

**ADAPTATION OF LIGHTING STYLES FROM TRADITIONAL PAINTINGS
TO COMPUTER GENERATED SCENES**

A Thesis

by

MUZAMMIL ABDUL MALIK

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

August 2012

Major Subject: Visualization

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Approved by:

Chair of Committee,	Philip Galanter
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ABSTRACT

Adaptation of Lighting Styles from Traditional
Paintings to Computer Generated Scenes. (August 2012)

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Chair of Advisory Committee: Prof. Philip Galanter

Image making using Computer Graphics has become extremely popular. Great advances in computer graphics have led to an increasing number of people using this medium. But Computer Graphics on its own is not art unless art principles are applied to it, as is the case with any other art medium. Studying art principles used in traditional paintings is an invaluable way of learning how to create images that tell a story, look believable, evoke appropriate emotions, and remain aesthetically alluring too. With that motivation in mind, a visual analysis of paintings of John Register, Jules Breton and Chris Peters was conducted to better understand their styles. Two paintings by each of the three artists were then selected for an in depth study and based on those, computer generated renderings were produced. Inspired by each artist's style, digital scenes were modeled, lit and rendered using 3D authoring tools. The final rendered images exhibit the lighting style unique to each of the three artists.

DEDICATION

To my parents and my family

ACKNOWLEDGEMENTS

All praise and thanks be to God. Next, I would like to earnestly express my gratitude to Professor Philip Galanter, my committee chair, for guiding me in the right direction and for providing me with helpful critique to make this thesis possible. I would also like to thank my committee members, Professor Autum Casey and Professor Carol LaFayette for their advice and for giving me a helping hand whenever I needed it.

I would like to thank the Visualization Laboratory faculty and staff for helping me during my graduate studies. I would also like to thank fellow Viz Lab students.

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CHAPTER I

INTRODUCTION

Digital image making using 3D graphics has become extremely popular with more people adopting this medium for creating art, because of great advancements in 3D graphics. The use of sophisticated 3D authoring tools on its own without the aid of traditional art techniques is not conducive to effective image making. The necessity for the use of traditional art techniques in contemporary 3D art can be justified by the fact that 3D art is a fledgling medium compared to other forms of fine arts like painting and cinematography. Traditional artists have already taken our appreciation of art to unprecedented levels. Trying to learn all that from the beginning is a futile exercise akin to reinventing the wheel. Instead, it would make much more sense to acquire inspiration from traditional art media [1]. Studying traditional art principles used in photography, cinematography, paintings, etc. is an invaluable way of learning how to create images that tell a story, look believable, evoke the right emotions, and remain aesthetically appealing. With 3D graphics, the process of making images is different from traditional art forms but the underlying principles of image making are essentially the same.

Lighting plays a vital role in the image making process. A wonderfully modeled scene with great textures and characters will not turn out to be impressive if it is not well lit. Lighting means so much to an image, it can make the same environment look

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

cheerful, gloomy, scary, lovely, mysterious, and can induce a wide variety of other feelings. It is also used to direct viewers' attention, convey time of the day, indicate the season, create depth and complement composition [2].

A detailed study of the lighting styles of each of the three selected artists - John Register, Jules Breton and Chris Peters was conducted and the results were used in reconstructing CG scenes. Although it has to be kept in mind that the colors cannot be guaranteed to look the same on different viewing devices, and this is an age-old problem in the CG/Movie industry because of calibration differences in monitors.

I.1 About the Artists

John Register (1936 – 1996) was a twentieth century American Realist Painter. Register paintings are characterized by isolated spaces mostly containing no human subjects, and in which “the viewer would personify himself or herself as the isolated one”. He had a rather unique process of painting, characterized by the use of his own photographs and “the distillation of the scene to establish formal clarity” [3] [4]. His paintings attempt to retrieve neglected beauty in unpeopled spaces, along with a “haunting stillness tinged with regret and hope” [5]. The justification he used for depicting “dingy restaurants, proletarian cafes, bus stations or hotel rooms” is that these interior spaces have a common denominator and are universally experienced, and are much less specific than his own living room. Hence his paintings arouse feelings everybody can relate to [6]. Though a great deal of consistency is evident from his paintings, it must be noted that his style underwent subtle changes to accommodate the

subjects he depicted. He started off referring to American precisionists like Charles Sheeler and Ralston Crawford but a decade later he produced landscapes inspired by the Romantic tradition in American art [7].

Jules Breton (1827-1906) is one of the most prominent French realist painters of rural life [8]. His upbringing in rustic environment heavily influenced his style. In fact, it has been asserted by Annette Lacouture that his love for nature sparked off his interest in landscape painting [9]. To better understand Breton's role as an interpreter of rural life, the social and cultural forces during his formative years (1847-1853) have to be taken into consideration. After the 1848 French Revolution, the laboring classes rose on the scene as the new center of interest. The social turbulence caused by the urban industrial development sparked off new interest in the peasant as a major subject for high art [10]. It is interesting to note that Jules Breton started to write and compose poems too, and his poems had an influence on his paintings [11].

He had a great admiration and love of nature. It is featured in his work from beginning to end. It was one of the most prominent ingredients of the paintings assembled for the exhibitions in Arras (1976-77) and even more so in Omaha (1982-83). He seldom chose to paint interiors; he actually painted only about 11 of them throughout his entire career. He almost always painted in the open air [12]. The turning point in his career came in 1843 when he presented his work to Felix De Vigne who was really impressed by the young Jules' work [13]. Breton soon began learning under Felix De Vigne who would go on to become his father-in-law [14]. He garnered laudable

meticulousness in drawing and form from his training in Belgium at the schools of De Vigne and Van der Haert [15].

Breton's approach to painting could be summarized in this fashion: Starting off with sketches for portions of the composition, or studies from nature made in a notebook, Breton would then sketch the whole composition and indicate the highlights of the subject he chose to depict.

Occasionally, this preliminary sketch would be executed in the open air to get the right ambience. Breton would mostly memorize the elements observed from nature and translate them into paintings. Rarely, he would work his way from a scene that had struck him or a scene he had experienced. Over time in his career, the number of sketches and preliminary studies that he conducted to produce a painting increased steadily. He used these sketches to achieve the effect he desired, which also indicates that the artist always saw room for improvement and never really got complacent with more experience. He pushed further to do better in terms of harmonizing figures, landscape and light [16].

Chris Peters is a popular contemporary Pop Surrealist painter. He received his education at the Gage Academy of Art in Seattle, USA. His works are featured in Copro/Nason Gallery in Santa Monica and numerous others [17]. He paints in the style of old renaissance masters like Rembrandt in his unique pop surrealist way [18]. At Gage Academy, Peters learned several techniques such as indirect painting, glazing, scumbling and mediums. In all of his paintings, he uses indirect painting technique, which involves gradually stacking up layers of paint one over other over time, with

upper layers concealing parts of the 'underpainting' and revealing others. Using this technique, one would start off painting without aiming for a finished effect. Once a base layer dries, a new layer is freshly painted over it and gradually the painting evolves. The concealing and revealing of underpaintings can be achieved by using either opaque paint or transparent oil color. The mixing of paint with oil color produces colors through indirect or optical mixture; and will have a greater luminous vibration. By glazing, a transparent film of color is laid over another paint surface and by scumbling; a film of color (quite opaque) is applied over another paint surface obscuring the layer(s) underneath [19].

Chris Peters' paintings find beauty in the blurred obscurity that exists between life and death. In his own words, he “develops a tension between quiet objects present in still life and disquieting sense that something is really quite wrong”. [20]. Mostly his paintings are based on the symbolism of Vanitas and the Catholic religious paintings, which have a strong underlying theme pointing to life, death and resurrection [20]. The Vanitas was not solely meant to be a work of art but serve as a means to foster a more sublime reminder that the vanities of this life are transient and erratic, and would readily be obliterated in the face of death [21]. So his paintings arouse thoughts of scrutinizing beyond the facade, deeper into the reality of life.

I.2 Why these Artists?

A brief discussion of the motivation behind the choice of the three artists:

Jules Breton paintings take you into a world of idyllic bucolic landscapes with natural outdoor lighting. His paintings portray the lives of ordinary peasants on the French countryside. The lighting and environments depicted in the Breton paintings can be widely used to imitate outdoor scenes with natural lighting in the Computer Generated Imagery (CGI) medium. Several CGI movies like *Shrek*[22], *Over the Hedge*[23], *AntZ*[24] and many others have the majority of shots set up in simulated outdoor environments - supplemented by many others which feature at least a few shots in outdoor settings. Being able to study in-depth the style of Jules Breton whose work overwhelmingly features magnificent outdoor scenes in natural lighting would indeed help in translating that beguiling natural charm created by his lighting style into Computer Generated Imagery. As it had been underscored earlier, the aesthetics and concepts of 'art' remain relatively constant across the media. The artistic bracket of a novel medium like CG can be pushed further to incorporate artistic impressions from a more established and time-tested media.

John Register paintings on the other hand present a very different genre of lighting. Unlike Breton's painting depicting outdoor landscapes, Register's paintings delineate reclusive urban spaces. His paintings feature highly contrasted (mostly indoor) lighting. They express his idea of the growing aloofness between people in the newly formed American urban society. In his paintings one would typically key out city spaces with no human figures, and strong lighting coupled with equally strong shadows. From an application to CGI perspective, his paintings provide an auspicious avenue to depict desolateness and desertion through a strong use of lighting. His lighting style is pertinent

in creating stylized indoor CG lighting for more common social places like restaurants, hotels, offices, etc. These places are familiar to pretty much every person in the society. Register's lighting style can be definitely worth experimenting in scenes containing human subjects as opposed to his conventional uninhabited scenes. Movies like *Ratatouille*[25] and several others, which are mostly shot indoors in urban environments, might gain a lot from Register's style of indoor scene lighting. Seamlessly integrating people in scenes with Register lighting style is an interesting proposition (in terms of making the lighting work out as nicely as it does for desolate inanimate objects typical of a Register painting). This approach worked out well in the Video/Film medium for the movie 'In Her Shoes'[26] and for the music video 'Turn my Head'[27], however it would be interesting to explore along the same lines in CGI. For the purpose of this research, the scope will be limited to only recreating the Register lighting style in CGI for a couple of his selected paintings, but for future research it would be interesting to see how his lighting style accommodates animated CG characters.

