Life @ Work

Screen Realty - a Primer

By Neil Sadwelkar

No matter which area of film and video production you work in, you have to work with computers. And, look at a display of some kind... computer monitor, broadcast monitor, TV set etc. And yet in almost all the articles - review or write-up - this device is almost treated as a given component. But display tech - screen realty as we've termed it - is an area that has seen tremendous growth and development in the past decade or so.

Just do a rewind to ten years ago, and picture the displays then. Most PCs had black and white 14' CRT displays. Rich people used colour displays. But still 14' was the norm. High-end image processors used large 17' displays and I remember my eyes nearly popped out when I first saw a 19' display at a steel plant control room. Yep, only they could afford a 19' monitor back then.

Today of course you don't need to be rich or even work in a steel plant to use a colour monitor. It's a given. So let's just pause and take a look at where we're at with displays. This isn't a product review or comparison of different monitors. Nor is it a 'how things work' description of machines. But a sort of a structured collection of musings if you like.

First the kinds of displays - present and future.

CRT

CRT - or cathode ray tube - is the oldest form of a TV display. CRT displays are the 'normal' computer monitors, meaning not flat LCD screens. CRTs are also used in broadcast monitors and TV sets. They were first developed in 1897. Yes, 2 centuries old. Even commercially viable versions date back to 1931. And we still use CRT displays in computers of '04 and TV sets and monitors too.

CRT displays have an inherent curvature on the front viewing surface. Though, in the past couple of years one can get a 'flat-screen' display. This isn't absolutely flat but very nearly so. CRTs create images by a 'beam scanning' method, so they are open to geometric distortions. In simple terms, CRTs may make your image look shaped funny.

But even with this curvature thing, CRTs are bright, give good colours, and are the cheapest form of displays yet. So they're still the most popular devices for viewing images - from a computer or a video device - yet.

But CRTs are large and heavy, and they consume a lot of power. Not more than your fridge, but large enough power [*and size*] to make them completely unportable. So that's where we come to a CRT replacement - LCDs.

LCD

LCD is short for liquid crystal display. These are the cool flat displays that you see in rich people's offices. LCDs are rather expensive as yet, but their prices are falling faster than the prices of colour monitors fell a decade ago. A 15' LCD can be had for under Rs 25,000. Now that may not seem to be exactly cheap, but remember, LCDs have a 'viewable area' somewhat larger than a CRT. Meaning a 15' LCD will give you an image as large as a 17' CRT. And a 17' LCD compares with a 19' or even 20' CRT.

LCDs are not only really flat, but the whole display is just an inch or two thick. Meaning you can actually hang your monitor on a wall. And because they don't create images by 'beam scanning', they don't flicker. They also consume very little power. That's what makes them ideal for laptops as well.

Apart from computer monitors, LCD TV sets and broadcast monitors are also beginning to emerge as an option to CRTs in demanding broadcast applications. But as yet, their colour fidelity and ability to show TV images is not yet compelling enough for purists to make that switch.

Plasma

Remember that large flat TV set behind the newsreader on some news channels? Well that's a 'Plasma' TV. This is a new display technology. Plasma displays use some advance gobble-di-gook science to create images on a flat thin display. Something about a hot gas and electricity passing through it.

Whatever it is, these displays are large, thin, very clear and bright and can be scaled all the way up to HD resolutions. They are still too expensive for most individuals especially the God-fearing and tax paying variety. That may change, though not very soon.

Video Projectors

Video projectors are increasingly being used as computer displays and even home theatres and even public theatres. Video projectors are basically magnified desktop displays.

Early video projectors used CRT where they had 3 CRTs for red blue and green. But large size, cost and power consumption have relegated CRT based projectors for use only in some high-end applications like flight simulators, planetariums [Nehru Planetarium, Mumbai has six, which show the whole sky!] So CRT projectors haven't died. They are just used less often than they used to be.

Then there are LCD based projectors. These use the same principle as LCDs for computers, except that the LCD is tiny and has a lamp behind it to illuminate it and a lens to cast an image at a distance.

The newest of projectors use DLP technology. DLP stands for digital light processing. In DLP projectors, there is a special device that comprises of lakhs of tiny mirrors. These are deflected to create light of varying intensities. Think of each microscopic mirror representing a pixel and you get an idea of how the picture is created. There is a colour wheel which creates three primary colour images to get a colour picture.

DLP projectors are the new kid on the block. According to some they produce images that are more 'film-like' than LCD or CRT projectors. Better blacks, better contrast etc. I've seen one and was impressed. If you use projectors to see movies, then DLP may be a better option to LCD.

What next?

LCoS and D-ILA

Meaning LCoS - Liquid Crystal or Silicon and D-ILA - Digital Light Amplification. These displays have chips or ICs that are an LCD and a processor combined. A silicon back plate has a reflective aluminium top layer that controls the display of the liquid crystals. It's not really that simple, of course, but this is a new technology that promises to shrink the size of video projectors.

OLEDs

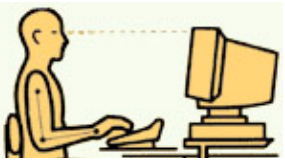
OLED - Organic Light Emitting Diode is actually a wide range of display products. Very basically, it's a thin flexible display created which consists of two conductors with an organic film in between. When an electric current passes through them, it emits a bright light. These displays will have a very wide viewing angle, won't need backlighting, will consume less power etc etc.

