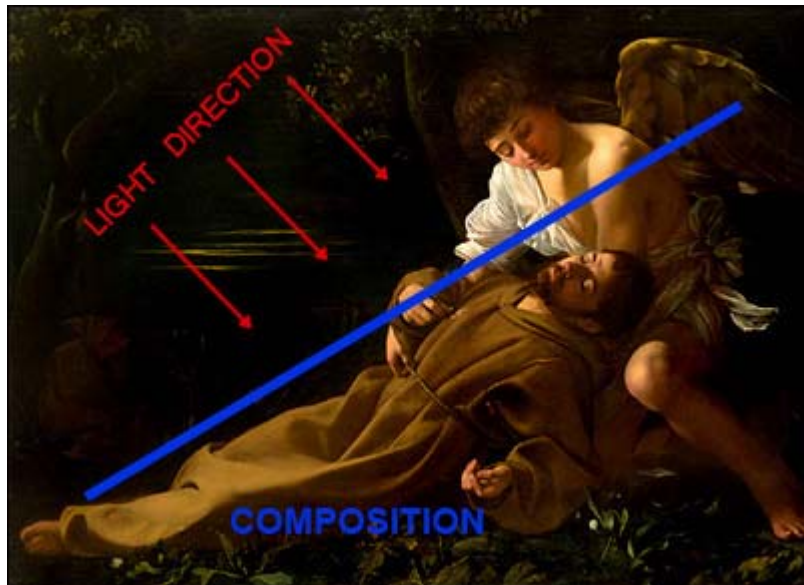


Fig. 55. A Graphical Analysis of a Painting by M. Caravaggio.

The most important element for creating chiaroscuro in photography is the development of a specific lighting design. One must follow certain compositional rules and achieve proper brightness values of subject and background.

V.2. Lighting Design

In photography and cinematography, lighting design determines visual character. Lighting design develops the specific genre or type of mood that is dominant in the scene. The closest correspondence to chiaroscuro in paintings is low-key lighting in cinematography.

The idea behind low key lighting is simple: dark tones, minimal lighting, and emphasis on certain areas of the subject. Low key light accentuates the contours of an object by throwing areas into shade while a fill light or reflector may illuminate the shadow areas to control contrast (Figure 56).

The relative strength of key-to-fill, known as the lighting ratio, can be measured using a light meter. Lighting ratio in photography refers to the comparison of key light (the main source of light from which shadows fall) to the fill light (the light that fills in the shadow areas). The higher the lighting ratio, the higher the contrast in the image, and the lower the ratio, the lower is the contrast. The term "low key" is used in cinematography to refer to any scene with a high lighting ratio, especially if there is a predominance of shadow areas (Figure 57). It tends to heighten the sense of alienation felt by the viewer, hence is commonly used in Film Noir and Horror genres [62].

V.3. Classic Portrait Lighting and Chiaroscuro Lighting

In order to understand lighting design for chiaroscuro, one can analyze today's classic studio portrait lighting to see the main difference. In classic photographic portrait lighting, priority is given visually defining the subject, rather than describing the subject emotionally. To demonstrate the difference, I will compare the two lighting strategies of classic portrait lighting and chiaroscuro lighting.

