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Exploring Nocturnal Darkness and Shadows with Digital Cameras

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“We can distinguish two sorts of nocturnal lighting: lunar lighting and composite lighting (…) We do not address the instance where light does not totally default- what we call the “dark night” – because, like filmmakers, artists have never treated it, the absence of lighting will not be able to generate visible images. »

Henri Alekan, *Des Lumières et des Ombres*

INTRODUCTION

Cinema was born from photography and phantasmagoria. This art of “making the phantoms speak in public” took place at the end of the XVIII century to project and bring to life on a canvas screen miniature painted or etched pictures on glass plates. The act of projecting has always been indivisible from the act of filming, as witness from the first motion picture projector “des frères Lumière,” a hybrid device that allowed viewpoints and their diffusion.

The issue of cinema is therefore to see, in the dark, printed images on a stand**,** where technical constraints and inspirations (esthetic and artistic) permanently mix together. To achieve this cinematographic “alchemy,” a projection window is opened to the spectator upon a world that is constantly recreated.

The projection of lighting cannot exist in contrast with the darkness of the room, the shadow and the light are indivisible and complementary. It is necessary to project in order to present cinema!

Jean Cocteau simply said, “*The cinema is the modern writing so the inc is the light*.”

Hence, the subject of my final study will be: how to project in a dark room, a story that takes place in the dark?

This question that may appear naïve will be able to touch upon the depths of what is cinema, because it also asks in a broader sense the question “can we all describe cinema?” (see *Henri Alekan's quotation on page 2*)

One thing is definite: to project the dark, it is necessary for light, so it is therefore necessary to illuminate!

The project of my final study, after that assessment, is the study of how to grasp this deep contradiction.

I wish to give you a photographic and technical answer in working particularly with new devices at our disposition, digital cameras.

As a result, the new generation of digital cinema cameras characterizes itself notably by a very important capacity to go search information in dark areas. The exposition latitude of the Canadian camera DALSA will be the closest to that of the human eye (12 diaphragms of latitude).

Through the study of these “digital” cameras and their “workflow” (chaine de production), we are aiming to show that work in low digital light is perhaps a rich and new trail of apprehension and obscurity, of the “dark” night, in cinematographic writing. Parallel to the evolution of the post production of film (even when filmed with traditional film) allows operations of special effects and calibration to go much further and to take advantage of the maximum potential of filmed images.

In our case, the true problem- other than technique- is to succeed in enriching the image to give it clarity, the dynamic of our gaze.

To reach this point, we will start by returning to different esthetic responses to this photographic “challenge” while of course focusing on cinema, but also other graphic arts like photography and painting.

In fact, the question of the “dark night” has been treated by intuition and by necessity in numerous works.

It is about rapidly analyzing films that treat this problem fairly precisely. This will certainly give rise to angles, relations in the world that are very different and symptomatic of periods and major trends of cinema.

I will show that the light, the narration, the stage direction then becomes fundamentally related. Here, we are in a situation where dubious methods are not possible and where the light must be entirely recreated, the interpretation becomes mandatory and paramount, each photon is a choice and thus makes sense. We will then speak of acting light or narrating light.

Technically and artistically the major problems and the responsibilities then lie with the “photo director.”

In the second situation, we are seeking to understand how and why the arrival of digital tools allows cinematographers and directors to go even further in their nocturnal explorations. It’s about looking for the subject matter, the techniques of points of view that capture a meaning and that bring an advantage in a situation of “complete dark.” To concretely define why digital is a particularly innovating tool to tell these kinds of stories.

Nevertheless these recent problems cannot be understood without a return about technical peculiarities of digital video and cinema and their comparison with **“**silver**”** photography of film.

The material, again rare and diversified, also merits in being addressed because today each digital camera in cinema proposes its own standard image.

Of course, we are then looking for examples of innovating film based on this idea that we are seeking to better understand. The work overseas of David Fincher or Michael Mann will be able to supply that reflection.

Finally, from the film of my final study that accompanies this memoir, we are also seeking to lean towards economic implications, human ones, and logistics of digital work in states of dark light.

This memoir is designed as a state of esthetic and technical places of possibilities that today offer filmmakers to tell their nocturnal stories. It is designed as a preliminary reflection, with images and examples in support that would for example allow a cinematographer to converse with a producer or a director to solve this very particular case.

The goal of this work is for me to better understand how, from the goals of the screenplay (*the night, in a dark forest*…), the chief cinematographer will have to articulate esthetic choices (*contrast and colors*) and techniques (*digital cameras?*) to arrive much closer to the goal of film. We are right in front of problems that unite image and narration, technique and sensibility. In short, the concerns of the cinematographer.

PART 1: THE NIGHT ALL THE CATS ARE GRAY?

1) To see in the dark? Photographic responses to our physiognomic particularities…

A. The nocturnal vision

The photographic representation has always wanted to take the base of its technical development the physiognomic characteristics of our eye. For the nocturnal vision, our system of visual perception has different functions from diurnal vision. In fact, if our eye remains the same, the treatment of luminous information that it receives is profoundly different. It's as if we are changing from silver film, just after dark. Night vision (Scopotique) does not function like day vision (Photopique) and that particularity is important to determine when we wish to photographically reproduce nocturnal "naturalist" images.

1. Day vision

It all begins by the reception of information in the retina. As a result, the photons that are received by the optic of the eye (iris and cristallin) are then "translated" into photo-electric impulsions by the cones and sticks that cover the bottom of the retina. These impulsions are then transmitted to the brain and become visual "sensations."

The cones are the numerous receptors and sensible to different wave lengths of the spectrum which thus form sensations of differentiated colors. Certain cones are sensible to Red, others to Green or to Blue. The syntheses of these colorimetric analyses in the brain allow us to determine a color seen with great precision. The more the cones, aside from their number and their finesse, have an account of very fine information of detail and definition. They allow us to distinguish contours and nuances of grids (contrasts) with a great precision. This capability is really a determining factor in our lateral vision that allows us to place in space and to instinctively "come to see" the dangers.

These receptors are therefore a flaw, their small tails render them less sensitive, that is to say that they have a certain flux of information to be activated, while the occurrence of a certain level of reflected luminosity by the subject watched. We well understand why they cannot suffice to assure all the functions of our vision. In the dark or the night, they are undernourished of light and become almost unable to operate. Their size being variable, only the most voluminous among them can then deduce information of colors in dark zones.

2. Noctural vision

It's specifically in these situations of weak lighting that activates the sticks that also populate our retina. The sticks are more voluminous, less numerous and

much less embedded than the cones. Effectively their treatment of luminous information is less precise. The more the sticks have flaws, they cannot realize difference of wave lengths between different photons and therefore do not know to translate colorimetric information. Logically they drag from all these handicaps a big advantage, they are extremely sensitive to the light and satisfy therefore a very weak level of luminosity. This particularity allows us to see fairly well in the dark (other animal species go even further) which has had to save many lives when we frolicked in the jungle.

The activation of that reception of sticks is progressive; to force to rest in obscurity, our brain "decides" to sacrifice the definition of information and the chromatic sharpness in order to allow us to repair in our environment thanks to the sticks. Effectively the situation of "dog and wolf," when day and night seem to coexist, is a particular stage where we use it to our ability (vision called Mèsopique). The maximum sensitivity is achieved, within Man, after about 45 minutes of staying in the dark, which corresponds to the time necessary to regenerate all the photo-receptive cells of the retina (cones, sticks).

All in all, the first thing to realize when we wish to reproduce our visual nocturnal perception with photographic means is that its physiognomic process is very different than that of day vision. It is characterized by a loss of definition that prevents us from demarcating certain contours and to see certain details, as a very weak colorimetric sensation which prevents us from differentiating a white cat, a red or gray cat…

B. Characteristics of photographic recording techniques

Unfortunately for us, the photographic technique does not have the adaptation abilities of the human eye. In fact it acts like a much simpler system where each photosensitive point (digital sensor or "silver film**")** is going to receive an information of brightness (more or less important according to the lighting) and information of reduced chrominance like in the eye according to the sensitivity to Red, to Green, and to Blue. Furthermore each support has its own (nominal) sensitivity that cannot really vary (except by interpolation in the digital case) and that determines its ability to render a visible image during situations of weak lighting.

Evidently that rather goes to the inverse of human vision which shows a great flexibility while dynamically evolving according to the level of lighting. To find in photo the perception of the human eye in the dark, it's necessary to divert this system that finally reacts in the way during the day or the night.
In fact, in photo, the first thing to define when seeking to reproduce a review of dark is the sensitivity of chosen support. Here is a photo taken in the night in instantaneous conditions (like the eye) with an equivalent visual review. The necessary sensitivity was then 3200iso.

The first thing that one remarks is the very strong granularity of the image. We then understand that in these conditions of weak luminosity a choice of very sensitive role of film cannot suffice in case of necessary capitation of little existing light because it has a big flaw to convey an image of very weak resolution what does not at all resemble the nocturnal vision of the eye. In effect, one often approaches in photography to lengthen the stages of exposures of points of view (the more of the stages of capitation=more captured light), to avoid using as extreme sensitivities with a “grainy” review.

Thus the speed is the second lever of action that can allow nocturnal capitations, this time with good definition. As we see it on the two photos can go very far in detail even in plain night. (Exposure of 30 seconds and one minute of night at 100iso)

Here is an example of realistic nocturnal vision. The direction of light comes from the moon. We also notice a sensation of color lightly exaggerated by relation to the vision of the eye.

Here we are on a longer exposure. We accumulated a minute of “lunar” light with a surprising review because very different review of the eye. The colors are very saturated and the deepness and the contrast of the image are very important. However the model has remained strictly rooted to avoid the fuzziness of “blurs”…

With these photos, we can better understand the fundamental difference between our eye and the camera. The photographic capitation is going to look for the dark to present us a review next to the image directed towards the day. Even

optimized, this image is not satisfactory in a naturalist perspective because it does not “tell” what we sense in the dark night…

Furthermore, the levers of action to photograph the dark that we have used before are again more limiting in cinema. The granularity actually has an unpredictable character (in silver film) that gives a tingling sensation of a very disturbing image for the spectator because each of the 24 recorded images in one second is “sounded” differently than the others. In effect the most sensitive “pellicules**”** have not been able to move at 800iso and are since withdrawn from operating…We are far from 3200 iso sometimes used in photography**.**

The other constraint of this art of movement is the time of recording. However this time is difficult to adapt to according to situations in cinema because it depends on the cadence of the camera and the angle of shutter (24i/s=1/48s of time of recording for a shutter at 180 degrees). To modify these characteristics intrinsically modifies the filmed image and distances us from the wished naturalistic review. In fact, a change of cadence is going to modify our temporal perception (slowed or accelerated) and render the points of synchronous sounds impossible. Similarly, a change of shutter is going to change the time of exposure of each of the 24 images and effectively, is going to create a sensation of different movement with the “fuzziness” of light blurs. Furthermore, very little silver film cameras allow opening their shutter to the normal (180 degrees) to achieve with luminosity.

Thus, we are in a technical impasse which concerns cinema; on one side a large envy to tell stories of the dark, to blow out lights, to lose ourselves in dark forests, and the other, a media ill-adapted to the capitation of these events.

C. Projecting dark in a dark room?

Despite these technical evolutions, only one show exists: to light up dark scenes to totally and artificially recreate this review if difficult of access otherwise**.** It is important to keep that in your head for that act of filming is not one part of the film process. The other moment of light is the projection.

1. The conditions of projection

The projection in cinema has a tendency to unwind in complete dark and therefore to entirely focus on the spectator’s vision. Moreover each image, each shot, has a period of observation demarcated by the editing. We cannot, as in a painting of a photo, stop ourselves before a shot to enrich the sensation that **we have**. In fact, this device implies a very strong attention and intention for each dark shot because the spectator must know where to look without “leaving” the film to seek unreadable information. Therefore the obscurity of the room allows going quite further in the “sous-exposition” because no light does not interfere with that that is projected and we now know the great capacity that our eye has to search for information in shaded regions. Thus certain skilled scene directors will be able to use this characteristic to make once more the spectator participate and put them in a state closer to the action.

The Time of the Wolf *by Michaeil Haneke takes place mainly during the night in a limited atmosphere of readability for the spectator. The photo, that always preserves detail and a true contrast of darks, holds a lot of narration.*

Unfortunately the issue of projecting a very dark image is not as simple as that. The human eye being a dynamic receptor, does not have the same quantification fix of black or white like a film roll. Moreover, the problem that one faces when projecting a lit and contrasted image (so that the eye can see) is that the image appears grey to the spectator because the eye offsets the very dark atmosphere of the room that the film is projected in and thus increases perception. We face a problem that cinematographers often face in camera angles and calibration: To be in the dark, is to see dark in the image so that lighting up dark is to make grey! The problem is thus to light up the dark leaving it full of depth and material. We then speak about, in just terms, the density of shadows.

