



# 3D Enthusiast's Guide

A viewer's guide to stereoscopic video in the luxury home

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## Introduction

### 3D for the Home

In this ebook, we explore the eight most important requirements for high-quality 3D home and equip enthusiasts to judge for themselves the quality of commercial offerings.

As the Vice President of Marketing for Runco International, a leader in home theater and video technologies, Ms. Jennifer Davis has unique insights to what luxury homeowners should be looking for in a 3D video solution: just in time for the release of *Avatar* (in 2D) and a host of innovation in the market prompts people to think about 3D in their homes. You will find more information about Jennifer at the Author page toward the end of this book.

*"Great 3D is nothing short of great storytelling. Technology doesn't create the stories, it emboldens them."*

*-Jennifer Davis*



Photo courtesy of James Cameron and [www.AvatarMovie.com](http://www.AvatarMovie.com)



## Introduction to 3D

### 3D on the Brain

Depth perception is a response created in the visual system. Each eye is separated by approximately 2.5" (65mm). Images pass through the lens of the eye to the retina which creates an electrical signal that travels down the optical nerve to the brain. The brain compares the views from the two eyes to determine depth. The more stereo separation, the greater the perceived depth.

The illustration to the right shows how the slightly- skewed views from the left and right eyes combine in the brain to create a sense of depth.

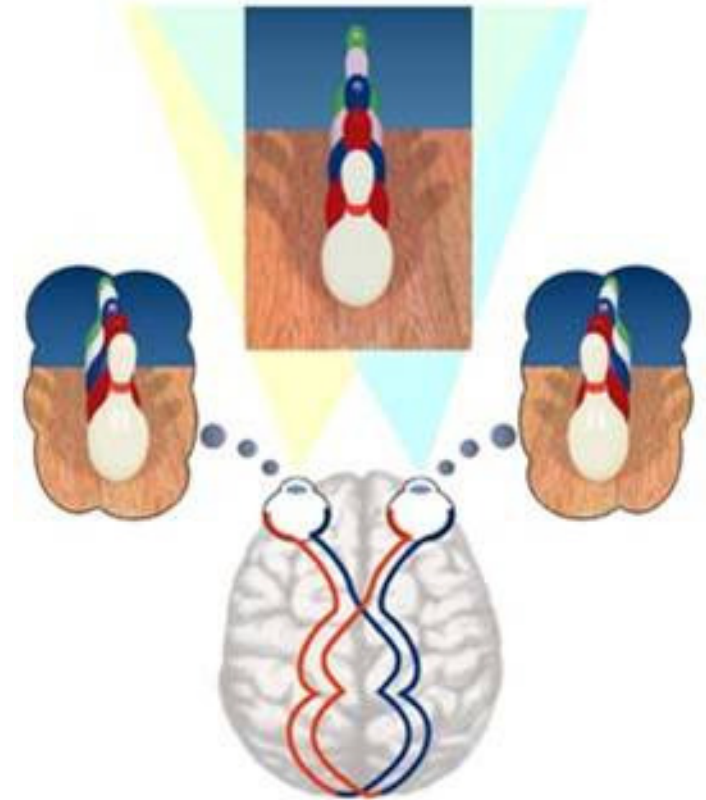


Diagram Courtesy of Pat Green, Planar Systems, Society of Information Displays November 2007



# Introduction to 3D

## 3D on our Minds

There are no fewer than 30 different approaches to 3D delivery. We've come a long way since Sir Charles Wheatstone's StereoScope and his experiments with stereo pair photography in 1838. Since then, there has been a repeating cycle; every 60 years the concept of 3D has taken off in the cinemas and has been promised in the home. Yet, each peak was followed by a valley as 3D implementation disappointed. For a host of reasons, unprecedented in history, we believe that 2011 is the year when the promise of 3D will be fulfilled and this ebook will help you sort through the hype.