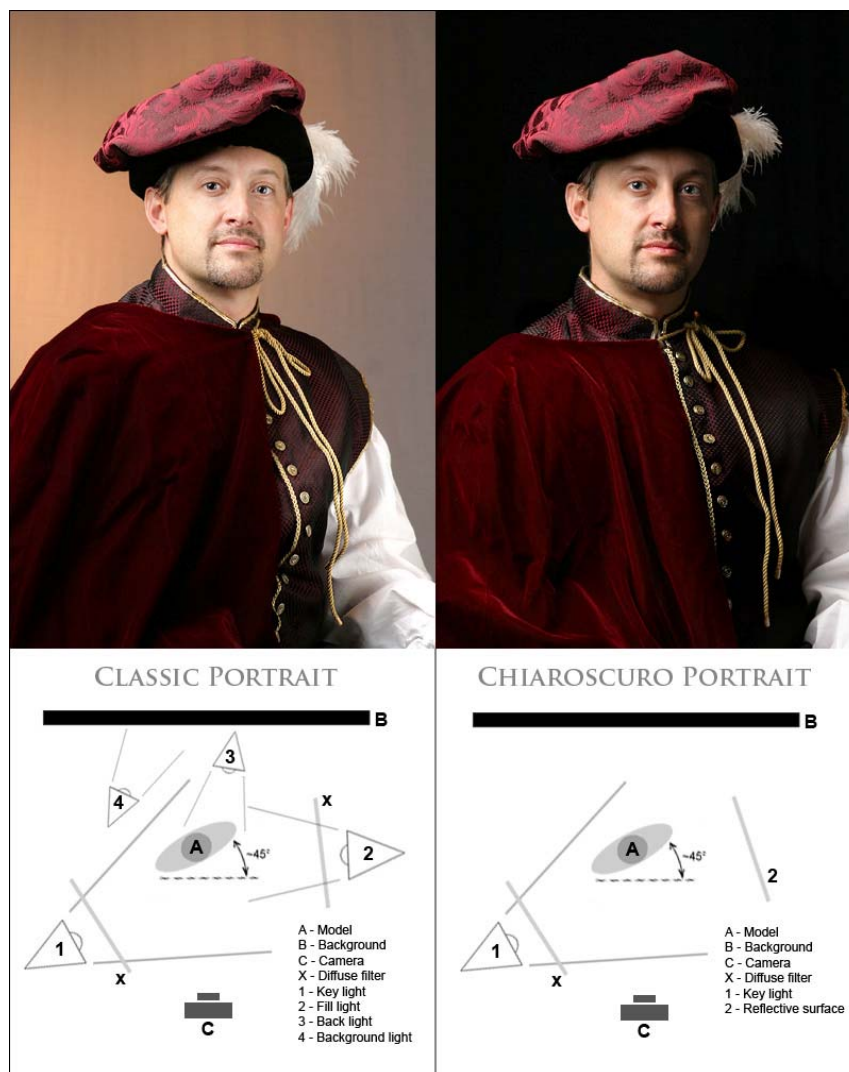


Fig. 56. A Photo 1 by I. Kraguljac.

Classic Portrait Lighting

Classic portrait lighting, also called *three point lighting*, is usually built upon three light sources for the object, and one for the background (Figure 56). Although this lighting approach is distinctive from the chiaroscuro lighting design, it is an important technical base from which one can better understand the lighting principals and logic that combine to create the chiaroscuro effect. To better understand classic portrait lighting I will take each element in turn and provide a description of its use.

Step 1 - Key Light

The main light or key light in classic portrait photography is utilized to reveal form (Figure 57). It can be diffused to create a softer, more flattering effect. A good starting point is to set the key light about 45 degrees from the camera to subject axis elevating it higher than the subject's head. This higher position increases the emphasis on facial texture and is desirable for character portraits.

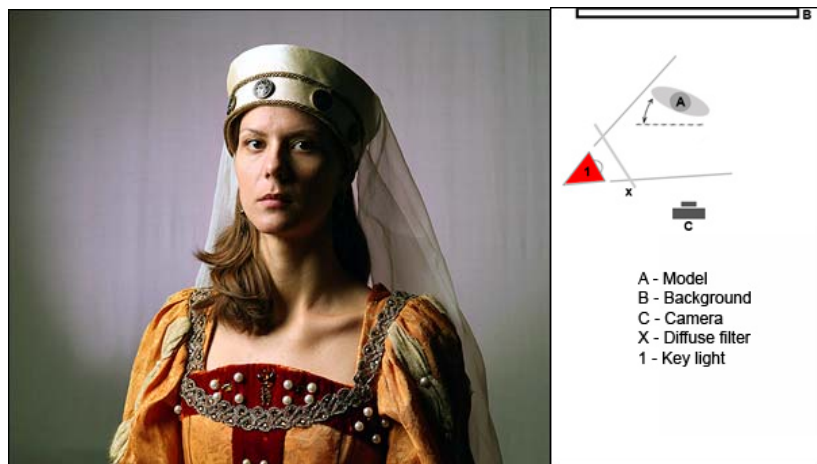


Fig. 57. A Photo 2 by I. Kraguljac.

