

The Retailing of HD-DVD and Blu-ray

Evan Powell, September 1, 2006

Recently I stopped into a prominent consumer electronics retailer in town to see how they were promoting the new HD disc technologies, HD-DVD and Blu-ray. Just inside the front door was a riveting demonstration of Samsung's new BD-P1000 Blu-ray player. It was connected to an impressive Pioneer Elite 50" 1080p plasma display. The video material that was playing was a loop from a Blu-ray demonstration disc that had been shot live with a high resolution 1080p video camera? not a transfer from film. If you ever see a product demo of this type you will be blown away by the spectacular image quality. The plain ole TV at home certainly never looked this good.

When I asked if they had a similar demo of HD-DVD, the salesman took me on a long walk to the back of the store. There on a small shelf was Toshiba's HD-A1 HD-DVD player. It was driving a 27" low resolution widescreen monitor. An HD-DVD movie was playing, and on this monitor it looked like pretty good DVD, but nothing special. That's because the monitor was incapable of displaying the full resolution of the HD-DVD format.

If this retailer's objective was to make Blu-ray look as good as possible and HD-DVD as bad as possible, they could not have done a better job. Any typical consumer walking into this store and seeing these demos would naturally assume, quite erroneously, that Blu-ray was a higher resolution format than HD-DVD.

We have visited over a dozen retail stores in the past month, including big chain stores like Best Buy, Fry's Electronics, Ultimate Electronics, Sears, and Tweeter. And with rare exceptions, the story is similar from store to store. Blu-ray is being featured as the premium solution, and HD-DVD is being downplayed as the cheaper and lower performance alternative. In some stores there is an active demo of Blu-ray, whereas there is none of HD-DVD. In others we found Blu-ray being demo'd on large native 1080p video displays, while HD-DVD was being shown on smaller 720p or lower resolution monitors. One store had Blu-ray on a beautiful 46" 1080p LCD flat panel monitor, and HD-DVD in a separate room on a 1080p DLP rear projection TV with ambient light problems. In only two of the stores we visited did we find both technologies being shown on similar 1080p video displays.

In addition to the favorable Blu-ray staging being done on retail floors, most of the sales reps we encountered were armed with a set of talking points. When we asked about the differences between Blu-ray and HD-DVD we got four stock answers:

1. Blu-ray is higher resolution 1080p, whereas HD-DVD is only 1080i.
2. Blu-ray has more storage capacity, so they can put more video on the disc.
3. Blu-ray is faster, so it can deliver a better picture.
4. Blu-ray has more Hollywood studio support, so you'll see more HD movies in Blu-ray than with HD-DVD.

That's a pretty compelling list of reasons to buy Blu-ray. It is hard to believe anyone would end up buying HD-DVD after a pitch like that. But let's take a look at each of these issues more closely.

1080i vs. 1080p

On our tour, one sales rep said pointedly, "The whole world is going 1080p; why would you lock yourself into something that was only 1080i?" It is tough for the typical consumer to argue with that since it makes perfect sense. As one of our readers said in a recent email, "Give me 1080p, 1080p !!! Nothing less will do."

Absolutely. We agree wholeheartedly. The newly emerging, cutting-edge video displays, both projectors and flat panels, are 1080p, or to put it more precisely, they have a physical pixel matrix of 1920x1080, and they are progressively scanned displays. To get the very best performance from these 1080p displays you need a 1080p source.

Contrary to popular misconceptions, HD-DVD and Blu-ray are both 1080p sources. As far as movies are concerned, both disc formats are scanned and encoded in 1080p from the original film. So why the confusion? It comes from the fact that the first HD-DVD player, the Toshiba HD-A1, outputs 1080i, while the first Blu-ray player, the Samsung BD-P1000, outputs both 1080i and 1080p. That sounds like a big deal, but in reality this is more of a marketing/perception problem for the Toshiba player than a technical limitation.