2. <u>Lighting up for projection</u>

In fact, the discovered cleverness of allowing good reception of dark images by the spectator is to modify the contrasts of the image. In creating a large dynamic in the projected image, notably with important and easily repairable "bright-lights" (white parts of the image) we can "excite" the eye of the spectator more directly and bring it to receive the image as it would during the day…so with cones, while bringing more colors, but above all, while correcting the density of shadows. Thus, the grey will seem dark in comparison to the rest of the image, and most importantly to the brightness that would have been predicted and recreated by the light team. The brightness thus comes from a white reference from our eye that standardizes and not longer seeks to increase its normal sensitivity.

Here is a photo from "Leila," my film of final study. The car to the right is digitally retouched to transform the dullness to brightness.

One well perceives the difference of atmosphere and perception of these two

photos besides being identical. The brightness in the first shot focuses attention and in comparison renders it more mysterious. Seen in a dark room, the décor will also seem darker. It allows obtaining dense and profound darks.

This issue concerning dark is again more important in the continuity of the sequence of a film. As the depth of the field or the used grain of the film roll, the level of the density of the darks must remain as constant as possible throughout the film because it gives an atmosphere and a style to the image. A change in quality of darks can disconcert the spectator if it is not justified by the narration.

Once the functioning of this known “projection,’ the chief cinematographers can of course design different kinds of luminous interpretations that respect these kinds of precautions. In simple terms, each visible light before being recreated, is often in scenes of dark night that the difference in esthetic sensitivity between two cinematographers or directors can be the most obvious. In total daylight we can pose a camera and turn it according to the hazard of this. In total darkness, each bit of light that enters the scene was guided there by intent or by choice. It remains for us to understand how to *manage the lighting of* these night scenes in a way that they best enhance the cinematic narration and how dominant a role the technical and esthetic choices play in the shooting of these sequence.

2) The cinematic illustration of the "dark" night and its challenges

A. <u>The narrative light at stake in the relationship of the director and cinematographer</u>.

1. <u>*Reading* from the screenplay</u>...

Staging the dark night is always a delicate task...Let's take for example a few lines from the script:

Pierrot, discombobulated ,wakes up in the Clio. Marie has gone leaving only a small yellowed envelope on her seat. Night has fallen, one can't see much of anything nearby. As Pierrot gets out of the car, the sounds of the surrounding forest become more oppressive.

Not having a flashlight ,he uses his cellphone to find a path the branches...

Here, as often happens in the scenes of "dark" nights, we could imagine numerous ways to manage the lighting. We will try therefore, as much as possible, to adhere

to the screenplay. We know in this instance that the character is inside a darkened car and that another individual is no longer in the car. We suspect then that we must not only reach a "level" of light inside the car that allows us to see Pierrot but also allows us to see the empty seat and "sense" the absence of Mathilde. We also know that**,** taken from the opposite perspective, it will be futile to light up the forest brightly since the script emphasizes the barely visible character. In the end, we know that we have two ultimate concerns at the end of this scene with a *common root* "the cellphone" which must light up the scene acutely (enough to allow the character to see the obstacles and, another significant challenge, we know that all these images are in motion.

We notice several things at this point:
- first, that the primary source is neither mentioned nor explained in the script
-and then, that the decision whether to light up certain elements or not, will influence the narration enormously. For example, the fact that one *sees or does not see* the interior of the car and then the empty seat, and then the envelope left on it, can strongly influence the staging. It is the lighting in this instance which will enable a context of suspense (where the spectator is a step ahead of the character) or of surprise (as the viewer discovers that the letter in the car...)
-Finally, we wonder about the character of the light given off by a tiny light source in the dark. Must it be soft and weak as it would be in real life or should it be hard edged like the dark night surrounding it and yet already lit up? Here, it is a matter of scaling the power of the light sources, *with utmost credibility***,** against the background atmosphere of a dark night.

This first reading, pragmatic, allows us to highlight the intentions and contradictions of the screenplay. In the opinion of many cinematographers, this step allows us to understand the author's vision of this dark night. It is thick and unsettling, sweet and enveloping, gray and mysterious...

2. **To stage scenes with lighting**

All of these problems, which often come right at the reading of the screenplay, are in reality symptomatic of stories regarding "dark" nights. They are concerns simultaneously for the direction and the photography. In fact, this type of intrigue requires, more so than others, a great collaboration between the two parties who must be able to decide together on the style of the imagery and the direction that it will take. Often, numerous difficulties evolve, for instance in this case, the need for a very dark and mysterious image and the need to be able to clearly see the motions and the expressions of the character during the whole segment... The cinematographer must find a lighting scheme which will allow, as much as possible, these contradictions (to drown a character in darkness while at the same time seeing him as if he were bathed in sunlight!). The goal is to reach a particular perspective on the action by utilizing the lighting scheme.

Hélene Angel's The Red Knight. *The lighting here is conceived intentionally to shed light on the child sleeping in the dark and to immediately point to the book he holds in his hands. These decisions bolster the direction of the scene by introducing a dream sequence well…*

Photographing commonly then becomes bound with framing. The light will outline "physically" a specific domain of the actual in such a way as to put it within the grasp of the viewer. The light then acts out the narrative.

To summarize, setting aside the problem of putting into words the cravings and impressions, (which often arise in a relationship between director and cinematographer), two fresh new difficulties maintain. Determining what the light hides or reveals in the background and in the action of the characters and addressing the level of legibility of the shots and of the components which make them up. This difficulty is practically insurmountable if shooting with film...

Scene of a countryside taken from the film The Time of the Wolf. *Hardly anything can be seen, one barely "feels" the building coming out of the sky. In cases as extremes as these, one wonders what is the logic of such a shot…*

It is difficult, in fact, to be able to tell if a face or a gray object, in the shadows, can be perceived with the eye. It is yet more difficult to say whether one can feel its color or not. And still more intricate to explain it to the director...

Obviously in this case one must use the light meter (to formulate careful light measurements) in the "zone system" mode which relates a standardized value of gray to each measurement depending on the aperture and time of exposure chosen. This method allows showing the director a gray scale to give him a notion of the final product.

Of course, we cannot lose sight of the fact that in these difficult situations, confidence and experience are the most precious and the most crucial ingredients of

the equation. On this matter, the responsibilities of the cinematographer in relation to the director can change subtly in the digital medium and it seems that each member of this working couple must find a new equilibrium in this relationship.

Here is the case in point of Gerard de Battista who often works in the digital format (HD) these days and certainly in the long term with directors such as Claude Lelouch and Claude Miller.

Interview with Gerard de Battista on the subject of Claude Miller's *The Secret* for the AFC.

Wilfred Sempe: Claude Miller was without doubt very pleased with the image of Little Lili, *but the question that she posed, for* The Secret: *to create it in film or in HD?*

Gerard de Battista: No, because first he wanted it like that for Little Lili. *With the HD, we cannot recharge all the time and we have 45 minutes of autonomy. For Lelouche, the HD represents 45 minutes of film and little of necessary lighting in the evening or nighttime, Claude Miller loved the digital result of* The Secret. *I know that the digital projection of the other night had delighted it: we made the calibration while projecting in digital, which we had found outstanding. I did not know any director in which I found in HD that said: "I will not find more with that". Moreover, the channel progressed a lot. Like I said the other night about the projection: " You are going to see the image in its original version".*

WS: Furthermore, there is even a possibility of dialogue with the director, who does not have the final image.

GdB: No, but it is very simple to explain to him what is going to be made at calibration. There was a little esthetic discussion from time to time, whether it would devote itself to the actors. Claude would not even come to see what I call "we rush to us," to know that all the evenings we envisioned the original cassettes on a big calibrated screen, before sending them back to the lab. As a revenge, Stora, Moati, or Lelouch help there.

As we come to see it, the work and the contribution of the chief cinematographer in these dark situations without justified light are not only narratives: of course the work of the lighting remains an esthetic reflection about the atmosphere, the sensation that can bring the image to the spectator.

B. <u>My Nights Are More Beautiful Than Your Days…</u>

The esthetic quality of the night has been unavoidably set apart in graphic art. The moment where perspective begins to blur and colors become the basis of the work has always attracted the attention of artists while, at the same time, has put them in an uncomfortable situation. The artist must, from his/her initial impressions, reinvent a light which does not exist (see the Henri Alekan citation

on page 2). Thankfully, the great artists were confronted with this problem and knew how to find strong visual responses to it. Of course their esthetic choices guided and influenced certain filmmakers…

1. <u>Expressions of the Dark…</u>

When considering the great masters who painted the dark, one thinks immediately of Georges De La Tour and the paintings which he illuminated with candlelight, although he worked very little with the dark night.

Saint Joseph the Carpenter, *Georges de la Tour 1645*
One notices here the precision of the gradation of warm colors in the dark parts of the painting (notably on Joseph's shirt) and the transparence of the child's hand which renders the scene very realistic. The brilliance and intensity of the candle, although not very credible, bring a dramatic force to the painting.

Another great painter, Francisco Goya (1746-1828), distinguished himself by his work with the dark night, notably with his *Black Paintings* series composed of multiple paintings of which two, rather famous, retain our purpose. According to Goya, the dark night is the occasion to make ghosts come out into the public view.

The Pilgrimage to the Hermitage of San Isidro, *1819 (Black Paintings)*

Here the figures are always lit by a soft yet directional light and the setting is hardly visible, plunged in the complete darkness as if to further decontextualize the subject. The dark background, this death of light, provokes a pessimistic, enigmatic, and frightening sensation which is reinforced by the artist's brushstrokes. Initiated by Caravaggio, this esthetic technique of representing the night subtly traverses all painting from Rembrandt to Soualges, and even Courbet.

Saturn Devouring his Son, *1819 (*Black Paintings*)*

Clothed Maya, *1799 (there is also a complementary nude version to this painting)*

A bit later, one finds this method being used in numerous films from different periods. For example, one thinks of Francis Coppola's *Apocalypse Now* where at times the characters begin in the shadows and are slowly illuminated on a black background.

In Francis Coppola's Apocalypse Now, the appearances of Marlon Brando's character are often shown on a black background with directional lighting. The mystery of this man and the fear that he evokes materialize in the light.

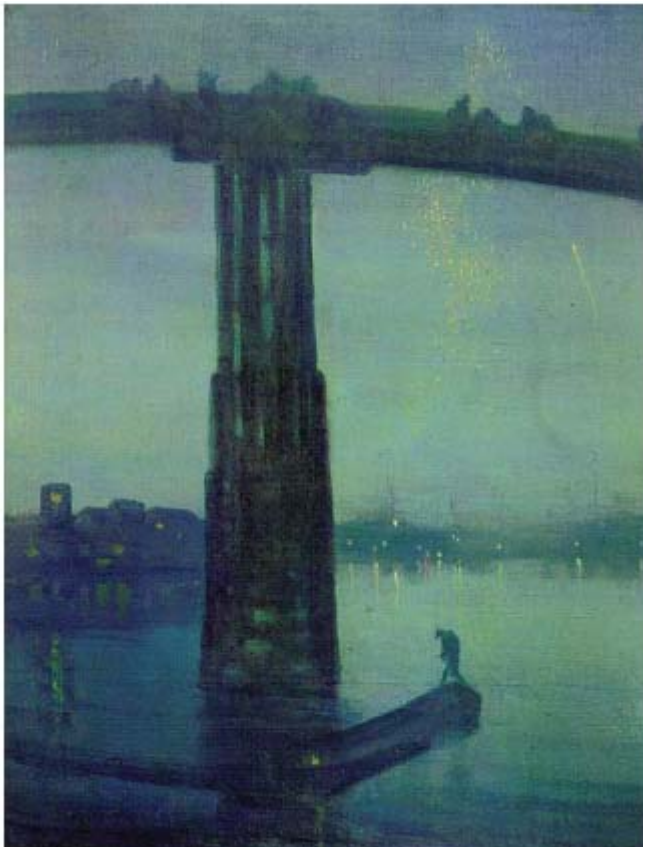
2. …and Gray Impressions

Some time after Goya, another artist is characteristic of a radical evolution in the dark night's treatment in painting.

James Abbott McNeill Whistler (1834-1903) is an American painter linked to the Symbolist and Impressionist movements. In his paintings of nighttime landscapes (often marine) he knew how to take great liberties in terms of colorimetry and contrast. In this Impressionist approach to representation, the night has only one color and is no longer a flat, uniformly applied black but a rich nuance of gray. Whistler's treatment of the night is antipodal to the sooty blackness found in Goya's works.

Nocturne in Gray and Gold, Snow at Chelsea, 1876

Nocturne Gray and Black, Westminster Bridge, 1871



Nocturne in Blue and Gold, the Old Bridge of Battersea, 1872

The series of nocturnes, carried out by Whistler as background work, is one of the most serious and successful studies of the dark night in painting. The search for the nighttime feeling fascinated the author who attempted to transcribe the nocturnal colors with his palette. Indeed, the artist shows us through his canvases, with his vague strokes and his granular material, that our perception of the night can be blue, green, black, grey or gold according to the location and situation. This approach is almost poetic.

In film the cameramen have the same need to interpret the "color" of the night in order to surprise the viewer and give a tone and an atmosphere to the film.