Step 2 - Fill Light

The fill light, which can also take the form of a reflective surface, is positioned to one side and not directly in front of the subject (Figure 58). The fill light illuminates the shadow side, filling in the darker areas caused by the key light. The fill light should be diffused. If it is not, it will create a double shadow and possibly a second catch light in the eyes. The intensity of the fill light should be half or less that of the key light and is described as a ratio of 2:1 or less. The typical position of the fill light will be at camera level or slightly higher. It is important to avoid lowering the fill light below camera height, as it will create an unnatural effect on the model's face.

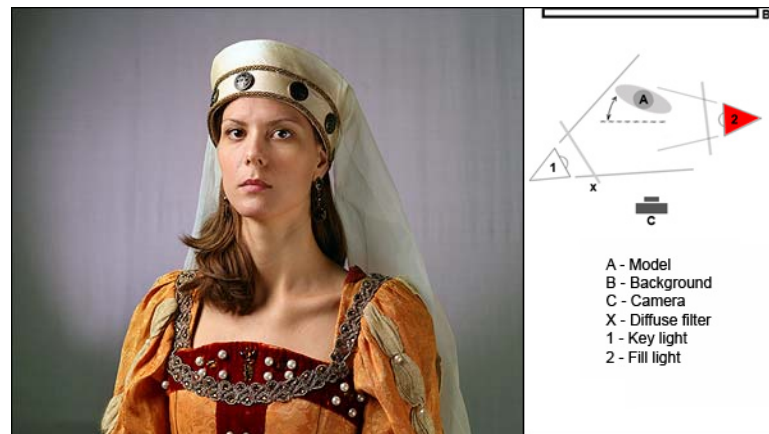


Fig. 58. A Photo 3 by I. Kraguljac.

Step 3 – Back Light (Hair Light)

The purpose of the hair light in portrait photography is to help separate the subject from the background and to add a greater sense of spatial dimension to the subject (Figure 59). A light source from above (and slightly behind) the subject will add the appearance of

roundness to the shoulders of the subject. It will also lighten the upper edge of the subject which is helpful in separating dark hair from a dark background. If the subject is dark and the photographer wishes to keep the background dark, this edge light will tend to brighten just the hair and shoulders, separating, but not overly brightening the subject.

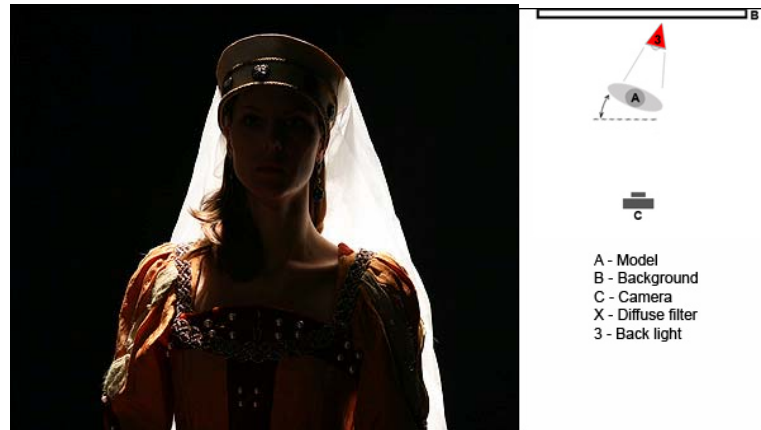


Fig. 59. A Photo 4 by I. Kraguljac.

Step 4 - Background Light

The primary function of background lights is to create separation between the subject and the Background (Figure 60). The background light should only illuminate a small area behind the subject. Some photographers use a snoot (a tube like attachment to constrict the light to a smaller area) to control light spillage. The light is positioned facing the background far enough away to create an arc of light around the subject. From the camera the light itself should not be visible. This creates a softly illuminated area on the background behind the model. A colored gel can be used over the light and should compliment the portrait and not look out of place. It is common practice to keep the background light at about the same output level as the fill light. One may

need to increase the power slightly to compensate for using a dark colored gel over the light.



Fig. 60. A Photo 5 by I. Kraguljac.

Chiaroscuro Portrait Lighting

In contrast to classic portrait lighting in which the object is always defined without shadows, chiaroscuro lighting design purposely utilizes shadow in defining the shape of the object and creating the three-dimensional appearance. The shadow effect is a result of using only two sources of light rather than the four in classic portrait lighting. Another important difference between these two lighting approaches involves the positioning of the key light, which is much higher in the chiaroscuro approach. Finally, the difference in intensity between the key and fill lights is much greater than in classic portrait lighting. It is these differences that create the dramatic effect characteristic of chiaroscuro.