Chris Peters is a contemporary artist whose paintings mostly feature still life. His paintings are characterized by predominantly saturated colors with high contrast. In general, they have matte surfaces that are characterized by their lackluster look, very low glossiness and vastly spread out highlights. This reduces the specular component to a negligible amount while retaining the gloss created by the use of oil colors. His style is inspired by Vanitas artwork, which is meticulously interlaced with Surrealism. His dramatic stylistic representation of light makes a strong case for its use in CGI because much of the CGI artwork is stylized (in contrast with strictly photorealistic graphics

which are restricted mainly to less pervasive areas of CGI like architectural and scientific visualization). However, stylization can be a really broad term covering an extensive range of styles. The approach towards understanding the different surrealist styles would be fairly standard, though the implementations may differ. Once the lighting style is grasped from a painting, it would be much easier to play with CG light/material parameters like intensity, position, color, shadow, texture, glossiness, diffuse color, specularities and so on.

CHAPTER II

BACKGROUND

II.1 Introduction to Lighting in CG context

Some basic principles of lighting will be covered in this section. This will equip the reader with an overview of some of the most important aspects of lighting relating to its use in works of art.

II.1.1 Lighting Terms

Key: The light with strongest intensity in the scene. It usually produces the strongest shadows (depending upon the number and intensities of other less intense lights in the scenes which fill up the shadowed areas with light) [28].

Fill: A Fill light is an ancillary light which is less intense than the Key light and "fills" in the dark shadow areas produced by the key. Usually, several low intensity fill lights can represent key light bounced off a surface like a floor or a wall [28].

Rim: A high intensity light which is positioned behind a subject in such a way that it strikes the subject along the edges. Rim lights are often used as hair lights, or to enhance a subject's outline making it pop out from the scene. Rim light is also referred to as backlight or kicker [28].

Lighting Ratio: Lighting Ratio (also referred to as ratio) is the ratio of intensities of the key light and the fill light. A low key scene has key to fill ratio (for example, 10:1) whereas a high key scene has a lower key to fill ratio (for example, 1.25:1).

Color Temperature: It refers to the hue of specific type of light source measured in degrees kelvin. The word temperature is associated with this term because when a block of carbon is heated, it turns different colors at different temperatures. Warmer colors are associated with lower temperatures and cooler colors with higher temperatures.

Ambient Occlusion: Ambient Occlusion (or Occlusion) refers to the CG technique of creating soft shadows for 3D objects. It specifically refers to the shadows that are formed in the creases or corners, where light cannot reach directly.

II.1.2 Functions and Qualities of Light

Lighting performs several functions some of which are listed below [29]. These are derived from theatrical lighting and they help in making correct CG lighting decisions. But it must be noted that CG based lighting is free from the physical limitations that are inherently associated with real-world theatrical lighting. For instance, to model the form of an object by placing a light directly below in theatrical lighting, the lighting designer is constrained by physical space. He cannot place a light source arbitrarily on the stage (as it will distract the viewers) or under the stage (as the stage would block light). All the decisions have to be made taking these limitations into consideration. But with CG based lighting, one can position a light source (which will not be visible) on the floor close to the feet of the CG characters without causing movement problems, or maybe even under the ground. If it is placed below the ground, this light can still illuminate the character by selectively excluding the floor from blocking this

light. So light will not be prevented from illuminating the figure from under the ground (even though the ground appears opaque in the render and not transparent). CG lighting provides the freedom to override shadows settings and turn the shadow casting ability off for opaque objects). Another aspect to compare is that in CG lighting, unlike Theatrical lighting, one does not have to worry about circuit boards or dimmers or electricity. You can create as many lights as your computer processor supports. Regardless, all the functions described below are as pertinent to CGI as they are pertinent to theatrical lighting (only difference being that CGI provides more liberty)

Composition: Light can be used in composing shots in order to achieve intriguing results [30]. In CGI, as discussed above, with the number of lights, their intensities/colors and positions not being physically restricted - the lighting artist has greater flexibility in creating compositions with fewer physical laws to worry about. Additionally, lighting can help in establishing the interpretation of a story by creating a series of interrelated images.

Visibility: Understandably, there should be enough light to see what is going on in the scene, but that does not mean everything should be equally visible in the scene all the time. Sometimes absence of light can create interesting effects and evoke feelings of fear/gloom/mystery (Fig. 1). In CGI, it is much easier to control the light visibility/light intensity values though one has to be careful to get the intensities right from an artistic perspective.

Modeling: Lighting can greatly help in revealing the three dimensional shape of the objects in the scene. 3 point lighting is good example of this in which lights with

different intensities from three different directions build up the form of 3D objects. Use of excessive ambient lighting gives opposite results making the scene look flat. By



Fig. 1. An example of selective lighting. A scene with directly lit regions and dark regions creating mystery and gloom [31]

lighting a model from different directions/angles, with lights of different intensities and even color can really go a long way in defining the shape and contours on an object. In CGI, you have the advantage of having the lights at pretty much any location you want as explained in the example earlier.

Focus: Sometimes it is a great idea to light different objects/figures in the scene with variable intensities to create focus even though it might not necessarily be a physically accurate phenomenon. For example, in an indoor scene with only one visible light source, the main actor might be lit more brightly than others to give him greater stature. Even though in Theatrical lighting, light intensities can be varied quite easily but they cannot be selectively turned on and off for specific actors/characters. For instance, say in Theatrical lighting if a more prominent character were standing right next to

another character, it would be difficult to light the two differently. But in CG, even if they're both right next to each other, you can assign a different light to each one of them, with greater intensity light assigned to the main character.

Information: Lighting can intuitively convey information about the scene like the time of day, the season, and the location. Some information may be conspicuous and some subtle. Using this property of light, an artist can set up a scene at a specific time of the day, in a specific season, or at a specific location to support his story. Lighting at dawn, morning time, noontime, evening time and nighttime is very different (Fig. 2, 3). It is also different in summer/winter/fall. Again it changes with geographical location too.



Fig. 2. An example of outdoor evening lighting. Characterized by saturated colors and soft shadows, defining time of the day [32]

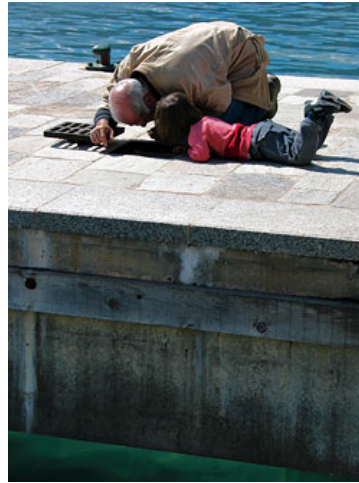


Fig. 3. An example of outdoor midday lighting. Characterized by short/sharp shadows, greater intensity; defining time of the day [32]

Mood: Lighting greatly influences emotions; it can foster feelings of affection, mystery, warmth, solitude, happiness, empathy, and so on. Dark gloomy lighting can immediately give an air of sulk to the scene. Bright cheerful lighting on the other hand gives a feeling of mirth.

A few relevant properties of light are discussed below briefly. Their relation to the above mentioned functions are also discussed [33]:

Intensity: The amount of light a source of illumination emanates. It is responsible for focus, visibility, modeling, mood, and provides information about the scene location and time. Setting proper intensity for lights in a 3D scene helps create interest. Depending upon the relative intensities of lights, a scene can be high key or low key – high key being characterized by a low key to fill ratio and low key being characterized by a high key to fill ratio. Furthermore, if the intensities of key light, fill light and kicker light are tweaked in the right proportion in relation to each other, it can really enhance

depth in the scene and model objects. On the other hand, if all lights in the scene are of the same intensities lighting the object from all directions, it will make the object look flat.

Color: The color of light plays a major role in defining the look of the scene, for example a scene illuminated predominantly with red light creates tension and might give a premonition of danger. On the other hand, use of cool colors like blue might imbue the scene with tranquility. Warm colors usually convey energy; yellow in particular induces feelings of joy and happiness while blue might strongly induce the feelings of despair and sadness. Simultaneous use of warm and cool colors can effectively represent noise and activity, and also establish spatial and temporal relationships [34]. See Fig. 4,5,6.



Fig. 4. “Sunflowers” (1888) by Vincent Van Gogh. Notice the warm colors [34]



Fig. 5. "The Tragedy" (1903) by Pablo Picasso. Notice the cool colors [34]



Fig. 6. "The Pool of London" (1906) by Andre Derain. Notice the warm and cool colors [34]

To make a simple demonstration of how color can completely redefine a scene, an image with really warm lighting was taken and using Photoshop, was converted to an image with cool lighting - and the difference between the original and the new image is huge (Fig. 7). The first one has warm colors that represent sunlight/energy and evoke emotions of excitement. The new image, which is lit in soft blue lighting, introduces serenity and calm in the scene, but it also suggests some gloom. This demonstrates how lighting can make an impact on the mood.