In film we have numerous examples of the Impressionist treatment of the night. Of course one thinks of the photography of Vittorio Storaro or of Darius Khondiji (*The City of Lost Children* directed by Jeunet and Caro). Already, in certain films by Einsenstein, one sees the birth of this type of delicate approach.

Nocturnal sequence on the port of Odessa in Einsenstein's Battleship Potemkin.

Based on the examples given above, one realizes that there are many factors involved in determining the construction of the light: first the relationship between the figure and the setting which surrounds it, then the contrast and the color of the scene and finally the credibility of the light, for realism is not always sought.

C. Each Sees Midnight at his Door

In esthetic terms another important consideration is the direction of the light source, which is needed to work with this inexplicable nocturnal light. Several solutions have been found in cinema and in photography.

1. Frontal Lighting

The first solution is illuminating the face, which fixes the figure in the night and gives the impression that the figure is very close to the spectator. The greatest flaw in this method is easily seen in flash photography or in the flashlight that television reporters use on their cameras. Obviously in this case the problem is the changing of light according to the scale of the shot (dark from a distance and overexposed if one comes too near the light). In addition, the quality of the light is often bad because the rendering is uniquely optimized to be the most powerful possible, to the detriment of the softness of the source (diffusion) and of its colorimetric equilibrium. These tools fight violently against the darkness and

obviously lack a certain finesse (only a choice of profundity, and a very elevated contrast).

Yet certain uses of this method in cinema have been revealed to be interesting (its dramatic use in *The Blair Witch Project*) but it is without contest that in photography one finds the greatest specialist (against his wishes?) of this nocturnal lighting: Weegee (1899-1968) who worked in the New York night during the 1940s and 1950s. His snapshots are taken in the dark, often without his protagonists knowing, and they are frozen in a light (that of the flash) in situations of complete darkness. They are part of a report and, at the same time, are themselves esthetic objects which are almost radiographic when the photographer manages, thanks to the instantaneousness, to surprise the wide-open eyes of movie-watchers, the stolen kisses in the dark corners…

Obviously reproducing these images in the cinema would not be easy, but they are a solid inspiration, notably in that which concerns the gazes, the position and the reaction of characters taken in "flagrant offense of darkness" in these photographs.

Weegee's photographs pull a great esthetic force from the equipment employed by the photographer. The flash "violently" invades the darkness and the subject of the photographs. The very rapid exposure of the photographs freezes them as if they were even more in the dark. One notices the eyes of the little girl, on the lower left, in which the pupils are very dilated because of the darkness of the movie theater. Why not try (with lenses?) to reproduce this special physiognomic feature in film to insist that our vision is modified in the night?

At a later time another type of lighting was developed specifically for the night and cameramen used it in order to light the greatest areas. The viewer has the impression of seeing these scenes as if they were in broad daylight… This technique, which gives a realist feeling to soft images, appeared in the 1960s and 1970s.

This esthetic execution requires either numerous light sources or a very powerful source with a great range of illumination. The game is to illuminate softly and diffusedly enough to avoid the moonlight effect (hard lighting which pierces darkness) while keeping a contrast in the image and distinguishing figure from setting. To obtain a vivid image with concentrated blacks and a good quality of light, we will seek to put diffused yet powerful sources overhead at a far distance from the action.

Night sequence in Georges Cukor's My Fair Lady. *The rough lighting "betrays" the use of a studio and the impression of night is not really conveyed. The direction of the lighting, which is too close and direct, flattens the contrast of the image.*

On the contrary, here is a pleasing approach in the soft and spread out light in The Time of the Wolf. *One sees in the shadows of the sun that a unique spotlight has been placed overhead.*

This distance is necessary because the illumination received by an object

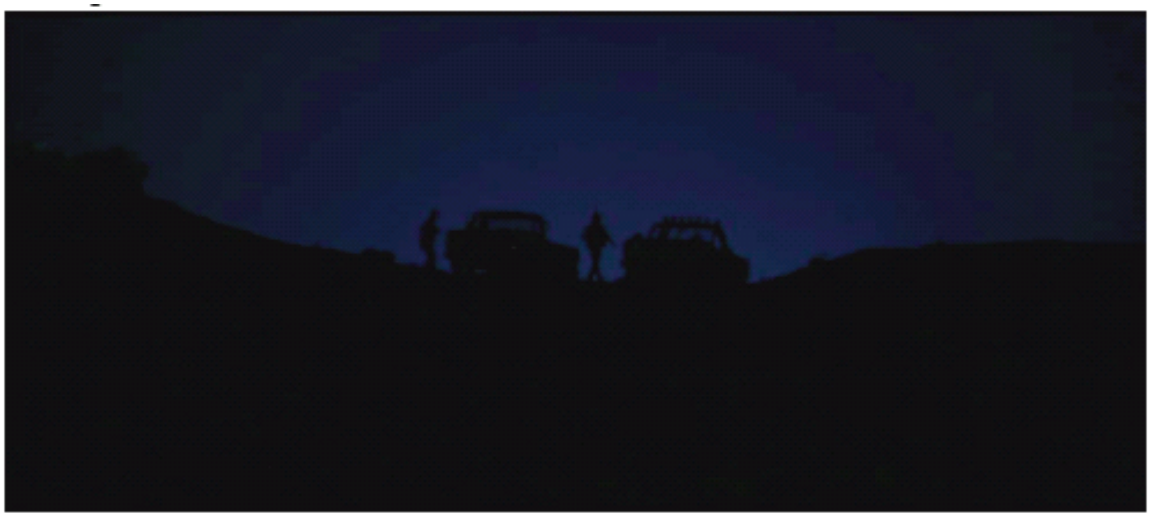
varies according to the square of the distance which separates it from the source of the light. In fact the illumination scale of a spotlight is not linear. For example, in practice one notices that the difference in light received between one and two meters from the source is equivalent to that perceived between 20 and 30 meters.

Thus in the review *American Cinematographer*, Roger Deakins explains how he created the soft and somber ambiance of the night in the first sequences of *No Country for Old Men*.

"That was kind of frustrating, because that whole sequence—when Moss goes back to a crime scene at night and is pursued by drug dealers—had to go from night through dawn and then into full daylight. I wracked my brain about how to do that, because the area we were filming in was a half-mile square in this big, dusty basin. I couldn't see any way around it other than to use a big wash of light on top of the escarpment above the location, so I put three Musco lights up there to create a moonlight effect. I didn't want to do it, but I didn't see any other possibility. After we set up the Muscos, I knew we needed more of them, but I was lucky to get the three."

"To try to make the transition to dawn, we picked out a rise where Moss parks his truck; when the drug dealers come back, they park their truck in the same spot with their headlights on. We tried to make the transition to dawn by lighting behind the trucks, as

though the sun was starting to come up beyond the rise. We got about eight 18Ks and literally just shot them up into the air to light the sky while flagging them off everything else. Those basically lit the dust into the air and created a very faint glow behind the trucks."



2. <u>Lighting in Contre-jour</u>

On the other hand, the solution can also be to light the pitch black sequences principally with backlighting on the figure and the setting. This method, used very early in film, has numerous advantages.

First, it seems more realistic for the viewer because the lighting serves to illuminate the contours of the elements in the frame without removing so much of their blackness and their "naturalism." One can then very easily fix the movements of the characters in the frame, see them glide within the setting and thus follow them in the dark.

Next, the contre-jour effect renders an important contrast and brings luster to the image in which, we have seen, permits the emphasis of shadows while rendering the darkness more profound. In contrast, as often at night, this effect requires a great quantity of light to be credible and envelop all of the set.

Finally, the contre-jour effect settles the problem of justification of the source because the spectator questions the origin of the light less often and accepts by convention the change between shot and counter shot, which have opposed directions of contre-jour… In fact, the backlighting is perceived by the spectator more often as clean lighting which is natural to the setting than as a direction of light needing justification.

In this photograph, the very apparent and lively contre-jour effect gives an almost metallic atmosphere to the scene without being inevitably justified. One believes it is night, without doubting that the bedroom should be, in reality, plunged in total darkness.

Same work in this shot in Tim Burton's Big Fish. *The gentle passing through of the frontal light and the gentler saturation of colors (rendered less monochromic) gives a more credible and less aggressive execution which does not pretend to be "naturalist."*

3. <u>"Expressionist" Lighting</u>

Finally a last esthetic preconception, which one often finds in the treatment of nocturnal light, is a directional and contrasted lighting inherited by expressionism. The idea is more to use night as an imaginary place than to seek to be consistent with our perceptions of night or our habitual nocturnal impressions. For this type of esthetic technique, the connection with the image is different.

An implicit agreement is made with the viewer: night is an interior, fantasized space where light can show and assert itself in all of its artificiality. This convention exists in film where the viewer knows that the images he sees are not really shot in pitch black. It is here that, if this agreement is strong enough, the "naturalist" conventions of film can shatter.

These two images of Jacques Tourneur's Vaudou *give a glimpse of a technique used in black and white films to illuminate the "expressionist" night. The loss of light sources' credibility was a signal for the viewer to identify the night in relation to the day, the distinction being made by the modification in the colorimetry…*

Indeed, questions for the explanation of light sources and our eye's perception are no longer posed. The idea is to describe the interior state of a character, or the mood of the setting with the lighting. Sometimes the mood thus created is in advance of the action of a film and contributes to the creation of a strong dramatic tension. Obviously this type of lighting is often used in fantasy or horror films.

In fact, beginning with the moment when credibility no longer matters, every interpretation is possible and we must propose a short account of certain very rich esthetic and narrative trails to explain the setting.

This image extracted from Joseph von Sternberg's The Blue Angel *is also classified as an expressionist inspiration for the dark night. The contrast is important and the effect is very blunt with a geometric motif on the wall.*
Though the shadows on the wall betray their sources, if the source were the light of the moon or the entrance of the night sky, the shadow of the man and of the window would have the same blackness. Here the man's shadow is much more severe.
This "flaw" again betrays the use of a studio and the artificiality of the lighting. In the present case, is it so important to avoid these "flaws?"

Another proposition of nocturnal lighting in Tourneur's Vaudou. *Here the assumed preconception for the entire film is that the courtyard is lit in almost an identical manner during the day as during the night. Shooting in the studio certainly has encouraged this choice, which furthermore brings a tremendous amount to the film: the confusion of day with night creates a suitable mood for the strangeness of that which plays out on this set.*

The film The Red Knight *offers a great range of different nocturnal lightings. Here the contre-jour effect is very intense and the excessive luminosity of the faces and of the depth gives a troubling aspect to the image which aptly marks the dreamlike character, near to the tale which characterizes the mise-en-scene.*

3. <u>New Directions in Photography</u>

From the same point of view, the work of the American photographer Gregory Crewdson must be presented. His work is very interesting because it summarizes the techniques invented to treat nocturnal light that were able to be adapted into film techniques. These photographs, taken with a large format camera, were lit and designed with film materials and by a team accustomed to working on films. The effects, which we previously talked about separately, are often associated in the same snapshot and the colors are deliberately very saturated. The idea, in contrast with "naturalism," is to maximize our physiognomic sensations in order to exaggerate the artificiality of the image. The artist claims himself to be representative of these sources of inspiration.

Here, the multiple light sources are in no way justified. The car's headlights are off while they light the room. In addition, the effects are much exaggerated and the colorimetry between the foreground and the middle ground changes without reason.

In part because of its "snapshot" characteristics, this photograph poses some real questions regarding the lighting. Of course one first wonders of the necessary credibility of the lighting. Really who could doubt that this is a nocturnal story?

One especially poses the question of the estheticism and the light's power of suggestion by its action and the references it invokes. Effectively, the concentration of the foreground's beam on the suitcases and the figure and the creation of an "expressionist" smokescreen in the background (all without need of credibility) focus our attention entirely on the foreground's action.

In addition, the pictorial references are so strong that the artist practically forces us to read the "plot" as if the photograph were a film.

If you don't think that there is a body or treasure in the last unearthed suitcase…Go to the movies more often!

Of course, this esthetic approach is interesting because it is cynical and indirect. By this method, which exaggerates (parodies?) certain traditional traits of Hollywood lighting, Crewdson seeks to denounce the standardization of the images which reach us and their conception. He also plays with the spectator's perception by arranging a strange, dramatic and disturbing staging in a disproportionately "esthetic" way. This technique obviously works to critique the futility of the cult of image and more widely, to show that behind the "Beautiful" often hide terrible secrets. This approach is interesting for us because these 90% nocturnal snapshots use codes of cinema (light, actors) to symbolize the American dream while showing it as a painting in which the varnish dissolves before our eyes.

D. <u>The Sun has a Date with the Moon</u>

Another approach that we must tackle, and which belongs to film, consists of sidestepping the difficulties and the constraints of filming the night by telling the stories of the "dark" night in full light.

The Empire of Light II by René Magritte 1954

The painter said of it:
"The landscape evokes the night and the sky evokes the day. This evocation of night and day seems endowed with the power to surprise and enchant us. I call this power poetry."

