The Look of Film

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Part 1 – Film vs. Video

Film is beautiful. It is an actual physical object that can be held between ones' fingers. It can be viewed directly, cut into pieces and reassembled with mylar tape, or even scratched, drawn on and baked in an oven to distort its delicate emulsion.

Basically three layers of light sensitive silver based chemicals suspended in an organic emulsion and uniformly spread over a long perforated strip of acetate, it is the stuff dreams are made of. The "dreamy" look of film is largely based on its physical characteristics and those of the cameras and lenses that are generally employed to actually expose it, as well as the range of practices and techniques that a film crew will bring to a production.

While video is unquestionably an electronic process (that current technology permits us to store on a wide variety of media such as video cassettes, hard drives, etc.), film is a precious object. Film is many other things that bear on this discussion: a mature mechanical technology, a chemical process, an aesthetic and even a culture.

We will begin our comparison of the two media by examining the different technologies, essential in understanding how video might be made to look like film. Motion picture film has been with us for a long time; it was the invention that bridged the gap between magic lanterns, which could project still images from slides, and kinetoscopes, which were moving "peep shows" in a box.

Today's perforated strip of plastic has to be manufactured to very high tolerances from very stable

materials in order to move consistently through the gate (the channel that guides the film past the shutter and optical system) of a camera, projector or telecine, and these in turn must have an effective, well maintained registration system.

A worn gate or inadequate registration can cause weave, the continuous movement of the film from side to side, and jitter, the intermittent stuttering of the film, up, down and sideways. Old or poorly stored film can shrink, discolor, stain, exhibit dirt and scratches, and even grow mold.

When a film is projected, dirt and hair can accumulate and jitter about the gate aperture. Film can suffer a multitude of indignities when shown with an unsympathetic projector: it can lose its loop, causing frames to appear to be sliding up or down; it can break, tear, stop and possibly catch fire.

These various imperfections may not define the look of film, but they certainly evoke many filmic associations and they have recently become very popular graphic devices. No real equivalent artifacts exist for video, though our senior editor assures me that in the future, drop-outs, JPEG mosquitoes, SC/H phase errors and 60 cycle hum will all become sentimental favorites, perhaps as popular as video hash.

The subtle properties of grain, tonal range and colorimetry, and the temporal characteristics of film do not draw attention to themselves, yet they are responsible for a film's look. The "look" of a film can speak volumes and it says something clearly different than "video."

Unexposed color film begins its life as a series of layers incorporating silver halide grains that have been sensitized to different wavelengths of light that once exposed and processed will be replaced by dyes which will sum up to the colors we expect to see.

Though the grains are washed away, they leave a "footprint" of their original shape and size, that will vary according to the particular stock and manner in which it was processed. The grains are spread uniformly over the surface of the film but with a totally random pattern. Depending on the effectiveness of the pressure

plate that holds the film flat against the gate, and the quality of the lens' color correction, one grain layer may be in sharper focus than another, or an entire frame, series of frames or portion of a frame may actually be out of focus.

In modern video cameras, a three CCD imaging block takes the place of film. The picture elements (or pixels) of each CCD are in a uniform array with very precise spatial alignment. A properly functioning camera and lens should always yield a consistently sharp image.

Resolution of the camera system will generally be greater than the tape format to which it records; this is important because the pixels in the grid are usually larger than film grains and have difficulty smoothly rendering diagonal lines, which will often appear to have a stair-step or aliased quality.

The apparent resolution of a film image will be dependent on the choice of film format, stock, optics and shutter angle. Video which is also dependent on tape format as well as camera and optical quality, generally has lower resolution than 16mm film but uses certain techniques that may actually allow it to appear sharper.

Though every video camera manufacturer has a different approach to image processing, they all use a variation on aperture correction, also referred to as detail enhancement. This technique of exaggerating the difference between thresholds of light and dark gives the illusion of sharpness. Unfortunately, when set too high it makes people look like outlined cartoon characters with very bad complexions. (Modern digital cameras have recently added the ability to decrease detail in an area localized by hue so that a subject's facial difficulties can significantly diminished).

