

OVER AND UNDER AND OUT

By Lenny Lipton

In the early 1980s, when I founded StereoGraphics Corporation, the first bit of revenue income we had came from a venture with Chris Condon of StereoVision International. Chris was a pioneer in the projection of stereoscopic movies using a single 35mm projector. He founded the company Century Precision Optics, which is now a part of Schneider; but he moved on from there, sold it, and created StereoVision International because he had a big hit with the '70s movie *The Stewardesses*. The success of that film set him to work on perfecting a single film approach to stereoscopic projection and photographic techniques. He settled on the above-and-below (also called over and under or over/under) format based on two two-perforation high subframes with the Scope 2.4:1 aspect ratio occupying the area of the academy aperture.

Two perf high frames are also known as the Techniscope format as were used for quite a few 2D movies. The process that was used by Sergio Leone to shoot his engaging spaghetti westerns, and the Japanese version was known as Tohoscope and frequently used by the master Kurasawa. Many a samurai movie did I watch at the Toho Cinema on the west side of Manhattan in my youth, but that's another story.

The format has been resurrected and is presently being hawked by three vendors. Despite the fact that it failed ignobly in the 1980s it's back. It's technically an interesting solution pregnant with possibilities but all pregnancies do not a healthy creature produce. Colonel Robert V. Bernier may be the first person to develop camera and projection optics for the format. His competition was the Marks brothers, Mortimer and Alvin, of Whitestone, New York, who in turn worked with an inventor named Kent who also designed and made camera and projection optics for the above-and-below format. By the early eighties there were other people working on it including Arriflex, Anthony Coogan, and the redoubtable Marty Sadoff.

In the early eighties as part of a deal StereoGraphics had with Condon I worked on *Rottweiler: Dogs of Hell* at EO Studios in Shelby, North Carolina using his camera optics. The producer of the film was Early Owensby, a good old boy and a good businessman, and the director was Worth Keeter, Jr., later of Power Rangers fame. Working for EO on *Rottweiler* was a grueling experience because of the fourteen hour days in extreme heat, not to mention that much of the crew wore sidearms – which they never had to use.

Chris had worked out an optical system for taking images from two perspective views and placing them above and below each other on a single piece of 35mm film as described above (or is it below?). This placed two 2.4:1-aspect-ratio images above and below each other within the Academy aperture – which is about the largest practical aperture you can have on 35mm, considering that one has to have room for soundtrack and one can't bump into the adjacent frames or perforations. If I recall correctly the left was on the top and the right on the bottom. Which frame contains which perspective is, as it turns out, to be of some importance, as we shall see.

If the taking optics don't account for the vertical offset between the two subframes the result will be vertical parallax in every shot, which is unacceptable. There has to be some way to shift the images a little

bit up and a little bit down from the two lens axes position. Chris came up with optics that could do just like Colonel Bernier whose lenses were used on *Flesh for Frankenstein*, also known as *Andy Warhol's Frankenstein*, despite the fact that Warhol had not a thing to do with the production. This version of *Frankenstein* is surely one of the oddest and blackest of comedies. Imagine a liver hanging out on the end of a pole into audience space and you'll get some idea. But for me the best part was Dr. Frankenstein's Hitlerian rant extolling the virtues of a conquering race of supermen made from cobbled together body parts. Bernier's optics were damn sharp, and his projection system was good too. But the camera lens didn't work for reflex cameras. Condon's did.

I had occasion to help project above and below films in a few venues and I saw a number of stereoscopic films projected in the 1980s using his and other optics. There were maybe a dozen bottom-of-the-barrel films like *Amityville 3-D*, *Jaws 3-D*, *Comin' At Ya!*, *Metalstorm* – not to forget *Rottweiler*, which did not achieve wide distribution. (It's available on DVD and I have a bit part as a tourist in a Hawaiian shirt. My voice is dubbed because the generator truck made so much noise.)