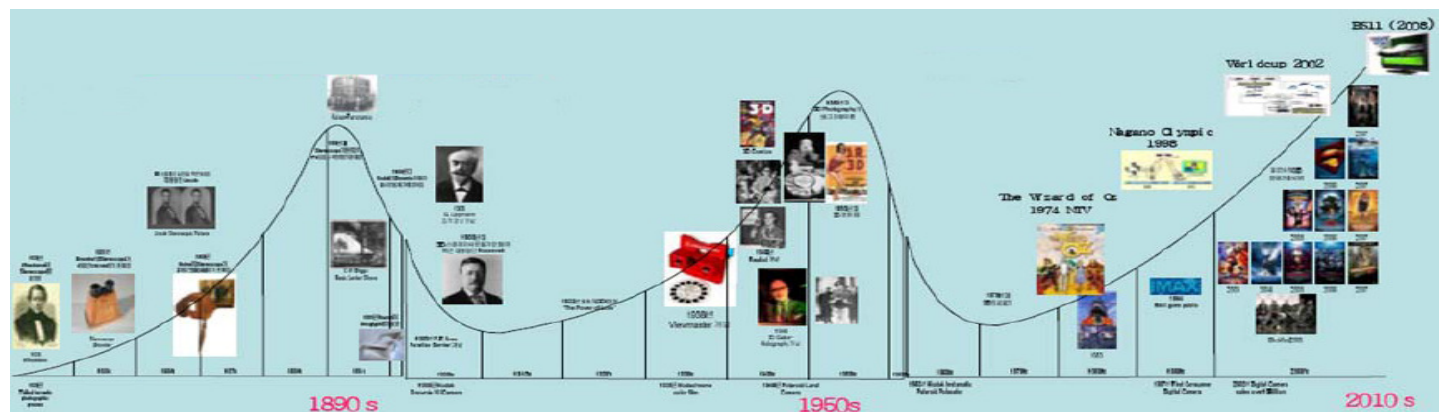


Diagram Courtesy of FFIC Korea



## Common 3D Approaches in the Home

There are a variety of 3D approaches that are being marketed for the home. Here are some of the most common ones (at press time). There are other approaches that are used in commercial theaters, but have not been widely commercialized for residential use. These include time-sequential, shutter lens (RealD®) and color wheel (Dolby3D®) approaches. Most current technologies use polarized light to direct the proper image to the correct eye when combined with a special 3D silver screen. There are glasses-free 3D displays that are used for digital signage applications, but they are inappropriate for the home because of low resolution and poor image quality.

### Anaglyph



- Any projection device or conventional display (or paper!)
- Inexpensive anaglyph glasses (\$.20 to \$10)
- Simultaneous delivery of right and left eye content
- Chromaticity compromised
- Example: SuperBowl 2009, Cowboys game, 3D Blu-Ray content available today

### Time Sequential – Shutter Glasses



- 120 Hz projector or 240 Hz flat panel television
- Sequential frame sequencing (½ refresh)
- Active LCD shutter glasses synchronized to emitter
- Active glasses are \$100-\$400 per pair (require batteries)
- Example: Xpand®, PC gaming, a host of front projection and television makers



## Requirement 1

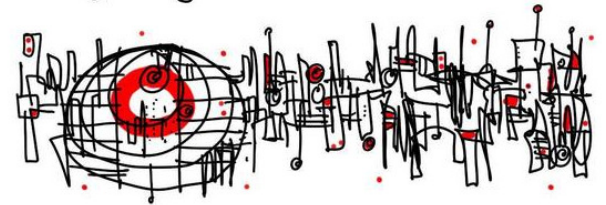
### #1 Stereo Video Quality

The first question that should be asked of any display, including 3D systems, is "Does it look good?"

Although there are scientific measurements to describe color, contrast, resolution, and the like, the most important criteria is whether it suits your individual tastes and watching preferences. In short, 3D should be amazing. Anything less isn't worth your investment.

There are common pitfalls to 3D that an educated viewer can see that will help you choose the highest quality approach for your home.

