4K, 8K, 16K-Stewart Filmscreen is There and Ready When You Are!

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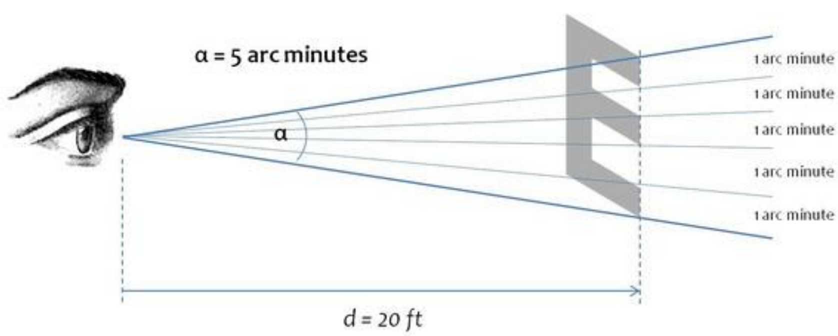
Just as we are beginning to embrace the 4K phenomenon in displays, we are already seeing the rumblings, dare I say emergence, of 8K and even 16K displays in the not-too-distant future. While some seem to be content with 1920 x 1080 or full HD, evidence shows 4K is here to stay – at least until the next evolution in resolution takes hold.

We have all seen articles with titles like “Is 4K Really Necessary?” and “Barriers to 4K.” Many of these articles talk about the availability of 4K source material and the bandwidth needed to stream 4K, while others mention that 4K is best viewed at close proximity and that there is little visible difference at longer viewing distances. There is no argument that we are in the midst of an evolution of source material and available bandwidth before we can embrace full 4K adoption, but the issue of visible differences is one that begs for more discussion centered around the science of visual acuity.

Understanding Visual Acuity and Pixel Density

Let’s start with pixels. AV experts and video enthusiasts know: The more pixels there are, the smaller they become, resulting in more overall picture information that can be displayed on a screen. This is true from a technical standpoint, but too simplistic to truly explain the relevance of greater pixel count. It ultimately boils down to what the human eye can resolve. So, just what *can* we see? Referring back to the Snellen eye chart to measure 20/20 human vison, we learn that the human eye resolves one arc minute of information. An arc minute is a subdivision of 1 arc degree. There are 360 arc degrees in a complete circle and 60 arc minutes in each arc degree.

As you can see from the diagram below, we can also subtend 1 arc minute because someone with 20/20 vision can see that letter E on the eye chart. In short, that’s what our eyes actually detect, but let’s do a little bit more math and relate it to pixels.



There are 10,800 arc minutes in 180 degrees of viewing. So the eye has a limited resolution of one arc minute and would require an image no less than 10,800 pixels wide. Achieving similar horizontal resolution with 1920 x 1080 projectors would require 10,800 divided by 1920 H pixels per projector, which is 5.6 projectors across edge to edge and 7000/1080 or 6.5 projectors vertically— and that’s without blending losses. So we would need about 6 x 7 or 42 of these HD projectors, minimum, to match human acuity. Clearly that is very expensive and not practical for most applications. But the example gives us some idea of what the human eye can actually see. Now, those 4K, 8K, and 16K displays begin to make more sense, because human vision really can detect a difference.

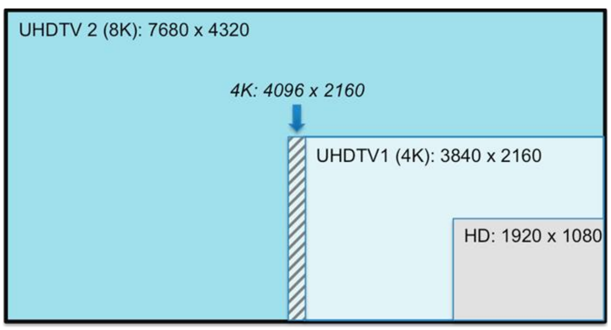
Image Resolution: More than Just Pixel Density

If we turn our attention to the display devices that create what we see and keep in mind the “holy grail” of what the human eye can resolve, let’s explore resolution from another perspective. Image resolution correlates directly to the amount of detail in an image. Higher resolution means greater image detail and more detail brings us closer to visual acuity.