(a) Warm

(b) Cool

Fig. 7. Same scene rendered in Warm and Cool colors

As discussed earlier, lighting can also provide information about the geographical location too. For instance, the outdoor lighting - in a hot desert (Fig. 8), in cold places (Fig. 9), on a beach (Fig. 10) - is totally different.



Fig. 8. An example of lighting on a hot day in a desert. Notice the warm colors [35]



Fig. 9. Example of lighting on a snowy day. Notice the cool colors [36]



Fig. 10. Example of lighting on a beach with pretty clear sky [37]

A CG artist might be free to choose any color from the color wheel and apply it to the lights in the scene, but he has to be very mindful of the implications. Color makes a huge difference to the final look of the scene. Making good color choices for lights can make the scene much more interesting and believable too.

Direction: The direction refers to the direction from which the light is cast onto the objects in the scene. It affects modeling, mood, and visibility and provides information about the scene location and time. Unusual lighting angles make characters/scenes dramatic (Fig. 11).



(a)

(b)

Fig. 11. Dramatic light directions [38]

The direction from which light is cast onto objects in the 3D scene in relation to the camera position can 'model the form'. Seeing CGI on 2-dimensional screens can

really flatten the scene. But by positioning the lights from the right directions, the shadows and highlights thus formed would enhance the form of the objects [33]. For example, see the right image in Figure 12 that shows the model illuminated by a light from behind the camera. It casts frontal light on the model, which results in the loss of form details. In contrast, see the left image in Figure 12, in which a single light directed from the left of the camera illuminates the model. Bulges, folds and depressions are clearly visible.



Fig. 12. A comparison of two lighting directions [33]

The choice of light color and light direction can also enhance the form. For example: The use of a warm light on the character from one direction and a cool light from the other direction (Fig. 13).



Fig. 13. Warm and cool lighting from opp. directions can enhance form [31]

Size: Depending upon the size of the light source, objects generate sharp shadows or soft shadows (Fig. 14). Light sources like Point lights, Directional lights and Spotlights are representative of light cast from single point sources. Real world examples of point lights can be Sun, a small candlelight, etc. but they technically are not point sources because they have dimensions and measurable size. Area lights in CG applications are sources of light that emit illumination from several points at a time so these innumerable mini-light sources illuminate an object from slightly different directions depending on their location on the source of light. This illuminates the 3D object 'softly' and removes blemishes that would probably be very conspicuous under point light source. Real world examples of area lights would be large diffuse glass windows letting in sunlight, or white reflectors used in outdoor photography to diffuse the sunlight, or overhead fluorescent lights clad in glass boxes.

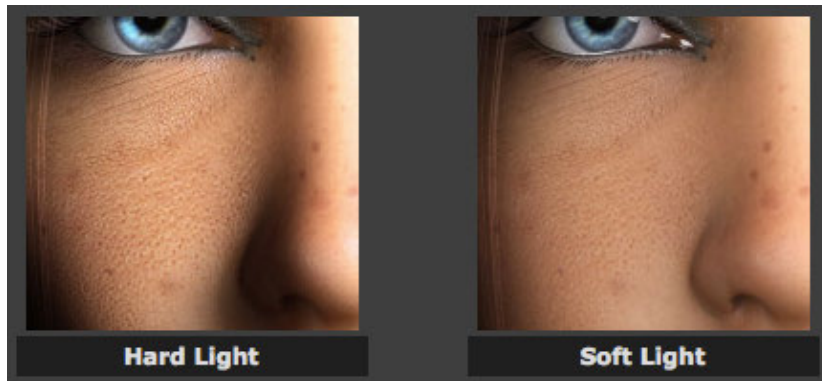


Fig. 14. Hard light vs. soft light. A character's face lit with hard light and soft light [39]

II.1.3. Categories of Lighting Styles

1-point: The 1-point lighting style is quite stark and dramatic. It involves a single key light source without significant supplemental lights. It was widely used in Film Noir style of lighting (although multiple lights were usually used for a shot, the result often appears as if a single light source exists) [28]. The lighting style used in 1-point lighting is alternately called 'low key lighting' featuring a strong key light and little or no fill light [40]. Working with 1-point lighting schemes becomes challenging in terms of setting the key intensity high enough to illuminate the parts not in shadow without washing out high exposure areas, with only one light to play with [41].

2-point: The 2-point lighting style is probably the most commonly encountered lighting setup in real world. It involves a high intensity key and an extremely diffuse fill. This style has been widely used in painted portraits, with key placed on one side of the subject and fill on the other side of the subject that eliminates stark shadows [41]. This style is not limited to portraits; outdoor scenes usually exhibit two distinct sources of light - a key (sun/moon) and fill (skylight and light bounced off the ground) [42].

3-point: The 3-point lighting is probably the most widely used lighting scheme. It involves a key light, a fill light and a rim light. The standard 3-point lighting setup consists of a key placed to one side of the subject (15-45 degrees off the camera axis), a fill with at least half the intensity of key placed on the opposite side and a rim light placed behind the subject to enhance the subject's edges [43]. This style of lighting is hard to find in painted portraits but is quite common in nature like sun lighting the clouds from behind [44].

Naturalistic: The Naturalist lighting scheme simulates the look of naturally occurring lighting like daylight using artificial sources. Any light that is visible in a Naturalist lighting setup is logically driven by a recognizable source, for example, the sun. It is sometimes called 'transparent' lighting because no artificial source of light can be detected [45].

Stylistic: The Stylistic lighting scheme uses exaggerated or stylized lighting to create a 'fantastic' look. It uses high key lighting in which the fill light intensity is quite high with very low key-fill ratio. This kind of lighting is also used in sitcoms with characters evenly lit with minimal existence of deep, dark shadows [45]. Stylistic lighting might also refer to a wider variety of fanciful lighting schemes.

CHAPTER III

METHODOLOGY

III.1 Analysis of John Register Paintings

III.1.1 Cadillac Hotel



Fig. 15. “Cadillac Hotel” by John Register, 1984 [46]

In this painting (Fig. 15), we see the typical John Register process of recursively simplifying the scene and ridding it of any extraneous clutter that might obstruct the viewer from relating to the painting straight on. This makes the painting more accessible to the viewer.

Register's adroit use of light and color is once again evident in this painting. The greenish blue wall, the blue sky visible from the large glass windows, a thin line of blue ocean merging with the sky at the horizon vs. the warm raking rays of sun add a lot of interest to the painting. The painting is balanced really well by the use of grays. The long extending shadows correctly represent sunlight during evening time; the length of shadows corresponds to the low angle of the sun. The shadows correctly portray another feature of sunlight, parallel shadows. In CG applications like Maya™ or 3ds Max™, a directional light would simulate the behavior of sunlight with parallel shadows instead of diverging shadows. This owes to the fact that a light source like Sun is effectively at an infinite distance from the earth so the shadows appear parallel. In the shadowed areas on the floor, a lot of 'color-bleeding' is seen (the blue from the walls). 'Color-bleeding' in CG refers to the color bounce from a vivid colored object to a light-colored surface.

Categorical lighting breakdown: The visibility in this painting is nicely restricted. The backside of the chairs which are facing the camera are in shadow; due to the key light being incident from the right side of the camera. This adds depth to the scene (high intensity key light and low intensity bounced light enhancing the form of simple objects like chairs). The lighting setup is 1 point/naturalistic (not including the bounced light). Hence there is no direct secondary light source. The light source (sun) is point size, and therefore the shadows are quite sharp and very long due to the light incident from a low angle. The color scheme is complementary with blue/green colored wall and sky working nicely with the warm colored light predominantly visible on the floor and the chairs; creating interesting contrast.

III.1.2 Mojave Bus Station



Fig. 16. “Mojave Bus Station” by John Register, 1978 [47]

In this work (Fig. 16), Register paints an outdoor scene – a bus station. His trademark scenic simplicity consisting of mostly blocky forms is apparent. The glass cladding the booth is partially reflective and partially transparent telling us more about surrounding environment through reflections, for instance electric poles and other buildings. The interplay of light and shadow cast by the booth glass is beautifully depicted.

The shadow is darker when the light casts shadow after passing through glasses on two different sides of the booth, at an oblique angle. On the other hand, the shadow appears lighter when the light wades through the glass only once. If you look closely, you can also see a couple of blocks of bright light reflected off the glass onto the ground. They might be confused with shadows, but they are actually reflections of light. In the background, we can see a train and further back are the mountains. The azure sky overhead is quite clear. The shadow cast by the stop sign pole indicates the scene is placed in afternoon. Telephones are figured strongly in Register's iconography, which is evident from paintings like these - Mojave Bus Station, (1978), Four Phone Booths, 1974; Phone by The Sea, 1977; Office, 1982 [48].

The scene seems to be set up in a bright sunny afternoon. The colors have a distinct yellowish tint instinctively insinuating that it is sunlight. There is something about the light that markedly tells that scene is located in a desert, maybe it is the crisp clarity of light, or the clear sky with warm yellow light color. In fact, the painting depicts a Bus station in Mojave Desert, California. The one thing that seems unrealistic from a physical lighting perspective is the orientation of the shadows – shadows created by sunlight must be parallel, but in this scene it can be observed that although the main source of light is apparently the sun, angle of the shadow of the stop sign pole and the shadow of the booth do not match.

Categorical lighting breakdown: This Register painting also features naturalistic styled one point lighting with the sun being the key light. The shadows are sharper in this painting than in "Cadillac Hotel", due to the key/fill ratio being relatively high (fill light with greater intensity would soften shadows). The key light is falling from a high angle, but it is not dramatic/stylistic because sunlight incident from high angles is an everyday natural occurrence. Again, the colors are considerably complimentary, with a warm colored building against a blue sky. In comparison with "Cadillac Hotel", the light color is less warm and the intensity is higher; indicating an earlier time of the day.