1. Night for Day

For this effect, the best known method is called night for day (la nuit américaine in French) which uses the sunlight to represent the softness and to make a model of nocturnal light. The recipe is simple: while placing the camera in contre-jour, under a mild and obviously out of the shot sun, one obtains an adequate direction of the light…one then seeks to darken the image as much as possible and to give a quasi-monochromatic tint with the help of a (often blue) filter.

In this excerpt of Billy Wilder's Some Like it Hot*, one recognizes a classic night for day. The shadows of the palm trees are too strong for the night and their direction shows that the sun, close to zenith, is opposite the action.*

Here the idea is to ban the weight of the light, of which we have previously talked, and to give a great liberty to the production in working almost so fast that we are in sequence while keeping a clear image. Of course this technique of night for day has numerous constraints. First it necessitates tests of the film prior to actual filming to determine how far the under-exposure must be pushed and how the colorimetry acts in the low light. In addition, night for day is a victim in its qualities: one finds the problem of continuity of light is often delicate on the exterior.

Effectively, the weather can change during filming and so is a great worry of the head cameraman who cannot work exactly like he would in broad daylight. One of the greatest flaws of night for day is the sky, which can vary enormously in luminosity in relation to the rest of the image according to the time, the weather and the clouds that pass.

To overcome these worries, one can use more or less progressive "neutral graduated" filters which make the upper part of the image darker. The flaw of these filters is that they become visible and therefore awkward as soon as the horizon line is modified in a movement. Otherwise, all of these variations of the

sky's density will be noted and will overcome the worries of continuity and of credibility in the film's editing. These false continuities can be really incapacitating because night for day strives to give the black night a realistic rendition, close to what is actually perceived.

In this film sequence the rendition of night for day is very fanciful. One notices the evolution of the sky in the day (sunrise, day, evening) which betrays the effect…
Fortunately, the cameraman sought to illuminate the light bulbs and the windows in the shot to suggest a nocturnal atmosphere.

If by convention the background can vary slightly in "night for day", it does not vary as much at night as it does during the day so the viewer would not understand that clouds appear suddenly in the nighttime sky. In addition, if clouds pass in front of the sun during a take or between two continuous shots, great problems arise and often echo mistakes in the staging of the shot (this method is supposedly a little onerous for producers…)

Night for day has of course another flaw in limiting the filming on location…which enormously reduces the usable shots.

2. Inlaying Effects

In fact another solution was sometimes used in studio in order to represent the night while lighting the set as if in broad daylight: this method is simply to inlay a night sky in the background. This execution, previously done by back projection, is now created by digitally inlaying on a green or blue screen…This practice permits one to work with a certain comfort and offers continuity in the execution

of an image all while allowing one to “see” the night sky when in reality the image was added in a studio.

One then needs to film the “skin,” inlayed backgrounds, which will be compatible with the setting and the type of intended photographic execution.

For Howard Hawks’ Gentlemen Prefer Blonds, *the discussions between passengers, which take place in the middle of the night must have posed a few worries; the film was shot, like often in that era, entirely in the studio.*
The back projection of “skins” filmed on location (during the day…) were used along with typical extravagances which were allowable during that époque.
Thus the actors are lit as if for daytime shots while the night is pitch black, without the moon or any light other than from the actors…
However it seems to me that there is a certain charm in this incoherence, because the “skin” and the lighting of the foreground agree in terms of contrast and preconception.

In Enki Bidal’s Immortal, *the same procedure is used, this time by a digital intermediate. It is surprising to see that this method has not changed much: the two characters are illuminated almost in the same manner (look at the shoulder which uncouples the background and the contrast of faces) and the result still seems unrealistic.*
In the first image, the special effect seems clearer than in Hawks’ film because the changes in luminosity and colorimetry between the “skin” and the actor shock our eyes.

2) Conclusion:

Even if one always sought to reproduce the vision of the human eye with photography, the night would still have a space in the imagination of the viewer. This imagination intuitively agrees to more affirmed, less justified and sometimes very different choices of what one might see in reality. We do not necessarily have tendency, envy, or interest in rendering all cats gray…

We are here of an "Impressionist" perspective where conventions are numerous but very often violated and revisited. Fortunately for the viewer!

These liberties are a double-edged sword for the director and his head cameraman who find they must compose, like a musician, the correct score, among an extensive range. The responsibility of the head cameraman and his team is to enhance the night, first with the director, but also technically where he will most often need to totally reinvent this particular luminous atmosphere that we visualize but which, in fact, does not exist…

PART II: THE DIGITAL INSTRUMENT: REVOLTUTION OR EVOLUTION?

1) The processing of digital, technical aspects and historical evolutions

A. Issue of the Evolution Toward Digital

Since the arrival of analog video in the 70s, cinema is no longer the only system of capturing and projecting moving images. Video very quickly became associated with television broadcasting, which required lower costs and a lesser quality than cinema specializing in the production of the type of films shown in theatres. With time, these differences were exacerbated although without exception, cinematic films were never filmed with anything but film. Then, at the beginning of the 90s came digital video. The better quality of image, the decrease in costs and the lighter weight of the cameras seduced certain film directors, for better or for worse.

Nevertheless this period of rapid transition passed quickly when Sony launched the first high definition camera (4K), adapted a new standard of great quality video for television. In fact this new format, truly good quality for video, was rapidly hijacked by cinema (one thinks first of George Lucas and the new Star Wars trilogy) and started to support the comparison with film, without overtaking it.

Then came the idea to adapt this digital technology to cinematic tools. Two standards were then created for digital cinema: the 2K and the 4K. Today we are only at the beginning of these two formats for filming cinema, although television has been using HD video, for the most part, for a year. Digital cinema is emerging mainly in projection; theatres equip themselves with it more and more, especially outside of France.

Aside of that, only a small number (about ten or so) of the cameras designed for digital cinema are actually used now for filming. Some digital films are filmed in the HDTV video and the majority still in film.

For cinema, the digital format is not yet a complete production system, as it had to become with photography, for example. It will age, rather, as one tool among others, to respond to the desires and to the technical and financial constraints.

For cinema crews, the issue is then to use, wittingly, digital cinema according to the needs of a film. Nevertheless that the digital formats required a certain amount of time to adapt themselves to the demands of cinema users, as well as in terms of quality and practicality, is what dissuaded some experienced cameramen.

For the distributors and producers, the issue is another entirely. The leading quality of digital film, recognized by all, is that of projection in the theatre. For distributors, the digital copy is an assurance of quality and of steady projection. No more broken reels, no more deteriorating copies, no more problems with fixedness, no more problems with reprints to satisfy demand…And especially, eventually, the possibility of flooding the international market by sending the film directly to the exhibitor/manager, through satellite server. Digital video allows, in fact, a much greater flexibility in the management and projection in reels of film, which will in addition be cheaper than in 35 mm.

The productions have for their part, two advantages in their uses as digital tools. They better fulfill the needs of filmmakers (special effects, retouching images) and also allow for lower costs and lighter materials. Of course several flaws in the digital system make some producers reluctant –

The digital image seems to be of a less “noble” quality than silver film.

We lack hindsight on the quality of preserving film backup – especially backup for distribution in the long term.

In certain cases and to a certain degree, the costs are greater with digital film.

The workflow of digital films lacks breaking in and can sometimes cause trouble with its complexity.

Completely digital workflow still being rare, we divide the actual uses of this technology into three jobs:
HD filming (digital video and camera)
Digital post-production (standardization, special effects)
Distributing to the public

B. Assets and Specifics of Digital Technology

In order to better understand the actual context, we are going to return to the technical particularities of digital technology.

1. A New Approach

On the issue of computers, the basic principle is simple. The quantification of information is received in a series of 1s and 0s which are

equivalent to Yes and No. On the other hand, there is analog, which reproduces a modulation of the intensity of the signal (luminous or sonorous), while digital assesses every intensity possible to see if it is or is not marked at a T moment.

In fact, digital quantification seeks to divide the signal into multiple information which characterizes it by quantifying its special features. The reproduction, the analog, is replaced by an analytic system. Therefore the quality of the digital processing depends on the quantification of received signal: if the same image is analyzed on 256 or 1024 levels of grey, the final result will be very different because the nuances will be more or less assimilated by the computer encoding and a cut of the gradations and the contours more or less realistic.

On the contrary, in analog, it will be more the quality of backup, its size and the dynamic response, which will be the issue for a reproduction that is faithful to reality. The big flaws of analog – the loss of quality through the copies and the wear and tear of the backup (with magnetic tape) -- no longer have a place with digital, because the analysis is reproducible to infinity, like a book that one can print as much as one wishes. The information is then more reliable and permanent.

The received information is then transformed into electronic impulses. The 1 and 0 become, then, the “flowing current” and the “non-flowing current.” This causes a “discreet” signal, meaning discontinued, contrary to analog. The quality of the digital encoding will then also be determined by its sampling which is the frequency with which the information is collected and recorded.
The sampling determines, in fact, the quality of the digital analysis because it is the dynamic link between the different units of quantification of which we spoke previously.
In digital cinema, one samples the luminescence and the chrominance of an image according to a spatial sampling which divides the image in pixels and then gives it its definition.

2. Standards of Definition For Recent Digital Images

Since the advent of High Definition video, the norms in terms of image definition were modified and simplified. In HD a single image size exists, which is 1920x1080 pixels. We speak now of 1080 lines. A rapid calculation allows you to see that this is a definition equal to 2 million pixels in a photo, which is relatively little. For HD, the international standard is the ration 16/9 (1,77 for film) which accepts more rates (24,25,30,60i/s) and an interlaced encoding (TV) or progressive image. So we speak of the 1080i and of the 1080p.

This standard, which is now imposed on French televisions, has the interest of allowing projection/broadcasting of the greater quality than beforehand and a unification of the means of projection across the world because in standard definition, different formats compete with each other.

The PAL system (European) and the NTSC (American and Japanese) divide the world in two different technologies: on one side an image of 720x576 pixels at 25i/s and on the other, 640x480 pixels at 30i/s…For a technology of equivalent projection, the Europeans made the choice of image quality and the

Americans that of the quality of rendering movements, notably to improve the replay of sporting events.

Then the standards of digital cinema appeared. These, much more flexible, are characterized by a progressive mode and a definition of 2048x1080 pixels for 2K and 4096x2160 for 4K.

3. Sampling and quantification: qualitative issues

In the different frameworks that are the formats of projection, exist of course, different qualities of obtaining the footage. If the digital processing seems perfect in theory, the engineers who design the problem are rapidly hit with problems of size. The most evident is the one of recording the image processing. Effectively, according to the standard of projection, a primitively processed image could be weighed more or less "heavy" (this depends on the amount of information that contains the image and then of the place that it takes up on the hard disk.) According to the points of the image, its inscription on backup recording will be longer or shorter. This period of inscription of information is essential in shooting moving images because the rate of the camerawork is incompressible. We very quickly realized that at the creation of the HD projection standard, no backup was capable of recording backup 20 times in one second for a quality image of this size during a satisfactory period.

Then, at the time, the first solution that the engineers found at the beginning of video was to diminish the precision of the digital analysis in order to reduce the amount of information that it includes and then to shorten the time of the recording.
Several methods of action were found:
Reducing the size of the processed image
Lowering the precision of the quantification of the colors
Limiting the band width reducing the quality of the sample.

The first invention was then overtaken by reduced image sizes at the time of the camera's internal analysis process. Sony and Panasonic made the choice immediately at the time of the creation of their first HD formats. Both permitting final projection in HD standard, they record and process the reduced image (respectively 1440x1080 and 1080x720 pixels).

The quantification of colors (expressed in bits per color) allows rendering, with precision, the nuances of color to be closer than we visualize. In practice the basic quantification on video is 8 bits for an analysis at 256 levels of Red, Green and Blue. If this adjustment is sufficient to render the colors credible, it gives little in terms of the nuances on the colors' surfaces and especially does not permit a great flexibility for afterwards. The nuances of signal being few in number, it will be difficult at the time of sampling to recover the information to improve the rendering. This modification, executed during the recording of the signal and its sampling, determines in the case of the shot where the colorimetric demands are important, particularly for a delicate rendering of actors' skin.

Once the quantification is executed in chrominance in the RVB (Red, Green Blue) space, the information is processed and interpreted during the sampling. This operation transforms the information because it reappears in a new space called YUV. The luminance information is processed in the Y, and the colors are deducted in a passage Red-Y and the other, Blue-Y. In fact as our eye is very sensitive to Green, the Green is assimilated to the luminescence of the image. At this moment, the translation of information will be compressed, reducing the amount of processed information. The non-compressed processing is 4:4:4 (we process all pixels in YUV.) but one can decide also to work in 4:1:1 as in the DV format (one then loses many nuances of color because only quantified information is recorded on 4) or in 4:2:2 like the majority of HD formats.