Temporal resolution is different from spatial resolution and one area where video's specs exceed those of film. Film operates in frames, commonly 24 per second, while each of video's 30 frames per second (fps) is made up of two interlaced fields. (Each video field occupies either the odd or even set of lines that compose the full 525 lines of the NTSC video image. Though one field actually follows another at intervals of about

1/60th of a second; as the TV scans, they appear to be "woven" together in each individual frame).

When film is projected, a multi-bladed shutter rotating between the projector lamp and optics serves to increase the rate of flicker from 24 fps to 72 fps; this is to achieve a rate above the threshold of human perception. NTSC video, consistent with the power mains in the United States, operates at roughly 60 cycles (or fields, or flickers) per second. The higher the temporal resolution, the more realistic the movement of an image.

Transferring film to video is accomplished with a telecine, which utilizes a "3:2 pulldown" to resolve the difference in frame rates between the two mediums. It takes more than a bit of fooling around to make 24 go evenly into 30, and no solution will yield motion that is identical to the original film. Because there are five video frames (or ten video fields) for every four frames of film, we must then derive ten fields from those four frames. If we simply to add those two fields at some random spot, we would slow down the movement at that point, but the 3:2 pulldown was devised to maintain smooth, consistent motion.

We accomplish this by creating a five frame repeating sequence of "whole" and "split" video frames. The "whole" video frames receive two identical fields from a single film frame, while the "split" video frames derive their first field from the already used film frame and then interlace it with a single field derived from the next film frame; this is done twice in a row in each sequence of five video frames. (Please refer to Figure 1).

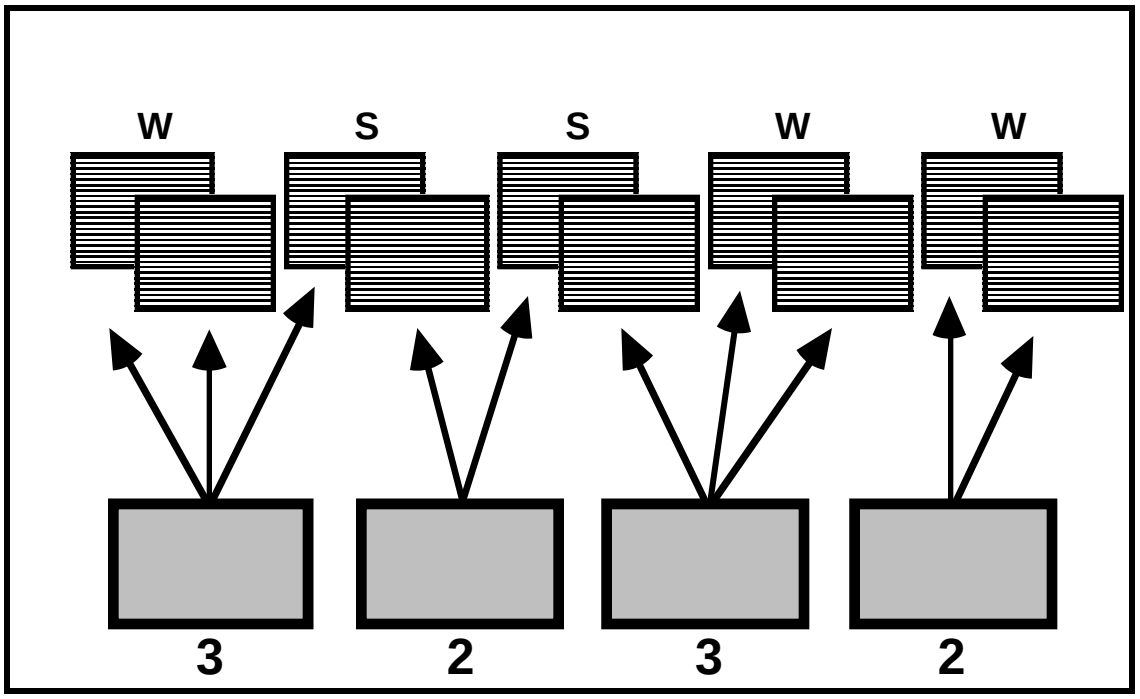

Figure 1

When we talk of "look" of film, it is really film on tape that is being compared to tape that originates in a video camera. The slightly discontinuous motion created by the 3:2 pulldown is actually part of the look that we find so appealing.