III.1.3 Phillippe's Restaurant



Fig. 17. "Phillippe's Restaurant" by John Register, 1975 [49]

John Register enjoyed working with mundane scenes. The challenge for him that kept him motivated doing this class of paintings was to make ordinary insipid scenes beautiful with deft use of form, light and color. For him, an object like a chair or a table in its ordinariness is not beautiful in itself; but his style of lighting brings out the beauty in such a simple object [50].

This scene (Fig. 17) has a few chairs around a restaurant table. Nothing extraordinary is displayed in the scene in terms of form or geometry. The interesting element in the painting is the lighting. The use of warm colors infuses zest in the environment. But at the same time, the painting is very calm, as is the characteristic of any other Register painting. Register would try to metamorphose an active and busy image into a calm painting [51]. Lighting such an un-inviting scene is quite formidable. But Register's panache for lighting brings so much life to the scene.

This scene appears to be lit by sunlight coming from two windows, one opposite to the camera and the other from the right side of camera. Because sunlight is not falling directly on the objects but instead through the windows, the lighting is quite soft. The window visible in the scene casts the shadows of the objects on the table. The other light source that is not visible in the scene casts shadows on the left (image left), prominently visible are the shadows of the chairs on the walls.

Shadows establish spatial relationship between objects in a scene and help integrate objects into the scene by reinforcing the relationship between them [30]. But too many shadows make the scene look cluttered. Artists sometimes have to make deliberate decisions to not paint these visually extraneous shadows.

Categorical lighting breakdown: This painting appears to use a 2-point light setup, with some doubts raised about this presumption above. The light source(s) are large in size (glass windows streaming in sunlight), which is evident from the soft shadows. The colors in the painting are warm. The time of the day seems to be somewhere around noon because of the high intensity light coming from the window. Like most of the other John Register paintings, this painting adopts a naturalistic style. The light facing the camera is the key light, and it also serves as a rim light brightening up the top edge of the middle chair.

III.1.4 Office



Fig. 18. “Office” by John Register, 1983 [52]

The beautiful interplay of shadows and light in this painting (Fig. 18) makes it remarkably beguiling. Jeffrey Browning, an art critic who had an opportunity to interview Register, describes this painting as a masterpiece [53]. The painting pictures an office room in the late hours of the day. The dark shadows in the painting add mystery and melancholy to the painting that lacks any human subject in the first place. But once again, sunlight with rich colors gleaming in to the room puts life into a seemingly barren scene [54]. Register's inspiration to paint this stems from his observation of sunlight streaming through the window into an office and highlighting the telephone, and the decal on the window also casts a shadow that resembles a telephone. The decal and its shadow on two different places, and a three dimensional telephone on the table suggest cubism to Barnaby Conrad [48]

The use of shadows in the painting gives it a great composition [30]. Even though the sun is the only direct source of light in the scene, there are several different shades of shadows. This is due to bouncing of light inside the room. The decal on the window casts a prominent shadow on the wall. The time of the day is incontrovertibly evening time before sunset - which can be deduced by the low angle of the sunlight, the long shadows and relatively saturated warm color of sunlight. Once again in this painting, decoding the shadows is exigent. It is extremely difficult to fully understand the interaction of shadows with the flat, polished surfaces. Several different angles of light had to be tested to get the shadows look similar to the ones in the painting, though not exact. Once again, it seems to be an artistic decision by the painter to render shadows in a specific way, not necessarily physically accurate. One of the things that had to be

improvised or 'cheated' was the soft self-shadow on the table. All the objects in the scene cast sharp shadows; except the table that casts a soft self shadow. It is not entirely clear what would cause it to cast a softer self-shadow, given that the only source of light in the scene is sun and bounced light in the rest of the scene did not generate soft shadows. Another aspect that is not entirely clear is what seems to be the shadow of the chair onto the table. Given the angle of the incident light, it is highly improbable that the chair would cast its shadow on the table like that. Instead, it would be more towards the right side (of the picture). To overcome this problem, a light was set up behind the chair that only casts shadows (with no illumination contribution). This is an example of how CG light can do certain things which a real world light cannot, which gives greater flexibility to artists to execute a desired look which might not be physically possible.

Categorical lighting breakdown: The limited visibility is the most interesting aspect of this painting. Once again, lighting is naturalistic with sun being the only key light (1 point lighting). The shadows are sharp (except the table's self shadow already discussed above). The colors are predominantly warm except the window exposing the blue sky and the blue telephone. The dark regions in the scene create a mysterious mood. The time of the day seems to be around afternoon (because of clear blue sky with lesser environment lighting contribution) although the scene setup with no people in the office suggests a time at the end of the day. Even though this painting is more naturalistic, it also appears to be a little stylistic. This could be attributed to the fact that the bounced light in the scene is minimal, despite of a high intensity key light.

III.2 Analysis of Jules Breton Paintings

III.2.1 The Weeders



Fig. 19. "The Weeders" by Jules Breton, 1868 [55]

"The Weeders" (Fig. 19) by Jules Breton recounts a picturesque outdoor natural setting in a field in Marlotte, Paris. Jules Breton cogitates about this painting and considers himself fortunate to get this rare 'ready-made natural painting' type of scene to paint which was an unusual occurrence for him [56][57]. The glow of muffled evening sunlight combined with Breton's flamboyance for landscape painting transfigures one of the most nondescript human labors in to an image full of character, richness and simplicity [56]. The critics seemed to have favored "The Weeders" of his three other entries that year, owing to its elicitation of near-religious solemnity in the women's labor and a mood enhanced by their twilight serene surroundings [57].

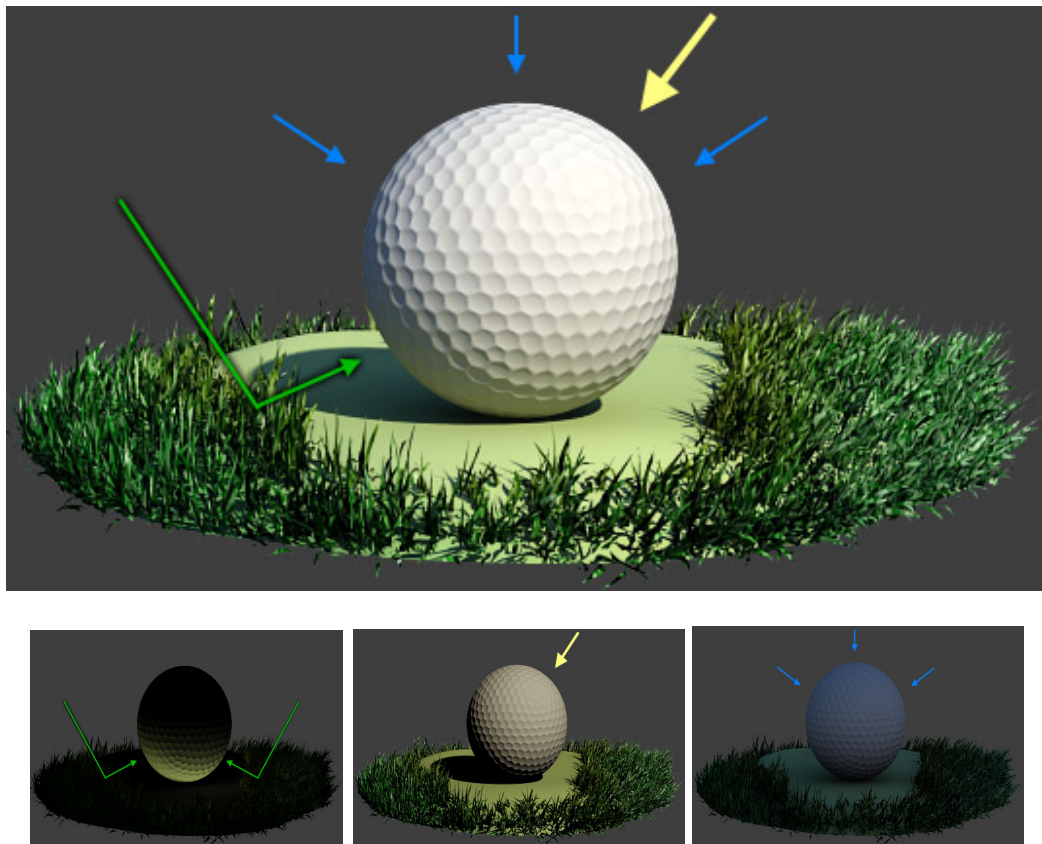


Fig. 20. Outdoor lighting breakdown. Top - final image, Bottom-left: bounced light, Bottom-center: sunlight, Bottom-right: skylight [32]

The figures above helps in making a distinction between different sources (both direct and indirect) of natural lighting as all the Breton paintings being discussed are set in natural outdoor lighting. Outdoor natural lighting can be broken down into three components: direct sunlight, indirect skylight and bounce light. Direct sunlight is simply the contribution of light from the sun directly without taking global illumination into consideration (indicated with yellow arrow in Fig. 20). Sunlight also disperses into the atmosphere and the sky acts as a giant light dome casting light indirectly on the objects,

therefore it is much softer and casts extremely soft shadows in all directions (occlusion). It is usually blue in tint because of the blue color of the sky and depending upon the weather or time of the day its intensity will be greater or lesser than that of sunlight - for example on a clear sunny day, sunlight contribution would be much greater than skylight contribution. But on a cloudy day or at dawn/dusk, the skylight component will be much higher. In the composite Figure 20, blue arrows represent skylight from all directions. Bounced light is the light reflected from the ground onto the object that is represented by green arrow below. Individual contribution from each of the three sources can be seen in the smaller images under the final composite image. The soft shadow cast by the skylight can be considered synonymous to contact shadow (soft shadow cast by an object where it touches the ground, used in CG to add realism).