But the most interesting part is that they will be flexible, meaning you can wrap one around your arm. Exactly how that will help and animator or an editor, I'm not really sure.

Using displays

Right! So we saw the various kinds of displays you have yesterday, today and tomorrow. Now some usage issues and home truths about displays.

Positioning



For a computer monitor, the viewing distance should be approximately an arms length away from your body. The top of your monitor should be at eye level or slightly lower.

The screen should be located at 90 degrees or more from a direct light source like a tubelight or a window. Else, shade the

light source from appearing as a reflection in the monitor. Here, LCDs score over CRTs, as they are naturally flat and have a matte finish, which doesn't reflect too much light.

For a TV set or broadcast monitor, the optimum viewing distance is 8 times the screen height. So a 25' TV should be seen from about 9 feet away. If you get closer you'll see a larger image, but it will get blurred and uncomfortable.

For HD TV sets or monitors, the best viewing distance is 3 times screen height or 3½ feet away for a 25' TV set or monitor.

Colours

The colour thing with displays is a huge topic on its own. But here too, some fundas to keep with you.

Our eyes can see a huge number of colour shades - some billions - and no display or print technology comes even close. The 'range' of colours seen by us is a 'space' called 'lab colour space'. You can choose to work in lab colour space in PhotoShop or even After Effects.

Displays use RGB or red, green, blue to create colours. But like I said earlier, these aren't as many as the eye can perceive. Print uses CMYK or Cyan, Magenta, Yellow, Black to create colours. These are even fewer than RGB. Meaning all the colours you see in print can be created on your computer monitor, but not all colours on your computer screen can be properly printed. When working within PhotoShop, it's possible to approximate this by converting to CMYK space.

Television systems like capture cards and effects software use another space called YUV - Luminance and a cocktail of Red and Blue for the U and V components. YUV supports fewer colours than RGB but more than CMYK. That's why things look different on the broadcast monitor as compared to the computer display and within PhotoShop.

So bottom line in RGB, CMYK and YUV.

Any colour present in a printed form can be created on a computer monitor or TV monitor. Not all colours created on a computer display can be accurately printed.

Any colour present in a TV monitor can be created on a computer monitor. Not all colours created on a computer display can be accurately shown on a TV monitor.

So that's why, in an edit room or graphics place one hears, 'How come this looks different on your computer screen?'

Also, the best way to reproduce colours with certainty is 'by the numbers' Have the art guys note down RGB colour readings for those colours in PhotoShop using the dropper. Then create that exact same colours by actually typing the numbers in PhotoShop at your end and use the eye dropper in your editing/fx application. Just do not rely on your eyes or scanners.

When it comes to colour matching, the human eye and brain that processes visuals have some remarkable qualities. If shown two visuals in succession, we are capable of colour matching that comes within a few percent of the colours. Not too good. But side by side, we can compare colours to within some parts per million. Few, if any, instruments made come even close.

Another issue - standardisation.

No two computer displays produce exactly the same colours. No two TV sets produce exactly the same colours. There are, however, specialized 'professional' computer displays. So too, broadcast monitors. These are produced with extremely small tolerances and can be made to produce nearly identical colours. Also, it is possible to use software 'calibrators' like Adobe Gamma and make multiple displays produce identical colours.

On the other hand when working in Television it is important to realise that the end-user - the viewer - will always view your work on a non-standard viewer, a TV set. Capable of reproducing far fewer colours than your broadcast monitor or computer display. With print, on the other hand it is possible to create offset printed material with closer matches to the original over extremely large quantities.

Bottom line in colour reproduction.

If you take a visual or a set of visuals in print form and publish these as a glossy magazine or brochure to distribute to a million users, you can ensure that all of them see nearly the same colours. If you convert the same to video and show it to a million households on TV, you can never be certain that they're all seeing the same colours.

In conclusion, maybe there will be a day when all displays will have such resolutions and colour fidelity that they exactly match our vision. Even print will get to the point where it is indistinguishable from reality. But till that happens, we will have to live with fundamental differences between what we see on a display and what is out there.

About Neil Sadwelkar

Neil Sadwelkar has little formal training, so he just about makes a living in the film & TV industry in India. His profession is a higher form of meditation through which one can deny hunger and sleep - it's called editing. In his spare time thinks hard and writes stuff like this piece above. And in whatever time is left over, he does his own accounts and chases clients for money. As you must have noticed by now, he is also shamelessly besotted with Macintosh machines and considers them as God-sent gifts to man kind!

He builds and tinkers with computers, so some people get conned into believing that he knows a lot about computers and editing software, so they even pay him as a consultant. Really! If you love what he's written you can drop him a line at neil@misenscene.net and tell him he's the greatest. He even has a web site dedicated to Final Cut Pro where you can take in more of his writings.

If you're a budding editor you can make him feel good by asking for advice. But if you're looking for work, don't bother because he doesn't have contacts. And if you really hate his writings, write to him and give him some work, so he has no time to write stuff like this. But don't make him chase you for money; else he'll go back to writing.