Both HD-DVD and Blu-ray have all of the progressively scanned 1080-lines per frame of information on the disc, and this information is not lost or compromised in 1080i transmission. The transmission interface is simply a matter of the order in which the scanlines are read and transmitted to the video display. If they are transmitted in 1080p, they are sent sequentially. If they are transmitted in 1080i, they are sent in two fields, with one containing the odd numbered lines and another the even numbered lines. These two fields are then reassembled into sequential frames by the video processor in the TV or projector. Either way you end up with the full 1080p frame being used to create the picture, so there is no difference in the end result.

What is not obvious to the consumer is that the Samsung player first converts the 1080p/24 information on the disc to 1080i/60. Once it is in that format, it can output it in either 1080i/60 if that is what the projector or TV takes, or it can convert it to 1080p/60 for output. The Toshiba HD-DVD player converts the 1080p/24 information on the disc to 1080i/60 and simply outputs it in this format. It is then converted to 1080p/60 in the video display. With either player, the signal passes through an interlaced state on its way from the disc to the screen.

Therefore, the 1080p output as implemented on the Samsung BD-P1000 is of no real value to the consumer in terms of enhanced picture quality. It is, however, of tremendous promotional value to Samsung and the Blu-ray group. The extra cost to add 1080p output onto the Samsung BD-P1000 pays handsome returns, because it inspires retail sales reps to say to their customers, "The reason you pay extra for Blu-ray is that it is 1080p, while HD-DVD is only 1080i" Or, as another rep told me last week, "The story is simple: Blu-ray is double the cost and double the resolution."

Now, an important side note is warranted. We are talking about the common form of 1080p in the NTSC world, which is 1080p/60. But another way to output the information is to simply transfer the data on the disc in its native 1080p/24 format without doing any conversion to 1080i/60 or 1080p/60. Contrary to what you might expect, 1080p/24 transmission actually can have some incremental benefit over 1080p/60. However, in order to take advantage of 1080p/24 output on the players, we will also need projectors and TVs that can recognize 1080p/24 signals and convert them to 48 or 72 Hz. The vast majority of HD compatible TVs and projectors that have been installed and are being sold today do not have 1080p/24 capability. However, they are beginning to appear in anticipation that Blu-ray and HD-DVD players will be able to output that particular signal format.

The advantage to 1080p/24 transmission is that it can eliminate artifacts associated with the 2:3 pulldown conversion that is common in the NTSC 60 Hz world. The disadvantage is that it adds

cost to both the HD disc players and the video display products. Moreover, the vast majority of consumers are not bothered by, or even conscious of the artifacts that it is intended to eliminate anyway. For the most part, 2:3 pulldown conversion is invisible to the viewer except in certain types of scenes, and even then they would not be noticed at a normal viewing distance on most 40" to 50" televisions.

Nevertheless, for videophiles using larger screen systems, 1080p/24 transmission and processing will eliminate 2:3 pull-down artifacts that they can certainly be aware of and bothered by. So as TVs and projectors come onto the market that are able to accept a 1080p/24 signal, both HD-DVD and Blu-ray players will show up that are able to deliver it. In fact, the next wave of higher priced Blu-ray players to hit the market this fall should have 1080p/24 output as an option. A good percentage of the higher end videophile market will be motivated by 1080p/24 transmission, so HD-DVD will need to follow suit in a timely fashion.

Do Blu-ray discs have more storage capacity, and is it relevant?

The present myth is that Blu-ray discs hold 50 GB of data, and HD-DVDs hold 30 GB. The truth is that storage capacity on both formats is evolving. The issues are how many layers can be encoded on a single surface, and whether one or two sides of the disc can be brought into practical use.