Breton had a knack of turning ordinary countryside landscapes in to sublime images of beauty that are totally disconnected from any traces of affectation. In this painting, he gracefully uses evening light to render the painting. The sun has sunk deep enough in the horizon to make direct shadows virtually invisible, all you see are occluded shadows from the indirect illumination coming from the sky dome, and they are not too pronounced.

Breton always evolved his work over time. He would repaint some of his paintings to ameliorate anything which he considered important and which he might have missed in his earlier painting. This might be attributed to Breton's lack of self-confidence and his sensitivity to criticism [58]. "The Weeders" is a classic example of this. He painted this in 1860 (which was exhibited in the Salon in 1861) and again after 8

years in 1868 [57]. Even though there are no overwhelming changes, there are quite a few which can be noticed without much effort. Although the two paintings in question have some differences like one of the women wearing a bonnet in one and not in another, the faces being different, and so on; we will focus on the difference in lighting.

Painting from 1860 (Fig. 21): The position of the sun behind the peasant women must ideally create a rim around their form, we do see that rim for the woman with pink bonnet (and around the forearm of the woman next to her). But the rest of the women do not seem to be wrapped with this rim, which in my understanding is unrealistic. It is inexplicable because the sun being the only direct source of light in the scene, should illuminate all the peasant women from behind with more intensity than skylight to create a golden rim. And in the painting, evidently only the woman with light pink bonnet has a nice rim around her. The overall color in the scene is quite warm, including colors in the sky. This gives the painting a congruent warm feel.



Fig. 21. “The Weeders” - 1860 (zoomed in and cropped) [59]



Fig. 22. “The Weeders” - 1868 (zoomed in and cropped) [55]

Painting from 1868 (Fig. 22): Breton painted the same painting again in 1868 and in this painting, he did correct the rim issue from his 1860 painting. We do see

sunlight brushing against the edges of the women's bonnets, their hands and their clothes. As far as the overall colors in the scene are concerned, this time Breton chooses to contrast the cool of the skylight with the warmth of sunlight. This evokes interest in the scene and breaks the harmony that was building up in the 1860 painting. In this aspect of choosing predominantly warm in 1860 vs. balancing warm and cool in 1868, a meticulous 'correct' way cannot be chosen. It is a decision that the artist needs to make to portray the painting in the light of what he thinks is more in line with his motivation.

Categorical lighting breakdown: The skylight and the setting sun illuminate this scene. The sun is the key light that also acts as a rim light. The sunlight is warm which is seen on the women's hands, and the skylight is cool which encompasses the objects in the scene from all directions. The intensities of key and fill lights are not too disparate, the key light being just a little brighter than the fill. The shadows that are cast by the key light (the sun) are really soft because of the skylight filling in the shadow. The soft fill light as well as the key light directed towards the camera nicely reveals the forms of the figures.

III.2.2 The Gleaners



Fig. 23. “The Gleaners” by Jules Breton, 1854 [60]

“The Gleaners” (Fig. 23) was Breton’s chief submission in the International Salon of 1855 and one of his first major successes which also found its way in the collection of the National Gallery of Ireland, 1854. In contrast with Francois Millet’s depiction of gleaners as socially crushed group of indigent women, Breton depicts gleaning as a mirthful communal activity carried out by women and children in colorful dresses [61]. This painting also flaunts an identifiable chiaroscuro look that is characterized by heightened contrast [61].

In this painting, Breton depicts a scene busier than usual for a Breton painting; or

at least the scene looks busier than others due to the lighting. Yet at the same time it carries a queer calm. Though it looks realistic, it stimulates a feeling of harmonious serenity despite all the movement going on in the scene [62]. Annette Couture points out one of the women on the left holding her hand up to shield her eyes from the sun, and Breton recounts that the while he would be painting them, occasionally they would stop and look at him with a confused and slightly taunting look [62].

With the same number of peasants in an evening lighting, the painting would evoke a totally different feeling of down-tempo and 'day coming to an end.' It must have to do with our psychological association of the evening light with end of daily work. The time of the day seems to be late hours of the morning (because of the bright warm colors with a very slight amount of haze), just before noon when the work is at full flow. The colors in the scene are dominated by bright/saturated sunlight, and the shadows are long - instigating emotions of energy and calm simultaneously. However, it is peculiar to note that none of the faces in the painting are in direct sunlight. Nevertheless, the animate objects in the scene still captivate the interest of the viewer. This goes against the general principle of lighting to direct viewers' attention by illuminating certain elements of the scene more than others. It seems like the viewers instinctually direct their gaze at the brighter areas of the painting to start with, but the way Breton composed the painting they unobtrusively glide their attention to the subjects in the scene, rather than the subjects' faces. Breton intelligently manipulates this attribute of lighting to highlight the actions of the subjects in the scene and their overall personalities instead of locking the

viewer's attention only to their faces, which would take away from the purpose of the painting.

Categorical lighting breakdown: The colors in this painting are really warm. This is a naturalistic outdoor lighting setup like in most Breton paintings. The shadows are sharp, and long; indicating a point source sun with negligible contribution from the large sky light source. The warm colors evoke a mood of energy and activity. The high contrast suggests time of the day past noon but not too late in the evening.

III.2.3 The End of the Day



Fig. 24. "The End of the Day" by Jules Breton, 1865 [63]

Breton had phases of discouragement and of joyful recovery that started in 1861 and lasted several years. During one of the depressing phases he was going through, he suddenly perceives a tall haymaker standing resting in the evening sun after finishing her work next to a more anonymous figure [63].

There is a deep sense of serenity both in the way the scene (Fig. 24) is lit and the way the two women stand. Annette Lacouture describes, "The rhythmical structure of this painting, with its open diagonals dividing the horizon and the upper part from the area containing the central figures, makes it one of the artist's most harmonious compositions" [63]. With this Salon picture, Breton accomplished the greatest critical success of his career [64].

Befitting the name of the painting, the lighting in the scene represents the end of the day with soft warm lighting. The shadows are long and are pretty much subdued, as it is typical of golden hour lighting (that is characterized by golden-warm colors near sunset time). The color is warm. The taller figure is rendered in more lurid light in comparison with the other figure, making the former become more prominent in the painting and nudging the latter into anonymity - especially with part of the face including eyes covered in shadow of her bonnet. The artist here is breaking the rules of how natural light should behave, but as discussed earlier this is probably done deliberately to direct viewer's attention to what the artist desires the viewer to see.

Categorical lighting breakdown: This is a relatively low-key painting with subdued lighting. The skylight appears to be the key light in this scene. The direction of higher intensity light striking the top portion of the women's bodies suggests high

incidence angle. However, at the end of the day the sunlight is incident from a very low angle, and also skylight will not illuminate objects differently from different directions as it illuminates pretty consistently from all four directions. Hence this can be justified by assuming this to be a deliberate choice of the artist to focus the women's faces, especially the one nearer to the camera. The painting therefore is not completely correct in physical terms. The contrast is really high.

III.3 Analysis of Chris Peters Paintings

III.3.1 Late Afternoon



Fig. 25. "Late Afternoon" by Chris Peters [65]

Chris Peters is one of the most popular American Pop-Surrealist painters in the contemporary world. Pop surrealism was considered more of an underground modern art movement but it is now garnering national and international recognition. It is quite unconventional and many have questioned its inclusion in mainstream fine arts. However, a considerable share of lowbrow artwork is finding its way into mainstream fine art galleries now.

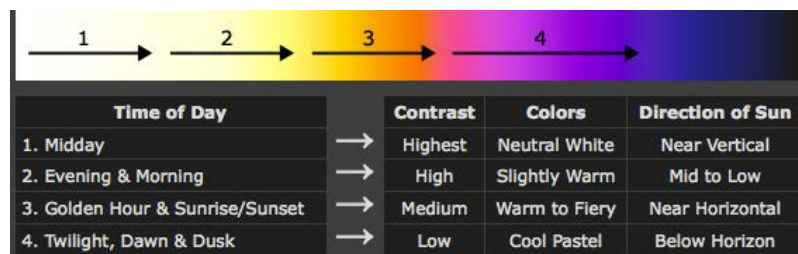


Fig. 26. Outdoor lighting and corresponding colors/contrast in relation to time of the day [32]

If it had not been for the title of the painting (Fig. 25), it would have been very difficult to tell what time of the day the painting the artist wanted to represent; and it is also possible that the title is more figurative than literal. And it being a pop-surrealist painting, which is more of dreamlike metaphysical art, it must be one of reasons why it does not follow conventional natural lighting principles. Yet, this has a bearing on CGI mostly because of its stylistic appeal and the relative similarities between CGI and surrealist art. The way the scene is lit, it looks a more like a scene lit artificially with tungsten bulb rather than natural sunlight. Late afternoon lighting gets progressively warmer and but it has lesser contrast due to softer light. It feels so because of the higher

contrast between the lighter and darker parts of the scene and greater saturation in general. The shadows appear realistic in terms of length for representing afternoon outdoor lighting.

Looking at Fig. 26 for more in-depth analysis of the time represented in the painting, it can be inferred that the corresponding colors in the painting refer to somewhere between evening time and golden hour/sunset time (represented by colors between 2 and 3 in the figure) but not exactly late afternoon as the name of the painting suggests. Fig. 26 also suggests that the contrast is high at this time but apparently the contrast between the lit skeleton and its shadow is quite low. Fig. 27 below presents an example of late afternoon sunlight that has higher contrast between (directly) lit and unlit areas.



