



## Evolution Toward the Third Dimension

### *You'll Want to Make Sure Your Next PC Can Handle 3D*

**Sponsored by NVIDIA**

*By Roger L. Kay  
President, Endpoint Technologies Associates*

If you've noticed a shift in the visual computing landscape lately, it's not a mistake. Even though the pictures and video you view on a PC have gotten ever denser, richer, larger, and more realistic, until recently all these gorgeous visuals happened on a flat plane. The PC industry had gone a long way toward rendering 3D effects on a 2D surface, but the third dimension, so vital to human understanding of physical space, was beyond the grasp of mere mortals until recently.

Scientists and perceptual psychologists have long known how stereoscopic 3D works, but the true effect could be produced only at great expense in laboratory settings. There have been previous (fairly lame) attempts to mainstream 3D. Everyone remembers the glasses with one blue eye and one red eye. They've been around for at least 50 years. But compelling technology that isn't too expensive has only arrived on the scene recently, and now 3D is set for mass adoption — of course in movie theaters, but also, and maybe more importantly from an awareness perspective, on personal computers and TVs in the home.

The most obvious development that led to this turning point is the 120Hz display. Most PC displays have only a 60Hz refresh rate, sufficient for computing as we know it today. But 3D technology fools the brain by treating each eye differently. The brain's attempt to resolve this double input produces 3D perception. All that remains is to show each eye its own, slightly different view, and suddenly everything appears in astoundingly realistic 3D perspective. Bring on the "shutter glasses," active electronic glasses that flip a set of venetian-blind-like electronic shades in perfect countercycles (using technology similar to that found in LCD displays), revealing to each eye its own image exactly 60 times per second. At that rate, the brain perceives smooth video, but the images carry the perspective of two cameras, as if they were set apart by the distance between two human eyes. There's a bit more

trickery involved: the computer needs a powerful enough graphics card to handle 3D rendering, a synchronized transmitter is required to send the right coordinating signal to the shutter glasses, and software that makes the whole thing work must be installed.

But the sum total for all this enchantment is only about \$300 dollars today, made up of the \$100 differential for the enhanced display and \$200 for the shutter glasses and related small USB transmitter. The software is included. Adding a Blu-ray player to for playing purchased 3D content slaps another \$100 on the tab, but streaming content from the Web starting to become available. Early adopters will likely be found among those 90 million PC enthusiasts who already have a graphics card sufficiently powerful to run 3D. In time, the display differential will disappear, the glasses will come down as volumes rise, the transmitter will be integrated into many mainstream computers, and the Blu-ray premium will decline, but, more importantly, the need for a Blu-ray player at all will decrease as broadband gets faster, more reliable, and ubiquitous, and much content is streamed over the Web. Thus, with mainstream adoption, 3D will be increasingly reachable from a pocketbook standpoint.

The effect of 3D is overwhelming at first. The rocket ship takes off from the screen and flies right into your body. Signs and objects seem to float at different places in space before you. But soon you get used to it, and watching a video or playing a game becomes almost magical.

The general public has begun to experience these effects in movies like Avatar, for which moviegoers were issued 3D glasses as they walked into the theater. People, many for the first time, felt as if they were inhabiting a fantasy world along with the actors.

NVIDIA, the sponsor of this paper, contributes to the adoption of 3D by mainstream consumers in multiple ways. First, it provides excellent 3D graphics hardware, the bedrock of the experience. Its discrete graphics chips and cards make the lightning quick calculations that not only allow 3D Blu-ray movies to play, but also make possible 3D environments in games that adjust to the player's activity on the fly. In addition, the company has developed the software that can take standard 2D games and re-render them in 3D, taking previously published games like Spore to a whole new level of experience. Through this process, NVIDIA has already made more than 400 games available in 3D and is working with game developers to ensure that most new games are 3D-ready. NVIDIA technologies are involved in production of 3D content in professional movies and video games as well as in professional 3D projection systems and 3D consumer PCs.

Of course, the advent of 3D is not a single-company phenomenon, and many others are filling out the ranks as it begins to establish. The hardware ecosystem includes makers of 3D monitors, 3D graphics chips and cards, 3D-ready desktops and notebooks, 3D still cameras, 3D video cameras, and 3D TVs. Of the top 10 monitor makers, six (Samsung, ViewSonic, Acer, Alienware, LGE, and ASUS) are shipping 3D Vision-capable monitors. Camera manufacturers like Fuji and Sony are shipping or set to ship new 3D digital cameras this year. Asus already has a product called the G51JX that ships standard with NVIDIA's 3D Vision active shutter glasses and software. A host of others will follow.

Driving hardware adoption is the rise of 3D content, particularly in the PC world, which is sufficiently flexible to host a plethora of new development. Gamers are drawn to the more immersive experience of 3D PC games, and more than 400 3D games are now available, with many more in the pipeline. The PC is well suited to the horsepower demands of 3D games. With PCs and TVs able to view them, 3D photos will become more commonplace, and the increasing popularity of 3D photo encoding will in turn invigorate the camera category with new 3D models.

The streaming of 3D content will be huge. As broadband access improves, 3D content streaming will grow beyond mainstream examples already in market, such as Hulu and YouTube. Software companies Microsoft and Adobe will push out new 3D streaming players rapidly. 3D sports webcasting was piloted for the first time this year during the Masters golf tournament, and other sports, such as soccer, car racing, hockey, and basketball, will surely join the 3D streaming horde.

And Hollywood has fallen in love with 3D. Producers and directors, seeking to further captivate their audience, are making 3D a major tool in their portfolios. Feature films in the mold of the recent production of James Cameron's Avatar will become increasingly common. These films will be enabled by 3D Blu-ray players, monitors, and

notebooks. For the first time, viewers' home PCs will serve as a personal 3D theater. Even today, a \$1,500 rig with 120Hz monitor, Blu-ray player, and active shutter glasses opens a world of 3D movies, photos, games, and streamed internet content is already available.

The rise of 3D TVs will aid the overall trend toward adoption. The volume of 3D TVs, added to that of 3D PC monitors, will bring down the cost of displays. Also, a 3D TV, equipped with an HDMI 1.4 connector, can serve as an output device for a 3D-enabled PC. In addition, 3D TVs will help acquaint the public with the 3D concept.

We're just in the early phase of 3D adoption, but the market is likely to grow dramatically over the next five years. Although in 2010, only about 1 million 3D PCs will ship, by 2014 that number will rise to more than 30 million. TVs will experience a similar curve, rising from a 2-3 million in 2010 to more than 50 million in 2014. During that time, the price premium for a 3D PC will drop from \$300 to nearly nothing, and while 30 million sounds like a lot of 3D PCs, that figure must be understood in the context of the overall PC market, which will ship around 350 million units in 2010 and rise to almost double that by 2014.

Just as the transition from standard definition to high definition and on to 3D TVs is moving along apace, so a similar conversion is underway from 2D to 3D PCs. Whether you go out and buy one today, wait until your next PC purchase, or hold off until everyone has one, you should definitely be aware of this "extra dimension" as you make your buying decision. It will be easy and inexpensive enough to pick up the necessary hardware, even if it's just a 120Hz monitor and sufficient graphics, so that you can make the transition when you feel the content is compelling enough. Then, you can snag the glasses and transmitter package and a Blu-ray drive as aftermarket add-ons. Or, if you feel like stepping right up, you can go out today and buy one of the new Asus or Toshiba 3D Vision notebooks, which have everything you need. 3D is a lot closer than you think.

*Roger L. Kay is the founder and president of Endpoint Technologies Associates ([www.ndpta.com](http://www.ndpta.com)).*

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