According to the processing executed at different steps, the points of each recorded image will vary in their particular proportions. To compare the characteristics permitting the evaluation of the quality of a format, we will compare their outputs in band width. For example, with Sony two HD formats have a very different band width (the HDCam at 110Mbits/s and the HDCamSR at 440 or 880 Mbits/s). It is necessary, moreover, to be careful to differentiate Megabits (Mb) and MegaBytes (MB). One byte (octet in French) = 8 bits (inscribed information 1 or 0). For certain processors the conversion can be rather of 6/7/9 bits for a byte, which is why the conversions I will execute subsequently will inevitably not correspond to the constructive data/information.

4. Different actual formats of "cinema"

As we have noted earlier, HD video is still often used by cinema crews. In HD several formats appeared rather rapidly but we will keep only three which all record on magnetic bands:

HDCAM:

It is the first HD format on the market with the caméscope Ciné Alta de Sony (HDW 900). It permits filming in 24p/25p/30p/50i/60i. Nevertheless this format is a little weak for mastering and projection because it creates loss of quality with each new copy (generations). This phenomenon takes place because the internal code of HDCam processes information in 1440x1080 with a sampling of 3:1:1 (for 4 pieces of information in luminance we calculate 3 of it and only 1 in chrominance!) then they project in 1920x1080 in 4:2:2. This is what we call a sub sampling. In summary, each time the images are reinterpreted by HDCam compression, they deteriorate with each copy.

DVCproHD:

A format developed by Panasonic first in 720p (intermediary format, 1080x720 pixels) which then declined to 1080i to compete with HDCam.

It is in 4:2:2 (without sub sampling) contrary to HDCam with one quantification of 8 bits per color.

Today this format is losing speed after being replaced at Panasonic by the AVC Intra, which has a bigger output of backup information.

HDCamSR:

A format created by Sony dedicated to digital cinema and to postproduction. It records in 10 bits without sub sampling with a strong output and thus a very weak compression. The processing of the signal is done in 4:4:4 which permits exceptional rendering of colors. It is nevertheless much more onerous than the HDCam which explains that Sony offers two formats that do not compete with each other.

The 2K and 4K:

The method of capturing changes in the world, we leave magnetic tape for Data recording.

Digital cinema effectively tends toward recording information via computer files on secure hard disks. This virtuality of images is entirely new and can again frighten some. Two types of recording are then possible: either in an "owner" file format readable only by machines of the brand (this is the case of RedOne for example) or in more open universal processing formats like Dpx or Tiff.

These formats have a great interest in being more flexible for users because they do not have constraints on processing, the size of the image or the band width while one records on tape.

2) Applications to Night Shooting

After this lighting technique it is important to understand how this change in technology modifies the esthetic and technical practices in night filming. For convenience we will approach the three aspects of the digital chain separately.

A. Digital Projection

To start with the projection might seem strange but this makes sense for two reasons. First because the finality of the film is very important for other choices in upper stages but also because this part of the chain is the one that we imagine concerns us the least. Outside of the domain of projection, the question of the quality of the dark colors that preoccupy us very much in our subject is in all respects crucial.

1. Disadvantages

Effectively until recently, the bad quality of projection of digital tools did not permit the rendering of deep blacks. The reason was simple: contrary to a film projector which uses the density of the positive to render the differences in luminosity, the digital projector sends different specific information for each pixel.

Indeed, while in film we obtain the black by a masking of density, in digital we will rather search to project a black pixel. It works in fact by sending a minimum of light which will be easily assimilated to black. Unfortunately given

the great sensitivity of our eye, this projected black appears to us as grey. Indeed, to render the black in lighting does not make sense. This aberration rendered the projected blacks digitally less well than those obtained by masking in 35mm.

2. The DLP Technology

Fortunately, the projection made a good one before with the invention of Texas Instruments and the DLP (Digital Light Processing) technology. The idea is that in place of lighting directly on the screen, each pixel is completed in a micro-mirror powered by an electric field: these mirrors can, if needed, mask the pixel containing the "black" information in the projected beam of light. Each one of the mirrors re-sends or does not re-send the light of the lamp towards the screen. This technology permits a luminosity varying from each pixel 0-100%, and then permits the restitution of more dense and deep blacks, as in film projection.

The majority of theatres that make digital cinema projection today in the world are equipped with projectors based on the DLP processor.
In 2007, Texas Instruments put on the market a smaller processor than the original silicon chip DLP: its length is 0,98 inches instead of the former 1,2 inches. This new silicon chip can be supplied by less powerful luminous sources than the 1,2 chip processor, which reduces costs in the creation and maintenance (the lamp…) of projectors. The projectors based on the 0,98 chip are destined for screens of small and modest size.

3. Future Perspectives

Today, the American organization DCI (Digital Cinema Initiative) considers that two digital projection technologies offer a quality of image at leas equal to that of 35mm: the DLP cinema of Texas Instruments and the SXRD of Sony.

The first offers an image resolution of 2K, the second permits projecting feature lengths with a resolution four times superior, the 4K (4K projectors can also project images in the 2K format.)

This chip put in place by Sony consists of micro-surfaces which, in place of moving like DLP mirrors, lighten or darken in function the information which is transmitted to them, they then re-send a more or less intense flow of light toward the screen.

Sony started to develop its technology later than Texas Instruments but the SXRD is adopted for a growing number of theatres notably in the U.S. and Asia.

B. Digital post-production

Today, the management of images in the laboratory is carried out more and more in digital. The special effects are executed in an incredible leap in quality and more decisive for us, the sampling tools are also greatly improving. The management of digital images posses effectively several assets:

The backup avoids loss of quality between copies if we have a master HDCamSR or if we stay in the DATA world.
The optimization and the conservation of original sources after filming "film" because the negatives are very much less put to the test because they are scanned then put to the side, subsequently.

The scanner of negatives, once set up for digital sampling, arrived at such a precision today that digital post-production permits fully taking advantage, finally, of the extraordinary scope of exposition with reel cinematography. For example the scanner created by ARRI can manage in parallel the 2K and the 4K with a precision of 16bits in quantification of colors. This precision of analysis permits extracting images of great quality from the machine in Tiff or Dpx format.

This allows in fact the operators to work differently in post-production and in filming. In the laboratory, one can search for information further in the dark areas of the image thanks to the analytic function of digital which for example works differently on the high averages or low values of luminance or on a single part of the RVB color spectrum.

These qualities permit thus several new adjustments: one can modify the contrast of an image, its saturation or again uniquely modify the red values of an image. In silver film, as one acted only on the curve of positive response impressed by the light, one could not modify the intensity and the color of this light for sampling.
The earning of trust is then enormous as is witnessed by this Laurent Daillard interview on the subject of *Man to Man* by Regis Wargnier, in the journal *Le Technicien du film:*

"*T.d.F: The sequence of night pursuit in the middle of the film is a real challenge in terms of image…*

L.D.: I have more and more trouble with resolving to light the forest, the night. In town, it's naturally very different, there are sources of all types which we can rely on. But in the country it suddenly takes gigantic proportions in terms of pre-light and expended material, for filming in a rather limited place. All that and more to lead to a rendering subtitled "You are at the cinema." It's for this reason that I wanted to shoot part of the digital sampling on Man to Man and to film entirely in pursuit of the "American night" of the third millennium. My worry again came from the weather forecast: I counted naturally on the grey-filled weather which is very common in Scotland, but the sky did not have the work plan! As chance would have it, we often found ourselves with a radiant sun! There again the standardization with Isabelle Julien permitted us to link-shot between different parts, the most delicate scene remaining the one of the collapse of Joseph Fiennes' horse, filmed in a heat wave. I was also able to keep the spirit of an evolution of light between the beginning and the pursuit, which seems to

unfold really at night, until the end atop the cliff, where the sky resolutely lit with dawn, the nights are short in Scotland…

T.d.F: The night sequence was then filmed without a projector?

L.D.: Yes, with the exception of little fluorescent lights on battery to give some light on the faces. In revenge, I often play the HF control diaph on the camera movements to be able to compensate according to the axis."

We understand that today the cameramen must conserve their night shots differently: the methods of post-production permit the execution of different and numerous precise adjustments to the image, their role will be to bring a maximum of information to the backup for footage in order to be able to leave the latitude of work optimal in the laboratory. But a problem is often encountered with the filmmaker at this stage of the film: as the cameraman looked to give priority to the harnessing of information, the image is often little contrasted, lightly super exposed in silver before the standardization.

For his part, the filmmaker has, most often, edited and followed the film since filming with this very particular setting of the image to which he is subconsciously attached by habit. It is necessary, then, that the cameraman discuss with the filmmaker to convince him of return thanks to the digital standardization to the image wished in upper stages of the capturing…

Otherwise said, it is very necessary to speak with the filmmaker in the upper stages, especially with digital, where he believes he can see the definitive image at each step, and to explain to him what involvement the technical and artistic choices have in common.

These new technical horizons lead to of course a modification of the work methods for everyone, the place of standardizer and the lead cameraman changed little in the process. So beforehand their relation was episodic and based on a system of propositions from the standardizer to the chief cameraman, we now see them working together, to advantage, for a longer amount of time. During two or three weeks for a long feature, the chief cameraman often comes to the laboratory to guide the standardizer in his corrections. In the United States the name for the standardizers changed: the "timer" of the period of the optical marksman, we passed on to "colorist" since the advent of digital.

"In the night scene where Jesse kills Ed Miller (Garret Dillahunt), Andrew wanted for them to ride the black horses but I explained to him that it would be very complicated at night. In this type of situation, we don't want to see to many details of the landscape, so I simply decided to light some little white trees so that we sense the background.

Andrew was fond of showing the characters so that they were heads without bodies, floating in the darkness, but I knew that it would be very difficult to capture these details seeing as the characters were advancing over a great distance. I lit this scene with a line of 10kw positioned about 150m from the

camera, cutting directly on the sun. I imagine that one could assimilate this source to moonlight. Andrew wanted a very particular light, silvery, for the night scenes, in this sense it was becoming unrealistic.

It's a scene where the digital standardization really was useful because it permitted using special effects on the horses to bring them out a little and on the other hand on the actors' faces to soften them. If we try to follow a man on horse over 100m with a fixed projector, it will become more and more burnt as he approaches the light except if the source is at a distance of at least a kilometer which was apparently not feasible. Thanks to digital standardizing, I could compensate for these flaws.

The most complicated scene in No Country for Old Men was the exterior night, finishing at dawn, of which we already spoke previously. The digital standardization was a great help, especially for the moment when the dog chases Moss into the river. From one shot to another the clouds left a place for the rising sun, which was reflecting in the

water. Thanks to the digital standardization I could use the effects to create the effect of the luminous sky despite the clouds.

Before we started to film Jesse James I didn't think of being available for the digital standardizing so I filmed numerous attempts of reference so that my standardizer Mike Hatzer could work without me. I have to say that the Efilm Laboratory was fantastic. I was filming in Connecticut and they were frankly sent for to put all the material in place so that I could work on standardizing at night and on the weekends. At the same time I standardized In the Valley of Elah in this same manner and the last weekend, I returned to Efilm in Los Angeles to validate the final rendering with the filmmakers. The negative side of this type of standardizing is that one must always be present during the corrections. There is such a number of variables and thus the choice that one can not leave anyone to decide in our place."

In addition to its capacities for modification to the image as a whole, the digital standardization permits us to reveal certain parts that are too dark or to diminish certain parts that are too light of the image, thanks to a system of masking. These masking effects can then be animated in time to evolve to the interior of the frame of the image in order to, for example, track the face of an actor that we rendered more elegant.

Of course the digital processing in post-production is only there to reveal the intrinsic quality of a format of the shot and to optimize it. One can thus, to "equal" backup, search for more information in the blacks and thus certainly dare more things at the time of filming. The head cameraman can take certain liberties which will permit him to concentrate on other more essential things for the *mise en scène*.

The digital standardization, used in 2007 on 40% of feature lengths, still remains onerous and is not, strictly speaking, in general use. Productions cannot easily access this technology which seems nevertheless poised to take the place of film standardization in the future.

C. Filming in digital

The choice of a digital camera in view of filming is of a crucial importance. At the moment, between HD video and Digital cinema, about twenty cameras of very different characteristics share the market. One part we will have to pay attention to is the formats of shooting, which as we have seen, are distinctive to each camera, but also to another important factor. Effectively, we say that in digital each camera contains its own film roll. This characteristic is due to another specific adjustment to digital which is that of Gamma. Gamma is the reinterpretation of recorded signals by the camera to render them closer to the human eye's rendering.

From the same sensor and in the same format, the contrast can vary enormously between two Gammas. The idea is simple: the gamma allows for assigning more or less brilliance to a captured white and more or less depth to a captured black. If the gamma is raised, the blacks are deep and the whites are brilliant but the rendering is very contrasting and if it is weak, the image will seem lackluster for the spectator. Nevertheless, for using cinema we have rather the tendency to favor a very soft image to the shot that we could re-constrast to the digital standardizing.

The quality of the rendering of gamma of the digital camera and the finesse of the adjustments which follow it (especially the Knee) could give a camera a great advantage over another in terms of flexibility to the shot and during the post production. In the frame of the night shot, it is evident that we have all the interest to recover a maximum of the information in the shadowy parts of the image in order to conserve, for the result, the details and nuances in these dark areas.