Fig. 27. Late afternoon sunlight example. Notice the higher contrast between (directly) lit and unlit areas [66]

Categorical lighting breakdown: In this painting, like most others that have been discussed earlier, the sun is used as the only direct source of light (1-point lighting). "But the lighting genre" in this "one" is "different" from "all" the "paintings" previously "analyzed" because this is lit "with stylistic lighting. "The painting alludes to late afternoon time. "But the lighting is" exaggerated" and as "discussed in" the "analysis "above, "does not "faithfully mimic real world late afternoon lighting. "The colors are really warm and the shadows are sharp. "The "key "light "is" pretty "high" intensity and the key/fill ratio is relatively high "(so darker shadows). "However, "the "key/fill" ratio" should" be greater for a more realistic"late afternoon lighting. The objects in the scene look relatively flat in a distinctive way.

III.3.2 The Fall



Fig. 28. "The Fall" by Chris Peters [67]

The Fall (Fig. 28) is a still life painting with apples, books and a small reptilian. The objects in the scene are quite matte, with the exception of the snake. Matte surfaces have a rough surface that diffuses light in different directions so specular highlights are not prominent. Some snakes have smooth shiny skin so the depiction of the snake looks pretty realistic. But the apples should have stronger specular reflections, in the painting it seems like the apples and the books have very similar surface characteristics. The colors are quite saturated warm, giving the feel of indoor artificial lighting.

The source of illumination is somewhere on the top left portion of the scene. The occlusion is stronger than what it usually would be in real life. Also the contrast in the scene is high creating more drama and interest.

Categorical lighting breakdown: For this painting, it is a little "difficult to" decide whether 1-point "or 2-point" lighting setup is used. "Assumption 1:"The key"light" is "from top left side of the camera and the fill light is from the opposite side of the key. "The right portions of the" books" not "directly "under "key" light" are "fairly" bright" compared "to" the shadow on the wooden block in the back-right corner, "so a fill light might be directed on the book" from the right side. "But the fill doesn't cast any" shadow from "right to lefts," so this "weakens" the" argument. "Assumption 2:"The "fill "light" could" be" argued" to be" just bounced" light" (thereby reducing the actual number of light sources to only one). "But the background" being" darker "could "just "be" an "artistic "decision "to "bring "the" foreground elements into focus. "After taking both the assumptions into consideration, arguments for Assumption 2 seem to be stronger.

CHAPTER IV

IMPLEMENTATION AND RESULTS

IV.1 Creating the Scenes

For creating the scenes, primarily three 3D authoring tools were used: *Autodesk Maya™*, *Autodesk 3ds Max™* and *SmithMicro Poser™*. Most of the objects in the scenes were modeled in 3ds Max and Maya, the human figures for Jules Breton paintings were clothed and posed in Poser and imported into Maya for texturing, lighting and rendering. Ready-made models of skeleton [68] and telephone [69] and flora were imported into Maya for use in the 3D scenes. The scenes were rendered in layers like occlusion, bounce, diffuse, ambient, etc. to provide for greater flexibility in tweaking contributions by each of those specific components. Later on, all the render layers were composited together in Eyeon Fusion. Some color corrections were applied in Adobe Photoshop finally if ever required, but this would not severely affect if this were an animation project given that such color corrections can be as easily applied to animation sequences as well (in applications like Adobe After Effects). For the Jules Breton scene “The Weeders” in which the grass was longer, its 3D version was created using a 3ds Max plugin Autograss and the grass model was later imported into Maya for rendering.

IV.2 Lighting & Color

IV.2.1 Painting 1 - Phillippe's Restaurant (John Register)

Phillippe's restaurant features a relatively simple scene in terms of geometric complexity. Some of the objects in the scene are really simple, like the table and the walls in the restaurant. The chairs and the objects on the table were comparatively more difficult. The textures were mostly plain in a peculiar Register style.

When it comes to lighting, the scene really comes to life. The light sources are large, and not point sources, permeating into the restaurant from the windows (which is equivalent to area light in CG terminology), thereby casting really nice soft shadows.

Determining the number of light sources in the image is a little daunting, but with a very close inspection it can be deduced that there are two light sources, one is opposite to the camera, and the other is coming from the right. Looking at the shadows in the scene, we can tell that the chairs and the table are casting shadows on their left; hence one source of light should be on the right. Also a strong specular reflection of light on the right side of the table also reinforces this hypothesis. But there is a problem, if the shadows cast by objects on the table are examined carefully; we see short shadows on their right. Some objects are casting shadows on the right and some on the left. But the illumination and the shadows in the scene do not have any evidence to prove this. From a physically accurate lighting point of view, this is impossible. The shadows from the light on the right should effectively cancel out the shadows cast by the back light, therefore only shadows from the light on the right would be visible.

So to come to a solution to this issue, it was decided that two light sources would be created. The shadows of objects on the table are comparatively negligible so the placement of backlight wouldn't be changed to try to resolve the shadows issue otherwise there would be much bigger problems in terms of illumination. With a few quick tests, it was found out that the lighting looks very different if a light source was placed on the left to create the shadows cast by objects on the table.

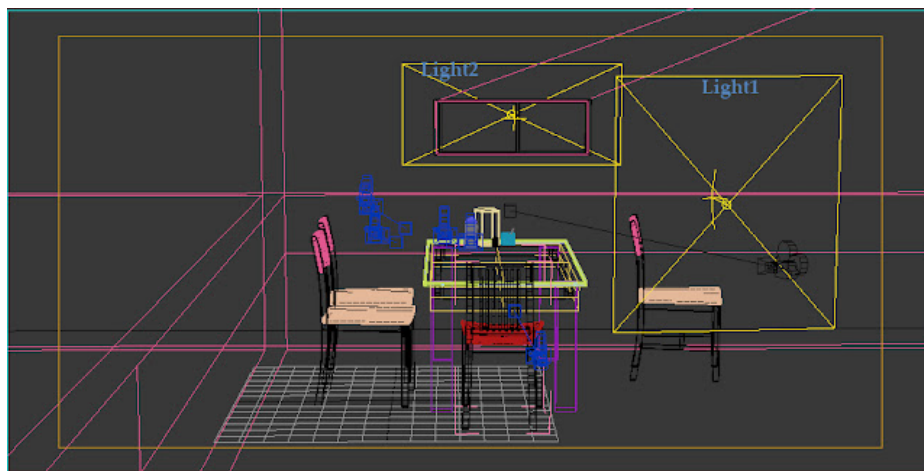


Fig. 29. Screenshot of 3D scene for “Phillippe’s Restaurant” showing placement of lights

Global illumination was used to create soft shadows in the scene with the help of an area light. The position of the light was carefully adjusted to make sure the specular highlights in the rendered scene match with original painting, especially for the more conspicuous objects in the scene like the chair with its back facing the camera and the table. V-Ray was used to render this scene that took an enormous amount of time so Mental Ray was used for the other scenes in Maya, which provided much quicker

results. Fig. 30 shows a screenshot of the scene, Fig. 31 and Fig 32 show original painting and CG render.



Fig. 30. “Phillippe’s Restaurant” by John Register [70]



Fig. 31. CG reconstruction of the Register painting “Phillippe’s Restaurant”

IV.2.2 Painting 2 - Office (John Register)

Compared to the previous Register painting above, the geometrical complexity of this scene is much less. But once again, the lighting in the scene makes up for all the lack of geometric complexity. The one element responsible for making this scene captivating more than anything else is shadow. A deeply insightful use of shadow adds so much to the composition of this geometrically unadorned scene, as discussed earlier shadow can add interest and improve the composition [30]. The scene is not made up of a big chunk of stark sweeping shadow; instead it is carefully broken down in the several snippets of lights and darks of varying intensities. There is more going on in the scene apart from just shadows; the scene has reflections and transparencies making it more complex from a lighting point of view. Only one direct source of light, evening sun, is illuminating the scene. Rest of the light comes from indirect illumination. There was one little problem in terms of lighting/shadows, the table's self shadow in the painting is soft and the rest of the shadows in the scene are quite sharp. This peculiarity could not be accounted for because there is only one point light source in the scene and it will cast only sharp shadows, so it was decided to soften the shadow in Photoshop after rendering.

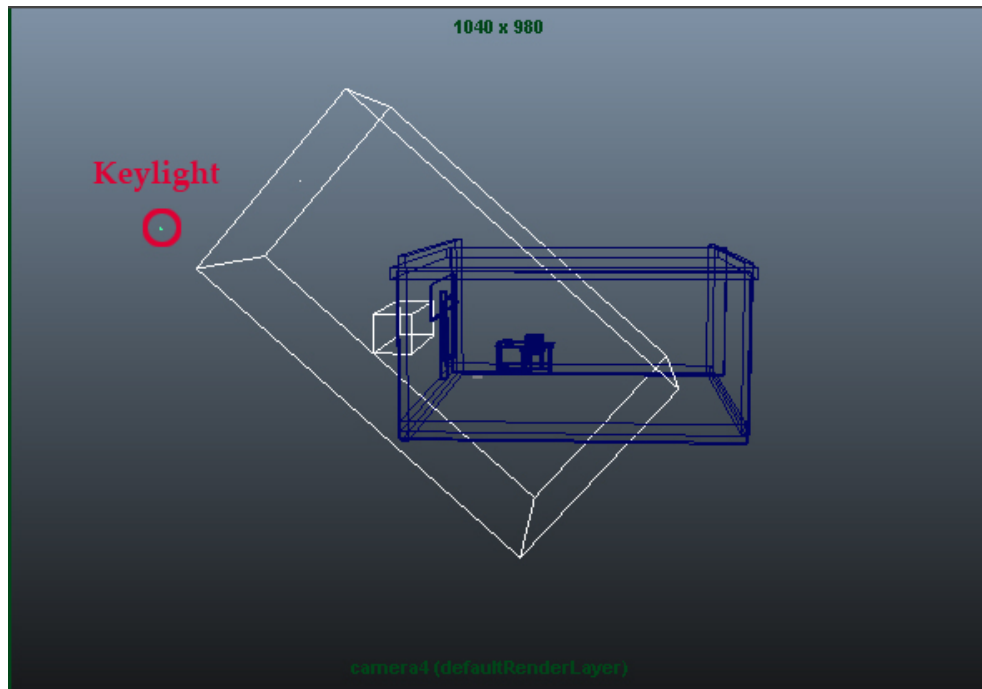


Fig. 32. Screenshot of 3D scene for “Office” showing placement of lights

For lighting this scene, the challenge was in adjusting the light position very carefully, because a minor change in the light direction and distance could ruin the delicate "shadow composition". Also, to avoid spending too much time in rendering GI using VRay, it was decided that Mental Ray with Final gather can be used and indirect lighting could be faked by using multiple lights in the scene instead of just one light simulating the sun. For simulating the sun, a spotlight was used from a very far distance to make sure it behaves like sun in terms of shadows being parallel and it was incident at a low angle for producing long shadows typical of later parts of the afternoon. This served as the key. A directional light was first tried (as it correctly simulates the sun), but it turned out that the shadows were not quite looking right. An area light was used to