Another motion characteristic that contributes to the special beauty of film is the blur that results from the camera shutter. The rotating shutter of a film camera typically opens for about 1/30th of a second, while the CCD of a video camera "opens" for half that time. The longer exposure duration of film causes its motion blur to be far more pronounced than video and this in turn increases the perceived smoothness of the motion.

The last aspects of the technology that we want to touch on are: colorimetry, dynamic range and tonal response; film origination has held all the cards as far as these particulars are concerned but this may soon change. Film offers dozens of unique stocks, each suited to different applications, with their own color rendering and contrast curves. Though individual video cameras have somewhat different looks, their signals generally conform to certain standards that do not reflect either the tonal qualities or contrast handling capabilities of film.

The latest generation of digital signal processing (DSP) video cameras offer many features relevant to those seeking the look of film. The Sony DVW-700WS, a Digital Betacam camcorder can not only handle the same dynamic range as a film camera, but it features a broad menu of user accessible image parameters that can be stored and retrieved from a small memory chip. Sony has configured set-up chips to match the color and tonal rendering of a variety of widely used film stocks; this is not to say that the output will look like film, but that it will match a particular stock in gamma and colorimetry.

Sony has marketed this camera for "Electronic Cinematography." They have packaged it with a film style matte box and motorized zoom control as well as making available an viewfinder extension and specially modified 16mm camera lenses. The "WS" stands for a 16:9 wide screen recording, a somewhat difficult to appreciate capability for 99% of the NTSC world, but it is becoming a more important format and is ideal for video to film projects.

A feature meant for theatrical release must currently be finished on film. But this reason to shoot film may become less of an issue as the marketing of films changes, and movie theater chains are already beginning to look seriously at video projection as a means of reducing their costs.

With all the differences between film and video, why go through the trouble to make one look like the other? The obvious reason is the look, but that very special look carries a host of associations along with it. Motion pictures have been penetrating our collective

unconscious for 100 years. It is the natural point of reference for story telling, sitting in a darkened theater with hundreds of others, absorbing its slightly diffuse, dream-like quality. We also associate it with higher budgets and specific genres, such as commercials, rock-videos and episodic television.

The look of video has its own set of associations that include soap operas, infomercials, news footage, live broadcasts, instructional programs and low budget anything, not awful company, but definitely b-list. Video has a less subtle color palette, and often exaggerated edges, clipped highlights and strange artifacts. Video has a strong feeling of reality and immediacy, with a look that suggests its electronic nature.

We now have the background required for understanding the issues involved when we return next month and discuss the tools and techniques that can actually transform your dull, everyday video footage into something approaching the lushness of richly textured film footage. We will be examining production methodology, facilities that are specialized in creating the look of film, techniques that can be used in your current on-line suite, and software applications that will enable you directly on your desktop, including taking a first look at the amazing CineLook plug-in for After Effects from DigiDesign.

Part 2 - Achieving the Look of Film

There are a number of ways that video can be made to look similar to film. The place to begin your efforts is definitely during production and there are a number of techniques that will improve the film look that can be achieved ultimately in post. There are two cardinal rules you cannot ignore: first, use the best equipment you can afford; second, shoot as if you are working with film.

Better equipment and superior tape formats will buy you greater parity with film from the get-go. Remember, we are striving for the higher resolution and greater contrast ratios of film. A Hi-8 tape with noisy, delayed chroma and twenty dropouts per minute will not

create a convincing illusion; DV would be a much better choice. Of course using a broadcast camera with BetaSP is excellent and Digital Betacam is an even better choice.