Step 1 - Key Light

The main light or key light in Chiaroscuro portrait photography, as is true for classic portrait photography, functions primarily to reveal form (Figure 61). The difference occurs in the positioning of the light, typically between 45 and 90 degrees from the camera to subject axis, and raised much higher than the subject's head. This single source of light emanating from a high angle is precisely what is seen in Baroque paintings and suggests a strong religious element by representing the divine blessing issuing from above.



Fig. 61. A Photo 6 by I. Kraguljac.

Step 2 - Fill Light

Similar to classic photography, the fill light in Chiaroscuro portrait photography has the same purpose of illuminating the shadow side of the subject (Figure 62). However, this light fills in her darker areas caused by the key light on a very limited level. The amount of fill light in Chiaroscuro portrait photography is much lower than that used in classic portrait photography. This smaller amount of fill light successfully preserves the

atmosphere established by the key light, while at the same time revealing smaller details within the shadow areas.



Fig. 62. A Photo 7 by I. Kraguljac.

The primary difference between the lighting strategy for classic portrait photography and Chiaroscuro portrait photography is in the number of light sources used. Chiaroscuro lighting design is a simplified setup, which utilizes a primary source of light shining down on the subject from a high angle. The lack of background lighting creates a dark background, which serves the purpose of clearly distinguishing the object and keeping it in the observer's focus.

The second difference exists in the relative intensities of the key and fill lights with chiaroscuro portrait photography utilizing a significantly decreased amount of fill light. These differences create the dramatic effect so recognizable in classic works of art, which can also be translated to the photographic medium (Figure 63).

