

Video Display Resolution Demystified

I thought I'd take the time to blog about this as there's lots of common prevailing misconceptions about video resolution. After all, knowledge gives people the power to make informed decisions on things that can improve their quality of life (like purchasing televisions!).

I'll get right into it and begin with the basics.

What is Resolution?

Display resolution can simply be termed as the maximum number of distinct pixels that can be displayed in an image. The resolution of an image is determined by the amount of pixels, which are tiny dots of illumination that display colour on a screen.

Now you've probably heard of video specifications such as 1080p or 1920x1080. This just means that the image the output device produces comprises of 1,920 pixels across and 1,080 pixels tall which, when multiplied together, gives 2,073,600 individual dots per image. The human eye can process about 2 million pixels as a single unified image and, therefore, the more the pixels within a picture, the greater the resolution, which ultimately results in better overall image quality for our human eyes to perceive.

Standard Definition v/s High Definition

A number of you will already be familiar with the above terms. As common as they are, I'd still like to talk about what these terms mean, for the benefit of those who don't already know about them.

So to begin with, standard definition (SD) is 720 pixels across and 480 pixels tall (i.e. 720x480). However, this varies in the UK. In the days of analogue, all televisions used the Phased Alternating Line (PAL) broadcast system, which displayed standard definition content at 576i (i.e. 720 pixels wide by 576 pixels tall or 720x576).

The video content associated with standard definition often lacks great detail, and can often look blurry when compared with the high definition video production of the present. This is because standard definition has fewer pixels per square inch, which equates to less detailed video output.

By contrast, high definition (HD) content provides a much higher level of detail on screen that provides more fluid video and vibrant colours.

High definition has three different types of video resolutions: namely 1,280 pixels wide by 720 pixels tall (i.e. 1280x720), 1,920 pixels wide by 1080 pixels tall (i.e. 1920x1080), or 1080i, which I will talk about later on in this blog post. I believe that it's very important to know the distinctions between the three before setting out to purchase high definition television sets and related accessories.

720p v/s 1080p

720p is more than twice the detail of standard definition, as it is 1,280 pixels wide and 720 pixels tall. This arrangement yields 720 horizontal lines on the screen, which are, in turn, displayed progressively, or each line displayed following another.

A 720p HD television will only be able to display video at this resolution and no higher. Televisions that display video output at this resolution are often marketed and sold as being “HD-Ready”. This is because 720p is the absolute minimum resolution required to meet this standard.

720p televisions are now very affordable, which is good news for those who haven’t yet made the leap from standard definition to high definition viewing. These TVs are a good fit for casual movie-watchers who don’t get too caught up in having the ultimate home cinema experience, as well as for people who are not that interested in online gaming.

On the other hand, 1080p is 1,920 pixels wide and 1,080 pixels tall. This arrangement yields 1,080 horizontal lines on the screen, which are, in turn, displayed progressively, or each line displayed following another.

The main difference between the two resolutions is the number of pixels that make up the respective 720p and 1080p images. There are around 1 million pixels for every 720p image whilst there are approximately 2 million pixels for every 1080p image. So for those who were unaware, 1080p televisions generally produce better quality video output than their 720p counterparts. What’s more, 1080p HD televisions, often marketed as being “Full HD” or “True HD”, are able to [upscale](#) 720p transmissions to fit on the screen.

One of the biggest advantages of having a 1080p HD TV is when watching Blu-ray movies. Blu-ray is a native 1080p format and therefore better suits televisions with 1080p displays. More so, if you’re interested in video gaming on the Xbox One or PlayStation 4, or streaming movies in their highest available quality on Netflix, then a 1080p TV set is better suited to your needs.

However, it is important to note that certain 720p TVs can actually look better than certain 1080p TVs. This is because what the viewer sees on screen is a combination of a number of different factors, with resolution being just one of them. Some of these other factors include, but are not limited to, colour processing, motion response and video scaling.

720p v/s 1080i

Have you ever looked at resolution specifications and wondered what the lowercase letters “p” and “i” stand for? Well “p” stands for progressive scan whereas “i” stands for interlaced scan.

Progressive scan simply displays images sequentially, all at once. The advantage of this method is that motion pictures often look more fluid and smooth, which allows for better overall video quality.