Blu-ray stores more information in a single layer than does HD-DVD, the difference being 25 GB for Blu-ray vs. 15 GB on HD-DVD. However, at the moment, Blu-ray can only produce single-layer discs. So the total storage capacity on all Blu-ray discs that have been brought to market thus far is 25 GB. Meanwhile, from the outset HD-DVD has been delivering dual-layer discs that hold a total of 30 GB on a single side of the disc. In addition, HD-DVD can presently encode dual-layer information on both sides of the disc, for a total of 60 GB per disc. Dual-sided encoding has been used so far in HD-DVD "combo" discs to put the HD version of a movie on one side, and the standard def version on the other. But both sides of the disc can be encoded in HD if the space is needed. So as of this writing, HD-DVD is capable of delivering 60 GB of storage on a two-sided disc compared to Blu-ray's 25 GB single-side, single-layer limit.

This of course is not the end of the story. The Blu-ray folks claim that they will begin to deliver dual-layer 50 GB Blu-ray discs by the end of the year. This may or may not happen. One cannot be faulted for some skepticism, since Blu-ray was supposed to be delivering dual-layer discs long before now. But if they do, then at the end of the year Blu-ray will have 50 GB of storage on a single-sided disc, and HD-DVD will have 60 GB on a dual-sided disc, with 30 GB on each side.

Beyond this, there are the futures being touted by both groups. The HD-DVD group has already developed but not yet released a triple-layer encoding capability that disc replicators have certified as good to go for mass production. This would boost HD-DVD capacity to 45 GB per side, for a total of 90 GB per disc. Not to be outdone, Blu-ray claims that it will one day deliver four-layer encoding capability for a total of 100 GB on a single side, and possibly even an eight-layer disc with 200 GB.

The question for the consumer is: Why should I care? How much storage is required to deliver an HD 1080p movie? Those who are enthused by the potential 50 GB limit of Blu-ray over the actual 30 GB capacity of HD-DVD are arguing that 30 GB is not sufficient to encode full length films in 1080p, and have space left over for all the special features that consumers enjoy.

If 30 GB of storage per side of the disc represented a practical limitation on quality, run time, or special features, we would be concerned too. But with the newer and much more efficient video codecs VC-1 and MPEG-4, as well as the advanced HD audio codecs, there is really no problem here. What we need is enough storage to hold a full length movie in 1080p/24 resolution, and to

deliver it to the screen without noticeable compression artifacts. Once that is achieved, we could double or quadruple the storage space available with no perceptible change in quality, because storage is no longer a limiting factor.

Practically speaking, what the home theater market needs is a disc that can deliver superb high definition video at run times longer than most people would want to sit in a chair without moving. In our experience, that is usually about three hours. The large majority of films ever made do not run anywhere near that long. But there are some that can run up to four hours. One of them is *Lawrence of Arabia* which I screened a while back with some friends. That movie comes on two DVDs. When it came time to switch discs, everyone leapt from their chairs, grateful for the intermission break. In reality, people rarely want to sit for four hours straight.

Currently Blu-ray is using the inefficient MPEG-2 video codec, which compared to the advanced codecs takes up a lot of storage space. Blu-ray is also using uncompressed PCM audio on many of its discs. The audio quality is superb, but uncompressed PCM chews up a lot of storage as well. Despite these inefficiencies Blu-ray is still delivering 1080p movies that run over two hours on 25 GB discs.

HD-DVD is currently shipping 30GB/side discs. But more importantly they are providing authoring tools for VC-1 and MPEG-4, and the HD audio codecs Dolby Digital Plus, Dolby TrueHD, and DTS-HD. With the incremental storage space and much better technical efficiency, one can achieve run times of four hours or more on a single-sided HD-DVD. In addition, since HD-DVDs can be encoded on both sides of the disc, studios can put a movie on one side and an extensive collection of HD special features on the other if the extra space was needed.

Is Blu-ray faster, and is it relevant?

On our retail tour, several of the sales reps we met said that Blu-ray has a higher bit rate, and the ability to read and transfer data more rapidly makes it a better solution for high quality video. They are correct that maximum bit rates on Blu-ray are higher than HD-DVD. The maximum bit rate on HD-DVD is 36.55 million bits per second, whereas it is 54 Mbps on Blu-ray. To people reading the spec sheets that sounds like a big technical advantage for Blu-ray. And in theory, the more data you can move and process in a given period of time, the better the picture and sound will be.