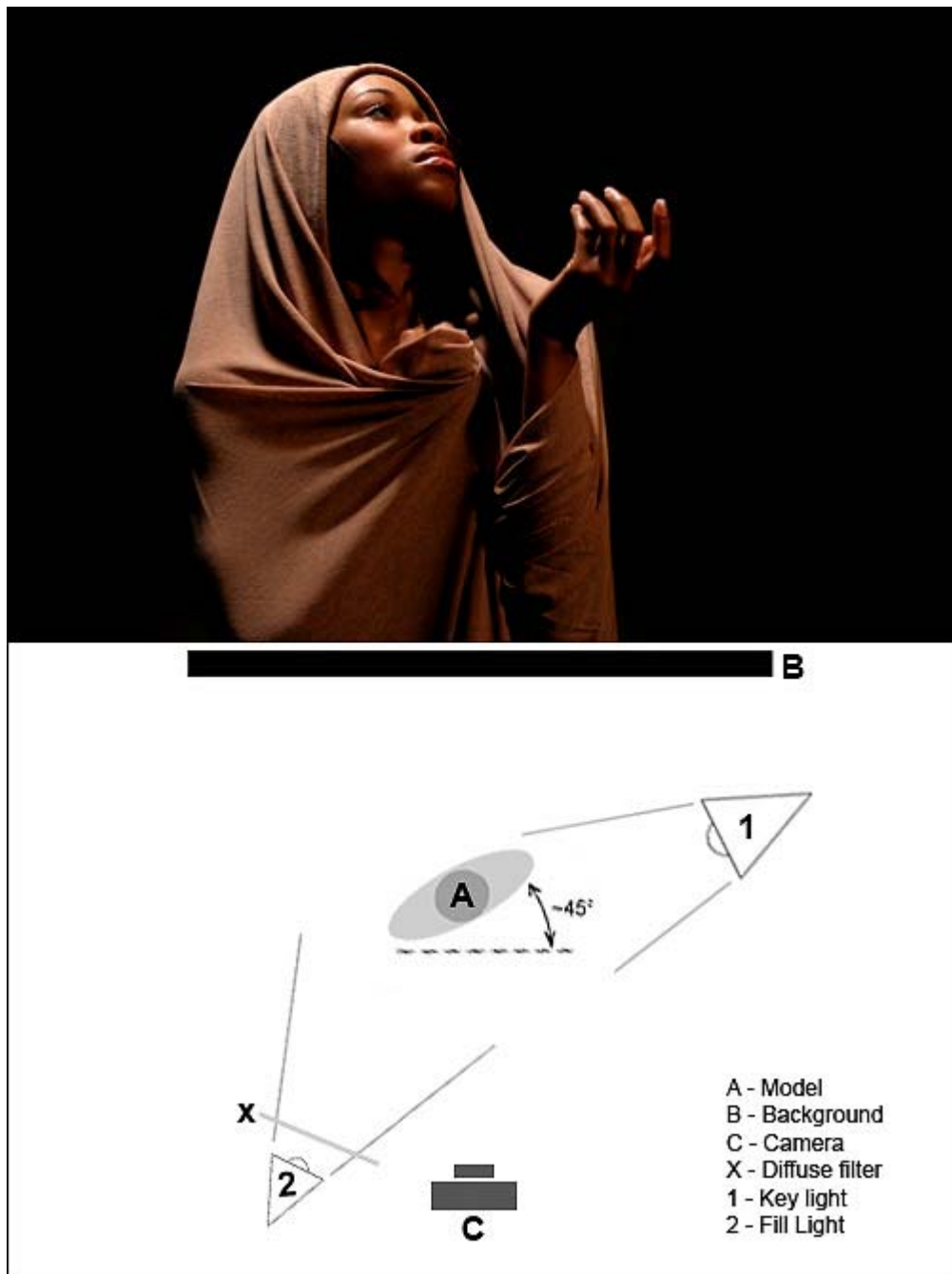


Fig. 63. A Chiaroscuro Lighting Setup and Photo by I. Kraguljac.

