

# 3D in Perspective – First Thoughts

**Update November 2012**

I just got a high end 55” 3D TV (Samsung 7500) and the 3D looks far better than in the movie theaters. It makes me appreciate 3D more but it home viewing story seems to not only at odds with the seeming goal of attractive people to pay more money in the theater. It may do just the opposite.

This is good news for the TV manufacturers who want to charge more for 3D as a feature but that effort is undermined by the problem getting a sense of 3D at many big box retail stores.

I’ve been a skeptic of mainstream 3D though over the years I have experimented with 3D pictures using a [Nimslo](#) camera. It generated prints with a grating so each eye could see a different image. The experience was marginal at best.



I never did go to the 3D movies with the red/green (or other combination) glasses because I couldn’t imagine the experience would be compelling other than the occasional pool cue pointing at the audience.



My opinion changed at the 2010 Consumer Electronics Show (CES) when I realized that you didn’t need a special 3D screen. You could use any screen by using inexpensive glasses.

That’s actually not true today. Very few of today’s screens are capable of 3D and the glasses are expensive.

I do need to be careful about the term “3D” since it can mean many things. In cartoons 3D is used to describe cartoons that give the illusion of depth rather than flat figures. For simplicity I’ll just use “3D” to mean stereoscopic – each eye sees a different image.

It’s interesting to compare (and, of course, contrast) the history of stereo in audio with stereo (OK, 3D) in video. In some sense we’re in the 1950’s when stereo audio was catching on and was a big deal. We first had Hi-Fi (High-Fidelity) sound available. For the most part that’s fine for listening but you did lack the feeling of being present at a live performance. But so what? To generate excitement there were stereo demo discs (records) that let you hear a train coming from one side of the room and passing by.

Stereo has become normal because it’s a small incremental cost and is fully compatible with mono. To broadcast in stereo you send the L and R channels but as L+R and L-R. If you hear just the L+R you get mono. To get stereo you add them together to get L and R back. This compatibility trick is repeated throughout consumer electronics so we decouple the content from the transport.

I [wrote](#) about this decoupling back in 1997. IEEE-1934 coupled the transport with the content and failed. This is a legacy of analog electronics for video which has a system carefully tuned to each format. Adding new formats can be a challenge though the trend has to be towards bit streams rather a system for each encoding.

The attempt to extend stereo quadriphonic failed – more is not necessarily better. Or did it fail? Isn’t Dolby 5.1 the successor? It is sold as high quality sound to those who care rather than as just stereo doubled.

It’s hard to improve a technology along multiple axes. Thus we have stereo for the high quality LPs (Long Playing 33’s) but not for the lower quality 45’s. (For you kids, the 33 and 45 was the number of revolutions per minute for the record.)

As an aside, improved sound gives a sense of presence to video but much of that is from a cheap subwoofer (low frequency speaker). But let’s not get too far into side issues.

The point is that video is different in many ways. One key difference is that our perception of depth is generated in our brain rather than just our eyes. We turn our heads to make our binaural hearing more effective but have to move to a different place to see behind objects. We generate stereo from fixed speakers that aren’t overly sensitive to head movement. Generating the correct image for each eye (I was about to say the right image for the right eye but that would’ve been confusing – again, another story) is far more difficult.

Our brain’s ability to learn also complicates the situation. Looking at some of the video at CES and using stereo views for still pictures I would see what my wife calls a diorama effect as if each image was a flat cardboard cutout in 3D space. Now that I am looking at lots of 3D photos I’m seeing the images with depth.

Psychology is a big factor. For decades after the success of *The Wizard of Oz* we continued to see films done in black and white because it was less expensive and audiences accepted the tradeoffs. Today much of the audience sees

black and white as dated; they expect color. This is even truer for still pictures.

We've had stereoscopes since the 1800's when there was a great deal of interest in 3D photography. You'd view the collection in the parlor much like going through a photo album. The stereoscopes never fully died out but neither are they very common. One reason, perhaps, is that 3D was a production technology and it was difficult to do your own 3D photographs and most of photography is personal.