1. The HD Cameras to come from Video

The first digital cameras used for cinema were a result of video. Their reduced cost, their lightness and their acceptable rendering pushed several small-budget films and a good number of documentaries to film in DV (Sony format in 720x576).

Since, things have not really changed. For a price equivalent to DV, two new formats have appeared in HD which suit this type of use for a markedly more "diffusible" rendering on a big screen. The chief cameraman Caroline Champetier, for example, used a Panasonic camera on certain long features such as Amos Gitai's *Terre Promise* or Benoit Jacquot's *A tout de suite*.

These two new "light" HD formats which are Sony's DV and Panasonic's DVCproHD don't have the same image quality. The DVCpro is a format of greater quality which is often used via the HVX 200 camera. This little camera of fist is very appreciated in very light configurations. Heavy enough to be stable, discreet enough to go anywhere! This camera also has, for recording interest, HD video flow directly on a memory card functioning as a hard disk. Even more, it allows filming in progressive like in cinema. But this quality has a price. The

camera is not then often used in plenty of definition. We reduce it to 1080x720 pixels and we lose a diaphragm of sensitivity which senses especially in the dark zones.

For a more prestigious but heavier use, some television HD cameras were launched on the cinematography market very rapidly. The most well-known of the cameras is the Sony HDW 900 which records in HDCam format. This camera served to film the first digital films such as *Vidocq* or George Lucas' *Star Wars Episode II*.

We find in these tools an inherited ergonomics of the world of video which can sometimes pose problems to cinema crews. It's why the renter Panavision rapidly rented out a HDW 900 "panavisée" which can receive the brand's attachments and optics. The keen interest for this type of camera is rapidly spreading, the dedicated accessories were created and certain optics adapted to the capture format of 2/3 inches (a size close to S16mm in film0 designed for prestigious makers like Zeiss (Digiprime series). For reasons previously mentioned, the engineers appointed to this camera certain "hypergamma" adjustments which permit the users to move closer to a film rendering in terms of contrast and thus to go further in the work of low lights.

Sin City, Roberto Rodriguez's film of which we will speak later, was filmed with this camera from 2005-2006 comes out less and less in cinema filming and seems rather to have a future in tele-film. This camera was the first to record a signal in 24i/s progressive adapted to cinema post-production.

Pierre Milon's commentary at the site of the AFC on this subject:

"For the film 'Lady Jane' (by Robert Guediguian), I opted for the Sony 900 with a Fujinon classic zoom. To monitor everything, Guediguian working without combo, I used the Astro which was indispensable to me for the oscilloscope. I spent some afternoons at TSF to familiarize myself with this camera. I thank them for their availability and their patience because it was necessary to repeat things to me three times for them to go in. I worked with a crew identical to a film crew except for my assistant who was alone. In seeing the film today, it is exactly in the tradition of Guediguian's films. I regret a little that we didn't find, with the digital sequence, a stronger singularity to the image…"

Another camera designed by Panasonic, the Varicam, has a profile close to the 900, being also issued from Video. It records in DVCProHD with a slightly lower image ratio (1080x720) but allows, contrary to the Sony camera, doing slow motion until 60i/s in progressive. This camera which enjoys a "Cinegama'' for a rendering adapted to fiction and the eventual return on film, did not, nevertheless, have the success of the Sony camera. Its use in France stayed rather secret, in cinema in any case.

Very recently, Panasonic put out a new generation of digital camera with an AVCIntra format which permits a more qualitative in relation to DVCProHD with the same output. Here, it's the compression which was improved to give images of more definition the same points as the former ones. The new camera of

this product range, the HPX-3000, nevertheless remains in ergonomic issue in the world of video.

2. Digital Cinema Cameras (D-cinema)

Several elements permit the characterizing of a digital camera and the differentiating of it from an HD video camera:
The size of the image and the standard used: (2K or 4K)
The recording backup which is most often in magnetic tape or in Data
The ergonomics of the camera, its level of noise and its compatibility with camera accessories and existing optics in cinema.
The size difference between the HD and the 2K do not seem "flagrant" for the user, some HD cameras which replace other conditions are similar to the digital cinema cameras.

a) The Viper

The first camera to appear in digital cinema, the Viper was designed by Thomson GrassValley in an exclusive cinematographic perspective. It was very quickly in demand with cameramen (Michael Mann's *Collateral* in 2004) notably for the few concessions that it makes to quality and because its capture permits shots in 2,35 without trimming the image.

This camera records files (in Data) in Raw format, which, as on actual digital photo cameras, permits conserving the great latitude of capture of the shot at the time of recording.

It's this characteristic which makes the Viper very efficient in the case which interests us. The images are recorded on Data on digital store (Venom Flash) or Dmag S-Two recorders, heavier but with a greater range. The Venom recorders designed for the camera give it lightness and flexibility similar to film. Capture is done in 4:4:4 and in 12bits, this camera permits recovering a great number of color information in shadow zones. At night, the Raw mode allows a greater flexibility.

Viper Camera in configuration of filming with the Venom store which has a range of 10 minutes in Raw mode (Film stream). We find then an ergonomic very close to that of a film camera. The descendant of this camera's philosophy will have in addition an aiming reflex and a mechanical shutter inherited from film like the D-20 Arri or the Dalsa Origin.

Interview at Cannes by the AFC with Philippe Van Leeuw, for the film *Les Bureaux de Dieu* by Claire Simon:

"AFC: Which camera did you choose?

PVL: The Thompson Viper with a fixed Fujinon series. First because it's the only camera capable of capturing images in 1:2,35 format (thanks to an ingenious function of the re-composition of pixels on its capture) without having a 'zoomer' in the 16/9th HD image. Also because it was more affordable that its peers (Genesis or D20). Used in a "Data" configuration, recording non-compressed FilmStream on hard disk (STwo or flash Venom store for some shorter shots) I recovered the integrity of HD signal and shot the best part of it in postproduction.

AFC: Did you encounter some limits?

PVL: All the same range. Each digital store on hard disk (D Mag) from STwo system having about 30 minutes of recording, one could not capture at the maximum two complete shots by store. At the same time, it was necessary to be able to manage all the information. In effect, the D Mags necessitate being downloaded at a service provider (for this film, TSF), and between the logistic and the downloading time, we didn't have the possibility to use at maximum the 6 DMag per day, or at maximum 180 minutes of rushes.

AFC: How were you able to pre-visualize the image on the film set?

PVL: On this shot, we were still very sparse. They had promised us at the time some LUT pre-visualization attempts compatible with our monitor, but they were never created. I tried in its place to use some preexisting LUT, put in place for other films or calibrated by TSF, but nothing was completely satisfactory. Some function well for low lights, but not at all for clear parts, and others vice versa…So I then became accustomed to looking at the "primitive" image on the monitor, in the manner to precisely visualize what was captured by the camera. By especially watching over it to not pass over into the extremes.

AFC: What is your assessment on this point?

PVL: I noticed an extreme latitude in high lights (+ 4 recorded diaphs), it's rather rare to find oneself with a white patch on the image! On the other hand, in the dark parts, I was made to trap myself two times, the signal being very present on the filming monitor, but the outline being even so under-exposed at the end of the chain. We suspected on this point a recent 'upgrade' which would have undergone 'firmware' from the camera, making it strangely less efficient in low lights…And as we know it, in these update stories, we cannot then return behind the times. On this subject, I would quote my friend Pascal Lagriffoul,

AFC: "Finally, in HD, we pass the time proposing the solutions to problems which did not exist beforehand!"

AFC: And the positive aspects?

PVL: Certainly the manner in which the Viper captures colors. As the signal is flattened on green information, all the balances of colors between the light of day and artificial light are cancelled. One has the sense, then, of seeing with the camera literally as we see with the eye. I even had fun on some sequences mixing the sources. For example, I used a non-corrected Dino Light (3200 K) to cheat the sun which came in from the windows; this effect mixed itself with the ambient

light and various 5600K fluorescent tubes or other small things on the inside. All that balanced in an extraordinary manner, and it's very different from a normal rendering from other HD cameras to balance the whites or even of course the film. And then, this extraordinary latitude in whites which I mentioned before."

These two images are from the same photo recorded in Raw. By uniquely modifying the luminosity and the contrast, we arrive at recovering enormously the details and the colors in the blacks without losing anything in character and of the original intention of the shot. This latitude allows, of course, showing night differently than in film.

b) The Genesis

After the Viper appeared two new digital cinema cameras. Although recording in HD format, these cameras were designed by the two biggest constructors of film cameras. The Genesis was designed by the American brand Panavision with the help of Sony and the D20 by Arriflex, German creator of film cameras.

The Genesis, placed on the market in 2004, started to become more accessible in prestigious productions or publicity in 2006. The recording, with this camera, is done in the HDCamSR format designed by Sony, either on Sony magnetoscope (SRW-1) which installs itself like a store on the camera, or on a new digital Data recorder (the SSR-1) which functions like the Venom flash on the Viper.

La Genesis® avec le SRW-1 embarqué (gauche) et le SSR-1 dans la même configuration

This camera served notably in filming the Brian Singer film *Superman Returns* or Mel Gibson's *Apocalypto*, or in France, the dernier *Asterix* and Jean Jacques Annaud's *Sa majesté Minor*. Genesis has the advantage of possessing, contrary to the Viper, a capture of the size of Super 35mm (16/9 relationship thus not possible to film in scope!) which permits placing all of the scale of Panavision optics on the camera but also finding a more cinematographic depth of field. Functioning in the same spirit and with the same recorders, the F23 Sony camera which just came out very much resembles the Genesis. Its internal processing is practically the same; the only notable difference is its capture, smaller than that of the Genesis.

c) The D20

For its part, Arri, in putting out the D20, took part in the same perspective of development since the film camera, while going still farther. Its definition is 2K and not HD, its capture 4/3 in 35mm format allows the use of a scope of optics and finally a shutter and an aim inherited from film which, then, increases the comfort of work for the cameraman. The problem with this camera is its backup

recording which was hazy for a long time. The recording can be done in HDCamSR as on the Genesis during a time but also in Data with Flash stores like those of the Viper. Unfortunately this camera which has more ambition than the Genesis was badly sold (arrived a little late) and badly designed (numerous returns in Germany for revision took place with the D20 on location at Bogard.) Finally this camera, which is as precise and interesting as the Genesis in the management of dark shades, virtually remains in the prototype stage.

Since April 2008, ARRI presented its new digital cinema camera, the D21 with a new "Data Mode 2K- ARRIRAW T-Link" in RAW 12 bit Bayer thanks to a new connection with two HD-SDI cables for transporting the signal. These cables which allow sending a n output of 2,5 Gbits/s, give the camera an increased length than the Genesis, all by keeping the option of recording in HD in 1080 for lesser needs.

On paper, Arri advertises an exposition latitude of 11 diaphs for this camera and a very big latitude of pose because one could use it from 100 to 800 iso. If this camera functions well, it could be the first digital cinema camera totally accomplished in terms of conception (it acts practically as a body of film camera with a digital "screen" as in the photo which in addition accepts 35 mm optics) but also in terms of definition (2K) and recording (Raw Data)!

d) The Red One

This new camera of the Red brand created by Oakley (sunglasses) relies on the same principle as the D-21. One has the choice between a multitude of formats (HD/2K/4K) which records on a hard disk or on flash cards in a code called RedCode Raw. This camera has not filmed enough at the moment to be able to say what its real capacities are. Sold at a price defying all competition (and from a distance…) and announcing extraordinary results, it leaves certain professionals circumspect. That as much as that RED has a very important policy of secrecy which blurs the trails and prevents determining between a stroke of genius and a smokescreen. The question which is behind the Red is: what does this digital camera sacrifice to the large image size that it proposes? We know that

the output of information that it processes (30 MB/s or 220Mbits/sec) is two times inferior to the Genesis with an image four times bigger in 4K! We doubt whether an equivalent definition in these difficult conditions that preoccupy us, a notable difference would necessarily be visible.

As the camera's capture is called Mysterium, the recording, REDCODE, and the standardization software, REDCINE, the user never knows the reality of the material with which he works. It seems proven, and it's only the eye which can judge, that the process of capturing with the camera (we speak of 8 diaphs) is far inferior to that which we could notice on other digital cameras (between 10 and 12 diaphs of latitude advertised).

On its internet website RED explains thus:
"The REDCODE is a magic code (pffff…) *which compresses the 4K Raw camera image to a usable file which can be recorded on whatever type media, from the compact flash card to a hard disk. Without the REDCODE in 4k at 24i/s the information output would be then 2,6 Gbits/s (20GByes/min)."*

Photo of the Red One in use…One can easily see here that the camera's plastic, which has nothing to do with the normal streamlining of cinema cameras, is rather damaged…

e) The Dalsa

The Dalsa Origin is a camera of engineers! Dalsa has been, for years, a maker of digital captures of high quality for very precise uses in medicine or the industry. Designed the opposite of the Red with a cost also immoderate of its weight, the Origin camera does not make any concession to its quality. The capture in 4K is done without compression with only one compression, of the camera's Raw information, of the lossless type, as in a ZIP file.

