

Digital Distribution Has Arrived. Where Is Production Going?

Montreux 2000 World Television Forum

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Good morning ladies and gentlemen. It is my pleasure to be able to address you this morning.

We are here in Montreux because it is a place where vision is debated. Looking back through two decades of attendance, I am amazed to see how much foresight the speakers and panelists have demonstrated. It is an honor to be invited to join in the discussion. This is a forum where the pros and cons of technology, trends, and innovation are stimulated by the clean mountain air.

When I first came to Montreux, the year was 1979 and the hot topic was digital recording. The burning question then was whether digital video should be composite or component. Twenty-one years later, the hot topic is still digital. The difference between then and now is the difference between a vision and the reality.

The title I chose for my comments is “Digital Distribution Has Arrived - Where is Production Going.” But, you may ask, is digital distribution really here? In some ways it is. In other ways it is not.

The Digitization of Television

Our road to digital television reminds me of trips here in Switzerland — mountainous and twisting. A footpath through formidable terrain can become a smooth and reliable route over time. This is what we are seeing today.

Presumably one builds a road to get someplace. You need a destination. Our destination is our audience. The road is still under construction with the terminus, or distribution channels, arguably further developed with a few lanes already open and handling traffic.

Satellites beam high quality digital transmissions around the world.

Digital cable systems deliver crisp pictures and CD quality sound.

We have launched digital terrestrial broadcasting in the United States.

A broadband future flirts with possibilities.

Meanwhile, Hollywood is carefully studying the best possible solutions for digital cinema, with some noble tests already deployed.

Then there is DVD, the bright shining light of digital distribution. Its adoption curve is higher than any preceding packaged media and its popularity will surely grow. DVD provides full studio quality in the home. Just a few years ago, that was unthinkable.

And now we can have high definition in the home! All of this helps to create the market for digital content. The consumer is digital ready.

My, how things have changed.

But have they?

Let me reminisce a bit. As I said earlier, my first Montreux Symposium was 1979. Quoting from the 15th Montreux Commemorative Issue, by Joe Roizen and Donna Foster-Roizen:

“In a private suite at the Montreux Palace Hotel, Ampex demonstrated their position that a [digital video recorder] should have no compromises such as bit rate reduction.”

Do you remember the Ampex machine? It was a modified two-inch quadraplex machine with eight heads. Some people were referring to it as an octoplex.

Continuing to quote, “In their booth, Bosch/Fernseh demonstrated a digital recorder built on a BCN transport and based on work done by the IBA.”

And, “In a suite at the Pavilion, Sony was showing 50th generation copies of both test pattern and live camera images.”

In a summary, Joe Roizen states:

“In retrospect, these demonstrations at Montreux 1979 represented the peak of more than a decade of experimental work on composite digital recording, for it was here at the 11th Symposium that there began to be a noticeable movement away from composite digital coding and toward component approaches.”

And another quote from the same book, this time about the 13th Montreux in 1983:

“As much as anything else, the 1983 Montreux Symposium may be remembered for its demonstrations. Overshadowing all was Sunday’s showing of the capabilities of NHK’s proposed HDTV system. In a program meticulously arranged by Dr. Paolo Zaccarian, the Montreux Pavilion was turned into an HDTV theatre with large screen projectors on the left and right and a center screen for video-to-film display.”

“There was a strong sense of history in the making among the SRO crowd in the hall and, after opening comments by Joseph Flaherty of CBS and George Waters of RTE, it was easy to see why. The six HDTV program segments that followed were obviously produced with great dedication and care by the participating broadcasters.”

One final quote, also from 1983:

“While HDTV held center stage, many other demonstrations marked the path of TV’s technological progress.... RCA unveiled experimental ENG cameras based on a new, frame-transfer CCD...”

I find these quotes quite interesting, for several reasons. You realize, that no matter how much things change, things stay the same. In 1979 there were concerns about recording with bit rate reduction! Did you notice all those different tape formats! Nonetheless, in the four years from 1979 to 1983, there were a lot of changes taking place.

CCD cameras were just being introduced replacing photoconductive tubes. Although not digital, the images were based on a sampled structure.

Actually, the digitization of television had begun about ten years earlier. The first significant digital equipment was the DICE standards converter. Digital time base correctors came second. Then frame synchronizers. And then digital video effects. Finally digital video recorders.

The Digitization of Television	
~ 1970	DICE
~ 1973	Time Base Corrector
~ 1975	Frame Synchronizer
~ 1978	Digital Video Effects
~ 1980	Digital Video Recorder

There was a common theme to all this equipment — it permitted you to do something you could not do before, or it made it much, much easier. Digital recorders, for example, brought about significant changes in the way production and post production could be handled. You could have multiple generations, and therefore multiple layers of effects.

Looking at the Future

So now, where are we today? George Lucas is shooting a movie using high definition CCD cameras that have built-in digital component recorders. All those visions that began to appear 20 years ago are a reality today.

Referring back to my title, has digital production arrived? Maybe it has. Much of television is produced with digital cameras, and most post production is digital.