However, this is true only to a point. Given the fixed limitations of other elements in the video system like film size, 1080p scans, and 24 frame per second film exposure rates, one cannot simply continue to increase bit rates and gain ever-increasing picture quality. Eventually you get to the point where the limits of the source and the displays are reached, and further increases in bit rates become irrelevant. And as far as 1080p/24 video material with the advanced codecs is concerned, if that point has already been reached with a maximum 36.55 Mbps bit rate, then incremental bit rates beyond that will not contribute to perceptible increases in image quality.

So how fast is fast enough? Transfer rates on standard DVD average about 5 Mbps and max out at 9 Mbps. Standard HDTV broadcast is at 19.4 Mbps. Clearly in the range of performance defined by DVD and HDTV *as encoded in MPEG-2*, more data and higher bit rates produce better images. Today's HDTV broadcasts on high resolution video displays look extremely good, and certainly they are head and shoulders above DVD.

Now, HD-DVD's maximum bit rate of 36.55 Mbps is about double that of broadcast HDTV. That by itself is enough to enable it to deliver spectacular picture and sound, the likes of which we have not yet experienced. But on top of HD-DVD's virtual doubling of HDTV's bit rate, there is the huge kicker in performance that is derived from the advanced codecs: HD-DVDs being made today are in VC-1 and MPEG-4, whereas HDTV is in MPEG-2, so with HD-DVD a lot less data

needs to be read and transferred in order to deliver a magnificent HD picture. HD-DVD can run circles around HDTV even when loping along at bit rates far below those of HDTV's 19.4 Mbps.

Therefore, as with the storage issue, HD-DVD's maximum bit rate of 36.55 Mbps is not likely to be a limiting factor in the quality of the home theater experience, at least as far as 1080p/24 film transfers are concerned. Many other factors have as much or more influence in setting the limits of picture quality including the physical limitation of film size, the condition and restoration of the film, the 24 frame-per-second exposure rate, the 1080-line scan format, the precision of the advanced codecs, and the non-transparency of today's 1080-line digital video displays. These limitations are equally inherent in both HD-DVD and Blu-ray. It is for these reasons that we maintain that once HD-DVD and Blu-ray are delivering their maximum potential (and neither one is there yet), the consumer will notice no difference between the two in terms of image and sound quality.

Yet, rather than debating the merits of the technical specifications to determine whether Blu-ray or HD-DVD is the better value, we'd be a lot better off if consumers could simply be allowed to see these two technologies side by side on identical 1080p flat panel monitors with comparable source material. This is ultimately where the retailers are failing the public. They have the opportunity to help consumers get a real feel for the differences, or lack thereof, between HD-DVD and Blu-ray. But instead, many of them are staging skewed demos to up-sell the customer to the higher priced product. They cannot be blamed for this. After all, the retailer's primary objective is to maximize profit and revenue per square foot, not educate the public. Nevertheless, it is unfortunate that consumers are not able to see the merits of these two impressive technologies in demos that show them both side by side on an equal footing.

But on second thought, even that might not make a difference. In one remarkable retail store we found both HD-DVD and Blu-ray being demo's on equivalent 1080p flat panel monitors. The Blu-ray demo was playing a movie and the HD-DVD was running a loop from the DVD Forum demonstration disc that had been taken with a 1080p video camera. As anyone would guess, the HD-DVD picture was smoking the Blu-ray due to the higher quality source. I asked the sales rep, "Correct me if I am wrong, but the picture on this HD-DVD actually looks better than the Blu-ray, wouldn't you agree?" He said, "No it isn't. It can't be, because it is only 1080i. The other one is 1080p." In the strange world of video marketing, specs trump the picture before your eyes.