Still pictures have other advantages in that they can be published in context whereas a stereo viewer requires just looking at the one image.

Today's technologies have changed the rules by giving us generic components that allow us to do 3D without having to development (much) technology just for 3D.



After CES I bought a [Fuji 3D WI](#) because I was curious about 3D and also had a practical application in capturing (taking pictures) of my wife's 3D fiber art. Unlike the Nimslo which took a few fixed images the Fuji

is able to take a guess at the appropriate angle to align the object in the scene but often it requires manual adjustment.

The results, however, can be spectacular, at least in some cases. For objects further away the effect becomes less obvious as the viewing lines become parallel.

The other change is in the viewing technologies developed for video. That's not entirely correct. We have a number of technologies developed for other reasons that can be used for 3D.

- High performance graphic boards were developed for gamers and now such graphic capabilities are mainstream.
- CRT technologies were able to take high refresh rates to improve sharpness
- LCD resolution has increased for computer screens and can be far higher than so-called HDTV but, alas, they are retreating to the mid-range 1920x1080p. Too bad.

LCD's have also been improving in a number of other ways. There have been all sorts of technologies to make images look good while saving money such as reducing the number of colors and mixing adjacent colors (dithering). The number of times per second the image is updated has also been increasing to maintain the sharpness of digital images. Today we expect to see 60 images per second (60 Hz) but the screens go beyond this to 120 and even 240 Hz to reduced perceived blur.

To do stereo video we use a 120 Hz signal to provide two streams of 60 frames per second. You wear shutter glasses that block one eye or the other in response to an infrared signal. While theaters use polarizing glasses shutter glasses don't require special screens or viewing angles.

But I'm getting ahead of myself. Let's go to the movies.

Out of curiosity I decide to see the 3D animated movie, *Up*. It was a pleasant enough diversion and the 3D trailers for other movies and for *Up* were stunning. But towards the end of the movie I noticed that I could take off the glasses and it didn't make a difference. The 3D had been front-loaded for effect. It was the story that carried the movie.

*Avatar* too was carried by the story but enhanced well-done 3D. The combination helped make box office history and, perhaps, gave 3D undue credit.

I next saw *Alice in Wonderland 3D* – some 3D but disappointing effects. Later I learned that 3D was added in post-production. Sprinkling 3D on adds little value to the experience.

Finally I went to see what I thought would be a showcase for 3D – *How to Train Your Dragon*. The movie was entertaining but the 3D was disappointing.

My take-away is that 3D isn't really that important in movies, especially when you are looking at large scenes. Our brains do a perfectly fine job of synthesizing 3D using the information at hand – stereoscopic vision is just one factor and it becomes less important with distance, motion and simply conceptualization of the scene.

The big bucks are in the movies so that is driving the process. But in looking at the latest<sup>1</sup> listings I see very little sign of 3D; just *Shrek 3D*.

The key is that we can do 3D in software. Software is a generic term and plays out in the particular contexts.

First there is the LCD screen. CRTs take their timing from the input signal and it's just a question of whether they can respond to the particular signal. LCD's are different; they are managed by onboard computers that process incoming signals. They need sufficient processing power to process a given refresh rate and to handle a given frequency. They also deal with encryption but that's a separate issue except that it too impacts performance.

Even though the display has a 120 frame refresh rate we need to buy an entire new monitor to get access to that refresh rate. It's like an all-in-one computer that can't be upgraded. A total waste but that's the world of electrons vs. the world of bits.

The good news is that the display supporting 120 Hz will become mainstream for 2D and will just happen to work for 3D.

We now diverge into the traditional world of DVD (AKA, Blu-ray) players and computers. The Blu-ray player software story is simple – new players will be software upgraded to support 3D by adding a second image. In addition to the first 1080 scan lines there will be another 1080 like the L-R for stereo.

The shutter glasses are the other part of the picture (bad pun?). Today they cost \$200 but the price will go down rapidly to become casual purchases. Within two or three years you can assume that you have a 3D ready system with the only special purchase being inexpensive 3D glasses. This is why shutter glasses are a key enabler.