Being totally frickin' amazing is Job One



high



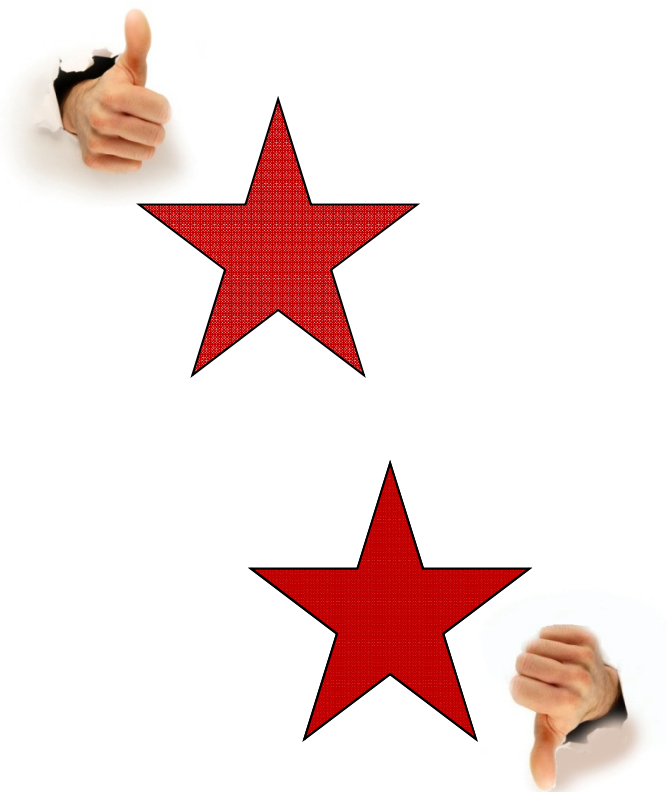
## Requirement 2

### #2 Low Ghosting

Ghosting occurs when the stereo effect is compromised and the image with glasses more closely resembles the image without glasses: it is doubled and blurry. This occurs when part of the right image is visible with the left eye and/or visa-versa. Ghosting (also called bleed through or crosstalk) is distracting and effects viewing comfort and visual performance. Ideally, 3D systems should have no crosstalk between images, because in nature your right eye perceives an object differently than your left eye.

Sometimes the ghosting appears as a navy blue shadow behind the image or sometimes it looks like a glowing double-edge to an object. The effect is most evident in high-contrast areas (i.e. white figures on a dark field) or in sharp transitions (like vertical lines in the video).

As a simple test for ghosting, focus on a static part of an image and alternate winking (or covering) your left and right eye. If you see the right eye image lingering when your right eye is closed, then you are experiencing crosstalk.



## Requirement 2



Photo courtesy of PDI DreamWorks

### Who You Gonna Call?

DreamWorks® has released a 3D Blu-Ray of their animated title *Monsters vs. Aliens*® (which was, at press time, the only commercially-available title in this format). There are a few scenes that illustrate these concepts perfectly and can act as test patterns for your evaluation:

- **UFO Control Center:** In the opening scene (time stamp 1:20 and following) it shows a control room. Right after the bouncing-a-ball-toward-your-face 3D trick, freeze frame the scene. Focus on the edges of the calendar that is in the background hanging on the wall. The sharp transition from the white paper to the black wall will provide you a line to focus on. There is also a pole in that scene that can work in the same way. Do you see a single line or are there two lines? Cover or wink your eyes slowly. Do you see the right eye content bleeding into your left eye and visa versa? There are other scenes in the movie where this is prominent. The studio made the hair of the main character white and set the scenes in dark space, which conveniently gives us many scenes that can illustrate this effect.
- **Porch:** Shortly after that scene, the opening credits roll over imagery of the heroine's front porch (time stamp 2:21 and following). All of the vertical lines of the porch and door in the foreground and background should be evaluated. Can you see crisp edges to the porch posts or are they blurry? Can you see crisp detail or are you seeing double? Tilt your head from side to side. When your head is in a comfortable upright position are you seeing one crisp image?



## Requirement 3

### #3 Comfortable Viewing

For movie lovers, it is critical that technology enhances the viewing experience. While most showroom demos of televisions last only a couple of minutes, the average movie is nearly 2 HOURS long and should be comfortable to watch.

Possible sources of discomfort are flicker and shuttering between alternate eyes (as opposed to both eyes seeing a continuous image), low brightness (which causes eye strain), ghosting, jittering, heavy glasses putting pressure on the nose or face (such as battery powered) or fatigue of the neck or shoulders.

Movie watchers may be able to tolerate minor discomfort for a short time, but long hours of subjecting the eyes and brain to the visual distress will take a toll.



## Requirement 4

### #4 High Resolution and Refresh

Viewing high-definition video on a low-resolution display presents a risk of missing important details and can contribute to blurriness and other video performance compromises.

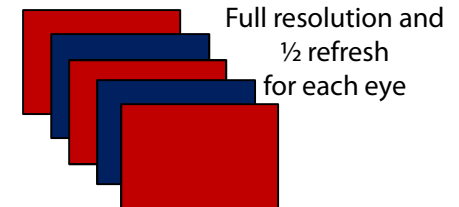
Sadly, the realities of video broadcast require a significant compromise in resolution. For example, broadcast HD content is distributed in 1080i resolution, which is half the resolution of full high-definition 1080p. When stereo pair images are distributed via the same broadcast capacity, the total available frame size is divided by two, one for each eye. As a result, each eye is only seeing 25% resolution.

The time sequential approaches meet the SMPTE 3D standard for full resolution, but rather sacrifice refresh rate as the left and right eye frames alternate.

