

4:3 and 16:9 What are the Choices?

As AV professionals, we are often confronted with a client asking about why they should install the newer 16:9 aspect ratio equipment for their new system. Also, we find ourselves in the position where we are doing an upgrade to a classroom or training room where the instructor is in conflict with the AV designer that would prefer to put a newer 16:9 projector that needs a larger 16:9 screen in the classroom that will cover up board space also needed for instruction. Everyday we as AV professionals are asked to make the final decision on what projection equipment to buy and what screen to install in a facility.

So let's begin with the definition of aspect ratio and what it really means in the AV world.

One way to express this ratio is to say that aspect ratio is the relationship of the image height to the image width. Doing the math, we can see that if the height is divided by the width the 4:3 ratio can be expressed as 1.33:1 or simply 1.33.

The 4:3 ratio is commonly thought of as the older format and is derived from the motion picture and photographic formats of 35mm motion picture and roll films. The horizontal 4:3 ratio display was extensively used for motion pictures and slide projection. Screen shapes followed suit because of the prevailing photographic and motion picture formats being produced in the early years making the 4:3 ratio the default for most display systems. Kim Milliken of Da-Lite Screen Company describes the 4:3 format's history in this way: "The photographic process was well-established previously, professional film widths and frame sizes were not standardised until the early 1900s when 35mm was accepted as the standard size in both the US and Europe".

Beginning in the 1950s the widescreen formats began to emerge in the motion picture industry to combat television's intrusion into the motion picture market. Movie theatres were offering larger and more impressive views (something TV could not do) using the innovations such as Cinemascope, 70mm and anamorphic projection systems. Many of the widescreen formats were slightly different, so the theatre screens were either masked or completely reinstalled to meet the new widescreen format demands. In many theatres, during this period, it was very common to see the newly installed widescreen fabric simply being masked by closing the theatre curtain to the appropriate opening to display the still common 4:3 aspect ratio.

The various aspect ratios driven by the motion picture and television industries are still with us and here follows a small grouping of some of the more common formats.

Today we have more display technologies and systems to

35 mm Academy Standard	1.33:1
NTSC PAL Television & Computers	1.33:1
HDTV	1.78:1
Panavision®	1.85:1
70 mm	2.05:1
CinemaScope®	2.35:1
Cinerama®	2.76:1

consider and the systems we choose to install are driven by the room function and the new media that needs to be displayed on these systems. So to begin the discussion, let's stay with the legacy 4:3 display. Many of the projector manufactures are still manufacturing 4:3 format products to deliver images for training venues. Here, the need is driven by images generated by the computer. The computers with the 4:3 ratio may still be with us for some time, but not too far down the road is the WXGA format for computing that is beginning to gain popularity and wider spread use. The WXGA is a 16:9 using 1366 x 768. Compared with the analogous standard 4:3 XGA of 1024 x 768, the WXGA is also coming closer to the HDTV format of 720p where the resolution is 1280x720 pixels progressive scan is used.

How fast will this new format in computing overtake the training room display environments is still a guess. But to be sure, the sales of these devices will be determined again by the amount of media available and the ability to display the native resolution images without distortions or loss of screen real estate. Clearly this is one technology to watch closely; not only when you purchase your next computer, but as you see your training rooms become more varied in use and more digital media being delivered through the computer in various formats and qualities.

So what are some of the options currently available to an AV designer?

Displaying 16:9 on 4:3

Direct view 4:3 equipment is still being made and the media available for this format is abundant given its long history of production thus creating huge libraries of content. So if you wish to watch older films or TV programmes in their original format — then there are still compelling reasons for purchasing equipment using this format. The downside is when you wish to play the 16:9 format on the 4:3 equipment. The results are that you lose much of the height of the picture because there are the black bands that appear when the wide screen format is played on a 4:3 device. Another downside is the media itself — some 4:3 recordings are done using the pan-and-scan technique where a portion of the film is scanned and the left and right sides of the original widescreen frame are cut off revealing whatever the technician thought was important to be in the 4:3 frame. In essence, the film is being re-edited by the technician. Personally, I don't like seeing films panned-and-scanned because they typically don't reflect what the director wanted the audience to experience. The tip off here is the disclaimer at the beginning of the programme that states: "This film has been modified from its original version to fit your television screen". After seeing this disclaimer, you can bet that this film has gone through the pan and scan process and will not have the same original impact.

In preference to the pan and scan solution, the 4:3 format will display a "letterbox" version which is truer to the original film format. The inherent problem here is that there will be black bars at the top and the bottom of the display. Depending on the original widescreen format you could lose 12% of the picture height at the top and bottom of the screen making the total loss of 24% of the screen's real estate. (See Figure 1)

Home Theatre projection systems are being deployed employing the 16:9 format in a big way and this is becoming the preferred format for these systems. Projection equipment costs are starting to fall in this format and the DVD and HDTV media is there to supply the bulk of the programming for these systems. In addition, since over the last 50 years or so motion pictures have embraced the wide screen formats there is also an

abundance of media available.