All that remains is buying a 3D Blu-ray disc. And, in fact, I have done just that. I bought Coraline and am now thoroughly confused after trying to play it in 3D on my 3D PC.

But first, what is a 3D PC? Once again we have a simple linear scale. While we can measure video boards along many scales we can simplify it to some sense of performance. Recent video boards are capable of producing a 120 Hz signal alternating two streams of images.

All you need to add is a 120 Hz capable screen. You don't need a TV capable screen, just a computer screen with a sufficient refresh rate. There aren't many available but you can buy one from Samsung, which I did, so I could view the photos and videos I take with my Fuji.

The big value is indeed the still pictures. The transition for stills is in some ways like the transition from black and white to color in family photos. Looking at images of a group of people, especially children and pets with 3D is a different experience from flat (boring?) 2D photos.

You also have more options for displaying 3D photos. There is a huge opportunity in 3D picture frames. The 2D digital picture frames have been slow to catch on. While they are nicer than hanging printed pictures the hokey/value ratio is off. But 3D is different and you can have displays which don't need glasses even if they require a special viewing angle.

But 3D stills have limits. How do we view multiple images on the same screen when our eyes might need to adjust to different viewing angles? Perhaps we can make up for this in software. I don't know. There also the challenge of editing in 3D.

For now though the PC software is decidedly lacking. Only NVidia is making a big 3D push. With enough effort you can make it work but it's still towards the novelty end

of the spectrum and is very clunky and buggy. For example, with the current versions setup is difficult because the mouse pointer keeps disappearing. It also gets confused with multiple displays. The biggest problem may be that it displays when it has exclusive control of the screen and you must leave 3D mode to interact with the program.

And Coraline? Still haven't been able to get it to work in 3D. I suspect it's supposed to work with the NVidia 3D software but can't be sure. It does come with red/green glasses but I haven't put in the effort to get it to work. It reminds me of my first attempt to use a smart CD when CD-plus was first making its appearance.

At this point it seems as if we have a cultural clash and the software associated with 3D is simply not up to the standards or even the culture of the PC world. But that's another story as Hollywood's fixation on DRM (Digital Rights Management) makes anything associated with their content far too difficult to deal with.

DRM puts a stake right through the heart of the dynamic that has made computing so vibrant. For 3D the wound might not be fatal but it certainly hurts.

Before I go on lets step back to CES 2009 when Texas Instruments was demonstrating their [DLP](#), Digital Light Projection, technology. A DLP chip is an array of microscope mirrors used to reflect a beam on a screen. In trying to look for new markets, no matter how far-fetched, they showed how shutter glasses could be used to let a family watch two different programs at the same time by choosing between A and B streams. For the same reason TI has also been in the lead in trying to make 3D happen.

In 2010 TI was joined by the LCD crowd demonstrating 3D (no shared screens). If you strip away all the hype the basic enabler for 3D is that in two or three years you'll likely have at least one capable 3D screen and will want to find a use for it. Or not. You aren't justifying the purchase based on 3D – it's just the standard high end TV, or more to the point, screen.

You may also be able to watch ESPN-3D. Just as sports were used for fifteen years to convince everyone that HDTV was important, sports is a rationale for 3D broadcasting. And maybe it is. But if so it will take a while because it requires so much else be done right. Another driver may be PC games. But both markets have their challenges.

So there you have it. 3D will happen because the technology is all capable of 3D simply due to normal improvements. But the software problems indicate a bumpy ride. We're also up against the physics of the eyes and the perceptual issues.

Since 3D is easy and available we will find uses. Maybe the hype will continue but if this week's movie listings are any indication of this, the umpteenth tide of 3D movies will subside but it won't go away. I do expect people to create movies that take advantage of the 3D but it may have to wait till it's safe to make a movie whose market is limited to those with 3D-capable gear.

PS: For an historic perspective (pun?) you can look at [these](#) 3d photos from the civil war.

---

<sup>i</sup> Too bad I can't provide a URL for listings as of today – I only have a generic URL for <http://www.boston.com/movies>.