Blu-ray has more studio support

The last pitch that we heard frequently on our retail tour is that we should buy Blu-ray because Blu-ray is supported by all of the major studios except one. While this is certainly true, the statement is intended to give the impression that there won't be much to watch if you buy into HD-DVD, and that is false.

It is true that only one major studio has refused to support Blu-ray. But that one is **Universal Studios**, a company with an extensive film library that includes popular titles like *King Kong*, *Gladiator*, *U-571*, *A Beautiful Mind*, *Jurrasic Park*, *Jaws*, *E.T.*, *Schindler's List*, *Scarface*, *The Bourne Identity*, *Back to the Future*, *The Mummy*, *American Pie*, *The Fast and the Furious*, *Seabiscuit*, *Love Actually*, *Munich*, *Apollo 13*, *Scent of a Woman*, *Casino*, *Field of Dreams*, *Bridget Jones' Diary*, and hundreds of others. As things stand now, these and all Universal titles will be released exclusively in HD-DVD.

Now, there are several major studios that currently plan to release their titles exclusively in Blu-ray, including **Sony Pictures**, **MGM**, **20th Century Fox**, and **Lions Gate**. Movies from these studios include the *Rocky* films, the *James Bond* films, the *Star Wars* films, *Charlie's Angels*, *The Patriot*, *The Mask of Zorro*, *The DaVinci Code*, *Spiderman*, *Legends of the Fall*, *Sleepless in Seattle*, *Black Hawk Down*, *Men in Black*, *A Few Good Men*, *Basic Instinct*, *Jerry Maguire*, *The*

Terminator, The Fifth Element, Dirty Dancing, Reservoir Dogs, Moulin Rouge, Minority Report, Fight Club, Never Been Kissed, Edward Scissorhands, Patton, Rocky Horror Picture Show, and of course many hundreds more.

However, in addition to the movies that are exclusively in one format or the other, there are many that will be released in both formats. That is because HD-DVD and Blu-ray both have the support of the studio giants **Paramount** and **Warner Bros**, as well as the strategically important **HBO Films** and, notably, **New Line Cinema**, a studio widely recognized as a leader in the delivery of high quality DVD transfers.

Titles from these studios that we can expect to be released in both HD-DVD and Blu-ray include the *Batman* films, the *Matrix* films, the *Star Trek* films, *The Lord of the Rings* trilogy, the *Austin Powers* films, the *Band of Brothers* mini-series, the *Mission: Impossible* series, *Indiana Jones*, *Raiders of the Lost Ark*, *Saving Private Ryan*, *Braveheart*, *Beverly Hills Cop*, *Forrest Gump*, *Ocean's Eleven*, *The NeverEnding Story*, *Goodfellas*, *Caddyshack*, *48 Hours*, the *Lethal Weapon* films, *Driving Miss Daisy*, *Officer and a Gentleman*, *Terms of Endearment*, *Ferris Bueller's Day off*, *Trading Places*, *Wedding Crashers*, *Dumb and Dumber*, *Rush Hour*, *Se7en*, and many hundreds of others.

The bottom line is that the consumer need not be worried about having enough to see in HD-DVD. At the moment, there are more HD-DVD titles than Blu-ray either available or about to become available. Therefore, when someone tells you that you need to buy the more expensive Blu-ray player because all of the major Hollywood studios support it except one, be on your guard. You are being told the truth, but it is not the whole truth.

So--what is the consumer to do?

This format war is not about image quality or the best technology. It is a struggle for money, power, and market share among the Hollywood studios and major consumer electronics firms. We as consumers have been dealt a hand, and it is up to us to play it to our advantage.

We have several options. First, we can do nothing and sit on the sidelines. That is certainly a reasonable choice for a lot of people who are not that motivated to get into the viewing of films in high definition. It will be years before most of the titles just mentioned above actually appear in either HD-DVD or Blu-ray. And not only that, the price of the HD-DVD and Blu-ray players will come down significantly as time goes on. Today's \$1000 Blu-ray player is likely to cost \$200 three years from now. So what is the rush?