Shooting like film means using similar care, particularly in lighting setups, and employing the conventions of film if possible. Strive to minimize the depth of field with longer focal lengths, wide apertures and ND filters. Apply a more filmic aesthetic to zooming (avoid it if possible) and camera movement (get out the dolly). Be especially careful to avoid strobing when panning or tracking. (Consult the American Cinematographer's Handbook for clear instructions on this issue). Avoid using the camera shutter, it will cut down on desirable motion blur.

There are many other techniques that may be suitable for your production, and testing is always worthwhile practice. Filters can be very useful tools. Besides the ND filter mentioned already, a ND gradient filter can help to lower contrast and avoid over exposed skies. Polarizing filters also help skies and improve the overall color saturation. Experiment with a stocking stretched over the rear of the lens or a filter that simultaneously lowers the contrast and diffuses the image, like a Tiffen ProMist Black 1/4 -1/2.

David Tamés, a DP who has often shot for a film effect recommends the "1/8th blue trick" to bring down video's "whiter than white" whites; throw up a 1/8th blue gel over your key light before you white balance. Three other camera adjustment available on a number of better camera heads include: bringing down the camera's detail level to diminish the harsh edges and noise in darker picture areas, reducing the camera gain to -6DB to increase the contrast ration and further reduce noise, and rolling off a few percent on the Dynamic Contrast Control's clip level.

There are several other steps to be aware of during your shooting. Because fine lines, diagonals and grids tend to become jagged with post processing, they are better avoided if possible. It is very important to avoid either crushing of blacks or overexposure, as these both effectively destroy image detail and reduce the ability to simulate film like tonal scales.

An interesting technique for shooters on a low budget, is the use of the slow shutter speeds in some prosumer and industrial level cameras. The popular Sony DVX-1000 has a 1/30th second shutter speed that doubles fields and can produce a very pleasing, motion-blurred look, though it tends to lower overall resolution and introduce some jaggies of its own. Panasonic's competing EZ-1U camera (as well as their AJ-D200 model) offers an improved slow shutter that appears to sample whole frames rather than fields and maintains a crisper look. (These two cameras also offer 16:9 aspect ratios).

Once we have done all we can in the course of production, we can apply the post technologies that actually complete the transformation, and I offer three courses of action: material can be delivered to a company specializing in this kind of process, one can employ several hardware tools found in the better equipped on-line room, or you can do incredible things on the desktop with a variety of software resources.

If you want "filmlook," there is actually only one way to achieve it; Filmlook is a Burbank, California post production facility that has offered the specialty of giving video the look of film for over eight years now, winning an outstanding achievement in Engineering Development award from the Academy of Television Arts and Sciences, and "Filmlook" is their wholly owned trademark. Using there own black box, a specially modified frame synchronizer, in combination with both gamma adjustments and grain simulations, it is a very convincing but somewhat expensive process.

They really know their stuff and offer several options with respect to apparent frame rates and grain simulations. I regret that, as a New Yorker, I have been unable to actually work in one of their post bays and compare the various alternatives first hand, but masters that they have processed for me have all been well received. Check out their work on "Beakman's World" and "Cosby." There are currently a number of other facilities around the country that are offering their own take on this process, and I can only suggest that you send for a reel and check out their work in advance.

A good on-line room and a skilled editor can go a long way with off the shelf hardware. A sophisticated color corrector like the Videotek SDC-101 or a daVinci Renaissance can allow you to adjust overall gamma as well as contrast at both the highlight and shadow ends of the tonal curve. We have developed a number of looks with these devices, from an exaggerated 1950's-ish color to a slightly clipped "glamour" look, as well as more generic film curves. The most important hardware for this purpose is the digital effects box. Rooms with dual channel Kaleidoscopes have often been called upon to create a filmic motion by repeating field one twice per frame and then mixing back in some of the missing field or whole frame. Adding this material back serves to compensate for the resolution lost by discarding alternate fields. Another device, Sony's powerful DME-7000 offers an out of the box 3:2 pulldown effect that we get many calls for at our facility. Some editors like to apply an additional bit of soft focus, and the 7000 can add a beautiful glow that has the feel of a double fog filter. Many facilities maintain a variety of film grain reels that they have actually struck off a telecine and can mix into your master.