Displaying 4:3 on 16:9

As long as content is delivered and displayed in the 16:9 format — all is well again. However, when displaying 4:3 format content on 16:9 displays another problem appears. The notorious black bars now show up as black pillars on the right and left sides of the screen. Also there is a distinct loss of impact due to the lack of picture height once enjoyed in the native 4:3 format using a screen of the same width. My point is here that if you can only fit a 243 cm widescreen in a room the image will be more impressive because it will be bigger (182 cm high) using the 4:3 format. The same 182 cm image height would require a screen over 323 cm wide to maintain the same impact in the HDTV format for example. So fitting the HDTV 1.78:1 image on a 243 cm widescreen would only give you an image 137 cm high. (See Figure 2)

Options here are again not the most desirable, with direct view devices (LCD or Plasma devices) you can use a feature sometimes called a "widescreen" button where the 4:3 image is stretched across the 9:16 display filling up the black pillars with image, but once this is done, every one on screen appears to put on 20 pounds and the vertical distortions are just too great to properly enjoy the film.

Another option is the "zoom" setting on some newer 16:9 projectors where the image is zoomed in essentially cutting off the top and bottom of the frame and filling up the pillars with a less distorted image. But again this is not perfect, because using this feature is similar to doing your own version of pan and scan. Essentially you are trimming the tops and bottoms of the frame instead of the left and right. Again the original frame is somewhat distorted using these electronic options.

Best Solutions — Native Formats

In conclusion, the best results are achieved using the native formats in their original forms. Projecting 4:3 content on 4:3 equipment and 16:9 format using 16:9 equipment is still the

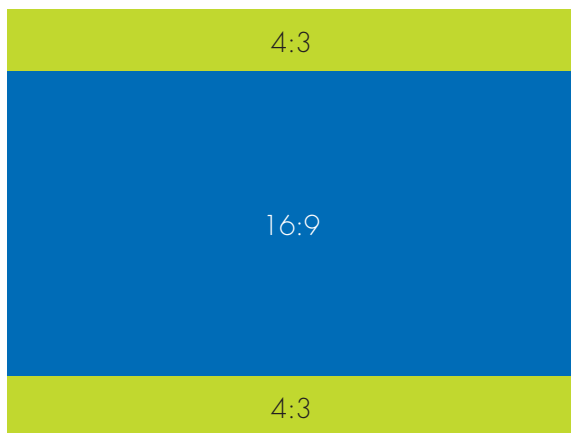


Figure 1
16:9 and 4:3 with equal widths
Height being a 4:3 advantage

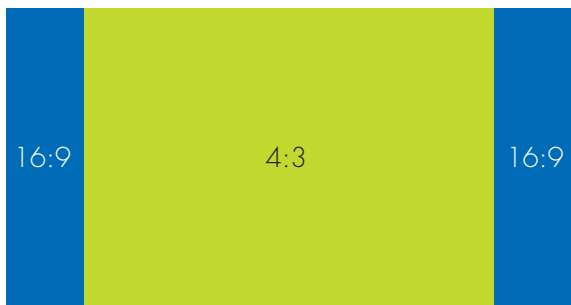


Figure 2
16:9 and 4:3 with equal height
Width being a 16:9 advantage

best way to maintain the integrity of original content. The type of media you wish to predominantly display on your system will be the driving force that should determine which system you ultimately install in the venue. The above choices are full of trade offs and to be fully aware of these options is an important part of the decision making process when a new system is being installed.


However, in parting, I should note that if there are instances where more than one format can be displayed in a native resolution then screen size can be the final choice where advantages may be leveraged.

Installing a 16:9 fixed screen in a venue might be the best solution despite my comments earlier in this article. As I pointed out — height is most important to image impact and if a screen can be mounted in a room utilising as much of the room’s height as possible then the current wide screen formats and the future wide screen formats that computers are migrating to will be displayed with maximum impact. Also, this idea will still accommodate the 4:3 media. The left and right pillars can be made less obtrusive by using the newer gray screen materials that will help the pillars go into a lower shade of gray than by using a matte white screen material that will reflect more of the ambient room light making the black level higher than desired. This gray screen idea may prove

to be an advantage as projectors are becoming brighter and folks are leaving more lights on while displaying content.

Best of all, visualise what you want to see in the room that you are about to build. Consider the primary uses of the room and calculate the appropriate screen size for the least favoured viewer using the 4-6-8 rule to figure your screen size. This means that the least favored viewer should be no more than 4, 6 or 8 times the image height from the screen. This rule can be used to calculate distances and screen sizes regardless of the aspect ratio used. Once you do the math and determine the predominant media shown in the venue, the aspect ratio choice should be easier once you consider all of your audience’s true needs. ¹⁶

About the writer...



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