This characteristic confers to the image of great richness drawn by Dalsa because the internal processes of the camera and the recording can be done in 16bits of quantification, which is unique right now, still more in the 4K format.

Apart from the quality of its capture and the richness of its recording, this camera is able to give a dynamic at least as good as 35 mm film (12 to 13 diaphs of latitude!) all while proposing a curve of digital gamma which is optimal in low lights. The recording in Raw gives thus great latitude of exposition (have another look at the night photos on the subject of the Viper) but here in unequaled definition and depth of color! The signal is so rich and heavy that no

standardization machine now permits working directly on Dalsa images in their full definition.

The most often, a pre-standardization of Raw is done in order to be able to limit the extent of the spectrum of luminance, thus a reduction to 10 or 12 bits for post-production. These adjustments make the effect of a "diaphragm" of post-production where the cameraman chooses his definitive pose to be able to then standardize; the pose in filming becomes only a path and aim especially to accumulate a maximum of information.

In this sense, the Dalsa functions a little like a film negative which has a very great latitude, but which cannot be exploited such as, in all its amplitude, on the positive copy.

The "practical" limit of Dalsa concerns the management of images and their storage. In full resolution (Raw), the output is 1,2GByte/s (either 9Gbits or 1 Terabyte all 15 minutes!) It's why an algorithm of owner compression (2,2:1), called L3, (Layered, Low-complexity, Lossless) is applied and must be decompressed in post production.

This camera seems, on paper, the most adapted to night shooting because it combines a high definition with a great latitude of exposition. This permits collecting numerous information in the dark zones, which will be as many shades of color as good surprises for the standardization.

3. A very different reaction from film

a) a difficult sensitivity to quantify

As we saw previously, the color quantification's dynamic and quality is not enough to judge the digital camera's quality and still less its sensitivity. As in film, we speak, in digital, of Gamma, but the reaction to this factor of contrast does not represent the straight part (average values) of the analog system, which is film. In digital, the Gamma is the camera's global response to luminous signals that it receives according to a precise signal standard. Effectively the digital signal is the electric order and diffusion is previewed between 30mV (black) and 0,7V (white) for a video signal considered usable from 0 to 1V. The gamma of the digital camera will be adjusted in a manner to give in this short electronic "field" a maximum of shades in relation to the photographed scene or a maximum of contrast.

Indeed the visual rendering of signal recorded by a camera (and thus its management of information in sight of standardization) will be more or less interesting according to the Gamma suggested by the maker or chosen by the user. Two types of practices are noted: in HD cameras resulting from video, we often find two types of Gamma one of which for fiction (Hyper gamma at Sony and Cinegama at Panasonic). On the contrary, D-cinema cameras always opt for a very soft Gamma which maximizes the capture of shades.

These gammas are often owner codes. I could have filmed my film at the end of my studies, the culmination of the research of this dissertation, with

Panavision's Genesis, which films with a Gamma called Panalog created specially for the camera and which gives it a large latitude for shooting. Each camera which records a video signal on bandwidth needs to satisfy this type of constraint. The cameras which record in Raw are rightly sensible not to possess another Gamma than the one appropriate for analyzing capture, where use of Raw files (primitive) are not necessarily diffusible as is but give a latitude optimal for post production.

Also the problem at the release of this type of camera is to obtain a video return acceptable for *mise en scene* because the makers are again persuaded that we can, in digital, see the final image on the film set! The conversion boxes which interpret Raw or Gamma from the camera to assign it pre-standardizing are parameters to help the LUTs (Look Up Tables). Several materials are circulating of which one is Panavision's Gamma Box which serves to modify the camera's Gamma for visualization.

We understand very well the difficulty of interpreting the quality of luminous reception of the camera in terms of film sensitivity. Effectively according to Gamma and the Raw recording mode, the nominal sensitivity will not be necessarily the same in the dark zones and in the clear zones. It's already the case in film furthermore, but here the effects are more spectacular because the gamma can vary very little in low lights which will give a very soft aspect to the image's shadows. For example, on *Leila* we tried to use the Genesis to several sensitivities and several adjustments permitted us to (deactivation of shutter, gain…).

In passing 400 – 1600 iso with the camera according to the needs we had to adapt certain difficult configurations of light to our small methods. Evidently some shots filmed at 400 iso with Genesis will have the necessity rather of 800 iso in 35 mm especially when the dynamic of the image is very strong with lots of details in big lights. Contrary to film, I neither had to lighten the shadows nor light the rest to obtain beautiful blacks…or very little! Effectively all the first sequence of the film, a real photographic challenge, was filmed only with a Kino Flo tube lowered to 18W (with gelatin…)!

I will cite, to extend this reflection, another excerpt from an interview for the AFC by Gerard de Battista on the subject of Claude Miller's film *Un Secret*:

Wilfried Sempé: The fashion in which the light falls on the faces of actors, in which the half-light sculpts the faces, really succeeded, so that we don't sense the projector, we have the impression of natural light.

Gerard de Battista: For nighttime interiors, with Jean-Pierre Kohut-Svelko, we did not have trouble with the lamps in the field, without necessarily lighting them all. I worked a lot with the cubes and the fluorescents, sometimes hidden in the décor, to double the natural light. For the lights styled as petrol lamps, it was lit by petrol. We had nothing more, for example when they go up the stairs in the country house: the shadows sweep the wall at the same time that the person who holds the lamp moves, and I love that. I suggested a little the petrol lamp, because we had tried with the curves of Olivier Garcia (ingévision), who suggested to me a curve for working at 9db without sound.

We did it in attempts with a petrol lamp, and that worked very well. In the scenes in the room, there is a little firefly with a 40 W lamp increased to reinforce the petrol lamp, and in the love scene, there is moonlight which enters from the window, it's a little HMI, the usual thing.

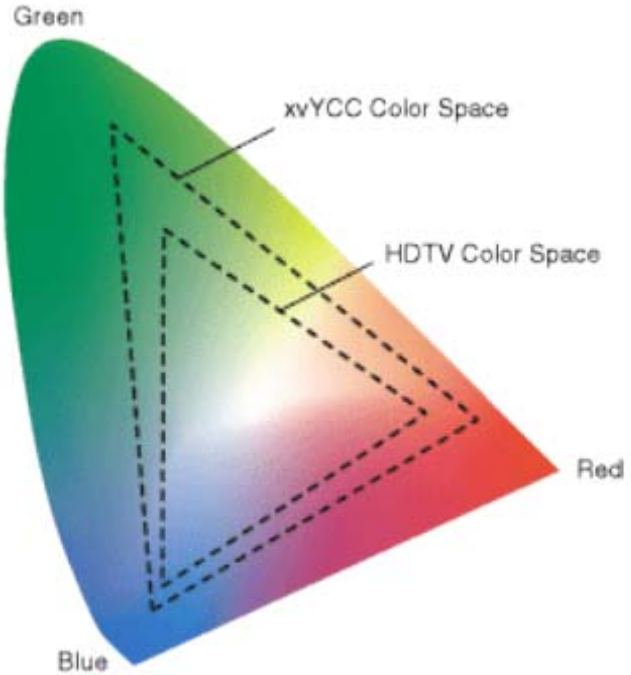
If we had filmed these interior scenes in film and if I had taken out a cell, I think I would have raised the light in power. We filmed in full overture, without pushing the gain, in studio for the night scenes we were at 0 db, but at 2, 2.1/2 diaphs, and with the fashion in which cameras respond in low lights, to have as much flexibility and the material in the under-exposition, we lit as if we were at 1,000 or 2,000 ISO, surely, and not 320 (nominal value of the camera in the middle of the curve).

WS: It's true that there is a kind of method, but we could go much farther, because the foot of the curve is really large…

GdB: In the middle of the curve, we are good at 320 ISO, I measured it on a grey neutral, with the camera's auto diaph. It's a kind of bizarre film, because it displays 320 ISO in average colors, but much less in high lights and more in low lights.

b) The spaces of colors and 3D LUTs

The other worry to pay for when we film in digital, and which is essential in our case, is the conformity of colormetric spaces between different stages of the workflow. Effectively, a D-cinema camera, a 2K projector and a positive film do not have all the same characteristics in their rendering of colors.



Here is a comparison between the HDTV space of color and the XYZ space which characterizes digital projection. We notice that it will be necessary to lightly convert the HD image to balance it in relation to that of the projector. Sometimes it even happens that some color spaces don't have certain colors in common; it will be necessary then to convert them in another space.

The role of the LUTs is just to integrate all the parameters in order to be able to pre-visualize in the defined colormetric space the final rendering of the image.

Of course, working without LUTs, or at least not doing trials in upper stages, can be dangerous because we believe we have captured an image in the shoot but this is not necessarily 100% compatible with the post-production profiles.

On *Leila*, I had this problem on some night sequences which were revealed darker and less saturated in post production in relation to filming.

The LUT is going to vary for each film because it is a simulation of all the workflow: for a classic film it understands the profiles of the camera, the digital standardizing projector and the film used for the final copy. Maybe added to this the propositions of standardizing which are close to *mise en scène* (for effects close to whitewashing, for example) or a specific profile for a comparative in difficult situations between a gain to the shoot on the camera and a "thorough" processing of digital information. On *Leila* we had thus thought with Thierry Baumel from Éclair, which followed the film, to have two LUTs on the Gamma Box: a normal and one which simulates a thorough processing of 1diaph and a half in post production in order to be able to make the choice between the camera gain and an adjustment at the lab according to the situations…Unfortunately Panavision's Gamma box was not, in the end, available on our dates of filming.

I will finish here with a quotation of Michel Abramowicz (my tutor on this final work of studies) which shows a certain wisdom in relation to the use of new digital cinema tools.

He introduces in this text the film *Taken* by Philippe Morel to his colleagues at the AFC. Some sequences of this film were filmed with the Panavision Genesis for the exterior night in Paris:

"Some sequences demand a lot of light. We decide, then, to do certain night scenes (not all) in HD. The sequences which it is necessary anyway to light (outside urban circuit) remain in 35. I like the idea of working in hybrid, of mixing the techniques, of not being systematic, of taking what is good and practical in each technology.

Film is my culture, my education. Our career finds itself in the middle of a technological revolution which primes its second half! What pleasure to use the technical instruments for them to give us the best! Film remains flexible, a known instrument and relatively light, rapid in use. Digital remains very practical for its sensitivity. Very good experience that I hasten to repeat very soon. I think that, in the near future, we will no longer have the choice, the workflow will be complete. And there will be no reason to continue to work on film, so take as much advantage of it!"

3) Toward a New esthetic?

All these technical revolutions of which we speak highly have, fortunately, had an esthetic impact on the manner of telling stories which unfold in the night. Very quickly, the very strong response in the cameras' dark shades permitted (in documentary, for example) going farther in capturing images. In DV, the NightShot mode permitted filming a part of the infra red spectrum of the light

while revealing to the spectator images of a new genre which were exploited from time to time in cinema (unfortunately the NightShot was not adapted to more demanding cameras which today use the cinematographic production.) Since, none of the cameras made for audiovisual sought to exploit the receptivity of digital captures in infrared.

Here is an image filmed in NightShot with a small Sony camescope. The noise is very important and the sensation of light increases as the subject advances toward the camera. These constraints make this "gadget" little use for a cinematic application.

The NightShot is in fact even the essence of the fantasy of some filmmakers who attempt to see in the dark by all the methods to lighten their *mise en scène* and create a singular visual ambiance.

A. New lights on the night

1. Liberty, I cry your name!

This need of liberty, which forces a closer system to capturing beforehand, really changes the information for esthetic and categorical questions. The fact is that until then, spectators did not see the night differently than interpreted by the light of the cameramen, which made them accustomed to a certain artificiality. Thus, primitive images filmed in full night, without the "prism" of cinematographic lighting, have the inverse effect of the outlines of fiction filmed with the same system in plain day. They do not result from a sentiment of realism and of reality but rather something strange. We suddenly feel the gravity, the anxiety, the trouble because this image moves so close to our vision that it is disconcerting.

The use of the great sensitivity of digital cameras of which we spoke highly in the American cinema industry thus permitted the birth of this new type of image, which did not exist in film.

The most talked-about example of this type of choice is the filmmaker Michael Mann.
Here, in order, some images resulting from his last three films filmed in digital. The grain is important, giving the image a bit of a dirty quality, but the definition and the light particular to these images give them a real esthetic force because they are the fruit of a real artistic bias.

In the United States, filmmaker Michael Mann is a fervent defender of digital, which he uses in a specific and reflective manner in these last three films. It does not act, there, as willpower to be state-of-the art technology, but really to exploit the tool to the maximum for a specific need in the *mise en scène*.

It is interesting, in approaching a little, to see the career of Michael Mann in relation to D-cinema. In 2001 on *Ali* (photo above) he uses HD for only one sequence in the film (the first) which presents the character interpreted by Will Smith. The boxer does his jogging in the street in full night but the ambiance does not resemble at all the view elsewhere. The moon seems to light like the sun and the clouds are menacing as on a rainy day.