Hang on a moment! About 75% of prime time television in the United States is shot on film!

Virtually all that film is transferred to video using digital equipment. And, this past television season, much of that transfer equipment was digital high definition.

A lot of work is taking place in Hollywood today looking at the quality of digital cinema exhibition. Committees are hard at work on the issue. SMPTE has a structure of committees looking at multiple aspects of the engineering. The Motion Picture Association is studying the needs of the studios. Position papers have been released by the American Society of Cinematographers.

I think it is fair to say that most everybody believes film will be here for a long time, and that digital equipment will get better rapidly, and pose various challenges to film. Both digital and film will find uses, sometimes based on creative content, sometimes based on ease of doing effects, and sometimes based on economics.

How should production for television be done? As I have said, most production for US prime time is film. Which is immediately converted to digital. This will move more and more to high definition.

And digital HD cameras will be used for television production. There will be a mixture of digital camera and film converted to digital. But most of the post production will move to HD. It has to. HD broadcasting, or distribution, will slowly grow, but grow it will. Programs that were done as standard definition only will have lower value.

Sure, I know that content is king, and content is what determines the value of a program. But, there is no question that a given program will have greater future value if it exists as HD!

Helping to create this situation is the world-wide standard for high definition production: 35 mm film!

And, the new world-wide standard for digital post production:

The ITU's 1920 by 1080 pixel 24 frames per second standard. Now you can have the best of both worlds, a 35 mm film camera and a 24P digital HD camera. If you do your post production at 24P, you can easily mix the two.

The 24P World-Wide Standard

Just for a moment, I would like to return to the topics that were being discussed at Montreux 1979. I presented a paper that year as the chairman of the SMPTE Working Group on Digital Video Standards. I reported that the United States was headed toward a composite digital standard based on sampling video at 14.3 MHz, or 4 times the NTSC color subcarrier.

As some of you may remember, at the same time, Europeans were talking about a component digital standard that would be common between PAL and SECAM countries. The sampling rates being discussed in Europe were 12:4:4, 12 MHz for luminance, and 4 MHz for U and for V.

Let me remind you of Joe Roizen's words that I quoted a few minutes ago, "for it was here at the 11th Symposium that there began to be a noticeable movement away from composite digital coding and toward component approaches." That is exactly what happened.

After returning home from that Montreux, I asked the Working Group to consider component sampling, thinking that there may be an opportunity for a world-wide standard. And, such a world-wide standard did eventually come about, CCIR-601. As you know the luminance sampling frequency is 13.5 MHz, not 14.3 MHz, and half that, not one-third, for the color-difference signals.

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We called CCIR-601 a world-wide standard, and indeed it is. We all sample at 13.5 MHz. We all use 720 samples per active line. But we still have differences, in the number of lines and in the number of fields per second.

Today, the dream of a world-wide digital standard has become a reality. The ITU has been hammering away at a standard for HD since the mid-eighties. There were attempts at Dubrovnik in 1986 to have a single standard. It did not come to pass. In 1990 ITU adopted Rec 709 which was similar to Rec 601 in that it recognized commonality among different standards, high definition standards in Rec 709 and standard definition standards in Rec 601.

It took another ten years to get the world-wide standard, but finally, this year, Rec 709 was modified to have 1920 samples per active line and 1080 active lines at all recognized picture rates. One of those rates is 24 frames per second. That is the one I am calling the world-wide standard. Production can occur at this rate and be shown easily, anywhere around the world, in any television system.

Whether shot on film or digital 24P, run it a little bit fast, at 25 frames per second, and you can have PAL, or SECAM, or digital 25 Hz components, or 25 Hz HD. Run it at 24 Hz with a 3:2 pulldown and you can get NTSC, or 1080/60i HD. Or, with the US digital broadcasting standard, you can broadcast 24P HD directly.

Again, I must say, future production for television will have greater value if it is 24P HD, whether it is shot on film or with a digital 24P camera.

"Timecode"

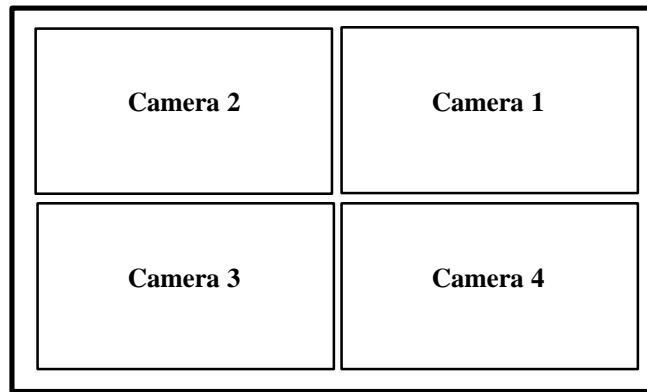
Have you heard about the new and quite different movie called "Timecode". Mike Figgis, the Director of "Leaving Las Vegas", wanted to tell a story showing more details than you normally can get in a movie. He used four cameras, each with a 93 minute load, to shoot a single-take movie.