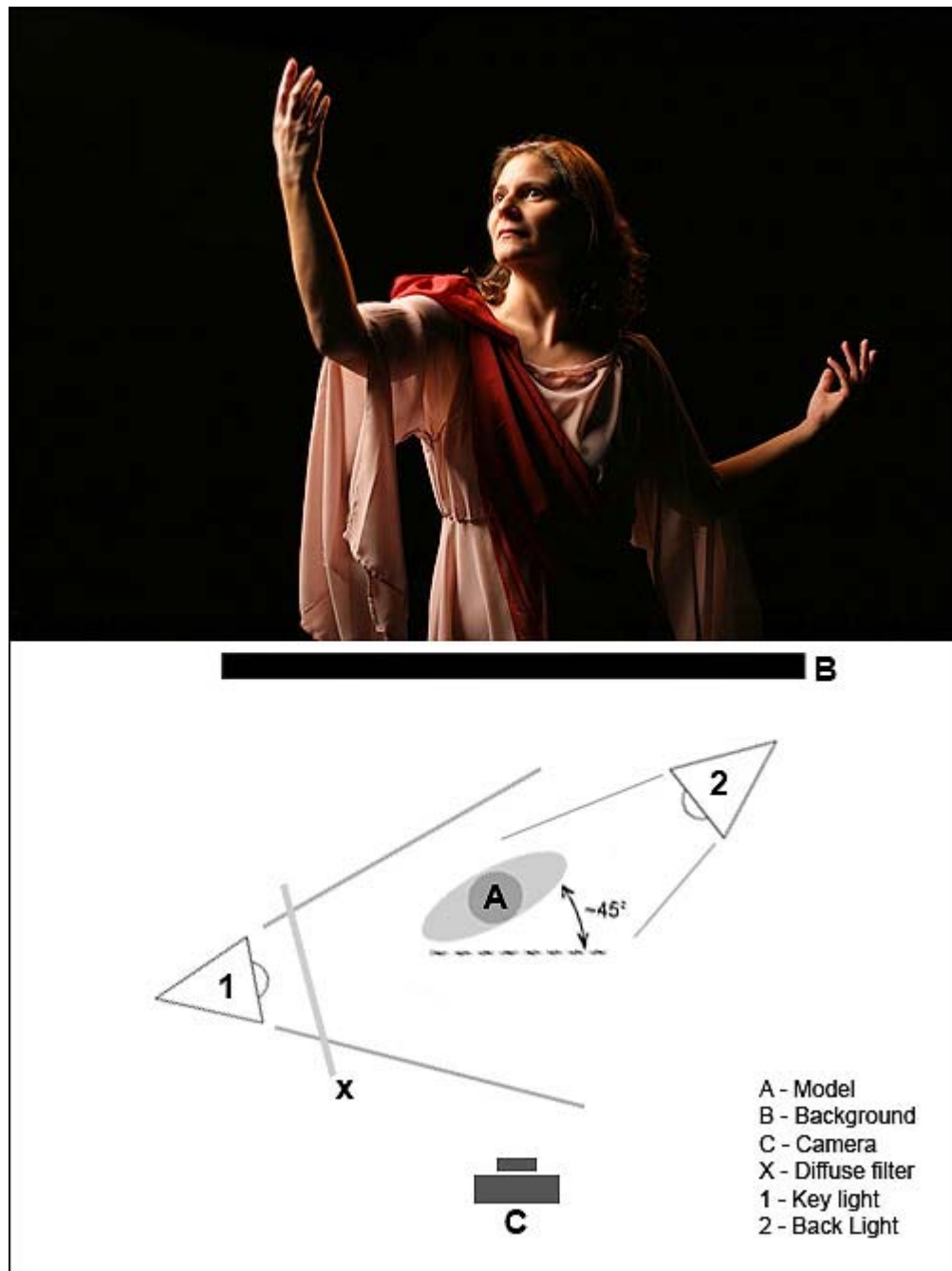


Fig. 64. A Chiaroscuro Lighting Setup 2 and Photo by I. Kraguljac.

Translating chiaroscuro lighting design into the photographic medium requires a different approach to studio lighting setup. The most commonly used three point lighting setup utilized for classic portraits cannot deliver dramatic chiaroscuro effect. The chiaroscuro effect requires a very dark background upon which the main object is defined with significant shadowing. By utilizing the light in a non-conventional way it is possible to recreate the chiaroscuro effect in the photographic medium (Figure 64).

One source of inspiration came from the pictorial richness of the famous mural in the Sistine Chapel (the official residence of the Pope in Vatican City from the late 15th Century), in particular, the section that presents the *Creation of Sun and Moon* (Figure 65), painted by Michelangelo Simoni. From this work, the author was motivated to discover a way to recreate the impression of weightlessness with a dramatic sense of depth achieved through chiaroscuro lighting design.



Fig. 65. A Fresco by S. Michelangelo [67].

First step – The objective was to use the same chiaroscuro lighting setup employed in the first experiment (Figure 66). In this setup, the goal was to achieve the same pictorial value seen in the portrait paintings of Caravaggio; a strong chiaroscuro appearance, diagonal composition and very dark background were the main elements of translation.



Fig. 66. A Photo 8 by I. Kraguljac.

Second step – The next challenge was to find the best manner in which to create the impression of weightlessness. To do this, the photographer initially attempted to pose the model in mid-air using a trampoline. This approach was incrementally successful, however, it also created unwanted effects including obvious muscular tension and a strained texture in the costume fabric (Figure 67).



Fig. 67. A Pphoto 9 by I. Kraguljac.

Third step – While satisfied with the lighting design, the photographer was compelled to find a better way of achieving a sense of weightlessness for the model and her costume. It was determined necessary to change the fundamental physical nature of the scene by transferring the model, camera and photographer into a liquid environment. This transition to an underwater setting produced a greater sense of serenity in the model and relaxed texture in the costume (Figure 68).

In the above circumstance, where the area between the model and lighting object was divided by water, it was important to have enough light power to overcome the strong light reduction made by water (Figure 69). Besides the light power, a soft box attached on the strobe (Figure 70) creates the certain quality of diffuse light that highly corresponds to the light quality seen on many Renaissance portrait paintings. It creates recognizable shapes of fabric and gives character to the human face (Figure 69).

V.4. Type of Light

The type of light used for this specific photo experiment was a strobe light, because it is capable of delivering a strong amount of light power in one burst. Strobes are around two to three times more efficient at converting electricity to light. Continuous watts at a shutter speed of one second are equivalent to watt-seconds. However, as one shortens the shutter speed, the continuous lights deliver less exposure to the film. So at typical moderate to high shutter speeds, 1000 watts of continuous light delivers much less useful light than a 1000 watt-second strobe.

Technical specifications for under water photo experiment:

Environment: Under the water.

Background: Black cotton fabric.

Lighting equipment: Strobe Light - JTL Mobilight 301.

Soft box: Photogenic Rectangular Softbox – 48”x72”.

