Curved Screens: The Difference is In the Picture
By Dennis Erskine

Ever since Stewart Filmscreen introduced the curved screen to the home theater market, a lot of questions have been raised about just what benefits they bring to the table. We can look at the primary advantages; but, it helps to first understand their history. A history that is long.

Commercial movie theaters have been using curved screens for years. The most dramatic use of a curved screen that I remember is the Cinerama screen I experienced at the Cooper Theater in Denver years and years and years ago. So curved screens are nothing new and certainly nothing new to Stewart who has been producing curved screens for decades for commercial theaters, studio screening rooms (including the Stag Theater) and for flight simulators. To them, the curved screen is just another day at the office.

For the home theater market, the curved screen is the new game in town. Ever since the home theater market started, the objective has been to bring the full movie experience into our homes. And, ever since home theater started, we've been missing the mark. Missing it big time. Typically, we see 16:9 (or more correctly, 1.78:1) aspect ratio screens in home theaters. Essentially, with a 1.78:1 screen, all we've been delivering are huge front projection TV sets. Oops…not exactly what we've been wanting to achieve. In fact, 1.78:1 has been so prevalent that the digital chips in our DLP (and most LCOS/DILA) projectors have also ended up with a 1.78:1 aspect ratio.

The disconnect is that most movies are produced in a Cinemascope aspect ratio, or 2.35:1. In other words, the movie is 2.35 times wider than it is tall. Cinemascope has proven to be just what the director ordered because it involves the viewer more into the movie. More of the movie is in our peripheral vision providing a more involving environment. One way to compare 2.35:1 to 1.78:1 is to say it is the same difference as watching the world go by through your picture window or stepping out onto your front porch and taking part in the world.

To watch a Cinemascope movie on a 1.78:1 screen means that we have black bars on the top and bottom of the screen…a letterbox if you will. That's pretty annoying all by itself. I, in particular, was annoyed at that for many reasons. I didn't like the black bars, I wasn't getting a theatrical experience and, more to the point, those black bars meant about 33% of the pixels in my high resolution, super duper, very expensive projector were being used to produce those black bars that I didn't want to see in the first place.

The solution was relatively easy for Runco International. They modified the software in their scalers to first chop off the black bars and then stretch the picture vertically to use ALL the pixels in the projector to produce the picture. The upsides were that I now used 100% of those pixels to produce the high resolution picture I paid for and those silly black bars were gone. There was one small little downside. I still had a 1.78:1 picture and everybody was tall and skinny.

The solution to this issue was to put an anamorphic lens in front of my projector. The anamorphic lens stretched the picture horizontally giving me natural geometry and a full, high resolution, Cinemascope picture. In fact, with the scaler, I had 33% more resolution than was originally delivered on the DVD!

In testing this process, there was a video artifact that appeared. As a result of the anamorphic lens, a type of distortion called “pin cushion” appeared. The shorter the throw distance of the projector, the greater the pin cushion. Back in the days of the CRT, pin cushion was easily fixed, but digital projectors do not have a means to correct for pin cushion (and didn’t need it until I started mucking with the optics by adding an anamorphic lens). Once again, with a little experimentation and a short conversation with Stewart Filmscreen, the problem was solved. The solution was to curve the screen! Pin cushion gone, and a gorgeous Cinemascope presentation, just like the director wanted, resulted.

Once I started installing these 10-, 12- and 15-foot wide screens, several other benefits of the curved screen became very apparent. These benefits were in foot lamberts and uniformity.

Foot Lamberts is a measure of how much light from the screen gets reflected back to where it counts…to the viewer’s eyeballs. As screen sizes get larger, getting the most out of your screen becomes important. Here’s where some basic physics and geometry come into play.

The angle of incidence always equals the angle of reflection. What this means is the light from the projector to the edge of the screen is reflected on to the walls and my eye balls are near a seat….not along the wall. Thus, as the image gets closer to the edge of the screen, more of the light finds its way to places I, and my guests, are not. That also means fewer foot lamberts are getting reflected back into the seating locations. The other side effect is as the image gets closer to the edge of the screen, the image becomes dimmer…or, in other words, I don’t have picture uniformity from the center to the edge of the screen. This problem is exacerbated by 2.35:1 screens because they are so much wider than what we’ve had in the past. Once again, however, the curve of the screen comes to our rescue.

Because of the curvature of the screen, the light is now reflected back into the seating locations (not on to the walls) which increases foot lamberts to the seating locations and improves picture uniformity!

There’s an acoustic improvement as well. Because of the width of the screen, the Left, Center and Right channel speakers can now be placed behind an acoustically transparent screen. This places the speakers where they should be for the development of an excellent sound stage and, for the first time, the sound comes from where it occurs…where the action is! Equally to the point, it’s exactly where the sound engineer mixed it to come from and exactly where the director heard it when he made the movie in the first place. If

you want a reference screening room to SMPTE or AMPAS standards, this is how you get it. What's the first step to good sound? Simple. Duplicate the mix environment!

Let's jump into that 'touchy' subject of acoustically transparent screens. I've had hardcore audiophiles and videophiles in my demo room that had no clue we were using a THX Ultra Certified acoustically transparent screen. Good enough for me. This is how the movie was mixed. We've duplicated the mix environment. We're hearing what the sound engineer and director heard and saw. The result is stunning!

Now, in fairness, there is a home theater designer (and, one I happen to hold in high regard) who has expressed concern that the curve of the screen will act as a "lens" focusing reflected sounds into the seating locations. Certainly as someone that takes two days to calibrate the audio in a room, little issues like this concern me as well. But, let's examine this potential issue from the viewpoints of both logic and physics.

On the logic side, we're talking about an acoustically transparent screen. It's acoustically transparent in both directions…not something like a one-way mirror. From that perspective, the sound striking the screen from the front is going to pass through the screen to the acoustic treatments behind the screen (you do have treatments there, right?).

From the physics side, let's assume the screen is only 90% transparent at some specific frequency. This means that 10% of the sound (at this frequency) striking the screen from the front is reflected back. Ok, let's deal with that 10%. First, where is this sound going to come from? One would be the sound from the front speaker(s) reflecting off the back wall, onto the screen and back into the seating area. Well, this isn't going to happen in a nicely treated room…that back wall has absorption and diffusion (right?). So anything reflecting off the back wall is reduced in energy by diffusion and, if it's going to do any damage, it already has passing by your ears on its way to the screen. The next point is that sound energy decreases with the square of the distance. Any sound taking this path has traveled twice the length of your room plus the distance from the screen to your ears. At that point, the sound is so far below its original dB SPL it is either completely masked or completely in audible.

The side surround speakers won't create this problem…the geometry doesn't work out. The rear effects speakers could create this problem but, again, they are off center so the geometry doesn't work out. But, assuming it did, the screen is only reflecting back 10% of the sound energy striking the screen, which again, is far below audible levels.

In the end, 2.35:1 and curved screens finally achieve what we've been wanting for years: a true movie experience in the privacy, comfort, and relaxing family environment in our home. If you want validation, speaker to a director or, better yet, visit a home theater showroom with a 2.35:1 Cinemascope theater and curved screen.