Of course, the early adopters and videophiles are not going to sit by and miss out on the grand experience of HD video and HD audio now that it is available. For these folks, there are three choices? Buy HD-DVD, buy Blu-ray, or for those with unlimited funds, buy both.

For those who want to get the maximum bang for the buck, one practical strategy may be this: buy HD-DVD today, and plan to buy Blu-ray in another year or two when the prices have collapsed and more titles are on the market. By doing so you will end up spending less for both technologies than you would by spending \$1000 just for Blu-ray today. At this writing, Amazon is selling the Toshiba HD-A1 HD-DVD player for \$450, with free shipping included. That is a manageable investment for most home theater enthusiasts. It lets you step into the world of HD today with a minimum outlay of cash, with an open option to pick up Blu-ray when it becomes a better value proposition.

There are several benefits to this approach. First, there are more HD-DVDs to choose from at the moment. Second, you can play all of your standard DVDs in upscaled 1080i format with digital

output. If your current player does not have these features, regular DVDs are likely to look better than they do on the player you currently have.

Another advantage is that the HD-DVDs that have been released so far are generally superior to the current crop of Blu-ray discs due to the use of VC-1 and MPEG-4. In addition, all of the HD-DVDs have high definition audio tracks on them. Many of the Blu-ray discs have uncompressed PCM, which certainly delivers excellent audio quality. But about a third of them have no advanced audio capability. For example, Warner Bros.' HD-DVD release of *Training Day* is in VC-1, and it includes Dolby Digital-Plus and Dolby TrueHD, whereas its Blu-ray edition of *Training Day* is in MPEG-2 and has only standard Dolby Digital. Early adopters and videophiles will prefer the HD-DVD as the collectible edition of this movie.

On the other hand, if you have more money available and want to upgrade your projector or TV to a unit that can recognize a 1080p/24 signal, then you might want to choose one of the new Blu-ray players to be released this fall from Pioneer, Panasonic, or Sony (make sure to verify the final specs upon release). The advantage is that you'll be the first on your block to have a full 1080p/24 system in operation. The downsides are (a) you will pay a lot more than your neighbor with the HD-DVD rig, (b) many of the current Blu-ray discs being released are not quite what they should be in terms of video and/or audio quality, and (c) you are betting that Blu-ray will get its fundamental problems worked out in a timely fashion. However, if and when we begin to see 50GB dual-layer Blu-ray discs in production, many of the current quality issues stemming from the use of MPEG-2 with a 25GB limit should be mitigated.

Overall, we would like to see both HD-DVD and Blu-ray survive and thrive. There is plenty of room for both of them in the marketplace, and there is no reason for either one to monopolize it. Currently HD-DVD has its act together and is delivering tremendous value at prices most consumers can easily afford. It is a shame that retailers are not more motivated to show HD-DVD to the public in its best light. But if Blu-ray gets high performance players with 1080p/24 output to market before HD-DVD does, and if it gets its quality problems resolved, then it will be offering a real value proposition to videophiles that would justify its existence as well.

The major studios have always been happy to release their movies on DVD in both Widescreen and Full Screen editions to accommodate the consumer's TV and viewing preference. There is no reason that all studios, once the two formats are firmly established, could not ultimately follow the lead of Warner, Paramount, and New Line Cinema by releasing their films in both HD-DVD and Blu-ray for the same consumer-friendly reasons.

Ultimately, a vigorous competition between the formats will hasten the collapse of HD player prices, and bring consumers closer to the day when both technologies are available at nominal cost. Keep in mind the rapid collapse of pricing in progressive scan DVD players over the last five years. Today's \$150 DVD player will outperform players that cost \$1000 five years ago. We can expect to see the same price erosion in the HD player market going forward. Once HD-DVD and Blu-ray players are widely available for \$200, it won't matter which technologies the studios decide to support. The consumer will have won the war.