It's kind of tough to carry 93 minutes of film, so he used digital video. He picked a camera based on its tape load, Sony's standard definition DSR-130.

For 93 continuous minutes, four camera men simultaneously followed the different actors who sometimes crossed over, and sometimes were separated. There was no script, only a general description of the action. The actors were free to give their own interpretations.

The movie was shot 15 times. The 15th take was the one used in the release. There was no cutting, the entire piece had to be accepted or rejected in full.

The four standard definition images were each placed in a quadrant of a high definition frame, like a “cut & paste”. The audio comes from one or more of the individual images and is moved around as appropriate.



The movie premiered at the Yahoo Internet Life Film Festival two months ago. It was a digital presentation using one of the projectors with the Texas Instruments’ digital mirror device.

Mr. Figgis also needed a 35 mm film version of the movie.

The “old fashioned” way to convert 60 Hz video to 24 frame film is by dropping every fifth field, and combining the remaining pairs of fields to make frames of film. This produces a motion judder, though.

The HD Center has a proprietary technique where we combine 60 Hz fields, and effectively re-sample at 24 frames per second. This does produce some “blur” in each film frame, but it simulates what happens in a film camera.

Film cameras have a shutter that closes during the film pulldown. Typically the shutter is open 50% of the time and closed 50% of the time, resulting in an exposure of 1/48 second, which also produces blur when there is any motion.

Using our technique, we converted the 60 Hz movie to 24 frames per second, and used an electron beam recorder to make black and white separation prints. The black and white prints were then step-printed to make a color negative. The Screen Gems film was released one month ago.

Let's watch some of "Timecode", but first let me give you a bit of the story line. "Timecode" is a black comedy thriller directed by Mike Figgis and starring Holly Hunter, Stellan Skarsgard, Saffron Burrows, Salma Hayek, and Jeanne Tripplehorn. Patrick Alexander Stewart was the Director of Photography.

In this clip, you will see Salma Hayek and Jeanne Tripplehorn in the upper left quadrant. They are a couple. Jeanne Tripplehorn's character has placed a bug on Salma Hayek's character, concerned that she is seeing somebody else, and she will be listening-in with headphones. They are in a limousine headed to a movie casting session. I am showing the 60 Hz version. [Run clip of "Timecode"]

Digital Archiving

Let me point out to you a problem that the digital engineers must solve. Archival storage. Now I will be the first person to tell you that this is not a problem. For example, suppose you shoot something today with the HD camcorder.

We all know that tape formats change, and often. So, to have that recording 100 years later, we will have to dub it to newer formats. But, it is digital, so that is no problem.

How many times will we have to dub it? At the current rate of new tape formats, maybe once every five years. Certainly once every ten years. So, we will have to copy the copy some 10 to 20 times over the next 100 years. No problem.

And it is cheap. The cost of tape for a two hour program may be \$500 or so. The price a facility charges will run about \$500. So, you spend \$1,000 ten or twenty times. Maybe \$15,000. That's much, much less than the cost of restoring film. And the 20th dub is identical to the first.

But, who is going to do this? Who will have the discipline to make new dubs every five to ten years? Who will want to spend the money, low though it may be?

And, with film, all you have to do is hold the film up to the light and you can see the picture. It is so simple. It is extremely difficult for digital to compete with that.

So digital engineers, I have already told you how to solve the problem. But, I think you can see that it is not a technical problem, it is a discipline problem. Nonetheless, I believe it will require a technical solution.

Closing

In a world of expanding and increasingly digital distribution channels, it is the ability to transition among the myriad of consumer formats that entices us to pursue these new technologies and adopt enabling standards.

The driving forces are image quality — our ability to maintain image integrity from acquisition to distribution — and standardization of the platform — enabling a seamless transition through the production, post-production and distribution pipelines.

For Mr. Lucas, who is ultimately making what will be classified as an all-digital motion picture, this new pipeline is a compelling alternative, one that capitalizes on direct digital image acquisition going straight into computer workstations, a direct digital interface being ideal for his particular genre of storytelling.

For Mr. Figgis, whose movie was shot all-digital, posted all-digital, and premiered all-digital, his vision could not become a reality without the digital equipment.

While I have given two examples of the renaissance of production, I must tell you that motion picture film acquisition, with the ever-continuing, constant improvement in film technology, will clearly continue to offer high production value for other forms of storytelling.

Our challenge is to smooth the production and post production road as we introduce a growing band of creative individuals to the freedom and possibilities of this digital platform.

For 21 years I have been coming here to Montreux, envisioning a digital future. This year it is less a dream and more the state of the art. Technology has completely revolutionized every aspect of the film and video process, although one thing remains fundamental — we create images to tell stories.

The promise of digital production and post production brings with it fresh opportunities for innovation and advancement. Where once there was a chasm between the film and video communities, the lines continue to blur. Now, the best aspects of each discipline are available to both. This will continue.

There are now some smooth sections amidst the mountain of change. There are bridges crossing some of the chasms. And, undoubtedly, there will be side routes with surprising points of interest.

I thank you for your attention.