simulate bounced light in the scene, without leaving it all to the renderer that would seriously slow down the render output. An ambient light was also used to make the scene a little brighter overall. Fig. 33 shows a screenshot of the scene, Fig. 34 and Fig. 35 show original painting and CG render.



Fig. 33. "Office" by John Register [71]

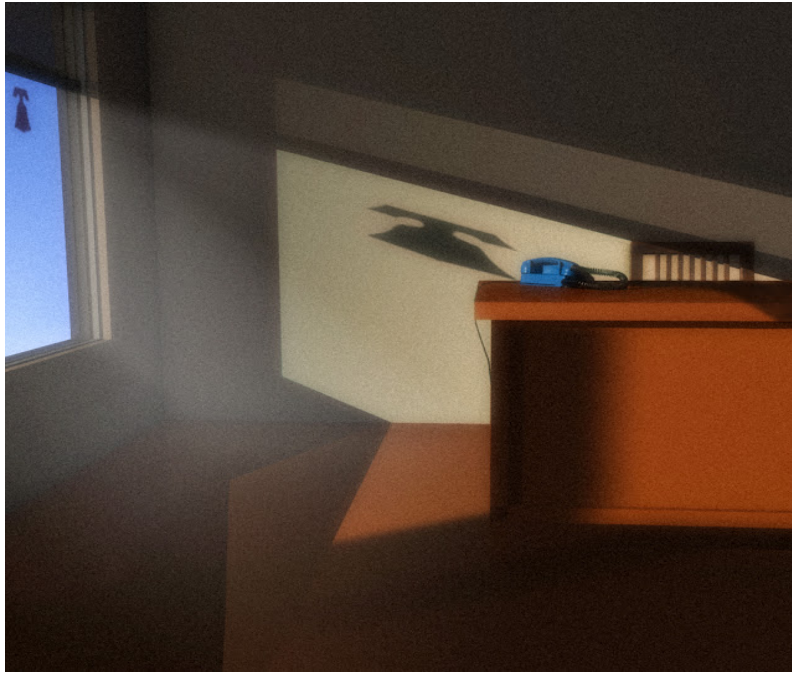


Fig. 34. CG reconstruction of the Register painting “Office”

IV.2.3 Painting 3 - The Weeders (Jules Breton)

This painting by Breton features an outdoor scene with clear sky and evening light. The colors are saturated and warm, the light is really soft because of the sun is setting and the sky is acting like a giant dome of light from all directions. There are shadows cast by the receding sun but they are indistinct because of low intensity skylight filling up the dark areas, the most prominent shadow belonging to the woman standing on the left. On a closer examination, murky shadows that pretty much blend in with the darkness in the whole environment can be seen for the other women sitting in the front. The difference in the shadows for the standing woman and the ones sitting cannot be accounted for, so this will not be duplicated in the CG scene. The skylight has bluish green tint, and is quite apparent in areas where the sunlight is not incident.

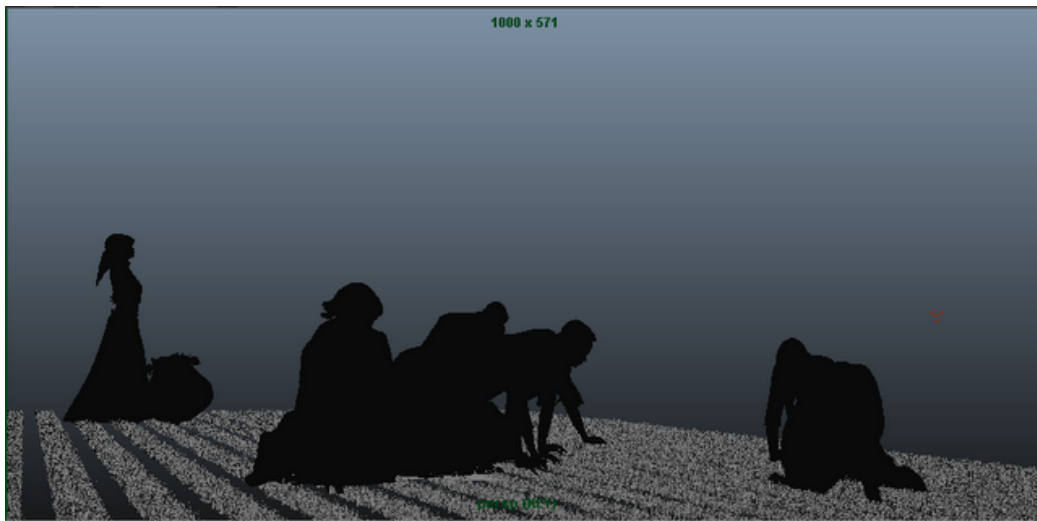


Fig. 35. Screenshot of 3D scene for “The Weeders”

To simulate the lighting for this scene, a directional light was used from a low incident angle. As discussed earlier, sunlight is best simulated by directional lights in CG applications because of their property of casting parallel shadows like the sun. The color of this key is warm orange. The skylight was simulated using a low intensity bluish green colored ambient light. Raytraced shadows were used to make them really soft. Fig. 36 shows a screenshot of the scene, Fig. 37 and Fig 38 show original painting and CG render.



Fig. 36. “The Weeders” by Jules Breton [55]



Fig. 37. CG reconstruction of the Breton painting “The Weeders”

IV.2.4 Painting 4 - The End of the Day (Jules Breton)

This is another painting set in the evening time by Breton. This painting seems to carry a more serious tone than the previous one in terms of lighting. The sun is not

completely set, as is evident from the brighter light coming from the left. The skylight acts a fill from all sides once again. The colors are warm but not as warm as in the previous one. The intensity of light on the face of the woman in the front is especially higher; the painter must have done that to exaggerate her importance in the painting. And the top portion of her body is brighter than the rest, if the lighting on the face and the feet is scrutinized then the face looks much brighter than the feet, again it must be to make her face more prominent.

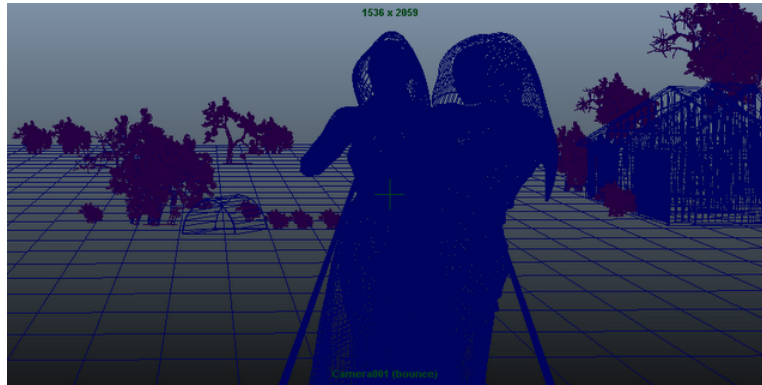


Fig. 38. Screenshot of 3D scene for “The End of the Day”

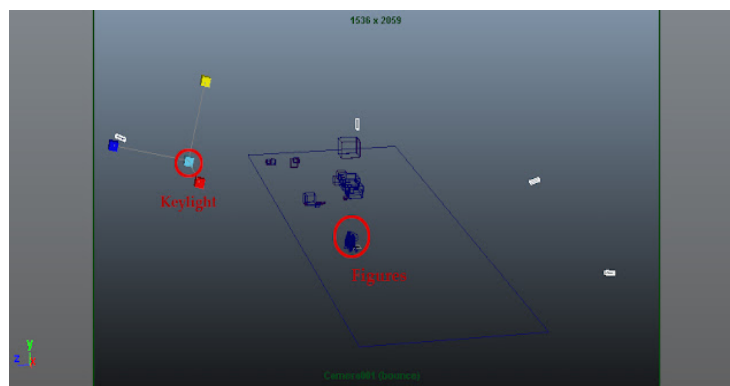


Fig. 39. Screenshot of 3D scene for “The End of the Day” showing placement of lights

For simulating the lighting for this scene, a directional light key was used for the sun. For the fill light, ambient light was used along with 3 more directional lights for providing the extra fill from various directions because using ambient light too much would make the scene flat. Fig. 39 and 40 show screenshots of the scene; Fig. 41 and Fig 42 show the original painting and the CG render.