So what does interlaced really mean? This [extract from Scenesavers](#) describes it perfectly:

“Interlaced video is a technique for doubling the perceived frame rate of a video display without consuming extra bandwidth. The technique uses two different fields to create a frame of video. Each field is made up of individual rows of pixels; one field contains all odd lines in the image, the other contains all even lines. When watching an interlaced video these lines are painted individually or scanned displaying all the odd fields, then even fields, odd fields, even fields, and so on. The scanning of each field happens so fast, that the human eye is tricked into thinking every frame of video is in fact 100% complete, when in actuality it is not. Amazing!”

1080i is 1,920 pixels wide and 1,080 pixels high. The resulting combination yields 1,080 horizontal lines (referred to as pixel rows) that are transmitted to a television alternately. In simpler terms, all the odd pixel rows are transmitted to the TV, followed by all the even pixel rows. Therefore, a 1080i output only sends 540 lines (half the detail) every 60th of a second. All the detail gets transmitted every 30th of a second.

This means that 1080i output produces greater detail than 720p output. Despite this however, fast moving objects, when watched on 1080i, can appear to exhibit slight interlacing artifacts such as jagged edges or slight blurring effects, as the increased detail is only sent every 1/30th of a second instead of every 1/60th of a second.

1080i v/s 1080p

As you now know, 1080p and 1080i are very similar video display resolutions, with the former being progressive and the latter being interlaced. The general consensus (mine included) is that 1080p video is of better quality than its 1080i counterpart, because of the *lack of* the interlacing effect that often renders 1080i video blurry during periods of quick motion displayed on screen.

1080p v/s 4K

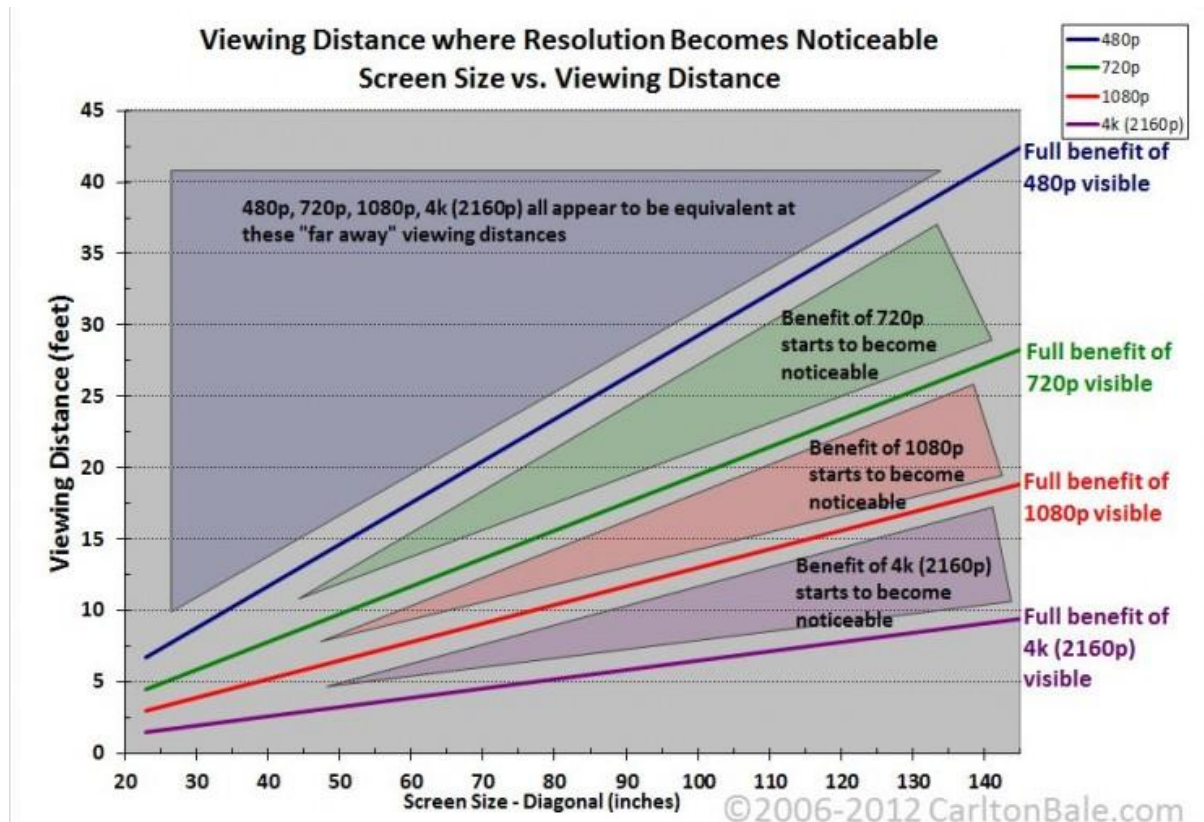
The following video gives a great overview of the state of 4K video resolution as of May 2016:

(VIDEO - https://www.youtube.com/watch?v=OiOEg2eG_c)

So there you have it, 4K video delivers four times as much detail as 1080p Full HD, which translates into 8 million pixels, compared to the two million pixels of 1080p.