Light direction: 90 degrees.

Camera: Canon 5D (Digital).

Lens: Canon 17-40mm.

Underwater camera-housing: Ewa-Marine U-B Series.

Wireless transmitters for strobes (Pocket Wizards).

Rip Curl Classic Full Wetsuit.

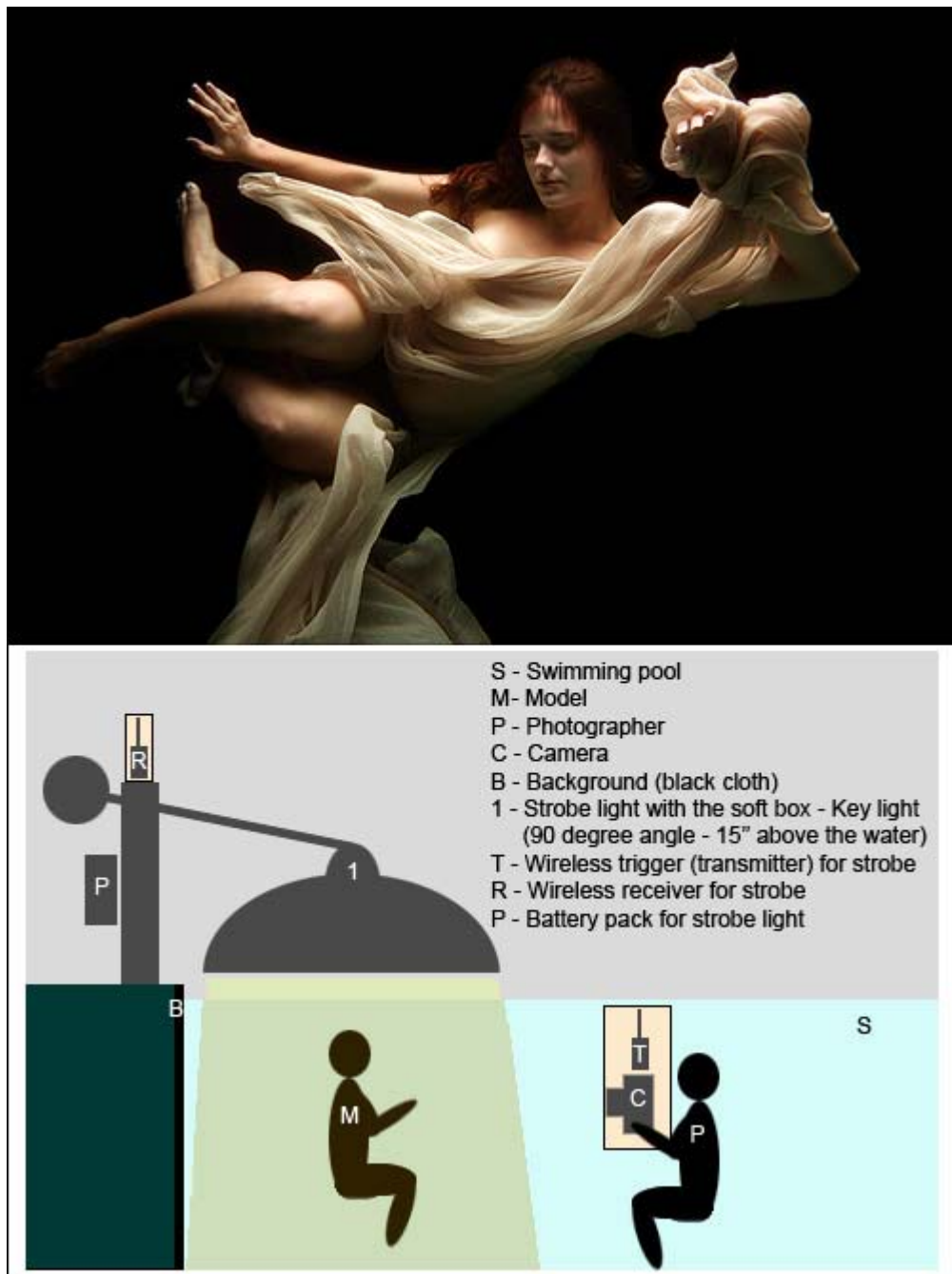


Fig. 68. A Chiaroscuro Underwater Lighting Setup 1 and Photo by I. Kraguljac.