I think it was rare to see the above-and-below format properly projected. It turned out, practically speaking, to be very hard to make it work. The tragic flaw was the fact that it is next to impossible to tell which frame is the left and which is the right – even if index marks are used. That matters because the light that passes through those subframes becomes polarized by two sheet polarizers located in the projection optics, and if the left image is encoded with the right polarization orientation (and vice versa), the audience sees a pseudostereoscopic image – one that's inside-out. It doesn't appear to be inside-out because there is a conflict of cues – a conflict of the stereoscopic cue and a conflict of the monocular cue – the image looks like a mess. People can't identify what's going on, and I don't blame them because they never seen a pseudostereoscopic image in the visual field; so there's no way to connect with it, no way to articulate what it is. But an expert can tell instantaneously that the projection is off. The only cure is to wear the glasses upside-down. Try filing a patent disclosure on that one.

So why can't the projectionist do it right? If there were index marks to identify the left or right frames the aperture and the gate of the projector will cover the index marks, so he can't use that as a guide when threading. Another problem – and it's just as serious – is the fact that movies are assembled on a large platter. It's a closed-loop platter that holds the 10 or 12 or however many reels of film it takes to make up a feature, all spliced together end to end. The film is fed into the projector using a series of rollers, and then returned to the center core of the platter so no rewinding required. It's an ingenious device, and almost as much fun to watch at work as a pool sweep.

The problem is that if the splice is made at the subframe frameline rather than the frameline the image sequence, instead of being left-right-left-right-left-right, will become left-right-right-left-right so that the left subframe will appear in the right subframe position (and vice versa) so the subframes will be improperly polarized. The result is that pseudostereoscopic image. This can happen with alarming frequency. The hallmark of a perfected stereoscopic projection system is that it ought to require little operator attention – not any more care than projecting a 2D movie. The stereoscopic digital cinema has succeeded because it is almost foolproof.

The above-and-below format was the inspiration for my first stereoscopic electronic display. I invented the first electronic flicker-free field-sequential stereoscopic system, and it's the basis for the vast majority

of stereoscopic displays, including the DLP-based stereoscopic cinema. Whether it's Master Image, Real D, XpanD or Dolby, they all use something I invented, namely that if you present left and right images rapidly in sequence at a sufficiently high field rate, when you look at them through an appropriate selection device, you will see a flicker-free stereoscopic image. And it was the above and below format, its electronic or video version, that I used to get a flicker-free image. StereoGraphics got started by tricking the 60Hz infrastructure into running at 120Hzs. And that's how the new stereoscopic TV industry is going about it.

It may not always be the specific invention that counts; it's the infrastructure. That's something I learned as a boy reading about Thomas Edison. It's not the invention of the light bulb that's the golden key, although it's a pretty good invention. It's the invention of the electrical distribution system that enables light bulbs, toasters, and every other electrical appliance.

In my life as an inventor Edison's example has guided me. I knew that I had to create a flicker-free system that worked with the existing computer graphics and television infrastructure, so I chose the above-and-below format. The above-and-below format for video is an elegant solution, if I do say so myself. That's because subfield or subframes that are spatially sequential become temporally sequential if handled properly. Looking at an above-and-below image on a 60Hz monitor one will see a left and a right image above and below each other. But if the monitor is goosed to run at 120 fields per second those two subfields will play at 120 fields per second with 60 lefts and 60 rights concatenated. Each subfield can occupy the entire height of the monitor's screen – not half the height of the screen. A synchronization pulse must be added within the subfield vertical blanking area so that the monitor can synch to the signals, but once this is done, the image can be perceived to be stereoscopic when viewed through shuttering eyewear, for example.

What worked wonderfully well for electronic stereoscopy turned out to be a flop for film projection. Resurrecting it at this time springs from the recognition that the film industry has a problem. There are not going to be enough stereoscopic digital projection theaters for some time to come. There are too many shows being released and too few theaters. That's the problem but the over/under system 35mm film system is not the answer. It's undependable.