Some people believe resolution relates *only* to pixel density or the number of pixels on a given imager or chip. It’s true that the number of pixels does correlate to the amount of information within the image. So, a digital chip at 1920 x 1080 provides the core capacity for higher resolution when compared to a chip with 1024 x 768 resolution. But the resolution we see on screen does not stop there. Other variables come into play, such as the light engine, processor, both internal and exit optics, as well as the projection screen.

As we illustrated in a prior example, 1920 x 1080 does not attain the threshold of visual acuity. Here are the current standards that are being embraced today and for the foreseeable future. These standards relate to a combination of visual acuity and overall source information on screen.

- 1920×1080: HD
- 2048×1080: 2K Digital Cinema
- 3840×2160: 4K UHDTV
- 4096×2160: 4K Digital Cinema
- 7680×4320: 8K UHDTV
- 15360×8640: 16K Digital Cinema

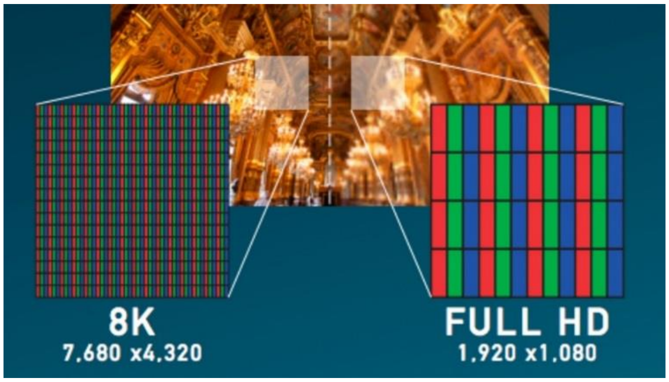


Why 4K Counts (So Does 8K and Beyond)

Lest it appear to be overstating the case in support of higher resolutions and dynamic range, we can see the recent developments in the real world of the UHD standard. It begins at 4K (3840 x 2160P) and goes up to 8K (76080 x 4320P) and embraces not only pixel density but advances in all optics, processors, and source material that can take advantage of higher resolution and high dynamic rate (HDR).

4K resolution is here and 8K is the successor with 16K waiting in the wings. As a point of reference, 8K UHD has two times the horizontal and vertical resolution of the 4K UHD with four times as many pixels overall, or sixteen times as many pixels as Full HD at 1920 x 1080.

We understand that there is little 8K source material available today, but an 8K display can also be used for the purpose of enhancing lesser resolution videos with a combination of techniques currently used in video and film editing. Resolutions such as 8K allow filmmakers to shoot in a high resolution and edit as they see fit to the appropriate size. NHK, Sony and Red Digital Cinema are among those that are embracing 8K and filmmakers are pushing for more.



The Right Screen Material for the Job

All of this increased resolution and dynamic range goes a long way toward images that approach what the human eye can see. But the other partner in the equation is the screen on which the enhanced images will be shown.

As in all things AV-related, one size does not fit all. It is the combination of the projector, the source material, the screen, and ambient light that makes the highest quality images possible. If the screen reflecting the image or transferring it through to the viewers is not compatible with higher resolutions, it becomes the weak link in the chain, reducing the overall viewing experience. And, it's worth pointing out that all screens are not created equal.

In this regard, Stewart Filmscreen is the technology leader in screen surfaces. If we use a Stewart ten-foot-wide screen as an example, it is equal to 3048 millimeters. Stewart Filmscreen fabrics are capable of resolving 6 line pairs or arc minutes per millimeter. So if we multiple 3048 millimeters by 6, we get a product of 18,288 possible pixel addresses per ten feet of screen width. This is greater than the resolution furnished by a 16K projector if one existed.

Stewart fabrics are able to resolve resolutions well beyond the limit of the human eye. As we progress from 8K to 16K and beyond, Stewart Filmscreen is ready and waiting. Give us your best and we will show you the best in return!