Fig. 69. A Chiaroscuro Lighting Setup 2 and Photo by I. Kraguljac.

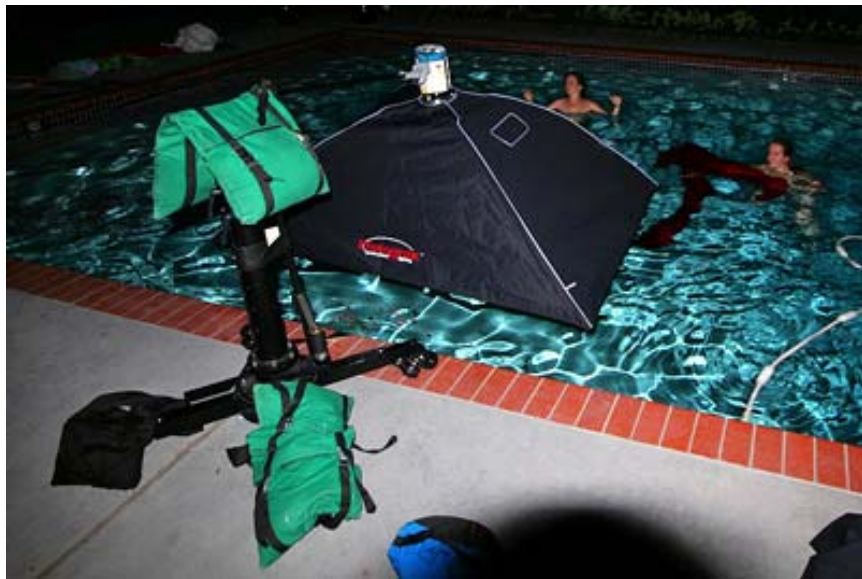


Fig. 70. A Chiaroscuro Lighting Setup 3 and Photo by I. Kraguljac.

CHAPTER VI

CONCLUSIONS AND FUTURE WORK

VI.1. Conclusions

This thesis translates the chiaroscuro effect from classical paintings to modern photography. Chiaroscuro is a technique used to create a sense of depth and volume in a two-dimensional medium. This effect was first seen in Roman and Greek murals and subsequently perfected by Baroque and Renaissance artists. A proper understanding of light and its effect on three-dimensional form is necessary to recreate this visual effect in a two-dimensional medium.

This leads to a specific lighting strategy. An additional element of this translation process involves the diagonal composition seen in the works of master painters. In an effort to understand the translation process, an analysis of the use of chiaroscuro by other artists in photography and cinematography was done. A side-by-side comparison of classical paintings with photographs and film scenes, which utilize similar effects, aid in further understanding the important aspects of translating chiaroscuro to photographic and film mediums. These comparisons highlight the importance of utilizing chiaroscuro in contemporary photography and cinematography to achieve the desired dramatic effect.

As a result of examining the historical development of chiaroscuro and analyzing how more recent artists have translated this technique to photography and film, the key elements were identified and applied to photographs for this thesis (Figure 71). A successful rendition of chiaroscuro using light design and composition principles was

achieved in the studio in several works presented. However, achieving the additional element of a sense of weightlessness and repose, was not satisfactorily achievable in the typical studio environment. Accomplishment of this task required placing the entire scene under water and applying the lighting and compositional elements in this new environment (Figure 72). The resulting photographs exhibit not only the key elements of chiaroscuro, but also extend the dramatic impact through a unique approach that eliminates some of the limitations of the typical studio environment.



Fig. 71. A Chiaroscuro in a Renaissance Period - Photo by I. Kraguljac.



Fig. 72. Underwater Photo Experiment by I. Kraguljac.

VI.2. Future Work

This research has the potential to inspire other projects and can be applied to other mediums. In modern film production, there is a growing trend for using digitally recreated 3D characters with all-digital lighting setups, as in the case of the character of Yoda in *Star Wars Episode II: Attack of the Clones* [2002], or even for entire scenes, as in *Beowulf* [2007].

Employing this lighting effect in films that use CGI (Computer Generated Image) animation would add more realism, texture, and atmosphere. One question that could be explored in future work is how the chiaroscuro effect can improve a digitally created character or environment to make it appear more realistic for the audience.

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