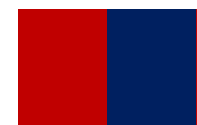
In any case, it is critical that the total 3D solution includes high-quality image processing and scaling to help compensate for less-than-ideal resolution or refresh rate.



Full resolution  
for each eye



Full resolution and  
 $\frac{1}{2}$  refresh  
for each eye



$\frac{1}{4}$  to  $\frac{1}{2}$  resolution  
for each eye



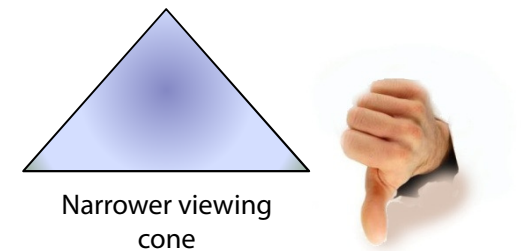
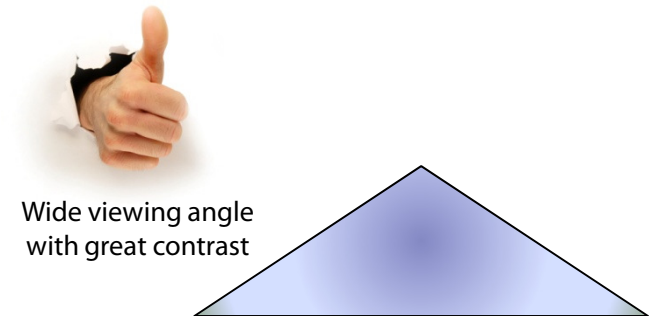
## Requirement 5

### #5 Wide Viewing Angle

Having a wide viewing angle, both vertically and horizontally, ensures a more comfortable viewing experience. Movie viewers should be able to move right/left, up/down, and back/forth and still see exceptional 3D.

A wide viewing angle is absolutely critical for theater or family room settings where the screen will be shared by a group of people. No matter where viewers are sitting in the room, the imagery should be stunning and the 3D effect convincing. This is especially true in large rooms.

With front projection systems, trade-offs can be made between luminance gain and viewing angle, while preserving contrast.



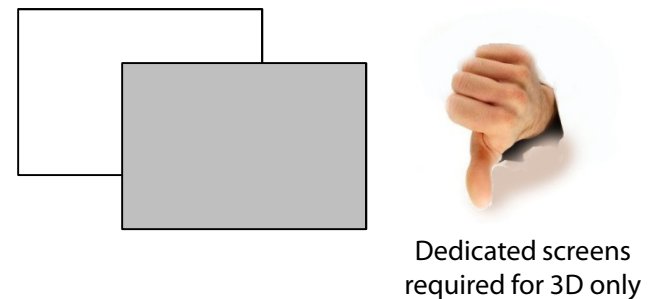
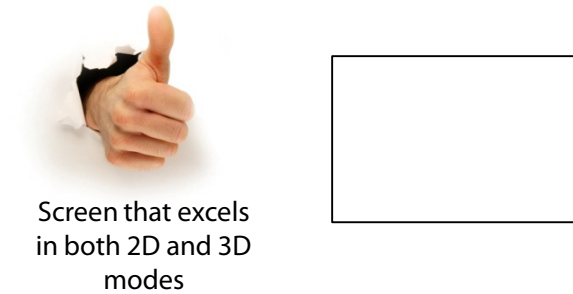
## Requirement 6

### #6 Screen Quality and Flexibility

In home theaters or media rooms where front projection is the best choice, the quality of the screen is critical to the overall performance of the solution. There are a number of factors to consider including image quality and gain.

When commercial cinemas convert to 3D, it most often requires a new silver screen to be installed, which limits what movies can be played in that theater in the future because 2D films won't always look good on high-gain 3D screens. It is unrealistic to assume that all or most of the video played in the home will be 3D so its important to find a screen that will excel in both 2D and 3D modes.

The same principle is true for flat panel displays as well. They should look fantastic in both 2D and 3D modes.



## Requirement 7

### #7 Compatibility

Homeowners would certainly prefer to spend their time enjoying movies or sports with their friends and family, rather than worrying about compatibility of their 3D Blu-Ray discs, televisions, and cable providers. There are a number of standards for broadcast and disc content that are emerging, but across the industry they are far from resolved.

Broadcasters like ESPN and DirectTV are hoping to lead the way in providing high-quality 3D content for home owners. There are standards associations, industry groups, and manufacturers all navigating the exciting and tumultuous world of 3D. Consumers should ask their audio/video dealers about compatibility and the available of appropriate content. The whole industry expects the number of channels and titles available in 3D to explode in 2011, but for now it is highly limited.