Afterwards, in *Collateral*, digital is going to be solicited for all film sequences which unfold in Los Angeles at night. For three quarters of the film, the 35 mm camera was then abandoned in favor of the Viper which records images in Raw and so manages the low lights and the colorimetric difficulties to connect the urban lighting. We are in 2004 and the gamble of filming a film of this financial stature in HD seems again surprising. Thanks to these technological choices, the changes of axis are rapid, and also the installation of lighting.

The end sequence, leaving a chase in the shut-down offices on the second floor of a building, is a great success. The night is black in the interior and clear on the exterior. It is the reflection of the city's lights on the clouds which restores a bit the level in the offices and especially creates a luminous screen on which the characters glide in silhouette. This light bias dared and succeeded in length because it did not create frustration for the spectator.

In 2006, Mann again did a remake with *Miami Vice* which was filmed exclusively in Viper. In this film the biases are even more unabashed; sometimes to outrageousness. The grain is very evident; the camera crosses the action in a documentary style with very large lenses. The digital Flash stores (Venom) made their appearance which confers a great liberty of frame on the filmmaker in low-lit sets.

Behind the system that we believe to be the fruit of chance or lack of the image's ambition, we discover in fact a certain meticulousness, and especially a real intelligence of the lighting. The skies are often filmed with clouds which reflect the light of the city; characters are always lightly lit when narration or acting demand, the quality of dark colors is often good in projection because despite grey or orange skies, the cameraman always silhouettes an element of the set or to create a contrast with deep blacks in the foreground.

We understand than that to film in this manner is the fruit of long-term work between a filmmaker, his cameraman and a particularly interesting tool for this type of film. Nothing seems left to chance in *Miami Vice* and even if certain moments border on bad taste, the image is one of great coherence with the subject and the city which it depicts. Miami, city of money and appearances, is seen under a very different angle than the one we know…nothing better for a film which speaks of its vices.

The first sequence of *Leila*, my film for the end of my studies, was filmed according to this principle with the Panavision Genesis. We used the camera with a gamma (panalog) powered by 1,5 diaphs and disabled electronic shutter (its

opening would be about 360° in film) to obtain a result rather close to that which Michael Mann can. It is notable that cameras such as D21 or the Dalsa do not permit this type of adjustment which doubles all the same the quantity of received light.

We were then at the sensitivity of the 2400 ISO that is 2,5 times the nominal sensitivity of the camera. The entire sequence was lit with less than 20W, the adjustments to the face done by a diffused flashlight! I am very happy with this photographic "experience" which proves rather successful. For this euthanasia sequence having a film set almost empty of material and very calm gave us a real emotional gain and concentration. The lighting set-up being reduced to the simplest expression, we could film quickly while changing axes in an instant and avoiding, in choosing the frame, constraints due to the light.

Photograph of Leila: we made up for the exterior sodium ambiance with a tube of fluorescent balanced as the only source.

On the same principle as Michael Mann, some other directors also decided to use digital cinema cameras to free the technical constraints and to differently tell nocturnal stories. We think in film of Cedric Klapish, *l'Auberge Espagnole* which was filmed in HD with several very clear night sequences of which one had the light turned off in the entire apartment.

2. Less material for the light?

This new liberty for filming deep night is also of the technical order: the great sensitivity of cameras, especially in weak light, permits much less lighting of certain sequences, for which a somber rendering is sought after. On the filming of *Leila* I then sought to develop the system of film with the history of the

character. The foreground of half-light is lit with 20W and the backgrounds are lit with 20KW (sometimes more…).

Here is one of the last shots of half-light of Leila. Here I used strong sources at a distance for a softer half-light rendering and a more important beach. There are in all 8KW HMI (=20KW in tungsten)

In addition to the advantage of reducing the necessary lighting material, I discovered that one of the real advantages of digital for lighting deep night is monitoring (screen but also oscilloscope). Even non standardized and without LUT conversion, a screen permits seeing what information exists in a tangible manner in the signal and can eventually be recuperated in the final image. Without LUT we of course do not have the certainty that it will be the case on the final copy but we can all the same get an idea of the pertinence of the diaphragm put in the camera. In addition the oscilloscope which allows verifying the recording of video signal is much more précis than the measuring instruments sued in film, in fact its function is different and also possesses other flaws.

Always it is only the oscilloscope that can bring precision to the weakly lit parts where a unit and a spot meter would indicate a diaphragm underneath 1 and thus impossible to interpret (on instruments on the digital screen, an error message appears in this way.)

Indeed, we will be able to dare to work at the border of interpretation and dynamic much more easily than in film where the result is visible only days after. This reason, much different than questions of sensitivity of backup, is much more important in my opinion because I am not sure that a film of 500ISO powered by a diaph approaches, with its great exposure latitude, the actual digital quality…

The liberty that D-cinema gives cameramen is to take risks with the shoot, all in not playing with fire. These risks must of course have a meaning in relation

to the film which one films and the story which one decides to tell through the image with the filmmaker. The light system (in light!) allows the Viper or the Genesis to serve some films and not others. It's why digital cinema cameras are still considered as particular tools by the users. In *Taken* by Pierre Morel, for example, the Genesis is used for some night scenes which unfold in pursuit on the quays of the Seine in Paris. In 35mm it would have been necessary to light hundreds of meters of the street for the several stealthy shots there where the Genesis worked with the ambient light of the city. We really see that a carefully thought out use of these tools where they are the most efficient (in low lighting), can allow truly new technical systems.

Nevertheless, today, with the new generation cameras the question inevitably remains. In *Leila* we filmed some day sequences to judge the quality of the camera in this configuration. It seems that strangely the camera responds in a manner closer to film, more anticipated (thanks to Panalog on the Genesis). The image recorded in day, if it was well composed, is luminous and very realistic, it is less surprising than that filmed at night because it is referenced in our seasoned spectator's eye. Contrary to the night images newly captured in digital cinema as Michael Mann does, we are more engaged because they are closer to our perception than those filmed and re-lit in 35 mm.

B. <u>Privileged Uses of D-cinema:</u>

In a completely different approach, it seems that digital cameras are also used in a qualitative perspective in shooting to continue to follow the classic practice of cinema. The idea is then to use the intrinsic qualities of the cameras to improve the design of images; especially for very specific lighting issues or with many special effects and complicated inlaying. For obvious technical reasons but also for numerous practical reasons this use becomes more accessible today.

Since film was filmed in original digital and placed to the side of a laboratory and copied out later without any loss of quality to the duplicate (in DATA in all cases where en HDCam SR if it's also the filming format). The file can then circulate more easily afterwards which permits more evident conformity of workflow if several providers must work on the same element.

This then greatly facilitates the work for filming in Data in relation to filming in film of which the Scan is nothing but a digital copy of an original negative.

Several films then made the choice to film in D-cinema to lighten their post-production, such as Thomas Langmann's *Asterix aux jeux olympiques* and Jean-Jacques Annaud's *Sa Majesté Minor*, two big French productions in 2007 filmed with the Genesis.

The numerous inlayings of sets and animations during length of the films persuaded the producers rather rapidly, despite a moderately higher cost. Later numerous French films took the step, notably under the influence of head cameramen like Yves Angelo or Jean-Marie Drejou in France who have filmed for some time in HD.

Jean-Marie Drejou, head cameraman for Jean-Jacques Annaud's *Deux Frères* in HD, is placed in digital cinema for using the Genesis for the first time in France on Dany Boon's *la Maison du Bonheur* and, since *Minor*, on Fabien Onteniente's comedy *Disco*. Despite the flaws of the camera which still limit its use for some, he uses it like a 35 mm camera capable of following a film's length and of adapting to the various light conditions.

In certain visually ambitious films such as David Fincher's *Zodiac*, the potential of the Viper seems optimized to the maximum in dark shades often with very fine and rich hues which give a special ambiance to this thriller.

This very esthetic film, which seems often very lit, wins with the Viper on the rendering of faces which are often left very grey by dramatic intention.

We then see all of the scale of the digital capture dynamic which yields complex shades of complexions of the skin even in low lights; where film often changes dangerously into colorimetry.

The question of the pose of faces is, of course, one of the principal preoccupations of the head cameraman for which digital is also very interesting. In dark areas we will be able to recover rather easily the information during standardizing all while keeping a balanced complexion even in lightly hair-lighting a face. Without necessarily leaving a realistic perspective, we will be able to rather easily find an elegant balance between disturbing darkness and the readability of the look and expressions.

In Zodiac, the look of the actors is often in shadow, as in these examples, but the quality of Harris Savides' lighting and the camera allow a rich rendering of shadowed faces which is readable for the spectator.

Here, next, an image of Leila where I tried to work on the same type of shadowed but expressive faces all while maintaining the material and the colors of the skin.

Digital was also used judiciously for certain nocturnal films which for the most part resort to retouching the image and to compositing. We think specifically of a film like Robert Rodriguez's *Sin City* which functions almost exclusively on this principle. In this case the filming was done entirely on green screen in HDCam which was at the time the best digital recording format. The integration of sets in post-production and the sequences of actors in black and white were strongly facilitated by video filming. In final we get again a film which treats the night with a new, esthetic, rather passionate look.

D-cinema is now often used for this type of film inlaying. We think of the last two components of George Lucas' *Star Wars*, but also of films such as Brian Singer's *Superman Returns*, filmed in Genesis.

The techniques of inlaying are better left to digital filming because the color information is easily manageable on the set; the integration is able to be done directly if needed and less static HD noise prevents certain aberrations on the edge of masking.

Here is an enlightening commentary from Jean-Jacques Bouhon on the subject of the film *Elephant Tales* which appeared on the AFC site:

The planned scenes demand rather numerous special effects because the film stars do not often accept appearing together in the image: Natty, the giraffe, and Chan, the chimpanzee, were the most capricious, not to mention the lion cub, born during the preparation and whose training radically lacked time…

The HD (here HDCam in 4:2:2 with a strong compression) is well known for not being an ideal backup for special effects, in particular green and blue screens. Also the visual effects specialists were brought from Australia, all the material for recording in 4:4:4 directly on disc (DATA) and thus avoiding too much compression in the recording on the cassette. This installation was not at all a rest in the sticks…

4) Conclusion

At the moment, digital cameras are still used very little and the standards are still too different to be able to speak of a digital revolution. Some cameras to come will certainly continue to jostle the established order like the Sony 900 or the Viper did but it seems that globally the philosophy aims rather to approach at maximum the 35 mm and its use on sets. This somewhat vain ambition, because the two technologies are two different to be truly comparable, has the interest of shooting for the high quality of digital cameras which depart in terms of conception of the world of Video for that of Cinema.

For cameramen the arrival of digital cinema is a windfall because it allows doing certain images differently. In nighttime stories, it opened new categorical ways of great modernity and of renderings of great finesse despite a cost and an excessive bulk for the most recent cameras and a post-production still in its infancy, a bit.

Today it seems obvious that the digital is the production chain of the future but also that 35 mm has some characteristics, richness, a grain, at least as interesting and important for the image of film and that digital will never know how to render perfectly…

<u>CONCLUSION</u>

For the issue of this "inventory" on the question of the deep night in current cinema, we can of course question the future of our cinematic practices and the new technical issues to come.

Digital technology, which has advantages in terms of capture and of light in relation to 35 mm, will inevitably continue to improve without ceases as it has done for years. The coexistence of cameras like the Red and the Dalsa which are exact opposites in terms of rigor of conception and of quality has something seductive when we know that it films everything in 4K, the format of the future for cinema production.

In post production this standard is also under consideration and some films in France and in the United States are starting to be processed in this format. This race for definition is important but it seems to me that it is far from being the priority for one notable improvement of the image that the spectator perceives or that on which the filmmakers work.

At the moment digital shooting is still desperately short of a standard shot common to all camera brands which could clarify notably the use of the Raw in cinema. This format is the ideal solution for conserving the captured image in its entirety during all of the production chain and not being able then to change arbitrarily in its conception according to different cameras.

The evolution of film shooting to digital seems inexorable but a revolution does not really seem to have taken place. The technical contribution of digital is not strong and affirmed enough for our fashion of making images to be fundamentally replaced as a result.

The importance as we saw in this dissertation is especially to determine the technical constraints which pose a manner to respond to a desire for *mise en scene* to filming and night sequences.

When we think again of the difference between dense dark shades in Andrew Dominik's *The Assassination of Jesse James by the Coward Robert Ford* and of the luminous and almost organic image of Michael Mann's *Miami Vice* we see very well interpretations that authorize darkness. The fundamental difference between these two types of approach is not technical; it is above all esthetic, categorical, because it results from the sensitivity of very different filmmakers and photo directors.

The choice of digital is then a tool which brings comfort, ease, and lightness for the films which have need of it.

The important thing for these dark night sequences is to know what we wish to tell and to find an adequate method which will make this particular experience come alive for the spectator.

The essential thing when we walk in deep night is not the pair of sneakers that we wear; it's especially to really look where we put our feet.

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