Fig. 40. “The End of the Day” by Jules Breton [63]



Fig. 41. CG reconstruction of the Breton painting “The End of the Day”

IV.2.5 Painting 5 - Late Afternoon (Chris Peters)

This Peters painting supposedly depicts afternoon time based on the title, but the colors do not quite give the same impression. This was discussed earlier during the analysis part for this painting. The lighting setup doesn't look too complicated; there is only one direct light in the scene, the afternoon sun. The shadows are sharp and short as is typical of a clear sunlit afternoon. The colors are really saturated and markedly yellow in tint probably to oversell afternoon lighting.

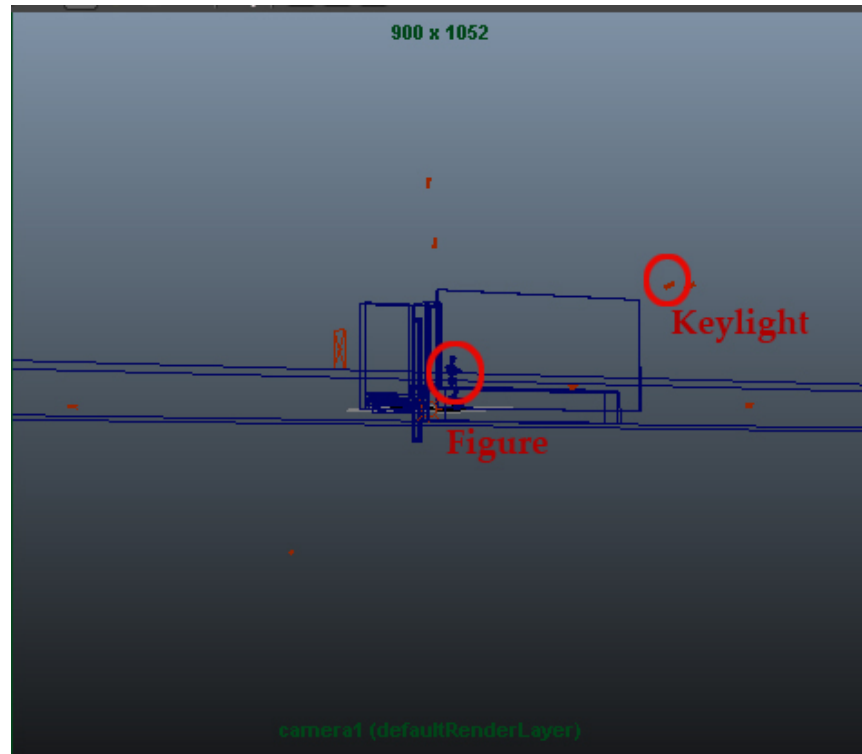


Fig. 42. Screenshot of 3D scene for “Late Afternoon” showing placement of lights

The key directional light substitutes the sun in the CG scene. This light comes from top right of the scene, slightly overhead. In order to make the renders much faster, again several directional lights from different directions along with an ambient light were used to simulate bounced light. V-Ray renders without any fake bounce light were taking enormous amount of time to render, as experienced while rendering "Phillippe's Restaurant" scene. Fig. 43 shows a screenshot of the scene; Fig. 44 and Fig 45 show original painting and CG render.



Fig. 43. "Late Afternoon" [65]



Fig. 44. CG reconstruction of the Peters painting "Late Afternoon"

IV.2.6 Painting 6 - The Fall (Chris Peters)

A still life by Chris Peters, the lighting in this painting is really warm and not quite soft. There is a single light source radiating light from the top left corner. The hard shadows demonstrate that the source of light used is a point source. The light is positioned at a relatively low angle, which is evident from longer shadows. There is a fair amount of bounced light resulting in reasonably well-lit areas which are not directly facing the light. The shadows on the block of wood have dark orange tint. The use of analogous colors, green in the predominantly yellow, makes the painting pleasing to the eye.

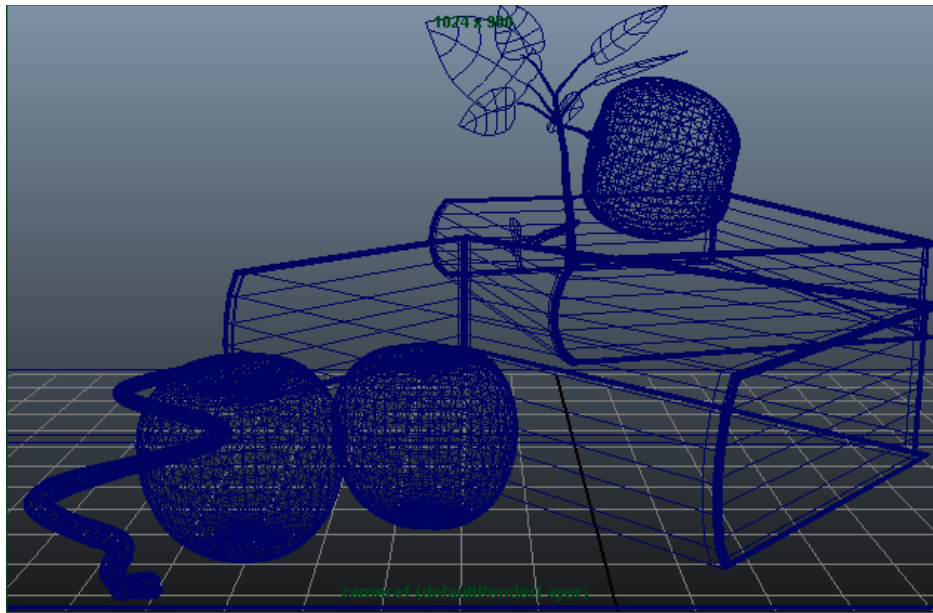


Fig. 45. Screenshot of 3D scene for “The Fall” showing placement of lights

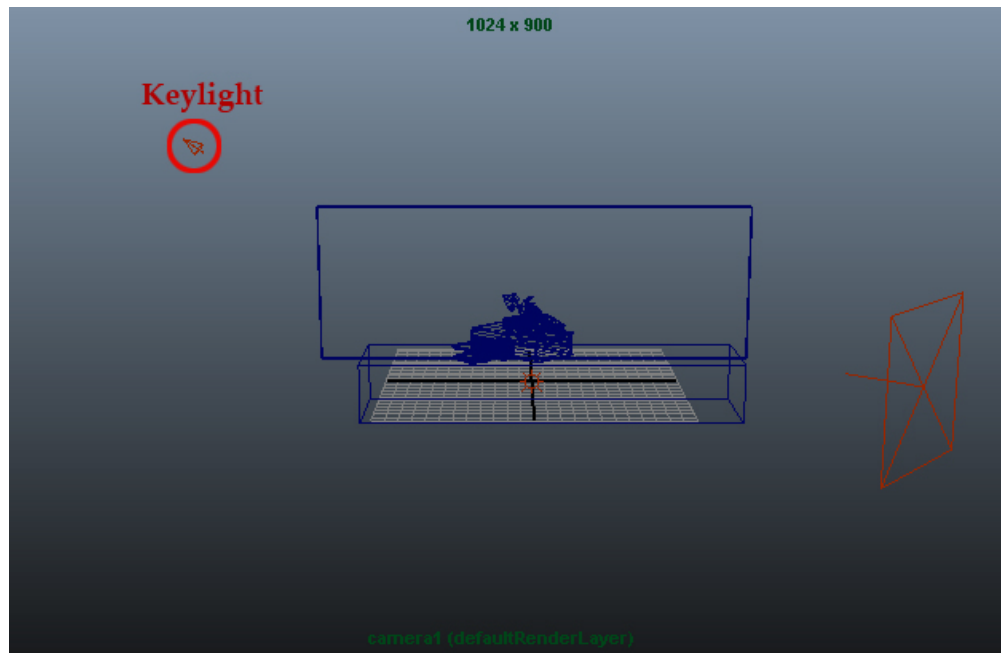


Fig. 46. Another screenshot of 3D scene for “The Fall” showing placement of lights

A spotlight was used as a key light from the left. A low intensity area light was also used to make the lighting a little soft, and a low intensity ambient light to illuminate the overall scene. To achieve the effect of dark orange colored shadows on the wooden block, shadow passes were edited in postproduction and given an orange tint. Fig. 46 and 47 show screenshots of the scene; Fig. 48 and Fig 49 show original painting and CG render.



Fig. 47. "The Fall" [67]



Fig. 48. CG reconstruction of the Peters painting "The Fall"

CHAPTER V

CONCLUSION AND FUTURE WORK

This thesis was an effort to create CG based lighting setups (along with scene objects/characters and environments for a full effect) inspired by two paintings each by three artists - *Office & Phillippe's Restaurant* by John Register, *The Weeders & The End of the Day* by Jules Breton and *The Fall & Late Afternoon* by Chris Peters to produce images similar to the these paintings. Whenever there was a conflict between the artistic interpretation of lighting in the paintings and the physically correct behavior of light, attempts were made to disregard the latter and incorporate the former. The lighting styles of each of the three artists were unique and interesting, and being able to extract their lighting style and applying it to CG medium has proven to a helpful procedure to get similar results for any other artist.

In the future, it will be exciting to have a software tool that takes a reference image or painting and synthesizes lighting information from it to automatically generate a lighting setup that will mimic the lighting. However, it is might be quite formidable because each artist has his own interpretation of lighting. Furthermore as it has been observed through this thesis, although a lot of attributes of real world lighting were faithfully represented in the selected paintings, there were quite a few aberrations from a real-world lighting perspective. If at least an approximation of lighting could be created accomplishing the bulk of work, then a little bit of fine-tuning and adjustments by a CG artist could yield impressive results quickly.

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