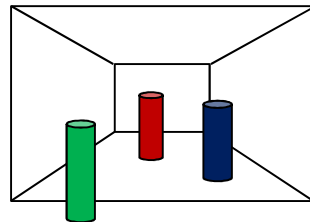
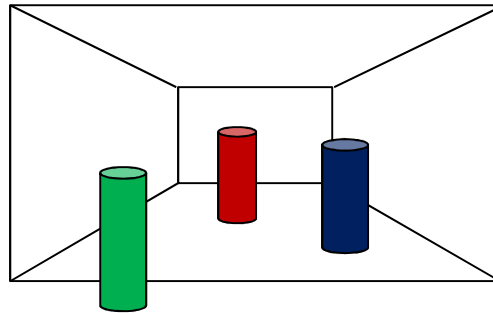
You should beware that not all Blu-Ray discs labeled as “3D” are compatible with the highly -advertised 3D televisions. **“3D Ready” is still a false assurance.**



## Requirement 8



Large screen sizes create a  
impressive virtual stage  
(greater than the diagonal  
measurement alone indicates)



Smaller screens  
compromise the  
immersive 3D effect

### #8 Display/Screen Size and Virtual Stage

The best 3D video is meant to be immersive and bring you completely into the story being told. The flat panel display or screen size can be compared to a theater stage. A realistic 3D effect essentially increases the size of the room by dozens of feet or more and creates an effect similar to having a mirror or mural on the wall, creating the illusion of a much bigger space. This is amplified even more with curved screens which add more implied depth.

As the physical size of the display or screen grows, as measured horizontal and vertical dimensions, the size of the virtual stage expands exponentially. The virtual space is measured in volume space as shown on the screen, not just in square or diagonal inches on the face of the display. When watching an outdoor event on a display, every 1" of diagonal size can add 400 cubic feet of virtual space to the scene.

The distance between the left and right eyes does not scale and this has implications on where you will prefer watching 3D in your home and what technology you may want to use. In any case, Runco highly recommends large screen sizes for 3D.



## Summary

In conclusion, there are 8 initial criteria that we recommend keeping in mind when evaluating 3D solutions.

These include the following:

1. Stereo Video Quality
2. Low Ghosting
3. Comfortable Viewing
4. High Resolution and Full Refresh
5. Wide Viewing Angle
6. Screen Quality and Flexibility
7. Compatibility
8. Display Size and the Virtual Stage

Runco looks forward to announcing our unique and innovative approaches to 3D display for the luxury home and to providing additional educational tools useful to enthusiasts and the authorized Runco dealers around the world.



## About the Author



### Jennifer Davis

#### Vice President, Marketing

Ms. Davis is an experienced executive with more than 16 years of experience in display technologies, software, and internet services. She has held leadership positions at companies ranging from a small software start up to Intel, a Fortune 50 technology firm. She joined Planar Systems in 1998 and has held operational, marketing, and strategic roles.

Jennifer graduated summa cum laude from Warner Pacific College with degrees in business and history and holds a Master's of Business Administration from Pepperdine University.

A self-described geek with a belief that technology "with a point" can be a powerful part of people's lives, she is proud to provide leadership to Runco's product planning and marketing efforts.

For further information on Runco's industry-leading video technology, please visit [www.runco.com](http://www.runco.com).

Special thanks to Planar Systems' 3D stereoscopic experts Adi Abileah (Society of Information Displays fellow and chair of the International Committee on Display Metrology), Pat Green, Ben Clifton, Scott Robinson, Terry Trover, Bob Williams and the entire Runco engineering team who contributed to this effort.



## Additional Information

Runco is a leading provider of premium video products for home theater and entertainment. Our expansive product line includes award-winning projection solutions, plasma and LCD flat-panel displays, as well as innovative product categories such as display walls and video processors.

Please visit us at [www.runco.com](http://www.runco.com) where you can learn more about Runco's video solutions that create an incomparable video experience, as well as to locate an authorized dealer near you, read our blog, and see a gallery of installations that might be useful to your own planning and design efforts.



## Authorized Dealer Profile: Sound & Vision



The professionals at Sound and Vision have the experience and expertise to advise, install, and ensure that you get the maximum enjoyment from your purchase. Experience 3D done right, visit the experts at Sound and Vision.

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[www.soundandvisionohio.com](http://www.soundandvisionohio.com)