But is the visual benefit of 4K over normal 1080p HD actually slightly exaggerated? I think so. A 4K display will only improve picture quality if:

- You are watching native 4K content
- You sit close enough to notice the difference



The diagram shows, for any given screen size, how close you need to sit to be able to detect some or all of the benefits of a higher resolution screen

The diagram above substantiates the claim. As you can see, for a 50-inch screen, the benefits of 1080p over 720p only begin to become apparent at viewing distances closer than approximately 10 feet, and become fully apparent at about 6.5 feet. 6.5 feet is closer than most people will sit to their 50-inch screen, and therefore the majority will not experience the full benefit of 1080p resolution. The same principle applies for 4K resolution as well.

In addition, contrary to popular belief, a 4K television does not improve the picture quality of lower quality content, such as 1080p Blu-Ray discs. This is because, with upscaling, the amount of information being transmitted in the signal does not change, and so there won't be any more detail present on a 4K display.

My parting shot on this would be to take your time to evaluate all options (i.e. screen size, viewing distances, etc) before purchasing a 4K television.

True 4K

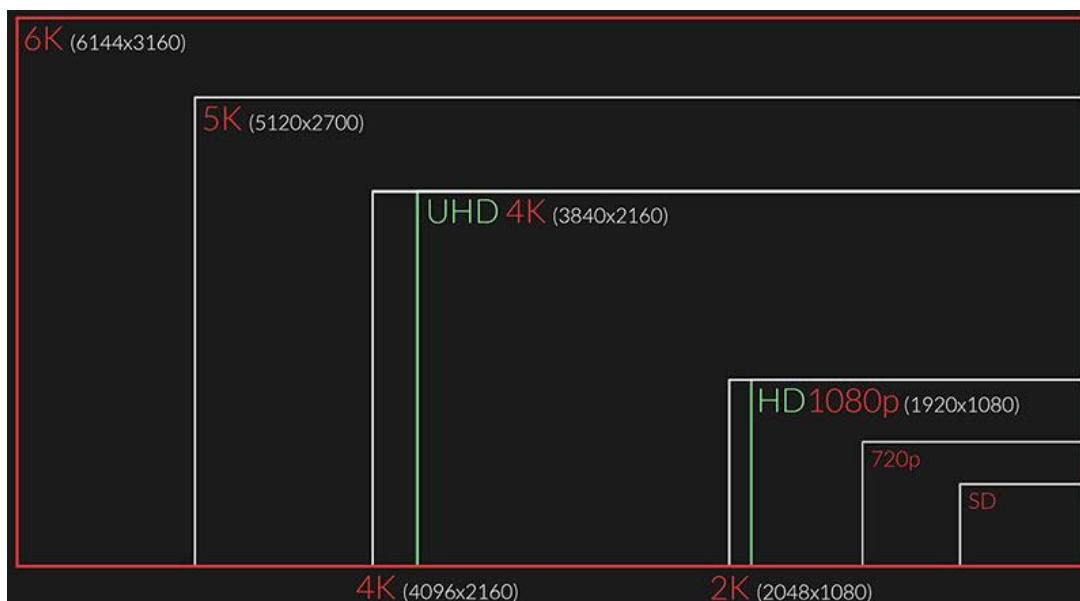
I've also come to realise that the term "4K" has been hugely misinterpreted by a lot of people, with "Ultra High Definition" being the culprit. Ultra HD is simply a derivation of the 4K digital cinema standard. So while cinemas display their content in native 4096x2160 (True 4K) resolution, the new ultra HD consumer format has a lower resolution of 3840x2160.

Point to remember:

True 4K – 4096x2160

4K Ultra HD – 3840x2160

The image below accurately details the most widely available video display resolutions in today's world.



Video display resolutions, from Standard Definition all the way up to 6K

And that leaves you with all you need to know about video resolution. This can be a very complicated area of technology to fully grasp right off the bat, so if you have any questions or thoughts, let me know in the comments section below.

Thanks for reading,

Samuel.