Adding your own film-like processing on a computer can offer you creative control that may equal or even surpass the resources I have already mentioned, but of course you will have to define your own look. I would like to look at one stand-alone tool, Movie Tools from McQ Productions, Adobe's venerable After Effects and CineLook, a powerful new plug-in from DigiEffects.

Lon McQuillan of McQ Productions has been writing code for the video applications for a long time and now has a catalog of four products (for the Macintosh only) as well as offering custom coding to the industry. When I first looked at a Movie Tools demo (download it from mcqpro.com) I sent him an e-mail suggesting some improvements in the way that the film grain simulation was applied. The next day I received a response that suggested I return to his web site and check out the new version of his software that incorporated my suggestions... well, he does promise the best support in the industry.

Lon describes Movie Tools as a "Swiss Army Knife" for desktop video and animation, and it does offer an amazing array of specialized tools in one inexpensive ($195.00) package. As regards its film simulation, it does a nice job of creating a 3:2 pulldown, albeit with a bit of the not unexpected jaggies that normally accompanies de-interlaced video fields. The grain generation is simple but passable, and I must confess that I would use any grain simulation with an extremely light touch. The product also features a straightforward and easy to use color correction module, in fact the entire product has an extremely straight-forward interface. Movie Tools also operates relatively quickly, enabling you to add pulldown, light grain and gamma correction in just a bit longer than After Effects would take to render a straight pulldown. (Some of Movie Tools additional features include: flipping & flopping an image, extracting & compositing Alpha channels, and resizing from square to rectangular pixels).

Adobe After Effects is an incredibly powerful and flexible program, but one that requires you to climb fairly steep learning curve. If you've scaled this peak and were not already aware, it can easily deinterlace and render with a pulldown, as well as apply some color corrections with only the standard package.

The pulldown and film effect is accomplished as follows:

1) After importing, with your original footage selected in the Project Window, access "Interpret Main" under the File Menu and select from "Separate Fields" most likely "Upper Field First" or possibly "Lower Field First," depending on your own video capture board. (If you are not sure of your field order, please refer to the directions in your After Effects User Guide). You might also check the "Motion Detect" box which will increase image quality in areas without movement (when rendering in high quality).

2) At this point, you may consider using some of the plug-in effects that come with After Effects to alter the tonal range and colorimetry. These tools include: Color Balance, which will allow you independent control over Red, Blue and Green gains; Color Balance (HSL), which functions somewhat like a video proc amp without

the pedestal adjustment; Gamma/Pedestal/Gain offers a useful Black Stretch adjustment; Levels, for you Photoshop savants, this one offers extremely powerful control through the use of a graphic curve metaphor.

Because there are so many film stocks and looks that we associate with film (like the encompassing darkness of Film Noir or the unreal richness of Technicolor), you might consider digitizing reference footage from a film that you care to emulate. Be aware that the tools I have described are not entirely intuitive and will probably require significant experimentation before one achieves their desired look.

3) Another optional effect is frame blending, about which we will have more to say shortly. This effect can be achieved by simply ticking the "F" checkbox for the layer that contains your footage in the composition timeline as well as the "Enable Frameblending" switch at the top of the timeline. Be aware that this will greatly increase your rendering time.

4) It is time to render and you must make a few special settings. In the Render Settings dialog you must set Frame Blending to Current Settings, Field Render to whatever stetting you had previously determined, 3:2 Pulldown to any sequence (unless you have to match other material**)**, and the Frame Rate (the message should read "Sampling @ 24 fps") should be set to 30. Now get a good book and let 'er rip.

After Effects can do plenty on its own, but there is a new product from DigiEffects, (the creators of the Berserk, Aurorix and Cyclonist plug-in sets) called CineLook, that can make the whole job easier and better. Cinelook takes After Effects natural capabilities and adds extensive controls over colorimetry, grain simulation, and temporal characteristics through its own excellent interface and adds an expandable library of preset looks. Chris Athenas, the genius behind DigiEffects, has really sweated the details with Cinelook, and the User Interface is better than half the story.

The standard plug-in interface has been subdivided with titled graphic devices into three distinct areas of function and over 50 different parameters: "Stockmatch"

controls grain amount, smoothness and focus; "ChromaMatch" defines color and contrast curves as well as standard proc amp functionality; "TimeMatch" controls slur or the frame blended blur level. The top of the plug-in has controls to store and recall presets (and Cinelook offers predefined settings for emulating near 40 different film stocks from Kodak, Fuji and Agfa) while a master "Blend" control sits lonely at the very bottom of the plug-in where it might be confused as an addition to the aforementioned "Slur" controls.

This variety of alternatives would be unmanageable if not for the four additional graphic interface screens. Each screen provides three preview screens (with zoom capability), permitting the simultaneous viewing of original footage, the footage with effect added and a third reference image; having these views available simultaneously will permit the novice colorist much greater control than otherwise possible.

Under the StockMatch and Grain windows, adjustments can be made via a Photoshop style "variations" method or by using graphical "knobs" for each parameter; the ChromaMatch window also employs the "variation" interface. The Curves window allows seven points at which one may shape of either master or rgb component response curves; moving your cursor over the image area will provide an indication on the curve display of that color's position on the curve.

These well thought out GUIs prove once again that interface makes the difference in achieving real functionality; go back to the After Effects plug-ins described earlier and you will have no doubt. The only weaknesses that I could find with these controls was that they could not take advantage of either dual monitors or larger screen sizes; (they are meant to fill a 640 by 480 screen).

Ease of use would be unimportant if CineLook did not deliver the look it promises. The colorimetry and contrast controls are as effective as many a dedicated hardware color corrector and the grain simulation tools should actually set a standard. As I said before, I believe that any grain simulation should be applied sparingly, and I would like to see a setable grain size

parameter, but the output of this module is stunning, particularly in simulating 8 & 16mm film.

Evaluating the performance of a special effects tool demands that we consider both resultant imagery and the time required to render it. By itself, color and contrast changes are very efficiently rendered, but once we begin to examine the temporal effects that involve frame blending, rendering can become a very serious issue with times as long as one minute per frame. There are several points that must be made in this regard: much of the rendering overhead is based on calculations that are inherent to After Effects rather than specific to CineLook; DigiEffects has promised that this product will be both "iced" and made MP aware in 1998 and these will provide significant speed improvements; the choice of settings will definitely impact your rendering times, for example some effects may be different but still equally appealing and much faster when rendered at medium quality.

The TimeMatch effects are the trickiest to use but potentially offer some of the most convincing illusions. The use of frame blending creates a smoothness of motion not achievable by other means and the "Slur" control offers a means of organically increasing the blur. Problems with any time remapping center around two issues: avoiding the loss of resolution and jaggies caused by utilizing single fields rather than full frames, and the artificiality that is revealed in rapid movement. Frame blending and slur go a long way to hiding the resolution loss but tend to create an excessive blur on moving objects that will definitely obscure detail. One solution to this problem is to apply different settings, dependent on the motion in the frame.

Let me close by saying that CineLook is a great product and if my past experience with DigiEffects is any measure, it is just going to get better as I continue to learn its mysteries, and Chris Athenas and his gang in Frisco continue to improve it.

Film Damage is a second plug-in that ships with CineLook. It is basically a more advanced version of DigiEffects' popular Aged Film plug-in (part of the Aurorix 2.0 set) with 47 as opposed to 21 separate

controls and a library of presets. Add a few grease pencil marks and some tape splices, and you'll have no trouble convincing people that you've dragged your workprint behind the car; its your basic way cool effect.

I have tried to cover the subject of making Video look like film as comprehensively as space allows. I have only touched on aspect ratios, haven't even begun to look at where the future might take us (Sony has unveiled a new video format to be used concurrently with film to permit more efficient integration of the two mediums). I would be negligent if I did not suggest that sometimes you just have to shoot film... but not as often as you once had to.